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EXODONTIA

Influence of George B. Winter on Development of Exodontia. Frank W. Rounds[4] (Boston) recalls that 25 years ago an unknown author completed a textbook on the extraction of the teeth. Since that time, the name of George B. Winter has become an international synonym for things that pertain to the present concept of the principles and practice of tooth extraction.

George Ben Wade Winter was born in Brooklyn, in 1878. His father, a newspaper man, whose work took him to various cities, finally settled in St. Louis. Eventually he left the financially precarious field of newspaper work, entered business and achieved moderate success until the panic of 1897 engulfed him. At 16, George was dependent on his own resources for further education and livelihood. By his own endeavors, he worked his way through elementary and high schools and carried on to obtain his professional education.

Winter carried on a general dental practice for a few years. He gives great credit to such leaders as Edward Angle and A. Bromley Allen in shaping his destiny. Endowed with a restless spirit which impelled him to progress from one accomplishment to another, Winter was unsatisfied with a merely creditable showing. He decided to specialize in the field that he liked best and for which he had shown the greatest aptitude. In this phase of practice he became a leader, but once more his innate desire for progress became insistent. He was convinced that methods of tooth extraction could be improved. His experience as a teacher in St. Louis University led him to the realization that the means of instruction were decidedly limited and far less efficient than one could wish. The literature in this special field was meager. The crude methods of the

(4) Am. J. Orthodont. 26:285-289, March, 1940.

day made clinical demonstration unsatisfactory to the exacting scientist. Asked to conduct a course of several lectures, he found that the sum of published knowledge on this subject could be told in a limited time and that the material was a hodgepodge of random information.

The next four years were spent in intensive research, from which Winter evolved a basic scientific principle on which tooth movement during extraction was established. In 1913, he was ready to publish his findings; 25 years ago he produced his textbook on the extraction of teeth. This book was the first comprehensive work on this subject that had ever been brought to professional attention. He captioned it with a title that has not only become standard in the science of tooth extraction but designates the individual who specializes in the removal of teeth. The thought and study given to this detail typifies the thoroughness with which Winter undertook every task.

Before a word was put on paper and before even one of the many illustrations was planned, it was first necessary for Winter to do the thing he was to write about, not once, but thousands of times, so that the technic might be perfected. He must be absolutely certain that he was right. As a result of this original research, he coined the word "exodontia" and dignified the specialist with the name "exodontist." He created a new specialty. Most research is based on and is a development of an extensive literature left by earlier workers. Winter had no such background, for he was investigating a scientific frontier. In fact, it was lack of earlier scientific investigation that led him to inaugurate his studies.

This text on exodontia created enormous interest among dental men. The small edition of only 5,000 copies was soon exhausted. It is now listed among rare works, and a large premium must be paid to obtain a copy today. The last chapters were devoted to the removal of impacted teeth. No sooner was the work published than the author became dissatisfied with this section. At that time the x-ray was new and roentgenographs were often inadequate. Once more, Winter started research. There were many cases of impacted teeth which clinical examination had failed to reveal. He felt the need of a definite operative procedure to eliminate the brutality and trauma which accompanied their removal. The revelations made by improved x-ray technic which he mastered, combined with the knowledge and experience gained by his investigations, convinced him that such methods were unnecessary. During 12 years he studied thousands of impacted teeth, preoperatively, operatively and postoperatively. The world was searched for mandibles of man from prehistoric times to the present. All findings were painstakingly tabulated and classified. As a result, in 1926 Winter had completed a text of 819 pages devoted to the mandibular third molar when impacted. It was amplified with hundreds of illustrations, which alone rendered the classifications visible to the student and exemplified the operative procedure in detail.

This edition was soon exhausted. Even operators who did not wish to master the technic for their practice were thoroughly convinced that the comprehensive classification was correct. It was felt that the last word had been said and written on this subject. In the author's mind, however, there still remained further work to be done. At the International Congress in Paris in 1932, he felt that he had found the medium he needed. On his return, he immediately investigated the possibilities for producing scientific motion pictures to illustrate his work. After long experimentation, he completed his first production, a silent movie which was shown all over the United States and abroad with such success that again he was stimulated to further efforts. It was a short but logical step to the talking picture. Winter's new sound movie was first presented at the Second District Dental Society of Brooklyn, in 1936. The results of all his years of research and investigation were so clearly demonstrated by this means that they were easily available. This method of propagating scientific investigation has attracted universal attention. Boldly and convincingly, he has put before the dental profession the fascinating probability that in the future much constructive dental teaching will be based on this new type of visual education.

[In his résumé of the life and work of George B. Winter, Rounds has paid tribute to one whose years of effort, research and many contributions so greatly influence the advancements made in exodontia.

In presenting this article at somewhat greater length than is ordinarily followed in abstracting an original contribution, this section of the YEAR BOOK OF DENTISTRY is desirous of joining with members of the dental and medical profession in honoring Dr. Winter and showing their appreciation for the many contributions he has made to the field of dentistry.—Ed.]

Mandibular Third Molar. The following series of reports,[5] selected because of the ever-growing importance of this subject in the field of oral surgery, were taken from the issue of the *Archives* dedicated to George B. Winter in appreciation of the outstanding importance of the work he contributed to this field of dentistry.

Development of the Occlusal Roentgenogram.—George B. Winter believed that the optimum position for the occlusal view film is obtained by placing the film flat on the first and second molars and moving it distally until it comes in contact with the ascending ramus. The anterior edge then is over or just distal to the mesial surface of the first molar. The final analysis of the salient points to be obtained by the occlusal view roentgenogram follows. It definitely establishes the available fulcrum for leverage. The heavy cortical plate buccal and mesiobuccal to the third molar is used for leverage in instrumentation and is important for the final delivery. It shows the ossistructure lingual to the tooth and definitely eliminates it for use as a

(5) Arch. Clin. Oral Path. 4:239 ff., Sept.-Dec., 1940.

EXODONTIA

TECHNIC OF EXTRACTION OF TEETH

G. B. Winter D.D.S. F.A.C.S.

Dec 1st 1927

EXODONTIA

A PRACTICAL TREATISE ON THE TECHNIC OF EXTRACTION OF TEETH

WITH A CHAPTER ON ANESTHESIA

A COMPLETE GUIDE FOR THE EXODONTIST, GENERAL DENTAL PRACTITIONER, AND DENTAL STUDENT

BY

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ILLUSTRATED WITH 245 ORIGINAL ENGRAVINGS

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THIS VOLUME IS DEDICATED

TO

A. BROM ALLEN, D. D. S.

MAY THE INFORMATION SOUGHT TO BE CONVEYED IN THIS BOOK BE AN AID TO A COMPLETE CONCEPTION OF THE PRINCIPLES OF EXODONTIA IS THE WISH OF

THE AUTHOR

PREFACE

In presenting this volume on Exodontia it is the aim of the author to submit a more extensive treatise on this subject than has heretofore been published. This effort to prepare a book that is comprehensive has been stimulated largely by the fact that only brief reference to this important subject occurs in works on operative dentistry. It has been the plan to limit the scope of the book to the subject of extraction, with an endeavor to treat that feature in a manner so complete and practical as to fully meet the requirements of the exodontist, general practitioner, and dental student.

The rapid and appreciable progress that has been made in dentistry in recent years is an indication that indefatigable scientific research in this profession has been instrumental in improving the technic of operation in the various branches of this calling, and the technic of extracting a tooth from its supporting tissues has advanced at least equally with that of the other branches. The advancement made in Exodontia has been the means of reducing tentative methods of operating to a system, and has thus established definite methods of procedure for the various cases.

In treating the subject of Exodontia it has been the intention to prescribe methods of operation that, with such slight changes in the technic of procedure as the peculiar condition of an unusual case may indicate, will be applicable to any case that may be presented, as it is impossible to establish an immutable rule to be followed in all cases. Exodontia is a branch of surgery in which operations are more frequently performed than in any other division of the surgical art, and there are cogent reasons why the removal of a certain tooth from its retaining tissues should be performed with as much precision and governed by as specific rules as any other distinctive surgical operation.

Operative skill in Exodontia is to be acquired only by careful study and practical experience, and it should be the ambition of the operator to so prepare himself as to be able to form a proper conception of the procedures to be followed in the various cases of extraction that may be presented.

With a view, therefore, of furnishing a guide for correct operative work, the technic of various operations and methods of after-treatment are given in detail. The extraction of normal teeth in the numerous stages of decay, the different malpositions, and the most frequent forms of abnormalities of teeth have been carefully treated. Variations in surrounding tissues and their pathologic conditions have been described, and the divers forms of fracture cases have been discussed. The important matter of position of patient and operator, together with the selection and application of suitable instruments, have been presented in a manner that will be readily understood. Practical methods of diagnosis, particularly in those cases where obscure conditions indicate resort to radiography, have been explained, with the aid of special illustrations, in a manner that will be helpful to the operator. Some space has also been devoted to the subject of general and local anesthesia, as the administration of anesthetics in the extraction of teeth is an important adjunct to the operation.

Pains have been taken to have the illustrations, all of which have been prepared especially for this book, made as nearly perfect as illustrative art and mechanical execution can produce. It will be observed that not only the illustrations of instruments are presented with a high degree of resemblance to the actual object, but that the illustrations of normal and abnormal conditions of teeth and tissues, as well as the methods of the operation, are shown with remarkable correctness.

G. B. W.

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EXODONTIA

CHAPTER I.

HISTORICAL.

By a natural process of reasoning, based on data of human anatomy and physiology, it is fair to conclude that diseases of the teeth and the involvement of contiguous parts had their origin with the beginning of the human race, and it is to be presumed that relief was sought for the pain resulting from a diseased condition of a tooth. It is not known what remedies or appliances may have been used in prehistoric times in an endeavor to render this relief, but in the course of time history began to record the efforts that were made to allay the pain caused by dental defects.

As in cases of various ailments of the human form in early ages the sacerdotal or priestly class, whose claim to mystic powers dominated primitive people, administered both local and general medicaments and executed incantations for the relief of bodily pain, it is very probable that the relief of pain from defective teeth was included in their practice of mysterious remedial ceremonies. This custom of sacerdotal treatment continued until the advancement of civilization developed physicians and surgeons, some of whom practiced the treatment of teeth as a part of their calling until dentistry became a separate profession.

There is no record as to when the extraction of teeth, either by drawing or other forcible method of ejection, may have been introduced as a method of relief from suffering. It was customary in ancient times to deposit surgical and other instruments of practical utility in certain temples, and it is recorded that leaden forceps were found in the temple of Apollo at Delphi, which indicates that this structure was used as an archive for such instruments in various arts as were to be preserved for the study of posterity. While this instrument is referred to as forceps, they were in all probability shaped more in the form of short-jawed tongs. It is evident that only very loose teeth could be extracted with such forceps, and it has been contended by some writers that these forceps were only a model, the original instrument being constructed of stronger material.

When, however, it is considered that various medicaments were at that time applied to the affected tooth and gums with the object of softening the surrounding tissue and thereby loosening the tooth before extraction, it is probable that the leaden forceps in the temple of Apollo were of sufficient stability to serve the purpose of extracting the loosened tooth. Application of sulphur, pepper, and roasted and pulverized spines or "stings" of the trygon fish were often utilized in the loosening process, and great importance appears to have been attached to these preliminaries. Tissue not previously destroyed by scurvy or other affection was scraped from the tooth, its attachment broken by concussion, and the tooth finally removed with the fingers or leaden forceps similar, no doubt, to those found in the temple. In fact, in some cases the normal gum and integument were excised from an affected tooth to such an extent that the root was exposed, when the tooth could be removed. To prevent the probable fracture of a carious tooth, the cavity was filled with lint, wood fiber, or lead to better withstand the pressure of the forceps. It was held that the operation of extraction should be attempted only after all known remedial agents had failed, and that even the extreme measure of applying the red-hot iron should first be tried.

CHRONOLOGICAL DEVELOPMENT.

Hippocrates (B. C. 460–357), the celebrated Greek physician, is reported to have been the first writer to mention the extraction of teeth. He is credited with the statement that such extraction was a simple and easy operation, but was contradicted by other authorities, who declared that the operation was a serious undertaking and sometimes resulted fatally.

Claudius Galen (130–218), an Italian physician, was of the opinion that the leaden forceps found in the temple of Apollo were intended for the extraction of loose teeth, and expressed the belief that, if such an instrument were to be used for the extraction of teeth that were tightly fixed, it would be made of stronger material. Galen, who gave a great deal of attention to the treatment of the teeth, did not attach much importance to extraction, and was more concerned about the application of remedies to cause the loosening and final falling out of the tooth.

Abulcasis (1050–1122), an Arabian surgeon, who was very much interested in matters pertaining to the teeth, scarified the tissue surrounding the tooth to be extracted, laid bare the root, endeavored to loosen the tooth, and then undertook to extract the tooth with what has been referred to as forceps. If, however, the extraction could not be accomplished with these forceps, he would apply an elevator-shaped instrument under the tooth and force it out in that manner, which indicates that the principle of the elevator was employed during the middle ages.

John Gaddesden (1314), an English physician, would extract a tooth only after his various medicaments—such as powdered dried dung, brain of the hare, green frog's fat, etc.—and even the red-hot iron had failed to give relief. He would then loosen the gum surrounding the root, and extract the tooth with the forceps. In some cases he would force out the tooth with an elevator-shaped instrument, whose blade was flat on one side and convex on the other, with a sharp edge, very much resembling in this respect some of the types of elevators used at the present time.

Ambroise Paré (1517–1592), a French surgeon, who brought the art of surgery up to a standard not previously attained, devoted considerable space in his writings to the treatment of dental affections. He claimed that a tooth should not be extracted until the pain was unbearable and all medicaments had failed to give relief, and directed that in case of a cavity it should be filled with linen cloth or lead to prevent fracture.

Among the earlier instruments employed for the removal of teeth were the pelican, lever, goatsfoot, ravensbill, storksbill, and key. There is some doubt as to the writer who first mentioned the use of the pelican, an instrument of peculiar construction, made from time to time in a number of modified forms, but all on the same principle, different authorities ascribing the first reference to the instrument respectively to Ambroise Paré, French surgeon; to Peter Foreest, Dutch surgeon; and to Walter Ryff, German surgeon. All of these surgeons lived at different periods from 1500 to 1597, and were largely interested in the treatment of teeth. Some authorities, however, give credit for the introduction of the pelican to Giovanni d'Arcoli, an Italian surgeon, who died in 1484, a number of years before the birth of any of the three surgeons named.

Croissant de Garengeot (1688–1759), a French surgeon, was for a long time considered, particularly by the French surgical profession, as the inventor of the key, but it appears that this instrument was used in Germany before the time of Garengeot, being known as the German key, and that de Garengeot, as well as Frére Côme, another French surgeon, simply improved the instrument in some respects. Previous to their time the instrument was known as the German key.

John Aitkin (1771), an English surgeon, made some further improvements on the key, which was subsequently referred to as the English key.

The key was an improvement over all instruments that had preceded it, and was generally conceded to be a great step forward as an instrument for extraction. Benjamin Bell declared himself in favor of its use in the extraction of molars and bicuspids, especially of those of the inferior arch, recommending the key as the only instrument to be depended upon when the forceps were found inefficient. There were, as stated, several forms of the key, but all constructed on the same general principle, which consisted of a shaft with a handle, interchangeable hooks for gripping the tooth, and a flat bar or bolster to rest against the gum and alveolar process, both of the latter acting as a fulcrum when the instrument was applied to the tooth. Its use caused contusion and laceration of the soft tissues, often fractured the outer plate of the alveolus, and resulted in many disagreeable and serious accidents.

Pierre Fauchard (1690–1761), a French dentist, placed the art of dentistry on a higher plane by introducing a systematic treatment of the teeth, and was instrumental in removing many of the former prejudices and unscientific beliefs, particularly the superstition that the extraction of teeth was dangerous to the eyes and other organs of the head. He also recommended the use of variously shaped instruments for the extraction of the different teeth.

Lecluse (1754) invented an elevator specially designed for the extraction of the lower third molar, and a modification of this elevator is in use at the present time, being considered a very serviceable instrument, but the scope of its utility has extended the use of the instrument beyond its sole application to the inferior third molar. As early as the time of Abulcasis (1050–1122) crude forms of elevators were used for the purpose of extracting the roots of teeth.

Joseph Serre (1759–1830), a dentist of Belgian birth, but whose professional activities were pursued in Germany, invented various extracting instruments, the one deserving special mention being the conical screw for the extraction of roots hollowed out by caries, an instrument which, in a modified form, is used at the present time.

From the time of the introduction of the key, efforts were made by various persons engaged in dentistry to invent an instrument with which a tooth could be readily extracted in a manner involving less danger of fracture to the tooth and injury to the surrounding parts. Instruments to answer the purpose of forceps, but in the shape of tongs, with short, rounded jaws and handles of convenient length, were made for the extraction of teeth, but were as a rule impracticable, as they were too crude and bulky. The operator was compelled to have these so-called forceps made in the rough and then shape them as well as he could to his idea of adaptability.

The methods and appliances heretofore described for extracting teeth prevailed, with immaterial changes from time to time, until Sir John Tomes (1840), an English dentist, originated the "anatomical forceps," devising a separate pair for each tooth and for each side of the arch, and were so constructed as to fit respectively the various shapes of the different teeth. These forceps were first used by Tomes in Middlesex Hospital, and proved to possess such great advantages that they were freely copied and used, to the exclusion of all other tongs or forceps. Because Tomes' forceps gave such security and ease to the operation, there followed an era of promiscuous "tooth-pulling," country doctors, barbers, and even village blacksmiths purchasing and using the forceps, as the pseudo-operators as well as the patients were ignorant of the possibility of preserving the teeth.

Tomes was not, however, given credit for his invention, which gave rise to a controversy, whereupon he in 1848 reissued his treatise on "Dental Physiology and Surgery" for the express purpose of establishing his priority, in which he states that, "after a lapse of seven years, the instruments in question have come into general use, whereas previous to his first paper, June 4, 1841, they had no such instruments." These instruments came into universal use, and our present forceps are only modifications of the original "Tomes" forceps, with the beaks and handles greatly changed, but retaining the principle of the beaks fitting the neck of a tooth. The forceps of modern construction are made of the finest steel, wrought in perfect form and finish, with different shapes of handles and beaks, the handles conforming closely to the hands of the operator and the beaks following the shapes of the different teeth.

PROGRESS OF MODERN METHODS.

Sterilization was unknown to pioneer dental operators, and it is related that blood was permitted to dry on the instruments repeatedly in order that their appearance of being much used might testify to the experience of the operator. The introduction of the principles of antiseptic surgery by Lister in 1867 improved the condition under which the operations were performed, and greatly reduced the ratio of infection resulting from extractions.

Modern dentistry has done much in developing methods for restoring teeth to such condition that they may again serve, so far as conditions will permit, the purpose for which they were intended, and the experience and knowledge of the operator must determine the procedure to be followed in any individual case. Many factors must be considered by the operator in reaching a conclusion, and the attending circumstances of a case will naturally govern his decision. It is now generally admitted that it is not good practice to sacrifice a tooth that can be restored, as artificial teeth, though more scientifically made than formerly, do not approximate the function of the natural teeth. The first step, therefore, in any procedure is a thorough examination of the existing conditions, embracing the tooth to be operated upon and the surrounding structures, and ascertaining their condition as accurately as possible. If there is doubt in the mind of the operator as to which tooth is involved, visible pathologic conditions and the sensations of the patient not making this point clear, recourse should be had to radiography. It may sometimes be advisable to withhold judgment, and treat the symptoms for a time in order that the pathologic conditions may become more apparent, but, if the diagnosis is clear and extraction is indicated, the patient should be advised accordingly.

The patient who places himself in the hands of the operator for an extraction desires the operation to be accomplished surely, quickly, and painlessly, but will forego "quickly" for "surely and painlessly," and, in turn, will sacrifice "quickly and painlessly" for "surely." The operator who can successfully combine these three factors will ever find his reputation growing in popularity and his patients increasing in number. To accomplish this desideratum requires, among other attainments, a thorough knowledge of the anatomy, histology, and pathology of the parts involved. This knowledge may be obtained from text-books devoted to these subjects and by close observation of all cases coming under the operator's hands. As complete a history as possible should be elicited from the patient, for much valuable data can thus be obtained, not only to form the diagnosis of that particular case, but to aid in the judgment to be exercised in future cases.

Within the last half century the science of dentistry has progressed very rapidly, and the restoration of teeth by filling and crowning has decreased the number of operations of extraction that would otherwise take place. Progress in the field of exodontia has been in keeping with the advances made in other departments of dentistry, and teeth are no longer extracted promiscuously. When extraction is determined, the tooth is usually affected by some pathologic condition involving the associated tissues that will not yield to treatment, or is so extensively decayed that it is impossible to restore it to a condition of future usefulness. The general public has also learned to care for the teeth, and is now demanding their restoration whenever possible. When, however, extraction can no longer be postponed, the operator should exercise tact and skill, as the average patient submits to such an operation with apprehension, and, should the patient suffer much pain or should the tooth be fractured during its removal, the operator is liable to be severely censured. If, on the other hand, the operation is successful, the operator will receive the commendations of the patient.

CHAPTER II.

INSTRUMENTS.

In considering the extraction of teeth as an operative procedure, it is assumed that the reader is familiar with the anatomy, histology, and physiology of the teeth. The proper selection of instruments for the operative procedure is an important matter, and a judicious choice should be made, as a great deal depends on the kind of instruments available for an operation. The essential ones are not numerous, and a few well selected are to be preferred to a larger number improperly chosen.

FORCEPS.

The forceps are the principal instruments for extracting, and are used more frequently than any other instrument designed for this operation. Their use is indicated where the tooth to be extracted is so situated in relation to the other teeth and the tissues of the mouth as to permit their free application, and, wherever indicated, a more accurate adaptation, better leverage, and a more nearly perfect control are to be had with them than with other instruments. As success, in so large a degree, is dependent on the forceps, their construction should be such as to be of the greatest possible utility. Painful accidents so frequently occur from the use of improperly constructed forceps that no operation should be attempted with any of that character. The operator should choose a well-selected set, and learn to operate exclusively with them, as by this course he not only lessens the possibility of accidents, but by becoming accustomed to certain instruments he greatly increases his skill as an exodontist, for it is only by the frequent use of an instrument that dexterity in its manipulation can be acquired. The component parts—beaks, joint, and handles—should be made of the best steel, and tempered to withstand any strain, without bending or breaking, that may be placed on them.

The beaks should be so constructed that they fit the neck of the tooth for which they are intended, so that, when adjusted, a firm grip of the tooth is obtained. The ends of the beaks should be thin enough to permit insertion under the free margin of the gum, by pressing it aside, without causing any considerable contusion of these tissues, and their edges should be sharp enough to cut through the alveolar process when it becomes necessary. The beaks should be canted at such an angle to the handles that they can be applied to the tooth in line with its long axis, and so curved that, when pressure is applied, the curvature will aid in loosening the tooth. The instrument, in all its parts, should be of a size that will permit a free execution of the extraction movements, the lifting of the tooth from its socket, and its final conveyance from the oral cavity.

The joint should have just enough free play to allow an easy opening and closing of the beaks without permitting any lost motion. The edges of the joint should be made in such a manner that the lips or other soft tissues cannot be caught between them while operating. Some of the English and German forceps are ideal in this respect, having joints with well-rounded edges, while in the American type the edges are usually so sharp and come together so close that there is always danger of tissue laceration. This danger is, however, readily overcome by rounding off its edges with a carborundum stone, which does not impair the strength of the joint or affect the usefulness of the forceps.

As the proper adaptation of the handles to the hand is very important in securing a firm grasp, maintaining steadiness, and applying proper leverage, it is advisable to have them conform as far as possible to the hand of the individual operator, who soon learns which style of handles is best suited to his hand and how to manipulate them to the best advantage. For the six superior anterior teeth the handles of the forceps should be straight, with broad, flat surfaces. For the superior bicuspids the handles should be of the same shape, but the beaks should be set about three-quarters of an inch out of line with the axis of the handles, giving the beaks the characteristic bayonet shape. The superior molar forceps have the same shaped handles, and the beaks are set in the same relation to them as are the beaks of the bicuspids. All the superior forceps should have swell-end handles to prevent bruising the palm when the hand is passed over them in the upward pressure when such pressure becomes necessary. For the inferior teeth the handles have a different shape, that part which fits into the palm of the hand being curved and turned on its axis, so as to conform to the anatomical shape of the palm. One of the handles is shorter than the other, but with the same form, except that near the end it is bent outward, so as to curve over the little finger, thus permitting the ready opening of the forceps without allowing them to slip through the hand.

As a large variety of forceps is manufactured, each having some special feature, a full description of all would only confuse. In order to simplify matters and make their selection practical, the set of Standard forceps has been taken as a basis for illustration and description. These forceps were selected because they approach the broadest range of usefulness, and because they have no superior in point of mechanism and general fitness. The number, limited to ten, comprises a minimum equipment, and at the same time is sufficient for the usual cases in which forceps are indicated. In rare instances special forceps prove serviceable, and such as are needed are also described.

Forceps for Superior Teeth.—For the superior teeth the following six forceps are necessary:

One straight forceps for the central and lateral incisors and cuspids.

One bayonet-shaped forceps for the bicuspids and molar roots.

Two molar forceps (right and left) for the first and second molars.

One third molar forceps, applicable to both sides of the arch.

One superior root forceps for very small roots.

Fig. 1 shows the forceps designed for the superior central and lateral incisors and cuspids, known as Standard forceps No. 1. The beaks are alike and are convex in their transverse diameter on the outer surface, which curvature produces sharp cutting edges, and longitudinally they taper and terminate in rounded ends that closely approximate the contour of the necks of the teeth for which they are designed. In cases where time is an important factor and access can be had to the posterior teeth, all the superior teeth may be extracted with these forceps, provided the crowns of the molar teeth are broken down so as to separate the roots and these roots are not too firmly attached.

Fig. 2 shows the forceps designed for the superior bicuspids, known as Standard forceps No. 2. They are also applicable to superior molar roots. The beaks are alike, and of the same shape as those shown in Fig. 1, but narrower. They may be used also on the lateral incisors when displaced or broken down, and the narrowed space does not permit the regular incisor forceps to be used. When operating under a general anesthetic, with the intention of extracting a number of teeth, this instrument can often be used to advantage instead of Standard forceps No. 1 for the extraction of the anterior teeth, and also for the removal of the roots of all the superior molars and the molars themselves when attachment is not too firm.

Figs. 3 and 4 show the forceps designed for the superior first and second molars, known respectively as Standard forceps No. 3 R and No. 3 L. The beaks are bayonet-shaped, with their outer surfaces convex. The inner surface of the palatal beak is concave, and the beak terminates in a broad, oval point, which is rather thin and sharp. The buccal beak has a concavo-concave inner surface, which brings the end of the beak to a decided point, and the outer surface is of such bevel as to make the point sharp. This point fits snugly into the space between the buccal roots of normal teeth, for which it was designed, and is the distinguishing feature of superior molar forceps. Where there is reason to conclude that there may be considerable resistance, which is frequently experienced with the first molar, these forceps should always be used, as their shape is such that the pressure applied with them to the tooth acts as a powerful force in releasing it and, in a measure, overcomes any unusual resistance that may be encountered.

Fig. 5 shows the forceps designed for the superior third molars, known as Standard forceps No. 4. They are the same shape as Standard forceps No. 3 R and No. 3 L, except that the two beaks are uniform and narrower. The narrowed buccal wall of the superior third molar, due to the absence of one of the buccal roots or the fused condition of these roots, often makes the application of the pointed beak of the regular molar forceps impracticable and unsafe. The same is true of the first and second molars when in like condition. These forceps are also very practical when operating under a general anesthetic and extracting all the superior molars, especially where the alveolar

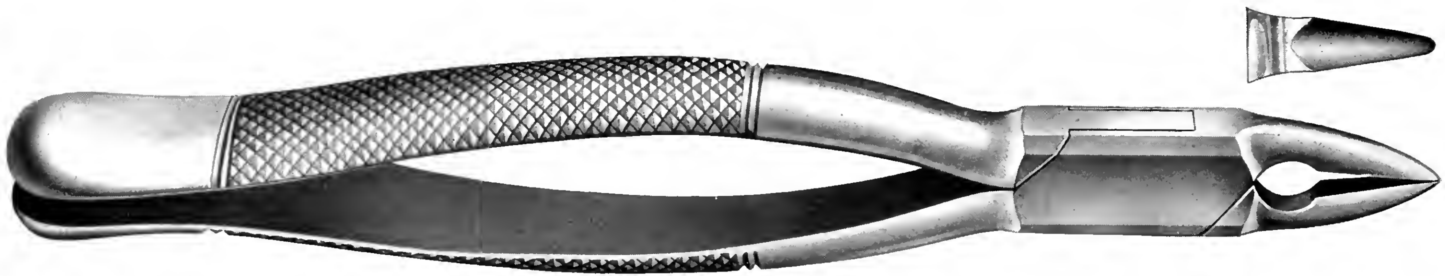


Fig. 1.—Standard Forceps No. 1. For extracting superior central and lateral incisors and superior cuspids. Both beaks are alike, and are set in line with the axis of the handles.

Fig. 2.—Standard Forceps No. 2. For extracting superior first and second bicuspids and superior molar roots. Both beaks are alike, and are set about three-quarters of an inch out of line with the axis of the handles, giving the beaks a bayonet shape.

Fig. 3.—Standard Forceps No. 3 R. For extracting superior right first and second molars. The beaks are different. The end of the buccal beak comes to a point, so as to fit between the buccal roots, and the palatal beak terminates in a broad oval point, which is rather thin and sharp. The beaks are set about three-quarters of an inch out of line with the axis of the handles, giving the beaks a bayonet shape.

Fig. 4.—Standard Forceps No. 3 L. For extracting superior left first and second molars. The beaks are like those shown in Fig. 3, except that they are reversed.

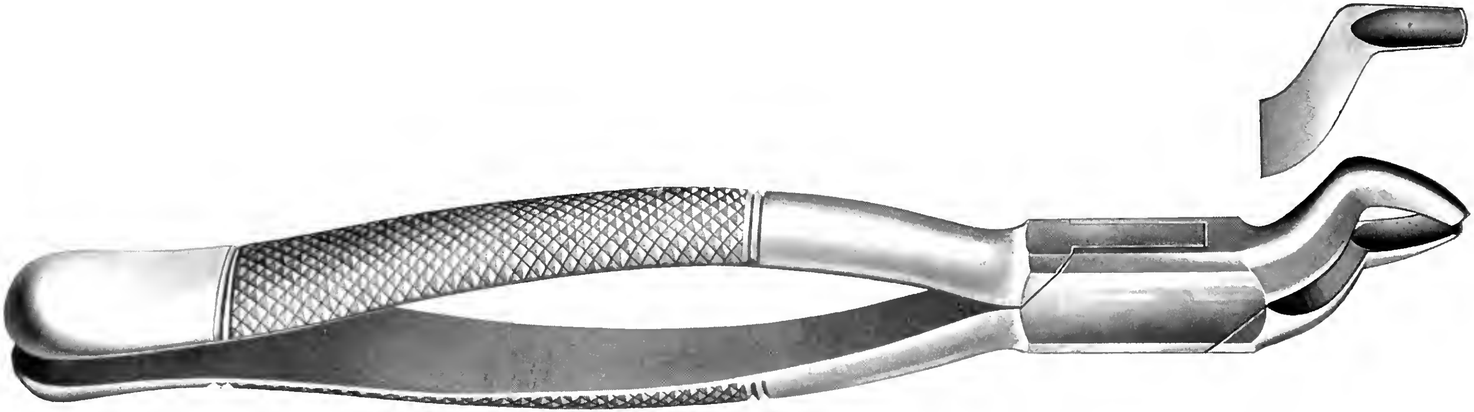


Fig. 5.—Standard Forceps No. 4. For extracting superior third molars. Both beaks are alike, and are set about three-quarters of an inch out of line with the axis of the handles, giving the beaks a bayonet shape.

Fig. 6.—Standard Forceps No. 5. For extracting superior roots. The beaks are long and narrow, and are slightly curved in their mesio-distal axis.

process is weakened by caries or the teeth are not too firmly attached.

Fig. 6 shows the forceps designed for the superior roots, known as Standard forceps No. 5. They resemble Standard forceps No. 1, except that they are lighter in general construction, the beaks are longer and narrower and are slightly curved in their mesio-distal axis, which allows their application to roots situated more distally than can be reached with the straight-beak forceps, while the narrow beaks permit them to be applied to roots that are wedged between adjacent teeth or to small roots that are situated under the gum margin. Indeed, these forceps are indispensable in some cases—especially where the two small roots of the superior first bicuspids are separated by decay or fracture.

Forceps for Inferior Teeth.—For the inferior teeth the following four forceps are necessary:

One forceps for central and lateral incisors, cuspids, bicuspids, and all inferior molar roots, applicable to both sides of the arch.

One molar forceps, applicable to both sides of the arch.

Two forceps for the ten anterior teeth, commonly known as hawksbill forceps.

Fig. 7 shows the forceps designed for the ten inferior anterior teeth and inferior molar roots, known as Standard forceps No. 6. They are applicable for the extraction of the ten inferior anterior teeth when space will permit their free application, and are also used for extracting molar roots. The beaks are set at an obtuse angle to the handles and curved downward. They are narrow, convex on the outer surface and concave on the inner surface, presenting sharp cutting edges and terminating in narrow, oval-like points. These beaks differ in a general way from the beaks of the superior forceps by presenting a second curvature, which allows the points to come close together, while considerable space is left between the long axis of the beaks, permitting them to be passed over the crowns of the lower bicuspids and allowing the ends of the beaks to be closely adjusted to the constricted necks of these teeth. When circumstances require it, the sharpened edges will facilitate the severing of portions of the alveolar process.

Fig. 8 shows the forceps designed for inferior molars, known as Standard forceps No. 7. They are used for the first and second molars, and to remove the third molar after it has been

Fig. 7.—Standard Forceps No. 6. For extracting the ten inferior anterior teeth and inferior molar roots. Both beaks are alike, are set at an obtuse angle to the axis of the handles, and are curved downward.

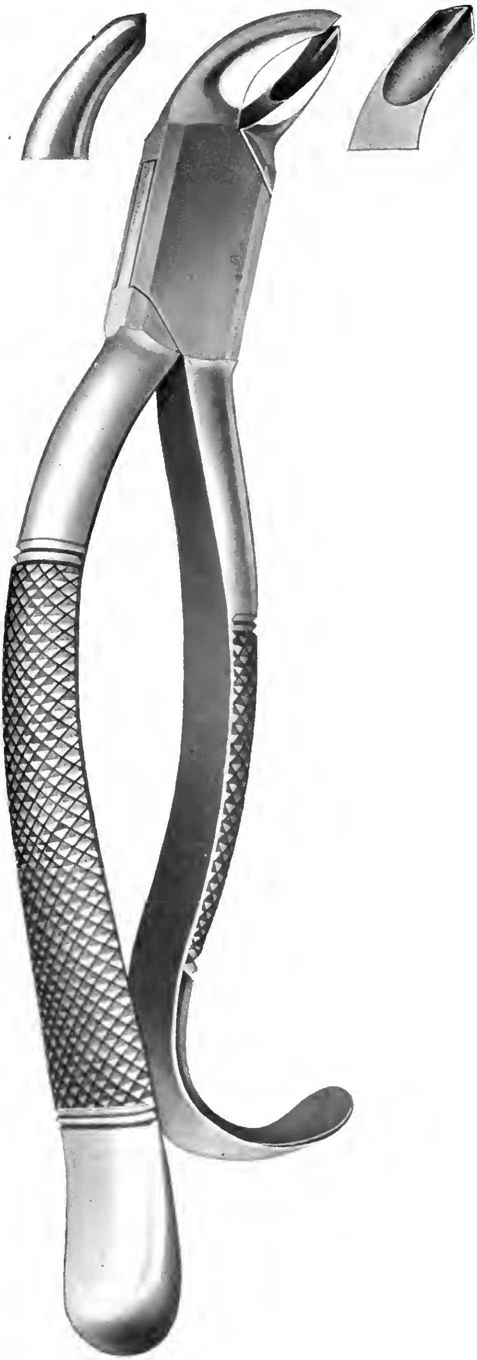


Fig. 8.—Standard Forceps No. 7. For extracting inferior molars. Both beaks are alike, are set at an obtuse angle to the axis of the handles, and are curved downward.

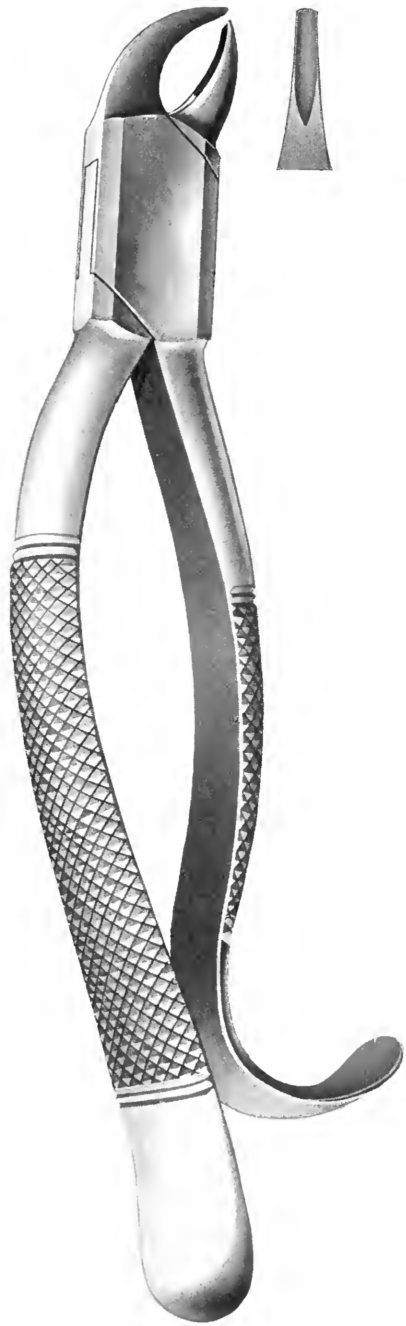


Fig. 9.—Standard Forceps No. 8. Supplemental forceps. For extracting the ten inferior anterior teeth. The lower beak is slightly shorter than the upper one, giving the beaks a hawksbill shape, and are curved downward.

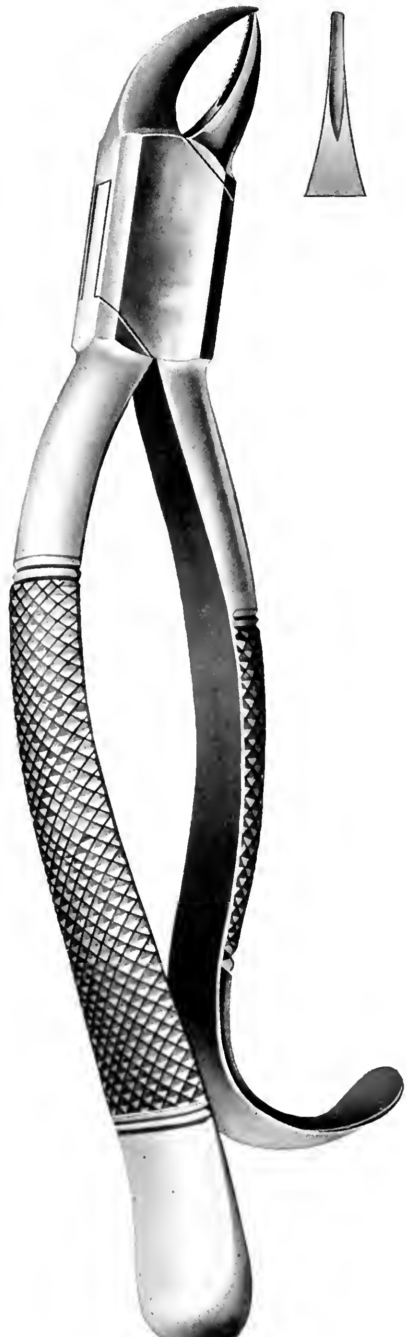


Fig. 10.—Standard Forceps No. 9. Supplemental forceps. For extracting the ten inferior anterior teeth. The beaks are like those shown in Fig. 9, except that they are longer and narrower.

loosened by the application of an elevator, or when the elevator is not indicated for its extraction. The beaks are set at an obtuse angle to the handles and are curved downward, so that when they are applied there is a clear view of the field of operation and clearance of the superior teeth. They are broad and convex on the outer surface, while their inner surface has a double concavity, terminating in a point or lip, thereby presenting a form which is a good counterpart of the buccal and lingual sides of the neck of an inferior molar. In applying them, the points of the beaks pass readily between the two roots of these teeth. The handles of these forceps are curved to the left of their main axis, which enables the operator to readily reach all parts of the inferior arch while standing back and slightly to the right of the patient and leaning over his head.

Figs. 9 and 10 show supplementary forceps also designed for inferior anterior teeth, known respectively as Standard forceps No. 8 and No. 9, and usually designated as hawksbill forceps on account of the peculiar shape of their beaks, which somewhat resemble the bill of a hawk. These forceps are used where any of the ten anterior teeth are irregular, or where the conditions are such that it is difficult or impossible to apply Standard forceps No. 6. The beaks are set at an angle to the axis of the handles, and are curved downward, the point of the upper beak extending slightly over the lower one, giving the beaks the characteristic hawksbill shape. The No. 9 forceps are a duplicate of No. 8, except the beaks are much narrower, thereby permitting them to be passed into spaces where the other forceps cannot be applied. As the inferior incisors are frequently in malocclusion, often making it difficult to apply Standard forceps No. 6 to them, no set of instruments for extraction is complete without these peculiarly shaped forceps, with beaks that pass easily into the narrow spaces often found in such cases.

The forceps described, and shown in Figs. 1 to 10, will suffice for the majority of cases in which forceps are indicated. They should be carefully examined from time to time, and given such attention as may be required. When the beaks become dull, they should be resharpened; and when the joints become loose, they should be tightened. If considerable operating is done with them, they will show the wear of service, but an occasional "toning up" will restore their usefulness.

The selection of a set of forceps is usually made at the beginning of the operator's career as an exodontist—at a time when practical experience has not demonstrated to him the value of the proper selection of forceps necessary to meet his demands. In such cases it is recommended that a set be selected as a unit, and to this set such forceps be added, in the course of his practice, as may be required. The set of Standard forceps described, and taken as a basis of illustration and description, has proved most satisfactory in the hands of the author. Some operators have, however, successfully used other makes of forceps, and for the information of those who prefer a different make the following comparative list of forceps, with the names of the manufacturers, is given:

Standard.	Claudius Ash, Sons & Co.	S. S. White Dental Mfg. Co.	Consolidated Dental Mfg. Co. Allen set.
No. 1—for superior incisors and cuspids..	No. 1	No. 201	No. 7
No. 2—for superior bicuspids, third molars, and molar roots...........	No. 52	No. 35	No. 8
No. 3 R—for superior right first and second molars.....................	No. 17	No. 253 R	No. 1 R
No. 3 L—for superior left first and second molars	No. 18	No. 253 L	No. 1 L
No. 4—for superior third molars.........	No. 19	No. 110	No. 2
No. 5—for superior roots................	No. 76 N	No. 76 A	No. 9
No. 6—for inferior incisors, cuspids, bicuspids, and molar roots...........	No. 48	No. 103	No. 4
No. 7—for inferior molars...............	No. 21	No. 215	No. 3
No. 8—hawksbill, with broad beaks, for inferior anterior teeth..........	No. 105	No. 209	No. 5
No. 9—hawksbill, with narrow beaks, for inferior anterior teeth.........	No. 106	....	No. 6

Special Forceps.—Figs. 11 and 12 show the forceps designed for the ten superior anterior teeth when out of alignment with the arch and the approximating space is narrowed, known respectively as Standard special A forceps and Standard special B forceps. These forceps are modifications of Standard forceps No. 2, and do not differ materially from the latter, except in the beaks, one beak being much narrower than its opposing one. They are made in pairs, affording the means of a ready application to a tooth that may be out of alignment, on either side of the arch, where the adjacent teeth closely approximate each other. The cases requiring these instruments are not numerous, but when a case of this character is presented they are very

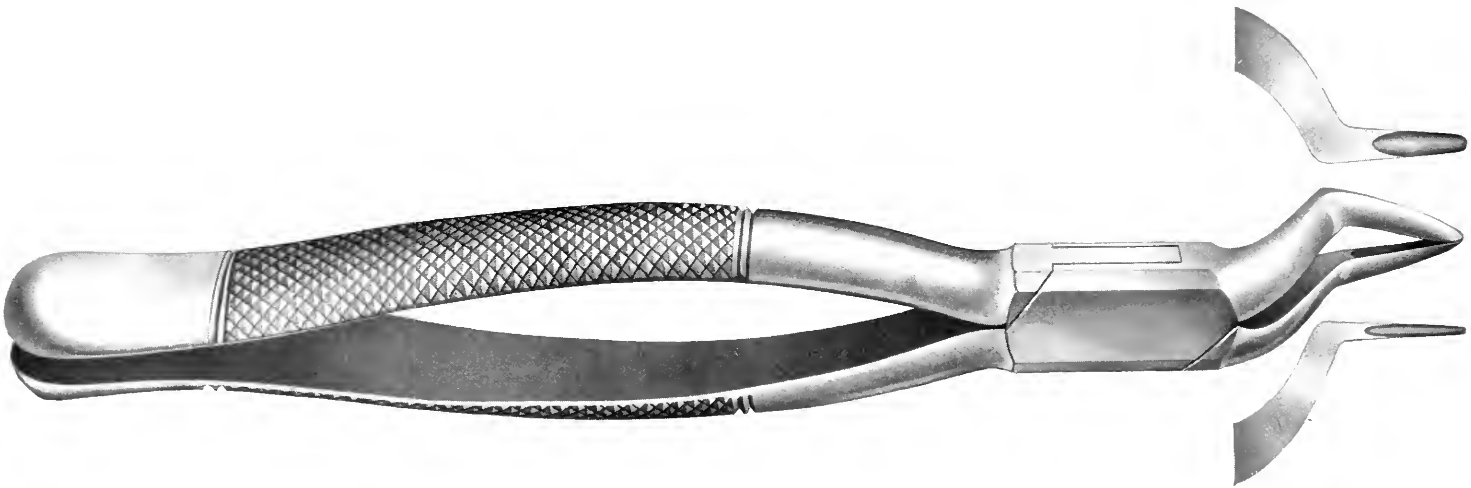


Fig. 11.—Standard Special A Forceps. For extracting the ten superior anterior teeth when out of alignment with the arch and the approximating space is narrowed. The beaks are different. One beak is narrower than the other, and both beaks are set about three-quarters of an inch out of line with the axis of the handles, giving the beaks a bayonet shape.

Fig. 12.—Standard Special B Forceps. For extracting the ten superior anterior teeth when in the same condition as those described in Fig. 11, but in opposite position. The beaks are like those shown in Fig. 11, except that they are reversed.

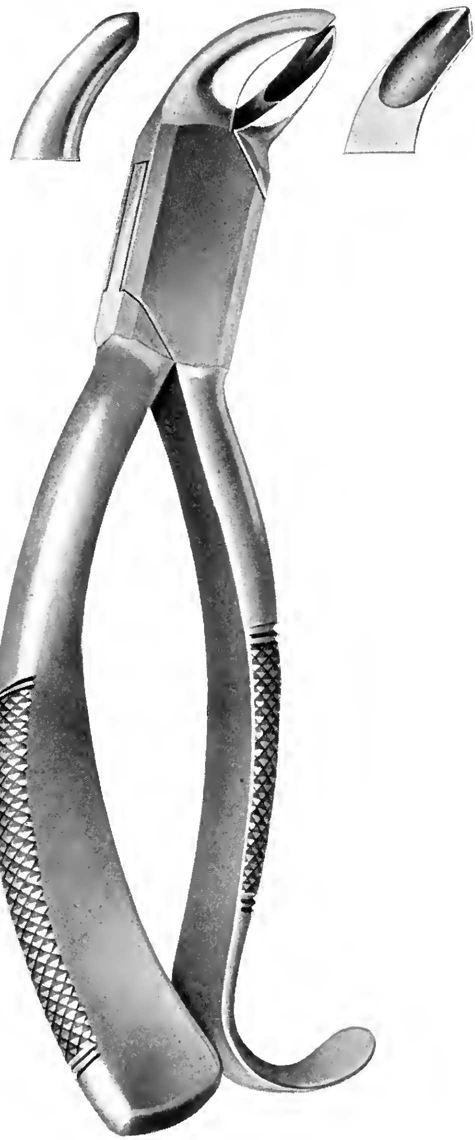


Fig. 13.—Author's Improved Standard Forceps No. 7. For extracting inferior molars. The improved feature consists in cutting about an inch off the long handle of Standard forceps No. 7 and forging a lug to the shortened handle, which obviates a shifting of the hand during any stage of the operation and affords a better grip.

Fig. 14.—Holding the Forceps. Illustration shows the manner of properly holding the straight-handle forceps (in this case Standard forceps No. 2, shown in Fig. 2) in the right hand.

serviceable, as their use may prevent disagreeable fractures of the tooth to be extracted or of the adjacent teeth, which so frequently occur by the use of the forceps not adapted to this condition.

Fig. 13 shows the author's improved lower molar forceps, designed as an improvement on Standard forceps No. 7 (Fig. 8), and this modification is made by cutting about one inch off the long handle of Standard forceps No. 7 and forging to the shortened handle a lug, as shown in Fig. 13, by which a broad, heavy oval end is obtained. In the application of Standard forceps No. 7 there are three essential movements—(1) the forceps are applied to the neck of the tooth, and the hand is shifted back so as to bring the end of the long handle into the palm of the hand; (2) pressure is now applied to send the forceps down upon the neck of the tooth; (3) the hand is again shifted back to the original position, the tooth firmly gripped, and the extraction movements begun. With these forceps as improved by the author this sequence of movements is unnecessary. The enlarged end of the handle fits snugly into the palm of the hand, and thus allows pressure to be readily applied during any time that the tooth is being grasped. As the hand remains in one position on the handle during the entire operation, the possibility of the forceps slipping off their adjustment, and producing possible laceration or contusion, is greatly lessened. The improvement of these forceps serves still another purpose in that, the handle being of greater thickness than those of Standard forceps No. 7, the hand remains more open, thereby affording the means of a better grip and steadier pressure during the operation.

The selection of the forceps comprising Figs. 1 to 13 has proved adequate, in the hands of the author, for all cases in which forceps are indicated, but any one desiring a greater number can be accommodated by applying to the manufacturers of forceps, who have these instruments in different shapes and sizes.

Holding the Forceps.—Having selected the proper forceps for the tooth to be extracted, the instrument is taken in the right hand, directing the beaks upward for the superior teeth and downward for the inferior teeth. One handle is placed toward the palm of the hand, and the opposing handle is engaged with the fingers. The thumb is placed on the inner surface of the handle that is away from the palm of the hand, and is used in opening and closing the forceps. The handles are then opened sufficiently for the beaks to pass over the tooth that is to be removed, and the forceps are directed toward it. Care must be taken, during the introduction of the forceps into the mouth, not to impinge on any of the soft tissues, and to keep the beaks as nearly as possible in line with the axis of the tooth to be extracted. As soon as the beaks reach the tooth, they are directed over the crown and are closed upon its neck. The thumb is then withdrawn from between the handles and placed on the outside, the handles being gripped at the same time so as to close the beaks sufficiently to hold the forceps in place. The hand is now shifted backward so as to bring the swell-end of the handle into the palm of the hand (Fig. 14), when pressure is applied and the beaks are sent to the marginal ridge of the alveolar process.

If the tooth is extensively decayed and the marginal ridge of the alveolar process affected by caries, the beaks may be sent to a point beyond its edge, thereby affording a firmer grasp of the root. Too much pressure should not be applied, but only sufficient to obtain a secure hold, as there is always danger of crushing the tooth. As soon as this hold has been obtained, the proper extraction movements are begun. After the tooth has been loosened and is ready for its exit from the socket, the operator should be careful not to injure the lips or other teeth with the forceps in the tractile movement. The forceps should be continually under the most perfect control, and should never be misguided or permitted to slip from the adjustment. After the forceps have been applied to the tooth, it should be carefully observed by the operator throughout the extraction movements.

ELEVATORS.

The elevator is an instrument designed primarily for loosening a tooth or root from its attachment preliminary to its final removal with the forceps or tweezers. It acts on the principle of a lever, wedge, or inclined plane, taking either a contiguous tooth, the alveolar process, or the operator's thumb or finger as the fulcrum or supporting abutment, and the tooth or root to be dislodged as the weight. Its use is indicated with a tooth or root to which forceps cannot be readily applied, as in the case of a fractured, extensively decayed, inaccessible, wedged, or impacted tooth. It is also a valuable instrument in the extraction of a tooth that is so situated in relation to the other teeth or parts of the mouth that, when the forceps are applied, force cannot be brought to bear in a direction that will effect its release. In fact, the elevator should be given preference to the forceps in most cases of badly broken-down teeth, as its use under such conditions will often prevent excessive laceration. It is often surprising what excellent results can be obtained with the elevator when properly used, and, its appearance being entirely different from the forceps, a patient who is not under a general anesthetic will submit to a free application of it with much less apprehension than to the use of the forceps. Adjunctively and in advance of the forceps, its use is at times indispensable, particularly with the inferior third molar, the loosening of the tooth in the manner indicated often preventing a fracture and greatly simplifying the operation.

The shank and blade of an elevator should be constructed in one piece, which should be of the best steel, and properly formed to accord with the location of the teeth for which it is designed, the point or edge of the blade being kept sharp when designed for cutting. The metal handle, which is a continuation of the shank, should be shaped to fit comfortably into the palm of the hand to allow a firm grasp.

The elevators described have been found most effective in usage, and are so simple in their construction that by a little practice their proper manipulation is readily acquired. The beginner should avoid haste in operating with this form of instrument. He should adjust the blade with precision, and apply the power gently, but firmly, maintaining perfect control of every movement, for, should the blade slip from the position in which it is engaged, considerable laceration of tissue may ensue.

Straight-Shank Elevator.—The simplest form of elevator is shown in Fig. 15. The shank is straight and in direct line with the axis of the handle. The blade is a continuation of the shank, being bent only slightly out of its line, and is about three-sixteenths of an inch in width, convex on one side and concave on the opposite; it tapers down to a thin, oval point, which gives it a wedge-like form, being suitably shaped for adaptation to the convex surface of the neck of a tooth. It is used where direct access is obtainable and where little cutting of process is required; and for teeth not too firmly attached, as badly broken-down roots or deciduous teeth, this elevator is a valuable instrument. It is held by placing the handle well into the palm of the hand, the index finger and thumb resting on the shank to guide the instrument, while the remaining fingers firmly grip the handle. In use it should be adjusted to the more accessible and, if possible, stronger part of the tooth, and sufficient force of a pushing nature, combined with a lever-like action, applied to lift the tooth from the socket.

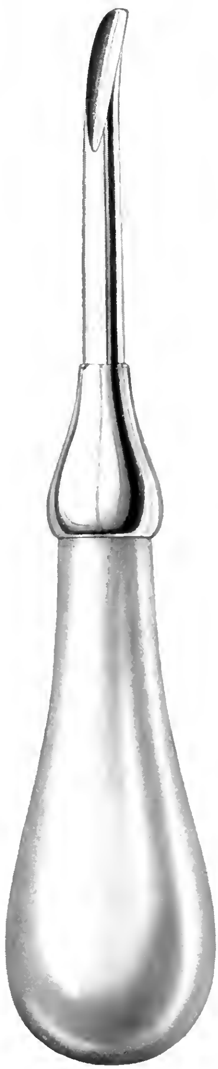


Fig. 15.—Straight-Shank Elevator. For extracting superior anterior roots. Used also for superior and inferior deciduous teeth and posterior inferior roots not firmly attached.

Curved-Shank Elevator.—This elevator (Fig. 16) is a modification of the primary form of elevator, so as to permit its use in a case where the parts are inaccessible to direct application. The shank is bent out of a direct line by a double angular curve, and terminates in a blade that is set at an obtuse angle to the long axis of the instrument. It is made in pairs, which, combined with its double curvature, renders either one or the other instrument applicable to all parts of the inferior arch. The point is concaved, and, rounding down to a thin edge, forms a good counterpart to the alveolar process surrounding the inferior teeth. This elevator is used for inferior incisor, cuspid, bicuspid, and molar roots. Application can be made to the lingual or labial surface of a tooth, although the labial surface is usually the more favorable.

Labial Application.—In applying the curved-shank elevator to the labial side of a root, the blade is forced as far down as possible under the free margin of the gum with a steady downward pressure. After adjustment is secured, pressure is applied lingually in conjunction with an upward movement, dislodging the tooth from its socket. If, during the effort to dislodge the tooth, resistance is encountered, the blade is forced further down on the root each time pressure is exerted, the sharp edge of the instrument cutting into, when necessary, a portion of the process to loosen the tooth.

Lingual Application.—When making a lingual application, the blade of the elevator may be set somewhat lower on the tooth than in the case of a labial application, as the process on the lingual side yields more readily. Less force is applied, and the extraction movement, while slightly labial, should be directed principally upward. Care should be taken to maintain a secure adjustment of the elevator.

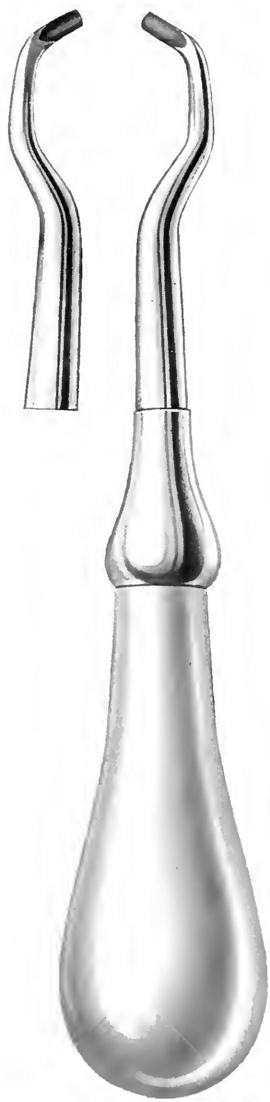


Fig. 16.—Curved-Shank Elevator. For extracting inferior roots. Made in pairs.

Knott Elevator.—This elevator (Fig. 17), designed by Dr. F. W. Knott, is made in pairs, Nos. 1 and 2, for mesial and distal application. The shank is about two inches long, and bent

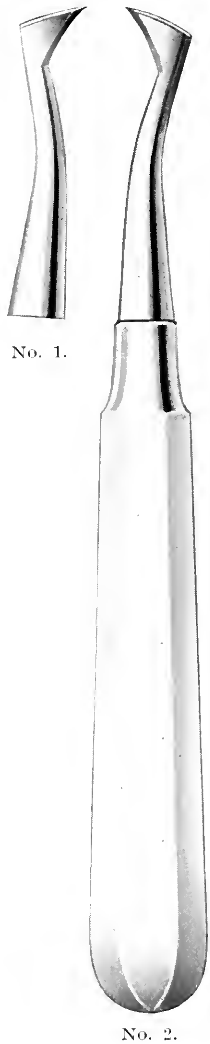


Fig. 17.—Knott Elevator. For extracting inferior molar roots. Made in pairs, Nos. 1 and 2, for mesial and distal application.

slightly upward the last half inch of its length, so as to allow the point to be inserted in line with the long axis of the root, while the shank remains well above the gum margin, which permits a firm downward pressure. The blade is triangular in shape, three-eighths of an inch long, slightly curved, with the outer edges beveled, and terminates in a sharp point. It is used mainly for the extraction of the posterior inferior teeth where there is an adjacent tooth or heavy process to serve as the fulcrum. When applied, it is held firmly in the right hand, and the point is passed between the root to be extracted and the contiguous tooth and alveolar process, with the broad surface of the blade toward the root, pressure being applied in a downward direction. When thus forced between two bodies, it acts as a wedge, and separates them from each other. The top of the handle is turned toward the fulcrum sufficiently to cause the point to take a firm hold on the root, after which a further turn of the handle will raise the root from the socket.

The author has found that the Knott elevator possesses many good features, and, by slight modification, has greatly increased its usefulness. A regulation pair, reduced about one-third of the original size, are well adapted to the extraction of fine, delicate roots that are either deep-seated or wedged between adjacent teeth, especially when the intervening space is so narrow that only a small instrument, such as this elevator, can be applied for their removal. They should be made with all-metal handles instead of wooden handles fastened to metal shanks, as usually manufactured, for, if made of one piece of metal, they can be sterilized by heat without loosening the handles.

Author's Lower Root Elevator.—This elevator (Fig. 18) was designed by the author for the extraction of inferior molar roots, and is made in pairs, Nos. 1 and 2, for mesial and distal application. In practice it has proven to be a most efficient instrument, and its use is indicated where the roots are partially united or entirely separated, and where they are covered by soft tissue or deeply seated. In most of these conditions it is superior to any other instrument, and it is invaluable as the primary instrument in the removal of an inferior third molar that is displaced too far buccally for the second molar to be used as a fulcrum, or where the third molar is isolated, whether the crown is intact or has been destroyed by caries. A secure adjustment and firm leverage can be obtained with the elevator. The blade is of a size that will bear a great amount of severe usage, but is not too large to interfere with its free application. The edges of the blade are

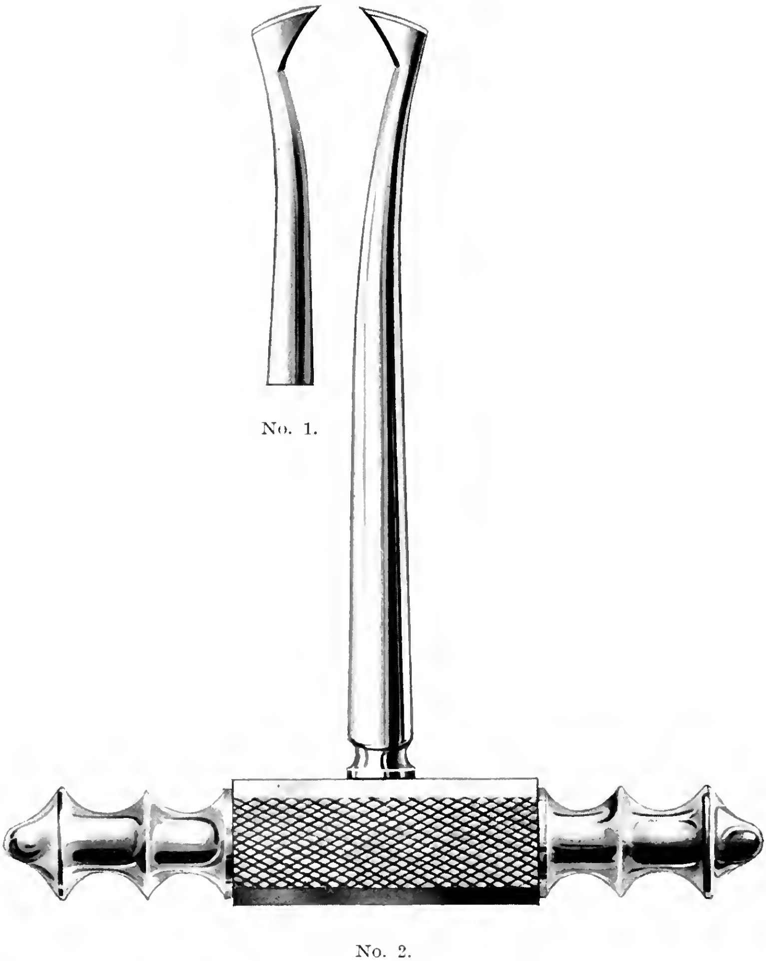
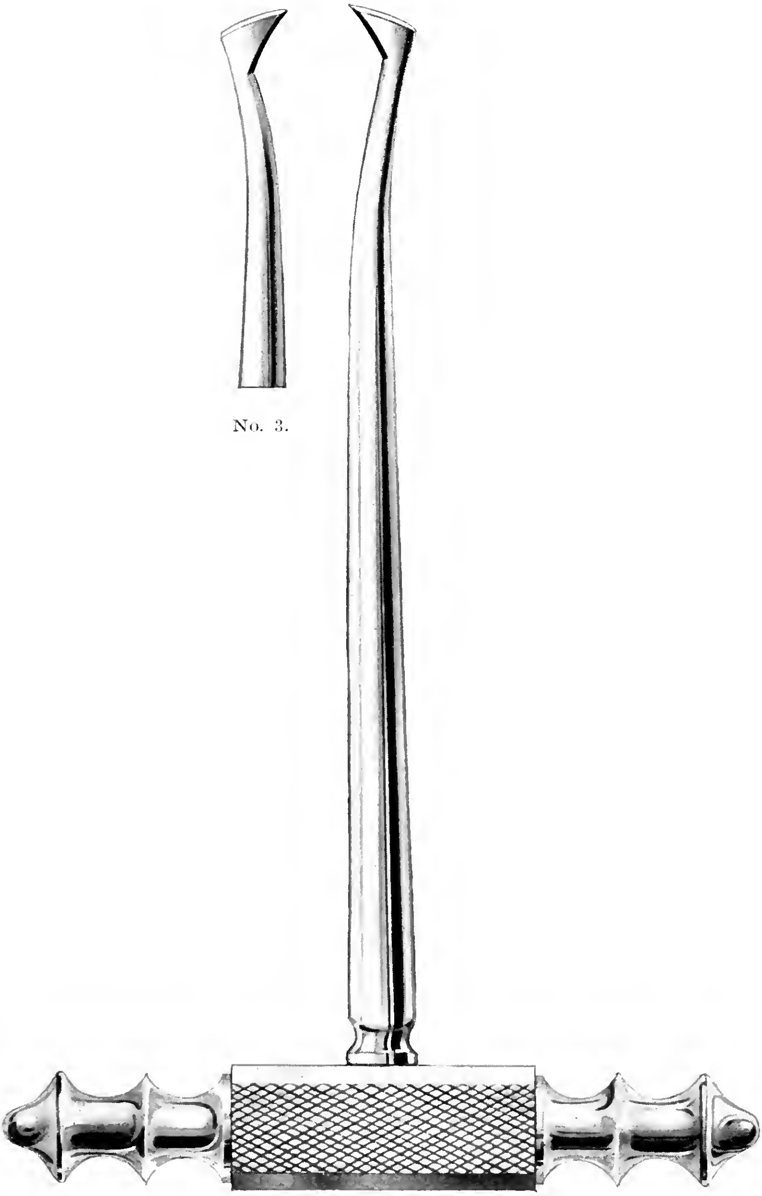


Fig. 18.—Author's Lower Root Elevator. For extracting inferior molar roots when partially united or entirely separated. Used also for the removal of isolated and displaced inferior third molars. Made in pairs, Nos. 1 and 2, for mesial and distal application.

sufficiently sharp to cut through the alveolar process when necessary, and the point is so shaped that it can readily engage the root of a tooth. The handle is of such form that it may be securely held in the hand, as shown in Fig. 19, and, if during the execution of any extraction movement with this elevator heavy resistance is encountered, the instrument can be kept in perfect control. In addition to this pair, it is advisable to have a pair with the shank about one and one-half inches longer (Fig. 20), Nos. 3 and 4, to enable the operator to work on the left arch from the right side of the patient whenever possible.

Fig. 19.—Holding the Elevator. Illustration shows the manner of properly holding an elevator (in this case the author's lower root elevator No. 2, shown in Fig. 18) for making an application.

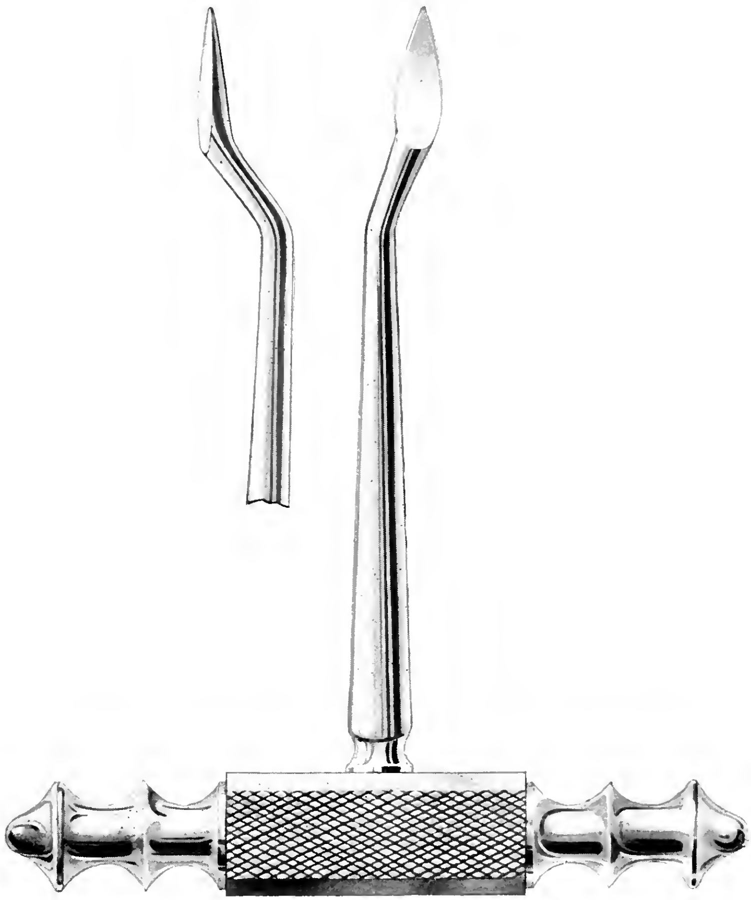
Lecluse Elevator.—This elevator (Fig. 21) is used mainly in the extraction of the inferior third molar, and for this purpose it is far superior to the Physick forceps, which are so commonly used in such case. It can be used also for the inferior second molar when the third molar is missing. While both the Physick forceps and Lecluse elevator were designed for the same purpose, the methods of their use are very dissimilar. Force is more effectively transmitted with the elevator, with less stress on the fulcrum, than with the forceps, especially where the tooth to be removed is impacted. In the transmission of force the forceps act first as a double wedge and then as a lever, working over the contact point of the approximating tooth, which in such case becomes the fulcrum. This application subjects the tooth that is being used as a fulcrum to severe strain at its neck, which may



No. 3.

No. 4.

Fig. 20.—Author's Special Elevator. Same instrument as shown in Fig. 18, except that the shank is one and one-half inches longer, so that it may be used for operating on the left side of the arch from the operator's position on the right side of the patient. Made in pairs, Nos. 3 and 4, for mesial and distal application.



No. 1.

Fig. 21.—Lecluse Elevator. For extracting inferior third molars. Used also for the second molar when the third molar is missing. The smaller illustration gives another view of the angle in the shank. Regular length, No. 1.

result in a fracture. With the elevator the force is transmitted to the tooth to be removed on the principle of the inclined plane, using the gingival third of the approximating tooth as the abutment, which greatly reduces the strain on this tooth. It is probably a little more difficult to master the manipulation of the elevator, but, once mastered, a better, safer, and surer operation can be accomplished with it than with the Physick forceps. The manner of holding this instrument is shown in Fig. 22, and the technic of its employment in the removal of the inferior third molar is described in the text on that subject.

Two Lecluse elevators, or what may be termed a set, are necessary for a proper equipment—viz., one a regulation-length ele-

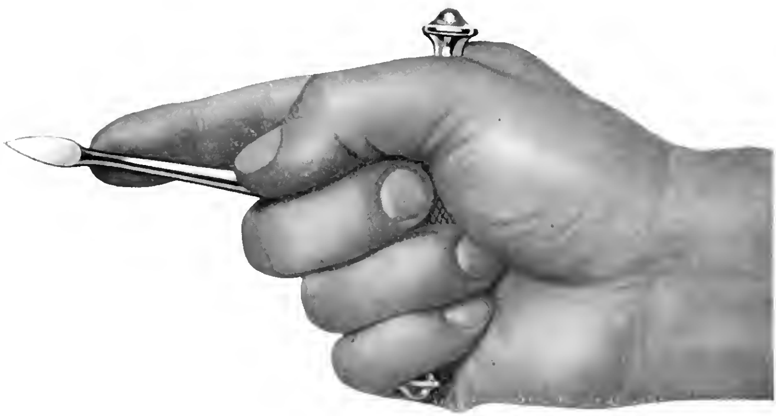


Fig. 22.—Holding the Elevator. Illustration shows the manner of properly holding an elevator (in this case the Lecluse elevator No. 1, shown in Fig. 21) for making application.

vator as usually made, to be used for teeth on the right side of the arch, and the other with the shank lengthened one and one-half inches, as designed by the author (Fig. 23, No. 2), for operations on the left side of the arch while the operator is standing on the right side of the patient.

Cryer Elevator.—This elevator (Fig. 24) is similar to the Knott elevator, but the blade is thinner and narrower, and tapers to a finer point. It is made in pairs, Nos. 1 and 2. The shank and blade of the instrument are in one piece, and the handle, which is of metal, is of a size to afford a secure grip (Fig. 26). This elevator is not strong enough to be used on the inferior first molar roots when they are large and firmly attached, but, when

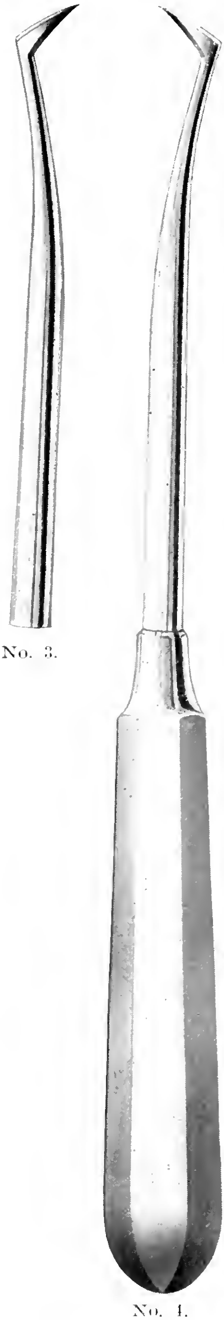
No. 2.

Fig. 23.—Author's Modified Lecluse Elevator. Same instrument as shown in Fig. 21, except that the shank is one and one-half inches longer, so that it may be used for operating on the inferior left third molar from the operator's position on the right side of the patient. Modified length, No. 2.

No. 1.

No. 2.

Fig. 24.—Cryer Elevator. For extracting roots. Made in pairs, Nos. 1 and 2.



No. 3.

No. 4.

Fig. 25.—Author's Modified Cryer Elevator. Same instrument as shown in Fig. 24, except that the shank is one and one-half inches longer. Made in pairs, Nos. 3 and 4.

the surrounding tissues are partially broken down and the roots are loosely adherent, good work can be done with it if properly used. For superior molar roots and other small roots it may often be used to advantage.

The author has also increased the efficiency of this instrument by designing a pair with the shank one and one-half inches longer than the standard size (Fig. 25, Nos. 3 and 4). This instrument is used to operate on the roots of teeth in the left side

Fig. 26.—Holding the Elevator. Illustration shows the manner of properly holding an elevator (in this case the Cryer elevator, shown in Fig. 24) for making an application.

of the mouth without the operator changing his position from the right side of the patient, and for cases difficult of access with the shorter instrument.

SCREW-PORTES AND REAMER.

Screw-Portes and Morrison Reamer.—The screw-porte is used only for the extraction of roots. It is especially serviceable where a tooth is decayed or is fractured below the margin of the alveolar process, and the soft tissues almost cover the root, making it difficult to apply the forceps or elevator to extract it without severely injuring the surrounding tissues. The location most available for the use of the screw-porte is the region of the six superior anterior teeth, as these teeth naturally have large root canals, which is favorable to the introduction of the screw. Its employment in the removal of the superior first bicuspid is not generally practicable on account of the bifurcated roots, but, if the roots are separated and the canals large enough to receive the screw, it can be used. It may be used also for the superior second bicuspid, particularly if the patient has a mouth that permits free access to the tooth. For the superior molar roots it is not well adapted, except when the roots are separated from each other and accessible, in which case good work may sometimes be done with it.

Fig. 27.—Morrison Reamer. For removing soft decayed tooth structure from a root canal preceding the application of a screw-porte.

The canals of the four inferior incisors are too small for the reception of the instrument, and consequently it cannot be employed successfully with these teeth. A screw-porte made fine enough to enter these canals would not have sufficient strength to withstand the strain necessary for the extraction. The inferior cuspids and bicuspids are more favorable for its use. The operator must, however, maintain a direct line with the tooth when the instrument is inserted and during the extraction, which in such cases is acquired by a position directly over the head of the patient. With the inferior molars the use of the screw-porte is prohibited in the anterior roots on account of the two canals. It may sometimes be used in a posterior root when the shape of the canal and the location of the root is favorable.

When a tooth has been mutilated by an attempted extraction and the pulp has been removed, the screw-porte will often be found to work excellently, but its utility is uncertain in a case where the roots are extensively decayed. If, however, the decay is not extensive, the soft, decayed structure may be removed from the root canal with the reamer (Fig. 27) or with a bur, after which the screw-porte is inserted into the canal and given a half-turn, the half-turn being repeated until the instrument is firmly attached to the root. A little practice will enable the operator to adjust the screw-porte with dexterity. After a good hold is secured, a firm grip is taken on the handle, and the root is extracted by force exerted in a direct line with the axis of the root. No luxation should be tried, as such attempt is liable to break the instrument. Caution must also be exercised against splitting the root in an effort to secure too firm an anchorage. If, however, the root splits, the screw

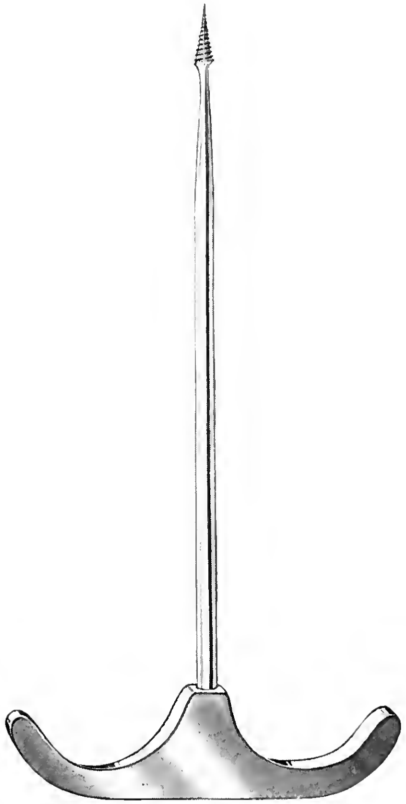


Fig. 28.—Long-Shank Screw-Porte. The handle is permanently attached to the shank.

Fig. 29.—Long-Shank Screw-Porte. Without handle. The shank has a ring end for receiving a small bar as a handle.

will usually bring out one of the segments, and perhaps both. The remaining part, if any, can be loosened by inserting an ordinary enamel chisel between the root and the alveolus, using the process as a fulcrum, and applying pressure. When the root fragment gives way, its final removal may be accomplished with Derenberg tweezers.

The screw-porte should be made of steel, and the threads must be sharp to insure a safe hold. If the threads become worn, they should be resharpened or the instrument discarded. The handle should be made sufficiently strong so that it will not break when the tractile movement is imparted. Whenever conditions allow it to be introduced into the root, the style of instrument shown in Fig. 28 should be given preference. This style is made about three and one-half inches long, with screw-shaft and handle united. The operator can maintain a firmer and steadier grip with this screw-porte than with one where a separate handle is improvised, as shown in Fig 29, which has a ring on the end for the reception of a small instrument or bar to act as a handle for screwing it into position and for the extracting movement. The use of the latter is indicated only when the loca-

Fig. 30.—Short-Shank Screw-Porte. Without handle. The shank has a ring end for receiving a small bar as a handle.

Fig. 31.—Keith Screw-Porte. Used where a screw-porte with a shank cannot be applied.

tion of the root will not permit the fixed handle of the former to be turned in order to introduce it into the root. An instrument with a shorter shank (Fig. 30) is used for bicuspid and molar roots, and is manipulated in the same manner as the long one.

Keith Screw-Porte.—Roots that are not accessible to shank screw-portes (Figs. 28, 29, 30) may sometimes be extracted with a smaller instrument designed by Dr. H. H. Keith (Fig. 31). The screw and handle of this instrument are constructed in one piece, and there is no intervening shank. The screw is inserted into the root canal, and the handle turned with the fingers until the screw has taken hold, after which the turning is continued by the application of forceps to the handle until the screw is firmly fastened. As the beaks of the forceps are already on the instrument, it is only necessary to apply the tractile movement to complete the extraction, taking care to extract in line with the axis of the root.

DERENBERG TWEEZERS.

These tweezers (Fig. 32) are made with the blades constructed similar to those of root forceps, but not so heavy or so strong. They are very practical in removing a part of a tooth or root that is loosely attached to the tissue. The tweezers are amply strong to detach such roots, as well as loose particles of process, overhanging tissue, and deciduous teeth that do not offer much resistance. They are also employed in dressing wounds, carrying cotton and gauze, removing blood clots, etc. In fact, the uses to which they are adapted are so varied that these tweezers are practically indispensable in a well-appointed office. When they are used to serve the same purpose as forceps, the mental effect on the patient is not so intimidating, which is a specially valuable consideration with children or nervous patients.

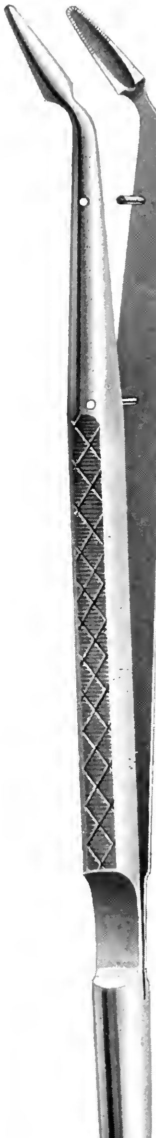


Fig. 32. — Derenberg Tweezers. For removing loose process and roots, dressing wounds, and for all purposes requiring heavy tweezers.

LANCET.

A practical lancet (Fig. 33) is the all-metal Volland lance, with a flat handle of convenient thickness. The ebony- or ivory-handled in-

Fig. 33.—Lancet. For lancing soft tissue over roots and over impacted and around isolated teeth. Used also for all minor incisions.

strument cannot be recommended, as it is almost impossible to keep it sterilized. The lancet is used to sever the soft tissue from around teeth wherever it is adherent to them, to cut away

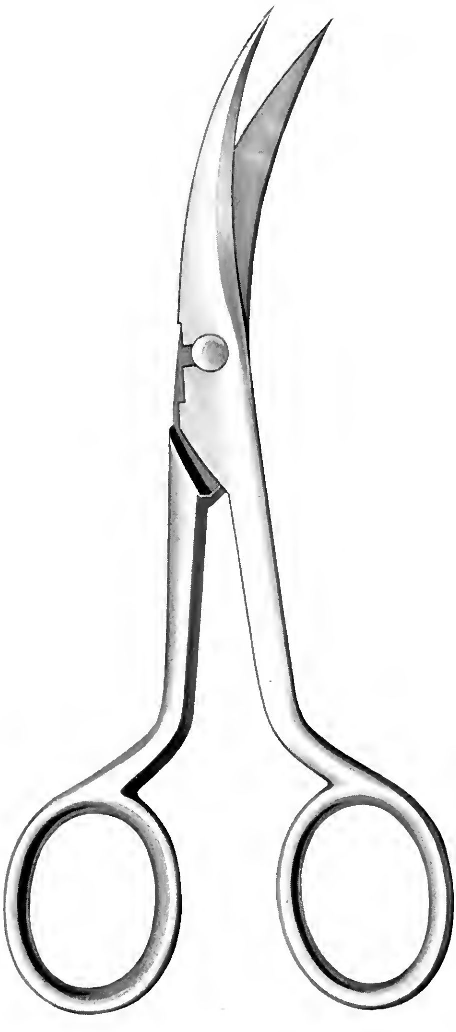


Fig. 34.—Curved Scissors. For cutting away soft tissues around a socket and over a tooth, and for making incisions. The blades are separable, so that the scissors can be readily sterilized.

superfluous tissue, relieve abscesses, and make all minor incisions. It should be employed sparingly preceding the operation of extraction, as the consequent hemorrhage obscures the field of operation and renders the application of the forceps uncertain. Frequently it is used unnecessarily with deciduous teeth, as these teeth are seldom firmly attached, and the lancing of the gum has a tendency to frighten the little patient, often making a difficult task out of an otherwise simple operation.

CURVED SCISSORS.

Curved scissors (Fig. 34) are often needed, and are used for severing gum tissue from loose teeth or roots, and for clipping the tissue from around the socket after extraction. When access can be had, more accurate incisions over impacted teeth can be made with them than with the lancet. To permit easy sterilization, the scissors with a separable joint are preferred.

SYRINGES.

Standard Syringe.—In Fig. 35 is shown a standard form of syringe used for clearing debris from around the tooth prior to operating and for treating a socket after extraction. Considerable force can be obtained with it—sufficient to wash any loose particles of tooth structure or alveolar process from a socket—and it is almost indispensable for irrigating abscess pockets. Though not always to be had, a compressed air

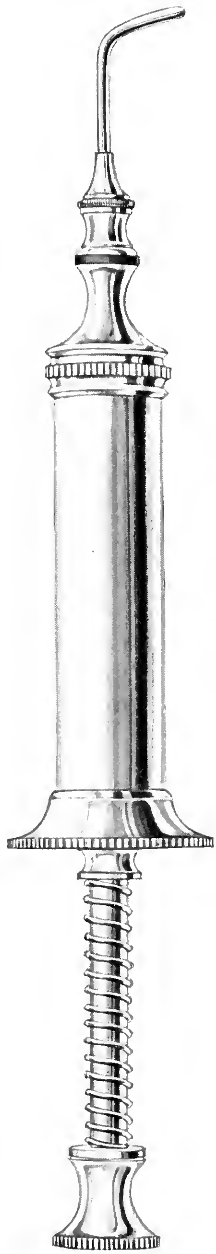


Fig. 35.—Standard Syringe. For irrigating and cleansing oral surfaces and lesions. Made of metal.

outfit, with a full complement of spray bottles, may be used instead of this standard form of syringe.

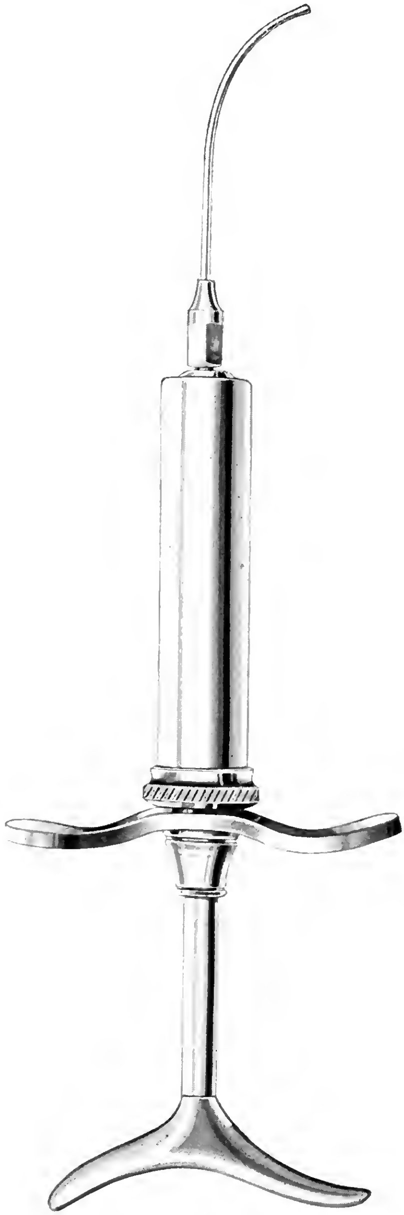


Fig. 36.—Bismuth Syringe. For carrying bismuth paste into a socket or a sinus.

Bismuth Syringe.—In Fig. 36 is shown a syringe of comparatively recent origin, which is used for carrying bismuth paste into tooth sockets and sinuses when such procedure is indicated. It has a metal barrel, fitted with a metal plunger, and its breech is readily unscrewed, allowing the removal of the piston for the purpose of filling the instrument. It is fitted with a broad finger-piece, which, in conjunction with the large butt on the end of the piston-rod, permits the application of such pressure as may be necessary to force the semi-solid contents of the syringe into any desired area. As supplied by the manufacturer, the instrument is furnished with two needles—one is a long-shank hypodermic needle and the other a larger needle with blunt point. The fine needle is not so practical, however, as the larger one for use in connection with the treatment after the extraction of a tooth.

When introducing the paste, the blunt point of the needle should reach the apex of the socket and is gradually withdrawn as the socket becomes filled. A layer of gauze placed over the filled socket will prevent the escape of the paste.

CURET.

The curet is an essential instrument for the exodontist. The one shown in Fig. 37 is a double-ended spoon curet, which is a very practical form of this instrument for use in the mouth. The shape is such that all of the alveoli may be reached with it, and, being double-ended, affords a means of a quick change of instruments, which is an important feature, because it is frequently necessary to curet several sockets at one sitting. Dexterity in the use of the curet should be cultivated, as in many cases of inflammatory conditions about a tooth nothing else will afford the same degree of relief after its extraction as a careful curetting of the socket, further relieving the congested condition, causing a more liberal evacuation of pus, or insuring the removal of gangrenous or necrotic tissue.

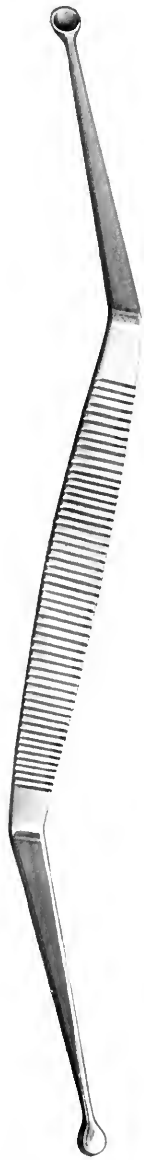


Fig. 37.—Curet. For curetting a socket after extraction.

MOUTH-GAG.

The mouth-gag shown in Fig. 38 was designed by Dr. A. Brom Allen, but the blades have been slightly modified by the author. It is intended to take the place of the Mason or the Doyen-Jansen gag for opening the mouth. In a case where there is a tension of the muscles, caused by inflammatory conditions, the use of the mouth-gag may be necessary, as access to the field of operation in such cases can be gained only by forcibly opening the mouth. When a general anesthetic is administered, especially nitrous oxid and oxygen, the prop is sometimes displaced, particularly with children, when it may also be necessary to open the mouth with a gag.

The long handles of the Allen gag present an advantage over the Mason or the Doyen-

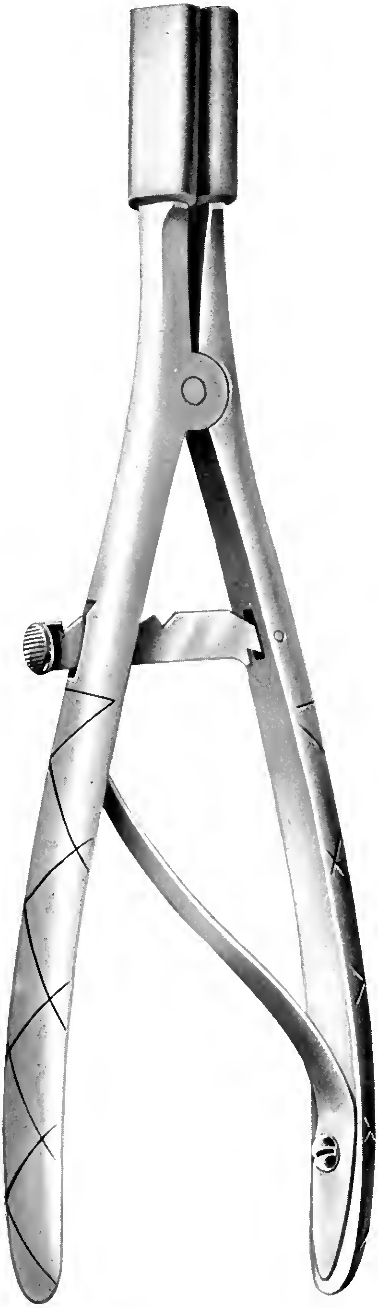


Fig. 38.—Allen Mouth-Gag. Two-thirds actual size. For opening the mouth where there is a tension on the muscles, and for holding the mouth open where the mouth-prop has been displaced during the administration of a general anesthetic.

Jansen gag, as with them the instrument can be held more steadily, thereby increasing the ease of the manipulation and reducing to a minimum the danger of slipping, and also affording greater leverage. The blades are strong, and taper to quite a thin, but dull, edge. The instrument should be applied by the operator's assistant, who inserts the blades between the teeth, and, by closing the handles, opens the mouth to any desired extent, holding it in that position until the completion of the operation. The length of the handles also prevents the hands of the assistant from getting in the way of the operator and interfering with his work.

The gag is always applied to the side opposite the field of operation. It is better to have the blades covered, which can be done by slipping a piece of sterilized rubber tubing over them. This covering will keep the metal from coming in contact with and possibly injuring the enamel of the teeth.

WOODEN WEDGE.

Where the teeth are closed, so that it is impossible to insert the blades of the mouth-gag between them, the preliminary use of the wooden wedge is indispensable. The wedge (Fig. 39) is made of a piece of soft wood, and is of the size and shape shown. It is inserted between the molar teeth, if present, because this is the most favorable place for its application. The flat surface of the wedge is placed between the teeth, when with a firm grip it is turned on its edge until sufficient space is secured for the insertion of the Allen gag. The operator should make the application of

Fig. 39.—Wooden Wedge. For opening the mouth preliminary to the use of the mouth-gag. Used also to open the mouth independently of the employment of the mouth-gag.

the wedge, and, when the mouth is open sufficiently, the assistant should insert the gag and continue the opening process until access is obtained, when the operator, discarding the wedge, proceeds with the extraction. If, however, space will permit, a small piece of wood, with a string attached, is placed between the teeth before the patient is anesthetized. The small opening

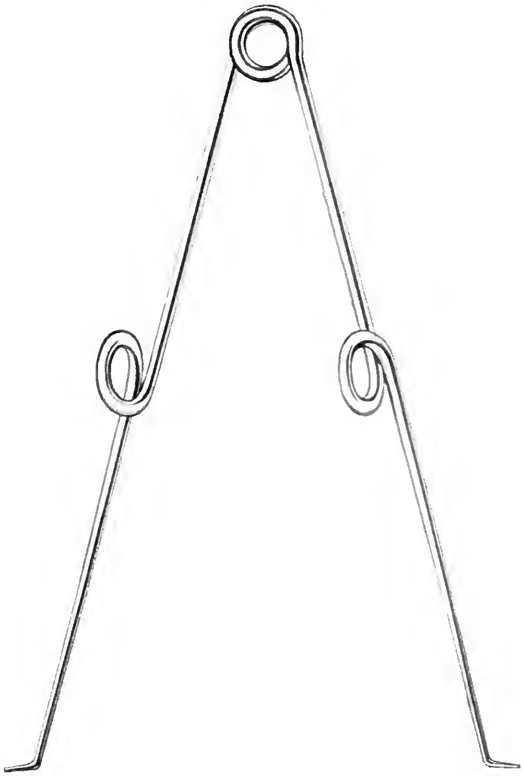


Fig. 40.—Retractor. For retracting the gum tissue over the socket and for holding the incised soft tissue apart when operating on an impacted tooth.

thus afforded will allow the freer introduction of the wedge. If the muscular tension is not too great and the molar teeth are in place, and the field of operation is on the right side, the wooden wedge, applied by the assistant on the left side, will frequently be all that is required for opening the mouth. Care should be taken, when using the wedge, not to allow it to impinge on the lips.

RETRACTOR.

The retractor (Fig. 40) is a small dilating instrument made of spring wire and having the action of a spring hinge. Each end of the retractor terminates in a fine point, which extends outward and at right angles to the axis of the instrument. It is employed for keeping open the field of operation after an incision has been made in the soft tissues preliminary to operating on the deeper structures. As soon as an incision is made to expose the process or tooth to be removed, the two points of the retractor are placed in the respective sides of the cut, and the constant outward spring force of the two ends of the instrument keeps the walls dilated. It is also used to retract the soft tissues about the sockets where they close the orifice and the condition of the alveolus necessitates curetting and irrigating. The retractor is held in place by the assistant, or by the operator if it is convenient for him to devote his left hand to this purpose.

CHISEL.

The instrument shown in Fig. 41 is known as a mastoid chisel. It is used for separating the roots of badly decayed inferior molars, which operation is performed by adjusting the blade at the bifurcation of the roots and giving the end of the chisel a blow with the mallet sufficient to separate the parts. It is also used in a case where the crown of the inferior third molar is decayed on its mesial surface and impinges on the

Fig. 41.—Mastoid Chisel. For separating roots and removing mesial contact point of decayed impacted inferior third molar.

crown of the second molar, and the impinging part is to be cut away. It is sometimes used as a substitute for the bur, and is especially applicable when a patient is under a general anesthetic and the operator wishes to get quick results. The chisel may, in addition, be used for an occasional operation on an inferior anterior tooth when displaced to the lingual side of the arch.

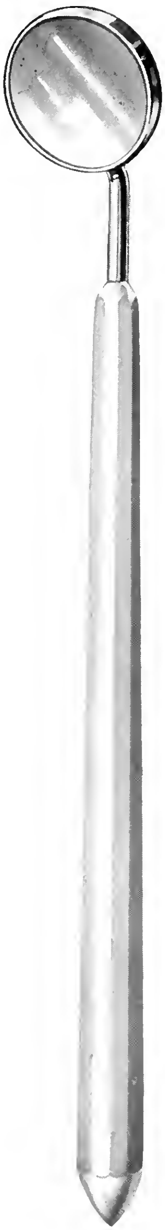


Fig. 42.—Mouth Mirror. For making examinations in the oral cavity.

INSTRUMENTS FOR EXAMINATION.

As no operation, however simple, should be begun without a careful examination of the parts, it is necessary that provision be made for this preliminary. The instruments commonly used for this operation are the mouth mirror, foil carrier, explorer, and probe.

Mouth Mirror.—The mouth mirror (Fig. 42) is used for making all preliminary examinations. The important features are a good magnifying lens, to insure a true reflection; a water-proof setting to allow of sterilization; and a handle of such length that all parts of the mouth can be readily examined with it.

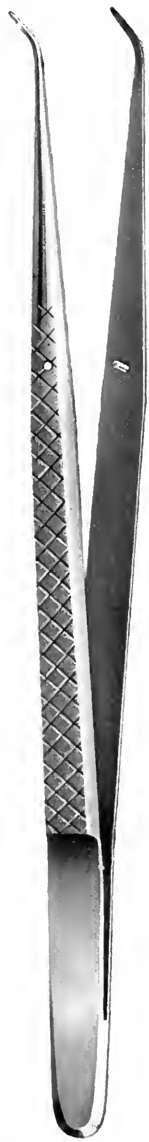


Fig. 43.—Foil Carrier. For carrying and removing dressing, removing foreign bodies, and for all purposes requiring light tweezers.

Foil Carrier.—The foil carrier (Fig. 43) should be practically universal in its use. One not over six inches in length, made of good spring steel, and with the points at an angle of about forty-five degrees with the axis of the handle, is most suitable. It is used for carrying pledgets of cotton or other material, for wiping away debris from parts to be examined, and for removing any small bodies from around the teeth.

Explorer.—A small selection of explorers should be provided. As the points of these instruments are delicate, they should be made of properly tempered steel, and the handles should be of metal to permit of ready sterilization. The instrument shown in Fig. 44 is a very practical explorer, and almost universal in application to the teeth.

Probe.—The probe (Fig. 45) is made of a single piece of slender metal, with a blunt point. It is used to ascertain the position of a tooth or root that is imbedded in or overgrown with soft tissue, or to determine the condition of any osseous structures not exposed to view. With practice the operator will be able to distinguish between tooth structure and the alveolar process, as the former is slightly mobile when pressed, and the point of the probe will slide along the surface instead of penetrating, while the latter is rough, immobile, and somewhat penetrable.

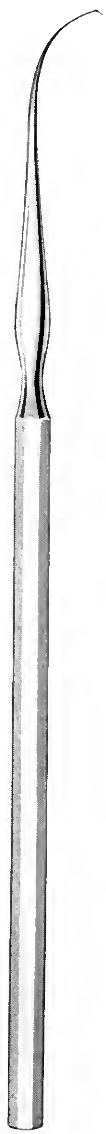


Fig. 44.—Explorer. For examining teeth and alveolar process.

Fig. 45.—Probe. For examining osseous tissue and exploring sinuses.

CHAPTER III.

OFFICE EQUIPMENT.

The office arrangement should consist of an operating, reception, and rest room, each separated from the other and containing respectively such equipment as will facilitate the work of the operator and conduce to the comfort of the patient. The nature of the work demands absolute cleanliness, and the equipment should be of a character to conform to strictly sanitary requirements.

OPERATING ROOM.

The extraction of teeth should be performed in a room specially arranged for that purpose. It is not necessary that the room be very large, a room nine by ten feet being of ample size. The floor should be of white floor tile, with a tile or marble baseboard. The walls should be tinted or painted, so that they can be washed, and, of all colors, white deserves preference, because any blood carried to the walls can then be noticed and removed quickly, while on any other color blood spots or other foreign matter are not so easily seen, and are thus allowed to dry and accumulate, thereby affording excellent means for the distribution of bacteria. For the purpose of minimizing the possibility of harboring bacteria, window curtains and all other forms of drapery, bric-a-brac, wall pictures, and all furniture, except such as forms part of the office equipment, should be excluded from the room.

The location of the window and operating chair should be in such relation to each other as to secure a good light for the operator, with just enough space between the window and chair for the patient to freely enter and leave the chair.

The operating room should be a convenient distance from the reception room, so that if a patient cries out during the operation, as is sometimes the case, especially when under a general anesthetic, it will not cause the patients in waiting to become nervous or to feel apprehensive in regard to their behavior during the operation to be performed on them.

Operating Chair.—The operating chair must be strongly built and stationary, but need not necessarily be as high grade a chair as is used for other dental operations. A practical chair for this operation is a Morrison, because it can be adjusted to high and low positions, and its mechanism is extremely simple. The one objectionable feature—that of raising or lowering it with a crank—is not worth considering in view of the advantage gained by the positions that can be obtained with it and the severe usage to which it can be subjected. Many operators prefer the old Archard chair, in which the patient sits very comfortably, and in giving nitrous oxid and oxygen this chair has the advantage of not allowing the patient to slide out of it so readily in case there is any struggling. Chairs of the newer types are also practical and have many good points.

Foot-Stand.—A small box or platform, for the operator to stand on, will be found a convenient accessory when operating on the inferior teeth. It should be about twelve by twelve inches square and from six to twelve inches in height, according to the stature of the operator. The use of such box will enable the operator to obtain direct access to the field of operation while standing behind the patient and operating on the inferior teeth. When not in use, the box should be placed back of the chair, so that it can be readily and unobtrusively shoved into position with the foot when needed. It is advisable to cover the box, both on the upper and lower surfaces, with rubber matting, so as to prevent slipping of the operator on the box or the box sliding on the floor, and this precaution will also render it noiseless.

Cabinet.—Next in importance is a suitable cabinet. Cabinets are constructed either of wood or metal. The author prefers one made of wood, as the doors and drawers can be made to fit closer, thereby better excluding the dust. White enamel makes a good finish for such a cabinet. The top should be covered with a heavy piece of plate-glass, which will serve as a suitable shelf on which to place instruments, receptacles for antiseptic solutions, etc., and blood or other foreign matter can be easily removed from a glass surface. The upper compartment consists of drawers whose bottoms are covered with glass, and these will be convenient receptacles for props, forceps, elevators, and such instruments as are used in the extraction operation. This arrangement has the advantage of having the instruments readily accessible and at the same time out of sight of the patient, as any unnecessary display of instruments will affect the average patient and render him less amenable to control. Below this tier of drawers are compartments for clean linen. The cabinet should be located on a line with and to the right of the operating chair, leaving space enough for the operator to readily pass between the chair and the cabinet. It will be found a good habit to keep the instruments in definite arrangement and to thoroughly familiarize oneself with this arrangement. This will enable the operator to lay his hand on any instrument needed without removing his eyes from the field of operation and without unnecessary loss of time.

Sterilizing Vase.—A small sterilizing vase is used for the reception of the mouth mirror, probe, and such instruments of general use that should always be sterilized before putting them into the mouth. The sterilizing vase is much better for this purpose than a drinking glass, which is so often used.

Cuspidor.—A fountain cuspidor, placed beside the operating chair, is indispensable. It is preferable not to have the cuspidor attached to the chair, especially when a general anesthetic is employed, for, should the patient struggle, he would possibly do damage to himself or the cuspidor, or to both. Such a cuspidor is fitted with an extension bracket, so that it can be moved forward, backward, or laterally. The bracket holding the cuspidor should be firmly attached to the wall, in front and about a foot to the left of the center of the chair. During the operation the cuspidor is shoved back to the wall and well out of the way, but can be readily swung over to the patient immediately on completion of the extraction. It should be kept scrupulously clean, free of all traces of blood from any previous operation, and always in readiness for use.

Pus Pan.—An accessory to the cuspidor is a small pan, such as is used by surgeons and known as a pus pan. It is held, when its use is necessary, under the chin by the assistant. Into this pan the patient expectorates the blood immediately after the operation and while recovering from the anesthetic, or is used when a patient is very heavy and cannot readily bend over to the cuspidor. A pan of this character will also serve as a receptacle for extracted teeth, cotton, and mouth props, and can be used to take away the instruments employed in the operation.

Artificial Light.—A good source of artificial light is essential, as frequently a diagnosis or an operation must be undertaken at night or on a dark day. The best method of obtaining suitable artificial illumination for this purpose has always been a problem. The majority of lamps designed for dental work throw a strong beam of light, intended to be focused into the mouth; but, should the patient's head be moved, the field of operation is obscured—perhaps just at the moment when light is most needed and when it is inconvenient to disengage the hands for its readjustment. The Rhein light, designed by Dr. M. L. Rhein, offers a satisfactory solution of this problem. Its construction permits it to be easily raised or lowered, and it should be so suspended as to hang about one foot in front of the chair.

Nitrous Oxid Apparatus.—The apparatus for the administration of nitrous oxid and oxygen should be conveniently located on the left side of the chair, and slightly in front or to the rear. The apparatus should be simple in construction, so that it can be easily kept in working condition, and allow any part that may become contaminated to be easily detached for sterilization. Scrupulous care in keeping all parts in order will avoid accidents while operating.

Dental Engine.—Some form of dental engine, of either foot or electric power, together with a selection of burs, should be kept within easy reach of the operator. It may be needed to remove the alveolar process from around a fractured root, for cutting away parts of an impacted tooth and the osseous structure about such a tooth, or for burring out roots which cannot be extracted by other methods.

Sterilizer.—The advance in bacteriologic science has proved conclusively that a simple cleaning of the instruments does not free them from pathogenic bacteria, and that in addition to the cleaning they must be thoroughly sterilized in order to avoid possible infection and prevent the transmission of disease. No instrument that is not surgically clean should be introduced into the mouth, and no modern operator should be guilty of such gross neglect as operating with unsterilized instruments, for by such conduct he would be doing injustice to himself and probable injury to his patients. The simplest form of sterilization is by heat, and this is preferably done with water as the medium. Any receptacle into which the instruments can be placed will serve the purpose. There are many varieties of sterilizers from which to select. A simple and practical one consists of an ordinary tank, made of copper and nickeled, fitted with one or more wire screen trays with which to carry the instruments into and out of the hot water. The water may be heated by any convenient means, such as alcohol, gasoline, gas, or electricity. A simple means of procedure is to thoroughly cleanse the instruments immediately on completion of the operation, after which they are placed into the tray, lowered into the sterilizer, and allowed to boil for several minutes. They are then removed from the sterilizer, thoroughly dried, and put into their proper places in the operating cabinet. A small amount of bicarbonate of soda added to the water in the sterilizer will prevent tarnishing of the instruments. As a further precaution, before proceeding with the next operation, the instruments should be placed for a time in alcohol or a strong solution of lysol, which should always be kept in some convenient place in the cabinet. Plain aseptic gauze, which should be kept in a close-fitting receptacle, will serve as a convenient method for removing any surplus solution remaining on the instrument. Most cases of pain or inflammation after extraction are attributed by the patient to the neglect of the operator, and the claim is invariably made in such instances that he has used unclean or "dirty" instruments. Sterilization is so simple that any operator should be able to exonerate himself of such charge.

Toilet Accessories.—A lavatory should be placed in the operating room, so as to be readily accessible to both operator and assistant. Foot-pedals for operating the faucets will be found a great convenience in the cleansing of the hands, as the water supply can then be regulated without the hands coming in contact with the faucets.

A sanitary soap receptacle, containing liquid soap, is cleanly, for by its use soap may be applied to the hands without contaminating the remainder with blood or other matter, as is frequently done when using ordinary cake soap.

Scrub brushes should be kept in a tray that can be readily cleaned, and the brushes should be sterilized repeatedly.

Another modern and sanitary convenience is a glass shelf connected with the lavatory, on which a number of clean drinking-glasses (inverted) and a supply of individual fiber drinking-cups should be kept.

With a room equipped in the manner described, the operator will find himself in a position to efficiently attend to any ordinary case, giving the greatest satisfaction to himself and comfort to the patient.

CARE OF THE PATIENT.

A well-appointed office should include, in addition to the operating room, a reception room and at least one rest room.

Reception Room.—The first impression received by the patient goes far toward inspiring his confidence, or causing a lack of it, in the operator. A neat, clean, and artistically arranged reception room will usually make the first impression a favorable one, and may be a simple means of establishing a good reputation with a patient, which will be one of the best assets of the operator during his future years of practice. Taste in the selection of the furniture, rugs, and decorations, aspiring to a harmonious *tout-ensemble*, will be found to amply repay the practitioner for the expenditure of thought, time, and money. A few magazines, neatly arranged on a table, covering a range of subjects likely to interest any grade of intelligence, may pleasantly engage the mind of the waiting patient and divert his thoughts from the approaching operation.

Rest Room.—The rest room should be conveniently located, and contain a couch and an easy-chair, with a fountain cuspidor so placed as to swing readily in any direction. Additional furnishings may consist of one or more chairs for the friend who may wish to remain with the patient during the recovery. A clothes-rack should be supplied, on which the patient's wraps may be placed previous to entering the operating room, and also a dressing table with a mirror, together with such toilet requisites as are in common use. While the relief afforded to most patients by the operation is such that they do not care to linger, the state of health of others demands that a short period of rest follow the operation. For the latter a time spent in the rest room will often restore the strength and quiet the nervous system, thereby adding greatly to the success of the operation.

Attendant.—To relieve the operator of much of the daily routine, and allow him to devote more of his time to the professional part of his practice, a well-trained lady attendant is invaluable. She receives the patient when he arrives, looks after his comfort, and makes him feel at ease while awaiting his turn for the operation. She takes the name of the patient to the operator, and conveys any other information that may be helpful in the work that is to be done. If it is a former patient, the records are consulted, and such characteristics or idiosyncrasies as may be peculiar to the patient are carefully noted. In the operating room she seats the patient in the chair, arranges the linen for the protection of the clothing from blood stains, and helps in soothing and encouraging timid patients, the latter attention being given particularly to children and to aged and nervous persons. During the operation she keeps the arms of the patient from interfering with the operator, hands the inhaler to the operator when nitrous oxid and oxygen is administered, opens and closes the valve of the apparatus, sees that the patient's mouth is kept open, and uses the mouth-gag when necessary. She should always be alert to hand the operator such accessories as he may require, so that he does not have to take his eyes from the field while operating. As far as possible she should keep the operating area clear of blood by swabbing, and catch all teeth that may be extracted. After the operation is completed she holds a pan under the chin while the patient is recovering from the anesthetic, hands the patient sterilized water for rinsing the mouth, and extends whatever little courtesies the patient should receive. Before proceeding with the next operation, the attendant rearranges the operating room, sterilizes all the instruments that may have been used and restores them to their proper places, and removes all traces of the preceding operation, so that the patient following will not be made to feel uneasy by any suggestive sights. With a competent attendant properly discharging these details, the operator can give his undivided time and attention to the operative procedure.

CHAPTER IV.

ANATOMICAL LANDMARKS.

The operator should possess a thorough knowledge of the anatomy of the teeth and surrounding parts. This is especially true in regard to the anatomy of the teeth in their relation to the bony walls which retain them. To emphasize the importance of this statement, as well as to serve as a sort of ready reference, and especially to make clear the extraction movements which are described in the chapters on extraction technic, a few illustrations are shown to present the general arrangement of the teeth and alveolar process. The illustrations presented may differ somewhat from the stereotyped ones frequently found in works on anatomy, but they are about as correct as can be obtained, and are sufficiently plain to form a basis for the study of the anatomy of these parts; for, while the bodily structure of different individuals is by no means uniform, its analogy to a prevailing form will convey a clear conception of the anatomy peculiar to any part, and variations from the common standard must be noted.

DENTO-OSSEOUS STRUCTURES.

Labially.—Fig. 46 shows an anterior view of an almost normally articulated set of teeth. Attention is directed to the heavy bony structure over the superior cuspids (canine eminence), and the height to which it extends above the alveolar ridge as compared with that over the central and lateral incisors. The diameter of the roots of the superior lateral incisors is much less than that of the roots of the teeth on either side of them. This peculiarity should be taken into consideration when studying the process, as it is deceptive, for, instead of being weak, it in reality possesses greater strength in proportion to the strength of the roots than that overlying the roots of either the cuspids or centrals. The superior central incisors are situated in close proximity to the suture uniting the right and left maxillæ, which is a matter of prime importance to the operator when the development of bone has not been complete in this region, as in a case of cleft palate. A comparison of the convolutions of the process over the six superior anterior teeth with the antero-posterior diameter of their necks will indicate the rotundity of their roots, and serve as a guide to the amount of rotatory movement that may be exercised in their extraction. The interproximal spaces between the ten inferior teeth, considered in relation to the external plate of the process, gives a fair outline of their roots.

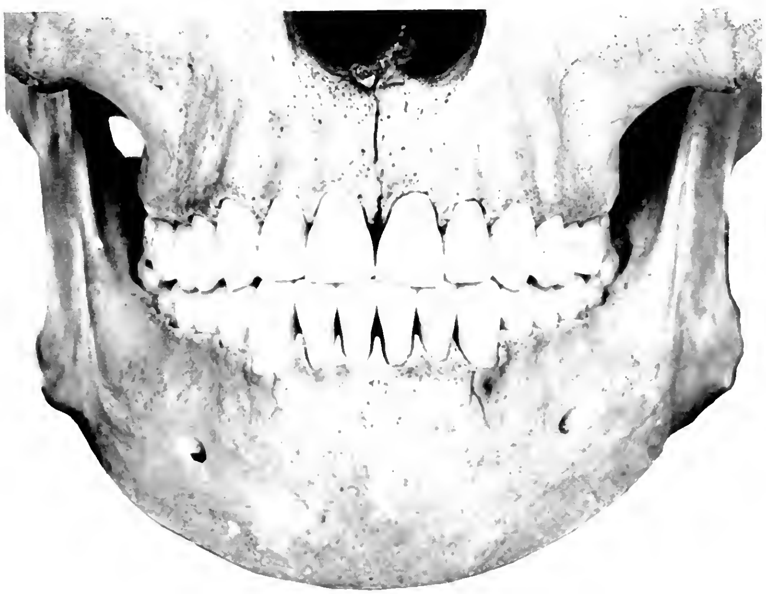


Fig. 46.—An almost perfect set of teeth. Anterior view, showing teeth and osseous structure.

Buccally.—Fig. 47 shows a side view of the same skull shown in Fig. 46. In this region attention is directed to the process over the superior first bicuspid, as it outlines with reasonable accuracy the root formation of this tooth. A narrow ridge, beginning near the gum margin and extending well up, indicates a bifurcation throughout the greater part of the root's length; a comparatively even process near the margin, with a sharp projection high up, indicates a bifurcated apex and probably some divergence, while lack of prominence to the ridge indicates a single-rooted tooth. The superior first molar is directly in line with the ridge, which, beginning in the cortical part of the process at this point, extends upward to form the malar process of the superior maxilla. There is much variation in the origin of this ridge. If it begins low, it always adds much to the strength of the buccal plate of the process, making it dense and rigid, while greater distance between the alveolar margin and the ridge indicates a more flexible process. The malar process of the superior maxilla is always to be observed in connection with the teeth, as is also the process covering the roots of the second bicuspid and first molar, to determine, if possible, the relation of the roots of these teeth to the floor of the maxillary sinus. The width of

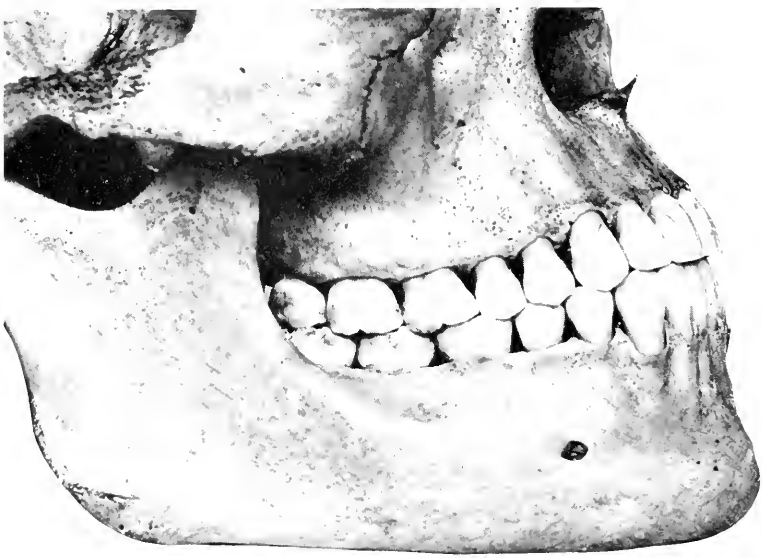


Fig. 47.—Same subject as Fig. 46. Side view, showing teeth and osseous structure.

the buccal plate of the alveolar process in the region of the inferior bicuspids and molars is subject to the usual variations that are common to the bony structures about the mouth, and such variations, when studied in conjunction with these teeth, present the usual points for determining the strength of these structures, which are always of interest to the operator.

Palatally.—Fig. 48 shows the occlusal surfaces of the superior teeth *in situ*, the lingual plate of the process supporting them, the palatal bones, and the palatal processes of the superior maxilla. These combined structures form the palatal arch, which varies

Fig. 48.—Same subject as Figs. 46, 47. View of superior arch, showing teeth and osseous structure.

Fig. 49.—Same subject as Figs. 46, 47, 48. View of inferior arch, showing teeth and osseous structure.

much in form and height. A high vault indicates a wide cortical plate of the alveolar process, and such a plate is usually thinner than the narrow plate found with the low vault. The thin wide plate is more flexible than the narrow one, and forms a less firm supporting wall for the teeth.

Variation in the superior arch reaches its maximum in the region of the third molars, and such variations are always to be studied in connection with these teeth. These tuberosities are

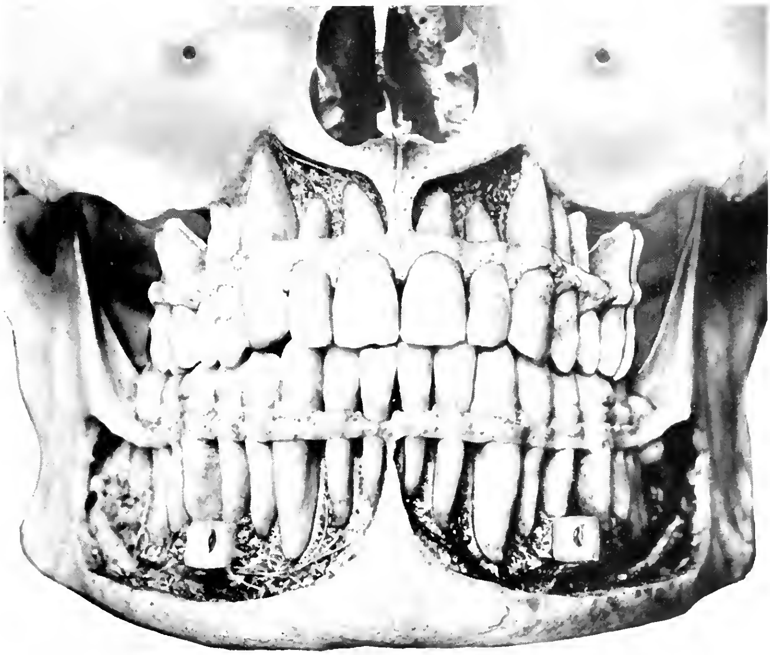


Fig. 50.—Superior and inferior arch. Anterior view, showing the roots of the teeth.

poorly supported, being the termini of the arch, and, at best, present an element of weakness that should always be given due consideration.

Lingually.—Fig. 49 shows an upper view of a mandible, with all the teeth in normal position, and exhibits the distal half of the third molars situated lingually to the anterior edge of the ascending rami. The alveolar process surrounding these teeth is almost entirely lacking on their buccal sides, the development of process consequent to their eruption being confined almost wholly to the lingual side. The alveolar process supporting the inferior incisors differs from that supporting any of the other teeth in that it has a greater labio-lingual diameter near its edge than it has well up on the roots of these teeth.

ROOTS OF THE ANTERIOR TEETH.

Fig. 50 shows an anterior view of the upper and lower jaws, with the cortical plate of the process removed, revealing the

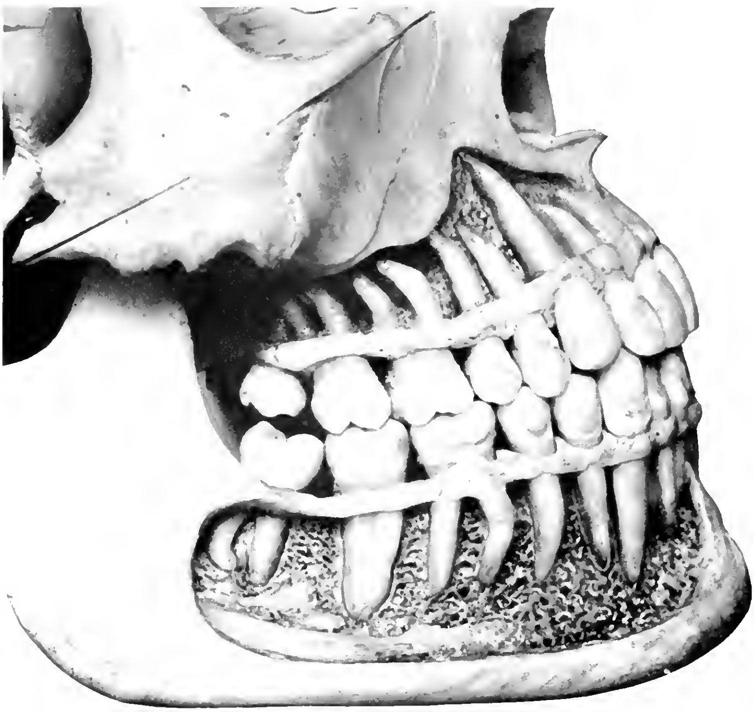


Fig. 51.—Same subject as Fig. 50. Side view, showing the roots of the teeth.

roots of the teeth. The illustration shows not only the position of the roots in the cancellous structure of the process, but also their relation to each other.

ROOTS OF THE POSTERIOR TEETH.

Fig. 51 shows a side view of the same skull. Attention is directed to the distal inclination of the roots, and also to the wide variation in the form of the roots of the inferior molars.

IMPORT OF ANATOMICAL LANDMARKS.

Dental anatomy, from the standpoint of the exodontist, should be studied in the light of mechanics in addition to that of description, for the extraction of a tooth—whether by forceps, elevator, screw-porte, or whatever means may be chosen—is only the separating from each other of parts that have been united in the development of the jaws. To the exodontist, then, the landmarks of mechanical strength are of the same import as are the landmarks of surgery to the surgeon. Indeed, he can have no greater asset than to be able to determine with reasonable accuracy the amount and direction of force required in the application of the instrument and in the execution of the extraction movements for the delivery of a tooth from its attachment in each particular case, as the variations to be met as well as the different conditions presented are practically unlimited.

CHAPTER V.

INDICATIONS AND COUNTERINDICATIONS FOR EXTRACTION.

Indications and counterindications for extraction are governed by the extent of the caries involving the tooth, its nerve and blood supply, the condition of its roots and associated tissues, its relation to the other teeth (occluding and approximating) and to the surrounding structures, its further usefulness as a natural or restored organ, traumatic injuries, chronic and surgical diseases (local or systemic), and the general health of the patient.

CONDITIONS THAT INDICATE EXTRACTION.

It is impossible to formulate a definite list of cases in which extraction is indicated, as the varying conditions to be met are too numerous for a set of rules that would apply to all cases. Unless counterindicated by individual conditions, surgical interference is indicated in all cases where the tooth is affected by caries to such an extent that the lost function cannot be restored.

Pathologic Conditions.—Other pathologic conditions that indicate extraction are as follows:

1. Where there is extensive loss of alveolar process, so that the tooth is no longer held firmly in position, the consequent luxation causing inflammation of the surrounding tissue, which cannot be relieved by treatment or appliance.

2. Where a tooth is involved in necrosis of the alveolar process, and its retention may endanger the peridental membrane of the tooth adjacent to the affected one or the periosteum of the maxilla.

3. Where a tooth causes an acute alveolar abscess, with diffusion, and the delay required in an attempt to save the organ may result in a general infectious process.

4. Where a tooth causes a chronic alveolar abscess that is not amenable to treatment, and its retention may cause a gradual breaking down of the surrounding tissues, or endanger the general health by the constant absorption of pus.

5. Where an affected tooth involves the lymphatic glands, and its sacrifice is preferable to an uncertain termination of the condition.

6. Where a tooth with infected or putrescent pulp tissue is the source of a disturbance, and a constricted or crooked canal prevents proper treatment.

7. Where the pulp of a tooth is encroached upon by pulpstones, and relief can be obtained only by extraction.

8. Where there is absorption of the apex of the root, and its resection is not practicable or has been a failure.

9. Where a tooth has a perforated pulp chamber or root, whose closure by artificial means causes chronic irritation.

10. Where a tooth causes a dental cyst, or where a superior second bicuspid or first molar discharges pus into the maxillary sinus, and the conditions can be remedied only by extraction.

11. Where the irritation of a tooth causes a simple or malignant epulis.

12. Where the lesion of a tooth is a source of irritation or pain, and the general health of the patient prevents alleviation.

Impacted Teeth.—A tooth that is partially or completely impacted and impinges on another tooth, which condition cannot be corrected by other means, and especially where the pressure of the tooth on another tooth or the associated tissues is causing constant irritation and there is danger of a general systemic disturbance, should be extracted.

Supernumerary Teeth.—A supernumerary tooth that is of no practical value, or where it interferes with the proper eruption of the normal teeth, thereby causing irregularties, or where such tooth causes irritation of the surrounding tissues, should be extracted.

Malposed Teeth.—A tooth out of alignment with the arch, where the condition cannot be corrected by the orthodontist or by artificial restoration, should be extracted if he so advises. An abnormally shaped tooth, with a crown that serves no practical purpose and is detrimental to the features, should be extracted. A tooth that has no occluding antagonist, or is elongated and irritates the tissues of the opposing jaw or other soft tissues, should be extracted.

Fractured Teeth.—Where the root of a tooth is fractured to such an extent that it cannot be repaired by an artificial crown or by some other method, or where a tooth that contains a large filling is fractured so that it involves the roots in such manner that they cannot be again made serviceable, extraction is indicated.

Roots Supporting Crown or Bridge.—Roots that support a crown or serve as the abutment for a bridge should be extracted when loosened through some pathologic condition of the supporting tissues that will not yield to treatment, and the resultant mobility is injurious to adjacent teeth or to the general health, or when these roots are fractured so that their usefulness in retaining an artificial crown is destroyed.

Artificial Dentures.—Where a tooth is in such position that it is not serviceable for either mastication or for the retention of an artificial denture, but may interfere with the articulation or adaptation of the denture, extraction is indicated.

Deciduous Teeth.—Extraction of deciduous teeth is indicated at the time the permanent teeth are to replace them, and in advance of this time if caries has attacked them to such an extent that they are beyond treatment, and are causing such a disturbance that the general health of the child is being impaired. Where the roots of the teeth remain, acting as an irritant, or where they have sharp edges, cutting the cheek, lip, or tongue, they should be extracted or rounded off.

Surgical Cases.—Teeth are often extracted preceding surgical operations about the oral cavity—viz., where drainage must be established, where necrosis involves the jaw and the affected part cannot be otherwise treated, and in those cases of infection of the maxillary sinus where drainage cannot be otherwise obtained.

Traumatism.—Extraction usually follows in a case of fracture of the jaw where the teeth have been loosened and cannot be successfully retained by the use of ligatures or appliances.

Neuralgia.—It is frequently advisable to resort to extraction in a case of trifacial neuralgia where a tooth is the etiologic factor and treatment is not practicable.

Infirmities.—In cases of aged, weak, sick, and neurasthenic patients who cannot very well withstand the treatment that is indicated to restore an affected tooth to its normal function, it may be better to resort to extraction than to subject them to the endurance of protracted treatments.

CONDITIONS THAT DO NOT INDICATE EXTRACTION.

An operator, before deciding to remove a tooth, should carefully consider its future usefulness, for the extraction of any tooth whose removal is not made necessary by local or systemic conditions is a careless destruction of tissue and a sacrifice of tooth function. The demand of a patient that a tooth be removed should not be considered sufficient cause for its removal, as the patient may not be a competent judge of the value of the particular tooth, and, usually not being versed in dental procedure, cannot correctly diagnose pathologic conditions that require surgical interference. Often a slight exposure of dentine, due to caries or even to recession of the gum, will subject the patient to considerable pain, and cause him to request extraction for relief, when the simplest sort of treatment would relieve the condition. There are numerous graver lesions of the teeth and surrounding tissues that often cause intense suffering, but that can be reduced and the function restored by modern dental art.

Unless contraindicated by general conditions of health or other circumstances, an operator should decline to remove any tooth that is of any value or can be made of any value to its possessor by reasonable treatment. Among other circumstances to be noted, the following conditions should be carefully considered before extraction:

Where a patient has lost a number of teeth and wishes to have some extracted that are affected, but that are in good alignment and will help to retain an artificial denture, they should not be removed. Requests for extraction under such conditions are often made, but the operator should be the judge of the procedure to be followed, and especially should his judgment prevail when the affected teeth are in the inferior arch, where the teeth are often the only means of retaining an artificial denture.

Often a patient with teeth in malocclusion will demand that they be extracted in order to correct this disfigurement. In such case every endeavor should be made by the operator to correct the condition, either doing this work himself or referring the case to a competent orthodontist.

When a patient in advanced age insists on extraction of teeth worn down by abrasion, but that are firmly supported by the tissues, the operator should remember that it is often preferable to retain such teeth, especially when other teeth about the mouth have been extracted and there is very little, if any, of the alveolar ridge to retain an artificial denture.

In a case of mesial occlusion, where the protrusion is marked, the patient often becomes discouraged with his appearance and seeks the extraction of the teeth. In such case it is advisable to explain that, while an artificial denture could be constructed, the articulation must in most cases follow the contour of the natural teeth, and in all probability a practical denture to correct the objectional condition could not be made, which explanation will generally dissuade a patient from having the teeth extracted.

Many other conditions similar to those mentioned may be presented, and the operator should inform the patient of the advantage of retaining teeth wherever it is at all possible to preserve them.

COUNTERINDICATIONS TO OPERATING.

Counterindications to operating are not numerous, and are usually presented in a case where the general health of the patient is such that the operation would be performed with some degree of danger to the patient's life. In such case the operator must exercise judgment in determining the situation, as he must decide whether it is advisable to remove the offending tooth, or permit it to remain and apply some palliative treatment until such time when the health of the individual has been restored sufficiently to allow an operation, if such procedure is at all possible.

Impaired health is often occasioned by the postponement of an operation, the patient, dreading the thought of having a tooth extracted, suffering from day to day and, in addition, losing much sleep, thereby causing the system to become gradually weaker. In such case the appearance of the patient will indicate the necessary precaution that must be observed preceding the operation. Inquiry should be made as to the length of time the offending tooth has been a means of disturbance and how long it has affected the general health. Where the tooth is the exciting cause of the condition, the removal of the cause is the usual course to pursue, and the severity of the operation then naturally becomes the next factor to be considered. If the operation is one that is difficult and requires some time to perform, and the patient lacks the strength to endure the ordeal, it should be postponed and treatment conducted in concurrence with the advice of the patient's physician. If, however, the operation is simple and can be quickly performed, it is usually better to relieve the condition than to permit the tooth to remain, with the probability of increasing the involvement.

Heart Lesion.—Counterindication to extraction may be presented in patients who have organic heart lesions, such as valvular insufficiency, hypertrophy, and fatty degeneration. An operation may result in a fatal shock to persons so afflicted, although the danger of such a termination is greatly lessened by the use of a general anesthetic. Where the case is of such a nature that the operation may endanger the life of the patient, restoratives should always be in readiness, and it is advisable to have the patient's physician in consultation and at the operation.

Abscessed Teeth.—A tooth that is the cause of alveolar abscess, with extensive infiltration of the surrounding tissues and excessive swelling, is often classified as a counterindication; but, as the tooth is the exciting cause of the condition, its removal will lessen the probability of endangering the structure beyond the area already involved, and facilitate the treatment of the infection. (See treatment for acute septic pericementitis, page 361.)

Acute alveolar abscess can be classed as a counterindication only when the physical condition of the patient will not allow extraction. The tissues surrounding the tooth are usually painful to the touch, and fear on the part of the operator of inflicting pain is undoubtedly the reason so many teeth that are involved in an acute septic disturbance are not immediately extracted and the operation is postponed until the case reaches a stage where extraction is imperative. There is a too common belief that an abscessed tooth should not be extracted until a free evacuation of pus can be had by lancing. This belief, carried into practice, usually prolongs the suffering, and sometimes permits the local infection to become systemic.

Temporary Ankylosis.—Often temporary ankylosis is classified as a counterindication on account of the inability of the patient to open the mouth and the painful procedure necessary to open it. This condition is more readily overcome by administering a general anesthetic and extracting the tooth, if it is the exciting cause of the condition, than by permitting it to remain. Counterindications occur only where the vitality of the patient is lowered to such an extent as to render him unable to undergo the operation, in which case the tooth should be extracted as soon as his health has been sufficiently regained to permit operating.

Hemorrhagic Diathesis.—With a hemophilic patient, where there is a possibility of a fatal case of hemorrhage following the operation, extraction is counterindicated. If palliative treatment can be applied and the operation avoided, it should be done; but, should this procedure be of no avail, and retention of the tooth would endanger the life of the patient as much as an operation, the operation should be performed. Where possible, there should be preliminary treatment preceding the operation. (See treatment for hemophilia, page 376.)

Pregnancy.—In all cases of pregnancy the operation should be postponed if possible; but, where the patient has had a number of sleepless nights, all palliative treatments failing to give relief, rather than have her subjected to any further suffering, a general anesthetic should be administered and the operation performed in the presence of the family physician.

Epilepsy.—Epileptics are unsatisfactory patients, as the shock of an operation may bring on an attack. If imperative, extraction can be performed, but the patient must receive constant attention to prevent him from injuring himself or others in case of an attack. Should an attack follow, the patient should be laid in a comfortable position, allowing plenty of air, and recovery will usually be rapid.

CHAPTER VI.

EXAMINATION OF THE MOUTH AND TEETH.

An examination of the mouth and the teeth to be extracted necessarily precedes every operation, and should be carefully conducted. A detailed survey of the entire situation must be made, as on the resulting conclusion may depend the success of the operation. A superficial inspection of the parts, with a hasty diagnosis, is liable to prove disastrous.

The operator should not depend solely on the word of the patient as to the identity of the affected tooth, but must bear in mind that irritation along a nerve trunk may produce a sensation of pain in any of its termini, and that any inflammatory or congested condition of one tooth frequently causes pain in another, even when the affected tooth has not seriously annoyed the patient. The majority of examinations can be made by inspection, manipulation, and instrumentation. The instruments required consist of mouth mirror, foil carrier, explorer, and probe (pages 54, 55), and should always be kept sterilized and in readiness. They are used in the same manner as for the examination preceding other operations about the teeth, the mirror and explorer being used first and the other instruments employed as the case may demand. When as thorough an examination as can be made with these instruments fails to reveal sufficient information for a correct diagnosis, a radiograph of the part will usually outline the existing condition.

ATTITUDE OF THE OPERATOR WHEN MAKING AN EXAMINATION.

During the examination the operator should use every tactful effort to establish and maintain the confidence of the patient, as such relation of confidence is an important factor in a successful operation. The operator's perfect self-reliance on his ability subconsciously produces a reciprocal feeling on the part of the patient, inducing him to more readily comply with any instruction relative to position or conduct previous to and during the operation. The operator, by his self-reliant conduct, allays any fear or excitement his patient may manifest, while any uneasiness, hesitation, or awkwardness on the part of the operator may cause interference and will increase the natural dread of the patient, frequently rendering a patient hysterical who would otherwise be composed and tractable. The operator should refrain from stating his opinion of the pending operation unless he expects to encounter difficulties or realizes the probability of an unavoidable fracture of the tooth. Forecasting the result of an operation should be avoided, as the outcome cannot always be definitely determined. Extensive caries or abnormalities of the roots of a tooth may cause unexpected resistance or fracture in contraindication of his prognostication, which would not leave a favorable impression on the patient. The operator must gauge the intelligence of the patient, and impart such information as may be necessary in phraseology suited to the comprehension of the individual.

EXAMINING THE MOUTH.

The examination of the mouth is made with the patient and operator in position similar to that occupied when operating (Chapter VII). When introducing the instruments and fingers into the oral cavity, care should be taken not to impinge on the lips, especially if they are fissured, or if the patient, in applying some home remedy to the affected tooth, has allowed some of it to come in contact with the lips, rendering them more sensitive. Any inflammatory condition of the mucocutaneous surface sometimes makes the parts highly painful to the touch, and they should not be disturbed any more than is absolutely necessary. The operator should observe the size of the oral cavity and the location of the affected tooth, and calculate to what extent the mouth should be opened during the operation in order to keep the involved tooth continually in view. The cheek muscles and tongue are considered, noting to what extent they interfere with the examination, as the same degree of interference will be experienced during the operation, and some method must be adopted to overcome it. In the case of a mouth that contains only a few scattered teeth, special observation of the lips, cheeks, and tongue is made, as they very often interfere with the application of the instruments. The necessity of supporting the mandible must also be considered, and the best method in which this can be done is determined. When a general anesthetic is to be administered, the insertion of a mouth-prop, together with its size and position in the mouth, must be taken into account.

REMOVING FOREIGN BODIES PRECEDING EXAMINATION AND OPERATION.

All artificial plates, loose crowns, and bridges should be removed before completing an examination. No attempt to operate should be made with these foreign bodies in the mouth, especially if the patient is to receive a general anesthetic. Any orthodontia appliance that may be in place and would be disturbed during the operation should be removed to prevent interference. Any cotton, gauze, or gutta-percha dressings that may be in the tooth to be operated on should also be removed, for, should the tooth fracture during the operation, these dressings may interfere with a reapplication of the instruments. Such dressings are not only a hindrance to the operator, but are also liable to drop on the tongue or pass down the throat, causing annoyance to the patient.

SURGICAL DISEASES ABOUT THE MOUTH.

Any surgical disease about the mouth or associated with the involved tooth must be taken into account during the examination. Alveolar abscess is the most common lesion, and, if present, the extent of its attack on the tissues is observed—whether a sinus is established and what other parts are affected by it are noted—the operator determining at the same time the treatment that may be required before and, in a measure, immediately after the extraction. Temporary ankylosis is often established in connection with this abscessed condition, the mouth being partially or completely closed. In such case it is noted whether the mouth can be opened sufficiently to extract the affected tooth, or whether it will be necessary to use the wooden wedge or mouth-gag to secure access to the field of operation.

As the maxillary sinus is occasionally involved when a tooth located in close apposition to it is diseased, the affected tooth and its associated tissues should be carefully inspected to determine whether the floor of the antrum is involved or is liable to be disturbed during the extraction.

Necrosis is a condition that is occasionally presented. The lower jaw is the one usually affected, and, when such condition prevails, its cause should be ascertained and the nature of the attack determined, whether confined to the alveolar process or affecting a greater area. The extent of the involvement should be established in order that the necessary treatment may be considered, and the proper surgical interference outlined in advance of the extraction.

If a previous fracture of the jaw has occurred, the patient will usually give its history, and, if of recent occurrence, special care must be taken not to subject the weakened mandible to greater force than it can withstand. Care should be observed also where a dislocation has occurred, and the liability of a recurrence of the dislocation be borne in mind.

The glands, when involved, must be examined, and the extent of the involvement carefully noted. Any foreign growths about the mouth should also be considered.

EXAMINING THE TOOTH, ADJACENT TEETH, AND TISSUES.

Before proceeding to the examination of the tooth to be extracted, the involved tooth and the tissues surrounding it are thoroughly syringed with an antiseptic solution to clear away any debris that may have accumulated. With absorbent cotton, in the form of a pellet and held in the foil carrier, all saliva that may interfere with the examination is wiped away. If the flow of saliva is too free, a large piece of cotton is placed on the buccal and lingual sides of the tooth to keep the field open for examination. In a pus case the same method may be employed, but pressure on the gum should be avoided, as it will produce pain and likely cause the pus to cover the affected tooth. Pressure should be avoided also when blood is oozing from the margin of the gum tissue.

When the peridental membrane of the tooth is in an inflammatory condition, the instrument used for examination should not be pressed on the tooth, as the resulting pain may be so intense as to throw the patient into a highly nervous state, and possibly cause the operation to be postponed. The same precaution should also be observed in touching sensitive parts of a tooth or root with an inflamed pulp.

Examining a Tooth Free of Caries.—The alignment of the tooth is observed, especially noting whether it inclines from the normal, and whether it is isolated or has teeth adjacent to it. The firmness of its attachment to the supporting tissues is investigated to determine the amount of force that may be required to detach it. The degree of its firmness is determined by placing the thumb and index finger on the sides of the tooth, or by adjusting Derenberg tweezers to each side of the crown, or by applying the probe or an exploring instrument to the occlusal surface, and swaying the tooth from side to side.

The shape and size of the crown and neck of the tooth are examined in order that forceps with beaks that most nearly conform to the shape of the neck, and that will grasp as much as possible of the tooth, may be selected. At the same time the advisability of making an adjustment to the root of the tooth or only to the neck is determined, which conclusion is governed by the strength of its attachment to the supporting tissues and the condition of the crown.

The necessity of loosening the tooth with an elevator preceding an application of the forceps should also be determined. When the approximating tooth is to be used as a fulcrum, its support is considered, as lack of attention to this detail may result in the loosening of the attachment of the tooth thus utilized.

Examining a Tooth with a Fractured Crown.—When examining a tooth with a fractured crown caused by defective filling or in some other manner, all the parts should be thoroughly examined. As a rule, one part of the crown remains adherent to the tooth, while the other part is loose; or both parts may be separated from the roots of the tooth and held by the gum tissue only. In case one part is firmly adherent, an examination will determine whether it is necessary to remove the broken fragment before applying the instrument to the part attached. In a great many cases the fragment is permitted to remain, as it seldom interferes with the operation. If, however, it interferes, it must be disposed of before the removal of the firmer part. If both pieces are severed, the necessity of removing them before the remainder of the tooth is extracted should be considered.

Examining a Tooth with Checked Enamel.—When the enamel of the crown of a tooth to be extracted is checked, the checked line should be followed with a fine explorer, in the same manner as if the tooth were to be filled, to determine whether the crown has been weakened, for, if there is a weakening of the crown and the parts are no longer firmly cemented, in which case a probable fracture may be suspected, the crown is not to be depended on to support the instrument.

Examining a Tooth Attacked by Caries.—Where the crown of a tooth has been attacked by caries, the amount of destruction and location of the cavity should be noted, as these conditions largely govern the technic of the extraction of the tooth. Where an extensive amount of caries exists on the occlusal surface, and the outer walls are intact, the operator should not be hasty in applying forceps, but should first examine the strength of the walls with Derenberg tweezers. It is frequent for the walls not to be as strong as they appear, and the application of the forceps will crush them, leaving the root *in situ*. Such an occurrence can be avoided by careful examination, for, when a condition of this character exists, the procedure should be as if only roots were to be extracted.

Where the caries is on the labial, buccal, or lingual surface, the extent of the involvement should be estimated. If it extends below the gum margin, the probe will generally reveal the amount of decay, and acquaint the operator with the depth to which he must apply the beaks of the forceps to obtain a hold that is sufficiently secure to deliver the tooth. Where the cavity is on the mesial or distal surface (commonly termed a proximal cavity), its extent should be especially noted in order that a detailed outline of the operation be formed.

Each part of a compound cavity should be examined separately and then considered collectively, as this dual condition usually increases the complication. There are cases, however, where the location of a cavity is such that a thorough examination is made with difficulty. Apparently the remaining part of the tooth is strong, but decay may have undermined the crown to such an extent that it would fracture under the stress of the extraction movements. In these cases every means should be employed to obtain as complete information of the amount of caries as is possible. Where caries has extended to the pulp chamber, the extent of its involvement is noted, and, where it has extended beyond the pulp chamber, the root canals should also be examined to determine how far it has spread. The firmness of the tooth's attachment should be tested in the same manner as if the crown were intact. The strongest and weakest points of the remaining part of the crown, its relative strength, and whether it is more favorable to the application of the forceps than the elevator, should be decided before removal is attempted.

When forceps are indicated, the possibility of their retention when the tooth is grasped by them, and whether the tooth will bear the strain necessary for its deliverance, are the important matters to be considered, and, where an elevator is indicated, the most favorable part of the tooth to which it can be applied is determined.

Examining the Root of a Tooth.—When a root is all that remains of a tooth, its location and relation to a normal position should be noted, and whether it is a part of a fractured tooth or the result of caries having destroyed the crown should be determined. The approximate size of the root can usually be gauged by its exposed surface, and is done by making a comparison of the circumference of that surface with the corresponding circumference of the root of the normal tooth. An inspection of the corresponding tooth on the opposite side, if present, will greatly aid in forming an idea of the dimensions of the root under consideration. When there is more than one root, the operator should learn whether the roots are firmly united to each other or separated. If there is a separation, the relation of one root to the other and the possibility of applying an instrument between the roots for their removal should be determined, and, where the roots are united, it is determined whether they should be extracted intact or separately. Where a root is affected by caries, the extent of decay and how far the root canal may be involved is ascertained by probing. The weakest and strongest parts of the root are then ascertained to determine whether the forceps or an elevator shall be used, and to indicate where the instrument selected can be best applied. The probable amount of resistance that may be encountered in its removal is estimated in the same manner as if the crown were intact (page 81).

Examining a Root Overlaid with Gum Tissue.—An inflamed area, a loose flap of gum tissue, a congestion of the soft tissues, or small, sharp, protruding edges of tooth structure, will usually indicate the location of the root of a tooth that is overlaid with the gum tissue. Frequently an external examination may be made by carefully inserting a probe or explorer underneath the gum tissue folds, but care should be taken to avoid a possible hemorrhage, which would interfere with a further examination. Where possible, an instrument is inserted into the root canal or applied to the edge of the root to ascertain the firmness of its attachment. One must not always depend on finding the root in its normal location. The author recalls examining an inferior first molar where the distal root of the tooth was lying on the buccal surface of the roots of the second molar. The history of the case indicated that the first molar had been operated on, the parts being abscessed, and that the former operator, after searching for the root a long time without success, informed the patient that "nature would throw it off." In this case he undoubtedly pressed the root of the tooth into the abscess cavity, which extended toward the second molar.

Examining a Filled Tooth.—A tooth that is filled with amalgam, cement, or gold should be closely examined, and notation made of the size and strength of the filling and the probability of the filling supporting the crown or surface of the tooth to which the instrument is to be applied during the extraction. Before the operation is begun, the operator should determine whether to remove a filling where extensive caries exists, or to permit it to remain, in the latter case depending on the filling to withstand the pressure of the beaks of the forceps or other instruments.

Examining a Root Supporting a Shell Crown.—When a shell crown is attached to a tooth to be extracted, a careful examination should be made to determine whether the crown is securely cemented to the tooth, and, as with a tooth that is filled, the propriety of removing the crown or permitting it to remain should be considered. A close examination of the neck of the tooth for probable decay and to ascertain the fit of the crown at this point is also necessary, in order to determine whether the artificial crown may be depended on to support the remainder of the tooth and carry it from its socket when the forceps are applied to it for its extraction. If it is decided to permit the crown to remain, the firmness of the attachment of the roots to the tissues should be noted in the same manner as if the tooth possessed a natural crown.

Examining a Root Supporting a Dowel Crown.—A tooth with a dowel crown, with or without a band, should be subjected to the same kind of examination as a tooth with a shell crown. The examination should be made with special reference to the manner of applying the beaks of the forceps so as to avoid any fracture of the artificial crown during the extraction. The operator should determine whether to depend on the crown to support the beaks of the forceps, or to operate independently of the crown and apply the forceps to the root above the crown.

Examining a Bridge Abutment.—When a piece of bridgework and the root which serves as its abutment must be removed, the operator should note the strength of the attachment of the root of the tooth to the tissue to determine whether he can remove the bridge and its abutment intact, or whether it will be necessary to first remove the bridge and then extract the tooth.

Examining a Treated Tooth.—A tooth that has been treated by another operator should be very carefully examined, and special inquiry be instituted to ascertain if an attempt has been made to devitalize the pulp. Arsenical necrosis has resulted from such treatment after extraction where the operator, not being aware of the presence of an arsenious compound in the tooth, proceeded with the operation without realizing the probable serious consequences. If the tooth fractures during the operation and any of the arsenic remains about the socket, the gum tissues would in all probability, in a few days after the extraction, be found in a gangrenous state and the alveolus necrotic.

Examining the Adjacent Teeth and Approximating Space.—The teeth adjacent to the one to be extracted should be examined to determine whether either will interfere with the free application of the forceps or the elevator, and prevent an unobstructed completion of the extraction movements and delivery of the tooth from the socket, bearing in mind that the tooth to be removed may have divergent roots, and not forgetting to calculate whether the exit can be made through the existing space or must be made laterally. This should receive special attention where the involved tooth is in malposition, or where the crown has completely decayed away and only the root remains. Where the adjacent teeth impinge on the defective tooth, the operator should ascertain the amount of interference, and determine whether a sufficient amount of structure can be removed from the tooth to be extracted to allow an unobstructed delivery.

The advisability of using an approximating tooth as a fulcrum in a case where it is deemed necessary to apply an elevator is considered, and by a proper test it is determined whether the selected tooth possesses sufficient stability to bear the strain of applying the instrument indicated in that particular case to dislodge the affected tooth. If the tooth to be used as a fulcrum is filled or crowned, the operator should determine whether the artificial structure will be disturbed by using the tooth for that purpose during the extraction. Care should be exercised not to intrude on adjacent teeth where they contain large fillings, or where they are decayed or being treated.

Examining the Gums.—The gum tissue should be examined, noting to what extent it surrounds the affected tooth, or whether there is any recession of it from the neck of the tooth. The examination should determine how firmly the tissue adheres to the tooth, the feasibility of applying the elevator or beaks of the forceps under its margin, or the necessity of lancing it from about the tooth.

The operator should endeavor to save as much as possible of the normal gum tissue, examining the parts with a view to avoid lacerating it during the operation. A loose tooth is often held in position by this tissue alone, and it is more liable to be torn away during extraction than the gum surrounding a normally attached tooth. When operating on an impacted tooth where the gum tissue partially overlies the crown, special note should be made of the amount of adhesion of the gum tissue, as there is a tendency to firm adhesion in such case. Where the alveolar process is liable to be exposed, it is essential that as much as possible of the normal tissue be retained for its protection. Especially should the gum tissue be retained where a number of contiguous teeth are extracted, for in such case it is of paramount importance to preserve the tissue for the protection of the alveolus after the operation.

Examining the Alveolar Process.—The examination must determine whether the alveolar process is in a normal or an abnormal state, and furnish reasonable knowledge of its density, elasticity, and the probability of it being dilated or fractured during an extraction. By passing the thumb and index finger over the gum tissue covering the alveolus a fair idea of the strength of the tissue may be formed. The strongest and weakest points of the process surrounding the tooth should be noted, and a conclusion reached whether its relation to the particular tooth will permit the free application of the beaks of the forceps or the blade of the elevator. Where the alveolar process is unusually heavy, the operator determines whether extraction is liable to cause a fracture of the tooth or the alveolus, and outlines his operation to avoid these accidents. When it becomes necessary to make an alveolar application, consideration should be given to the extent to which such an application can be safely made. When the margin of the alveolar process is carious, the extent of the involvement is partially revealed by observing the inflammation coexisting in the gum tissue. If the process has been weakened, the amount of destruction that has taken place should be ascertained, and at the same time it should be learned whether the parts are broken down sufficiently to permit an easy delivery of the tooth. The advisability of removing the defective alveolus at the same time the tooth is extracted should be considered. The alveolar process, from the standpoint of the exodontist, is always a very important structure, and not to give it adequate consideration will often result in a failure to extract the tooth in its entirety.

USE OF THE RADIOGRAPH IN EXAMINATION.

If the examinations mentioned do not convey to the operator sufficient information concerning the tooth to be extracted, he should resort to the use of the radiograph to outline a definite plan of procedure. Since the introduction of the radiograph into dentistry, and more especially for its use in connection with the operation of extraction, it has become indispensable for the purpose of securing a correct diagnosis of a tooth that is beyond the view of the eye or the reach of instruments.

The radiograph has made obsolete those explorative examinations that require considerable lancing of the gum tissue and the cutting away of the alveolar process to diagnose the condition, which, even with all this lancing and destruction of tissue, give no definite knowledge of the anatomical relation of the tooth to the alveolar structure or to the adjacent teeth, or of the conformation of its roots. The outcome of an operation based on a diagnosis made by this explorative method has always been very uncertain, notwithstanding the skill that may have been possessed by the operator and the pains taken by him to perform a successful operation.

With the aid of a radiograph the operator has the advantage of forming a positive diagnosis of the condition of the involved tooth, for by interpreting the picture he can outline the required operative procedure in advance of the operation, enabling him to eliminate all unnecessary loss of time in operating and conserve the greatest possible amount of tissue by the operation.

Obtaining a radiograph of a tooth is a comparatively simple matter for the patient. Radiographs are obtained in two ways, and are termed intraoral and extraoral.

Intraoral Radiograph.—The intraoral radiograph is obtained by using an ordinary photograph film, cut into suitable size to cover the area to be brought into view. The film is securely wrapped in double thickness of black paper, so as to exclude all daylight, and this in turn is protected by rubber tissue, similar to that employed by surgeons when using a moist application. The film, so protected, is placed in the patient's mouth adjacent to the parts to be radiographed, and held firmly in place with the hand, or with one of a number of devices in use to avoid exposing the hand to the x-rays. The exposure is from two to ten seconds, and is so short that the liability of a patient being burned by these rays is practically nil. Frequently a patient objects to the use of the radiograph on account of fear of the rays, but, if it is explained to him that the exposure is very short, and that a special device is used to protect him from any possible injury, his mind is readily placed at ease. Wherever possible, the intraoral method should be adopted, as the film has the advantage of showing a much clearer detail of the anatomical structures, thereby affording a better outline for the study of the many minute normal and abnormal phases which should be taken into account in connection with an extraction of the involved tooth.

Extraoral Radiograph.—To obtain an extraoral picture, a photographic plate is used instead of the film. The plate is protected from the action of daylight by inserting it in a double envelope made especially for this purpose, or it can be deposited in a regular plate holder. The plates used for this work are of various sizes, the operator selecting such size as will give the amount of surface he desires to secure. The extraoral method of obtaining a picture is used where it is impracticable or impossible to put the small film into the mouth, as where the area is painful, or where the tooth is situated in the posterior part of the mouth and the tissues are very sensitive, and also in a case where temporary ankylosis is established and the patient is unable to open the mouth.

WHEN THE RADIOGRAPH IS INDICATED.

Probably the most important use that can be made of the radiograph in examination is in all forms of impacted teeth.

Impacted Tooth.—When a tooth is impacted and missing from its usual position in the arch, an examination of the parts where the tooth should be normally situated is made. Considerable knowledge concerning the tooth can usually be gained by passing the fingers over the gum tissue, and noting whether there is a bulging of the alveolus, or whether a part of a cusp of a tooth is protruding through the soft tissues. An inflamed area or pus infection of the tissues in the suspected region of the impacted tooth usually denotes its presence.

In the case of an impacted tooth the use of the radiograph is a humanitarian aid to a speedy diagnosis. Before the development of röntgenography, operations on impacted teeth were made, owing to imperfect diagnosis, with a feeling of uncertainty as to the possible delivery of the tooth *in toto* from its socket, and any such feeling of uncertainty has a tendency to militate against the success of the operation.

When a radiograph of an impacted tooth has been obtained, the diagnostic points to be interpreted are its location as compared with its normal position, its relation to the adjacent teeth, the contact point that interferes with its proper eruption, the shape and size of the crown and root or roots, and any abnormalities that may be present. An estimate is made of the amount of alveolar process involved, the space through which the tooth in question must be extracted, and the most favorable direction, taking into consideration its long axis, in which the imbedded tooth can be removed from its position.

Deep-Seated Root.—The radiograph is indicated in the case of a root that is deeply seated in the tissues, especially if a large amount of soft tissue overlies the root of the tooth and its location is obscure. The advantages presented by the radiograph in such case are that it will reveal the size and location of the root, the depth of the root in the tissue, and the amount of tissue that may be involved. From the picture the operator can determine the manner in which the root can be extracted with the least amount of destruction to the tissue and the method of applying the instrument to make certain the delivery of the root. Remarkable deviations from the normal are revealed in many instances by an x-ray picture of the root. A frequent abnormal condition of the root of a tooth is hypercementosis, and where this condition prevails a great deal of tentation may be avoided by being aware of its presence.

Suspected Unextracted Root.—A case is often presented where a patient will state that a former operator had presumably extracted a tooth, but the patient feels that the operation was not complete and that a part of the tooth remains. In such a case, if the socket is inflamed and the parts are sensitive, it is usually impossible to introduce a suitable probe to make a thorough examination. The radiograph will, however, determine whether a part of a root is present, and will at the same time give an outline of the socket, so that it can be treated according to the condition revealed.

Tooth or Root Below a Bridge.—Where the sharp edge of a part of a root or the cusp of an unerupted tooth appears under a bridge that is permanently cemented in place, it is frequently the case that the relative position of the bridge and imbedded root or tooth cannot be determined by an external examination. If it is suspected that an attempted extraction would endanger the work, a radiograph should be made, which will, in addition to outlining the size of the imbedded tooth structure, show its relation to the artificial restoration, and make it possible to operate in many cases without disturbing the bridgework.

Abscessed Tooth.—Often in the case of an abscessed tooth the operator desires to gain a knowledge of the extent of the affected region and the amount of bone tissue that has been attacked.

A radiograph will readily disclose the condition, and the abscess will be recognized by a dark area in the picture. On completion of the extraction the after-treatment should be according to the information conveyed by the radiograph.

Unerupted Tooth.—The radiograph is often indicated in the case of an unerupted tooth in order to locate it and determine whether it has a tendency to assume a normal position in the arch. Freakish and unusual positions are sometimes assumed by unerupted teeth, causing annoyance and intense suffering. Nothing is gained by a delayed diagnosis, and it is better to resort to the x-ray in order to clearly define the condition of the postponed eruption.

Deciduous Tooth.—The radiograph is also used in the case of a deciduous tooth where the root is interfering with the proper eruption of the permanent tooth, or where the operator has reason to suspect that the extraction of the deciduous tooth is liable to endanger the permanent tooth.

Maxillary Sinus.—The radiograph is a great aid in diagnosing any disturbance of the maxillary sinus. Where the operator is unable to decide whether to treat the sinus through the pulp canal or to extract the tooth in order to proceed with the treatment, the radiograph will so clear up the situation that the operator can decide which course to pursue.

Other Conditions.—In addition to the cases mentioned for the use of the radiograph, it is employed in extensive fracture of the alveolar process in order to gain some idea of the size of the fracture, and to ascertain whether the fractured process should remain or be removed. In a case where the operator has reason to suspect that the tuberosity about the superior third molar may have been fractured by a previous operation, the radiograph will determine whether there is a fracture, and, if a fracture is revealed, its extent, together with the best possible way to treat it, will be indicated by the radiograph.

The radiograph is advantageously employed in abnormal conditions and diseases of the maxilla and mandible, such as necrosis, fracture, etc., and, in fact, it should be used previous to every operation where a correct diagnosis is otherwise questionable. When the operator finds that the radiograph is the means of minimizing the possibility of disappointment and disaster, and materially aids him in his operative technic, he will take the precaution to employ it in all complicated cases. The only objection that may be advanced against the use of the radiograph is that of cost, but, when the possible dangerous results of an incorrect diagnosis are taken into consideration, with the attending loss of time, unnecessary pain, and annoyance caused by other methods of examination, the radiograph will be found a profitable investment and certainly more reliable.

Procedure Outlined.—At the conclusion of an examination the operator should possess a clear mental picture of existing conditions, from which he is to carefully outline the operative procedure that is to follow. As far as possible, each movement should be studied out in advance, formulating at the same time the methods to be adopted to meet any contingencies that may arise during the operative procedure, which will enable the operator to accomplish the desired end in the most practicable manner that conditions will permit. Such a course will inspire the operator with confidence, rendering him selfpossessed in demeanor and deliberate in execution, with every movement under perfect control. All unnecessary movements should be avoided, and the first adjustment of the forceps or elevator should, if possible, be the final one.

CHAPTER VII.

POSITION OF THE PATIENT AND OPERATOR.

In the extraction of teeth the relative positions of the patient in the chair and the operator are very important features to be observed. The position of the patient should be as comfortable as possible, taking into consideration the location of the tooth to be extracted. The position of the operator should be such as to give an unobstructed view of the operating field and permit a direct application of the instrument, so that the extraction movements can be properly executed and the tooth safely conveyed from the oral cavity. The particular positions of the operator for extracting the different teeth and the method of exposing the operating field are described respectively under headings pertaining to the extraction of the various teeth.

POSITION FOR OPERATION ON THE SUPERIOR TEETH.

Position of the Patient for Operation on the Superior Teeth.—The patient should sit erect, with the head in line with the axis of the body. The chair should be so adjusted that the body will be thoroughly supported, both as to the back and head, when the muscles are relaxed, and not interfere with free breathing. The position of the body in the chair is seldom changed, a higher or lower position being obtained by adjusting the chair. It will, however, be necessary to so arrange the posture of the head as to conform to the position required for the extraction of any particular tooth, and it may be necessary to turn the head sidewise in the head-rest, which should be of sufficient size to prevent the head from slipping from the desired position. The head-rest should be so constructed that it is easily adjusted, and allow the arm of the operator to be readily placed around the head of the patient to assist in supporting the head when the nature of the extraction requires such support. The arms of the patient should be relaxed, with the hands lying loose in his lap. If, however, the patient is of a nervous temperament, the operator may instruct him to clasp his hands together. If a general anesthetic, such as nitrous oxid and oxygen, is to be administered to a nervous person, the operator may instruct him to follow the psychologic demonstration of raising and lowering the index finger of his left hand, which will usually distract his mind from the operation. The limbs of the patient should be relaxed and not crossed, and his feet should rest solidly on the foot-rest of the operating chair.

The operating chair should be adjusted to a height to suit the stature of the operator, with the head of the patient about in line with the shoulder of the operator. This position insures a good access to the tooth, and at the same time permits the extraction movements to be made in their regular order. No tilt of the chair is necessary, except in very rare cases with the third molar when that tooth is obscured by the tissues.

If the operator anticipates any interference from the patient during the operative procedure when a general anesthetic is not employed, he should inform the patient that any interference with the operator's hands will affect the results to be obtained. Such interference is not only a hindrance to the operator, with the effect of prolonging the operation, but frequently causes a disagreeable fracture of a tooth. The operator's assistant, who stands to the left of the chair, should always be on the alert to prevent the hands of the patient from getting in the way during the operation.

Position of the Operator when Employing Forceps on the Superior Teeth.—The position of the operator when operating on the superior teeth is to the right of the operating chair (Fig. 52). His body should be well balanced, and his feet should rest solidly on the floor, be free of the base of the operating chair, and so placed that they can not slip. His limbs should be slightly separated, but straight, and, when the forceps are applied and the extraction movements begun, are slightly bent during the tractile movement.

For the extraction of an anterior tooth—for example, the central incisor—the operator stands to the right of the patient, stepping slightly to the rear as he progresses to the posterior teeth on the right side of the arch if any of those teeth are to be extracted. For an anterior tooth on the left side of the arch, his position advances toward the front of the patient, and, as he proceeds to the posterior teeth on the left side of the arch, it will become necessary for him to step slightly to the rear and lean further over the patient, so that he inclines well toward the left of the patient.

Fig. 52.—Position of the operator when applying forceps to superior teeth.

If a number of teeth are to be extracted, involving both sides of the arch, the operator starts on the left side, the most posterior teeth or roots being extracted first, and operates forward, following the order of extraction to the central incisors; then, changing to the right side of the arch, the most posterior teeth on that side are extracted, and he again operates forward, following the same order of extraction to the central incisors. Especially should this method be followed when a general anesthetic is employed.

POSITION FOR OPERATION ON THE INFERIOR TEETH.

Position of the Patient for Operation on the Inferior Teeth.—The position of the patient in the chair is similar to that for operation on the superior teeth (page 93). The head is, however, brought slightly further forward by adjusting the head-rest.

The operating chair is placed as low as possible for all inferior teeth, and tilted slight backward for the ten anterior teeth, the tilting being still a little further backward for the posterior teeth. If anterior and posterior teeth are to be extracted at the same sitting, the position should be as if only posterior teeth were to be extracted. The chair should, however, be tilted forward as soon as the operation is completed.

Inferior teeth present more complex operations than superior teeth because of the mobility of the mandible, which, coupled with interference from the tongue, renders application of the forceps more difficult, and care is necessary not to injure the tissue or strike the superior teeth in the tractile movement upward or when carrying the tooth from the mouth.

Position of the Operator when Employing Forceps on the Inferior Teeth.—The operator assumes a position back of the patient. When ready to apply the forceps, he steps on a stool or platform in the rear of the operating chair and inclines his body forward (Fig. 53), with limbs slightly flexed at the knees. When the upward tractile movement is begun, a straightening of the limbs will increase the lifting power. As when operating on the superior teeth, his feet should rest solidly on the surface on which he stands. In the position described the operator is directly over the inferior cuspid, and in line with the axis of the root. As he approaches the posterior teeth on either side of the arch, he inclines his body correspondingly to the right or left to maintain his position in line with their axes. This procedure has the advantage of permitting a direct application of the forceps to all of the inferior teeth, while any desired amount of pressure can be accurately gauged and directed in line with the axes of the roots, and the extraction movements can also be carried out freely. Another advantage is that the tooth under operation is in view throughout the entire procedure, the value of which will be fully recognized in case complications arise. The

Fig. 53.—Position of the operator when applying forceps to inferior teeth.

direct pressure afforded will frequently deliver an anterior tooth from the socket under its initial application, and this position is advantageously employed, especially when using the improved molar forceps (Fig. 13), with the molar teeth, where the field is often quite obscured.

The position usually assumed is at the right side and toward the front of the patient—almost similar to that used for the superior teeth, being only more to the front of the patient. While this position may commend itself to some, the author believes it has several serious drawbacks. The introduction of the forceps obscures the view of the field of operation, and the line of force applied in directing the forceps downward to grasp the neck of the tooth is at such an angle that it requires a much stronger wrist action and firmer grasp on the forceps than are necessary when the operator is above the patient. There is also a greater probability to misjudge the exact axis of the tooth, and, if misjudged, will cause an insecure grip to be taken on the tooth. Even if a firm grip is secured and the extraction movements are begun, greater judgment is required to execute them correctly, as all force is applied at an angle instead of in a straight line, and as a consequence the tooth may be easily fractured. If the space for the passage of the tooth is limited, the application of the forceps is more difficult when working at an angle than when operating in a straight line. The operator will find that he can exert more force in a direct line than at an angle, not to mention the increased power and better control of arm and hand that can be exercised when the arm is partially flexed, a position given the arm when the operator is back of the patient.

POSITIONS FOR VARIOUS CONDITIONS.

Position of the Operator when Employing Forceps where Superior and Inferior Teeth are to be Extracted at the Same Sitting.—When one is accustomed to both superior and inferior positions, changing quickly from one to the other becomes a matter of habit. In the majority of cases the extraction of the inferior teeth precedes operating on the superior teeth, and the operator accordingly assumes the position for extracting the former. When the operator has completed the extraction of the inferior teeth, he quickly tilts the operating chair forward, steps down—right foot first—from the foot-stool on which he has been standing, and assumes the position for extracting the superior teeth.

The position to the left of the patient is rarely, if ever, required for the superior teeth. The author does not recall a case where it became necessary to step to the left when operating on this arch. Such change of position is, however, occasionally necessary when operating on the inferior arch, as, for example, in the case of a right inferior bicuspid or third molar when these teeth are out of alignment and displaced to the lingual side of the arch, being directed toward the tongue, when it is advisable to use forceps indicated for the superior teeth and operate from the left side in order to secure direct access to the tooth.

Position of the Operator when Employing an Elevator.—The position of the operator for using the elevator is on the right side of the patient. The elevator is held in the right hand, the left hand being employed to control the soft tissue of the mouth, so as to keep it out of the way of the instrument and to admit light, and also to give support to the jaw, adjacent teeth, and alveolar process wherever necessary. The majority of elevators, as manufactured, have very short shanks, compelling the operator to change his position to the left side of the patient for teeth on that side of the arch. The author has, however, overcome this objectionable feature, and has also increased the efficiency of the elevator, by having an additional set made in which the blade of the regular make is reproduced, but with the shank one and one-half inches longer, which he uses in conjunction with those of regular manufacture (Figs. 20, 23, 25). This improvement enables him to operate on the left side of the arch without changing to the left side of the patient, with the following exceptions: where the inferior bicuspids on the left side of the arch have deep-seated roots, and direct leverage cannot be obtained from the right side; where the inferior left first and second molar roots present considerable resistance, and extraordinary force is required to release them; where the inferior left third molar is affected on its mesial surface with caries, which indicates an adjustment of the elevator to the buccal surface; and where the tooth is out of alignment or impacted, and it is necessary to send the tooth toward the lingual side when that plate has been dissected away, as direct pressure cannot be secured from the right side. When operating on the left side, the operator should stand slightly to the rear, with his face directed toward the left side of the patient.

Position of the Operator when Operating on a Child.—The position of the child in the chair, the adjustment of the chair, and the position of the operator are practically the same as for an adult person when extracting superior or inferior teeth. The height of the patient is, however, taken into consideration, and the newer type of dental chair has a special arrangement for a child's position. In the ordinary chair a number of pillows may be used, and the patient can be propped up to a sufficient height to secure good access and at the same time provide a comfortable position. The operator should not be too hasty with the arrangement of the child, and not frighten it with the preliminaries to obtain the desired position, being careful that the child is so placed that it does not slip from the position selected.

In case the child is unmanageable, and the operator deems it advisable, the patient may be taken in the lap of the assistant. If, in the case of a child that is small and delicate, a deciduous tooth is to be removed prematurely on account of some pathologic condition that cannot be treated in any other manner, it may be advisable for the mother (if she is not in a nervous condition) or the nurse accompanying the child to take a position in the operating chair and hold the little patient in her lap, care being taken, before attempting to operate, that the head of the child rests firmly against the shoulder of the person holding it. Such a position will usually be taken with less apprehension on the part of the child, and result in a successful operation when without such course there would be a failure for lack of submission on the part of the patient.

Position of the Operator at the Home of the Patient.—Occasionally it becomes necessary to operate at the home of a patient because his general health will not permit him to go to the office of the operator. When this is the case, the operator should secure at the home as favorable an operating position as possible for the patient and himself, and have the patient placed close to as good a light as is obtainable. When practicable, the patient should be placed in a sitting position, as the operator is accustomed to such posture, and it will aid in obtaining better results. This position may be secured by the use of a Morris chair, or, if that is not available, by taking two ordinary chairs with low backs, and placing one in front of the other, tandem fashion. The patient is seated on the front chair, and the operator, taking a position to the right of the patient, places his left foot on the rear chair, with his knee elevated, covering the knee with a towel. The head of the patient is drawn slightly backward, and made to rest on the knee of the operator. This gives a fairly comfortable position for the patient, and at the same time gives the operator access to all parts of the oral cavity. If the condition of the patient does not permit removal from the bed, he is brought as close as possible to its edge, preferably to the right side. In this position the head of the patient should be raised, or, if possible, he should be placed in a sitting position. In such case the operator must incline his body and operate as well as the circumstances will allow.

Position of the Operator in the Hospital.—The operator secures the best possible position after the manner adopted for operating at the home of the patient if the patient is able to sit up. If the patient is unable to sit up, he is placed on the operating table, with the head, supported by a pillow, as close as posible to the end of the table, and the parts to be operated on made as accessible as conditions will permit. For the inferior teeth the operator should assume a position back of the head. While operating he must be careful to support the inferior mandible, and allow the head to be turned to the left or right, as the case indicates. When operating on the superior teeth he should stand on the right side and face the patient, securing as direct access as is possible. When operating on an impacted third molar, it is preferable to operate from the side on which the affected molar may be located.

CHAPTER VIII.

PRECAUTIONARY SUGGESTIONS.

In the practice of exodontia certain contingencies may be presented that require special mention, and the necessary degree of precaution should be exercised by the operator to properly meet these conditions, as frequently a successful operation in a case presenting peculiar features will depend on the ability of the operator to readily comprehend the condition and adopt the correct procedure.

PRELIMINARY PROCEDURE.

Before proceeding to operate, the crown and neck of the tooth to be extracted, together with the associated tissues, should be thoroughly cleansed by syringing with a lukewarm antiseptic solution, using the syringe shown in Fig. 35 or a spray bottle connected with a compressed air apparatus. The neck of the tooth should then be carefully gone over with a pledget of absorbent cotton saturated with alcohol to more effectually sterilize the field of operation and to prevent infection of the wound, a condition that would likely ensue if the debris were not removed, as it would in all probability, if allowed to remain, be carried under the free margin of the gum and into the wound during the operation.

Any salivary calculus that may be attached to the tooth should be removed if it is liable to interfere with a free application of the forceps or to be carried into the wound. If pus exudes from around the free margin of the gum and continues to flow after the area has been thoroughly syringed, absorbent cotton or sterilized gauze should be applied to absorb the exudate, or it may be withdrawn with a hypodermic syringe. There will, however, be cases where this method of temporarily checking the exudation will not be practicable on account of the large flow of pus. Where such condition exists, a sufficient quantity of absorbent cotton or sterilized gauze is placed over the exuding area, and, when the operator is ready to apply the instrument, the assistant quickly removes the cotton or gauze, which has in the meantime absorbed the pus to such an extent as to permit a proper application of the instrument to the tooth.

TIME OF DAY FOR OPERATING.

The most favorable time of day for the general dental practitioner to extract teeth is in the morning, as the patient is then, as a rule, in the best physical condition, and the operator is not fatigued with the work incident to the daily routine duties of his profession. Such operations will, however, from necessity often be performed in the latter part of the day, as a patient will be prompted to seek relief when he realizes that he must undergo "the ordeal" to insure against another sleepless night. The extraction of a tooth is held in dread by the average patient, and in many cases submission to the operation is not yielded until the pain becomes unbearable, when the patient goes in quest of immediate relief.

IMPAIRED HEALTH.

Where the vitality of the system of the patient is impaired and he is in a debilitated condition, the operation should be performed in a hospital, and the general treatment of the patient be in accordance with the directions of the family physician.

ADVISING THE PATIENT BEFORE THE OPERATION.

It is advisable in a case where the associated tissues are infected, or where other unfavorable symptoms are present, to apprise the patient in advance of the operation of the nature of the contemplated extraction, and especially should this precaution be taken where any difficulty is anticipated or where the severing of a considerable amount of tissue around the tooth will be unavoidable. The patient should be given to understand that the extraction of a tooth involved as the one under consideration will not always give immediate relief, and that it will be imperative to give the wound proper attention after the tooth has been removed.

The average patient is disposed to associate a certain degree of similarity with the extraction of teeth, and be under the impression that all such operations are very much alike. A patient may, for example, have in mind a previous operation of a simple character where the parts healed immediately, but the case under consideration may be so entirely different, both in character and extent of involvement, that, if the extraction proves more complicated than the previous operation, the work of the operator may be regarded in an unfavorable light. It will, therefore, be prudent for the operator in such case to advise the patient, to such an extent as may be justified by the intelligence of the patient and the character of the operation, as to the contingencies that may arise.

UNCERTAINTY OF RESISTANCE ENCOUNTERED.

The degree of resistance to the force applied with the instrument used in the extraction of a tooth is always problematical. Frequently the tooth has the appearance of being easily released from its attachment, but great resistance is encountered when the instrument to remove it is applied. Then, again, its extraction may seem difficult, but the mere application of the instrument will release the tooth. The operator should always be prepared for any condition that may arise, keeping in readiness such instruments as may be required in case unexpected resistance is encountered. He should also guard against losing control of the tooth in case it is released from its socket on the initial application of an instrument.

TOOTH AFFECTED BY PYORRHEA.

No great amount of force is necessary, as a rule, to detach from its supporting tissues a tooth affected by pyorrhea alveolaris. It is advisable not to apply to such a tooth all the extraction movements that might be considered necessary for the same tooth if not so affected, and only such movements should be executed as may be required to sever the attachment. The pressure of the beaks of the forceps on the tooth, or only a slight movement laterally, will often release it, but precaution should be taken against tearing the soft tissues when carrying the tooth from its socket, as they often adhere more firmly than is superficially indicated, and especially should care be exercised in a case where the tooth is very loose and held in place only by these tissues.

UNSUCCESSFUL OPERATION BY ANOTHER OPERATOR.

A case where another operator has failed in an attempted extraction of a tooth is usually not presented until several days after the attempted operation, and in the interim the patient has probably suffered until a highly nervous state supervenes in addition to the pain. The operator should make a thorough examination of all the affected parts, carefully observing the condition of the soft tissues, alveolus, and the amount of tooth structure remaining. If the pulp is exposed, which is quite frequent in such a case, it should not be disturbed with the exploring instrument, as the explorer can be placed against the marginal edge of the part remaining to determine the degree of firmness with which it may be attached. If the tooth does not contain a vital pulp, the explorer can be placed in the pulp chamber or root canal, and the amount of mobility ascertained. In case several days have elapsed since the previous operation, the peridental membrane is usually congested and the tooth somewhat loosened, which will tend to simplify the operation. In addition to examining the parts mentioned, the teeth adjacent to the tooth to be extracted should be inspected, as the previous effort to release the tooth may have loosened other teeth without the patient being conscious of the occurrence, and the contemplated operation will unavoidably dislodge the loosened teeth, in which case the patient will in all probability censure the operator if he has not previously explained the existing condition. At the same time an examination should be made to determine whether the maxillary sinus or tuberosity is involved where the tooth is situated in close proximity to either of these parts.

While making the examination it should be the object of the operator to ascertain the cause of the failure of the previous operation, which may have been caused by a misapplication of the forceps, lack of access, abnormal condition of the alveolar process, improperly applied extraction movements, or interference of the patient. During the preliminaries the patient may take occasion to express an unfavorable opinion of the previous attempts at extraction, but it is advisable for the operator to diplomatically refrain from engaging in any censurable discussion of the matter. Where a number of attempts at different times have been made to extract a tooth, the patient will, as a rule, voluntarily give the history of these attempts, and in such case there is usually found an abnormality connected with the tooth that was not indicated by a superficial examination. The operative technic in these cases is described under headings pertaining to the extraction of the various teeth.

In all cases where unsuccessful attempts at extraction have been made it is advisable to administer a general anesthetic, as it will sometimes be necessary to prolong the operation on account of peculiar existing conditions.

TEMPORARY ANKYLOSIS.

Occasionally temporary ankylosis is present in a case where extraction is indicated. This condition is a partial or total temporary closure of the jaws, but, as a rule, the teeth are not held in complete occlusion, and a slight space can be obtained between the superior and inferior teeth. While there are quite a number of affections that may cause temporary ankylosis, the most frequent cause is an inflammatory condition produced by the malposition or delayed eruption of an inferior third molar, and sometimes, but rarely, of a superior third molar.

Access to the affected tooth is the first step to be considered, but opening the mouth for this purpose cannot, in many cases, be accomplished without causing the patient great pain on account of the rigidity of the muscles and the extreme sensitiveness of the area involved, unless a general anesthetic is administered. When the patient has been anesthetized, the jaws are gradually separated with the wooden wedge (Fig. 39), which is adjusted preferably between the posterior teeth, avoiding, if possible, those that support artificial crowns and those that are weakened by caries. If it is not practicable to open the mouth to its full extent with the wooden wedge, a further separation of the jaws can be gained with the Allen mouth-gag (Fig. 38). When the mouth has been opened sufficiently to permit the adjustment of the instrument to the tooth to be removed, the jaws may be held open with the Allen or Doyen-Jansen mouth-gag, or with a mouth-prop.

Where temporary ankylosis is caused by malposition of a tooth, the inflammation subsides on its removal, and the jaw soon regains its normal function. If septic pericementitis, alveolitis, or other inflammation of the tissues is associated with the temporary ankylosis, the affected parts are treated as described for these conditions in "Treatment After Extraction" (Chapter XV).

CHAPTER IX.

EXTRACTION TECHNIC OF THE SUPERIOR TEETH.

The extraction of the superior teeth is not, as a rule, as difficult an operation as that of the removal of the inferior teeth, as the superior teeth are more accessible, and there is no such mobility of the maxilla as is the case with the mandible. The superior teeth are extracted principally with the forceps, but such other instruments as the elevator, screw-porte, and chisel have their special adaptability in connection with their removal, and the application of these instruments is described under the extraction technic where their use is indicated. Special care should be taken, when operating on the superior teeth, to protect the cuspid eminence, maxillary sinus, and maxillary tuberosity from injury.

SUPERIOR CENTRAL INCISOR.

The extraction of the superior central incisor when the greater part of the crown is intact, if the extraction technic is properly executed, is a very simple operation. When, however, the tooth is extensively attacked by caries, some difficulty will be encountered in certain cases. Access to the tooth is favorable and abnormalities are not frequent. Fig. 54 shows the various types of superior central incisors that are usually seen.

Position of Patient and Operator.—The patient is properly seated in the chair, and the operator assumes the position for extracting superior teeth (page 94). The left arm of the operator is placed around the head of the patient, with the palm of the hand over the left cheek. The index finger raises the upper lip, exposing the field of operation; the second finger passes into the mouth in the region of the superior cuspid on the left side, with the tip of the finger extending to the right cuspid; the third finger is placed on the labial surface of the inferior teeth, and prevents the forceps from impinging on the lower lip (Fig. 55). This position of the arm and hand, in addition to affording an open field for the operation, gives the operator an easy and at

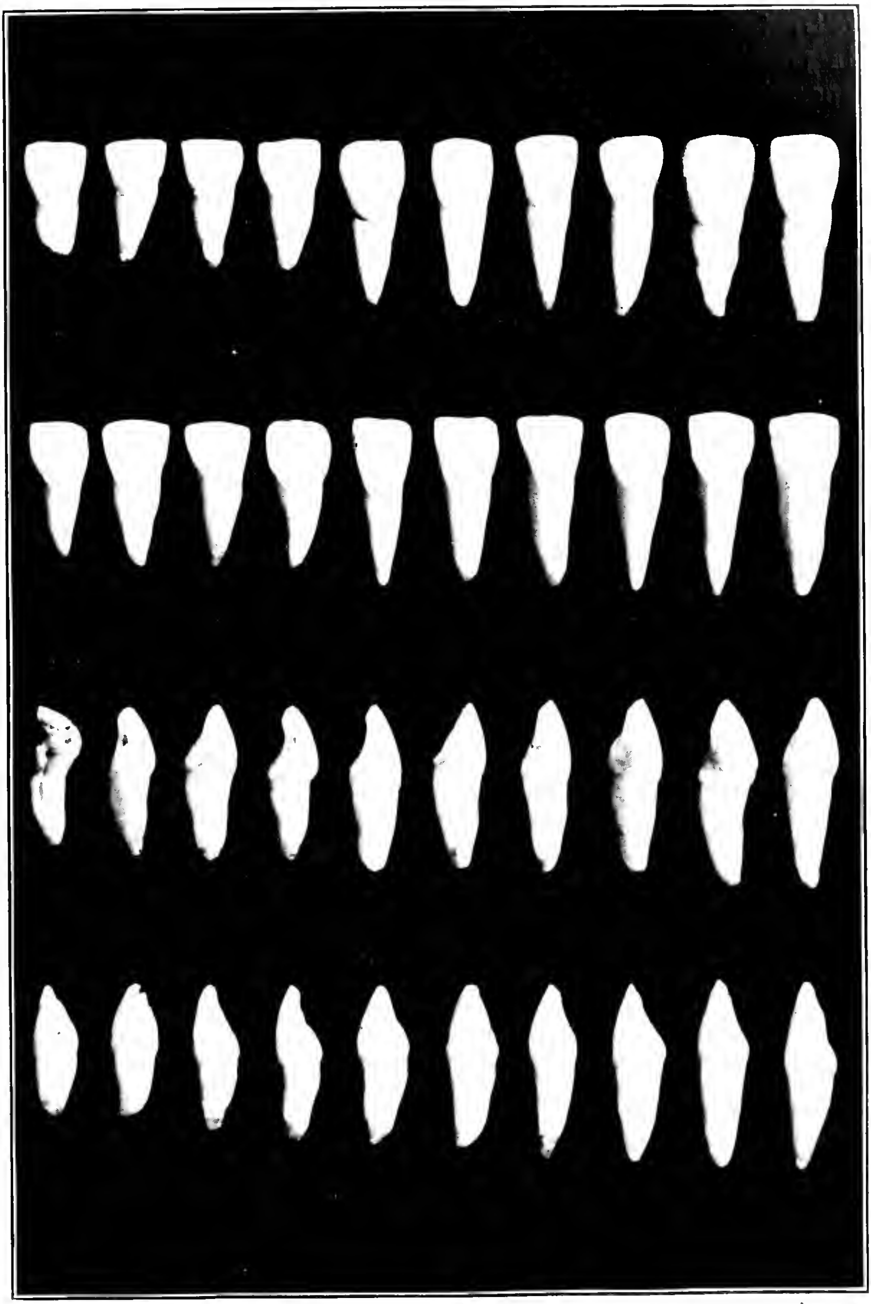


Fig. 54.—Types of superior central incisors. The first row shows the labial, the second row the lingual, the third row the mesial, and the fourth row the distal surface.

the same time a secure hold of the patient's head, and, when the extraction movements have begun, enables him to keep the head in position by holding it firmly against the head-rest of the operating chair.

Fig. 55.—Position of the operator's hands and disposition of the fingers when applying forceps to a superior incisor. Illustration shows the application of forceps (Standard No. 1) to the superior left central incisor.

Forceps.—The forceps usually employed in the extraction of a superior incisor are Standard forceps No. 1 (Fig. 1). Standard special A and special B forceps (Figs. 11, 12) are sometimes used when this tooth is partially displaced labially or lingually. The labial surface of this tooth being broader than the lingual, it has been claimed that forceps with a narrowed lingual beak should be employed in its removal, but the narrowing of the beak on the lingual side is of little or no importance. The only occasion where the operator would use different forceps is when extracting other teeth at the same sitting, in which case, if the teeth are not firmly attached, they may be removed with Standard forceps No. 2 (Fig. 2). Especially would there be occasion to employ Standard forceps No. 2 if operating under a general anesthetic, where time is always valuable, and they were to be used in the removal of other teeth, which would obviate the change of instruments, with the consequent loss of time.

Order of Extraction.—In a case where it is necessary to remove an adjacent lateral at the same sitting, the extraction of the central incisor should, whenever possible, precede that of the lateral. This order will often enable the operator to secure a better adaptation with the beaks of the forceps on the lateral, but this order should not be followed when the central is the more difficult to remove.

Application of Forceps.—Having selected the forceps, application is made to the tooth by first adjusting one beak to its lingual surface and then the opposite beak to the labial surface. The hand is slipped down to the ends of the handles until their swell-ends rest in the palm of the hand, and with sufficient pressure the beaks are sent up under the free margin of the gum to the edge of the alveolar process, the beaks being tightened enough at the same time to grasp the tooth firmly. If this movement is carefully performed, sufficient pressure can often be exerted while executing it to loosen the tooth from its attachment. The operator should be sure that the forceps are adjusted in a direct line with the long axis of the tooth, for, if this is not done, it will be difficult to properly gauge the amount of force to be applied in the extraction movements that are to follow. This adjustment should, however, be comparatively easy, as access to the tooth is not difficult, and the forceps selected have the beaks and handles in the same plane.

Alveolar Application of Forceps.—The method of application described in the preceding paragraph will answer for the extraction of most cases of central incisor in which there is enough structure remaining for the tooth to be removed with Standard forceps No. 1. There are cases, however, where in the application of the forceps it is necessary to pass the beaks a little above the edge of the process, carefully cutting through this tissue with the sharpened beaks before beginning the extraction movements. Such a condition is usually found where the tooth has been isolated for some time, or where there is a loss of the posterior teeth, leaving a few anterior teeth to support the jaw. Nature, in her effort to compensate this loss, thickens the external plate in order that the anterior teeth may bear the increased strain imposed on them. There are also instances where there is a large percentage of mineral matter in the tooth, which makes the tooth brittle, a condition usually found in elderly people, in which case the alveolar application is necessary. Unless the attachment of the tooth has been weakened by disease, greater care should be exercised in its extraction with persons past middle life than with younger persons, as the change which occurs in the bony structure with advancing age decreases the liberties that may be taken in the extraction movements.

In the alveolar application of the forceps, care should be taken not to force the beaks too far over the process, but just enough to cut through the crest of the ridge located near its margin. Proper care in the extraction of a tooth by this method will often leave the margin of the socket in better condition than if this course had not been pursued, for, in addition to lessening the danger of fracturing or breaking away a part of the process and leaving the edges sharp or irregular, the margin will be cut smooth, thereby anticipating a part of the work of resorption. Another advantage is that there is less bony structure to be covered by the soft tissue, which reduces to a minimum the amount of exposed process.

Extraction Movements.—When the application has been completed (Fig. 56, *A*), and the tooth has not been loosened by such application, the extraction movements are applied. They are begun by drawing the tooth slightly labially (Fig. 56, *B*), and then reversing the movement lingually (Fig. 56, *C*), being certain that the tooth is held securely enough in the beaks of the forceps to actually carry out these movements, instead of allowing the beaks to slide over the surfaces of the tooth, to which there is a tendency. If the beaks are permitted to slide in such manner, a fracture of the root is almost certain to result, as the force is being exerted transversely to the axis of the tooth, with

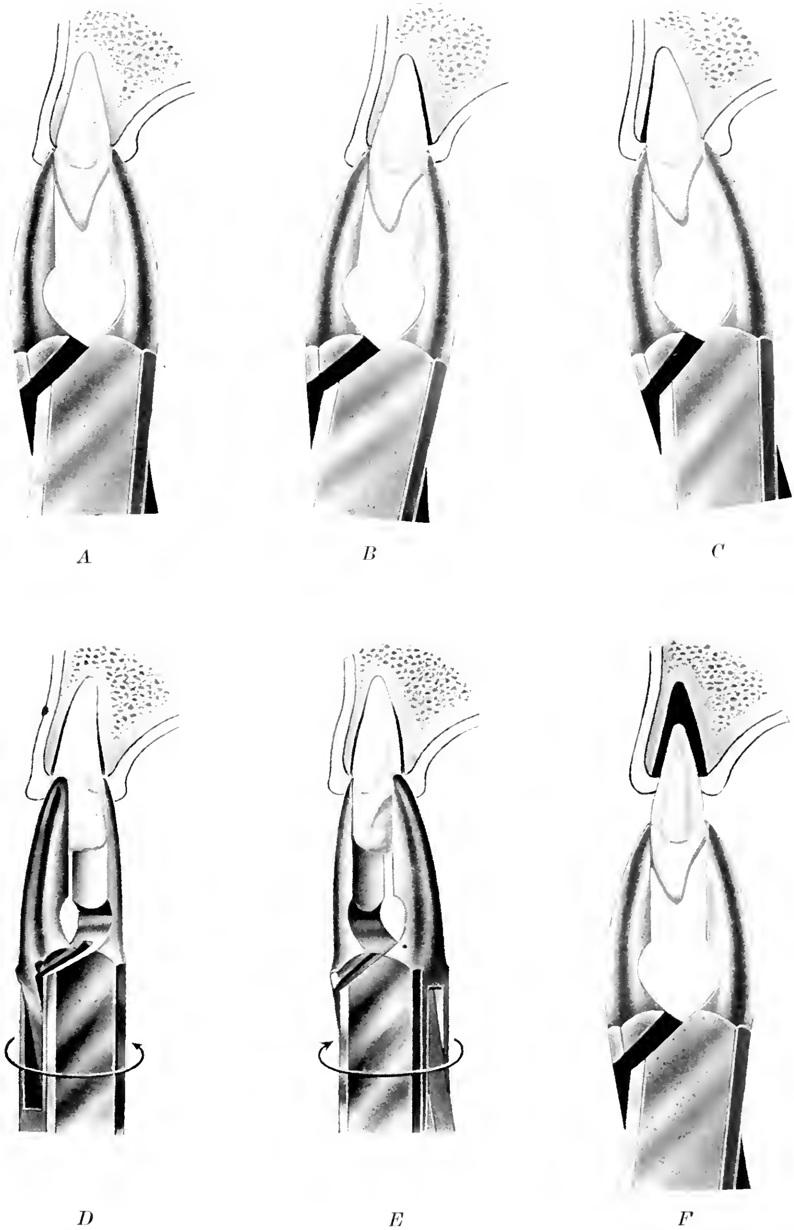


Fig. 56.—Extraction movements for superior central incisor. *A*, forceps (Standard No. 1) applied; *B*, first movement to the labial side; *C*, reversed movement to the lingual side; *D*, rotatory movement from the labial to the distal side; *E*, reversed rotatory movement from the labial to the mesial side; *F*, tractile movement downward in line with the original position of the tooth.

the process acting as a fulcrum. The other extreme, grasping the tooth too lightly, must also be avoided, as by such course the tooth may be broken off by the shearing force thus exerted. Care and practice will develop judgment in this application: The first two movements being completed, a rotatory movement is made by which the tooth is slightly turned from the labial toward the distal (Fig. 56, *D*), followed by a reversed rotatory movement from the labial toward the mesial (Fig. 56, *E*). After these movements, cautiously made, the tooth should be loosened from its attachment and is delivered from the socket with a tractile movement downward and in line with its original position (Fig. 56, *F*). The amount of force required to execute these movements will vary with different teeth, and must be carefully gauged in each case.

Displacement—*Complete Lingual.*—The superior central incisor is rarely completely displaced to the lingual side of the arch, and, when it is so displaced, an adjustment of Standard forceps No. 1 is made to the mesial and distal surfaces in the same manner as in the case of the lateral incisor (Fig. 61). When a firm adjustment has been secured, the extraction movements are made by first bringing the tooth forcibly to the lingual side, followed by the mesial and distal movements, which movements are to be repeated, if necessary, until the tooth's attachment is broken up, when it is carried out of its socket in line with its original position.

Complete Labial.—Where the tooth is completely displaced labially, the beaks of the forceps are applied to the mesial and distal surfaces. When applied, the first extraction movement should be toward the point of least resistance, which is necessarily to the labial side. As the reverse movement cannot be executed, owing to the impingement on the arch, the first movement is followed by a slight rotatory movement from the labial to the distal side, and then reversed. These movements are continued until the tooth is sufficiently loosened to be carried from its socket in line with its axis.

Partial.—In case of partial displacement, either lingually or labially, in which the intervening space between the two adjacent teeth is not wide enough for the application of Standard forceps No. 1, Standard special A or special B forceps are employed, with the narrow beak inserted in the intervening space to the labial or lingual surface of the tooth, depending on the direction of displacement. The extraction movements are curtailed, but in the main they are the same as employed in the removal of the same tooth in normal position.

Rotated.—Where the tooth is partially or completely rotated in its socket, the application of the forceps should be made on the surfaces that will permit the greatest bulk of the tooth to be secured in the beaks of the forceps. The extraction movements should be as near as possible like those described when the tooth is in alignment. The same technic of application will apply to any other tooth when rotated in a like manner.

Caries on Labial Surface.—Where the tooth is attacked by caries on the labial surface, one beak is applied to that surface first, followed by applying the opposing beak to the lingual surface. When the beaks are adjusted, a pressure is made upward in line with the tooth's axis. The labial beak is watched so that it does not involve any alveolus unless that structure is carious; if carious, the beak is sent on further so as to cut through the affected part to secure a firm hold on the tooth. The extraction movement is made by carrying the tooth as forcibly to the labial side as can be safely done without fracturing the alveolus or the tooth, and, if this fails to release it, the regular extraction movements applicable to this tooth follow, always using care to exert as little force as possible lingually, lest the tooth be fractured.

Caries on Lingual Surface.—Where there is extensive decay on the lingual surface, but with reasonably good structure on the labial surface, extraction is accomplished by applying one beak of the forceps well up on the lingual and bringing the opposite beak over the labial surface, when a very slight movement labially will determine whether the tooth is secured between the beaks of the forceps. When the tooth is properly secured, the tooth is loosened from its attachment by a rotatory movement, combined with such labio-lingual movement as can be safely applied without causing a fracture of the tooth.

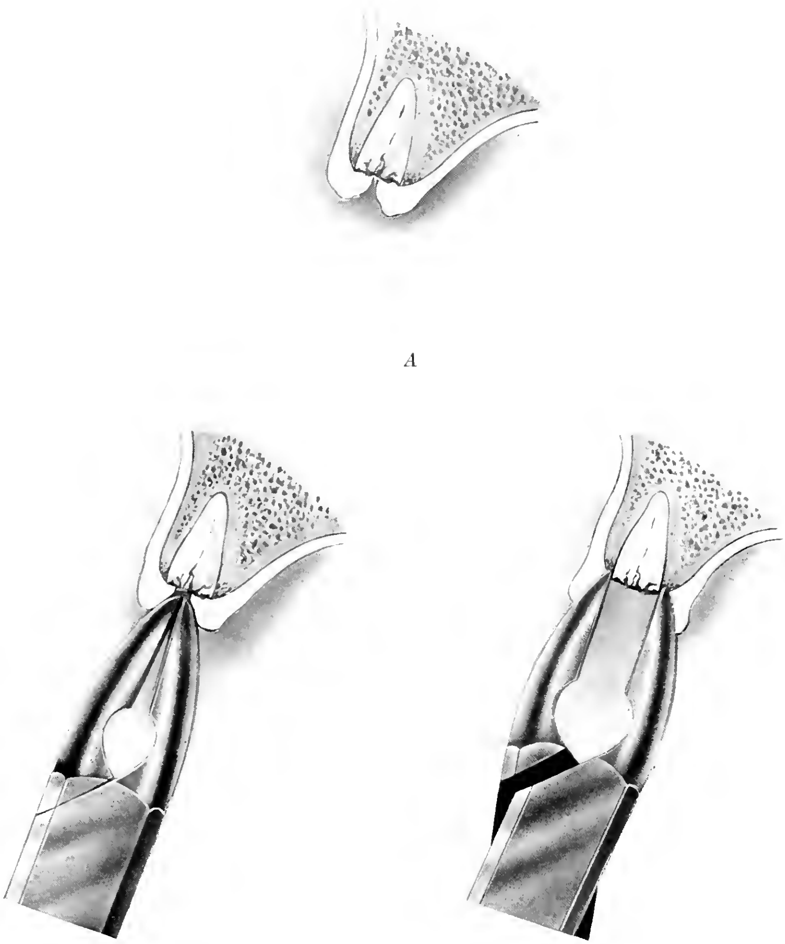
Extensive Caries.—Where the seat of caries is on the mesial or distal surface, or on both these surfaces, and a reasonably strong wall remains on the labial and lingual surfaces, the technic of operation is the same as given for crown and root intact. Where caries is extensive, and little support can be had from the crown, the operator should adjust his forceps independent of the crown and extract the tooth as if he were operating only on the root.

Caries Above Gingival Margin.—Where the tooth is decayed above the gum margin, and the labial and lingual walls are too weak for it to be firmly grasped by the forceps, but where the attachment is not too firm, having been loosened by alveolitis or other cause, extraction may often be performed by the continued force of application carefully executed without resorting to any of the other movements of extraction. The force of application thus executed acts as a double wedge through each beak of the forceps, and drives the root downward between them.

Central Incisor Root.—Where only the root of the tooth remains, and decay has not extended far up into the root canal and weakened the outer walls, Standard forceps No. 1 are used, and, when adjusted, the extraction movements are followed as when no caries exists. If the space over the root has been narrowed by the tipping of the approximating teeth mesially, the root must be brought well to the labial side in its removal from the socket to prevent injury to these teeth.

Split Root.—Frequently the root of a tooth is split its entire length, a condition probably more often associated with a central incisor than with any of the other teeth. This tooth is the most frequent recipient of a crown attached by means of a post in the pulp canal. Being less protected than any of the other teeth, traumatism, undue stress on the artificial crown, badly decayed root before receiving the crown, and poorly fitted post are some of the common causes of longitudinal fracture of this tooth. Where the root is in this condition, the method of operation is to adjust Standard forceps No. 1 to both halves of the root if they are adhering firmly to the tissues; if the parts are not firmly adhering to the tissues, the forceps are applied to the stronger section, and an endeavor made to carry the weaker portion from its position with the stronger portion. The extraction movements consist in applying rotatory movements from one side to the other until the parts are loosened. For cases of this nature associated with other teeth the technic of operation is the same, except the extraction movements are applied in accordance with the movements peculiar to the particular tooth.

Root Covered by Gum Tissue.—Where decay extends well toward the process, and the area once occupied by the neck of the tooth is nearly covered by gum tissue (Fig. 57, *A*), the tissue may be preserved by passing the closed beaks of the forceps up to the end of the root (Fig. 57, *B*), when the beaks are carefully opened



A *B* *C*

Fig. 57.—Method of avoiding the use of the lancet where the gum tissue covers the root. *A*, root of a superior central incisor covered by gum tissue; *B*, forceps (Standard No. 1) introduced between the gum tissue; *C*, spreading the gum tissue to allow the application of forceps.

sufficiently to pass over the root (Fig. 57, *C*), thus dilating the gum rather than cutting it. With the beaks opened to the outer margins of the root, a little firm, steady upward pressure will usually suffice to force it from its position, as such a root is seldom firmly attached.

Screw-Porte.—The use of the screw-porte (Figs. 28, 29, 30) for extraction is more applicable to the central incisor than to any other tooth, and this instrument is indicated where the tooth has been fractured above the process by traumatism or by a previous attempt at extraction. It may be used also on roots reduced by decay that has extended well above the process, but where the remaining structure is firm. The application of the instrument and the extraction movements being practically the same in all cases, the method of its use is described under screw-porte (page 41).

Elevator.—The use of the straight-shank elevator (Fig. 15) for the removal of the root of this tooth is indicated where decay is extensive labially, but a firm lingual wall remains. This condition is very common, as the beginning of decay near the gum margin labially on the central incisor is of frequent occurrence. The operation in such case is performed by holding the handle of the elevator high in the palm of the hand and grasping it tightly, passing the blade between the lingual wall of the tooth and the gum tissue (Fig. 58). A steady application is now made, in the meantime executing a slight right-and-left turning movement while tipping the handle distally. By these combined movements the point of the instrument is forced between the root and the process. The root is then lifted from its socket, using the elevator as a lever and the lingual margin of the socket as its fulcrum.

Where decay is so extensive that only a small amount of badly broken-down tooth structure remains, it can usually be removed with a Cryer elevator (Fig. 24), and is accomplished by passing the sharp point between the remaining tissue and process on the lingual side, after which the point of the instrument is turned labially and the root extracted.

Fracture.—A fracture of this tooth while operating is not of such frequent occurrence as with the other teeth in the superior arch. If a fracture occurs, and a reasonable amount of structure remains on the labial and lingual sides, the forceps are reapplied. If the fracture, however, is so high that the process interferes with the usual application, the alveolar application may be resorted to; but if this is deemed inadvisable, the screw-porte or

Cryer elevator should be used. When using the Cryer elevator for these cases, the chair is adjusted as low as possible. The operator should take a position to the right side of the patient and apply the elevator to the lingual surface, and, when the point has engaged the root, exert pressure labially, at the same time turning the instrument so as to bring the point downward, which will release the part if a secure hold of the root has been obtained.

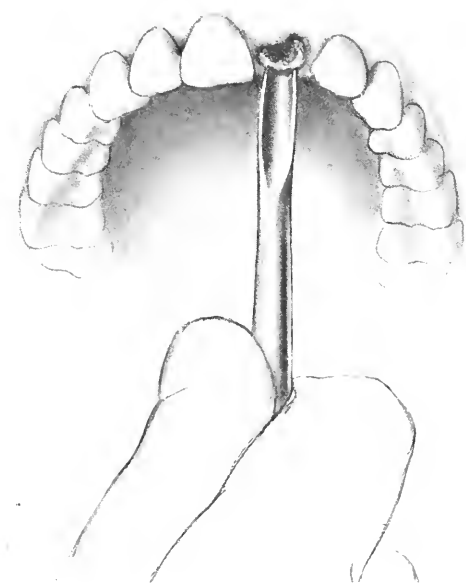


Fig. 58.—Straight-shank elevator (Fig. 15) applied to the lingual surface of a superior central incisor root.

Chisel.—When the root remaining is well tunneled, leaving only a thin wall hugging the process, the ordinary enamel chisel is often a reliable instrument for its removal. The removal is accomplished by separating the shell-like portion of the root from the process at two or more points, forcing the root toward the center, and, when loosened, removing it with the Derenberg tweezers.

Reinforcing Root.—In a case of very extensive decay, or where the root has been weakened by a previous removal of tooth structure from the root canal for the insertion of a metal post, some operators advocate filling the root canal with cement or amalgam to increase its strength. This procedure will suffice only in very rare cases, and, as a rule, is not good practice.

SUPERIOR LATERAL INCISOR.

The extraction of the superior lateral incisor is a little more difficult operation than the extraction of the central incisor, as the neck of the tooth is often constricted and is prone to fracture if a good adjustment of the forceps is not obtained. The tooth is more frequently displaced than the central incisor, and obtaining direct access in such case is an important matter. Fig. 59 shows the various types of superior lateral incisors, and attention is directed to the occasional distal inclination of their roots.

Position of Patient and Operator.—The position of the patient in the chair and that of the operator is as described for extracting superior teeth (page 93). The position of the arm of the operator and the arrangement of the hand and fingers are as described for the central incisor (page 108). A slight variation of the position of the head of the patient is occasionally made—the face being turned partially toward the operator where unusual resistance occurs during the extraction movements.

Forceps.—Standard forceps No. 1 (Fig. 1), which are principally employed in the extraction of the central incisor, are also the most suitable forceps for operating on the lateral incisor. The variations in the size of the crown and frequent malposition of the tooth, however, compel changes in the selection of forceps. Where the crown is of small size, especially if it is of the peg-shape type, Standard forceps No. 5 (Fig. 6) may be found more suitable. Where the tooth is displaced lingually or labially, preference should be given to Standard special A or special B forceps (Figs. 11, 12), as they can be more readily adjusted. These forceps are bayonet shape, but, if the operator is careful, he can gauge his application so that the beaks will be in line with the axis of the tooth. The shape of this instrument should not be of any great hindrance in applying the extraction movements, as the resistance encountered with this tooth is not very great, although one with beaks in line with the handle is preferable for the six anterior teeth wherever it can be used. When operating under a general anesthetic, and one or both of the bicuspid teeth, or the molar roots, are to be extracted in addition

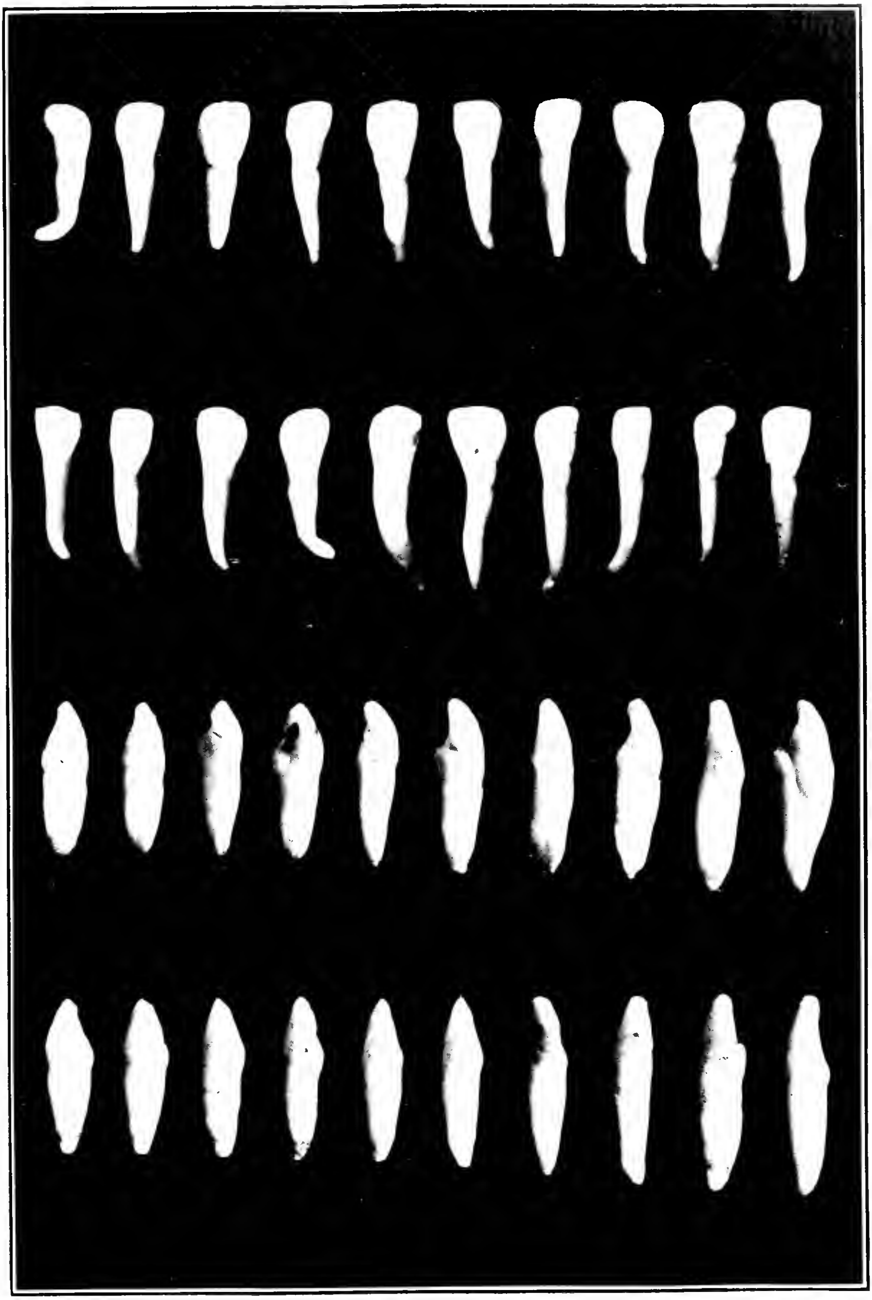


Fig. 59.—Types of superior lateral incisors. The first row shows the labial, the second row the lingual, the third row the mesial, and the fourth row the distal surface.

to this tooth, Standard forceps No. 2 (Fig. 2) can often be applied with good results.

Order of Extraction.—As previously stated (page 111), the extraction of the central incisor precedes that of the lateral when both of these teeth are to be removed. If the cuspid is also to be removed, the order should continue and the lateral be extracted before the cuspid. This order should always be followed unless contraindicated by untoward conditions, as the lateral incisor is usually not so difficult to dislodge from its socket as the cuspid. The order of extraction mentioned allows a freer application of the beaks of the forceps to the cuspid, and in some cases the extraction of the lateral weakens the septum of alveolus between the lateral and cuspid, which materially lessens the resistance of the cuspid to dislodgment.

Application of Forceps.—The application of the forceps to the neck of this tooth is made in a similar manner to that described for the central incisor. The beaks should, however, be sent a little further up on the neck of the tooth on the lingual surface than is done in the application to the central incisor. The adjustment of the beaks of the forceps to this part of the tooth should be accurate, and so made that it covers the greatest possible amount of surface. In sending the beaks up under the free margin of the gum, the operator must progress slowly, so as to carefully gauge the required amount of force, as the process surrounding this tooth is constricted, and there is danger of forcing the forceps too high and unnecessarily destroying healthy tissue.

Alveolar Application of Forceps.—An alveolar application can be more readily made on this tooth than on the central on account of the depression of the process in this region. As decay above the gingival line is of frequent occurrence and the small neck closely approximates the alveolar border, either of which increases the liability to fracture, alveolar application becomes necessary more often than with the central incisor. The technic is similar to that for operating on the central, but greater care must be exercised to prevent the forceps from slipping too far over the alveolar border into the incisal fossa and causing an ugly wound.

Extraction Movements.—The extraction movements are different from those applied to the central incisor. Rotatory move-

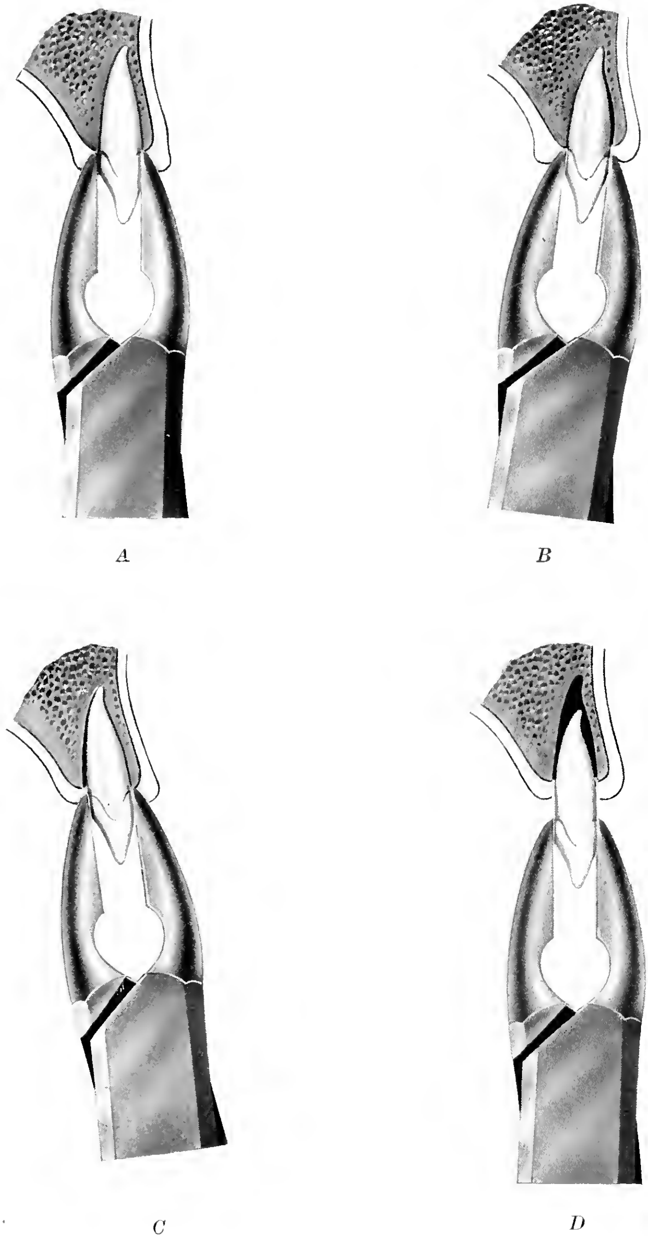


Fig. 60.—Extraction movements for superior lateral incisor. *A*, forceps (Standard No. 1) applied; *B*, first movement to the lingual side; *C*, reversed movement to the labial side; *D*, tractile movement downward in line with the original position of the tooth.

ments must not be attempted here, as the root of this tooth is flattened on its mesial and distal surfaces. If the application of the forceps (Fig. 60, *A*) has not loosened the tooth in its socket, the next step is to direct the first extraction movement to the lingual side (Fig. 60, *B*). Directing the forceps to the lingual side should not be attempted too forcibly, as this movement is made principally for the purpose of sending the beak adjusted to the lingual side further up on the neck of the tooth, so that it may be more securely placed. This movement is followed by bringing the tooth with the same amount of force to the labial side (Fig. 60, *C*). The alveolar process, being the weaker on this side, allows the tooth to be more readily forced in this direction, and considerable space is gained. These two movements will in most cases loosen the tooth from its attachment, and, if not, they are repeated until it is loosened, when it is brought back to its original position and the extraction completed by a downward tractile movement applied in line with the axis of the tooth (Fig 60, *D*).

The operator should bear in mind that the neck of this tooth is frequently constricted, which necessarily causes weakness at this point, and he should gauge the force of the extraction movements accordingly, lest fracture occur. Special caution should be observed where the central and cuspid are in position, or where the tooth is partially displaced lingually, to avoid injuring the enamel of these teeth with the forceps.

Displacement—*Complete Lingual.*—Where the tooth is completely displaced to the lingual side of the arch, and the space where it should normally be situated is closed, lingual and labial application is often impossible. Standard forceps No. 1 should be selected, and the beaks are applied to the mesial and distal surfaces of the tooth (Fig. 61). In adjusting the forceps to these surfaces, care should be taken that the beaks grasp as much as possible of the tooth structure. If the distal surface of the tooth is in close contact with the cuspid, Standard forceps No. 5 can often be advantageously used. In making the application and during the extraction movements the operator should be careful not to injure the enamel of adjacent teeth by bringing the beaks too forcibly against them.

When the forceps have been applied, the first extraction movement is to the lingual side, and is made with as much force as possible without causing fracture. If this movement does not loosen the tooth from its attachment, a slightly swaying movement in the most favorable direction is executed, followed by again bringing it to the lingual side. When the latter movements have been made and some space has been secured, the tooth is brought to the labial side as far as the distance created by the lingual movement will permit, when, with a degree of force downward direct in line with its original position, the tooth is delivered from its socket.

If the execution of these movements, however, fails to dislodge

Fig. 61.—Mesial and distal application of forceps (Standard No. 1) to a superior lateral incisor completely displaced to the lingual side of the arch.

the tooth, they must be repeated until extraction is finally accomplished, and on each repetition of the movement advantage should be taken of any space that may have been gained, which is done by making a higher adjustment of the forceps on the tooth.

Complete Labial.—Where this tooth is displaced completely to the labial side of the arch, the application of the forceps will be the same as where it is displaced completely to the lingual side, but the application should be made with some degree of force, as a complete delivery of the tooth on the first application may often be accomplished. If such delivery cannot be made, the first movement should be labially, then slightly lingually, and repeated until the tooth is loosened, when it is brought straight from its socket.

Extraction of laterals in labial occlusion is usually not difficult, as the process external to the root is not heavy.

Partial Lingual.—In a partial lingual displacement, Standard forceps No. 1 are to be preferred, but, if space will not permit their application, the operator should choose between Standard forceps No. 5 and Standard special A or special B forceps. If the crown is small and the space limited, Standard forceps No. 5 should be used. If the tooth is large, and space between the approximating teeth is sufficient for one narrow and one broad beak, one of the Standard special forceps are selected, in which case the narrow beak is first applied to the narrow space on the labial side. The first extraction movement is made to the lingual side with sufficient force to loosen the tooth if possible, care being taken to avoid a fracture. The beaks are then sent further on the tooth, when it is brought slightly to the labial side and then carried forcibly to the lingual side, followed with a tractile movement downward, and the tooth delivered from its socket.

Partial Labial.—Where the tooth is partially displaced to the labial side, the same forceps and technic are used as described where it is displaced lingually, and the principal movement is to the labial side.

Rotated.—Where the tooth is partially or completely rotated in its socket, the selection and application of forceps and the extraction movements are similar to those employed when operating on the tooth in normal occlusion.

Impaction.—This tooth, like the central incisor, is seldom impacted, and, if in that condition, it is rarely extracted, as such case is usually referred to the orthodontist for correction.

Extensive Caries.—The lateral incisor is subject to decay above the gingival line—both labially and lingually, especially lingually—as the enamel coverings in the lingual pit and the linguo-gingival groove are often imperfect. The application of the forceps and the extraction movements, eliminating any attempt at rotatory movements, are the same as for the central incisor in a like condition, and the same care in the application of the forceps and force of the movements should be exercised as with the central incisor. Where the tooth is attacked by caries on the mesial or distal surface, or both surfaces, and the decay is very extensive, it should be treated as if it were a root, and the technic of extraction is the same as for a lateral incisor root.

Lateral Incisor Root.—The extent of decay and the strongest and weakest parts of the root govern the selection of forceps and the amount of pressure that may be judiciously used in their application. Care should be taken when operating on the root of this tooth on account of its proneness to fracture. Where a fairly sound structure is found at the neck, Standard forceps No. 1 should be applied, and the extraction movements are the same as where the crown is intact. Where the root is small, Standard forceps No. 5 should be used, and are applied well up on the root to secure good adjustment. Where the forceps cannot be applied, extraction may be performed with the elevator as described on page 128, and for the removal of a deep-seated root the procedure may be as described below under root fractured.

Root Covered by Gum Tissue.—Frequently the root of this tooth is partially or completely covered by gum tissue, and in such case the application of the forceps is the same as for the central incisor in a like condition (page 116). Marginal alveolar caries is nearly always present when the root is in this condition, and, when present, a freer application of the forceps can be made than where the process is normal. Application of the forceps is governed by the operator's sense of touch, which will convey to him the difference between sound and carious alveolar structure. After the application, the extraction movements are executed as outlined for this tooth if the pressure of the application has failed to release it.

Root Fractured.—The root of a lateral incisor frequently tapers to a very fine point, which is usually curved distally. The root is easily fractured at the point of greatest deflection, and, when fractured at this point, the extraction of the remaining tip becomes a very delicate operation. It is usually beyond the reach of forceps or elevator, and may be left *in situ* if it is thought that it will not cause any further disturbance; but, if a pathologic condition is present at its apex, removal may be a necessity. The fragment can usually be cut out with a small rose bur with less injury to the tissue than if its extraction is attempted with either forceps or elevator. Where the part remaining is rather large, and the alveolus is projecting sufficiently to interfere with the application of the beaks of the forceps or the blade of an elevator, the method of operating is to cut away enough process with a sharp bur to allow the forceps to be adjusted or the blade of the elevator to be applied to the root. If the root is large enough, the screw-porte may be used instead.

Root Wedged.—Where the approximal space is closed over the root by the central incisor and cuspid, and the root is not firmly attached, the straight-shank elevator (Fig. 15) may be employed, as described for the central incisor, to dislodge it (page 118). If the root is firmly imbedded, it is detached from its socket with the Cryer elevator (Fig. 24), and, if necessary, the straight-shank elevator is then applied to push it further toward the labial side, where it can be reached with the forceps or Derenberg tweezers. Where the root is very frail, and the use of an elevator is impossible, the chisel will serve to separate it in sections, and the parts are removed with the Derenberg tweezers.

Screw-Porte.—The application of the screw-porte is limited more in the case of the lateral incisor than that of the central, as the root canal of the former is not so large and does not receive the screw-porte so readily. Where the root is deep-seated, and the alveolus interferes with the adjustment of the forceps or the application of the elevator, sometimes extraction can be successfully accomplished by selecting a screw-porte with a fine point.

Elevator.—The use of the straight-shank elevator as described for central incisor (page 118) is not practicable when the root of this tooth is of considerable size, as the elevator can be used successfully only where the root is short and not firmly attached. When the elevator is used, it should be applied to the lingual side and given a pushing movement to the labial side until the root is entirely dislodged, or loosened sufficiently to be removed with the Derenberg tweezers. Where there is a strong wall on the distal side and decay has undermined the other part of the root, the Cryer elevator can be advantageously applied in some cases to the disto-lingual side, using the cuspid as a fulcrum. When the elevator is applied, the blade is sent as far down as possible on this side of the root and turned, engaging the root with the point of the elevator and lifting it from its socket.

SUPERIOR CUSPID.

The extraction of the superior cuspid is usually attended by considerable resistance, depending on the size of the tooth and the strength of the alveolar process. Fig. 62 shows the various types of superior cuspids, some of them presenting the occasional distal inclination of their roots.

Position of Patient and Operator.—The position of the patient in the chair and that of the operator is as described for extracting superior teeth (page 93). When operating on the left side of the arch, the head of the patient is turned toward the operator. The left arm of the operator is placed around the head of the patient, with the palm of the hand over the left cheek; the index finger raises the upper lip, exposing the field of operation; the second finger is placed on the labial surface of the inferior teeth; the third and fourth fingers are placed against the lower part of the cheek (Fig. 63). This position gives the operator an unobstructed view and also supports the patient's head.

When operating on the right side of the arch, the head of the patient is placed straight in the head-rest or turned slightly toward the left. The left arm of the operator and the palm of the hand are arranged in the same manner as when operating on the left side of the arch, but the fingers are brought toward the right cuspid (Fig. 64). Changing from one position to the other can be quickly done, and, when both cuspids are to be extracted, the left one is removed first.

Forceps.—Standard forceps No. 1 (Fig. 1), which are usually employed in the extraction of the central and lateral incisors, are also the most suitable forceps for the removal of the cuspid. A number of heavy-handled forceps are manufactured especially for the extraction of this tooth, and some of these forceps are practical, but the author is of the opinion that better execution can be had by the operator accustoming himself to the use of the one forceps, so that his sense of touch will readily convey to him the extent to which the instrument accommodates itself to the condition presented. Standard forceps No. 1 have been found to possess sufficient strength to meet any requirement. Where the tooth is displaced, Standard special A and special B forceps are employed, and used in the same manner as for centrals and laterals in a like position.

Order of Extraction.—Where the teeth adjacent to the superior cuspid are also to be removed, their removal, in order to reduce the amount of resistance that is nearly always encountered in the extraction of this tooth, should precede that of the cuspid. This procedure will afford a better adjustment of the beaks of the forceps to the latter tooth.

Application of Forceps.—The operator should bear in mind that the head of the patient is turned to the right, or possibly slightly to the left, and note, when applying the forceps to the cuspid, that the application is made in line with its axis. The order of first adjusting one beak to the lingual surface of the tooth and then the opposing one to the labial surface should be followed, as when making application to the incisors. As the cuspid possesses a long and heavy root, surrounded by dense, heavy process, with a firm alveolar ridge, much greater pressure may be exercised in sending the beaks of the forceps on this tooth than on any other. This is done by placing the palm of the hand against the swell-end of the handle of the forceps as soon as adjustment has been had, and exerting a firm, steady pressure upward. Special care must be taken in adjusting the beak to the lingual surface, as there is little constriction of this tooth at its neck, and, the linguo-gingival ridge being very near the margin of the process, there is a tendency for this beak of the forceps to slip from its position.

When the lateral incisor and first bicuspid are missing or have just been extracted, a better application can often be made by adjusting the forceps to the mesial and distal surfaces of the tooth (Fig. 65). The advantage of this application is a better adaptation of the beaks of the forceps, owing to the flattened surfaces of the tooth at its neck on these sides. The firmer grip thus secured enables the operator to make the extraction movements with greater freedom of motion, and lessens the danger of fracturing the process.

Alveolar Application of Forceps.—Alveolar application to the cuspid is not practicable, and should not be attempted unless the process has been weakened by caries. If it is necessary to apply the beaks of the forceps above the margins of the process to obtain a secure adjustment to the tooth, it is advisable to

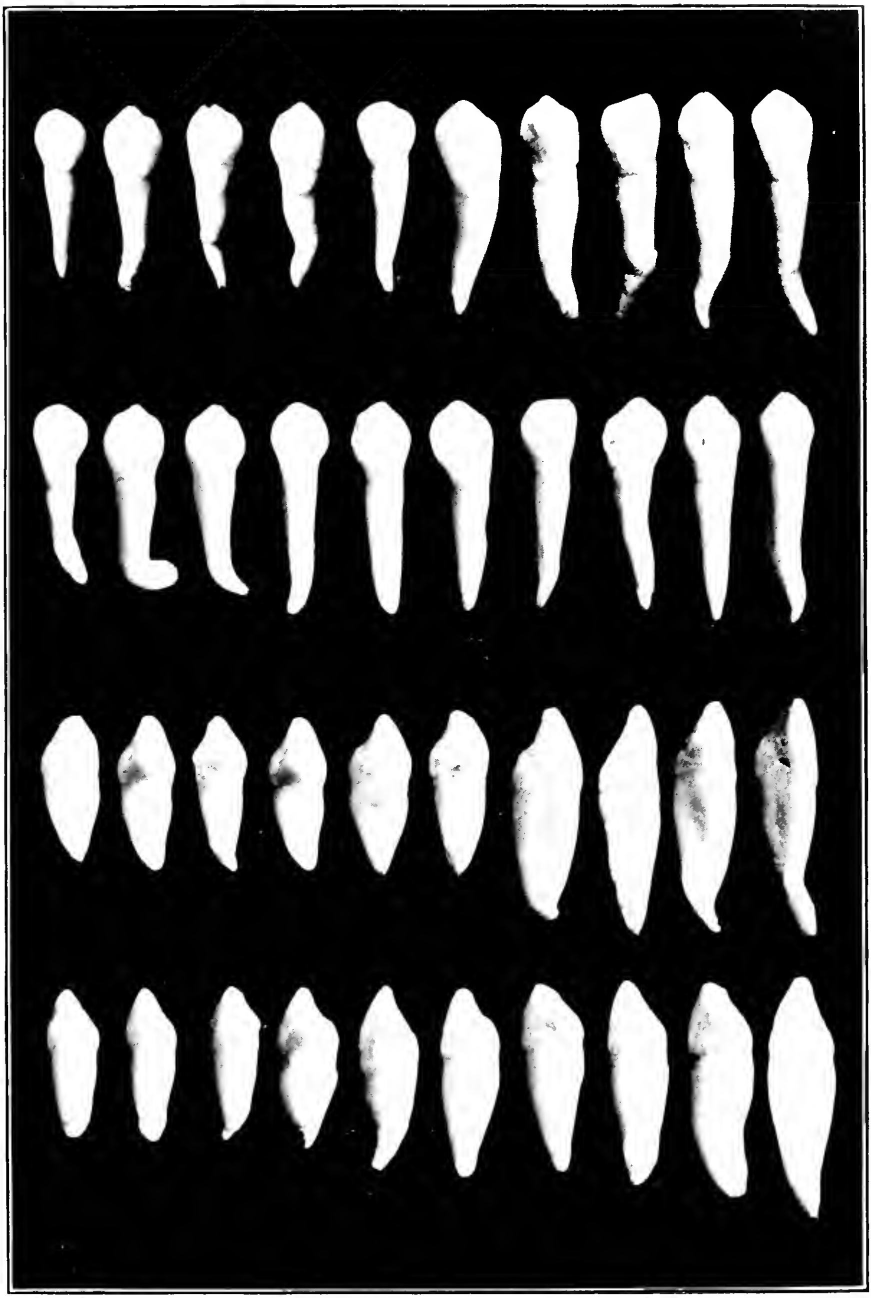


Fig. 62.—Types of superior cuspids. The first row shows the labial, the second row the lingual, the third row the mesial, and the fourth row the distal surface.

remove a part of the process with a cross-cut bur before attempting the application. This removal of the marginal ridge of the process with a bur is preferable to endangering the external plate by the heavy force which is sometimes required to loosen

Fig. 63.—Position of the operator's hands and disposition of the fingers when applying forceps to a superior cuspid on the left side of the arch. Illustration shows the application of forceps (Standard No. 1) to the superior left cuspid.

the tooth from its attachment. Where the posterior teeth have been lost for a considerable time, the process in the region of the cuspids is usually very thick and dense in order that these teeth may bear the increased pressure constantly exerted on them. Examination should be made for the probable existence of this condition, and, if present, there should be no hesitation to remove part of the process before attempting to adjust the forceps.

Extraction Movements.—With Standard forceps No. 1 applied to this tooth (Fig. 66, *A*), the first movement, with a force gov-

Fig. 64.—Position of the operator's hands and disposition of the fingers when applying forceps to a superior cuspid on the right side of the arch. Illustration shows the application of forceps (Standard No. 1) to the superior right cuspid.

erned by the size and strength of the root and the resistance offered, is to bring the tooth to the labial side (Fig. 66, *B*), this being the direction of least resistance, and then, reversing the movement with an equal amount of force, the tooth is forced lingually (Fig. 66, *C*). These two movements, carefully executed, should enable the operator to fairly judge the strength of the tooth and the resistance to be overcome. This knowledge having been gained, these movements are repeated with increased stress in each direction (Fig. 66, *D, E*) until the attachment of the tooth has been broken up, when it is brought back to its original position and removed from its socket with a tractile movement downward in line with its original position (Fig. 66, *F*).

If the technic described above fails to loosen the tooth from its attachment, conditions other than normal may be suspected.

Fig. 65.—Mesial and distal application of forceps (Standard No. 1) to a superior right cuspid when both adjacent teeth have been extracted in advance of the cuspid.

A condition frequently exists in which there is partial or almost complete loss of the peridental membrane, due to a thickening of the pericementum. Where this condition exists, the adhesion of the root to the process is very tenacious, being at times so complete that parts of the process will adhere to the tooth on its removal without disturbing the plates of the process itself. If this condition is present, the adhesion should be broken up by a very slight rotatory movement of the tooth from the labial to the mesial side, but it should be borne in mind that, as the root is flattened in its mesio-distal diameter, the reverse rotatory movement should not be attempted, as it will probably cause a

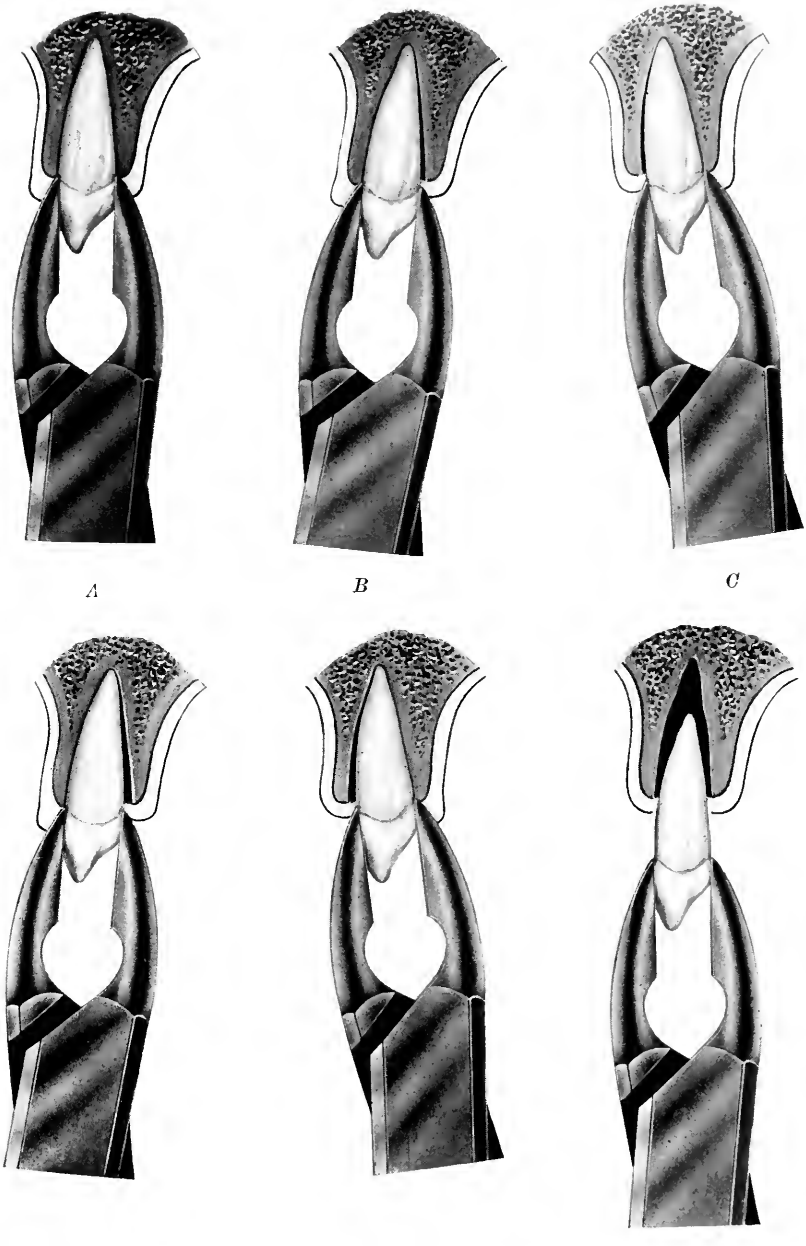


Fig. 66.—Extraction movements for superior cuspid. *A*, forceps (Standard No. 1) applied; *B*, first movement to the labial side; *C*, reversed movement to the lingual side; *D*, *E*, movements *B* and *C* more forcibly repeated; *F*, tractile movement downward in line with the original position of the tooth.

fracture of the root near the apex if this part is curved distally. If this slight rotatory movement, combined with the other movements described and illustrated, fails to break up the attachment of the tooth, the operator should remove the margin of the process about the tooth with a cross-cut bur before proceeding with the extraction movements.

Displacement.—Where this tooth is displaced to the lingual or labial side of the arch, it should not, as a rule, be extracted for the purpose of correcting the defect. Such a condition should always be referred to the orthodontist for treatment, as the facial expression and contour of the arch depend very much on this tooth. Occasionally in advanced age, when regulation is no longer expedient, extraction may be indicated.

Complete Lingual.—Where this tooth is in complete lingual displacement, and application of the forceps to the labial and lingual surfaces is possible, the forceps should be applied in that manner. If, however, such application is impossible, a mesio-distal application may be made, as described and illustrated in the case of lateral incisor (page 124). When application has been made by either of the above methods, the first and principal movement is to the lingual side, with such labial movement as the location of the tooth will permit, and, as space is gained by these movements, a reapplication should be made so as to secure as firm grasp as possible to the tooth. When the tooth has been loosened, it is carried from its socket in the usual direction.

Where the tooth is only partially erupted, and there is process still covering any portion of the crown, an incision is made in the soft tissues to fully expose the crown, when a sufficient quantity of the bony structure is removed with a bur to fully expose the crown, after which the forceps are applied and the tooth removed. Frequently the Cryer elevator (Fig. 24) can be used to advantage in loosening the tooth before applying the forceps. When the elevator is used, the first bicuspid or the process serves as a fulcrum, a very slight turning movement is executed to engage the tooth, and, when engaged, a further turn of the point of the elevator toward the tooth should break up its attachment.

Complete Labial.—Complete labial displacement is common with the superior cuspid, and, in addition to this displacement, its position varies greatly in its relation to the lateral incisor and to the first bicuspid. In infra-occlusion it may appear at any point on the gum from the deflection of the lip above to the normal gingival margin below. Standard forceps No. 1 (Fig. 1) are used for its extraction, and, where possible, the labio-lingual application is made, but, when this cannot be obtained, the forceps are applied to the mesial and distal surfaces. Frequently the simple application of the forceps is sufficient to loosen the tooth from its attachment, as the process surrounding its root is usually not heavy. If the application does not loosen the tooth, the first and principal extraction movement is labially, followed by such lingual movement as space will permit, and, if resistance is still encountered, the slight rotatory movement as described under extraction movements for this tooth (page 134) may be applied. Occasionally it is necessary to re-apply the forceps after the tooth has been loosened, and continue the extraction movements, before the tooth can be brought from its socket.

In all cases secure adjustment must be had, as an attempt to apply the extraction movements while grasping only a part of the crown will, as a rule, result in the forceps slipping from the tooth. If eruption is incomplete, sufficient process around the tooth should be removed with a cross-cut bur to allow the proper application of the forceps. Occasionally the Cryer elevator (Fig. 24), applied to the distal side of the crown, may be advantageously used to loosen the tooth preliminary to the application of the forceps. Complete extraction should not, however, be attempted with the elevator.

Partial Lingual or Labial.—Where this tooth is displaced partially to the lingual or labial side of the arch, and the approximating space between the lateral incisor and the first bicuspid is large enough, Standard forceps No. 1 should be used for its removal. Where the space will not permit the beaks of these forceps to be introduced, Standard special A or special B forceps are employed. The application of the forceps and the extraction movements do not differ materially from the technic in the case of lateral incisor, applying such increased force as the greater strength of the tooth and its attachment may justify.

Impaction.—To define the ordinary meaning of the word "impacted" is comparatively easy, but the term in its application in practice is often ambiguous. Owing to the difference of opinion generally prevailing as to what is an impacted tooth, the author deems it advisable to state what should and what should not be considered an impacted tooth from the standpoint of an exodontist.

Impacted teeth are divided into two general classes: First—an unerupted or partially erupted tooth that causes no trouble may not be classed as an impacted tooth while in this condition, but, should the process of eruption reëstablish itself, and sufficient inflammation arise to produce greater or less local or systemic disturbance, and further eruption is prevented by another tooth, alveolar process, or gum tissue, the tooth immediately becomes an impacted one. Second—an erupted tooth, partially or completely, that cannot be removed from its socket in line with its axis without the disturbance of another tooth or the removal of alveolar process, is also an impacted one, whether it is or is not in process of further eruption.

Where the superior cuspid is impacted, and located either to the labial or lingual side of the arch, if there is sufficient eruption for the application of the forceps or the elevator, the usual procedure for extracting the cuspid in labial or lingual occlusion applies. If the eruption is not sufficient to obtain a clear outline of the tooth, the operator should not proceed until such an outline has been established. In such case resort should be had to radiography, as a good radiograph will enable him to clearly diagnose the case. The diagnosis having been completed, an incision is made in the soft tissue over the crown of the tooth, and sufficient amount of alveolar process is removed to fully expose the crown, when the forceps may be applied and the tooth removed from its position. The Cryer elevator may often be used preliminary to the application of forceps.

Caries.—For the removal of a superior cuspid attacked by caries above the gingival line, either labially or lingually, the technic is practically the same as for the central incisor in a like condition, except that rotatory movements should be attempted only as explained in extraction movements applicable to the cuspid, and that alveolar application of the forceps should be attempted only where marginal caries of the process is present.

Where the tooth is attacked by decay mesially or distally, or both, and the decay is not extensive, the application of the forceps and the extraction movements should be executed as though the tooth were not affected; but if the decay is extensive, the same technic as for extracting roots is followed.

Cuspid Root.—The root of a badly broken-down superior cuspid is, other conditions being equal, more difficult to remove than that of any other anterior tooth. Standard forceps No. 1 (Fig. 1) are usually used for its removal, but, where better adaptation to the root can be secured with Standard forceps No. 2 (Fig. 2), recourse may be had to them. In making the application, owing to the increased labio-lingual diameter of the tooth, care should be taken to open the forceps sufficiently wide to embrace the entire circumference of the root. With the forceps adjusted, the usual movements applicable to this tooth are employed, but no tractile movement should be attempted until the root has been loosened. At times a good method of procedure is a repeated application of the beaks after each labiolingual movement, which forces one or both beaks of the forceps between the periphery of the root and the process, and loosens the tooth by the wedge-like force thus exerted.

Where the root is deeply seated and covered by the gum tissue, the same technic applies as described and illustrated in the case of centrals (page 116.) In removing small tips of the root, it may be necessary to resort to the dental engine and the round bur, and in roots well hollowed out the enamel chisel is sometimes employed. In the latter case, however, if the walls remaining possess sufficient strength, the screw-porte is a better instrument for extraction.

The use of the straight-shank elevator (Fig. 15), as sometimes employed in the removal of the roots of the central incisor, is not usually practicable with this tooth, owing to the increased resistance to be overcome. The Cryer elevator (Fig. 24) can, however, often be used to advantage, and, when used, application is made at the disto-lingual side of the root, using the first bicuspid and the alveolar process in this region as the fulcrum. When this elevator is forced well up and turned sufficiently to engage the root with its point, a force exerted labio-occlusally will dislodge it sufficiently for the forceps to be applied. When the root is reasonably strong and the alveolus firm, it is good practice, before applying the elevator, to remove a part of the alveolar process from the root at the point of application, so as to insure a secure adjustment.

Fracture.—Where a fracture of this tooth occurs while operating on it, and sufficient structure remains for Standard forceps No. 1 to be adjusted, the forceps should be quickly applied, care being taken that in the reapplication the beaks do not engage the alveolar process instead of the tooth. If the fracture is above the margin of the process, recourse may be had to the screw-porte or to the Cryer elevator, the latter being applied as described under cuspid root (page 139).

SUPERIOR FIRST AND SECOND BICUSPIDS.

As the operations for the removal of the superior first and second bicuspids are nearly the same, the extraction technics of these two teeth are given together, and attention is directed to any variation in the technic wherever it is indicated. Fig. 67 shows the types of superior first and second bicuspids that are usually seen.

Position of Patient and Operator.—The position of the patient in the chair and that of the operator is as described for extracting superior teeth (page 93). When operating on the left side of the arch, the head of the patient is turned toward the operator. The left arm of the operator is placed around the head of the patient, with the palm of the hand over the left cheek. The index finger raises the upper lip, exposing the field of operation; the second finger is placed on the labial surface of the inferior teeth; the third and fourth fingers are placed against the lower part of the cheek (Fig. 68).

When operating on the right side of the arch, the head of the patient is turned slightly toward the left. The third finger raises the upper lip, exposing the field of operation; the second finger passes into the mouth and retracts the cheek; the index finger is placed on the buccal surface of the inferior teeth, and prevents the forceps from impinging on the lip (Fig. 69). If, however, considerable resistance is encountered, the left arm of the operator may be placed around the head of the patient as shown in Fig. 68, with the arrangement of the hand and fingers as described for the cuspid (page 129), except that the position of the fingers is a little more posteriorly.

Forceps.—Standard forceps No. 2 (Fig. 2) are the most suitable for the extraction of these teeth, and are adaptable to both sides of the arch. These forceps are also used in the extraction

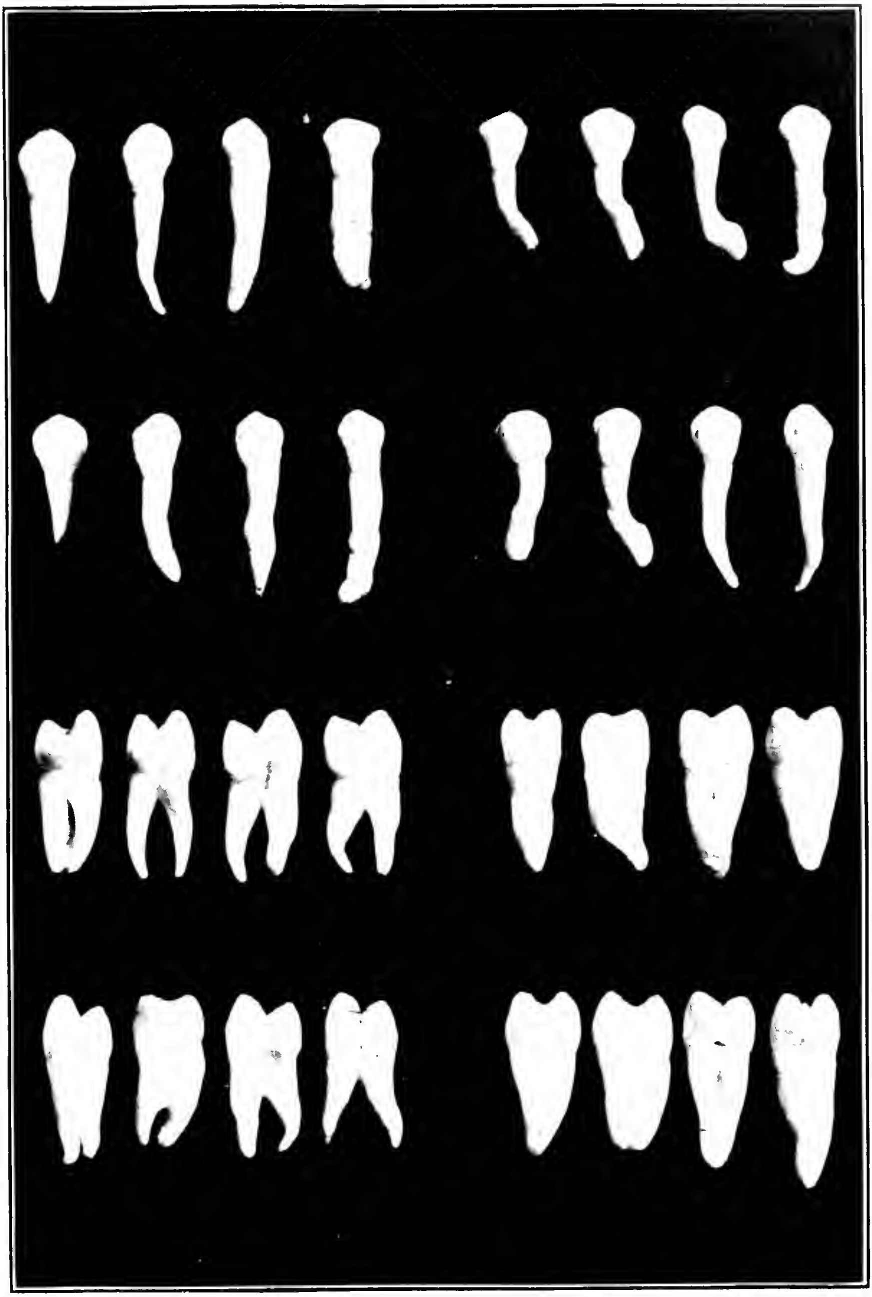


Fig. 67.—Types of superior first and second bicuspids. First row—first four teeth, buccal surface of first bicuspids; second four teeth, buccal surface of second bicuspids. Second row—first four teeth, lingual surface of first bicuspids; second four teeth, lingual surface of second bicuspids. Third row—first four teeth, mesial surface of first bicuspids; second four teeth, mesial surface of second bicuspids. Fourth row—first four teeth, distal surface of first bicuspids; second four teeth, distal surface of second bicuspids.

of the roots of the second bicuspid and the roots of the first bicuspid when they are firmly united, or when the roots are entirely separated if they are reasonably strong. These forceps, the beaks of which are known as the bayonet type, are made in

Fig. 68.—Position of the operator's hands and disposition of the fingers when applying forceps to a superior bicuspid on the left side of the arch. Illustration shows the application of forceps (Standard No. 2) to the superior left first bicuspid.

several sizes by different manufacturers, and the operator may select an extra pair to suit his individual idea, which may be a very good adjunct to his regular pair.

Standard forceps No. 5 (Fig. 6) are suitable for extracting the roots of the first bicuspid when they are entirely separated and of small size, and for removing the roots of this tooth and the second bicuspid when they are deeply seated in the tissues. They are sometimes employed in removing either one of these teeth when wedged between the adjacent teeth.

Fig. 69.—Position of the operator's hands and disposition of the fingers when applying forceps to a superior bicuspid on the right side of the arch. Illustration shows the application of forceps (Standard No. 2) to the superior right first bicuspid.

Standard special A and special B forceps (Figs. 11, 12) serve their greatest use in connection with these teeth, and were originally designed for them. They are used for removing these teeth when in partial or complete buccal or lingual occlusion, and when a root is wedged between the adjacent teeth.

When accessible, Standard forceps No. 1 (Fig. 1) may be used in the extraction of these teeth, if their attachment is not very firm, when this instrument has been used in removing other teeth at the same operation.

Order of Extraction.—The extraction of the first bicuspid precedes that of the cuspid wherever such order may indicate the simpler operation. Where the second bicuspid is also to be extracted at the same sitting, it should be removed before the first bicuspid and before the first molar if both second bicuspid and first molar are to be removed.

Application of Forceps.—The application of Standard forceps No. 1, used in the extraction of the six superior anterior teeth, is comparatively simple, owing to their beaks and handles being in the same line, but the application of the bayonet-shaped forceps, used in the extraction of the superior bicuspids, with their beaks set about three-quarters of an inch out of line with the axis of the handles, requires greater caution, and care should be taken that the beaks of the bayonet forceps are also applied in line with the axis of the tooth. The application of Standard forceps No. 2 (Fig. 2) to a bicuspid tooth is made by passing one beak well up on the lingual side of the tooth, followed by placing the opposite beak to the buccal side, being practically the same method of application as is made to anterior teeth. Usually, in making the application to a bicuspid, it should be made with sufficient force toward the process to assist in loosening the tooth. The mesial and distal application is practicable only when the tooth on either side of the one to be extracted has been removed at the same sitting and a fracture of the bicuspid has occurred.

Alveolar Application of Forceps.—Alveolar application to these teeth is very easily made, and is quite often indicated. When the forceps are applied, adjustment should be made more freely to the buccal than to the lingual side of the tooth. The technic of application is the same as in the case of central incisor (page 111).

Extraction Movements.—With Standard forceps No. 2 securely applied to the superior first bicuspid (Fig. 70, *A*), the first extraction movement is executed very cautiously to the buccal side (Fig. 70, *B*). With the exception of the inferior third molar, this tooth is probably more difficult to remove, without fracture,

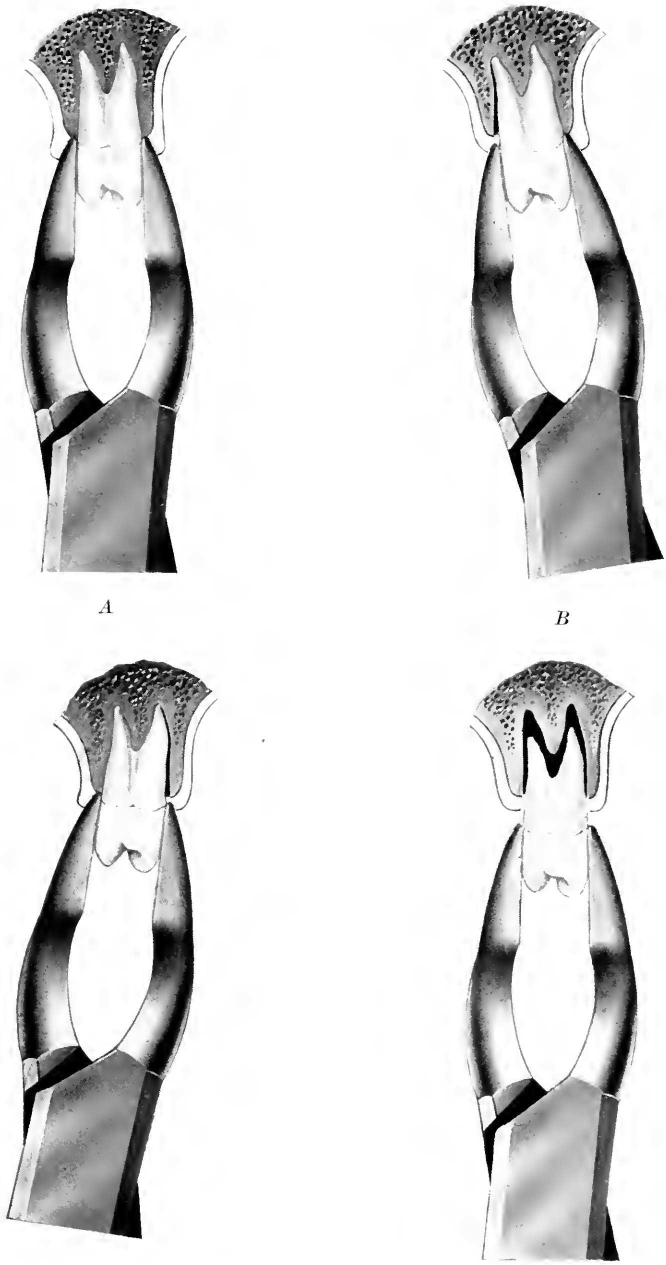


Fig. 70.—Extraction movements for superior first and second bicuspids. *A*, forceps (Standard No. 2) applied; *B*, first movement to the buccal side; *C*, reverse movement to the lingual side; *D*, tractile movement downward in line with the original position of the tooth.

than any other tooth in the mouth. Even the skillful operator will find it impossible to remove this tooth intact in every case. As the root is often bifurcated—at times only partially, and varying from partial to complete bifurcation—and as it is impossible to accurately diagnose these conditions beforehand, each operation should proceed as though the roots were extensively separated. In addition to the uncertainties in the bifurcation, the ends of the roots above the bifurcation may incline anywhere from a slight mesial inclination to an extensive distal one, and may vary in curvature anywhere from being widely divergent to being curved together at their apices. Frequently the tooth is very much constricted at its neck, the mesio-distal diameter here often being less than one-half of the thickness of the crown. The first extraction movement having been carefully applied, the amount of resistance that has been encountered is noted, and the amount of force that can be safely used in the next movement, which is to the lingual side (Fig. 70, *C*), is judged, and should be a little more forcible than the one to the buccal side. If the tooth has not been loosened by these movements, they are repeated until the attachment is broken up, when the tooth is removed from its socket by a tractile movement downward in line with its original position (Fig. 70, *D*). This last movement varies slightly, however, and the amount of deflection from the original position is governed by the curvature of the roots. If the roots are widely divergent, or the curvature of the tips are reversed, a slight swerving motion bucco-lingually during the tractile movement will often enable the operator to remove the tooth from its socket without fracturing the tips. Occasionally it is good practice, before completing the operation, to readjust the forceps higher on the tooth as space is gained in executing the extraction movements.

The same extraction technic applies to the second bicuspid as to the first, but it is not necessary to proceed with the same precaution, as the root of this tooth is seldom bifurcated, and the constriction at the neck is less.

Displacement—*Lingual.*—Where a superior bicuspid is displaced partially or completely to the buccal or lingual side of the arch, extraction is usually complicated, especially with the first bicuspid, owing to its proneness to fracture. When this tooth is displaced to the lingual side of the arch, the amount of space between it and the adjoining teeth is carefully observed to ascertain which forceps will be most suitable for its removal. If space permits, Standard forceps No. 2 are used, but the cases in which they can be used are comparatively few, as the application of the beaks of the forceps to the buccal surface of the tooth is one of the difficulties to be overcome in its extraction. Standard special A and special B forceps (Figs. 11, 12) were designed especially to meet this condition. In their application the small beak is first adjusted as far up on the buccal surface as space will permit, and the opposite beak is brought over to engage the lingual surface. When applied in this way, a cautious movement is made lingually, exercising care that the small beak does not slip from its adjustment, and noting the amount of resistance offered by the tooth. If some space has been gained by this movement, a readjustment is made so as to bring the small beak as far as possible up on the tooth, when a similar lingual movement is again executed. The space thus gained is taken up each time by a buccal movement, and these movements are repeated until its attachment has been broken up, when it is removed by a tractile movement as nearly as possible in the direction of its axis. Greater force is permissible with this tractile movement than is allowed in extracting the same tooth in normal occlusion. The technic for extracting the first bicuspid is also applicable to the removal of the second bicuspid when in similar displacement.

Where the superior second bicuspid is completely displaced lingually and in close proximity to the first molar (Fig. 71), the application of the modified Cryer elevator (Fig. 25) to its distal surface (Fig. 72), preceding the adjustment of the forceps, is usually good procedure. In the application of the elevator the mesio-lingual angle of the molar and the process about it are used as a fulcrum, followed by the usual pressure upward to engage the tooth with the point of the instrument, when it is forced downward and away from the adjoining teeth. The same procedure is applicable to the superior first bicuspid when situated in similar relation to the second bicuspid, but care must be exercised in the application of the elevator, lest also the second bicuspid be loosened.

As the amount of displacement varies greatly with these teeth, and as they are nearly always more or less rotated, the operator should possess sufficient ingenuity to be able to select the technic of operation best suited for each case presented, bearing in mind that the bicuspid teeth are much flattened in their mesio-distal diameter, and that, when displaced to the lingual side of the arch, they are more or less wedged between the adjoining teeth on the one side and the firm palatal wall of the alveolar process on the opposite. The operator should never be hasty in the application of the movements, but, while grasping the tooth firmly, execute a short, steady movement in the direction of least resistance, and never lose sight of the tooth's greatest diameter, as a very small amount of force in the opposite direction will usually result in fracture.

Fig. 71.—Superior second bicuspid displaced to the lingual side of the arch.

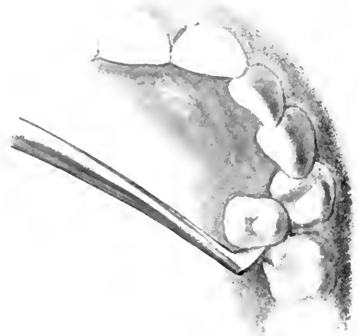


Fig. 72.—Cryer elevator applied to a superior second bicuspid displaced to the lingual side of the arch.

Buccal.—Where one of these teeth is displaced buccally, as where displaced lingually, Standard forceps No. 2 are used for its removal wherever adjustment can be had with them. Where the displacement is only partial, and the intervening space between the approximating teeth is not entirely closed, either Standard special A or special B forceps are adaptable to the condition. When one of these forceps are used, the application is the same as in the case of lingual displacement (page 146), always applying the smaller beak first and being careful not to let it slip from its adjustment. The forceps having been applied, the same movements, but in a reverse direction, are used as have been described for lingual displacement (page 146). After adjustment has been made, extraction is usually not difficult, owing to the weakened condition of the external plate of the process. There is often greater danger of tearing away the process than of fracturing the tooth. Where space will not allow the application of forceps, the tooth can often be tipped away from an adjoining tooth with the Cryer elevator to permit their application. When using the elevator, care must be taken that it does not slip from its adjustment and do serious injury to the surrounding tissues.

Extensive Caries.—Where one of these teeth is attacked by caries on the buccal surface, especially when it extends above the gum margin, the condition favors a greater buccal movement in its extraction. With the forceps applied in the usual way, and the adjustment as far up as possible on the tooth, the principal movement of extraction is to the buccal side, with just enough lingual movement to take up the space that has been gained by the buccal movement. If the decay is extensive above the gingival line lingually, very little movement is permissible buccally, and a careful lingual and a greater tractile movement should be executed to remove the tooth.

Where there is extensive mesial or distal decay—and as it is always desirable to remove the tooth *in toto* when possible, and especially is this desirable in the case of the first bicuspid if decay has not extended above the bifurcation of the roots—alveolar application is permissible and advised in these cases.

Bicuspid Roots.—Where the crown of a bicuspid is destroyed, leaving only the root, application is made with Standard forceps No. 2 as far up on the root as the process will permit, and the root is removed in the same manner as though the crown were intact, using, however, greater precaution in the execution of the extraction movements. If the part of the root below the process does not possess sufficient strength to withstand the extraction movements, alveolar application should be made. Some marginal alveolar caries is nearly always present with these teeth when decay is extensive, and an alveolar application in such case is comparatively easy. Where caries of the process is not present, it is usually better, when this method of application is followed, to cut through a part of the process, to secure an adjustment, than to take the risk of spreading the process by a too forcible upward pressure of the forceps, and cutting the process usually insures an intact removal.

The extraction of the first bicuspid where decay has not progressed far enough to separate its roots (Fig. 73) is performed with Standard forceps No. 2 as though only one root existed. In the application of the forceps, the beak is first applied to the side of the root where decay is most extensive, as this method affords a better adjustment. Where the two roots are separated (Fig. 74), Standard forceps No. 2 are used, and the two roots are taken out separately. If the two roots are extensively decayed, or situated in close proximity to each other, Standard forceps No. 5 are most suitable for their removal. Application is always made first to the stronger and more accessible root. Where the

Fig. 73.—Superior first bicuspid with crown destroyed by caries. Decay has not extended far enough to separate the roots.

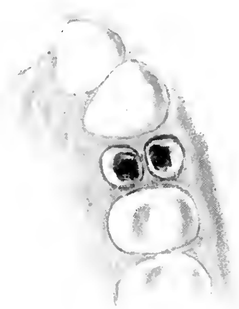


Fig. 74.—Same subject as Fig. 73. Decay has extended so far that the roots are separated.

roots are to be extracted separately, a slight rotatory movement is often permissible. In rare cases this tooth possesses a third root, which is formed by a bifurcation of its buccal root. Although this latter condition is not of frequent occurrence, it is well to know of the possibility of its existence, for, if present, the third root may be left unextracted and the operator fully believe that all of the tooth has been removed.

Where decay is extensive with the buccal root of the first bicuspid, the process is often carious in this region. When this condition exists, the operator should use more than ordinary care in his efforts to grasp the buccal root, or, in attempting to apply the forceps to the lingual root, see that the beak does not strike against the buccal root, for in either case there is liability of forcing the buccal root high into the soft tissues (Fig. 75). Such displacement of the buccal root will, however, sometimes occur, and, when it does take place, the operator should discontinue the use of the forceps and flush the socket until hemorrhage has stopped, when the misplaced root is to be relocated, which is done by passing the finger over the soft tissue on the buccal side. When the root has been located, it is again forced down into its socket by pressure on the parts above it, after which it may, with care, be removed with the Derenberg tweezers, or an explorer is passed up so as to engage the root and withdraw it from its lodgment.

Bicuspid roots are frequently covered by gum tissue, and, when so covered, the procedure is as described and illustrated for central incisor (page 116). In applying this procedure to a

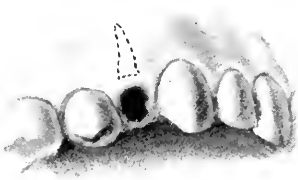


Fig. 75.—Buccal root of a superior bicuspid displaced into the soft tissue external of the socket. Position of the root is indicated by dotted lines.

second bicuspid root, the operator should bear in mind that its apex often terminates in close proximity to the maxillary sinus, and he should be sure that the forceps are opened sufficiently to engage the root, and not press upward on it, as by such pressure the root may be forced into this sinus. In using the forceps to dilate the soft tissues over a broken-down superior first bicuspid, great care is required in making the application on account of the probable presence of two roots.

Screw-Porte.—The screw-porte is not a practical instrument for the removal of the roots of a superior first bicuspid, as the bifurcation of the root will not permit the use of the screw-porte. Sometimes the screw-porte can be used in removing the root of a superior second bicuspid if access can be secured and the root has only one canal. As a rule, the instrument is not practical for removing the latter root, and its use is not attempted unless the root cannot be removed in any other way without considerable destruction of tissue.

Elevator.—The elevator is not as practical for the extraction of the roots of the superior first bicuspid as for the roots of the teeth anterior to it, and is seldom used for this purpose, except in case of malocclusion or where a fracture has occurred. The use of the elevator where either of the latter conditions exists is described under displacement and fracture (page 146 and below under fracture). Cases will occur where the roots are small and not firmly attached, when the straight-shank elevator (Fig. 15) may be applied, and is used by adjusting it to the buccal surface of the roots and dislodging them with a pushing movement to the lingual side.

A number of elevators are made with the blade shaped in the form of a hook, any one of which is used by applying the elevator to the lingual side and removing the tooth with a pulling motion to the buccal side. The use of such elevator is left to the choice of the operator, as, wherever it can be applied, delivery can also be accomplished with the forceps.

The elevator is used more frequently on the second bicuspid than on the first. The Cryer elevator (Fig. 24) is the one best adapted for use on the second bicuspid, and is especially applicable for the removal of a root covered by gum tissue and where deeply seated, as with its use in these cases the tissues are conserved. Wherever possible, application should be made to the distal side of the root, and, if application cannot be had distally, a mesial application may be made. The modified Cryer elevator (Fig. 25) should be used when operating on the left side of the mouth. When making the application of the elevator to this tooth, care should be taken that the point of the instrument is introduced between the process and the root, and not against the end of the root.

Impacted Teeth.—The superior bicuspids are seldom found impacted, and, when that condition exists, they are usually displaced either to the lingual or buccal side of the arch. The technic of operation is the same as for the cuspid when impacted (page 137).

Fracture.—A fracture of the superior first bicuspid is of frequent occurrence, and is sometimes unavoidable. When fracture does occur, the error should not be made of attempting to hastily complete the operation by repeated application of the forceps, which usually results only in repeated fracture of the tooth. A careful examination should be made and the existing condition ascertained, in order that the operation may not be continued in an ineffective manner. If an examination reveals that the process surrounding the tooth is carious, or that the alveolar margin is not heavy, alveolar application may be made and the tooth removed by the usual alveolar method. If fracture occurs a short distance above the margins of the process, and the process is heavy, the latter should be removed with a bur and a new application of the forceps made. If the cuspid and second bicuspid have been removed at the same sitting, a mesio-distal application can often be advantageously made.

If the fracture is quite a distance above the process, and the two roots are held firmly together, the roots are separated at their bifurcation with a bur and an elevator is adjusted between them, using one of the roots as a fulcrum to dislodge the opposing one. If only one root remains, Standard forceps No. 5 (Fig. 6) are adjusted, and the root slightly rotated, when it is carried from its socket by a tractile movement. If only a small tip of the root remains, and no pathologic condition exists, it may be left undisturbed. If, however, a pathologic condition is present in connection with the tip, it will be necessary to remove the tip with a bur, but the bur should be used only where the part remaining is inaccessible to forceps or elevator. In case tips of each of two roots remain, the procedure will be the same as where one tip remains.

Fracture is not so frequent with the superior second bicuspid, but, if it occurs, the technic of operation is the same as for the first bicuspid, as described above where a fracture of the latter tooth occurs not far enough above the process to separate its roots or to demand the separation of the roots for their removal.

SUPERIOR FIRST AND SECOND MOLARS.

As with the superior bicuspids, the extraction technics of the superior first and second molars are so nearly the same that the operations for these teeth are given together, and, as with the bicuspids, attention is directed to any variation of operation that may be applied to either tooth. Fig. 76 shows the types of superior first and second molars that are usually seen.

Position of Patient and Operator.—The position of the patient in the chair and that of the operator is as described for extracting superior teeth (page 93). When removing these teeth, the chair may be raised a little higher than for the teeth anterior to them, but should not be raised too high, as better control of the muscles is had when the body is slightly crouched.

When operating on the left side of the arch, the head of the patient is turned toward the operator. The position of the arm of the operator and the arrangement of the hand and fingers are as described for the first and second bicuspids (page 140), except that the position of the fingers is a little posterior to that used for the bicuspids (Fig. 77).

When operating on the right side of the arch, the head of the patient is turned toward the left. The arrangement of the hand and fingers are as described for the first and second bicuspids (page 140), except that the position of the fingers is a little more posterior (Fig. 78). If, however, any difficulty is encountered, the left arm of the operator may be placed around the head of the patient as shown in Fig. 64, with the arrangement of the hand and fingers as described for the cuspid (page 129), except that the lips are drawn further back to expose the field of operation.

Forceps.—It is necessary that the operator possess separate forceps for each side of the arch, the construction of the two forceps being the same, except that the beaks of one have reversed position from that of the other, and these two forceps are usually referred to as rights and lefts. The selection of suitable forceps for extracting these teeth is an important matter, as the instrument to be used must bear the great strain imposed on it, and the beaks must be so shaped that they are adaptable to the necks of the tooth while grasping the greatest amount of its surface. Standard forceps No. 3 R and No. 3 L (Figs. 3, 4) meet these requirements, and are used wherever the crown is intact, or where the greater part of it remains, and the tooth is firmly attached to the tissues. These forceps are so constructed that they can be advantageously used in almost all cases where extraction is indicated. In addition to these two instruments, Standard forceps No. 4 (Fig. 5), which are designed for the superior third molar, are occasionally employed for a first or second molar when the tooth is loose or the crown is malformed. Standard forceps No. 2 (Fig. 2) are also used in the extraction of the tooth

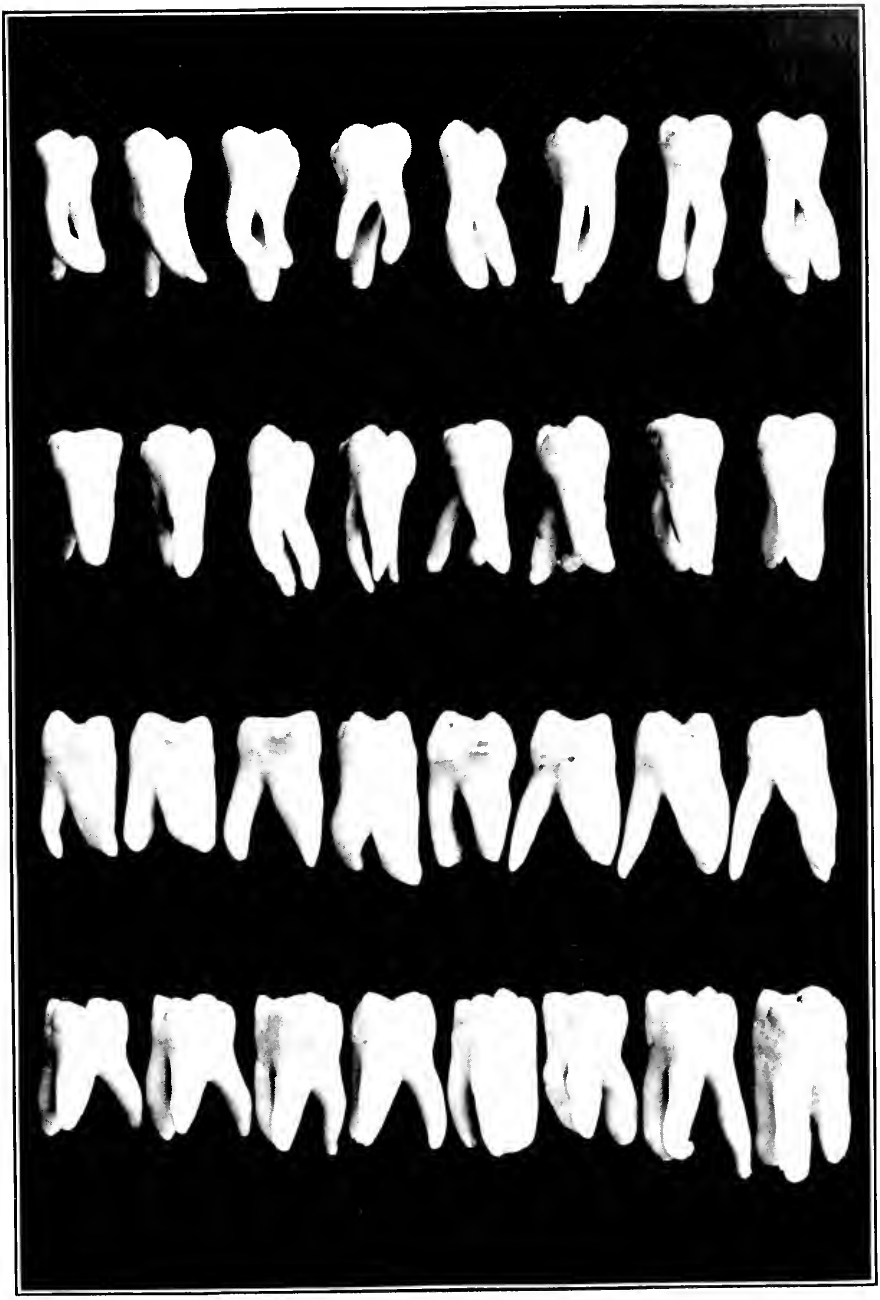


Fig. 76.—Types of superior first and second molars. The first row shows the buccal, the second row the lingual, the third row the mesial, and the fourth row the distal surface.

where the crown has been destroyed by caries and only the roots remain.

Where the operator is using either Standard forceps No. 3 R or No. 3 L and suspects a probable fracture of the crown or

Fig. 77.—Position of the operator's hands and disposition of the fingers when applying forceps to a superior molar on the left side of the arch. Illustration shows the application of forceps (Standard No. 3 L) to the superior left first molar.

breaking up of its roots, he should have Standard forceps No. 2 either in the hand of his assistant or within easy reach, so that they can be quickly applied if a fracture occurs or if one of the roots remains unextracted. Especially should this precaution be taken when a patient is under a general anesthetic.

Order of Extraction.—The extraction of the superior second bicuspid precedes that of the first molar when necessary to remove both of these teeth. If the second molar is to be extracted at the same sitting, it is taken out before the first molar, espe-

Fig. 78.—Position of the operator's hands and disposition of the fingers when applying forceps to a superior molar on the right side of the arch. Illustration shows the application of forceps (Standard No. 3 R) to the superior right first molar.

cially if some difficulty is anticipated in the extraction of the first molar. Where also the third molar is to be removed at the same sitting, the second molar is removed before the third molar only when it is difficult to gain access to the third molar and when the removal of the second will facilitate the removal of the third.

Application of Forceps.—The proper application of the beaks of the forceps to these teeth is important, as a firm adjustment greatly aids the operator in the extraction movements that follow. In making the application, the axis of the tooth, as in the case of the bicuspids, should be carefully observed, as here there are three roots with which to contend. The forceps having been selected, the oval blade is adjusted to the lingual surface of the tooth, followed by the application of the opposite beak of the buccal surface. In making this application, the lingual adjustment must extend well up to the alveolar process, and care must be taken that the point of the buccal beak passes between the buccal roots, so that the forceps will not slip from their adjustment when force is applied, as considerable pressure gingivally is required in making this application. Occasionally, when access is difficult, due to heavy cheeks or other conditions, the order of application of the beaks to the second molar is reversed, and the first application is made to the buccal surface of the tooth.

It is not uncommon with these teeth, especially with the second molar, that the bifurcation of the roots is not complete, the two buccal roots or the disto-buccal and the lingual roots being united into one broad root. In either case the crown of the tooth is usually diverted from its imperfect rhombic form to one more nearly rhomboidal, and sometimes even to that of an imperfect trapeziform. Where this condition is present, it must be carefully observed in making the application of the forceps, as the force of the extraction movement has a tendency to slide the beaks around the neck, especially if the small tip on the buccal beak is not properly engaged. In such case better application can be had with Standard forceps No. 4 (Fig. 5) than with the regular forceps designed for the superior molars.

The superior molars are frequently inclined mesially, due to the loss of the immediate tooth in front. Where so inclined, the amount of inclination must be carefully judged, as, when the forceps are applied, their beaks and handles must be applied in line with the axis of the tooth.

Alveolar Application of Forceps.—No attempt should be made to secure an alveolar application to these teeth, as the beaks of the forceps cannot penetrate the alveolar process, when normal, without causing an unnecessary amount of destruction to this tissue. Where an alveolar application would ordinarily be indicated, but the alveolus interferes with the adjustment, removal of the process from the neck of the tooth with a cross-cut fissure bur is the better technic. Alveolar application is especially contraindicated with the second molar when the third is missing, as a fracture of the tuberosity may result.

Extraction Movements.—The forceps having been adjusted (Fig. 79, *A*), with a firm grip on the tooth and with the hand well down on the handle of the forceps, the operator directs the first movement to the buccal side (Fig. 79, *B*). Too much pressure should not, however, be exerted on this initial movement, as the firm or loose condition of these teeth is usually of an extreme character—that is, they are either easily removed, as when the tissues supporting them are weakened by disease, or they are poorly developed; or they are firmly attached, as when the tissues are normal and healthy, and development is complete. The first extraction movement having been made, the next movement is to the lingual side (Fig. 79, *C*), with about the same amount of force. These two movements having been made, the tooth is brought with increased force buccally (Fig. 79, *D*). These movements are usually sufficient to loosen the tooth from its attachment, but, if not, the movements are repeated with increased force until the attachment is broken up, when the tooth is carried back to its original position and removed from the socket with a tractile movement downward (Fig. 79, *E*).

Where the roots of these teeth are markedly divergent, which is not uncommon with the first molar, much resistance is often encountered, and the extraction movements must be executed firmly, but not too forcibly. If too great force is applied, one or more of the roots may be fractured, or a large area of the buccal plate of the alveolar process may be removed, or the tooth on one side or the teeth on both sides of the one being extracted may be carried from its socket. No tractile movement downward should be attempted until the tooth has been sufficiently luxated to expand the alveolus enough to allow its exit from the socket. The operator should not be too hasty in the extraction, but should proceed cautiously and with precision, carefully observing the result of every movement in order that the force to be used in the movement to follow may be carefully judged. In addition to the contingencies mentioned in connection with these teeth, they are also subject to fracture at their

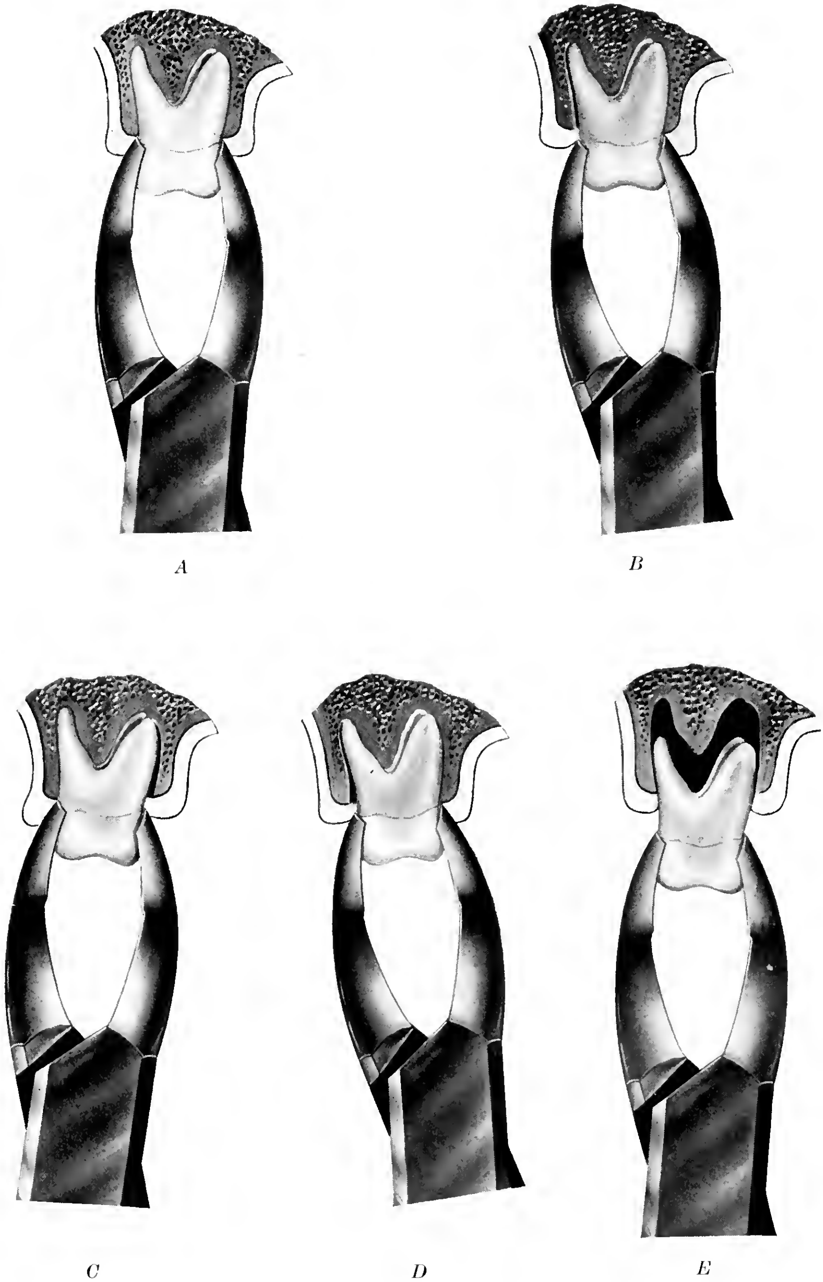


Fig. 79.—Extraction movements for superior first and second molars. *A*, forceps (Standard No. 3 L) applied; *B*, first movement to the buccal side; *C*, reversed movement to the lingual side; *D*, movement *B* more forcibly repeated; *E*, tractile movement downward in line with the original position of the tooth.

necks, and too great a force in the application of the tractile movement or excessive pressure on the beaks of the forceps while any of the movements are being executed should be avoided.

If it is noted during the extraction movements that the buccal plate of the process is being endangered, the movements should be discontinued and a better application of the forceps made. If it is impossible to preserve the external plate of the process in this manner, the tooth should be removed in sections. If any disturbance to an adjacent tooth is noticed, the operator's thumb should be placed on the imperiled tooth in order to hold it in position while completing the operation. If the teeth on both sides of the one being removed are disturbed, it will be better to discontinue the extraction movements and remove the tooth in sections than to cause the loss of an adjacent tooth.

Where these teeth are inclined mesially, which is not an uncommon occurrence, or are inclined in any other direction than normal, care should be taken that all the extraction movements are made with the forceps in line with the inclination of the tooth's axis, as all the force executed at an angle to the tooth's axis results in just so much force being exerted transversely on the tooth at its neck, and does not aid in breaking up the attachment of the tooth from the tissues, but adds that much force to a probable fracture at its neck.

Displacement.—These teeth are rarely found completely out of alignment, and the author has never had occasion to operate on a superior first molar so situated. On rare occasions such tooth may be partially displaced buccally or lingually, but the displacement is usually very slight, and, when such a case is presented, the use of either Standard forceps No. 3 R or No. 3 L (Figs. 3, 4), if their adjustment can be obtained, is preferred. If, however, these forceps cannot be applied, then Standard forceps No. 2 (Fig. 2) are used, first applying one beak to the surface on which the space is narrowed by the displacement, and then applying the opposing beak to the opposite surface. Standard forceps No. 2 should be used only to gain an adjusting space for Standard forceps No. 3 R or No. 3 L, and, as soon as sufficient space has been gained, the tooth is released and application is made with the latter instrument. The first extraction movement is made to the lingual side in lingual displacement, and to the buccal side in buccal displacement. The extraction movements should follow, as closely as possible, the movements described for the removal of the tooth in normal alignment (page 159).

Caries on Buccal Surface.—Where decay is extensive on the buccal surface of these teeth, the forceps are first adjusted to this surface of the tooth, sending the blade as far as possible under the gum tissue with a degree of pressure varying with the amount of decay and the size of the tooth, the object being to get a good adaptation at the bifurcation of the buccal roots.

The first extraction movement is directed quite forcibly to the buccal side. The movement to the lingual side is made cautiously and with little force, the operator observing the buccal blade carefully to see that it does not slip from its adjustment. A forcible movement is again made to the buccal side, which has a tendency to send the beaks further up on the root. These movements from the lingual to the buccal side and vice versa should be continued until the tooth is loosened from its attachment, when it is brought back to its original position and carried downward from the socket with a tractile movement. If the attachment is unusually strong, a reapplication of the forceps higher up on the tooth will be necessary before completing the extraction movements, but care must be taken not to engage healthy process in the beaks when making the reapplication.

Caries on Lingual Surface.—Where these teeth are decayed on the lingual surface, one beak of the forceps is first adjusted well up on this surface of the tooth, followed by applying the opposing beak to the buccal surface. If the decay extends well above the gum margin, the inclination of the crown of the tooth must be noted, so that, in forcing the beaks of the forceps up on this surface of the tooth, it is sent in the right direction. The interproximal alveolus on the mesial and distal sides of these teeth is heavy, and the same is true of the alveolar ridge along their lingual sides. This condition must be borne in mind, so that, when application is made, the process is not engaged instead of the tooth.

The first extraction movement is to the lingual side, but should not be too forcible, and should be carefully guarded. If the movement is carefully executed, it will serve to send the beak of the forceps further up on the lingual root of the tooth. The next movement is made buccally with as much force as the lingual wall will bear without fracture. These movements should be continued, swaying the tooth backward and forward linguo-bucally until loosened, when it is carried from its socket in a direction downward approximating its original position. The amount of stress that a tooth decayed in this manner will withstand is problematic, and a certain sense of touch must be cultivated by the operator so that he may apply a maximum amount of force to break up its attachment without exceeding the strength of the crown and causing a fracture.

If, in executing the extraction movements, the lingual root is separated from the crown, but the forceps still hold the buccal roots securely, the extraction of the latter should be completed, after which the lingual root can be removed with Standard forceps No. 2 (Fig. 2). The right-and-left rotatory movement is nearly always permissible in extracting the lingual roots of these teeth.

Extensive Caries.—Where these teeth are attacked by extensive caries on their mesial or distal surface, and a careful examination convinces the operator that sufficient structure remains for the extraction of the roots intact, application and extraction with Standard forceps No. 3 R or No. 3 L (Figs. 3, 4) are performed in the usual way. If decay is more extensive, but the parts remaining possess sufficient strength, Standard forceps No. 2 are sometimes substituted. If decay is so extensive as to so weaken the tooth that it cannot be taken out intact, extraction is performed in the same manner as when operating on roots (pages 163–166).

Fused Roots.—Two-rooted superior molars are not uncommon, especially in the case of the second molar. These roots, when present, are usually formed by the union of the disto-buccal and lingual roots, but are occasionally formed by the two buccal roots. Where this condition exists, if the roots are short and the process not heavy, they are easily dislodged from their sockets, but, if the process is heavy or the fused root is long, curved, or deeply grooved, extraction may be a very difficult operation. This condition can usually be diagnosed by the shape of the crown, or, if the tooth is badly broken down, by the shape of the parts remaining. Other means of diagnosis are: if, in applying Standard forceps No. 3 R or No. 3 L, secure adjustment cannot be had to the buccal wall, fusion of the roots may be suspected; or if, when executing the extraction movements, unusually firm resistance is encountered, it is a fair indication that this condition is present. Standard forceps No. 4 (Fig. 5) are indicated in a case of this character, and greater tractile movement is permissible than for the removal of roots that are normal. If extraction cannot be completed with the forceps without endangering the process or possibly fracturing the roots by the excessive force required to loosen the attachment, extraction movements should be discontinued and the margins of the process removed lingually and buccally with a bur, after which the forceps are reapplied and the extraction is completed.

Where these teeth are badly broken down, they can usually be loosened by an application of the modified Cryer elevator (Fig. 25) to the mesio- or disto-lingual surface, following the same technic of operation as for the use of the elevator on the superior molar (page 167). When applying the elevator, no attempt should be made to complete the extraction with it, using only sufficient application to loosen the tooth, the extraction being completed with the forceps.

Occasionally a superior second molar is presented that has the three roots fused into one. It is comparatively easy to extract such root, as it tapers rapidly from a crown that is excessively large to be supported by a single root and terminates with a blunt apex.

Three Roots United.—Where the entire crown has been destroyed by caries, the operator must use careful judgment in the technic of extraction he is to employ. If the three roots are united, application is made with Standard forceps No. 3 R or No. 3 L (Figs. 3, 4), depending on which side of the arch the roots are situated, and the extraction movements usually applicable to superior first and second molars are executed, with the difference that the tractile movement is almost entirely eliminated and the upward force of application continued throughout the operation. In most cases these movements will suffice to remove all the roots, but, if they do not, they will break up their attachments, and usually one or more will be carried from their socket. The remaining ones, loosened by the operation, are readily removed with Standard forceps No. 2 (Fig. 2). Where the tooth to be extracted is of irregular triangular shape, as is common with the second molar, due to its having but two roots, Standard forceps No. 4 (Fig. 5) are employed, as described in the case of fused roots (page 163).

If one or both of the buccal roots are extensively affected by caries, Standard forceps No. 2 are used, applying one blade to the lingual root and the opposite one to the mesio-buccal or the disto-buccal root, whichever is the stronger. Other conditions being equal, application to the disto-buccal and lingual root is preferred. The roots are disengaged by a swaying movement bucco-lingually, which will usually carry the remaining root along with the others, but, should it not, it is extracted with the same forceps, or, if small, with Standard forceps No. 5 (Fig. 6).

Two Roots United.—Where the two buccal roots are firmly united and the lingual root is partially or completely separated from them, operation on the two sections is performed separately. In case separation is complete and considerable space intervenes between the roots, the two buccal roots are engaged with Standard forceps No. 4, application being made well up on them, and the principal extraction movement is executed buccally. If, however, the lingual root is more accessible, it is extracted first, using Standard forceps No. 2, which are applied where there is least interference, and the root is loosened by a right-and-left rotatory motion. If, when extracting the two buccal roots, a tooth is missing on either side of the roots, application may be made to the mesial and distal surfaces instead of by the usual method, using Standard forceps No. 2, and the roots carried in the direction described above. If either the mesio-buccal and lingual or the disto-buccal and lingual roots are united, and the remaining root is separated from them, they are all extracted with Standard forceps No. 2, as described for a similar condition in the case of three roots united (page 164).

Separated Roots.—Where all the roots are separated, application and extraction are performed as if operating on individual teeth, and Standard forceps No. 2 are usually employed. The lingual root should be extracted first if access can be obtained, for, when it is removed, application can be more readily made to the buccal roots. If, however, application cannot be easily made to the lingual root, then it is made to the most accessible one, and the next application is made to the next most accessible root. In removing the buccal roots, the first and principal extraction movement is buccally, while the right-and-left rotatory movement is the principal one used in breaking up the attachment of the lingual root.

Roots Covered by Gum Tissue.—Where the gum tissue covers the broken-down crown of a superior first or second molar, a careful examination should be made to ascertain the condition of the underlying tooth structure in order to determine the method of operation that is to follow. The diagnosis having been made, the forceps, if indicated, are applied in the same manner as described and illustrated for the superior central incisor (page 116), care being exercised to open the beaks sufficiently to engage the entire area of structure where the parts are to be removed *in toto*. After access has been obtained, the extraction technic is the same as for a like condition where the tooth is exposed to view. If, however, the parts are so obscured that, after irrigating them with an antiseptic solution, a correct diagnosis cannot be made, it is sometimes permissible to apply the forceps as though all the roots were intact. If the broadest linguo-buccal diameter has been engaged between the beaks, it will usually result in the extraction of the roots, or at least one of them; and, if only one has been extracted, the others can be taken out by methods previously described.

In removing roots that are obscured by the soft tissues, an examination should be made of each part extracted in order to determine the number of roots that may be present, for, if only two roots are present, the mistake may be made of making a third application to some part of the process.

Deep-Seated Roots.—No attempt should be made to make a vigorous application of the forceps to a deep-seated root, expecting thereby to break down parts of the alveolar process and thus secure an adjustment to the root. As previously stated (page 158), alveolar application should never be attempted with the superior molars unless a careful examination shows that a considerable portion of the process is carious, and even then it should not be attempted above the carious area. When application cannot be had otherwise, the procedure should be to remove parts of the process with the cross-cut fissure bur, so that the forceps may be applied or the elevator adjusted. In extreme cases, where a small part of a root remains and it is in a pathologic condition, it may be necessary to remove it with a round bur.

Screw-Porte.—Cases for using a screw-porte on these teeth are not numerous. Its use is indicated only where the operator has to remove a root that is deeply seated and the alveolar structure that surrounds it is heavy, or where the case is of such a nature that the elevator will not dislodge the root, as in hypercementosis. In such case the Keith screw-porte (Fig. 31) is used.

Elevator.—Some operators do not favor the use of the elevator on the superior molars, but the author has found that there are many instances where the Cryer elevator (Fig. 24), especially the modified Cryer (Fig. 25), can be used advantageously on these teeth. If, when extracting a superior molar, one of the roots is so shaped that it cannot be removed with the crown, its attachment can, as a rule, be readily broken up with the modified Cryer elevator, and removed from its socket with the Derenberg tweezers, which method is better than attempting to reapply the forceps.

If, when extracting superior molar roots, the application of the forceps is difficult, but access can be had with the Cryer elevator, application should be made with it to the most accessible part of the root, the process or tooth in closest proximity is engaged as the fulcrum, and the root is loosened, when its extraction is completed with the forceps or the Derenberg tweezers.

If, when extracting superior molar roots, all three are united, it is not infrequent for one or two of the roots to remain, and these can often be more readily removed with the elevator than with the forceps. When decay has advanced so far that the roots are not strongly united, they can often be broken apart by the use of an elevator, which operation also usually loosens them from their attachments.

If, when extracting a superior molar, the roots are fused and the crown considerably broken down, good results can often be had by applying the modified Cryer elevator to the mesio- or disto-lingual walls and breaking up the attachment before attempting to apply the forceps. When these teeth are so badly broken down and the process so heavy that neither forceps nor elevator can be applied, the procedure should be to remove a part of the process with a bur and apply the elevator.

If, when extracting a superior molar, decay has destroyed a considerable portion of the crown and the approximating teeth have narrowed the space to such an extent that the tooth cannot be taken out *in toto*, the remaining parts of the crown should be removed, the roots separated with a cross-cut fissure bur, and the attachment of the roots broken up with the Cryer elevator. In using the elevator, the blade is introduced between the roots, one of which is used as a fulcrum until one or two of the roots have been removed, when the most available part of the process is used as a fulcrum to complete the operation.

Impacted or Wedged.—The superior first molar is never impacted, but is sometimes wedged between the second bicuspid and second molar, due to a partial or complete destruction of its crown. When in this condition, its extraction is accomplished in the same manner as though it were not wedged, provided this can be done without disturbing the tooth on either side of it; but, if this cannot be done, the crown should be removed and the roots extracted by the technic of operation described under elevator (page 167). When extracting a wedged superior second molar, the operative technic is the same as for a superior first molar when it is in a similar condition.

Impaction is not common with the second molar, but sometimes occurs, and, when it is impacted, the third molar is usually missing and the crown of the second molar engages the distal wall of the first molar: or the impaction may result from heavy alveolar process, due to a deflection from its normal position while erupting. Such impacted molar is removed by the same method of operation as applies to the superior third molar in a like condition (page 179).

Fracture.—A fracture during the application of the extraction movements to a superior molar is an accident that will happen to the most skilled operator, as it is not always possible to definitely judge the strength of the tooth when it is extensively attacked by caries, or to know the firmness of its attachment in the alveolar process.

The technic of the operation that should follow a fracture will depend entirely on the location of the fracture and the condition of the remaining parts. Whatever this condition may be, the operation must proceed by the method that will best accomplish the desired end and conserve the greatest amount of tissue.

If a reasonable part of the crown remains, the same forceps are reapplied and the extraction movements continued. Sometimes the fracture will show that the margin of the process is carious, and at other times the tooth will split obliquely upward, distally or mesially, so that either the disto-buccal or mesio-buccal root will be nearly detached by the fracture. In either case, Standard forceps No. 2 (Fig. 2) should be applied to the lingual root and to the root most firmly united with the lingual, and the extraction should proceed as when the crown is intact.

If the fracture occurs well up on the tooth lingually, but enough of the tooth remains buccally for the application of one beak of the forceps, the method of procedure indicated is either the removal of the alveolar ridge lingually and a reapplication of the forceps, or a separating of the lingual root from the buccal roots with a fissure bur, in the latter case the blade of an elevator being adjusted between the separated parts to break up their attachments, as described for the use of the elevator (page 167).

The fracture may occur in a reverse direction, leaving sufficient structure lingually for the application of the forceps and none buccally. When this occurs, the marginal ridge should be removed buccally and the forceps reapplied; or, if the parts remaining on either side are too short for a reapplication, a removal of the marginal ridge on both sides is permissible. This technic is indicated only where the parts of the tooth that remain are firm and not weakened by decay.

Where fracture occurs at a considerable distance above the process both lingually and buccally, and the forceps or the elevator cannot be applied without the removal of quite a portion of the process, the roots should be separated from each other with the fissure bur, their attachments broken up by introducing the elevator between them, and, when loosened, removed with Standard forceps No. 2.

Where fracture has occurred in the case of a superior molar that has only two roots, the fused root may be very broad, with a groove extending down each side. Where this condition exists, it may require quite an effort to entirely separate the root with a bur, but, if separated for a considerable distance, the separation may be completed by the use of a heavy enamel chisel. The extraction is completed by loosening the roots with the Cryer elevator and removing them with the forceps or Derenberg tweezers.

If fracture occurs so far beyond the neck of the tooth as to nearly separate the roots, they are broken apart by the application of the Cryer elevator. The roots are then extracted by introducing the elevator on the distal side of the disto-buccal root, using the process as a fulcrum to remove it, and after its removal a mesial application to the mesio-buccal root in the same manner will usually dislodge it, as the space caused by the removal of the disto-buccal root will greatly aid in the extraction of the mesio-buccal root.

Where a fracture occurs, and one root leaves the socket intact with the crown, but one or two roots remain, the latter may be removed with the Cryer elevator.

Maxillary Sinus.—In all operations on the roots of deep-seated superior first and second molars, whether applying forceps or elevator, pressure must not be exerted upward on them, as the floor of the maxillary sinus may be situated immediately above their apices. This precaution must be especially observed with the buccal roots of the superior first molar, whose apices often form convolutions in the floor of the sinus. If the operator is in doubt as to the existing conditions when operating, he should carefully flush out the sockets with warm sterilized water before further procedure and make a thorough examination, as a little precaution may obviate serious trouble.

SUPERIOR THIRD MOLAR.

The extraction of the superior third molar is indicated almost as frequently as that of the inferior third molar, and Fig. 80 shows the various types of third molars that are usually seen. Abnormalities of the crown and roots of this tooth are not uncommon, and Fig. 81 shows various types of these abnormalities. As may be noted, this tooth varies both in the size and shape of its crown. Occasionally the crown is of about the same size as the crown of a normal second molar, and may vary from this size down to one only a few lines in any of its transverse diameters. In shape it will vary from the imperfect rhombic form of the second molar, through all the variations in the shape of this tooth, to the imperfect cylindrical form peculiar only to this tooth and supernumerary teeth.

Where the eruption of this tooth is obstructed, the condition does not cause the great amount of distress that usually accompanies a similar condition of the inferior third molar. The resistance to its eruption by the hard tissue is not so great as

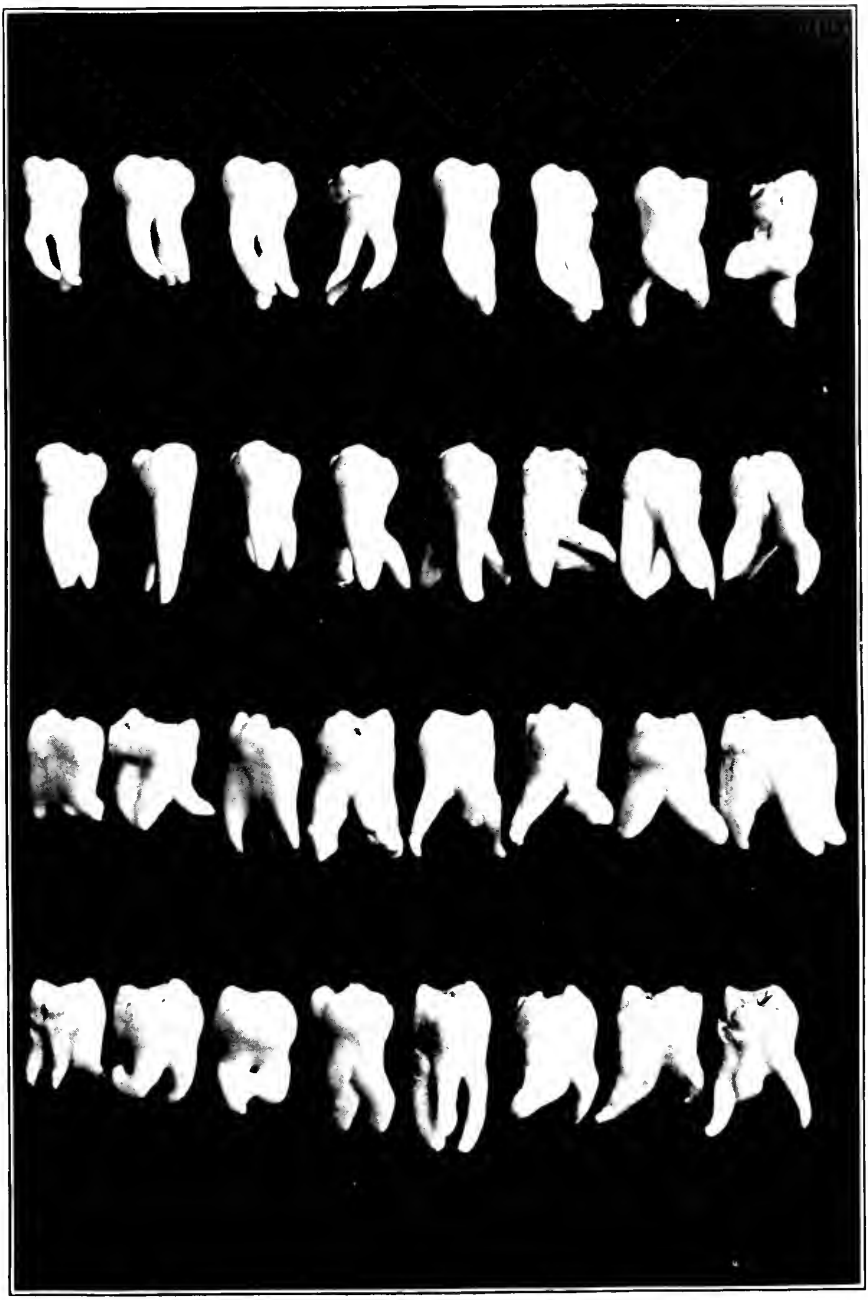


Fig. 80.—Types of superior third molars. The first row shows the buccal, the second row the lingual, the third row the mesial, and the fourth row the distal surface.

with the inferior third molar, and the superior third molar, if it erupts in malposition, usually inclines to the buccal side of the arch or posteriorly.

Position of Patient and Operator.—The position of the patient in the chair and that of the operator is as described for extracting superior teeth (page 93). In some cases, however, where the tooth is obscured by displacement or other interference, better access to it can be had by raising the chair until the head of the patient is slightly above the shoulders of the operator.

When operating on either the left or right side of the arch, the head of the patient as well as the position of the arm of the operator and the arrangement of the hand and fingers are the same as described for the first and second molars (page 154), except that the position of the fingers is a little more posterior and the raising of the lip is done principally at the corner of the mouth.

The mouth should seldom be opened to its fullest extent, and especially should this not be done if the mouth is small, the patient is fleshy, or the tooth is displaced buccally. In opening the mouth to the fullest extent, the ramus and coronoid process of the mandible are drawn down past the third molar and in close proximity to that tooth. This not only obscures the view of the tooth, but interferes with the application of the forceps and prevents the proper execution of the extraction movements. Opening the mouth about two-thirds of its full extent will usually allow the best access to this tooth, and the operator's position at the chair should be such that he has a good view of the tooth throughout the operation.

Forceps.—Standard forceps No. 4 (Fig. 5) are usually employed in the extraction of this tooth. If the tooth is normally developed and has three roots, Standard forceps No. 3 R and No. 3 L (Figs. 3, 4) may be used; and if it is small or conical-shaped, Standard forceps No. 2 (Fig. 2) should be used.

Order of Extraction.—The extraction of this tooth should, as a rule, precede that of the second molar, and, in fact, where a number of teeth are to be extracted from different parts of the superior arch at the same sitting, if conditions are favorable, the third molar should always be extracted first. The rule is reversed only where the tooth is impacted or difficult to remove, and where the second molar is also to be extracted and its

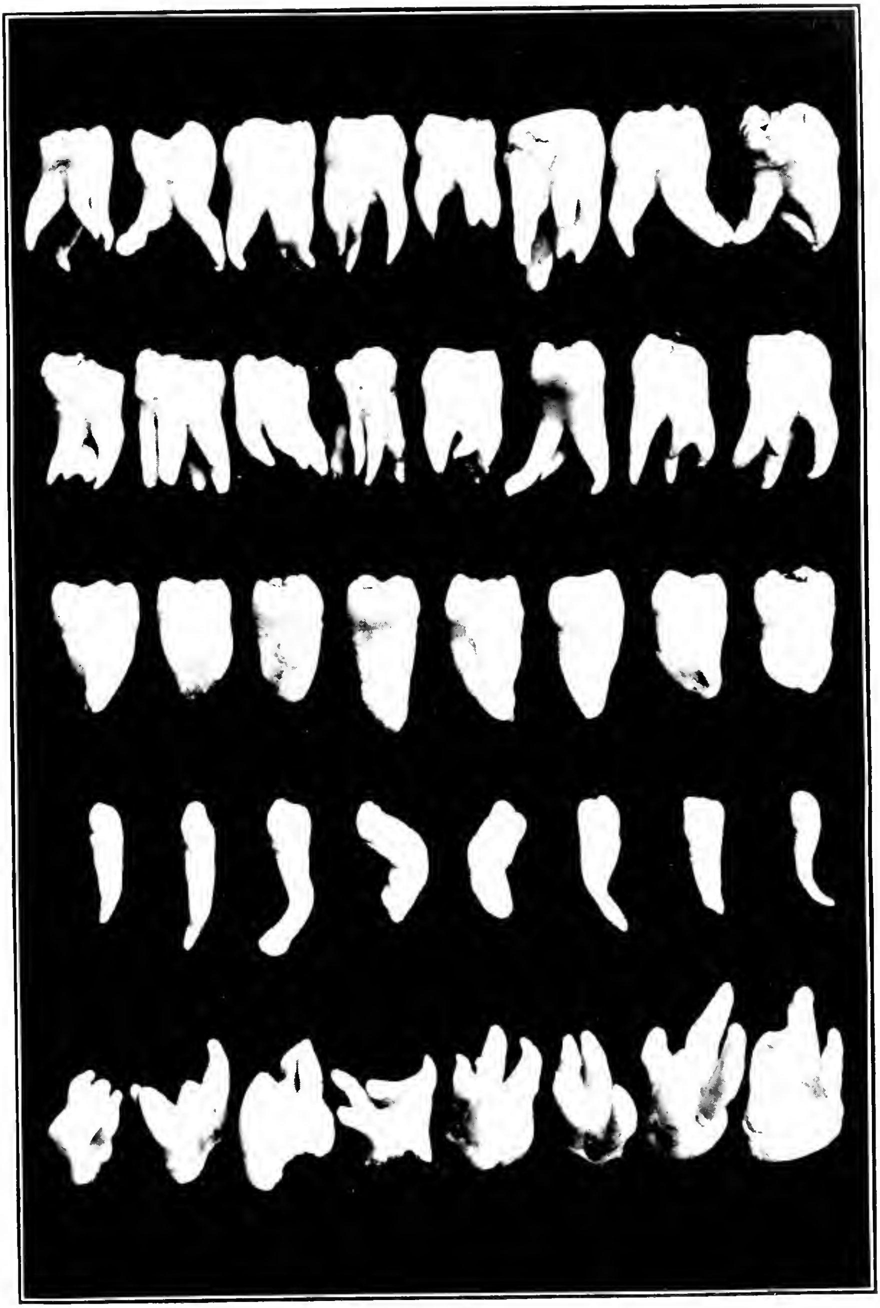


Fig. 81.—Types of abnormal superior third molars. The first and second rows show four-rooted teeth, the third row shows teeth with roots that are fused, the fourth row shows teeth having crowns with a single cone and only one root, and the fifth row shows teeth having roots in which there is great variation in form.

removal will simplify access to the third molar. Where both of the superior third molars are to be extracted, the one on the left side is removed before the one on the right side.

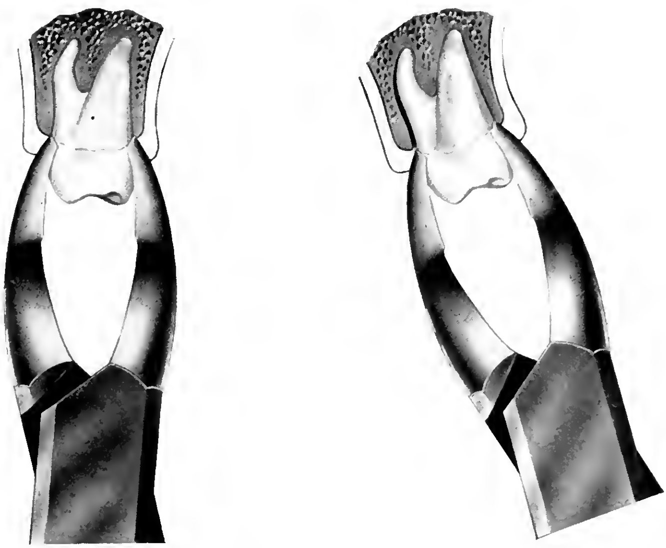
Application of Forceps.—Securing a good adjustment of the forceps to this tooth is often virtually the completion of the operation, as frequently its roots are so shaped that the tooth leaves the socket on the initial application. The forceps having been selected, the lingual beak should be adjusted first and then the buccal beak, provided that access to the tooth is readily obtained. If, however, the tooth is hidden by the soft tissues toward the buccal side, it will be advisable to make the adjustment to the buccal side first. In applying the forceps, the operator should avoid engaging the tuberosity posterior to this tooth or the gum tissue, the latter sometimes being unusually heavy about the tooth.

Alveolar Application of Forceps.—As with the two molars anterior to it, the alveolar application should not be attempted with the superior third molar when the process surrounding it is not diseased. Where the process is carious, slight alveolar application is permissible, but should be made with care, as there is always danger of fracturing the tuberosity, especially if the latter is prominent. Wherever it is necessary to secure an adjustment of the forceps above the margin of the alveolus, removing a part of the process with a bur is a safer course to pursue.

Extraction Movements.—When Standard forceps No. 4 (Fig. 5) have been adjusted to a superior third molar (Fig. 82, *A*), and this adjustment has not loosened or dislodged the tooth, it is carried buccally with a degree of force varying with the strength of the tooth and the resistance to be overcome (Fig. 82, *B*). In most instances this will release the tooth, when it is carried from its socket by a tractile movement downward in a line usually buccally of the median line of the ridge.

Where the roots are considerably spread, more resistance will be encountered, and in such case the operator must proceed cautiously to avoid fracturing the tooth or the tuberosity. When the buccal movement does not break up the attachment, the tooth is carried back lingually and carefully swayed back and forth until its attachment is broken up, when it is carried from its socket in the direction of least resistance. When necessary, some force downward may be exerted in executing the tractile movement.

The two buccal roots of this tooth will on rare occasions be divergent, the mesio-buccal root inclining mesially and the disto-buccal inclining distally. In such case the removal of a small area of the buccal plate of the alveolus with the tooth is unavoidable. Where this condition is observed, to avoid such an accident, the extraction movements should be discontinued, and the alveolus removed from the buccal wall of the tooth before completing the extraction.



A *B*

Fig. 82.—Extraction movements for superior third molar. *A*, forceps (Standard No. 4) applied; *B*, extraction movement to the buccal side.

The fusion of all the roots into one is very common with the superior third molar, and, where this condition exists, its extraction is usually a very simple matter. The application of the forceps, with a slight pressure on the beaks, will usually cause the tooth to leave its socket, and it will often slip down between the beaks of the forceps so suddenly that the operator will think he has produced a fracture.

In any operation on the superior third molar, the tuberosity should be considered, and during any application to this tooth the slightest movement of the tuberosity should be taken into account. Rather than endanger the tuberosity with a possible fracture, it will be better to discontinue the operation and remove a portion of the process from about the tooth with a bur. Where the superior third molar has been isolated for some time, the attachment of the tooth is usually more firm, and greater care should be observed in its extraction than if the teeth in front of it are in position. In some mouths the gum tissue is very heavy on the lingual side of the tooth, or the entire crown of the tooth may be deeply seated in the soft tissues, and, where this condition exists, care should be taken that the tissue is not lacerated during the extraction.

Displacement.—This tooth is out of alignment more frequently than any other superior tooth, and is usually displaced to the buccal side of the arch. Where displaced in any other direction, the displacement is so slight that the technic of operation is the same as for a tooth in normal occlusion.

Where this tooth is displaced buccally, the displacement will vary from a very slight displacement to a complete eruption on the buccal side of the alveolar process, with the occlusal surface directed toward the cheek. Where the tooth is displaced in this manner, the greatest difficulty in its extraction will be to secure an adjustment of the forceps. Where access can be had, Standard forceps No. 4 (Fig. 5) should be used, and, if access is difficult, Standard forceps No. 2 (Fig. 2) are substituted. If possible, the adjustment is made in the usual manner, but, if this cannot be done, the order of application of the beaks is reversed. The forceps having been applied, the tooth is extracted by movements executed as nearly as possible as those given for extracting the same tooth in normal occlusion (page 174).

Caries.—Where the superior third molar is extensively involved with caries on its mesial or distal surface, application and extraction is performed with Standard forceps No. 4 if good adaptation can be had; but where caries is very extensive, and the part remaining is rather firm, better execution can usually be accomplished by the use of Standard forceps No. 2.

Gingival Caries.—Caries on the buccal surface of the superior third molar, extending around and above the gum margin, is very common. Where the decay is of considerable extent, one beak of the forceps is sent up quite a distance and with some force on the lingual surface of the tooth, and the opposite beak is carefully adjusted to the buccal surface so as to cover as much of this surface as possible, but no attempt is made to send it excessively high on this side. The forceps, when being applied, should not impinge forcibly on the tissues of the cheek. Extraction is obtained by the usual movement buccally (page 174).

Gingival decay is not frequent on the lingual surface of this tooth, and, when present, the removal does not differ from the usual extraction of the tooth, care being taken that good adjustment of the forceps is had to its lingual side.

Three Roots United.—Where the crown is destroyed by caries and the roots are left united, the roots are often fused, and when in this condition are generally dislodged by the initial application of the forceps. If the parts are of considerable size, Standard forceps No. 4 (Fig. 5) should be used, applying the same extraction movements as when the crown is intact (page 174). If the remaining parts are small, adjustment is made preferably to the lingual and mesio-buccal surfaces with Standard forceps No. 2 (Fig. 2), and the roots carried out toward the buccal side. In most of these cases the beaks should be sent well up on the roots for a firm adjustment, but this must be done very cautiously, as the process is never very heavy in this region, and no great amount of force is required to effect this adjustment. If, after the initial extraction, one of the roots remains, it is extracted with Standard forceps No. 2 (Fig. 2) or No. 5 (Fig. 6) by a rotatory movement.

Two Roots United.—With superior third molar roots not many cases occur where two roots are intact and one is isolated. Where this condition exists, Standard forceps No. 2 should be adjusted to whichever two roots are united, and they are extracted by the usual movements. Their extraction will usually loosen the remaining root, but, if it does not, it is extracted with the same forceps, or, if small, with Standard forceps No. 5.

Separated Roots.—Where the roots of this tooth are separated, Standard forceps No. 2 should be used if the roots are of considerable size; but if they are small, Standard forceps No. 5 are employed. The extraction of these roots is performed by adjusting the forceps to the most accessible root first and releasing it by a rotatory movement. This movement is applied to a majority of superior third molar roots, but where a root is flattened it is loosened with the linguo-buccal movement. Where decay is extensive, the application of the modified Cryer elevator (Fig. 25) is made to the mesio-buccal root, using the second molar or the process as a fulcrum, and, when loosened, it is extracted with forceps or Derenberg tweezers. The same technic is applicable to the palatal root. The disto-buccal root is disengaged by applying the elevator to its distal surface and forcing it mesially.

Roots Covered by Gum Tissue.—Where the broken-down parts of the superior third molar are covered by the soft tissue, an examination of the parts should be made to ascertain the original size of the tooth and the amount of its structure remaining. If the tooth is of considerable size, Standard forceps No. 4 are used, but, if small, better application is had with Standard forceps No. 2.

It is seldom necessary to lance the tissue over the tooth, and application should be made as described and illustrated in the case of the superior central incisor (page 116). Severing the tissue over this tooth with the lancet is not advised, as the attending hemorrhage usually so obscures the parts that it is difficult to proceed with the operation. Lancing the gum is indicated only where the tissue covering the structure is so firm or so adherent to the tooth that it cannot be severed with the blades of the forceps. After application has been obtained, the technic of extraction is the same as for removing roots of this tooth unobscured when in a like condition of decay.

Deep-Seated Roots.—When the remaining roots of the superior third molar are deeply seated, great care in operating on them should be exercised to avoid a fracture of the tuberosity. The technic of operation does not differ materially from that on the roots of superior first and second molars when in a like condition.

Elevator.—The number of cases for the application of the elevator to the superior third molar is limited, and no attempt should be made to apply this instrument when the crown is intact, or the tooth is in normal alignment, or the tuberosity is of considerable size, as it is seldom practicable to force this tooth posteriorly as a preliminary to applying forceps. The elevator can be appropriately applied, if judiciously used, to a tooth that is impacted and displaced buccally, or to one impinging below the crown of the second molar, but only in the capacity of slightly loosening the tooth. The elevator can be employed also on the mesio-buccal root of a third molar where only this root remains. Where the forceps cannot be applied to the disto-buccal root in a case where the mesial root has been removed, the disto-buccal root may be brought mesially with an elevator, but never distally. Careful judgment is necessary in the use of the elevator on the third molar.

Impaction.—The superior third molar is not so frequently impacted as the inferior third molar, and, when impacted, it is not so firmly attached, nor does it assume such inaccessible positions, as is common with the latter tooth. When a pathologic condition ensues as a result of the impaction, the inflammatory

Fig. 83.—Impacted superior third molar. Radiograph shows the eruption of the tooth retarded by the crown of the second molar a short distance from its normal position.

conditions in the vicinity of the superior third molar are seldom as acute or as extensive as in the case of the inferior third molar.

Partial Gingival or Alveolar.—Where this tooth is partially impacted by the gum tissue, the operator may be led to believe that the tooth to be removed is small or that it is a supernumerary tooth, but on the attempted application of the forceps a fully developed tooth is encountered. Little attention should be given to the heavy tissue covering the tooth, provided the forceps can be securely adjusted to the tooth without lacerating this tissue, for, once the forceps are adjusted, the tooth can usually be removed as readily as one completely erupted.

If a part of the crown, in addition to being covered by the gum tissue, is covered by the alveolar process, the latter should be removed with a round bur over the occlusal surface of the tooth and with a cross-cut fissure bur along its buccal and palatal walls, after which Standard forceps No. 2 (Fig. 2) are adjusted and the tooth removed by the usual technic. If, during the operation, any movement of the tuberosity is observed, a part of the process distally should be removed with a bur before attempting to complete the extraction. If the tooth is only slightly impacted (Fig. 83), the extraction may often be completed with Standard forceps No. 2 by the usual methods without removing any of

Fig. 84.—Impacted superior third molar. Radiograph shows the crown of the tooth inclining distally.

the process. The extraction movements are the same whether the tooth is displaced lingually or buccally, or in normal occlusion.

An occasional form of impaction of this tooth is seen where its crown lies below that of the second molar and is inclined distally (Fig. 84). In such case it is necessary to make an incision of the gum tissue over the crown with the lancet and apply Standard forceps No. 2. When the forceps are adjusted, the tooth is directed slightly distally, if the tuberosity will permit it, in addition to the buccal movement. When the tooth has been loosened, the delivery is made in line with its axis.

Complete Alveolar.—An abnormality of not very frequent occurrence is that of a superior third molar completely imbedded in the alveolus, with the crown in an almost horizontal position (Fig. 85). Where the tooth is impacted in this manner, its position is usually to the buccal side of the arch. Where such a condition is presented, a radiograph of the parts should be obtained in order that a definite outline of the tooth and its rela-

Fig. 85.—Impacted superior third molar. Radiograph shows the tooth in a horizontal position.

tion to the surrounding tissues may be had. After gaining the desired information from the radiograph, an incision should be made in the gum tissue and the process covering the crown carefully dissected away. The modified Cryer elevator (Fig. 25) is adjusted to the mesio-buccal surface of the crown with sufficient pressure to engage the tooth with the point of the instrument, and a pulling force is applied occluso-buccally, repeated application being made until it is entirely disengaged. No pressure should be applied distally, nor should a too forcible application be made in any direction. It is better to remove more of the process than to endanger the parts by attempting to extract the tooth by force alone.

By Approximating Tooth.—Where the crown of the superior third molar is directed below the normal contact point of the crown of the second molar, a radiograph should be obtained before attempting to operate in order that the development of the third molar and the amount of its impaction be ascertained. If the radiograph shows that the amount of impaction is not extensive and that the third molar is small, Standard forceps No. 2 (Fig. 2) are adjusted. The tooth is first carried cautiously toward the buccal side of the arch, then back slightly to the lingual side, and again with increased force to the buccal side. These movements are continued until the tooth is released from its attachment, when it is carried from its socket buccally.

If the operator finds that the tooth cannot be extracted without fracturing it or endangering the tuberosity, the operation should be discontinued and enough process removed to allow the tooth to be released from its impacted position. If it is impossible to secure a good application with the forceps, the modified Cryer elevator may be inserted into the available interproximal space, being applied to the lingual or buccal side, and rotated sufficiently to loosen the tooth, when its extraction is completed with the forceps. No attempt should, however, be made to complete the extraction with the elevator, as that would endanger the tuberosity.

If impaction is so complete that the tooth cannot be removed without the destruction of considerable process, the part of the crown in contact with the second molar should be cut away with a carburundum stone or the fissure bur before attempting to remove the tooth.

Fracture.—If the superior third molar is fractured while attempting to remove it, due to the operator misjudging the extent to which it is decayed, or due to his failure to secure a good application of the forceps because of its posterior location, the forceps may be reapplied, if sufficient structure remains, before hemorrhage has obscured the parts. Where the fracture is so far beyond the neck of the tooth that the forceps cannot be reapplied, a part of the process on the buccal and palatal side should be removed with a bur, Standard forceps No. 2 applied, and the tooth removed by the usual movement buccally.

If, after a fracture, the remaining part of the tooth is slightly detached or is not very large, and the alveolus on the buccal side interferes with the reapplication of the forceps, the modified Cryer elevator is applied to its mesial surface with only sufficient pressure to loosen it. When loosened, the part is engaged with Standard forceps No. 2 and removed. Care must be taken not to lacerate the soft tissues nor engage the process with the forceps.

If one or two roots remain, and they are lingual or mesiobuccal, they are released with the modified Cryer elevator. Access is facilitated by employing the mouth mirror and holding the elevator as when using an excavator in removing decay from a disto-occlusal cavity in this tooth. In most cases this method of applying the elevator will be found very practicable, and will obviate the necessity of reapplying the forceps.

If only the small tip of a root remains and it is not involved in any pathologic condition, no attempt should be made for its removal, as usually it will not cause any trouble. If the tip, however, subsequently causes any inconvenience, it will occur at a time sufficiently remote from the operation that its removal will be very much simplified by the absorption of the process that has in the meantime taken place on account of the loss of the tooth.

CHAPTER X.

EXTRACTION TECHNIC OF THE INFERIOR TEETH.

The extraction of the inferior teeth is, as a rule, more complicated than that of the superior teeth. Forceps are not so freely used on the inferior teeth, and the judicious use of the elevator is advocated wherever its application is practicable. An operation on the inferior third molar, which is one of the most difficult teeth to extract, becomes more complicated when this tooth is impacted. In order that the operation in the case of an impacted inferior third molar may be more clearly differentiated from an operation on this tooth when not impacted, a separate chapter has been prepared on the extraction technic of impacted inferior third molar (Chapter XI).

INFERIOR INCISORS.

The inferior incisors are extracted less frequently than any other teeth, except the inferior cuspids, and, when their extraction is indicated, it is as often caused by recession of the supporting tissues or pyorrhea alveolaris as by tooth decay. They are not, however, immune from caries, and when once attacked by it the progress is usually rapid and difficult to control.

The inferior incisors—two centrals and two laterals—are so nearly alike in form and attachment, and their surrounding tissues are so similar, that the technic of extraction applicable to one of them is with very little variation applicable to all. Fig. 86 shows the various types of inferior incisors that are usually seen.

Position of Patient and Operator.—The operator assumes the position described for extracting inferior teeth (page 96). The position of the head of the patient is straight in the head-rest. The left arm of the operator is placed to the left side of the head of the patient, with the palm of the hand over the left cheek. The index finger is inserted in the oral cavity on the lingual side of the anterior teeth; the second finger depresses the

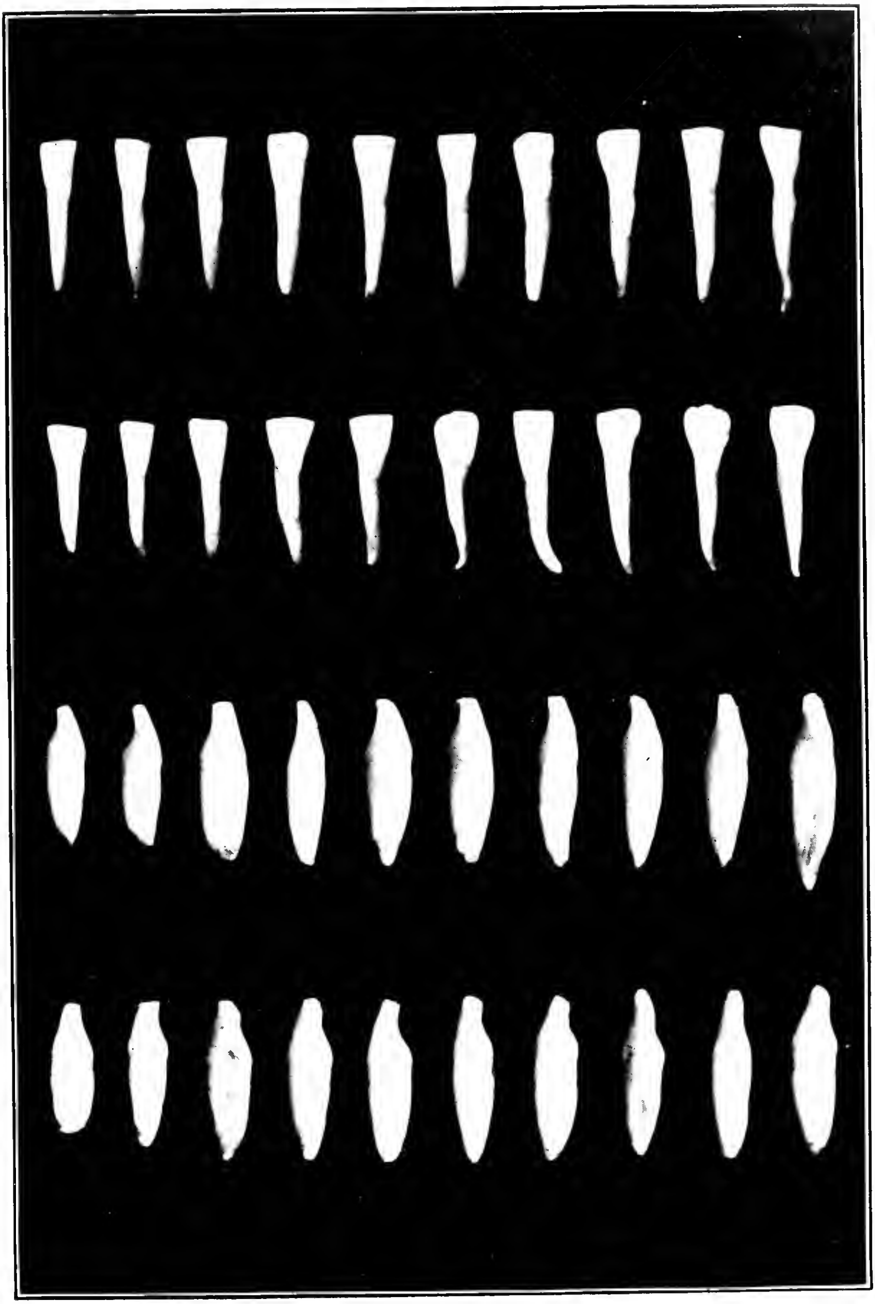


Fig. 86.—Types of inferior central and lateral incisors. The first row shows the labial, the second row the lingual, the third row the mesial, and the fourth row the distal surface.

lower lip, exposing the field of operation; the third and fourth fingers are placed beneath the chin to support the lower jaw, and they must not be removed during the extraction, as a very slight movement of the mandible may prevent a successful appli-

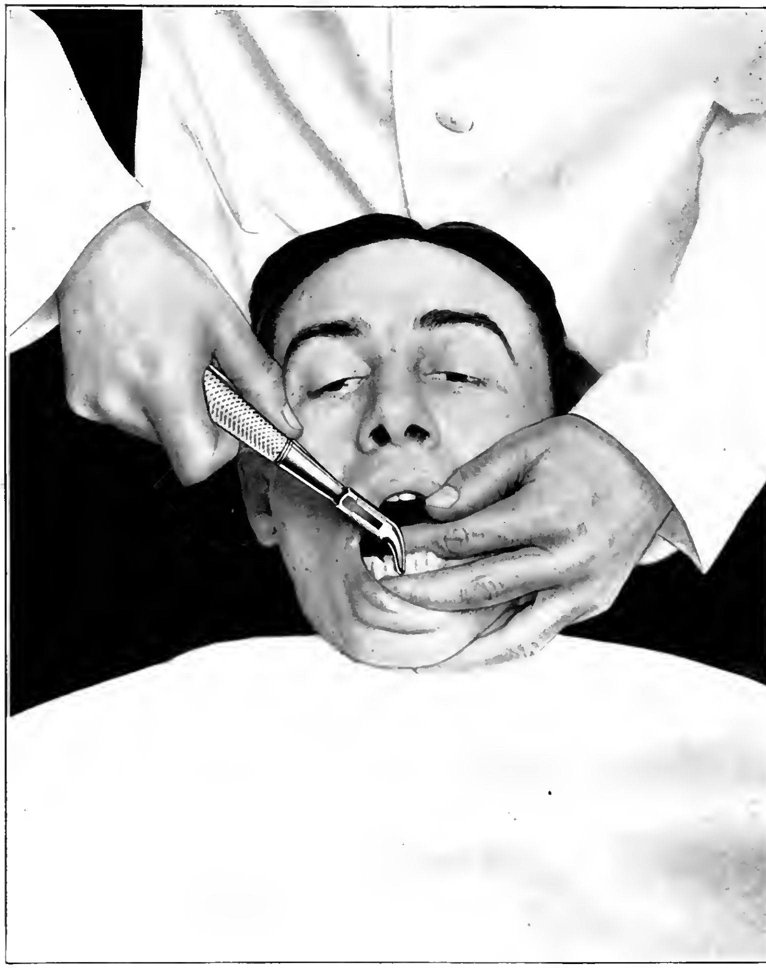


Fig. 87.—Position of the operater's hands and disposition of the fingers when applying forceps to an inferior incisor. Illustration shows the application of forceps (Standard No. 6) to the inferior right central incisor.

cation of the forceps or a proper execution of the extraction movements.

Fig. 87 shows the method of applying Standard forceps No. 6, and Fig. 88 shows the method of applying Standard forceps No. 9. Either of these methods gives the operator direct access, and the fingers placed as shown render them instantly available for ejecting the extracted tooth from the mouth in case the forceps lose control of it.

Forceps.—Standard forceps No. 6 (Fig. 7) are usually em-

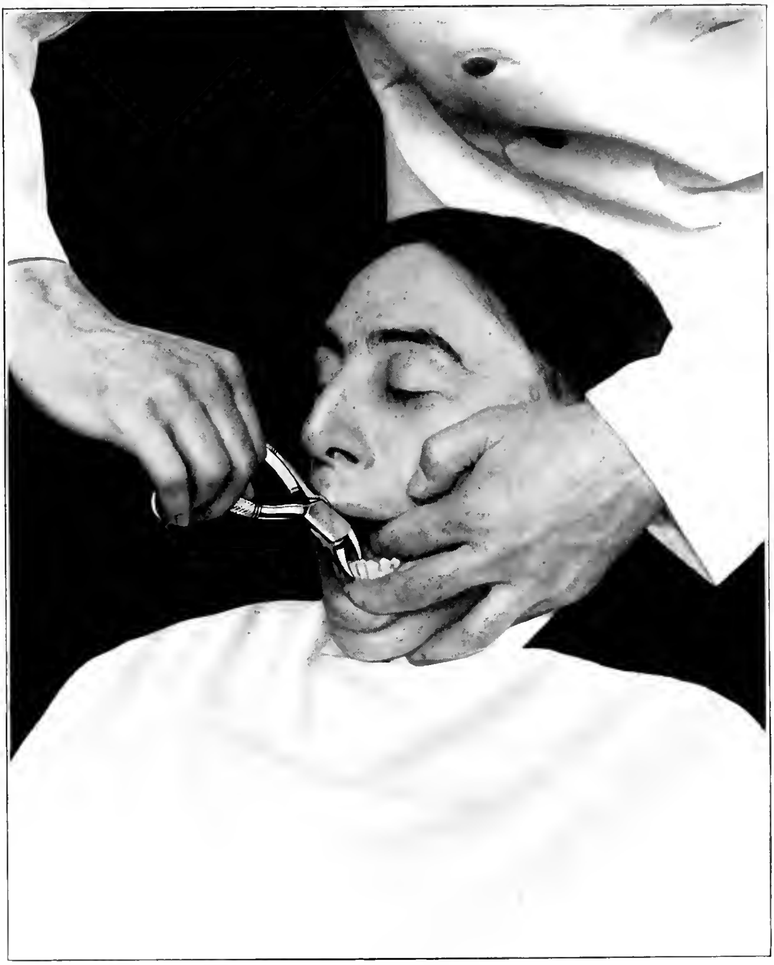


Fig. 88.—Position of the operator's hands and disposition of the fingers when applying forceps to an inferior incisor. Illustration shows the application of forceps (Standard No. 9) to the inferior right central incisor.

ployed for the removal of all inferior incisors, and are well suited for the extraction of these teeth, provided they are of fair size and in normal alignment in the arch. Equally satisfactory results can be had also with Standard forceps No. 8 (Fig. 9), and, if on account of any abnormal condition of mouth, arch, or teeth, good access cannot be obtained with Standard forceps No. 6, the use of Standard forceps No. 8 is indicated. For teeth that are small, crowded, or irregular, Standard forceps No. 9 (Fig. 10) are used, which are a counterpart of Standard forceps No. 8, but with narrower beaks. In fact, Standard forceps No. 8 and No. 9 are better adapted for the removal of a majority of inferior incisors than Standard forceps No. 6.

A liberal use of Standard forceps No. 8 and No. 9 is recommended, not only for the extraction of the incisors, but for all the ten anterior inferior teeth, as they are invaluable instruments in the hands of a skilled operator for the removal of many of these teeth where application is difficult or impossible with any other forceps. Every operator should, therefore, master the technic of their use, which may seem difficult at first, but is in reality readily acquired. The basic principle of a correct design in forceps is that, when application is made, tooth, beaks, and handles are all in the same plane, and that, when the power is applied with the hand, the tooth can be brought from its socket also in the same plane without impinging on the other tissues of the mouth. The hawksbill forceps (Standard forceps No. 8 and No. 9) come nearer to conforming to this principle than any other forceps designed for the inferior anterior teeth.

Order of Extraction.—If both central and lateral incisors are to be removed, and conditions pertaining to both are similar, the extraction of the centrals should precede that of the laterals. The position of the centrals in the arch affords better access. As the centrals are the first teeth to erupt, they are less frequently in abnormal position; and, as they are smaller and have shorter roots than the laterals, and as the alveolar process reaches its minimum thickness over them, they are correspondingly easier to extract.

Application of Forceps.—More difficulties are encountered in the application of the forceps to the teeth in the inferior arch than in their application to the superior teeth. The parts in the inferior arch are not as accessible, and the view on their lingual sides is often obstructed by the tongue, while in the superior arch there is an open field. The lower jaw being mobile, its movements must be controlled, and the teeth, especially if badly broken down, are often immersed in saliva and, if there are a number of extractions, in blood.

One beak of the forceps should be first applied to the lingual side of the tooth, passing it well down to the gum margin, followed by the application of the opposing beak to the labial side, and this order of applying the beaks is reversed in case the tooth is badly decayed gingivally on its labial surface and the lingual wall is comparatively sound. Holding both beaks in close proximity to the tooth, they are sent down rather firmly, but never with sufficient force to break down the process. The alveolar arch that rises from the incisive fossæ labially and from the depression above the genial tubercles lingually is much narrower in its mesio-distal diameter at its base than at its margins. This condition and the narrowness of the roots of these teeth should be borne in mind, and care taken that the forceps are not misdirected, as in case of misdirection of the forceps the beaks would grasp the alveolar process surrounding the tooth or the septum on either side of it, thus weakening or destroying the supporting tissues of an adjacent tooth, thereby unnecessarily causing its immediate or early loss. Any rotated position of a tooth should be noted, so that it may be grasped by the forceps in its greatest transverse diameter, provided the adjoining teeth permit such application.

Alveolar Application of Forceps.—Alveolar application of the forceps to the inferior incisors should be made sparingly, and, when made, should be done with caution. This application is indicated in the case of fracture by traumatism, or by an attempted extraction, where the break is a little above or flush with the alveolar margin; in case of decay that has destroyed the crown, but the root at or immediately below the process is firm; and in some cases of displacement. Alveolar application to either the labial or lingual side may also be made independently of the opposing side, and is at times indicated.

Application is made by passing the beaks just far enough over the process to grasp the root, and never below the marginal ridge. The danger lies in letting the forceps slip all the way over the ridge and grasp too much of the process, and, to avoid this, the labial beak should be controlled with the index finger of the left hand. No attempt at extraction movements should be made until the beaks have cut through the process and engaged the root, which part of the procedure is readily revealed by a cultivated sense of touch, and the pressure applied in cutting through the process is all that is usually necessary to loosen the root.

Extraction of badly decayed or deeply seated roots of inferior incisors should not be attempted by alveolar application.

Extraction Movements.—Using Standard forceps No. 6, and having applied them as previously described (page 188) and as shown in Fig. 89, *A*, the first extraction movement is made by bringing the tooth labially (Fig. 89, *B*), followed by a like movement lingually (Fig. 89, *C*). These movements are repeated until the tooth is loosened from its attachment, when it is carried from its socket by a tractile movement upward and in line with its original position (Fig. 89, *D*). The same technic of operation is applicable when using Standard forceps No. 8 or No. 9. The roots of the inferior incisors are smaller and more fragile than those of the other single-rooted teeth, and the force of the extraction movements should be gauged accordingly. A short labiolingual movement under perfect control should be used in preference to any extended movement, and in case of extensive caries the beaks of the forceps should be sent as firmly against the process as its strength will bear without fracture.

In case of gingival decay, either labially or lingually, the first extraction movement is made in the direction of the cavity, followed by carrying the tooth only far enough in the opposite direction to take up the space gained by the first movement. As the roots of the inferior incisors are much flattened in their mesiodistal diameter, it is important that all extraction movements be started with the beaks of the forceps in the same plane as the greatest transverse axis of the tooth, and that they be kept in this plane throughout all the movements. The compound obtuse angle by which the power is transmitted from the hand to these teeth—that is, when using any forceps other than the hawksbill, some of whose advantages have been considered, or forceps canted with beaks and handles at right angles, and which cannot be controlled in any tractile movement—demands that more than ordinary skill and judgment be exercised in the extraction movements; but the necessary skill and judgment should be acquired, as a high percentage of failures is attributable to a lack of the necessary knowledge of the tractile movements. The flattened roots preclude any attempt at rotatory movements, and even in the presence of torsal occlusion all lateral force should

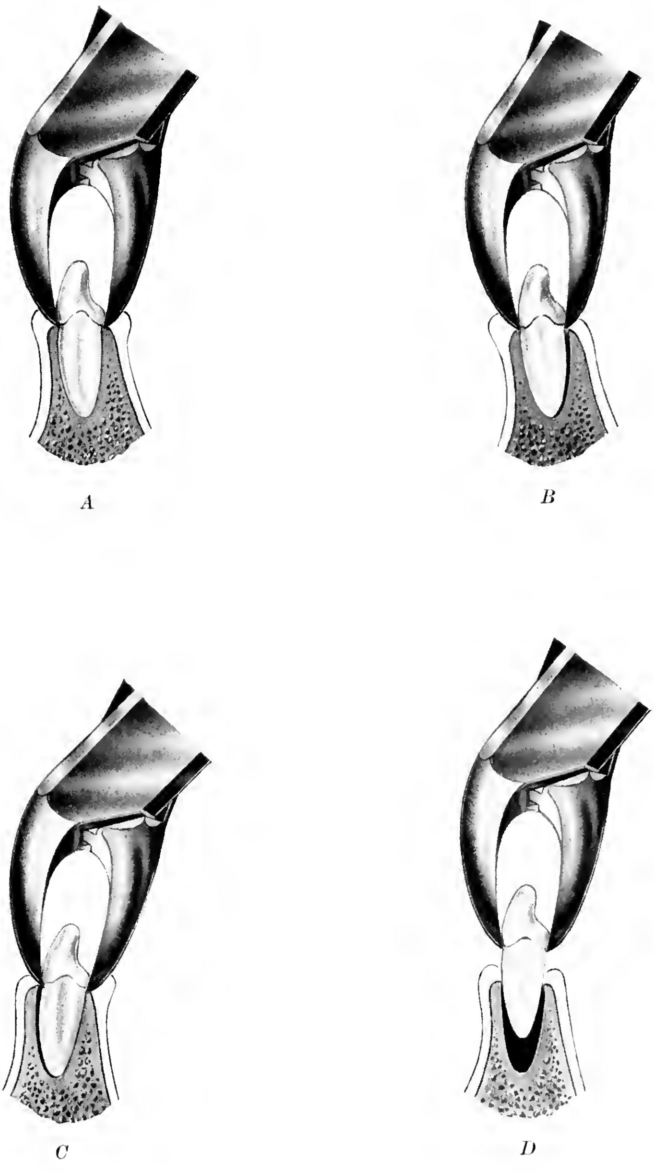


Fig. 89.—Extraction movements for inferior incisor. *A*, forceps (standard No. 6) applied; *B*, first movement to the labial side; *C*, reversed movement to the lingual side; *D*, tractile movement upward in line with the original position of the tooth.

be exerted in the direction of the tooth's greatest transverse diameter, provided the approximating teeth permit such procedure.

Displacement—*Complete Lingual.*—In the extraction of an inferior incisor that is in complete lingual occlusion, application should be made, if possible, to the labial and lingual surfaces with either Standard forceps No. 6, No. 8, or No. 9, selecting the pair with which the best access can be obtained. There will be, however, only few cases in which labio-lingual application can be made, and, if impossible to make it, a mesio-distal one is made, using Standard forceps No. 8 or No. 9. Application having been made, the tooth is forced lingually, using the minimum amount of force necessary to break up its attachment, and attempting only sufficient counter-movement to take up the space thus gained. More tractile force is permissible than where the same tooth is in normal alignment, but such force must be under perfect control, so as to avoid the possibility of injuring any of the superior teeth with the forceps on a sudden release of the tooth.

Complete Labial.—The application of the forceps and the extraction movements necessary to remove an inferior incisor in complete labial occlusion is identical with that for removing the same tooth in complete lingual occlusion, except that the order of the extraction movements is reversed. The removal of the tooth is usually less difficult than when in lingual occlusion, as access is better, and, being on the convex instead of the concave side of the arch, with a thinner plate of process for its support, the attachment is not so firm. The greater danger lies in carrying a tooth labially with more force than is necessary to loosen it and splitting off a considerable area of the process.

Partial.—Standard forceps No. 8 or No. 9 are especially suited for the extraction of an inferior incisor in irregular alignment, preference being given to those with the broader beaks, provided one of the beaks can be introduced between the crowded teeth. Having selected the forceps, one beak is first applied to the labial wall in lingual displacement and to the lingual wall in labial displacement, passing it well down under the free margin of the gum, and noting the relation of the tooth to the approximating teeth, so that the latter may not be injured by the extraction movements which are to follow. The forceps having been adjusted, and while holding the tooth only firmly enough to prevent it slipping from adjustment, the labio-lingual or the linguo-labial movement, depending on the direction of misplacement, is used in a modified form, during which procedure the forceps are sent down against the process with some degree of force, but never sufficient to fracture either of the plates. This downward pressure is a reliable force in loosening the tooth from its attachment, and does not subject the adjoining teeth to the dangers of the broad swaying movement.

The practice of too frequently extracting an inferior incisor to relieve a crowded condition is not approved, as the resultant loss leaves a space that subjects the supporting tissues to probably grave pathologic conditions.

Impaction.—An inferior incisor is seldom impacted, and, when impacted, it is usually located on the lingual side of the arch. To extract a tooth so impacted, an incision of the soft tissue should be made to expose the crown and that part of the alveolus that must be removed. The alveolus is then dissected away from the mesial or distal side of the tooth to a distance where the point of the elevator can penetrate the root. The regular or modified Cryer elevator (Figs. 24, 25) is selected, and the blade adjusted to the side of the root, sufficient pressure upward being applied to loosen the tooth from its attachment, and, when necessary, using the forceps to complete the operation.

The success of the operation is dependent on removing a sufficient amount of osseous tissue, and at the proper place, to release the tooth from its impaction, and therefore the operation should not be attempted without a correct diagnosis having been previously made with a radiograph.

Fracture.—Unless adequate skill has been acquired—including good judgment in selecting the proper method of operating and the exercise of due precaution in executing the details of the operation—fracture will not be uncommon in the attempted extraction of inferior incisors, especially in the case of a person past the meridian of life, with the process heavy and in a good state of preservation, and the teeth frail and in a poor state of preservation.

In case of fracture anywhere from a little above to a short distance below the process, alveolar application should be made and the root removed as if no fracture had occurred. In such case and also in deeper-seated fracture, if the two approximating teeth have been removed at the same sitting, application is made by introducing the beaks of Standard forceps No. 8 or No. 9 into the vacant sockets, and cutting through the septi to secure an adjustment on the root, after which it can be readily removed. It is sometimes necessary to remove a small area of the process with a bur and engage the part thus exposed with a Cryer elevator to break up its attachment. It is not infrequent for a tooth to fracture obliquely, and the latter method is usually very practicable in such cases, as, by selecting the most elevated part of the root, application can be made with the Cryer elevator with little or no loss of tissue.

Roots.—In the extraction of the root of an inferior incisor the operator is governed by the extent of decay and the condition of the surrounding structures. For most cases Standard forceps No. 8 or No. 9 are used in preference to Standard forceps No. 6. If sufficient structure remains above the process for an application, it is made in the usual way, followed by a firm downward pressure as the primary extraction movement, and combining this movement with the lateral movements, which are secondary. Just enough tension is placed on the forceps to hold them in position on the root, as any greater amount increases the liability to fracture without in any way assisting in loosening the root.

For the removal of a root that possesses considerable strength at or immediately below the marginal ridge, alveolar application is made and the root removed in the same manner as if operating on a tooth free of caries. Occasionally a case is presented with one wall comparatively sound and the others destroyed. If the sound structure is mesial or distal, good work can be done with the Cryer elevator (Fig. 24), engaging the solid portion of the root with the point of the instrument, and using the adjoining septum and tooth as the fulcrum. If the sound structure is labial or lingual, the curved-shank elevator (Fig. 16) is sometimes employed for the extraction, and is used by engaging the part intact on its external surface as close as possible to the process and carrying it in the opposite direction.

A root that is too extensively destroyed to be removed by any of the above methods is treated as a deep-seated root, and is extracted by the technic applicable to the removal of such root (page 195).

For operating on a root covered with hypertrophied tissue, the forceps are applied, where possible, as described and illustrated for superior central incisor (page 116), and in other cases where this cannot be done the methods described for deep-seated roots may be used.

As the roots of the inferior incisors are comparatively small and the septi separating them are quite large, it is sometimes difficult to distinguish septum from root, and, when the operator is in doubt, the parts should be exposed in order to avoid possible serious damage to adjacent teeth.

Deep-Seated Roots.—If no pathologic condition is present, it is often advisable to allow small tips and deep-seated roots of inferior incisors to remain, as is done in the case of some other teeth, until by resorption of the process they are brought nearer the surface, thereby simplifying what would otherwise be a tedious operation.

If removal is necessary, and the gum tissue interferes with the examination or operation, which it usually does, it may be displaced with the Derenberg tweezers, or the retractor (Fig. 40) is used to spread the tissue and expose the field of operation.

If the process is weakened and the root is not firmly attached, extraction may be accomplished by carefully passing the beaks of Standard forceps No. 9 (Fig. 10) between the dilated gum and over the process, when a small amount of pressure will force the tooth out of its socket with very little injury to the tissues. A root that is too deeply seated for this operation can often be removed by carefully engaging its strongest wall with the Cryer elevator. If, however, neither of these methods is deemed advisable, an enamel chisel is a very practical instrument to use. Selecting a suitable chisel for the particular case presented, it should be forced down between the root and process on the mesial or distal side, or on both, and a combined rotatory and lever action is applied until the root is loosened, when removal is completed with the Derenberg tweezers.

Screw-Porte.—The use of the screw-porte on inferior incisors is limited, and should not be depended on as an instrument for their extraction. It may, however, be employed in a few cases of deep-seated roots where the canal is sufficiently enlarged to receive it, and in some cases of fracture where an adjustment can be secured.

Elevator.—The use of the elevator for the extraction of inferior incisors is limited, and is confined to the Cryer, with an occasional use of the curved-shank. The use of the elevator in impacted and fracture cases, and on roots deeply seated, extensively decayed, or covered by soft tissue, is not frequent, and its use in these cases is therefore described under the respective headings.

INFERIOR CUSPID.

The inferior cuspids are usually the last teeth to be removed from the mouth—not because they are less subject to decay than the inferior incisors, but on account of their value for supporting various kinds of artificial work, and therefore the operator should hesitate to remove them unless their extraction is absolutely necessary. Fig. 90 shows the various types of inferior cuspids that are usually seen, and attention is directed to the occasional bifurcation of the root and to the curvature of the root at its apical third.

Position of Patient and Operator.—The position of the patient in the chair and that of the operator is as described for extracting inferior teeth (page 96). The position of the arm of the operator and the arrangement of the hand and fingers are the same as described for the inferior incisors (page 184), but the head of the patient is turned slightly to the right or left, as the case may require.

Figs. 91 and 92 show the forceps applied respectively to the right and left side of the arch. These two positions are of such importance in connection with these teeth, as they give direct access in line with their axes and allow the extraction movements to be properly executed, that they are both illustrated, although the positions are similar to the positions for the inferior incisors (page 184). Fig. 93 shows Standard forceps No. 8 (Fig. 9) applied to an inferior right cuspid, and the direct access to this tooth obtained when applying these forceps in this manner.

Forceps.—Standard forceps No. 6 (Fig. 7) are as applicable for the removal of the inferior cuspids as they are for the inferior incisors. Standard forceps No. 8 (Fig. 9) are also serviceable for the removal of the inferior cuspids, and are frequently employed in fracture cases and where decay is extensive, especially

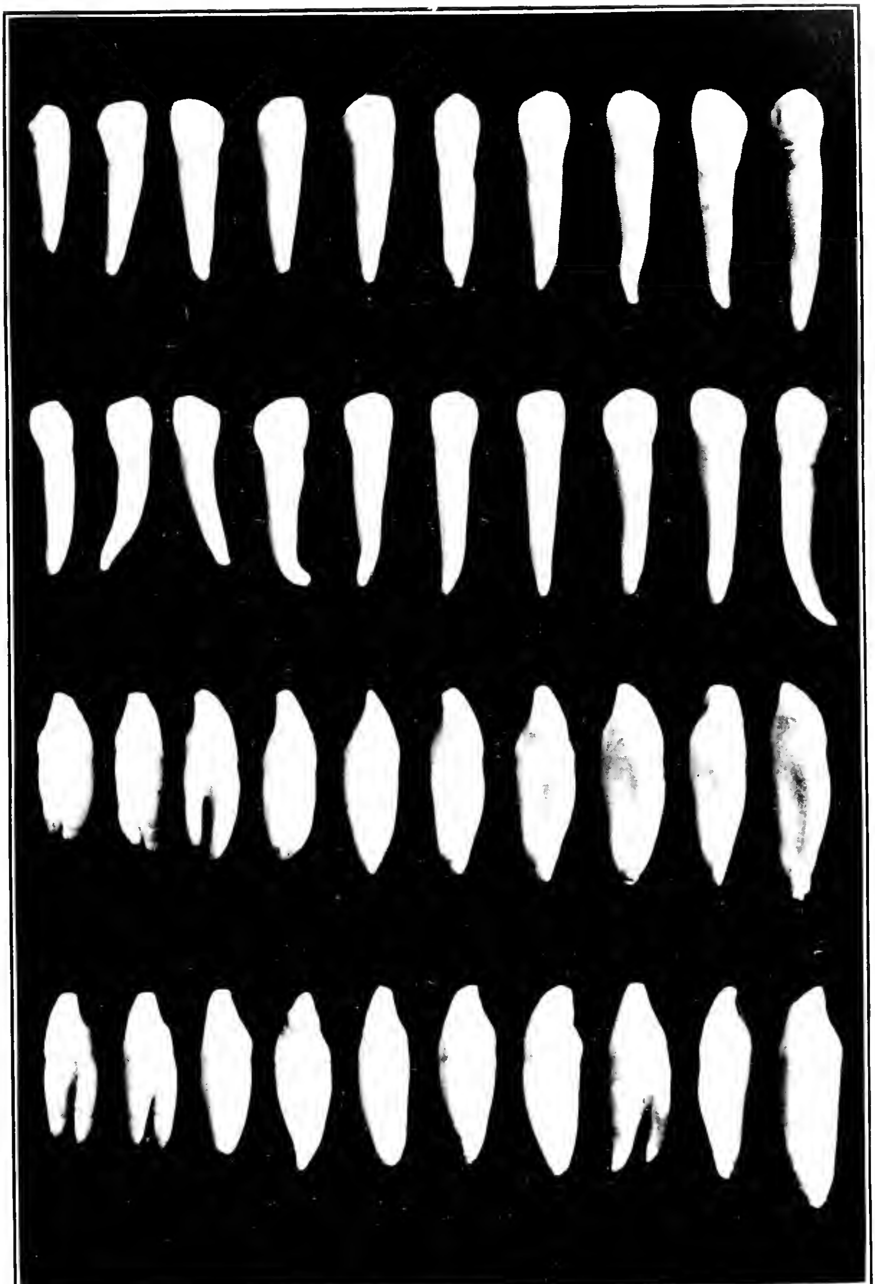


Fig. 90. Types of inferior cuspids. The first row shows the labial, the second row the lingual, the third row the mesial, and the fourth row the distal surface.

for the inferior right cuspid. In impaction and crowded conditions Standard forceps No. 9 (Fig. 10) are sometimes used.

Order of Extraction.—The same order of extraction applies to the inferior cuspid as to the superior cuspid (page 130). Where

Fig. 91.—Position of the operator's hands and disposition of the fingers when applying forceps to an inferior cuspid on the right side of the arch. Illustration shows the application of forceps (Standard No. 6) to the inferior right cuspid.

a tooth on either side of it is to be removed, such tooth is extracted in advance, as that procedure will allow a better adjustment of the forceps, lessen the resistance to be overcome in the removal of the cuspid, and permit the extraction movements to be more effectively made.

Application of Forceps.—The application of the forceps to a cuspid is the same as that described for an incisor, one of the beaks being first applied to the lingual surface, followed by applying the opposing beak to the labial surface, using the same

Fig. 92.—Position of the operator's hands and disposition of the fingers when applying forceps to an inferior cuspid on the left side of the arch. Illustration shows the application of forceps (Standard No. 6) to the inferior left cuspid.

precaution to avoid engaging the soft tissue with the forceps as is exercised with the incisors. With the beaks applied as described, and with the hand well back over the end of the right handle, the beaks are sent down with sufficient force to carry them firmly against the process.

The application of the forceps to this tooth, when properly made, is often the final stage of the operation, as frequently, when the beaks are applied with some pressure in line with the axis of the tooth, if the root is of a conical shape, the tooth will be loosened by the application.

Alveolar Application of Forceps.—Where the alveolar process surrounding this tooth is normal, an alveolar application is not practicable, and especially is it not practicable to the lingual surface. The tooth being situated at the angle of the arch, the alveolar structure on the inner curvature is too dense to allow the beaks to cut through it with any degree of success. The alveolar application is made only when the margins of the alveolus are carious, and this affected structure should be removed at the time the tooth is extracted.

Extraction Movements.—If the pressure effected in the application of the forceps has not loosened the tooth, the extraction movements described and illustrated for the superior cuspid (page 133) are used, modifying the force of the movements to correspond with the resistance to be overcome.

Displacement—*Complete Labial.*—Complete labial displacement is common with this tooth, and the method of extraction is very much like that for a superior cuspid in similar displacement. The mesial and distal application should be made, using Standard forceps No. 8 (Fig. 9) if space permits; and if the displaced tooth is in too close proximity to the lateral and first bicuspid, Standard forceps No. 9 (Fig. 10) should be the second choice. The first and principal extraction movement is, of necessity, labially, taking up such space as is gained by a higher application on the tooth. If resistance is unusually strong, it may be necessary to make a labio-lingual application, after the tooth has been forced away from the approximating teeth, before completing the operation.

If the crown is so displaced that the forceps cannot be securely adjusted, the Cryer elevator (Fig. 24) is applied to the distal surface, sending the blade down to where the point of the instrument will penetrate the root of the tooth. This application having been made, the first bicuspid, or, if its use is not feasible, the alveolar process, is used as a fulcrum, and the handle of the elevator is turned distally and slightly raised. If this does not loosen the tooth, the blade is released from the point of penetration and sent further down on the root, repeating the movement until the tooth is loosened sufficiently to be delivered from its socket with the elevator or by an application of the forceps.

Complete Lingual.—This tooth is not often completely dis-

Fig. 93.—Position of the operator's hands and disposition of the fingers when applying forceps to an inferior cuspid on the right side of the arch. Illustration shows the application of forceps (Standard No. 8) to the inferior right cuspid.

placed to the lingual side of the arch, but, when such a case is presented, the use of the Cryer elevator should, wherever possible, precede the forceps. The elevator should be applied to the distal surface of the tooth, using the first bicuspid as a fulcrum. When the tooth has been loosened, either Standard forceps No. 8

or No. 9 are employed to complete the extraction. Occasionally the position of the tooth is such that the Cryer elevator cannot be applied far enough down on the neck of the cuspid to utilize the first bicuspid as the fulcrum without endangering the loss of the latter tooth, and this difficulty is overcome by removing the crown of the cuspid before attempting to apply the elevator. It is needless to say that this operation should not be undertaken except under a general anesthetic.

A simpler operation, and one that is recommended wherever the tooth to be removed is in a fair state of preservation, and the approximal space between the lateral and first bicuspid will permit its use, is to loosen the tooth with a mastoid chisel. This operation is performed by placing the chisel against the labial side of the tooth at its neck, and, while holding the chisel at an angle of about forty-five degrees, striking it a sharp blow with a plugging mallet. The amount of force that the tooth will bear should be gauged, and it will be better to apply a series of blows of medium force than to possibly fracture the tooth by too great a force in the initial blow.

The above technic is equally applicable to an inferior incisor when in similar displacement, modifying the operation as may be necessary for the particular tooth to be removed.

Partial.—In partial displacement of this tooth, Standard forceps No. 8 or No. 9 are used, depending on the amount of available space for their adjustment. One beak is first applied to the labial side in lingual displacement and to the lingual side in labial displacement, followed by the application of the other beak to the opposite side, and when adjusted they are sent against the process with such force as it will bear, which movement will usually loosen the tooth. If this application fails to loosen the tooth, the next force is applied labially in labial displacement and lingually in lingual displacement, taking up such space as may be gained by a reverse movement, and repeating these alternating movements until the tooth is released.

Extensive Caries and Roots.—If the destruction of the tooth by caries is principally on its mesial side, with comparatively good structure remaining distally, its attachment is broken up by applying the Cryer elevator to the distal side, using the first bicuspid as the fulcrum. This method of operation cannot, however, be reversed if the decay is on the distal side, as the lateral incisor does not possess sufficient strength to be used as a fulcrum. In such case it may be necessary to remove enough of the process to permit a dependable application of Standard forceps No. 8.

If the seat of caries is located labially or lingually, but not extensive enough to materially weaken the tooth, the forceps should be applied as though the loss of structure did not exist, care being taken that the beak engaging the tooth over the area of decay passes below the gingival margin of the cavity. The cavity may extend below the process, but in that case the process is usually carious, allowing enough alveolar application to engage firm tooth structure. If the lateral and first bicuspids have been extracted, mesial and distal application is made. The first and principal extraction movement is to the side affected by caries.

The method for removing the root of an inferior cuspid, if sufficient structure remains to permit the use of the forceps, differs little from that for removing the superior cuspid; but if decay has progressed to a point to preclude the use of the forceps, the application of the Cryer elevator is usually indicated, and the instrument is applied to the distal side of the root.

The method of applying the forceps to an inferior cuspid covered by gum tissue is the same as for a superior central incisor in a similar condition (page 116), and, as the process surrounding a root in this condition is usually carious, especially in the inferior arch, the pressure of application usually suffices to extract the root.

Seldom, if ever, should an attempt be made to extract an inferior cuspid root with the forceps if the root is deeply seated. If the part remaining is badly reduced by caries, it is removed with the Cryer elevator; but, if it is in a fair state of preservation, the use of the screw-porte is indicated, as the position of the inferior cuspid and the shape of its root favor the use of this instrument.

Impaction.—The inferior cuspid is seldom impacted. The technic of diagnosis and operation in impaction are the same as described for a superior cuspid in a similar condition (page 137).

Fracture.—Where a fracture of this tooth occurs while attempting to extract it with any of the forceps indicated for its extraction, the forceps should be immediately reapplied if the process permits, and the extraction be completed as though operating on a root.

Where the alveolus is projecting above the root, and the latter is in normal condition, it is often practicable to engage the root with the screw-porte. If, however, this instrument cannot be used, the process is removed from the distal side of the root to allow the blade of the Cryer elevator to be adjusted. When the elevator is applied, sufficient pressure should be exerted to force the root from its socket, and, if this procedure fails to release the root, alternately turning the handle of the elevator distally and repeating the pressure will deliver the root from its socket.

Where the fractured part is deeply seated, and consequently none of the above methods can be applied, the remaining part, if it is not liable to subsequently give any trouble, is left *in situ;* but, if its removal is deemed necessary on account of existing conditions, it should be removed with a bur in the manner described for inferior bicuspid (page 219).

INFERIOR FIRST AND SECOND BICUSPIDS.

The technic of extraction of the inferior first and second bicuspids is so nearly the same in all its details that the two teeth are considered together. Fig. 94 shows the various types of inferior bicuspids that are usually seen.

Position of Patient and Operator.—The position of the patient in the chair and that of the operator is as described for extracting inferior teeth (page 96). The placing of the arm of the operator and the arrangement of the hand and fingers are almost the same as described for the inferior cuspid (page 196). The head of the patient, as in the case of the cuspid, is turned to the right or left, as the case may require.

When operating on the left side of the arch (Fig. 95), the index finger is placed at the corner of the mouth, retracting the lip; the second finger depresses the lower lip, exposing the field of operation; the third and fourth fingers are placed below the jaw.

When operating on the right side of the arch (Fig. 96), the index finger is placed to the lingual side of the arch, the second finger depresses the lower lip, and the third and fourth fingers are placed below the lower jaw. Special precaution should be taken, when operating on the right side of the arch, to hold the

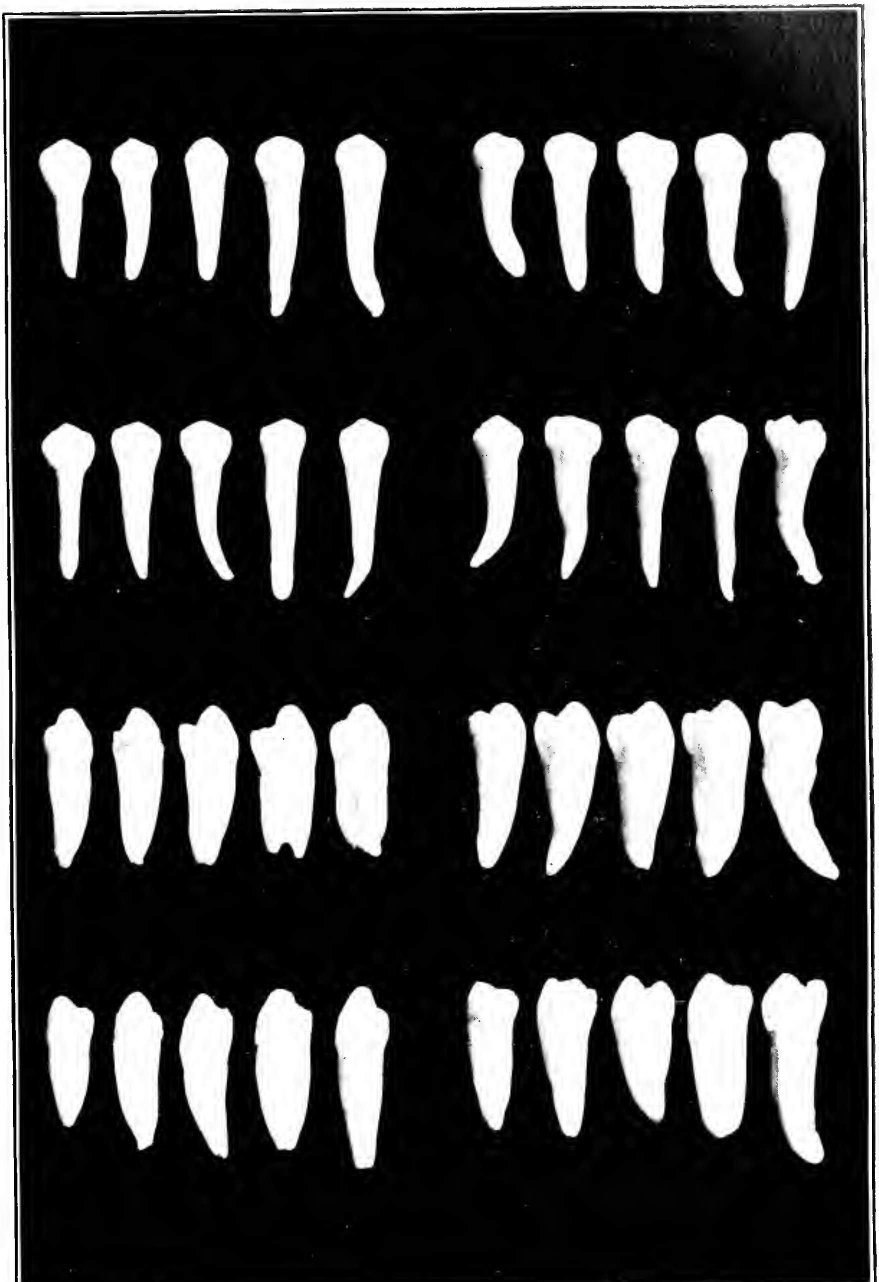


Fig. 94.—Types of inferior first and second bicuspids. First row—first five teeth, buccal surface of first bicuspids; second five teeth, buccal surface of second bicuspids. Second row—first five teeth, lingual surface of first bicuspids; second five teeth, lingual surface of second bicuspids. Third row—first five teeth, mesial surface of first bicuspids; second five teeth, mesial surface of second bicuspids. Fourth row—first five teeth, distal surface of first bicuspids; second five teeth, distal surface of second bicuspids.

lips clear of the field of operation, as otherwise they may be caught between the joints of the forceps, or, in case of misapplication of the forceps, the beaks may slip from their adjustment and bruise these tissues.

Fig. 95.—Position of the operator's hands and disposition of the fingers when applying forceps to an inferior bicuspid on the left side of the arch. Illustration shows the application of forceps (Standard No. 6) to the inferior left first bicuspid.

Forceps.—Standard forceps No. 6 (Fig. 7) are also used for the extraction of the inferior first and second bicuspids. The beaks of these forceps should be kept sharp when they are to be employed on these teeth, as dependence is frequently placed on them to cut through the alveolus in cases where alveolar application is indicated. As the edges of the beaks of forceps that are used quite frequently become dull or will turn, and as the necks of these teeth are often narrowed, the beaks should always be in good order.

Fig. 96.—Position of the operator's hands and disposition of the fingers when applying forceps to an inferior bicuspid on the right side of the arch. Illustration shows the application of forceps (Standard No. 6) to the inferior right second bicuspid.

Where one of these teeth is displaced out of alignment of the arch, either Standard forceps No. 8 or No. 9 (Figs. 9, 10) should be used; and where the tooth is completely displaced on the lingual side of the arch, Standard forceps No. 2 (Fig. 2) may be indicated.

Order of Extraction.—Where both the inferior first bicuspid and cuspid are to be removed, the removal of the bicuspid, if it is the simpler operation, should precede the removal of the cuspid. Where both the inferior first and second bicuspids are to be removed, the removal of the second bicuspid, if conditions are equal, should precede the removal of the first bicuspid.

Application of Forceps.—In the application of the forceps to one of these teeth, when properly made, as in the case of the inferior cuspid (page 199), one of the beaks is first applied to the lingual surface, followed by applying the opposing beak to the buccal surface, when pressure downward is immediately effected, sending the forceps as far as possible down on the neck of the tooth without injury to the margin of the alveolar process.

Where the cuspid is missing from the arch, or its crown has been attacked by caries, leaving only the root, the first bicuspid is frequently found inclining mesially. In this case the application, if Standard forceps No. 6 (Fig. 7) are employed, should be made so that the beaks are kept in line with the axis of the tooth, and the extraction movements should be made in the same plane. Where direct application in such cases cannot be obtained with Standard forceps No. 6, Standard forceps No. 2 (Fig. 2) may be used, the operator assuming a position in front of the patient when applying the forceps and executing the extraction movements. The same technic applies to the inferior second bicuspid when in similar condition.

Alveolar Application of Forceps.—The location of the inferior bicuspids and the process surrounding them are more favorable for an alveolar application of the forceps than are the conditions of any of the other teeth. Excessive alveolar application is not advocated, but, when cautiously made, this form of application to these teeth may be indicated even when these teeth are supported by a normal, healthy process, and it is usually indicated when the process is in a carious condition. It is made preferably with Standard forceps No. 6, but occasionally it may become necessary to use Standard forceps No. 8 or No. 9. When making an alveolar application, the operator should be careful to adjust the beaks so that they will cut through the alveolus covering the root and not intrude on any approximal alveolus, and no extraction movement should be attempted until the forceps have severed the process and engaged the root.

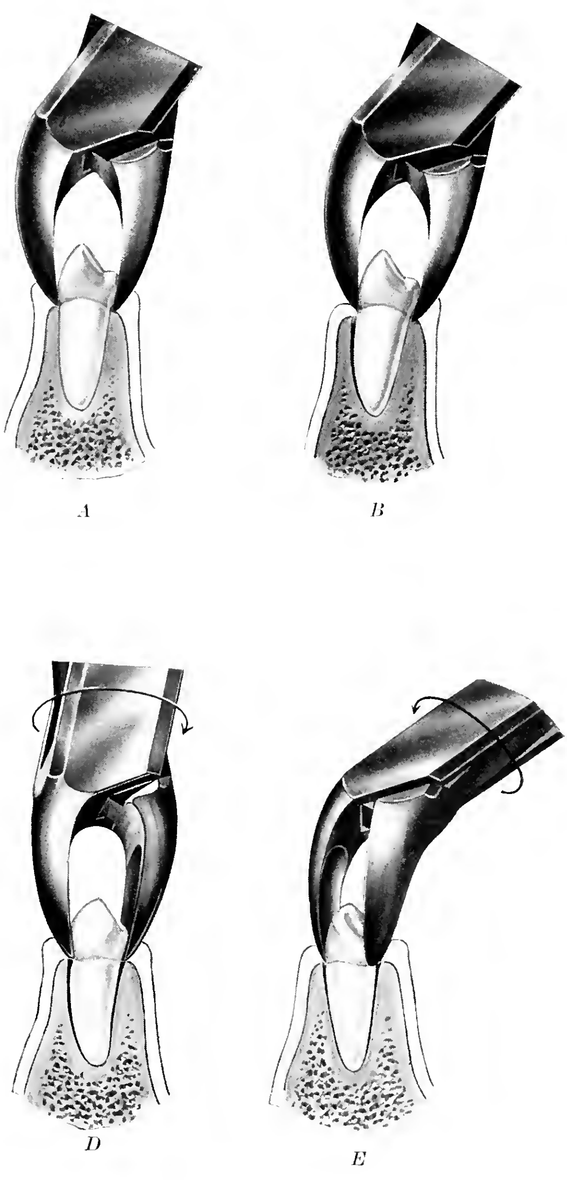


Fig. 97.—Extraction movements for inferior first and second bicuspids. *A*, forceps (Standard No. 6) applied; *B*, first movement to the lingual side; *C*, reversed movement to the buccal side; *D*, rotatory movement from the mesial to the buccal side; *E*, reversed rotatory movement; *F*, tractile movement upward in line with the original position of the tooth.

Extraction Movements.—When Standard forceps No. 6 have been securely adjusted, as shown in Fig. 97, *A*, which shows them applied to the inferior first bicuspid, and if the pressure that has been effected when making the application has not loosened the tooth, the first extraction movement is made by bringing the tooth with a slight force to the lingual side (Fig. 97, *B*), followed by a movement with about the same force to the buccal side (Fig. 97, *C*). If these movements do not loosen the tooth sufficiently for the tractile movement to be made, a rotatory movement is executed by turning the mesial surface slightly buccally (Fig. 97, *D*). If it is observed that the tooth does not yield to this movement, it should not be forced, but, if it does give in that direction, the movement should be followed by the reversed rotatory movement (Fig. 97, *E*). When the tooth is loosened during the execution of any of these movements, it is carried from its socket by a tractile movement upward and in line with its original position (Fig. 97, *F*). If resistance to the rotatory movement is such that this movement cannot be executed without subjecting the tooth to undue stress, the operator may surmise that the root is flattened on its mesial and distal surfaces, and in that case the lingual and buccal movements should be more forcibly repeated until the tooth is sufficiently detached to be conveyed from the socket by the tractile movement. Where the first or second bicuspid is firmly attached to its supporting tissues—as, for example, in the case of one that has been standing alone for some time, with the process very heavy around it—the extraction movements should be slow and cautious, and no tractile movement should be attempted until the tooth has been entirely detached, as an attempt to remove the tooth from its socket by this movement before its attachment has been broken up will result in a fracture.

Displacement—*Complete Lingual.*—It is not unusual to find the inferior first or second bicuspid completely displaced to the lingual side of the arch, a condition that makes it impracticable in most cases to satisfactorily employ Standard forceps No. 6, No. 8, or No. 9, and apply the necessary extraction movements for its removal.

Where one of these teeth is so displaced, with its crown directed toward the tongue (Fig. 98), the operator should assume a position on the side of the patient opposite to that on which the tooth is located, and Standard forceps No. 2 are selected and applied (Fig. 99). Applying the forceps in this manner gives a more direct access to the tooth, and permits a wider range for the extraction movements, which are necessarily limited by the abnormal position of the tooth. When the forceps are securely adjusted, a right or left rotatory movement of the tooth is made, and the particular movement that has been made is reversed. If these two movements do not loosen the tooth, a slight force is exerted lingually and, in reversed direction, buccally, which is

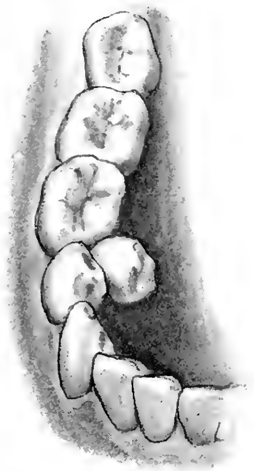


Fig. 98.—Inferior right second bicuspid in complete lingual displacement.

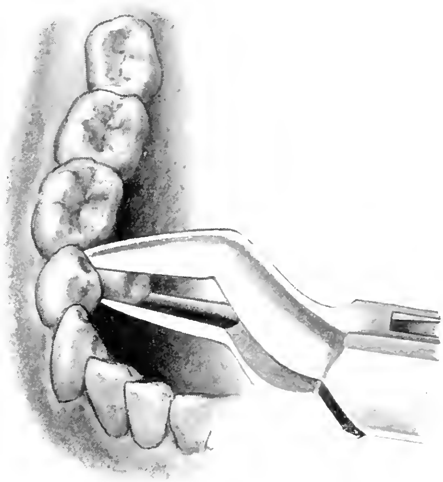


Fig. 99.—Same subject as Fig. 98. Standard forceps No. 2 applied to the inferior right second bicuspid in complete lingual displacement from position on left side of patient.

followed by the application of a tractile movement as near as possible in line with the original position of the tooth. Applying too great a force during the extraction movements, or exerting too much pressure on the beaks, will result in a fracture and complicate the case, and therefore every precaution should be taken to avoid such mistakes. Rarely is a case presented with the conditions mentioned where Standard forceps No. 2 (Fig. 2) cannot be engaged as described; but, if such a case occurs, the operator should resort to the use of the modified Cryer elevator (Fig. 25), applying the blade to the mesial surface of the tooth and engaging the tooth anterior or the alveolar process as a fulcrum. When the elevator is firmly adjusted, the handle is turned mesially to loosen or release the tooth. Repeated application of the blade of the elevator with considerable force and the accompanying turning of the handle will be necessary in some cases to disengage the tooth. The elevator is also used in the manner described where the crown is extensively decayed or has fractured, and the beaks of the forceps cannot be securely adjusted.

Complete Buccal.—Where one of these teeth is displaced completely out of alignment to the buccal side of the arch, and the space on the lingual side will permit either Standard forceps No. 8 or No. 9 (hawksbill, Figs. 9, 10) to be used, such forceps should be selected. One beak is first inserted into the narrowed space between the approximating teeth and applied to the lingual surface of the tooth, after which the opposing beak is applied to the buccal surface. When both beaks are placed, pressure is applied downward, and, when an adjustment has been secured, the first extraction movement is made to the buccal side. This movement should, however, be very slight, and only sufficient to secure a reapplication of the beaks of the forceps, so that the beak which is engaged in the narrow space can be sent further down on the lingual surface. When the additional space has been obtained, another movement more forcibly buccally is made, after which the tooth is returned as near as possible to its original position, and partially rotated if at all practicable, or the buccal movement is more forcibly repeated. When the tooth is loosened, the extraction is completed by a tractile movement upward in line with its axis.

Where the beak cannot be applied to the lingual surface of the tooth, space can often be gained by applying the Cryer elevator (Fig. 24) to the mesio-lingual surface, using the same technic as when the elevator is employed for this tooth displaced to the lingual side of the arch (page 210).

If, on account of the lack of space, it is impossible to apply the hawksbill forceps, and space cannot be obtained with the Cryer elevator, an application should be made to the mesial and distal surfaces of the tooth with Standard forceps No. 6 (Fig. 7). After taking hold of the crown in this manner, the tooth is brought slightly buccally. When this has been done, and space obtained on the lingual side, the tooth is released, and the hawks-bill forceps are adjusted to the lingual and buccal surfaces, being sent down as far as possible on the tooth without injuring the adjacent teeth, after which the extraction movements are made as described above.

The liability of the tooth to fracture in these cases continually confronts the operator, and each movement should be under perfect control and never hastily executed. If the operator is of the opinion that there is a probability of the tooth fracturing, it will be better to discontinue the use of the forceps or elevator and use a bur to dissect away part of the alveolar process on the buccal side, so that the tooth may be more readily released and the accident of fracture avoided.

Partial.—Where one of these teeth is partially out of alignment either to the lingual or buccal side of the arch, Standard forceps No. 6 may be applied if they can be adjusted. If, however, these forceps cannot be used, then either of the hawksbill forceps are selected. As in the case where the tooth is completely displaced buccally, one beak is first applied to the surface of the tooth within the narrowed approximating space, followed by applying the opposing beak to the other side. The extraction movements are principally toward the lingual side where the tooth is displaced in that direction, and are reversed when the tooth is displaced buccally, employing the rotatory movement when practicable.

Caries on Buccal or Lingual Surface.—Where caries involves the buccal or lingual surface of these teeth, and enough of the neck of the tooth remains to allow a firm adjustment of Standard forceps No. 6, these forceps should be employed, one beak being first applied to the side attacked by caries and the other beak applied to the opposite side, after which the extraction movements follow as described for this tooth where the crown is intact (page 210). Where the cavity extends below the gum margin, the beak on the involved side is sent quite a distance downward, and an alveolar application may be made to insure a firm grasp on the tooth. A forcible movement is then made to the affected side, which is followed by a rotatory movement if the shape of the root permits this movement. If these movements fail to release the tooth, a cautious movement is made to the unaffected side, which is followed by bringing the tooth with increased force to the involved side; and if by these efforts the tooth is not released, the movements should be repeated with increased force until the release of the tooth is effected.

Caries on Mesial or Distal Surface.—Where one of these teeth is attacked by caries on the mesial or distal surface, and enough of the neck of the tooth remains to allow a firm adjustment of Standard forceps No. 6 (Fig. 7), these forceps should be employed, and the extraction movements are executed as described for this tooth with the crown intact (page 210). If, however, the greater part of the crown is destroyed on either of these sides, and caries extends below the neck of the tooth, which contraindicates the use of the forceps, the Cryer elevator (Fig. 24) should be applied to that side of the tooth which has not been weakened by caries. For example, when the cavity is on the distal surface

Fig. 100.—Inferior first bicuspid root weakened by caries on the distal surface.

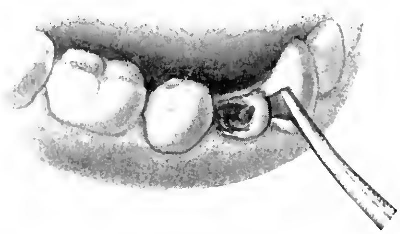


Fig. 101.—Same subject as Fig. 100. Cryer elevator (Fig. 24) applied in the interproximal space between the cuspid and first bicuspid root.

of the first bicuspid (Fig. 100), the point of the Cryer elevator is applied in the interproximal space on the mesial side (Fig. 101), and, when so applied, a pressure calculated to cause the blade to penetrate the mesial side of the root is effected. When a firm adjustment has been obtained, the top of the handle of the elevator is turned mesially, using the cuspid as a fulcrum. In most cases this movement will either loosen or entirely release the tooth, but, if greater resistance is met than this force will overcome, the movement should be repeated, sending the blade further down on the root with each movement, thus using the elevator as a wedge and also increasing the amount of leverage. There will be cases where the tooth cannot be entirely liberated by this technic, and where such a case is presented the tooth should be forced out of the socket with the elevator only far enough to allow the forceps to be adjusted to complete the extraction. When operating on the second bicuspid, the adjustment of the elevator is preferably made to the distal surface, as the first molar makes an ideal fulcrum. Where the adjustment is made to the mesial surface of the first or second bicuspid, and the tooth posterior to the one to be extracted is missing, extraction of the tooth is much simplified. Where the mesial surface is involved, preventing an application of the elevator to this surface, and the tooth posterior to it is missing, the alveolus at the distal side is used as a fulcrum.

Roots.—Where only the root of one of these teeth remains, and the buccal and lingual sides are strong enough to support Standard forceps No. 6 (Fig. 7), these forceps may be employed, and the extraction movements made as when the crown is intact (page 210).

Where Standard forceps No. 6 cannot be securely adjusted, and the mesial and distal sides are strong enough to permit the application of the Cryer elevator (Fig. 24) as described when caries exists on the mesial or distal surface (page 214), this instrument is to be preferred for its extraction. Less destruction of the hard and soft tissues is caused by this method than by an attempted use of the forceps, and in the majority of instances the root can be more readily extracted by this method than by any other.

Where the sides of the root have been attacked by caries to such an extent that neither Standard forceps No. 6 nor the Cryer elevator can be successfully used, either Standard forceps No. 8 or No. 9 (hawksbill, Figs. 9, 10) should be employed, and, if necessary, an alveolar application is made to secure a firm adjustment for the completion of the extraction movements.

Where the root is not firmly attached, and also where only the buccal or lingual wall remains, the curved-shank elevator (Fig. 16) may be used as described on page 30.

Roots Covered by Gum Tissue.—Where the gum tissue covers the root of one of these teeth, the adjustment of the forceps is made with some degree of guesswork, and may cause an unnecessary destruction of tissues, with uncertainty as to the final result. The author's experience has been that a surer, quicker, and better operation can be accomplished with the elevator than with the forceps in a majority of these cases. The technic of operation is the same as described for employing the elevator when the cavity is on the mesial or distal surface (page 214), the elevator being applied to whichever surface of the root that an explorative examination indicates as having the strongest wall. The blade of the elevator presses back the soft tissue from over the root or cuts through this tissue to gain the adjustment.

Roots Wedged Between Adjacent Teeth.—Where the crown of a tooth has been destroyed by caries to such an extent that only the root is left *in situ*, the adjacent teeth will often be deflected so as to partially close the space formerly occupied by its crown, and Fig. 102 shows an inferior first bicuspid root so situated. In such case the operator should first ascertain, by careful examination, the strength of the marginal edges of the root, the condition of the alveolar process on the lingual and

Fig. 102.—Root of an inferior first bicuspid wedged between the two adjacent teeth.

buccal sides, and how far it may be possible to carry the root from its socket without interfering with the adjacent teeth. If a reasonably strong structure remains on the buccal and lingual surfaces, the operator selects either Standard forceps No. 8 or No. 9 (Figs. 9, 10). The curvature of the beaks of these forceps favors a direct application without interfering with the adjacent teeth. When the adjustment has been made, it is followed by the lingual and buccal movements, and then a tractile movement to raise the root slightly out of the socket. If the tractile movement cannot be executed, a more forcible movement to the lingual and buccal sides is repeated until the tooth is well loosened from its attachment. If the tooth can be moved buccally, it is sent in that direction, after which the forceps are released and applied to the mesial and distal surfaces, and the extraction is completed toward the buccal side. If, however, the extraction cannot be completed by this method after the root has been loosened, it is raised far enough to allow the straight-shank elevator (Fig. 15) to be applied to the buccal surface of the root (Fig. 103), when pressure is directed toward the lingual side with sufficient force to release the root in that direction. If this procedure does not entirely liberate the root, it can usually be pressed lingually far enough to allow the extraction to be completed from a position of the operator on the side of the patient opposite to the location of the tooth by applying Standard

Fig. 103.—Same subject as Fig. 102. Straight-shank elevator (Fig. 15) applied to the buccal surface of an inferior first bicuspid root, wedged between the adjacent teeth, to remove it after it has been loosened with forceps or elevator.

forceps No. 2, and employing them as where the tooth is displaced on the lingual side, as shown in Fig. 99.

An operator who is accustomed to operating with hawksbill forceps may save a change of instruments by utilizing one of its beaks as an elevator, applying it to the buccal surface of the root and directing the pressure lingually. A wedged tooth should never be raised in the socket further than the free approximating space will permit, as an attempt to raise it further may interfere with its successful extraction, and is liable to loosen the adjacent teeth. The tooth should, however, if possible, be raised in the socket far enough to allow it to pass in a buccal or lingual direction; and, if lifted beyond this point, it should be pressed back to where it can be directed toward either of these sides.

If the root of the tooth is so frail as not to permit a secure adjustment of the beaks of the forceps, or if the sides that are seized by the beaks fracture during the attempted removal, the Cryer elevator should be used. The elevator is applied to the mesial or distal side of the root, using the adjacent tooth as a fulcrum. The root is loosened from its attachment with the elevator, but, as in the case of using the hawksbill forceps, the root should not be raised to where it will come in contact with the crowns of the deflected teeth. The straight-shank elevator is then applied to the buccal side of the root, as described above, to displace the root lingually. If this technic cannot be executed, it becomes necessary to bur away the alveolar process from the buccal or lingual plate to expose the root, when an elevator is applied to the opposite surface and the root is directed from the socket toward the side where the process has been dissected away from it.

Screw-Porte.—The screw-porte may, in some instances, be used advantageously in a case of the first bicuspid where that tooth has been fractured (page 219), especially if the case is complicated with hypercementosis. This instrument is, however, seldom used for the second bicuspid, being applied only where good access can be obtained.

Impaction.—The inferior first and second bicuspids are not very often impacted, and, when this condition exists, it does not cause the disturbance that is usually associated with the superior or inferior third molar. The tooth, when in this condition, is as a rule left *in situ*, and, if an operation is considered necessary, a radiograph should be first obtained in order to establish its exact position. If the tooth is located on the lingual side of the arch, the lingual plate of the alveolar process is removed, using the technic of operation described for removing the plate when operating on the inferior third molar (page 311). If the impaction is on the buccal side of the arch, the buccal plate is removed in the same manner as described for the removal of the lingual plate. After the plate is removed the tooth is released from its imbedded position by applying the Cryer elevator at the most available location to carry the tooth in the direction of least resistance.

Fracture.—Where a fracture occurs during the extraction movements with Standard forceps No. 6 (Fig. 7), a readjustment of the forceps is made if sufficient structure remains for that purpose, as is done when such an accident happens with the cuspid. Where the neck of the root is fragile and the alveolus weakened, either Standard forceps No. 8 or No. 9 (hawksbill, Figs. 9, 10) may be used and an alveolar application made. Where the operator has reason to suspect that a firm adjustment cannot be obtained with the forceps, the Cryer elevator (Fig. 24) is applied to either the mesial or distal surface, employing the technic described when caries involves either of these surfaces (page 214). Where the remaining root, if it is that of the first bicuspid, is of considerable size, with a large root canal and the

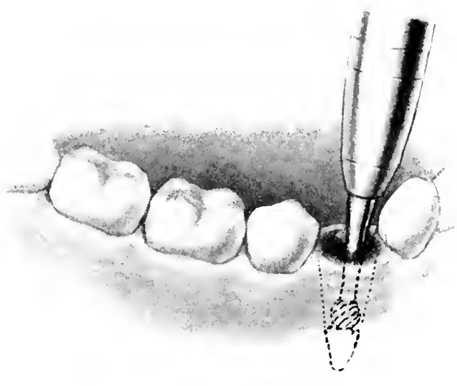


Fig. 104.—Method of using a bur to remove a small part of a root of an inferior first bicuspid beyond the reach of forceps or elevator.

alveolus firm and projecting beyond the root, a practicable method is to use the screw-porte. This instrument is inserted into the root canal, and, when firmly fixed, the operator assumes a position back of the patient to apply the tractile movement.

If the apical end of the root of one of these teeth fractures during the operation, and the operator observes, as the tooth leaves the socket, that the part remaining is only a small piece, and if the surrounding alveolar process is normal, it is not advisable to reapply the forceps in an attempt to secure this small remaining fragment. If no pathologic condition exists at the apex of the root, or if a bridge is not to be made to fill the space, this unextracted part should be left undisturbed, as it will not usually give any further trouble, and it will be more readily released when the alveolus has been reduced by resorption.

If, however, conditions make it necessary to remove the unextracted part, the operator examines the extracted tooth to determine the size of the part remaining. He then selects a bur of a size corresponding to that of the remainder of the root, and, inserting the bur into the socket and on the root (Fig. 104), the remaining part is burred away. Care should be taken to keep the bur in line with the axis of the root, so that cutting into the alveolus may be avoided.

INFERIOR FIRST AND SECOND MOLARS.

The extraction of the inferior first molar is unfortunately very common. Its early eruption subjects it to all the inattention and abuses of childhood, and, as it erupts before the loss of any of the deciduous teeth, it is frequently mistaken for them. If it is attacked by caries, the care of it is often neglected with the belief that it will be replaced, and that it is an unnecessary expense for a child to have its teeth kept in condition for mastication. If this tooth is attacked by caries, every effort should be made to retain it, as the relation of the inclined planes of the cusps of the first permanent molars establishes and fixes the relation of the inferior arch to the superior arch during the time all of the deciduous teeth are being replaced by the permanent ones when the latter are normally erupted and left undisturbed. When, however, extraction becomes imperative, the operation, in addition to being usually difficult, owing to the commonly advanced state of decay, is often attended by unavoidable fracture of its crown. Fig. 105 shows the various types of inferior first and second molars that are usually seen.

Position of Patient and Operator.—The position of the patient in the chair and that of the operator is as described for extracting inferior teeth (page 96). When operating on the left side of the arch, the head of the patient is turned slightly to the right. The left arm of the operator is brought to the left side of the head. The index finger is placed at the corner of the mouth, retracting the cheek; the second finger depresses the lower lip; the third and fourth fingers, with the thumb, are placed below the jaw (Fig. 106).

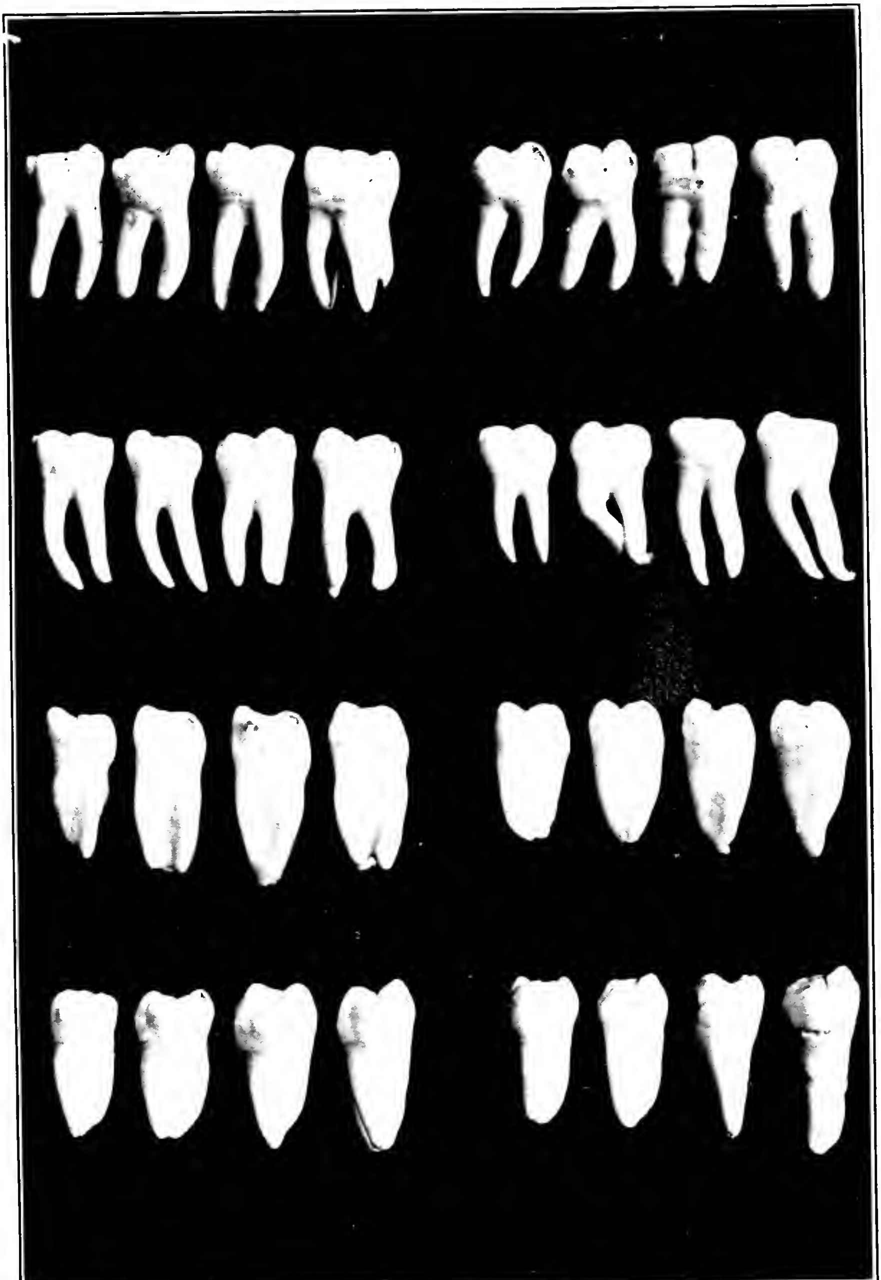


Fig. 105.—Types of inferior first and second molars. First row—first four teeth, buccal surface of first molars; second four teeth, buccal surface of second molars. Second row—first four teeth, lingual surface of first molars; second four teeth, lingual surface of second molars. Third row—first four teeth, mesial surface of first molars; second four teeth, mesial surface of second molars. Fourth row—first four teeth, distal surface of first molars; second four teeth, distal surface of second molars.

When operating on the right side of the arch, the head of the patient is also turned slightly to the right. The left hand of the operator is brought further toward the front of the mouth. The index finger is placed along the lingual surface of the right arch,

Fig. 106.—Position of the operator's hands and disposition of the fingers when applying forceps to an inferior molar on the left side of the arch. Illustration shows the application of forceps (Standard No. 7) to the inferior left first molar.

the second finger depresses the lower lip, and the third and fourth fingers are placed below the jaw (Fig. 107).

Forceps.—Standard forceps No. 7 (Fig. 8), which are designed for the inferior molars, are so constructed that they are adaptable to both sides of the arch, and their use is indicated for the extraction of all inferior first and second molars where enough of the buccal and lingual surfaces of the tooth remains to allow the forceps to be securely adjusted.

For some years the author's experience with Standard forceps

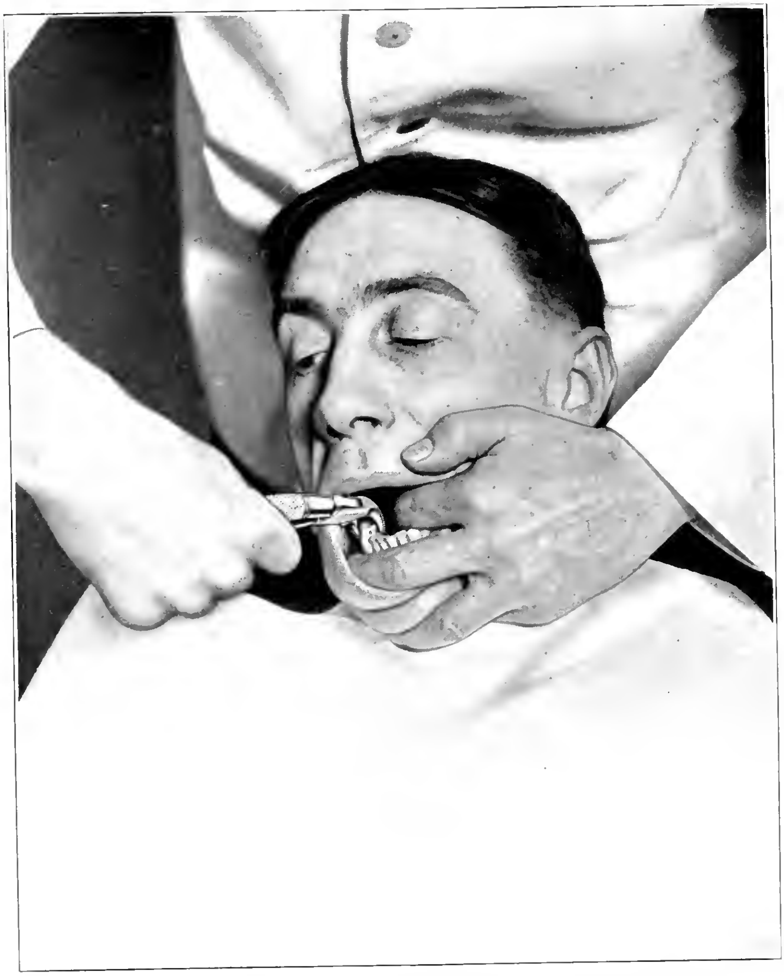


Fig. 107.—Position of the operator's hands and disposition of the fingers when applying forceps to an inferior molar on the right side of the arch. Illustration shows the application of forceps (Standard No. 7) to the inferior right first molar.

No. 7—or, in fact, with any of the various other forceps designed for the inferior molars—was not entirely satisfactory on account of the difficulty of properly gauging the amount of force to be exerted, and at the same time keeping the beaks under perfect control, while applying the downward pressure or wedge movement of extraction. The defects of this instrument have, however, been largely overcome with the improved Standard forceps No. 7 (Fig. 13) described on page 27. With these improved forceps, properly used, the inferior molars should in a majority of cases be delivered in their entirety. This instrument should not, however, be used without a proper regard for the conservation of the tissues, as the handles, on account of their improved shape, fit so snugly into the palm of the hand when the beaks are in position on the tooth that the amount of force that can be applied is limited only by the strength of the operator.

In the description of the technic for the extraction of the inferior first and second molars, Standard forceps No. 7 (Fig. 8) are the forceps referred to, as they are the best instruments regularly manufactured for the extraction of these teeth. If it is desired to utilize the added advantage of the improved Standard forceps No. 7 (Fig. 13), described above as an improvement on the regular Standard forceps No. 7, such advantage may be secured by altering the handles of the regular forceps to conform to the shape of the improved forceps, which may then be advantageously used in nearly all cases where the regular Standard forceps No. 7 are indicated.

Standard forceps No. 6 (Fig. 7) are used for the extraction of these teeth where they are not very firmly attached; or where the remaining surface of the crown on the mesial or distal side is strong enough to allow their adjustment, but not enough structure remains for the application of Standard forceps No. 7; or where only the roots remain.

Some operators advocate the use of the cowhorn forceps for extracting the inferior molars, and especially for extracting the first molar. The application of the cowhorn forceps is not, however, so generally practicable as is that of Standard forceps No. 7, as the former are indicated only where the roots are not markedly separated, and even in such case Standard forceps No. 7 are the better instrument. The great disadvantage of using the cowhorn forceps is the uncertainty of the outcome of the operation, as in the application of force it is impossible to definitely ascertain whether process is being broken down or tooth attachment broken up. A change of instrument becomes necessary when any resistance is encountered, and there is then also a lack of control over the tooth when it leaves the socket, the latter feature being very dangerous when the patient is under a general anesthetic.

Order of Extraction.—As in the case of the superior first molar (page 157), the tooth anterior and posterior to the inferior first molar should be extracted first where all three of these teeth are to be removed, especially when the first molar is firmly supported. Where the third molar is also to be extracted, and the second molar is to serve as a fulcrum, the second is never extracted in advance of the third molar.

Application of Forceps.—The forceps having been selected, application should be made slowly and cautiously, and the beaks are opened gradually as they approach the tooth. Where Standard forceps No. 7 are used, one beak is first applied to the lingual wall of the tooth, followed by the application of the opposing beak to the buccal wall. When both beaks are in position, they are sent down under the free margin of the gum to the marginal edge of the alveolus, keeping them in a direct line with the axis of the tooth, and taking care that the points of the beaks are between the two roots. This application, executed with sufficient pressure, is of great value, and should be depended on to materially assist in the dislodgment of the tooth. Application with the improved Standard forceps is made in the same manner, but much better control of the beaks is had with this instrument than with the regular Standard forceps No. 7.

It is not unusual to find the crown of one of these teeth inclined mesially where the tooth anterior to it has been missing for some time. Where this condition exists, such an instrument must be used as will permit the application to be made in line with the axis of the tooth. Whenever possible under these circumstances, Standard forceps No. 7 should be used; but if the inclination is so great that these forceps cannot be applied with the beaks in line with the axis of the tooth, Standard forceps No. 2 or No. 4 are employed. When using either of the latter forceps, the operator assumes a position in front of the patient for their application.

Alveolar Application of Forceps.—An alveolar application is not practicable where the alveolar structure surrounding these teeth is in a normal state, and should be made only when the margin of the process is affected by caries and the carious condition will permit a limited alveolar application being made to the roots of these teeth with Standard forceps No. 6, but should seldom be attempted with Standard forceps No. 7.

Extraction Movements.—Practically the same extraction movements apply to both the first and second molar, modified only where the anterior border of the ramus and the external oblique line rising from it are to the disto-buccal side of the second molar, in which case the buccal movement cannot be executed as freely with the second molar as with the first molar, and the main extraction movements for the second molar are then to the lingual side, combined with the wedge movement that is made by the downward pressure.

When the forceps have been securely adjusted to one of these teeth, as shown in Fig. 108, *A*, illustrating Standard forceps No. 7 applied to the inferior left first molar, the first extraction movement is executed by bringing the tooth slightly lingually (Fig. 108, *B*), followed by directing the tooth with about the same force buccally (Fig. 108, *C*). If these movements fail to loosen the tooth, the lingual movement is repeated more forcibly (Fig. 108, *D*), and is followed by bringing the tooth with the same increased force to the buccal side (Fig. 108, *E*), when the tooth is extracted with a tractile movement upward in line with its original position (Fig. 108, *F*), provided the tooth is not crowded by the approximating teeth or its roots are not divergent. If continued resistance is encountered and the alveolar process is unusually heavy, which condition is the most common cause of the greater resistance, the beaks are sent further down on the tooth with slightly increased pressure on the handle of the forceps, which serves the double purpose of adding the wedge movement and permitting greater force to be used in the linguo-buccal movements without causing fracture, as it diminishes the leverage on the neck of the tooth by applying the force nearer the point of resistance. If the root is fused, which is frequently the case, especially with the second molar, the wedge movement will often loosen the tooth sufficiently to allow the tractile movement to be applied. If, however, the latter extraction movement does not sufficiently loosen the tooth for the application of the tractile movement, the extraction movements previously described must be continued until the final tractile movement is possible.

Where the two roots of these teeth diverge to such an extent

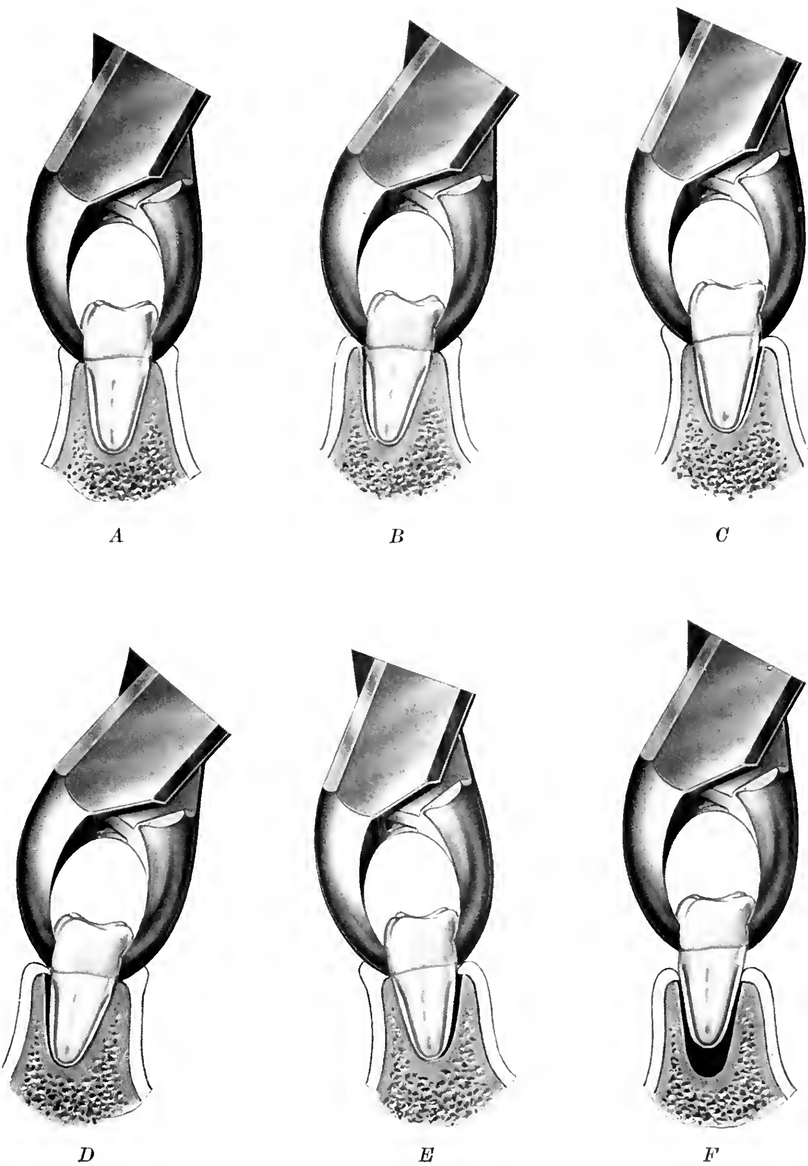


Fig. 108.—Extraction movements for inferior first and second molars. *A*, forceps (Standard No. 7) applied to the inferior left first molar; *B*, first movement to the lingual side; *C*, reversed movement to the buccal side; *D*, *E*, movements *B* and *C* more forcibly repeated; *F*, tractile movement upward in line with the original position of the tooth.

that the distance between them is markedly greater at the apical third than at the gingival third, which condition is very prevalent with the first molar and uncommon with the second, there is always danger of loosening one or both of the adjacent teeth when removing the affected tooth from its socket. The adjacent teeth should be carefully observed during the execution of the tractile movement, especially if the preliminary examination revealed the fact that they are not firmly adherent to the supporting tissues. If any movement of either of these teeth is discerned, the tractile movement in the direction of the original position of the affected tooth is immediately discontinued, and, while supporting the disturbed tooth with the thumb of the left hand, the tooth is carried buccally far enough so that, when it is finally drawn from its socket by the tractile movement that is again applied, its divergent roots will not interfere with the approximating teeth. In executing the tractile movement on a tooth with divergent roots, no attempt should ever be made to carry the tooth from its position by sheer force alone, but the linguo-buccal movement should be continued in combination with the tractile movement for the purpose of ascertaining the direction of least resistance. If these combined movements are correctly executed, the flexibility of the roots and also of the process, which factor they possess in a ratio corresponding to the percentage of mineral matter they contain, may be utilized to its fullest extent and a tooth difficult of extraction be removed without fracture of roots or process.

On completion of the extraction, the dilated socket may be readily reduced by applying pressure to both of its sides with the thumb and index finger, as shown in Fig. 187, and pressure should also be applied on the approximating teeth to ascertain whether they are in normal position. If both adjacent teeth are observed to be distributed by any tractile movement, it is preferable to fracture the crown of the tooth to be extracted by exerting a forcible pressure on the beaks of the forceps and separating the roots, as described in the case of fracture (page 244), after which each root is separately removed.

Occasionally the inferior first or second molar is supplied with a third root, which can more properly be classed as a supernumerary root than a bifurcation of either of the other roots. This supernumerary root is conical in shape, small, and rather long compared with its diameter. It usually rises from the crown of the tooth a little below the neck, being located either slightly distally of the mesial root or slightly mesially of the distal root, and may appear on either the buccal or lingual side of the tooth.

The presence of this extra root, which is not perceptible, is not suspected until extraction is undertaken and unusual resistance is encountered. When, however, its presence is indicated, the principal extraction movement is made to the side opposite to the extra root, and it will be found to be exceedingly difficult to remove this root intact with the tooth. In case of its fracture, the operation described for removing fractured parts with Standard forceps No. 6 or with the elevator (page 244) is applicable for its removal.

Displacement.—Inferior first and second molars are occasionally partially displaced buccally or lingually, but the author has never seen either tooth in complete displacement to either side of the arch of which it forms a component part. In partial displacement, when the space on the narrowed side will permit the beaks of Standard forceps No. 7 (Fig. 8) to be applied, the use of these forceps is preferred, but, if their application is not practicable, Standard forceps No. 6 (Fig. 7) should be substituted. The latter forceps are used, however, only to gain space for the adjustment of Standard forceps No. 7. The first extraction movement is made to the side to which the tooth is displaced, and then reversed toward the opposite side as far as the space will permit. These two movements are repeated, applying increased force to the first movement, and, if necessary, using in conjunction the wedge movement, as described (page 226), until the tooth is loosened from its attachment, when the extraction is completed by the tractile movement as nearly as possible in line with its original position.

Caries on Buccal or Lingual Surface.—Where caries involves the buccal or lingual surface of one of these teeth, and the unaffected surface is reasonably strong, Standard forceps No. 7 or —especially in such cases—the improved Standard forceps No. 7 are indicated. One beak should be first applied to the involved surface, and, if the decay extends below the gum margin, this beak is sent quite a distance down on this surface to gain a firm adjustment, after which, if the margin of alveolus is partially carious, judicious alveolar application may be made to the affected surface. The first extraction movement is made to the carious side, and, if this movement disengages the beak on the weakened surface, the beak should be sent further down on that surface before bringing the tooth slightly in the opposite direction. These movements should be continued, with the more forcible one always to the side attacked by caries, until the tooth is loosened from its attachment, when, with a movement to the weakened side, it is delivered from the socket by the tractile movement.

Caries on Mesial or Distal Surface.—Where there is a cavity on the mesial or distal surface of one of these teeth, and there is

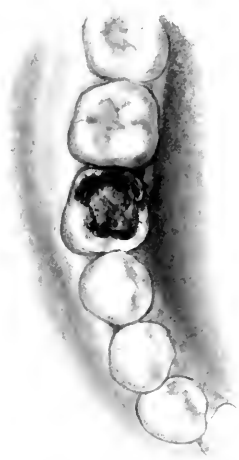


Fig. 109.—Inferior first molar. Distal surface destroyed by caries.

enough structure on the lingual and buccal surfaces for Standard forceps No. 7 to be securely adjusted, this instrument should be employed, and the same technic applied as when the crown is intact (page 226). Where either of these surfaces is involved by caries to such an extent that the beaks of the forceps can be adjusted only to the mesial or distal half of the neck of the tooth, and no support can be had from the involved side, Standard forceps No. 6 should be used. In Fig. 109 is shown a first molar with the distal side of its crown destroyed by caries. In such case Standard forceps No. 6 should be applied to the mesial half of the crown, and the extraction movements made in the same manner as when the crown is intact. Usually the distal half, if the two roots are partially united, will be carried out of its socket with the mesial root; but, if this is not accomplished, it will usually be loosened and is removed with the same forceps. If this adjustment cannot be made, the author's lower root elevator (Fig. 18) is employed to extract it in the same manner as this elevator is used for the extraction of roots (page 233). The same method of operation in a reversed order prevails where the tooth has been attacked by caries on the mesial side.

Where caries involves the distal surface of the second molar and the third molar is missing from the arch (Fig. 110), it is

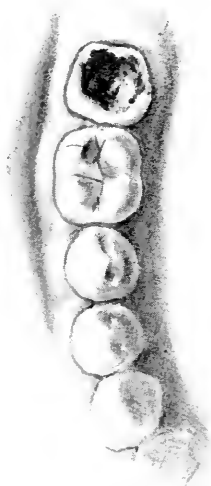


Fig. 110.—Inferior second molar. Distal surface destroyed by caries, with the third molar missing. In such case the Lecluse elevator (Fig. 21) may be used preceding the application of the forceps.

advisable in most cases to first loosen the tooth with an elevator, as this procedure simplifies the operation and also decreases the liability of a fracture. Here the blade of the Lecluse elevator (Fig. 21) is applied to the mesial surface of the crown or the neck of the second molar, using the distal surface of the first molar as a fulcrum. The blade is sent between the two teeth with considerable pressure and acts as a wedge. If this fails to loosen the tooth, the blade is directed slightly distally (Fig. 111) by turning the upper end of the handle in that direction, but the amount of force that may be applied is slight compared with the amount that may be exerted when this instrument is employed on the inferior third molar. The elevator is used merely to loosen the tooth, and as soon as this is done the forceps are applied to complete the operation. If, when using the elevator in this manner, rather firm resistance is encountered while executing the distal movement, no attempt should be made to force this movement, as a fracture will result. Resistance to this movement of the elevator is indicative of fused roots or roots that are not in-

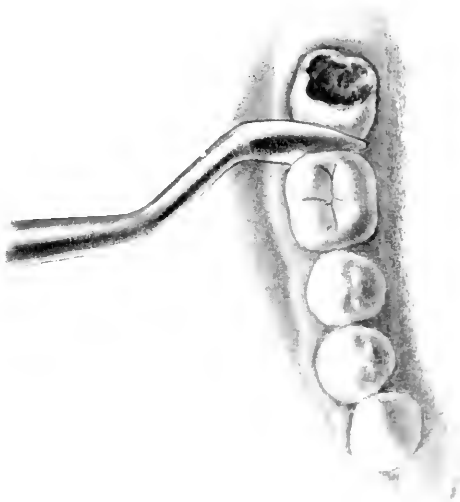


Fig. 111.—Same subject as Fig. 110. Illustration shows the extraction movement with the Lecluse elevator (Fig. 21), the blade of the elevator directing the tooth distally.

clined distally, and in either condition the use of the elevator should be discontinued and the forceps applied.

Two Roots United—*Forceps Indicated.*—Where the two roots of a first or second molar remain and they are rather firmly united to each other, are of considerable size, and the part remaining above the healthy alveolar process is sufficiently strong to allow Standard forceps No. 7 (Fig. 8) to be securely adjusted, this instrument is applied and the extraction movements are executed as though the crown were intact. Where either the mesial or distal root has been weakened by caries to such an extent that Standard forceps No. 7 cannot be securely adjusted, as in the case where the crown of the tooth is extensively involved by caries on the mesial or distal surface (page 230), and one of the roots possesses enough firm structure to allow Standard forceps No. 6 (Fig. 7) to be adjusted, this instrument is applied to that root and the extraction movements are executed. The other root, as in the case where these forceps are adjusted to the mesial or distal half of the crown (page 230), will accompany the extracted root; but, if it does not come out with the extracted root, it is usually loosened, and can be removed with the same forceps or with an elevator.

Elevator Indicated.—Where the two roots remain, and they are not fused and only slightly united, and caries has destroyed them to such an extent on the buccal or lingual surface that their removal with the forceps is uncertain for the want of structure to secure a firm application, the elevator should be selected for their removal. Either the Knott (Fig. 17) or the author's lower root elevator (Fig. 18), preferably the latter, should be used, as the blade of either of these elevators is broader and stronger, and better adapted to the strain that would naturally be imposed on it when applying a leverage on these roots, than that of the Cryer elevator (Fig. 24), which is more appropriately used on the teeth anterior to the first molar. Where the tooth is on the right side of the arch, the short-shank elevator is used; where it is on the left side, if the roots are not firmly attached, the long-shank elevator (Fig. 20) is used, with the operator in position on the right side of the patient, the adjustment being made at the bifurcation on the lingual side. Where a tooth is on the left side of the arch, and its attachment is so firm as to make repeated application possible, it is advisable to use the short-shank elevator, the operator in such case assuming a position on the left side of the patient or stand on the right side and lean across the front of the patient, turning the latter's head toward the right. When using the author's lower root elevator, the point of the blade is applied between the tooth or root and the alveolar process, with the concave side of the blade toward the part to be dislodged, and the instrument is held so that the point of the blade is directed as nearly as possible toward the apex of the root. Pressure carefully applied will force the blade between the root and the alveolar process, when a slight turn of the handle will cause the point of the blade to engage the root.

The convex side of the blade, resting on the process or on another root as a fulcrum, completes the lever arrangement, and the tooth is pried from its position if this desired result has not already been accomplished by the wedge force of the application.

In applying the author's lower root elevator to extract the roots of an inferior first or second molar where the roots are not firmly united, the point of the blade is presented buccally at the bifurcation of the roots (Fig. 112), and force is applied lingually and downward, which will direct the blade toward the median line of the tooth and separate the two roots (Fig. 113). This operation alone will usually be sufficient to dislodge the distal root, but, if it is not dislodged, the point of the blade, without being removed from its position, is applied to the distal root in the manner described above for the application of the elevator, and the root is removed from its socket (Fig. 114). Where the parts anterior to the mesial root are suitable for a fulcrum, the elevator is applied to the mesial surface of this root (Fig. 115), and it is removed by the same technic of operation.

Where there is a cavity on the distal surface of the tooth anterior to the one to be extracted, such anterior tooth cannot be utilized as a fulcrum, and a mesial application cannot usually be made under such condition. In such case, as soon as the distal root has been extracted, the mate to the elevator just used is applied to the distal surface of the mesial root, and, if the septum separating the two roots is very heavy, it is utilized as a fulcrum to complete the extraction; but where the septum is thin or weakened by caries, the operation is performed in the same manner as when operating under a like condition with the two roots separated (page 240).

When operating with the author's lower root elevator (Fig. 18) on the left side of the arch, the position of the operator should be changed to that side of the patient, except where the attachment of the roots is not very firm, in which latter case the author's special lower root elevator (Fig. 20) may be used to advantage as a time saver.

Where the two roots of the first molar cannot be separated with the author's lower root elevator, and if the attachment is not unusually firm, the extraction can often be accomplished by applying the point of the blade on the buccal side of the tooth well under its crown and at the bifurcation of the two roots.

Fig. 112.—Crown of an inferior first molar destroyed by caries, with the roots partially united. Illustration shows the application of the author's lower root elevator No. 1 (Fig. 18) from the buccal side, with the point of the blade inserted at the bifurcation.

Fig. 113.—Same subject as Fig. 112. Illustration shows the blade of the elevator directed midway between the roots and separating them.

Fig. 114.—Same subject as Figs. 112, 113. Illustration shows the method of removing the distal root. The upper end of the handle of the elevator is turned mesially, the point of the blade engages the mesial surface of the distal root, the mesial root being used as a fulcrum, and the turning of the handle raises the root from the socket.

Fig. 115.—Same subject as Figs. 112, 113, 114. Illustration shows the method of removing the mesial root after the distal root has been removed. The blade of the elevator is inserted into the interproximal space between the root and the second bicuspid, the latter being used as a fulcrum.

The adjustment having been secured, pressure is directed against the tooth lingually, with which is combined a lifting force toward the occlusal. If resistance is still encountered, adjustment of the point of the blade is made further under the tooth, which applies the two forces common to this elevator, and the lifting movement is again executed. If these movements are skillfully performed, excellent results can often be accomplished by this method of operation.

In extracting an inferior second molar where the third molar is present, the author's lower root elevator should be applied, and an adjustment secured on the mesio-buccal surface, using the first molar or the alveolus as a fulcrum. The technic of operation applicable to the use of this elevator (page 233) will usually release the roots; and, if it does not, a lifting movement is applied, which will complete the extraction in a majority of such cases. This method is especially indicated when operating on this tooth where its roots are fused. Where this procedure is not practicable, the technic of operation for removing these roots when a fracture has occurred should be followed as described on page 244.

Two Roots Separated—*Forceps Indicated.*—Where only the roots of these teeth remain, and they are separated, but accessible, and the parts projecting above the alveolar process are reasonably strong, Standard forceps No. 6 should be employed, applying them first to the root most accessible and with the strongest structure. Other conditions being equal, the distal root has the preference. In Fig. 116 are shown the forceps applied to the distal root of the first molar. When the forceps have been securely adjusted, the extraction movements are in the main the same as though the crown were intact. After one root has been removed, the forceps are immediately applied to the other root before it has been obscured by hemorrhage, and is extracted in the same manner.

Where only one root remains, the same technic of operation is applied as where the roots are separated, using either Standard forceps No. 6 or the author's lower root elevator.

Where both roots are separated, and only one root is to be extracted, the other root to be used as an abutment for an artificial crown, it is preferable to remove the former with the forceps. If an elevator is employed, an adjacent tooth should be used as a fulcrum, as the root to be crowned must not be used for this purpose.

Elevator Indicated.—Where the two roots are separated, and their lingual and buccal surfaces are not strong enough to allow Standard forceps No. 6 to be securely adjusted, the author's lower root elevator should be used, as a quicker and more effective operation, with less destruction of the tissues, can be accomplished with this instrument than with the forceps. When the two roots are in close proximity, and their approximating surfaces have not been weakened too greatly by caries, the ele-

Fig. 116.—Standard forceps No. 6 applied to a distal root of an inferior first molar.

vator is applied between them, the same technic of operation being followed as described for operating on the two roots when united (page 233). If an application cannot be securely made between the roots, an application is made to the mesial surface of the mesial root or to the distal surface of the distal root, whichever is more accessible and the stronger, taking into consideration at the same time the most available fulcrum. With the first molar the extraction of the distal root is favored, as a better fulcrum is had on the second molar than on the second bicuspid. With the second molar the mesial root should be removed in

Fig. 117.—Same subject as Figs. 112, 113, 114, 115. Illustration shows the method of removing the mesial root by distal application after the distal root has been removed. The blade of the elevator is inserted into the empty socket created by the extraction of the distal root, the point of the blade cuts through the septum, and the turning of the handle extracts the root.

advance of the distal root where conditions will permit, as the first molar is a better fulcrum than the third. The elevator is applied as described for the use of this instrument (page 233).

Where the septum supporting the two roots is very thin, or where it has been weakened by caries, and one of the roots has been removed, the remaining root is extracted by inserting the instrument into the socket of the extracted root (Fig. 117). This method obviates changing from one to the other elevator, as the case may be. For example, if the mesial root is fragile and the distal root is the first to be removed, the elevator is inserted into the socket of the distal root at about its middle third; the blade is directed against the septum supporting the two roots, and a forcible pressure is applied, with a slight turn of the instrument. This procedure will loosen the root with little injury to the tissues, and it is then removed with the Derenberg tweezers. The order of extraction of the two roots may be reversed if the condition of the distal root and the fulcrum make the reversed procedure the more favorable.

Roots Covered by Gum Tissue.—Where the gum tissue overlies the roots, and Standard forceps No. 7 or No. 6 can be adjusted, either of these forceps may be used. The method of spreading the gum with the beaks from over the roots is the same as in the case of superior central incisor (page 116). Where an adjustment cannot be obtained with these forceps, or to adjust them would cause too great destruction of tissue, the author's lower root elevator should be used. The roots are uncovered with the blade of the elevator in the same manner as when the forceps are used. If the gum tissue is in the form of a loose flap, the uncovering is readily done; but, if the tissue is firmly adherent, it will be necessary to make an incision to permit the elevator to be applied.

Deep-Seated Roots.—Where the roots of these teeth are deeply seated and the alveolar process is normal, the technic of operation is applied as described for fracture cases (page 244). Where the alveolus has been weakened by caries, the roots are readily released with the Cryer elevator (Fig. 24) if situated on the right side of the arch, and, if on the left side, with the modified Cryer elevator (Fig. 25). Fig. 118 shows a condition frequently seen in connection with the inferior first and second molars. Careful judgment must be used by the operator in such case, and the operation for the removal of the roots should not be attempted until after the existing conditions have been thoroughly outlined. Often in these cases all of the tooth structure that remains is a frail enamel wall of the crown, with just enough dentine at the neck of the tooth for the whole shell to be supported only by the gum tissue, and the pulp chamber is filled with a very vascular polypus. The part of the crown remaining possesses no strength, so that the first application of any instrument will crush it. If such condition is suspected, it is advisable to make an examination with the explorer, by passing it below the crown at several points, to ascertain whether the roots are

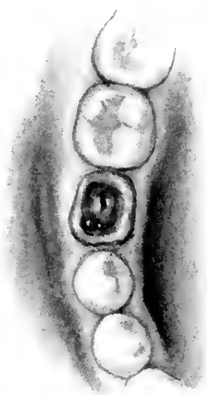


Fig. 118.—Inferior first molar affected with extensive caries. Illustration shows the remains of the enamel wall of the crown, with the chamber filled with a vascular polypus.

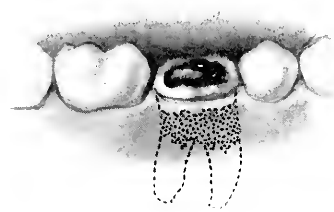


Fig. 119.—Same subject as Fig. 118. Illustration shows the condition of the hard structure and roots.

connected with the crown. Fig. 119 shows an outline of this condition of a tooth and the relation of the crown to the roots that may often be found in such cases.

If an area of tooth structure between the crown and roots is destroyed by caries and the surrounding alveolar process is carious, the two roots are in reality entirely separated from the structure above and are deeply seated. The operative technic in such case is to remove the outer wall of the crown with Derenberg tweezers, or, if it is more firmly attached to the gum tissue, with the forceps. The crown having been removed, the roots are extracted with the author's lower root elevator, the technic of operation being the same as that applicable to the use of the elevator for the extraction of two roots when they are united or separated, as the case may be. The increased difficulties when operating in such case are the hemorrhage induced by the removal of the crown and the fullness of the gum tissue surrounding the roots, which greatly obscures the field of operation.

In the cases described there is always considerable carious alveolar tissue, and the after-treatment of the socket should receive careful attention.

Screw-Porte.—The screw-porte is not often used in connection with these teeth, and is indicated in very rare cases, as, for example, where the distal root is deeply seated, firmly attached, and inclined enough mesially to be accessible with the Keith screw-porte.

Impaction.—It is very rare to find one of these teeth impacted in the manner that occurs with the inferior third molar. Occasionally the inferior second molar is partially impacted, and, when such case is found, the technic of operation will closely follow that described for partially impacted inferior third molar (Chapter XI).

Fracture—*Two Roots United.*—Where a fracture of an inferior first or second molar occurs while Standard forceps No. 7 or No. 6 are being used, and if by a misapplication of the beaks the fracture occurs above the marginal ridge and this ridge is carious, a readjustment of the particular forceps in use should be made to complete the operation.

In making a reapplication of the forceps at any time following a fracture, care must be exercised to avoid grasping parts of the process between the beaks of the forceps instead of the fractured tooth, and, if there is an inclination of the tooth, to see that the reapplication is made in line with its axis.

Where a fracture is low, and the margin of the alveolar process projects beyond the remaining part of the tooth and is in a normal state, it becomes an interfering factor and hinders the reapplication of the forceps. In such case the beaks should not be driven against the process with the intention of breaking it down in order to secure an adjustment, as an aggravated condition will result. Where both roots are left united, an examination should be made to learn whether the remaining part of the tooth can be more readily released by dissecting away enough of the alveolar process with a bur on the lingual and buccal sides to allow a readjustment of the forceps, or whether the two roots should be separated. If it is decided to remove the process, it is usually good practice to cut away a little more of the alveolus than is absolutely necessary, so that when the forceps are applied the operator can depend on their remaining firmly adjusted for the delivery of the tooth.

Where the fracture extends quite a distance below the neck of the tooth on either the lingual or buccal side, or on both sides, or

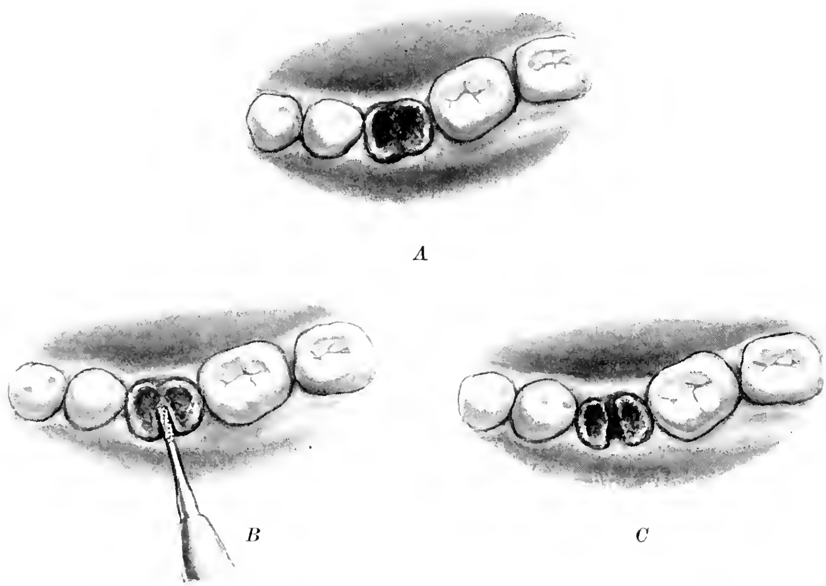


Fig. 120.—Method of separating roots. *A*, fracture of an inferior first molar at the gingival border, both roots remaining and firmly united; *B*, separating the roots with an engine bur; *C*, the roots separated.

where the alveolus is difficult to remove and the remaining structure is of considerable size, the operative procedure should be to separate the roots and remove them with the author's lower root elevator. The separation of the two roots is made at their bifurcation with a cross-cut fissure bur. Fig. 120, *A*, shows the first molar fractured, with both roots remaining and firmly united. To separate the roots, the burring is started on the buccal side (Fig. 120, *B*) at the bifurcation of the two roots, and is continued until both roots are separated (Fig. 120, *C*). If the two roots are not firmly united, a quicker separation can be accomplished by placing the edge of the mastoid chisel (Fig. 41) against the occluso-buccal side of the tooth at the bifurcation of the roots and striking it a sharp blow with a plugging mallet.

Where a fracture of the second molar occurs below the margin of the alveolar process and the roots are fused, separating the roots is impracticable. The technic of operation in such case is to apply the blade of the author's lower root elevator (Fig. 18), or, if the attachment is not too firm, the Cryer elevator (Fig. 25), to the disto-buccal surface of the remaining part of the tooth (Fig. 121), and send the blade as far down as possible between the tooth and the alveolar process, when the lever force of the instrument is applied. This procedure will usually dislodge the tooth from its attachment. If the first adjustment of the eleva-

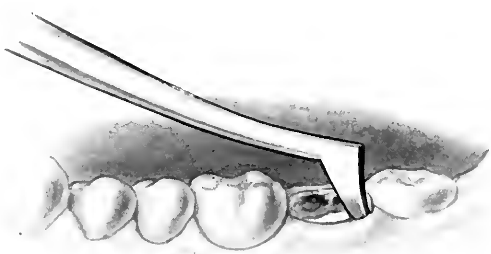


Fig. 121.—Author's modified Cryer elevator (Fig. 25) applied to the disto-buccal surface of a fractured inferior second molar, the roots being fused.

tor fails to release the tooth, the blade is sent further down, and the turning of the handle is then repeated until the tooth is detached.

Two Roots Separated.—Where a fracture occurs, and the two roots remain and are separated, Standard forceps No. 6 (Fig. 7) should be used to complete the extraction if application can be made with them. If it is impracticable to adjust these forceps, the author's lower root elevator (Fig. 18) should be used. When the alveolar process projects to such an extent that the blade of this elevator cannot be applied to either root, a part of the process is cut away from either the mesial or distal side of the root, as the case may indicate, to allow the blade of the elevator to be applied. The septum separating the two roots may also be removed. The tooth anterior or posterior to them, or the alveolar process, is used as a fulcrum, and the operative procedure is the same as that described for using the author's lower root elevator (page 233).

Single Root.—Where only one root remains as the result of a fracture, the size of the root and its accessibility should be quickly noted to determine the instrument most suitable for its removal. If the part remaining is beyond the reach of the forceps or author's lower root elevator, the Cryer elevator should be used, applying it to the most available surface, and using the septum or alveolus as a fulcrum. If the root remaining has been loosened, it can often be readily lifted from its socket with an ordinary explorer introduced into the root canal.

Roots Deeply Seated.—Where one or both roots remain as the result of a fracture, and the parts are deeply seated and the alveolar process is normal, a definite outline of the remaining parts should be obtained before attempting to remove them. The modified Cryer elevator (Fig. 25) is usually used to remove such roots, and, if the alveolus interferes with its application, the blade may be utilized to cut away the process sufficiently to allow an adjustment. When operating on the second molar, the alveolus to the buccal side should, if possible, be used as a fulcrum, and, when operating on the first molar, the septum should be used. If the blade of the elevator cannot penetrate the root, the process is cut away sufficiently with a suitable bur in the right-angle to permit the use of the elevator. Where this technic is not practicable, the parts should be removed with a bur, as described for inferior bicuspid (page 219).

Wedged Roots.—Where the crown of an inferior first or second molar has been lost for some time, and the adjacent teeth have tipped and partially closed the space it formerly occupied, so that the roots cannot pass through the intervening space, and if an examination reveals both roots to be firmly united and of considerable size, they should be separated with a fissure bur as described in the case of fracture (page 244). When the separation has been accomplished, the author's lower root elevator should, if possible, be adjusted. If the space will not, however, permit this instrument to be adjusted, the Cryer elevator should be used, and the blade adjusted to the most accessible root, or to one that will be the easier to release without disturbing the adjacent tooth. On completion of its removal, the remaining root is released with the same elevator. If the two roots are not firmly united, the elevator is applied between them to break up their union, and they are extracted separately with the same instrument. When only one root remains and the space is narrow, the Cryer elevator should be used.

Carious Tooth Isolated.—Where the crown of the second molar is destroyed by caries, overlaid with gum tissue, and isolated, the author's lower root elevator should be applied for its extraction, and the technic of operation is the same as that described for the third molar when in the same condition (page 282).

INFERIOR THIRD MOLAR.

The inferior third molar is extracted more frequently than any of the other inferior teeth. The position of the tooth in the mouth renders its cleansing difficult, and the free margins of the gums often form thick folds or flaps about it that extend well up on the sides of the tooth, holding around its enamel surfaces any debris that may be forced between these folds and the tooth. During the eruption of the tooth, after the occlusal surface has effected an opening in the soft tissue, further development may be retarded for an indefinite period, thereby forming an excellent receptacle for the retention of foreign matter. These factors cause the tooth to receive very imperfect prophylactic care, even in the mouths of the most scrupulous, and it is thus subjected to conditions that cause its early decay. Where the tooth has been attacked by caries, an attempt to retain it by filling is often a moot question, for, if the remainder of the teeth in the arch are in good condition, it possesses little value as an organ of mastication. If the lesions of its surface have advanced far enough to affect the pulp, successful treatment of the condition is an uncertainty owing to the common difficulty of access to its canals, to the uncertainty of reaching the ends of many of these canals with any instrument even after access to them is obtained, and in some cases to the impossibility of inserting a canal filling that will cause no irritation on account of the large apical foramen, due to the incomplete calcification of its roots. If caries has progressed far enough to make the crowning of the tooth imperative if it is to be retained, such procedure is seldom advisable, unless it is in mesial occlusion, due to the loss of teeth anterior to it, or it is to serve as an abutment for a bridge, as the shape of its

Fig. 122.—Types of inferior third molars. The first row shows the buccal, the second row the lingual, the third row the mesial, and the fourth row the distal surface. The fifth row shows incomplete and malformed molar roots.

crown and the relation of the tooth to the surrounding tissues are such that the fitting of any artificial crown with sufficient accuracy to prevent irritation of the tissues is, in a majority of cases, almost an impossibility. The fact that the posterior teeth in the superior arch are also subject to early loss, which loss leaves the tooth without an antagonist, is another factor that often makes it a useless organ.

In addition to the pathologic conditions that so frequently make the extraction of this tooth necessary, it is more frequently malposed than any of the other teeth, and its malposition is frequently of such character that, during ordinary mastication, the cheek and other parts of the mouth are subjected to severe traumatic injury by its peculiar relation to them. The aggravated conditions caused by the impaction of this tooth are so common that a separate chapter (page 283) is devoted to the treatment of these conditions.

Figs. 122 and 123 show various types of inferior third molars. In Fig. 122 the first row shows the buccal, the second row the lingual, the third row the mesial, and the fourth row the distal surface of these teeth. Attention is directed to the variation in the shape of the crown and roots, and also to the distal inclination of the roots. The last row shows two inferior third molars with incomplete development of the roots, and the other teeth in the row with markedly divergent roots. Fig. 123 shows various types of inferior third molars with roots nearly straight.

Position of Patient and Operator.—The position of the operator for the removal of this tooth is such an important matter that the success of the operation, in a large degree, depends on it, and the operator should not attempt the extraction until he has assumed the correct position. The operating chair, as explained for the position of the operator and patient for operating on the inferior teeth (page 96), should be adjusted as low as possible and slightly tilted on account of the posterior location of this tooth, to which access is not so easily obtained as to the teeth anterior to it.

Where both the elevator and forceps are employed, the operator has two positions to assume. The application of the elevator usually precedes that of the forceps, and the change from one position to the other is quickly made. When the elevator is applied, the operator stands to the right of the patient, and,

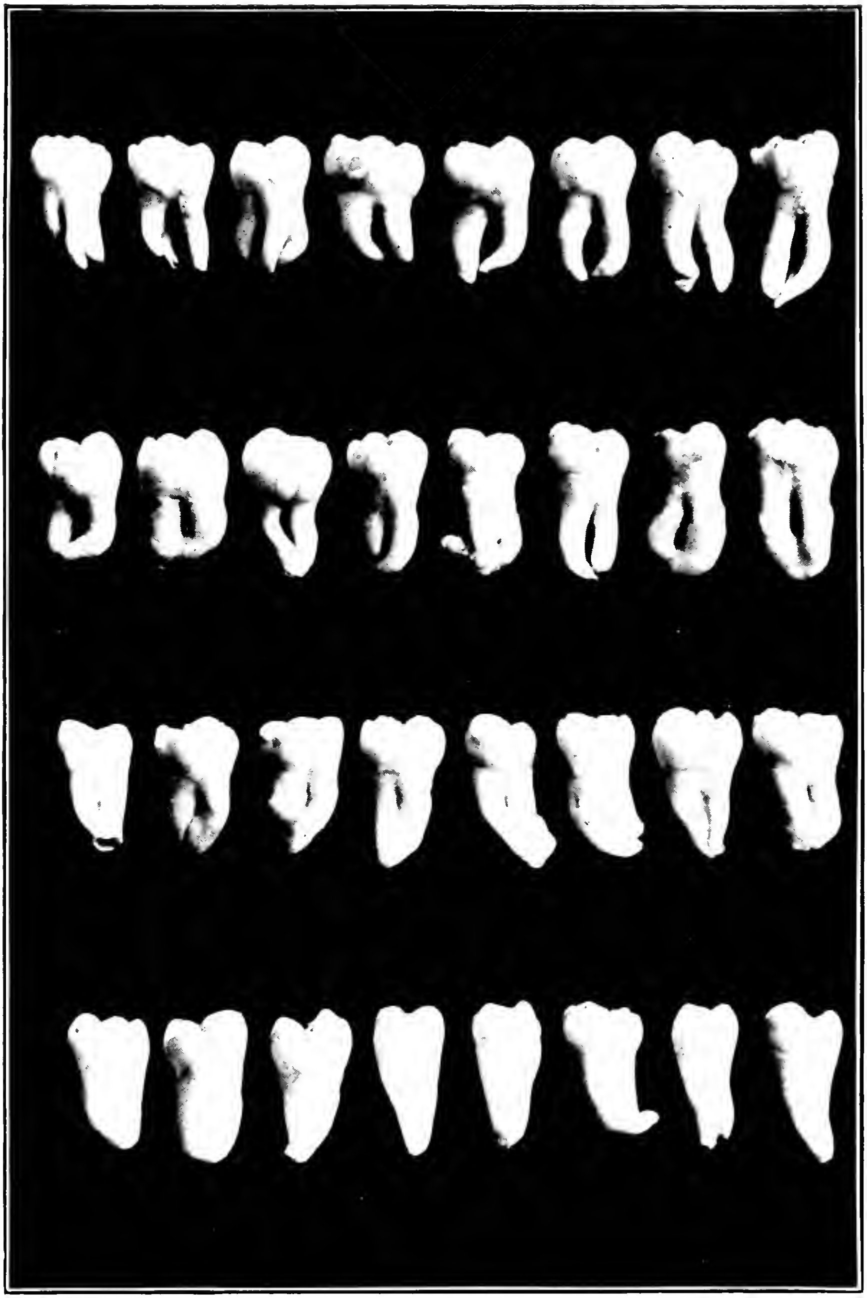


Fig. 123.—Types of inferior third molars. In the first row the roots are entirely separated, in the second row the roots are united at the apices, in the third row the roots are united throughout the entire length, and in the fourth row the fusion of the roots is complete.

when the change to the forceps is made, he steps on a stool behind the patient.

When operating on the left side of the arch with the modified Lecluse elevator (Fig. 23), the head of the patient is about

Fig. 124.—Position of the operator's hands and disposition of the fingers when applying the elevator to the left side of the arch. Illustration shows the application of the author's modified Lecluse elevator (Fig. 23) between the second and third molars.

straight in the head-rest. The left arm of the operator is placed around the head of the patient, with the palm of the hand steadying the head. The index finger is used to retract the cheek; the second finger depresses the lower lip; the third and fourth fingers are placed below the jaw to support the mandible (Fig. 124).

When operating on the right side of the arch with the Lecluse elevator (Fig. 21), the head of the patient is turned slightly to the right. The left arm of the operator is placed around the head, with the palm of the hand steadying the head. The index

Fig. 125.—Position of the operator's hands and disposition of the fingers when applying the elevator to the right side of the arch. Illustration shows the application of the Lecluse elevator (Fig. 21) between the second and third molars to remove the third molar.

finger is directed toward the lingual side of the tooth that is to be extracted, but should not come in contact with the tongue; the second finger depresses the lower lip; the third and fourth fingers are placed below the jaw to support the mandible (Fig. 125).

After the elevator has been applied to either side of the arch, and the change from elevator to forceps is to be made, the operator—with the left arm, hand, and fingers remaining in their respective positions—steps upon the stool back of the patient, and, inclining his body forward, is in the correct position to apply the forceps to the tooth.

Maximum Value of Elevator.—A greater variation of form and a less established relation to its surrounding tissues are presented in the inferior third molar than in any of the other teeth. The roots vary from a single fused root to two well-formed roots, either or both of which may be bifurcated, thereby forming three or four distinct roots, and, in the relation of the roots of this tooth to the mandible, the variation is from a slight mesial inclination to any angle of distal inclination, which irregularities, combined with the many axes of its roots, subjects it to almost unlimited variations in both form and relation.

In the extraction of inferior third molars, no other instrument for primary application approaches the effectiveness of a correctly made elevator when that instrument is properly applied. If the tooth to which application has been made cannot be delivered from the socket with the elevator, the attempted extraction will furnish a more dependable diagnosis of the form of the tooth, its relation to the mandible, and the strength of its attachment than could have been obtained by any other method of examination, except a radiograph, and such diagnosis will have been made without injury to tooth or surrounding tissues. The elevator is employed in advance of the forceps in almost every case when operating on this tooth, and so much depends on the proper use of this instrument that the operator should thoroughly familiarize himself with its use, so that its application may be as effective as possible.

The elevator selected should be of such design that it will materially assist in the dislodgment of the tooth with the least possible destruction of the tissues and without causing fracture. The Lecluse elevator (Fig. 21) and the modified Lecluse elevator (Fig. 23), the shank of the latter being one and one-half inches longer than the former, are most frequently brought into service. In addition to these the author's lower root elevators (Figs. 18, 20) are used where the roots are to be removed, or where the tooth is in malalignment or isolated, and both the regular and modified Cryer elevators (Figs. 24, 25) are used where fractured or deep-seated roots are to be extracted.

An objection sometimes advanced against the use of an elevator on this tooth is that it may fracture the enamel on the distal surface of the second molar when that tooth is used as a fulcrum to support the instrument. Such an accident occurs, however, only in rare instances, and can be avoided if the operator uses good judgment in the application of the elevator.

Forceps.—The forceps to be selected for this tooth are the same as those used for operating on the inferior first and second molars (page 222). Some operators use for the extraction of this tooth an instrument known as Physick forceps. The use of these forceps is not recommended, but, as there are advocates of their use, reference may be made to them with propriety. Their use is limited to this tooth, and the author's experience has led him to discard them, as a surer, safer, and more effective operation can be performed with the Lecluse elevator. When applying the Physick forceps, two blades must be contended with, and the parts subjected to operation are so obscured by the size of the instrument that the effect of the force of application cannot be observed, thereby courting serious damage when using them, while the Lecluse elevator has only one blade and the parts being operated on can be observed throughout the operation. Where resistance is encountered, repeated application with the blades of the Physick forceps cannot be so well made as with the blades of the Lecluse elevator. Where there is an impingement of the crown of the third molar on that of the second molar, the blade of the Physick forceps cannot be successfully applied, and in such case often the blade of the Lecluse elevator can be readily inserted into the interproximal space. In addition to this, where temporary ankylosis is present and the mouth cannot be opened very far, the Lecluse elevator, being a smaller instrument, is applied from the buccal side, whereas in using the Physick forceps the mouth must be opened far enough to admit this large instrument. It is therefore advisable for the operator to familiarize himself with an instrument that is susceptible of more general application and whose use is more effective and far more safe.

Order of Extraction.—Where conditions permit, the extraction of the third molar should precede that of all other inferior teeth, and especially that of the second molar, which in the majority of cases may be used as the fulcrum to support the elevator when extracting the third molar. When both third molars are to be extracted, the one on the left side of the arch should be extracted first.

Fulcrum.—Where the elevator is to be used in the loosening or removal of an inferior third molar, the selection of the fulcrum is of first importance. In the majority of cases where the second molar is *in situ*, it serves as a fulcrum, and a definite knowledge of its condition should be obtained before operating. Where the second molar cannot be used as a fulcrum, or where it is missing, or where the third molar is displaced to the buccal side of the arch, the alveolar process may often be utilized as a suitable fulcrum.

When the Second Molar May be Used as Fulcrum.—Where this tooth is in alignment with the arch, and the teeth anterior to it are *in situ*, the second molar will be an ideal fulcrum if it is firmly supported by the tissues, is free from caries or filling on its distal surface, or is not crowned. Where the second molar is not firmly attached, too much reliance should not be placed on it for a fulcrum, unless it can be effectively supported, in which case it may be used for this purpose. A second molar unsupported by a tooth anterior to it should not be depended on as a fulcrum unless it can be supported, in which case it can often be made an ideal fulcrum. Fillings in the second molar on any of its surfaces, except the distal, unless they are of considerable size, will not prevent the use of the tooth as a fulcrum; and, even with small fillings on its distal surface, the tooth may be used as a fulcrum if the elevator is so applied that it will not come in contact with the filling or margins of the tooth about the filling. Where the second molar is supporting a well-fitted shell crown and the third molar is not firmly attached, the second molar may also be used as a fulcrum.

When the Second Molar May Not be Used as Fulcrum.—Where the second molar is attacked by caries, the location and size of the cavity should be considered in connection with the possibility of this tooth being used as a fulcrum. If the mesial, occlusal, or buccal surface is involved, but not extensively, and the tooth is firmly attached to the tissues, it may be used as a fulcrum. If, however, caries is extensive on the distal surface, involving the neck of the tooth, it should not be used for this purpose. Large fillings on the distal surface of the second molar, smaller fillings when projecting beyond the enamel margins, and imperfectly fitting crowns also prevent it from being utilized as a fulcrum.

Where the second molar is supported by a tooth anterior to it, but it is not firmly attached to the tissues, it must not be depended on for a fulcrum unless it can be supported by artificial means. If the second molar is serving as an abutment for a bridge, and the span of the bridge it supports is composed in part of porcelain, it must not be used as a fulcrum; but, if the bridge is an all-metal one, a cautious use of the second molar as a fulcrum is permissible.

Methods of Reinforcing the Fulcrum.—In some cases, where a movement of the second molar is noticed while it is being used

Fig. 126.—A decayed third molar to be removed with the elevator. The second molar is in normal position, but the teeth anterior to it are missing. If in such case the second molar is used as a fulcrum without being reinforced, the tooth will in all probability be loosened if considerable force is applied to it.

as a fulcrum, the tooth may be quickly reinforced by placing the thumb of the left hand on its occlusal surface (Fig. 130) and exerting a pressure downward, which will enable the operator to complete the extraction with little interruption. If, however, unsuspected resistance is encountered in the third molar, and this means of reinforcing the second molar is not sufficient, its use as a fulcrum should be abandoned rather than incur the possible loss of a useful tooth. The reinforcement of the second molar with the thumb as described is good technic, and is often sufficient to allow this tooth to be used as a fulcrum in a case where it would not be practicable to employ it unsupported.

Where the second molar is well supported by the tissues, but one or more teeth anterior to it are broken down by caries or have been extracted, any great amount of leverage placed on the second molar would in all probability result in the tooth being loosened. To avoid such an accident, the second molar may be reinforced in a manner that will render it serviceable as a fulcrum. Where one or more teeth anterior to the second molar

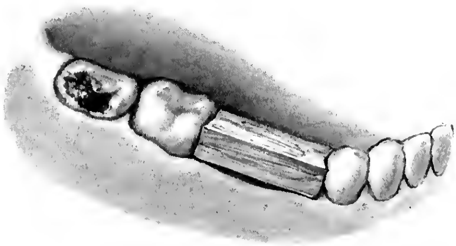


Fig. 127.—A decayed third molar to be removed with the elevator. Illustration shows the method of reinforcing the second molar with a wood block where the tooth is to be used as a fulcrum and where the teeth anterior to the second molar are missing.

are missing (Fig. 126), a piece of wood may be shaped to fit the distal surface of the first bicuspid and the mesial surface of the second molar (Fig. 127). When pressed into position, it should fit tightly, so that when the elevator is applied the second molar is supported as though the second bicuspid and first molar were in their respective places.

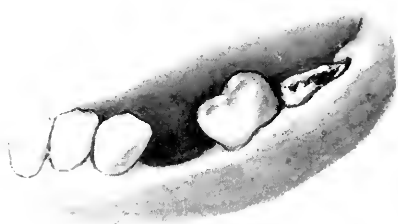


Fig. 128.—A decayed third molar to be removed with the elevator. The intervening space between the bicuspid and second molar, on account of the inclination of these two teeth, will not permit a wood block to be properly adjusted to support the second molar when it is to be used as a fulcrum.

It is impracticable to insert a wooden block of this kind if the crowns of the adjacent teeth are tipped respectively mesially and distally (Fig. 128). In such case modeling compound should be substituted for the wooden block. A sufficient quantity of the compound is heated and pressed between the deflected teeth, leaving a surplus of the material projecting on the lingual and buccal sides, which is forced into place with the thumb and index finger until the mass is molded snugly into the intervening space (Fig. 129). After the modeling compound has hardened, it possesses sufficient rigidity to support the second molar.

Fig. 129.—A decayed third molar to be removed with the elevator. Illustration shows the method of inserting modeling compound between the bicuspids and second molar where a wood block cannot be properly inserted to support the second molar where the latter tooth is to be used as a fulcrum.

Where the block or compound is used in the manner described, the thumb of the left hand should, if possible, be applied with pressure on the supporting material during the operation as an additional means of support.

Impaired Fulcrum.—Where the third molar is not firmly attached to its supporting tissues and the second molar is similarly

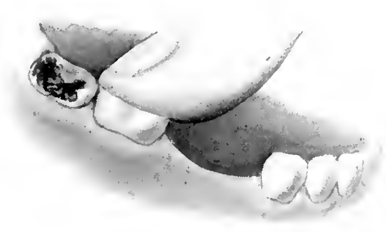


Fig. 130.—A decayed third molar to be removed with the elevator. Illustration shows the method of applying the thumb to reinforce the second molar where it is to be used as a fulcrum and where the teeth anterior to the second molar are missing.

impaired, the second molar may be used as a fulcrum to extract the third molar by simply supporting the second molar with the thumb of the left hand; or, if the second molar is not supported by a tooth anterior to it, but is firmly attached to the tissues and the third molar is not firmly attached, it may be used as a fulcrum by supporting it in the same manner with the left thumb (Fig. 130). In either case any movement of the fulcrum must be noted to avoid possible damage to the second molar.

Where the third molar is firmly attached to the supporting structures, and the second molar is not firmly attached, or it is supporting a shell crown or an inlay, or it has a large filling on the distal side, or its distal side is extensively involved by caries, any of which conditions would not permit the second molar to be used to support the elevator, this instrument may be applied independent of the second molar. In such case the elevator is applied to the buccal side of the third molar as described when this tooth is weakened by caries on the mesial side (page 272).

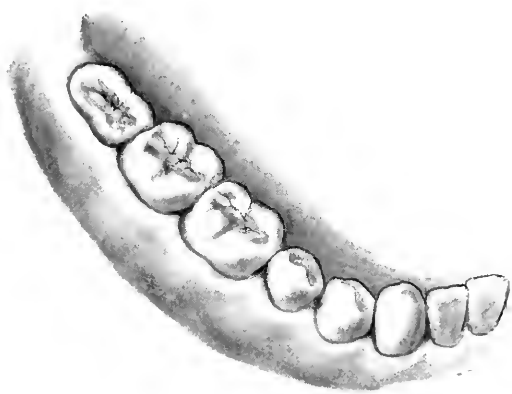


Fig. 131.—Extraction of a third molar with the elevator. The second molar is in alignment, the teeth anterior to it are present, and it can be advantageously used as a fulcrum.

Use of the Lecluse Elevator—*Obtaining Free Access.*—When the mouth is fully opened, the muscles of the lips and cheeks are stretched taut, in which condition it is impossible to distend the tissues to either side sufficiently to obtain free access to the field of operation when operating in the posterior part of the mouth. A less obstructed view is had when the mouth is only partially opened. To apply the Lecluse elevator (Fig. 21), it will be found advisable, as when applying forceps, to sacrifice a part of the distance that the teeth can be separated in order to obtain a greater retraction of the cheek tissues. The tooth should at all times during the operation be kept in sight by the operator, for, if the tooth drops on the tongue and is not caught, it may pass down the throat. During the operation touching the tongue in the region of the third molar should be avoided, as it will gag some patients, and may cause an interruption of the operative procedure at a critical time and delay the completion of the extraction.

Operating on the Right Side of the Arch.—The Lecluse elevator (Fig. 21) is applied to the inferior right third molar when it is in alignment (Fig. 131), and the second molar is being used as a fulcrum, by holding the elevator firmly in the right hand, when it is directed from the buccal side of the arch into the inter-

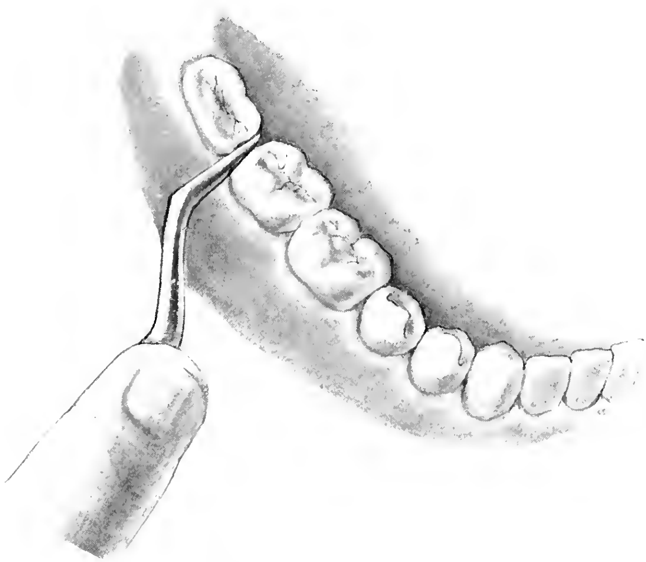


Fig. 132.—Same subject as Fig. 131. Illustration shows the application of the Lecluse elevator (Fig. 21) into the interproximal space between the second and third molar from the buccal side.

proximal space between the second and third molar. The flat side of the elevator is turned toward the mesial surface of the third molar, while the convex side engages the distal surface of the second molar. With the elevator in this position (Fig. 132) the blade is forced between these two teeth. As the blade from its point to the shank of the instrument is shaped in the form of a wedge, this pressure will often be sufficient to effect a complete delivery of the tooth from the socket, and it is advisable to be prepared to catch the tooth if it is extracted at this juncture. If this application fails to loosen the tooth, the extraction movements are then made as described for the use of this instrument (page 263).

Operating on the Left Side of the Arch.—When removing the inferior left third molar, the application of the instrument and use of fulcrum are the same as described for the right side of the arch, but the modified Lecluse elevator (Fig. 23) should be used where the teeth are in normal alignment and the attach-

Fig. 133.—Application of the author's modified Lecluse elevator (Fig. 23) between the second and third molar on the left side of the arch from a position of the operator on the right side of the patient.

ment of the tooth to be removed is not unusually firm. The elevator is held firmly in the right hand, and is inserted into the interproximal space on the lingual side in the same manner as the regular Lecluse elevator (Fig. 21) is introduced into the interproximal space when operating on the right third molar. With the elevator thus applied (Fig. 133), it is wedged between the teeth in the same manner as is done with the Lecluse elevator when it is used on the right side of the arch. The author recommends this method of applying the elevator from the right side because it avoids the necessity of the operator changing his position to the left side of the patient, and, not being required to change from the right side, he is enabled to quickly assume the position for using the forceps if they are found necessary to complete the operation.

Where the inferior left third molar is attacked by caries on the mesio-lingual surface and the mesio-buccal surface is the stronger, or where considerable resistance or difficulty is encountered, or where temporary ankylosis is present, it will be necessary to operate with the regular Lecluse elevator from the left side of the patient.

If, in removing an inferior right third molar so displaced buccally as to prevent the use of the second molar as a fulcrum, the elevator being introduced from the buccal side, the second molar can often be made available as a fulcrum by introducing the modified Lecluse elevator from the lingual side while standing on the left side of the patient, in the same manner as described above for the use of this elevator on the inferior left third molar in normal position.

Extraction Movements.—If the application of the Lecluse elevator as shown in Fig. 132 does not loosen the tooth, the first extraction movement is to direct the top of the blade of the elevator distally (Fig. 134), which is done by turning the upper end of the handle in that direction, and, if abnormal resistance is not encountered, the tooth will, as a rule, be partially or entirely raised from the socket by the simple turning of the instrument. If, however, this movement fails to loosen the tooth, the movement is reversed and the lower edge of the blade of the elevator is directed distally (Fig. 135). If resistance is still encountered, these movements are repeated, and the blade is sent more gingivally and further between the teeth with each succeeding turn of the handle. The first movement—the top of the blade directed distally—is favored, as the roots of a majority of inferior third molars incline distally, and this movement is the most effective in these cases. If the elevator does not entirely liberate the tooth from the socket, the forceps should be used to complete the extraction. The distance that the third molar may be forced distally will depend on the curvature and amount of distal inclination of its roots, and the resistance encountered during the extraction movements. The operator's sense of touch should enable him to quite accurately determine the curvature and inclination of the roots.

When using the Lecluse elevator, one side of the blade being flat and the other convex, turning the instrument transmits the force by means of an inclined plane. The flat side of the blade being toward the tooth to be extracted, turning the instrument moves the incline over the side of the fulcrum and directs the force against the opposing object, thus separating one from the other. The greater the curvature and distal inclination of the

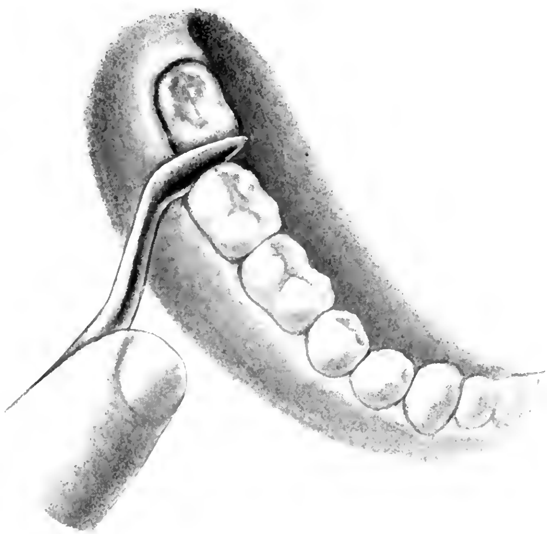


Fig. 134.—Same subject as Figs. 131, 132. Illustration shows the first extraction movement with the Lecluse elevator (Fig. 21) to remove an inferior third molar, the tooth being directed distally by turning the upper part of the blade of the elevator in that direction.

roots of an inferior third molar, the more favorable the tooth is to the application of the Lecluse elevator and the less favorable it is to the application of the forceps. Where the curvature and distal inclination of the roots are extensive, which is the most common condition of this tooth, the effect of the force thus applied is much the same as when a pinch-bar is used under a wheel to cause it to revolve. The curvature and distal inclination of the roots make the axis of the tooth describe a part of the circumference of a circle, and the force transmitted by the elevator turns the tooth out of its socket.

Where the crown of the third molar is of a small size, the Lecluse elevator should necessarily be used preceding the application of the forceps, as even this tooth may have roots distally inclined and of considerable size, and care should be taken to avoid fracturing them.

Where the soft tissue overlies the disto-occlusal surface of the third molar, care should be taken not to force the tooth too far distally during the extraction movements with the Lecluse elevator, as forcing the tooth too far in that direction will

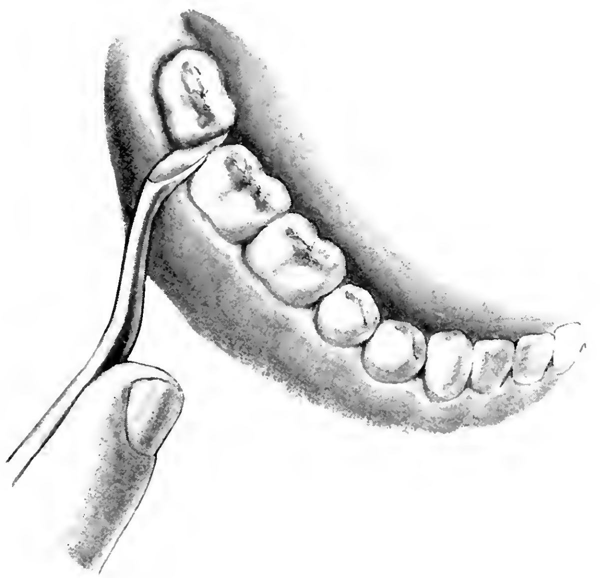


Fig. 135.—Same subject as Figs. 131, 132, 134. Illustration shows the second extraction movement with the Lecluse elevator (Fig. 21) to remove an inferior third molar, the tooth being lifted from its socket by turning the lower edge of the blade of the elevator distally and engaging the tooth at its neck.

make the subsequent application of the forceps more difficult if it is necessary to apply them to complete the extraction. Where it is found that the alveolus posterior to the tooth has been weakened by marginal caries, special precaution should be taken to avoid this occurrence. Where this tooth has been forced too far distally, the elevator is released from its adjustment on the mesial surface and applied to the distal surface, and the tooth is pressed mesially to a position where the forceps can be applied. If pressing the tooth mesially in this manner cannot be done with the elevator, it may be accomplished with a hook-shaped scaler, applying it to the distal surface of the tooth and pulling it forward.

Where, during the extraction movements with the Lecluse elevator, such resistance is encountered that the tooth cannot be loosened, the operator will be justified in concluding that the roots are not distally inclined, when the procedure will be to disengage the Lecluse elevator and apply Standard forceps No. 7.

Application of Forceps.—An application of the forceps is seldom made to an inferior third molar, when firmly attached to the tissues, until after it has been loosened with the elevator. Only in those cases where the roots are not distally inclined, or where the tooth is very loose and little resistance will be encountered, should the forceps be applied without the previous application of the elevator. As the roots of this tooth are usually curved and inclined distally, the application of the forceps where these conditions prevail without first loosening the tooth with an elevator is not good practice, as it is difficult in a majority of cases to execute any extraction movement with the forceps that will apply any great amount of force disto-occlusally or in the line of the tooth's least resistance, while force in this direction is readily transmitted with the elevator. Force applied in any other direction than in line with a continuation of the curvature of the roots must necessarily be more or less exerted transversely to their long axes, and, when thus applied with greater stress than the roots will withstand in a transverse direction, they will fracture unless the tissues surrounding them are weaker than the roots.

The extreme posterior location of the tooth, and in addition the gum tissue, cheek, and tongue, require that the application of the beaks of the forceps should be carefully and accurately made. As in the case of the first and second molars, one beak is first applied to the lingual surface of the tooth, followed by the application of the opposing beak to the buccal surface, care being taken not to seize any of the soft tissue in the beaks.

Alveolar Application of Forceps.—An alveolar application with the forceps should never be attempted when the alveolar process surrounding the tooth is normal. The buccal ridge is very heavy on that side of the tooth, and will not allow the beaks of the forceps to penetrate it. On the lingual side the process is somewhat lighter, and will allow an application of this kind to be made. Some operators advocate an alveolar application on the lingual side when considerable resistance is encountered, the beaks of the forceps being sent well down on the lingual plate, and the extraction movement is made forcibly toward the lingual side, taking with it a part of the process. This is not a good procedure to follow, and in most cases results in a fracture of the tooth, with considerable destruction of the alveolus, which should be avoided. If the forceps are to be used, a safer operation is to dissect away any of the alveolar process that may interfere with the application of the beaks of the forceps.

Extraction Movements.—After the tooth has been partially loosened with the elevator, and an adjustment has been secured with Standard forceps No. 7, the first extraction movement is to bring the tooth slightly to the lingual side, after which it is directed posteriorly, if possible, as far as the curvature and distal inclination of the roots demand, and then upward out of the socket. If any resistance is experienced while the tooth is being carried out of its socket with the forceps, the operator's acute sense of touch should indicate to him the direction of least resistance. While the least resistance is usually disto-lingually, it is not always the case, and the force of the tractile movement should be in the direction that offers the least resistance. Caution should be exercised not to cause a fracture of the roots of this tooth during the tractile movement by applying too much force in any direction, as they are frequently of small diameter, especially in the apical third, and may curve in any direction.

Where the application of the Lecluse elevator has revealed the fact that the roots of an inferior third molar are not distally inclined, and Standard forceps No. 7 have been applied to extract the tooth, they are sent down on the tooth with a firm, heavy pressure, and the tooth is carried slightly lingually. If the roots are straight, this movement should loosen the tooth from its attachment, when the extraction is completed by the tractile movement upward and in the direction that offers least resistance. If, however, the tooth is not loosened or slightly raised out of its socket by this movement, the beaks of the forceps are sent further down on the tooth, and the movement repeated until the tooth is sufficiently detached to be delivered from its socket.

Occasionally the operator will be confronted with a peculiar condition after the tooth has been loosened with the Lecluse elevator and has been partially raised from its socket. When the beaks of the forceps have been securely adjusted to the tooth, it may be impossible to execute any extraction movement to deliver it from its socket. The tooth has a tendency to move back to its original position, and usually does return to that position if the roots are fused, curved, and inclined distally to a marked extent. In such case a forcible extraction with the forceps should not be attempted, as it would cause the tooth or lingual plate to fracture. The tooth should be released and the Lecluse elevator reapplied, and the extraction movement made by turning the upper edge of the blade of this instrument distally, so as to dislodge the tooth in that direction. This movement is repeated if necessary, sending the blade further down on the tooth with each succeeding turn, until the tooth is entirely liberated from the socket. This method of operating when this condition is presented is a far safer procedure than an attempted forcible extraction with the forceps.

The condition described above must not be mistaken for one occasionally presented in which one or both of the roots form a curvature and then converge so as to closely approximate or be entirely united at their termini, and the septum is inclosed in the eyelet thus formed. In such case there is not the same tendency for the tooth to return to its original position after it has been loosened and the forceps have been applied as in the former instance, and, when this condition is encountered, the extraction is completed with the forceps, combining a short, swaying movement in the direction of least resistance, which is usually distolingually, with a forcible but firm tractile movement. When the tooth has been lifted a short distance from its socket, the forceps are reapplied as far down as possible, and the extraction movements and reapplications are repeated until its delivery is completed.

In the extraction of an inferior third molar, no attempt should be made to force the tooth buccally, as is done with the first and second molars, as the bony structure on the buccal side of the third molar is too rigid to permit a successful movement in this direction.

Displacement—*Complete Lingual.*—Where this tooth is completely displaced to the lingual side of the arch, a condition that is less frequent with this tooth than a complete buccal displacement, the operation for its removal should be carefully executed to avoid injury to the tongue and other soft tissues that closely approximate it on the lingual side. Fig. 136 shows a dry specimen of a complete lingual displacement, with the alveolus partially overlying the occlusal surface of the tooth. The removal of the alveolus in advance of the application of any instrument for the extraction of the tooth is the correct procedure, as the

Fig. 136.—An inferior third molar completely displaced to the lingual side of the arch, with the alveolar process partially covering the occlusal surface.

alveolus interferes with the releasing of the tooth. When the process has been removed with a bur, or if the case is one of complete eruption and this preliminary procedure is not necessary, the modified Lecluse elevator is applied to the mesial surface of the third molar, the second molar or the alveolus is engaged as a fulcrum, and the blade is turned so as to force the tooth slightly distally. At this juncture the forceps are applied, and, as it is impossible to use Standard forceps No. 7, Standard forceps No. 4 or No. 2 are selected. For the application of either of these forceps the operator assumes a position at the side of the patient opposite to the one where the tooth is located, as when operating on a bicuspid similarly displaced. When the forceps have been applied, the extraction movement should be made with a pressure slightly lingually and then distally, repeating these movements, if necessary, until the tooth has been sufficiently loosened to be delivered from its socket.

Complete Buccal.—Where this tooth is completely displaced to the buccal side of the arch, it is impracticable to employ either Standard forceps No. 7 or No. 6, or to apply the Lecluse elevator for its extraction. Cases of this character formerly gave the author considerable concern on account of the difficulty of gaining access and properly adjusting an instrument whereby the operation for the removal of the tooth could be undertaken with a reasonable degree of certainty as to results, but since designing the elevator shown in Fig. 18 satisfactory results are obtained with this instrument in the operation for the extraction of an inferior third molar when so displaced, while the laceration of the tissues and the possibility of accident are reduced to a minimum. In the use of this instrument for the removal of a third molar in this position, the first step in the procedure is to examine the soft tissue which usually partially overlies the occlusal surface, after which the mesial surface is examined to ascertain the practicability of applying the blade of the elevator on that side. As a rule, such an application can be made, but, in case the alveolar process interferes, it is dissected away sufficiently to allow the application. It is seldom necessary to cut away any of the soft tissue previous to operating, as it does not materially interfere with the application of the instrument. The blade of the elevator is introduced, and presses away the soft tissue from over the occlusal surface of the crown in the same manner as is done with the beaks of the forceps where they are applied to a root that is covered with gum tissue. When the blade of the elevator has been properly applied to the mesial surface (Fig. 137), the necessary pressure downward is exerted —if necessary, cutting through any alveolus that may interfere —and the blade sent down to a point where a firm adjustment is had. When such adjustment has been obtained, the upper end of the handle of the elevator is turned mesially, the alveolar process anterior to the tooth being used as a fulcrum, which is dense enough in this region to bear the strain. This procedure will loosen the tooth sufficiently to allow the blade to be sent further down on the tooth, when the handle is again turned mesially, which will, as a rule, release it from the socket. If, however, the tooth is not entirely liberated, it will be loosened and raised from its socket to such an extent that one of the Standard forceps, the particular one to be used depending on the condition presented, may be adjusted and the extraction completed, care being taken in the application of the forceps not to injure the cheek.

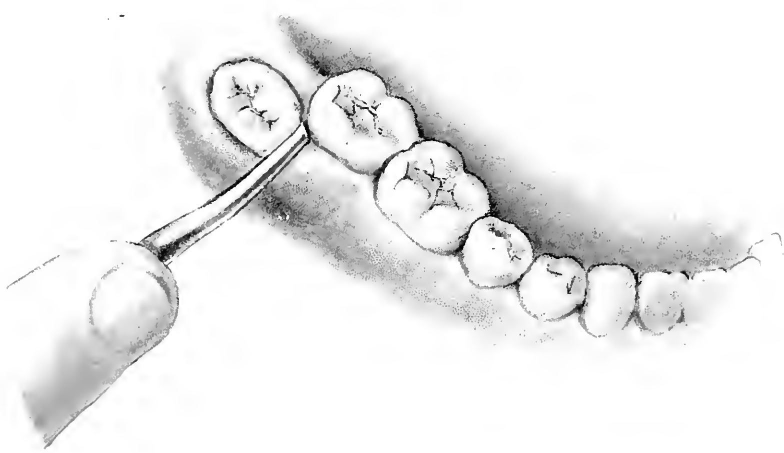


Fig. 137.—An inferior third molar completely displaced to the buccal side of the arch. Illustration shows the application of the author's lower root elevator No. 1 (Fig. 18) to the mesial surface of the tooth.

Partial Lingual.—Where the inferior right third molar is partially displaced lingually, the same technic of applying the Lecluse elevator for its extraction is used as that given for the tooth in alignment (page 263). Where the inferior left third molar is displaced lingually in the same manner, it is frequently impracticable to apply the modified Lecluse elevator from a position on the right side of the patient, as described (page 262), and in such case the operator changes his position to the left of the patient and applies the Lecluse elevator from that side in the usual manner. In other respects the method of operating on the inferior third molar in partial lingual displacement is the same as on one in alignment with the second molar.

Partial Buccal.—Where the inferior left third molar is displaced buccally, one-third to one-half of the crown being out of alignment, the modified Lecluse elevator is used in the same manner as when the tooth is in alignment (page 262). Where the tooth is on the right side, the operator assumes a position to the left of the patient, and uses the modified Lecluse elevator from that side in the same manner as when the tooth is in alignment. If the tooth cannot be entirely removed with an elevator, the forceps are applied to complete the operation, the method of their use being the same as is employed where the tooth is in normal position.

Crown Distally Inclined.—Where the tooth is in alignment, but its crown is directed distally, the operator should follow this inclination in the extraction movements that are to be made with the Lecluse elevator, aiming to direct the tooth more distally by continued reapplication of the instrument. This procedure will dislodge the tooth and prevent fracture of the roots, as in such case the roots are usually inclined in the same direction as the crown.

Extensive Caries—*Buccally.*—Caries on the buccal surface of this tooth is common, and, when present, does not as a rule greatly complicate its extraction. The Lecluse elevator is applied to the mesial surface of the tooth as though no caries exists (page 260). Where caries is extensive, the operator should endeavor to remove the tooth entirely from the socket with the Lecluse elevator, so as to avoid the necessity of applying the forceps. When, however, it becomes necessary to use the forceps, the buccal beak is first applied, care being taken to place it as far down as possible on that surface, and the usual extraction movements are employed for the removal of the tooth.

Lingually.—Where this tooth is attacked by caries on the lingual surface, the beak of the forceps should not be applied to this surface until after the tooth has been loosened with the Lecluse elevator, care being taken that a firm grasp is obtained with the forceps on the buccal surface also, as the first extraction movement is made forcibly to the lingual side. and it is important that the beak engaging the lingual side retains its position, or a fracture will usually result.

Mesially.—Where the seat of caries is on the mesial surface, and the mesio-buccal wall is the stronger, the Lecluse elevator is applied from the buccal side; but, if the mesio-lingual wall is the stronger, the modified Lecluse elevator is applied from the lingual side. In most of these cases it is advisable to secure an adjustment on the neck or mesial root of the tooth, and not depend on the crown for support.

Where the mesial surface is involved by caries to such an extent that it is fragile, and not strong enough to support the Lecluse elevator, the instrument should be applied to the buccal surface if that wall remains intact. In making this application, the flat side of the blade is applied to the buccal side of the tooth, and sufficient pressure is exerted to send the blade below the free margin of the gum and down between the marginal edge of the alveolus and the tooth, when the handle of the elevator is brought with some force downward and buccally, the alveolus, which is heavy on this side, serving as a fulcrum. This movement will direct the tooth disto-lingually and raise it partially out of its socket, when the blade is sent down into the space gained and the handle is again directed downward and buccally, after which, while retaining a secure application of the instrument to the tooth, pressure is exerted disto-lingually. This method of operating, if properly executed, should release the tooth to such an extent that the forceps may be applied to complete the extraction.

Distally.—Where this tooth is attacked by caries on the distal surface, with a reasonably strong mesial half of the crown remaining, the technic of applying the Lecluse elevator is the same as though no caries exists (page 260). After the tooth has been loosened or partially brought out of the socket with the elevator, the forceps are carefully applied, the operator using Standard forceps No. 7 or No. 6, depending on the size of the remaining part of the tooth. Where the cavity is large and the crown considerably weakened, the blade of the elevator is applied to the neck or even to the mesial root of the tooth, as reliance should not be placed on the crown to withstand the force necessary for the extraction.

Two Roots United—*Elevator Indicated.*—Where only the roots of this tooth remain, and they are still united or fused into one root, are of fair size and reasonably sound, and are firmly attached to the tissues, the Lecluse elevator is employed for their removal. When applying this instrument, the blade should be sent with sufficient pressure between the second molar and the mesial root to carry it to a point where a good adjustment is had on the sound structure of the root before the extraction movements are attempted. When the roots are not entirely liberated by this procedure, Standard forceps No. 7 or No. 6 are used to complete the extraction. If the mesial root is so fragile that the blade of the Lecluse elevator (Fig. 21) cannot be securely adjusted to it, the author's lower root elevator (Fig. 18) should be used. The blade of the latter instrument is sent into the interproximal space, and, if necessary, the blade cuts a short distance into the alveolus in order to gain a firm adjustment. The upper end of the handle is then turned mesially, which will cause the point of the blade to engage the root, which movement will usually release the roots. If resistance is still encountered, the application of the blade and turning of the handle are repeated until the extraction is completed. The roots will usually leave the socket together, but, if they become separated, the mesial root will be released. Where the distal root remains, the blade of the author's lower root elevator is inserted into the socket of the extracted mesial root, and the blade is sent as far down as possible on the mesial surface of the distal root. As the blade of this elevator is rather large, the second molar can be utilized as a fulcrum, when the handle is turned mesially with sufficient pressure to engage the distal root and lift it from its socket.

Forceps Indicated.—Where the roots are united or fused, and are not firmly attached to the tissues, Standard forceps No. 7 or No. 6 may be used to extract them. This method of procedure is favored where the forceps can be used successfully for their extraction, especially when the same forceps are to be used to extract one or more teeth anterior to this one at the same sitting, and the operator desires to avoid the loss of time required to change instruments. When the beaks of the forceps are applied, a firm, steady downward pressure will usually release the roots on the initial application. If, however, the roots are not released, the extraction movements described when the crown is intact (page 267) will detach them.

Two Roots Separated—*Elevator Indicated.*—Where only the roots of this tooth remain and are separated, are of fair size and accessible, and are firmly attached to the tissues, they are extracted by the application of the Lecluse elevator to the mesial root in the same manner as when the roots are united (page 273). If the distal root is in close proximity to the mesial root, frequently the carrying of the latter root distally in its extraction will release the former. If the distal root is not released with the mesial root, the elevator is applied to the mesial surface of the distal root to dislodge it, as described (page 263).

Where the mesial root is fragile on the mesial side, and the distal root is in close proximity to that root, the author's lower root elevator should be adjusted between the two roots, and the mesial root or the septum used as a fulcrum to dislodge the distal root, after which the mate to the elevator is inserted into the empty socket, and the blade is adjusted to the distal side of the mesial root for its extraction.

Forceps Indicated.—Where only the roots of this tooth remain and are separated, are accessible, and are not firmly attached to their tissues, Standard forceps No. 6 may be applied as described when the roots are united (page 274), applying the forceps first to the stronger or more accessible root.

Single Root.—Where only one root of this tooth remains, and it is the mesial root, if of fair size and firmly attached, the Lecluse elevator is applied as described for the extraction of the mesial root when both roots are separated (page 273); or, if the remaining root, whether mesial or distal, is not firmly attached, Standard forceps No. 6 may be employed for its extraction, provided application to it can be made with them.

Roots Covered by Gum Tissue.—If one or both roots remain, and the gum tissue covers them, the operator should not attempt to apply any instrument for their extraction until after he has learned the size and position of the roots and their relation to the tissues. In such case the explorer should be introduced below the soft tissue, and, if possible, the desired information obtained by a careful examination. If it is impossible to make an accurate diagnosis by explorative examination, a radiograph should be secured, especially where a previous attempt to extract the roots has been made. If in such case the application of an instrument is attempted without first procuring a radiograph of the parts, the accuracy of the application will be in doubt, and a failure to extract the roots will likely be the result, especially if they lie in a horizontal position, or if they impinge on the distal root of the second molar.

Where the examination shows that the roots are not inclined from their normal position, and a good adjustment can be made with the Lecluse, author's lower root, or Cryer elevator, the elevator most suited for the particular case is selected, and it is applied by the method indicated for operating on a similar root with the field of operation exposed, using the lancet to sever the parts only when it is necessary to permit an application of the instrument or to allow a free exit of the root from its socket.

Where a radiograph shows that the roots are not favorably situated, and impinge on the distal root of the second molar, or are in a horizontal position, the same technic of operation is applied as when the tooth is impacted in a similar position.

Screw-Porte.—The screw-porte cannot be used in connection with the extraction of this tooth, as it is impracticable to use the instrument on account of the curvature of the roots and the extreme posterior position of the tooth.

Fracture.—A fracture of this tooth in an endeavor to extract it is of quite common occurrence, and is sometimes unavoidable, as its abnormalities are numerous and the pathologic conditions of the tooth and tissues are varied, and these factors, combined with the peculiarities of mouth and individual, make an almost unlimited number of difficulties to be overcome in its successful extraction in all the cases presented.

Where a fracture of the crown occurs, the operator should quickly determine whether he can reapply the elevator to complete the extraction, as time and inconvenience is saved if this can be done and the instrument reapplied before the hemorrhage obscures the remaining part of the tooth. Usually the elevator can be successfully reapplied in such case, and the extraction completed as though the accident had not occurred. Where such fracture occurs, the operator is often tempted to apply the forceps, but this is not a good procedure, for, if the forceps were not indicated before the fracture, they are seldom indicated after the fracture. If the hemorrhage has obscured the parts and the operator is uncertain as to the condition of the structure remaining, the parts should be freed of blood with absorbent cotton and carefully examined. If the remaining part of the tooth is normally situated, and there is sufficient structure to permit the Lecluse or author's lower root elevator to be applied to the mesial surface, such application should be made. If, however, the alveolus interferes with the application of the elevator at this point, a part of it anterior to the tooth is cut away with a fissure bur, so that a reapplication of the elevator can be made to complete the extraction.

Where the fracture extends quite a distance down on the mesial surface, and the parts are firmly attached, an adjustment of the blade of the elevator to that surface is often impracticable. In such case the operator should examine the buccal surface, and, if it is found firm and the alveolus does not project beyond the part remaining on the buccal side, the Lecluse elevator should be applied to this surface and the tooth extracted by the method described when the mesial surface is extensively attacked by caries (page 272). If this method of operating is impracticable, the process should be dissected away, preferably on the mesio-buccal side, and the Lecluse or author's lower root elevator adjusted to that side to effect the delivery of the parts remaining.

If the fracture involves the mesial and buccal sides to such an extent that an application of the elevator cannot be made on these sides, the operator should examine the alveolus on the lingual and distal sides for an adjustment. Occasionally the fracture will extend diagonally across the tooth, the lingual or distal wall remaining well above the process, while mesially and buccally it has extended for quite a distance below the process. When this occurs, the modified Cryer elevator can often be applied to the lingual or distal wall and enough leverage obtained to loosen the parts. All other conditions being equal, the side affording the better access, adjustment, and fulcrum is selected; but, if the roots are considerably curved and incline distally, the distal application is preferred, while the lingual application is best suited for a tooth with straight roots and little distal inclination. In either application the process on the side of the application is utilized as a fulcrum, and the point of the elevator is forced between it and the tooth, being turned so that the point of the blade engages the root. If a lingual or distal application of the modified Cryer elevator is not practicable, the roots, if fused into one, are removed by cutting away the alveolar process before applying the elevator. If an examination indicates that the tooth has two roots, and they can be separated, a division is obtained by using a bur, as described when separating the roots of the first molar (page 244) in which case the author's lower root elevator is adjusted to the mesial surface of the distal root, using the mesial root as a fulcrum, and the root is dislodged distally. When the distal root has been extracted, the mate to the elevator is introduced into the empty socket and applied to the distal side of the mesial root, which is then dislodged by turning the upper end of the handle distally.

Where the fracture occurs below the alveolar process, but the alveolus surrounding the tooth has been weakened by caries, and the remaining fractured part is of considerable size, the author's lower root elevator is applied to extract the tooth, as the blade of this instrument is sharper than that of the Lecluse elevator, and can cut through any diseased alveolus that it may be necessary to penetrate in order to obtain an adjustment to the fractured part of the tooth.

Single Root Remaining.—Where only one root remains and it is the mesial root, the Lecluse elevator, if it can be securely adjusted, is applied. If, however, the mesial root is so located that the Lecluse elevator cannot be applied, the author's lower root elevator is introduced into the empty socket and the blade engages the distal side, using the alveolus as a fulcrum. If the distal root remains, the author's lower root elevator is applied to its mesial side by introducing the blade into the socket of the mesial root. Where the part is not very large, the modified Cryer elevator is favored, and is applied in the same manner as the author's lower root elevator. Where the root is so deeply seated that a firm adjustment cannot be obtained with the elevator, sufficient alveolus must be cut away from the root to permit the adjustment of this instrument and allow the leverage necessary to release the tooth from its attachment.

Application of the elevator to a root must be made in such manner that it may be carried from its socket in the direction of its axis, and, as the roots of an inferior third molar are prone to take a position in the tissues at nearly any angle of inclination, great care must be exercised in their extraction and no attempt should be made to perform the impossible. To illustrate this statement, a case is presented from the practice of the author, as follows:

After the fracture the socket was cleared of blood with absorbent cotton and the root located. Examination of the extracted tooth and the part remaining in position showed that the root was markedly inclined distally and lay in an almost horizontal position. To apply the blade of the elevator below or to the side of the root to release it was not practicable, as the process over it would prevent its delivery. The root was exposed by burring away a small portion of the alveolus overlying it. The blade of the modified Cryer elevator was applied in such manner that its sharp point penetrated the root from its upper side, after which the root was brought mesially with some degree of force in line with its inclination and carried out of its socket. No attempt was made to carry the root upward, as this would have been an impossibility.

Roots Deeply Seated.—Where small parts of the apical ends of the roots are *in situ* and are deeply seated in the tissues as the result of a fracture, they should be allowed to remain if they are not the exciting cause of some pathologic condition; but, if a pathologic condition exists, these parts must be removed. The socket should be cleared of blood, and the soft tissue sufficiently dilated to allow an examination to be made for the purpose of locating the parts. When the parts have been located, the method of operating should be carefully outlined in advance so as to remove them with as little destruction as possible of the adjacent tissues, and with as few attempts to release them as conditions will permit. The preferred method in such case is to use the modified Cryer elevator to effect their delivery. The blade of this elevator is forced between the remaining roots and the alveolus, and the handle turned to dislodge them. If, however, this instrument cannot be adjusted so as to engage the roots, they should be cut out with a bur, as this method is preferable to any other procedure that may cause extensive laceration of the surrounding tissues.

Isolated Tooth—*Crown Intact.*—Where this tooth is isolated (Fig. 138) and extraction is indicated, the operator is warned against the immediate application of the forceps if the tooth is firmly attached to its supporting tissues, as the alveolar process is, as a rule, very dense around such a tooth, and this, with the usual distal inclination of the roots, would predispose the neck or roots to fracture. The many cases of failure in the attempted extraction of such a tooth that have come under the observation of the author has led him to conclude that it is a common practice in such cases to apply the forceps without a previous application of the elevator. The operative procedure in this case differs from that described where the second molar can be used as a fulcrum, as the operator must depend on the alveolar process anterior to it for a fulcrum. The author's lower root elevator (Fig. 18) is the instrument indicated for preliminary application.

Fig. 138.—An isolated inferior third molar.

The blade of the elevator is applied to the mesial surface of the tooth (Fig. 139), and is sent between the free margin of the gum and the tooth to the margin of the alveolar process. If a good adjustment can be obtained at this point, the extraction move-

Fig. 139.—Same subject as Fig. 138. Illustration shows the application of the author's lower root elevator No. 1 (Fig. 18) to the mesial surface of the tooth.

ments are immediately begun. If, however, the tooth cannot be properly engaged with the point of the elevator, or the process does not serve as a suitable fulcrum, the pressure on the blade is increased so as to cut through the process to provide a firm support. The extraction movements are then executed by turning

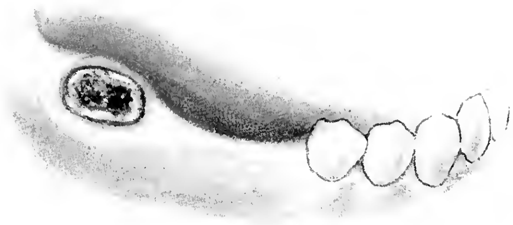


Fig. 140.—An isolated inferior third molar, with the crown destroyed by caries.

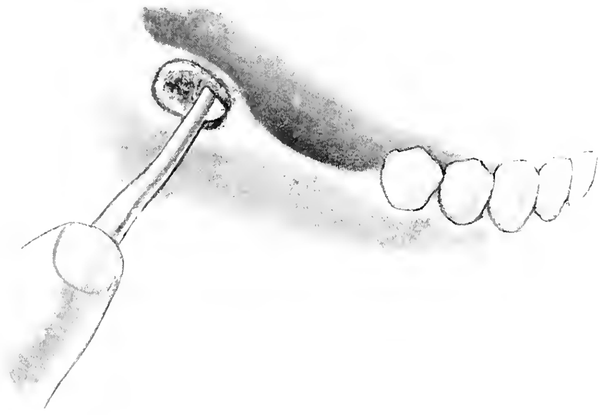


Fig. 141.—Same subject as Fig. 140. Illustration shows the application of the author's lower root elevator No. 1 (Fig. 18) to the mesial surface of the tooth.

Fig. 142.—Same subject as Figs. 140, 141. Illustration shows the tooth partly delivered from its socket with the elevator.

the upper end of the handle mesially with a force varying with the rigidity of the tooth's attachment. This will send the point of the blade into the tooth, and a repetition of these movements will raise the tooth out of the socket so that the extraction can be completed with the forceps.

Crown Destroyed.—Where the crown of an isolated third molar has been destroyed by caries and only the roots remain, the gum tissue usually covers them partially or completely. The application of the forceps in such case would be extremely difficult, and could not be made without considerable laceration of tissue. In addition, a certain amount of guesswork would attend the application, and probably several attempts would be necessary before a satisfactory adjustment could be made. As the process is frequently very dense around such roots, and, unless this process has been weakened by caries, it is frequently impossible to secure an adjustment with the forceps that will deliver the roots. In a case of this kind the result of the operation will be surer if an elevator is used before the application of the forceps. Where the entire crown is destroyed, leaving only the roots (Fig. 140), the author's lower root elevator is applied to the mesial side (Fig. 141), and the blade is sent between the root and gum tissue with sufficient force to cut through, if necessary, enough of the alveolar process for the point of the instrument to engage the root. When this has been done, the process anterior to the tooth is used as a fulcrum and the top of the handle of the elevator is turned mesially, which will prize the tooth from its socket (Fig. 142). If the extraction is not completed by this operation, the attachment of the tooth will have been sufficiently broken up and the parts elevated from the original position enough to allow them to be readily removed with the forceps.

CHAPTER XI.

EXTRACTION TECHNIC OF IMPACTED INFERIOR THIRD MOLAR.

The inferior third molar is impacted more frequently than any other tooth, and, when extraction is indicated, the selection of the correct operative technic necessary for its removal demands good judgment and the execution of the technic requires considerable skill. The removal of this tooth is strictly a surgical procedure, and should be executed in a manner not to disturb the second molar or to cause unnecessary injury to the associated tissues. Any pathologic condition of the surrounding structures that may be associated with this tooth when impacted should be taken into consideration preceding, during, and following the operation.

To alleviate the pain caused by the tooth, and quite frequently to avoid operating where an operation is indicated, the tissues overlying the occlusal surface, when in an inflammatory condition, are irrigated with antiseptic solutions, and such medicaments as iodin, aconite, campho-phenique, or nitrate of silver are applied. In case of the first attack, temporary relief will usually be obtained by this form of treatment, but, where a number of such attacks have occurred or where suppuration is established, little or no relief may be expected from such application. The tissues about the tooth are severed with a lancet also in an endeavor to relieve the condition, but this usually increases the trouble and affords a favorable field for infection.

To postpone the removal of this tooth when it is a source of irritation to the patient, and the conditions cannot be corrected except by its removal, only tends to complicate the operation for its ultimate extraction.

The extraction of the inferior second molar is advocated by some operators to relieve the pain caused by an impacted third molar. The author does not favor sacrificing the second molar in such case, although it is a comparatively simple procedure to extract that tooth. When such extraction is made, it is more frequently a failure than a success so far as obtaining the desired relief is concerned, and, moreover, the subsequent extraction of the third molar may be found necessary. It is therefore better to remove the involved third molar at the outset, and leave a good second molar to perform its function. Some operators extract the inferior second molar to obtain space through which to remove the third molar when it is impacted, but this unnecessary destruction of a valuable organ of mastication cannot be too strongly disapproved, and such a procedure is not countenanced in the practice of the author, as the impacted third molar can be removed without disturbing the second molar.

The superior third molar is also extracted by some operators with the object of relieving the pain from the impacted inferior third molar under the impression that the removal of the superior molar will avoid pressure on the tissues over the impacted tooth, or that the inflammatory condition of the tissues buccally and distally of the inferior third molar is due to injury inflicted on them by the superior third molar. This may give temporary relief in some cases, but is seldom effective, as there would be no pressure on the tissues about the inferior tooth if the parts were not inflamed, and, as the inferior third molar is the source of the inflammation, either by direct irritation or by leaving the tissues about it in a condition to retain debris and thus invite infection, the extraction of the inferior tooth is necessary to remove the cause and relieve the malady.

Several methods have been devised for removing an inferior third molar when it is impacted by its crown impinging on the distal surface of the second molar. One method is to fasten a metal band, with a spur attached to its disto-buccal or disto-lingual side, around the second molar, and place a metal ligature around the third molar, drawing the ligature taut over the spur in an endeavor to raise the third molar. The ligature is drawn taut each day until the third molar has been raised far enough from its abnormal position below the second molar to allow it to be extracted without interference from the latter tooth. Another method is to fasten a metal band on both second and third molars, and place a jackscrew between these teeth, the ends of the jackscrew being adjusted respectively against the band of the second and third molar. The jackscrew is lengthened each day until the third molar is forced distally far enough to relieve its impingement on the second molar. Either of these methods is not practicable, and can be used only where the roots of the third molar are short, or where there is not too great an impingement on the second molar. If the associated tissues are in an inflamed state, such procedure will cause an excruciating pain that cannot be endured by the patient. The better procedure is to remove the tooth by a surgical operation, and avoid the danger of increased inflammatory conditions that may arise as a result of the delay caused by completing the operation by any of the methods mentioned.

ETIOLOGY.

A careful examination should be made to determine the cause of the impaction, which is probably due more frequently to heavy gum tissue overlying a part or the whole of the occlusal surface of the tooth, but is sometimes caused by the superior constrictor muscle of the pharynx or by the buccinator muscle. The origin of these muscles, especially the buccinator, may extend well up on the alveolar surface of the body of the mandible at and forward of the angle formed by it and the anterior border of the ramus, and have their attachments directly over the parts of the bone that is being displaced by the erupting third molar. When this occurs, it is not uncommon for muscular fibers to pass over the occlusal planes of the tooth, carrying with them a mass of mucous and submucous tissue which is abundant in this region, and, being drawn taut into the sulci of the tooth by its eruption, most effectually ligate the tooth in the position it has taken soon after it has emerged from the bony structure.

Other causes of impaction are: (1) where the alveolar process extends over parts of the occlusal surface of the tooth; (2) where a dense ledge of bone projects over the disto-occlusal surface of the tooth; (3) where the tooth is so far imbedded in the body of the mandible that little or no alveolar structure is formed about it, the forces of development being insufficient to overcome the resistance offered by the bony structure; (4) where the third or second molar is in malposition and there are abnormalities in the form of either of these teeth, as when the crown of the second molar is unusually large in its middle diameter compared with its gingival diameter and engages the third molar below this projection; (5) where the approximating surfaces of the second and third molars are broad and flat instead of the oval shape peculiar to normal teeth, which condition may compel the sliding of one broad surface over the other to complete the eruption of the third molar; (6) where there are supernumerary teeth about the third molar; and (7) where there is not sufficient space between the second molar and the ramus to allow the passage of the third molar.

HISTORY AND NATURE OF THE OPERATION.

A history of the case should be obtained prior to operating on an impacted inferior third molar. The patient should be questioned as to the duration of the existing condition and any previous disturbance that may have been caused by the tooth, the frequency of the attacks in the region of the tooth, and the duration and severity of these attacks. As far as possible, the extent of the inflammation at previous attacks should be ascertained, and it should also be learned if any previous attempt has been made to extract the tooth. Frequently a patient is under the impression that the operative procedure of extracting an impacted inferior molar is similar to extracting any other tooth. Where this idea prevails, and if the operation is expected to be complicated, the operator should explain to the patient before extraction the character of the operation, using, if convenient, a dry specimen or a picture of a similar case for the purpose of illustration. If such an explanation is not made, and the operation consumes considerable time, causing a greater disturbance of the tissues, followed by more pain than is usual with ordinary extractions, the patient may become apprehensive, as perhaps on a former occasion the patient had some other tooth extracted and the operation was a very simple procedure, or some friend may have had a third molar removed with little difficulty.

OPERATIVE TECHNIC.

In giving the operative technic for the removal of the numerous forms of impacted third molars in the various conditions surrounding them, the most practical procedures have been assigned for the different cases presented. Numerous cases of common occurrence are described and illustrated in such manner that each step in the technic of the operation may be thoroughly understood and followed. To simplify the presentation of this subject, impactions are classified as partial and complete. While it may not always be possible to assign each individual case with certainty to the class to which it belongs, owing to the different phases of the numerous cases presented, a careful study of the conditions surrounding each case will usually present enough similarities to permit a proper classification, and thus enable the operator to more readily outline the plan of operation.

PARTIAL IMPACTION.

A partial impaction refers to that class of cases where the tooth is not deeply seated in the tissues, and where the position of the crown and its relation to the surrounding structures can usually be determined by an explorative examination, as where the eruption is retarded a short distance from what would be the normal position of the tooth by the soft tissues, osseous structures, or supernumerary teeth, or where, in case of malposition, the tooth impinges slightly on the second molar.

Diagnosis.—A correct diagnosis preceding the operation is a very important matter, as the operative procedure will be governed by existing conditions, and a correct knowledge of these conditions in each case should be obtained as a guide in properly determining the technic of the operation. The operator, by examining the part of the crown that is visible, notes the position of the tooth as compared with what would be its normal position if fully erupted, and ascertains whether it impinges on the crown of the second molar, determining at the same time whether the gum tissue, when it partially overlies its occlusal surface, should remain undisturbed or whether it will be necessary to make an incision before applying any instrument to remove the tooth. The probable presence of foreign bodies or supernumerary teeth should be determined; the alveolar process should be examined to ascertain if it is in a healthy condition; the interproximal space is investigated to learn whether the blade of the Lecluse elevator can be applied between the second and third molar; and the second molar, if it is in alignment, is examined with a view of using it as a fulcrum. If the operator is unable to satisfy himself as to the position of the tooth and the surrounding conditions by an explorative examination conducted without injury to the parts, a radiograph should be obtained.

Anesthetic.—The selection of a suitable anesthetic should be made, as, in order that the operation may be successfully executed, a secure adjustment of the instrument is essential, and, after the adjustment has been made, the operation must proceed without any interference on the part of the patient. Securing a proper adjustment of the instrument for the extraction, especially where the associated tissues are in an inflammatory condition, will inflict considerable pain. In such case a local anes-

Fig. 143.—A dry specimen of two partially impacted inferior third molars.

thetic is not always satisfactory, and it is advisable to administer a general anesthetic—preferably nitrous oxid and oxygen.

Partial Impaction—*By Soft Tissue.*—The soft tissue, which is more frequently the cause of a partial impaction than any other factor, will often, when it is heavy and resistant over the occlusal surface of this tooth, retard it at a short distance from its normal position (Fig. 143). This tissue, which is not shown in the illustration, will, when in the shape of a loose flap, often form pockets for the reception of debris, which will continually irritate the tissue surrounding the tooth, and in most cases this condition, if of long standing, can be relieved only by extraction.

Where the examination shows that the crown of the tooth is assuming a normal position, but its occlusal surface is slightly lower than the occlusal surface of the second molar, and the gum tissue, in the form of a loose flap, partially overlies the disto-occlusal surface, no attention should be paid to the soft tissue, and extraction should be performed in the same maner as where the tooth is in normal occlusion.

Frequently the soft tissue, when it overlies the major position of the occlusal surface, can be easily displaced, and does not greatly interfere with the application of the elevator and the raising of the tooth to a point where the forceps can be adjusted without interference from the tissue. In such case, as when the tissue partially overlies the disto-occlusal surface, the elevator is

Fig. 144.—Model of a partially impacted inferior third molar. The gum tissue is firmly adherent about the crown.

applied without severing this tissue with a lancet previous to the application. If, however, it is observed that the tissue is firmly adherent about the tooth (Fig. 144), and will interfere with the application of the instruments and the extraction, the lancet should be used, starting the incision at the contact point with the second molar at about the center of the occlusal surface and incising distally far enough to expose the entire crown. In some cases, where the tissue is dense around the distal side, it is advisable to partially sever the tissue from that surface. If the operator, while dislodging the tooth, and not having previously lanced the tissue, observes that the tissue interferes with the delivery of the tooth and is liable to be lacerated, he should release the instrument and sever the tissue from about the tooth sufficiently to allow it to be released without causing unnecessary injury to the parts.

Where the crown of the third molar is slightly lower than that of the occlusal plane of the second molar and is inclining distally, with the soft tissue partially or completely covering the third molar, the method of operating for its removal is the same as for a like condition of the tooth not covered by soft tissue (page 272). In such case the lancet should be applied, especially on the distal side, prior to adjusting the elevator to free the parts of this tissue, so that there will not be any interference from it during the extraction movements.

By Osseous Tissue.—In addition to the eruption of the tooth being retarded by the soft tissue, the bony tissue also will retard its eruption and interfere with the application of an instrument for its extraction, especially where the alveolus extends over the occlusal surface. In such case the alveolus should be cut away

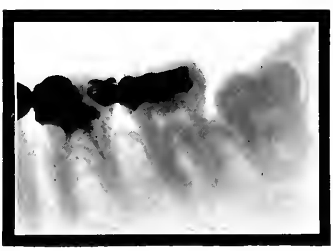


Fig. 145.—Radiograph of a partially impacted inferior third molar. The tooth is retarded a short distance from its normal position by the osseous tissue over its disto-occlusal surface. The third molar is not in contact with the second molar.

from over the occlusal surface with a bur or chisel, care being taken to remove enough process to insure extraction, which is then made in the same manner as though the tooth had not been impacted by the process.

An interesting case, and one not frequently presented, is shown in Fig. 145. In this case the alveolar process overlies the disto-occlusal surface of the crown, and there is no contact of the third molar with the second molar. In such case the elevator should not be used, as its use would only force the tooth against the hard tissues on its distal side, and the tooth could not be carried from its position in this direction. The removal of such a tooth is accomplished by cutting away all process over the occlusal surface and enough on the lingual and buccal surfaces to permit Standard forceps No. 7 (Fig. 8) to be applied to the tooth. When the forceps have been adjusted, a slight movement to the lingual side is made, followed by a forcible tractile movement to deliver the tooth from its socket.

Where both the gum tissue and alveolus overlie the crown, and the tissue has been incised and the alveolus removed in the man-

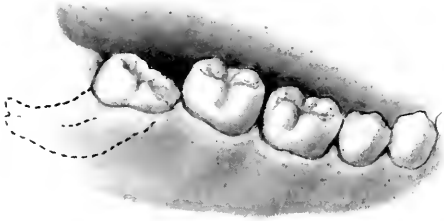


Fig. 146.—A partially impacted inferior third molar. The impingement of the impacted third molar is on the neck of the second molar. The disto-occlusal surface of the crown is free of both soft and hard tissue.

ner described above, but the tooth is affected by caries on any of its surfaces, the operation for its removal is the same as that applicable for the removal of an inferior third molar in a similar condition of decay and as previously described.

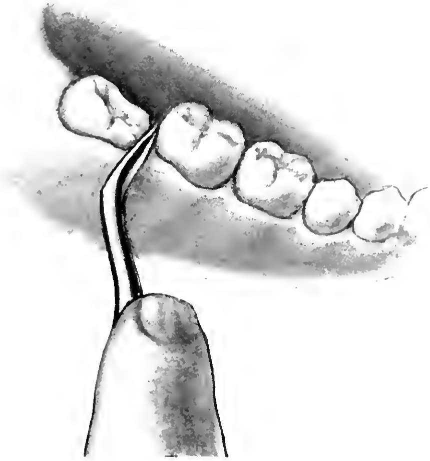


Fig. 147.—Same subject as Fig. 146. Illustration shows the application of the Lecluse elevator (Fig. 21) between the second and third molars at the point of impingement, and the third molar moved distally.

By Malposition and Malformation.—Where the third molar is in malposition and the crown is slightly lower than the occlusal plane of the second molar, and impinges on the latter tooth, but its position will not prevent the application of the Lecluse elevator (Fig. 21) to the mesial surface of the crown, and the gum tissue and alveolus will not interfere with the liberation of the tooth (Fig. 146), the Lecluse elevator should be applied in the interproximal space between the second and third molar and from the buccal side. When the elevator is adjusted (Fig. 147), the tooth is loosened by turning the upper end of the handle mesially, followed by a slight pressure downward on the handle to bring the crown of the tooth upward to a point where it can be directed distally. When the tooth is sufficiently loosened with the elevator, the forceps are adjusted to complete the extraction.

A radiograph of a case similar to the one described is shown in Fig. 148, but the second molar is filled on the distal surface.

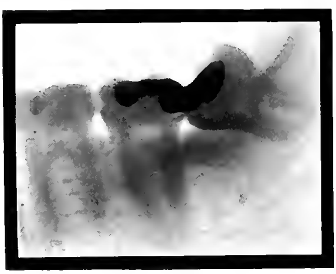


Fig. 148.—Radiograph of a partially impacted inferior third molar. The contact point will not obstruct the application of the Lecluse elevator (Fig. 21), but the filling in the second molar will prevent the use of the latter tooth as a fulcrum.

Fig. 149.—Radiograph of a partially impacted inferior third molar. The crown of the third molar impinges slightly on the second molar, but will not prevent the application of the Lecluse elevator. The process is heavy on the distal side of the third molar.

The method of applying the elevator in this case is modified, and, instead of using the second molar as a fulcrum, the alveolus is used for that purpose. The flat side of the blade of the Lecluse elevator is applied to the mesial side of the third molar, and a downward pressure is exerted on the handle to raise the tooth to a point where the forceps can be adjusted to complete the extraction.

Where the crown of the third molar impinges slightly on that of the second molar, but does not interfere with the introduction of the Lecluse elevator into the interproximal space, and the osseous tissue on the distal surface of the crown is heavy, as shown in Fig. 149, which is a radiograph of a case of this kind, a part of the osseous structure on the distal side should be removed before the elevator is applied. The method of procedure is to incise the soft tissue, which is not shown in the radiograph, a little further than the point to which the operator intends to remove the bony wall, after which it is cut away with a fissure bur from the distal surface of the tooth to such an extent that, when the Lecluse elevator is adjusted for the extraction, little resistance will be encountered.

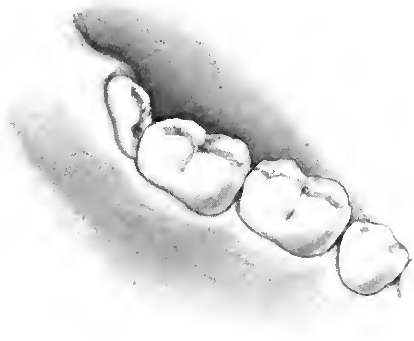


Fig. 150.—A partially impacted inferior third molar. The mesio-occlusal surface impinges on the second molar, and the contact is such as will obstruct the application of the Lecluse elevator (Fig. 21) to the mesial surface of the third molar.

Where the crown of the third molar impinges on that of the second molar to such an extent that it interferes with the introduction of the elevator into the interproximal space (Figs. 150, 151), and the soft tissues and process on the distal surface of the

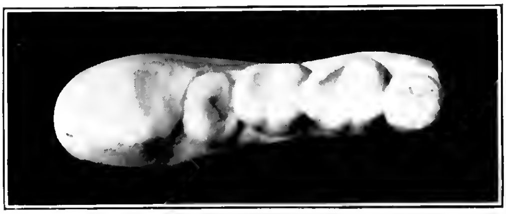


Fig. 151.—Model of a partially impacted inferior third molar. The contact point will interfere with the application of the Lecluse elevator (Fig. 21) to its mesial surface.

tooth are not interfering factors, that part of the crown of the third molar that interferes with the application of the elevator is removed with a fissure bur or knife-edge carburundum stone. The author prefers the use of the bur (Fig. 152), as it can be kept under better control, and there is not the liability of injuring an adjacent second molar or an opposing tooth. The contact point that impinges on the second molar is cut away sufficiently to allow the Lecluse elevator to freely enter the interproximal space, after which the elevator is adjusted and the extraction movements follow as described for a similar case where this preliminary procedure is not necessary.

Where the impingement of the crown on the second molar interferes with the adjustment of the Lecluse elevator, and the soft and osseous tissues interfere on the distal side with the delivery of the tooth (Fig. 153), the contact point that impinges on the second molar should be cut away as described above, when

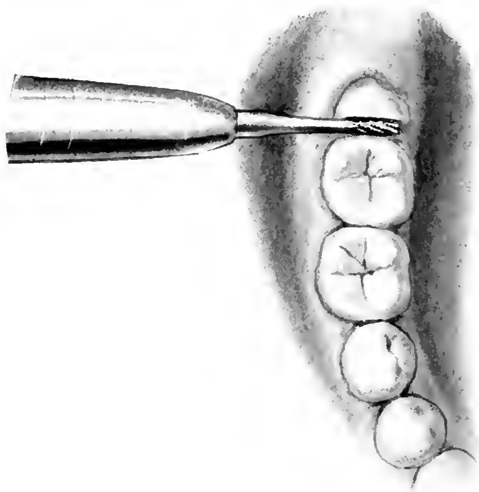


Fig. 152.—Method of removing the contact point from an impacted third molar with a cross-cut fissure bur to permit the application of the Lecluse elevator (Fig. 21).

the soft tissue is lanced and enough of the bony tissue removed on the distal side to allow the tooth to be as readily lifted from its socket with the elevator as though these conditions were not present.

Where there is a large proximal cavity on the mesial surface of the third molar, with that part of the crown impinging on the crown of the second molar, and the surface that is in contact with the second molar is not strong enough to support the Lecluse elevator and at the same time interferes with the application of this instrument, the mastoid chisel (Fig. 41) may, in order to save time, be used instead of the bur to cut away enough of the third molar to permit the elevator to be adjusted. The chisel is adjusted from the buccal side to the part of the third molar that interferes with the application of the elevator, and with a blow of the mallet is broken down, the fractured part being removed with Derenberg tweezers, after which the tooth is released with the Lecluse elevator in the manner as described above, or raised to a point where the extraction can be completed with the forceps.

Where the crown of the third molar impinges slightly on that of the second molar, and the roots of the third molar are not curved or inclined distally, the usual extraction movements as applied with the elevator will not always loosen the third molar, and even repeated efforts in some cases will not have any effect

Fig. 153.—Radiograph of an impacted inferior third molar. The crown of the third molar impinges on the second molar and prevents the application of the Lecluse elevator (Fig. 21). The osseous structure is heavy on the distal side.

on it. If, after the application of the elevator and the execution of the extraction movements, it is observed that these movements have no effect on the tooth, the elevator is released and Standard forceps No. 7 are securely adjusted, when the tooth is directed to the lingual side just far enough to slightly loosen it in its socket. As soon as the tooth has been loosened in this manner, the elevator is applied to its buccal surface and the tooth is forced lingually and upward, after which it is lifted from its socket with the forceps.

By Supernumerary Teeth.—Cases of impacted third molar caused by supernumerary teeth are not of frequent occurrence, although the author has removed in a single case as many as eight small supernumerary teeth that were imbedded over the crown of the third molar. The operation in such cases is very simple, and the removal of the supernumerary teeth precedes the extraction of the impacted tooth where it is necessary to remove the latter to relieve the condition, the impacted tooth being taken out by whichever method is applicable to the class of cases to which it belongs.

COMPLETE IMPACTION.

A complete impaction refers to that class of cases where the tooth is deeply seated in the tissues, and where the position of the crown cannot be determined with an exploring instrument, being described as follows: (1) where the tooth is located quite a distance from the occlusal plane of the second molar; (2) where there is lack of space between the ramus and the second molar for the third molar to erupt; (3) where the tooth is inclined or in a horizontal position, with its occlusal surface directed toward or impinging on the crown, neck, or distal root of the second molar; (4) where the tooth is malposed in any direction, and little can be ascertained of its relation to the other tissues by explorative examination. If an extraction is attempted in any of these cases without a thorough diagnosis having been obtained—if necessary, with the aid of the radiograph—the operation will be of an empirical character, with probably an unnecessary destruction of tissue, and result in failure, as when operating under such pronounced uncertainties the inefficiency and danger of misapplied force are at their maximum, with the consequent liability to fracture of tooth or osseous structure, and the removal of the cause of the pathologic condition left unaccomplished.

Radiographic Diagnosis.—The diagnostic points to be interpreted from a radiograph of a completely impacted third molar are: (1) its position as compared with what would be its normal position if fully erupted; (2) the distance of its crown below the occlusal plane of the second molar; (3) its relative position to the second molar; (4) the amount of its surface involved if there is contact with the second molar; (5) the size of its crown and roots, and the division of the roots and their curvatures; (6) the amount of osseous tissue over the occlusal and distal surfaces of the crown and its distal root; (7) the available space between the second molar and the ascending ramus as compared with the size and position of the third molar; (8) the condition of the second molar and the amount of alveolar process supporting it. The radiograph has been the means of positive diagnosis and of greatly simplifying the operation for the removal of these teeth. By its use the operator is enabled to adopt the quickest and least complicated method of obtaining the desired result. The small film for intraoral purposes (page 88) should be used where possible in radiographing this tooth, as with it the details are brought out more clearly. The extraoral method of radiographing is used only where temporary ankylosis is present, as in that case it is not practicable to insert the film into the mouth to obtain a radiograph. The extraoral plate will give the position of the tooth and general outlines, but lacks the finer details produced with the film.

In some cases the radiograph reveals the fact that the patho-

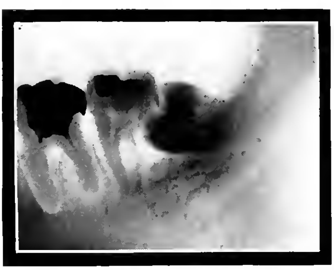


Fig. 154.—Radiograph of an impacted inferior third molar, with a large cavity in the distal root of the second molar.

Fig. 155.—Radiograph of an impacted inferior third molar, with a large cavity on the distal side of the second molar.

logic condition is not due to the third molar, but to other causes, and thus prevents an operation which would not relieve the condition. Fig. 154 shows an interesting example. The patient in this case had experienced considerable pain in the region of the second and third molars. As the tissues surrounding the third molar were found to be normal, and the tooth was apparently not giving any trouble, the filling in the second molar was removed by the attending dentist to determine whether the pulp of that tooth was involved. The examination indicated a live pulp, and the tooth was refilled, the third molar then being suspected as the cause of the pain on account of its malposition. The case was referred to the author, and a radiograph (Fig. 154) was obtained of the parts. The radiograph, in addition to showing the condition of the impaction, also showed a large cavity on the distal root of the second molar, evidently caused by the pressure of the third molar against the tooth at this point. The second molar was, therefore, the seat of the disturbance instead of the third molar. If in this case the third molar, in the absence of a radiograph, had been extracted, the second molar would probably have been fractured or loosened by the operation to such an extent that it would have left its socket, as its strength had been considerably weakened by the pressure of the third molar upon it. The second molar was, therefore, extracted and the third molar allowed to remain. Fig. 155 shows a case similar to the one just mentioned.

Another interesting example is shown in Fig. 156. In this case a number of attempts had been made to extract the third molar, and the history given by the patient was that forceps had been repeatedly used on it. Each attempt had evidently re-

Fig. 156. Radiograph of an impacted inferior third molar in a horizontal position. The crown of the third molar has been fractured by repeated attempts to extract it.

sulted in an additional fracture. As the tooth was deeply seated and as it lay in a horizontal position, a correct conception of the position of the tooth had undoubtedly not been obtained. An attempt to extract a tooth in such position by applying forceps to its crown and executing a tractile movement upward would necessarily result in a failure. In this case the radiograph was of great value, as it was the means of obtaining a correct diagnosis of the condition and thus indicating the best method for extracting the tooth.

Anesthetic.—Where the operation is not difficult and will consume only a short time, nitrous oxid and oxygen should be the anesthetic, but nitrous oxid, oxygen, and ether should be used where the tooth is very deeply seated in the tissues, or where it lies in a horizontal position, or where it is so inclined mesially that the greater part of its occlusal surface impinges on the second molar, or where the roots are of a large size, or hypercementosed, or markedly divergent, with a heavy septum between them, and are not curved and inclined distally. In other words, the latter combination is the most suitable anesthetic, and should be used where the operation will consume some time, or where inflammation is so extensive as to cause temporary ankylosis. For a number of years the author operated in his office on cases of the character mentioned under nitrous oxid and oxygen anesthesia, but his experience has demonstrated that this arrangement is not as satisfactory as operating on such cases in a hospital, where the facilities are better adapted for the care and after-treatment of the patient than in the office of the operator. The operation in these cases is strictly a surgical procedure, and the operator should not attempt to be both anesthetist and operator. Experience has shown that the attempt of the operator to keep the patient anesthetized with nitrous oxid and oxygen, or to depend on the office assistant to attend to it, and operate at the same time is an undertaking fraught with great danger, as no operator can properly administer the anesthetic and efficiently execute the technic of the operation. It is, therefore, essential in these cases that the anesthetic be administered by a skilled anesthetist, so that the operator may devote his entire attention to the extraction.

Complete Impaction—*By Soft Tissue.*—Where the tooth is deeply seated and the tissue about it is very dense, and an external examination seems to indicate that, if the eruption were complete, the tooth would be in a normal position, the operator may be tempted to immediately apply an instrument in an attempt to extract the tooth. This would be a doubtful procedure, as experience has shown that in such cases there may be unexpected conditions that would militate against a successful operation, and in all such cases it is advisable to obtain a radiograph of the parts before attempting extraction. If the radiograph shows that the tooth, in addition to being deeply seated, has a tendency to erupt toward a normal position, a notation should be made, among other points to be determined, of the distance of the tooth from the occlusal plane of the second molar. If the roots are distally inclined, if there is no process over the occlusal surface, if the osseous structure is not dense on the distal side of the crown or distal root, and if the Lecluse elevator can be adjusted to the crown, the procedure for its extraction is the same as where the tooth is in alignment, the soft tissue over the occlusal surface being incised to allow the tooth to be more easily liberated. If, however, the roots are not distally inclined, but straight and fused or markedly spread (Fig. 157), Standard forceps No. 7 should be applied and the extraction completed with this instrument. Before applying the forceps, the operator should ascertain with an exploring instrument whether an application can be made on the lingual and buccal surfaces of the tooth. If such an application is not practicable, the bony tissues on these surfaces are burred away sufficiently to allow a good adjustment. When the forceps have been applied, the first extraction movement is forcibly to the lingual

Fig. 157.—Radiograph of a completely impacted inferior third molar. The crown is quite a distance from its normal position, and the roots are almost straight and are widely separated.

side, followed by a cautious tractile movement, which should loosen the tooth, when the forceps are sent further down on the tooth and the movements repeated until the tooth is extracted.

By Osseous Tissue.—Where the tooth is deeply seated and the osseous tissue is over the occlusal surface, the same technic is followed as where this condition exists and the tooth is partially impacted (page 290), but a radiograph should be obtained before extraction is attempted.

By Insufficient Space.—Where the tooth is deeply seated and there is insufficient space for its eruption, the crown may be directing distally and the hard tissue partially or completely overlying its occlusal surface, or the tooth may be lying at an angle, with the greater part of its crown impinging on the neck of the second molar. If the radiograph reveals that the crown is markedly inclined distally and the hard tissue is dense over the occlusal surface (Fig. 158), it presents one of the most difficult forms of impaction encountered with this tooth. In such case the elevator cannot be applied to the mesial surface of the third molar for the purpose of directing it distally, as the hard tissue on that side will interfere; and it will be impracticable to apply forceps to the buccal and lingual surfaces, as the position of the crown will not allow a movement to the distal side or a tractile movement. In the case shown in Fig. 156 it was impracticable to obtain an intraoral radiograph with a film on account of the extensive inflammation of the gum tissue, and therefore an extraoral radiograph was made. As much of the detail on the plate could not be transferred to a print, a drawing was made in which the details were correctly reproduced. The gum tissue was incised on the lingual side to a point slightly

Fig. 158.—Radiograph of a completely impacted inferior third molar, the impaction having been caused by insufficient space. The crown is markedly inclined distally and the hard tissue is dense over the occlusal surface.

beyond the end of the roots, and the retractor (Fig. 40) placed in position to hold back the tissue, when the alveolar process was cut away in the manner described for removing the lingual plate (page 311), to allow the tooth to be liberated toward the lingual side. The gum tissue over the occlusal and buccal surfaces was also incised, and the hard tissue removed on these parts, so as to allow the Lecluse elevator to be properly adjusted.

Where the entire crown impinges on the second molar, and the roots are fused or so shaped that the septum between them is of large size, and the hard tissue over the distal surface of the crown or on the distal side of the distal root is so heavy that the tooth cannot be directed distally with an elevator or upward with forceps (Fig. 159), the tooth is almost as difficult to remove as when the crown is directed distally, with the osseous tissues dense over the distal surface of the crown. In such case a radiograph should be made of the parts as a guide for the operator. The best method for extracting such tooth is to cut away a part of the lingual plate and then remove enough of the hard structure on the distal and buccal sides to allow an adjustment of the blade of the Lecluse elevator, after which the tooth is forced to the lingual side to release it.

Fig. 159.—Radiograph of a completely impacted inferior third molar. The entire occlusal surface of the crown of the third molar impinges on the second molar.

Fig. 160.—An impacted inferior third molar in horizontal position. The third molar is small, with fused roots, and is not in contact with the second molar.

By Malposition and Malformation.—Where the impaction is caused by malposition, which is usually associated with more or less malformation of the third molar and occasionally of the second molar, the tooth may be in a position varying from a slight inclination from the perpendicular to a complete horizontal position. The shape and size of the crown, shape and direction

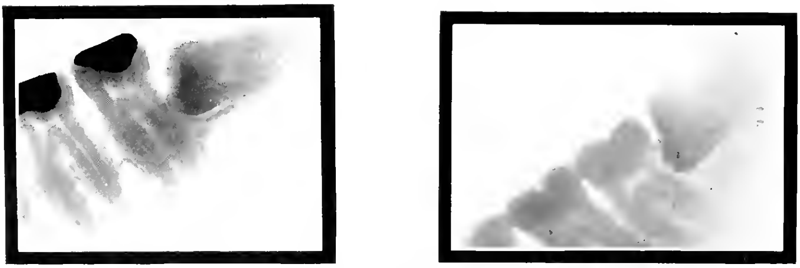


Fig. 161.—Radiographs of impacted inferior third molars in horizontal position. There is little process over the distal surface and slight contact with the second molar.

of the roots, amount of bony tissue over the distal surface of the crown and distal root, and the position and amount of contact with the second molar govern the operative technic for its removal.

Where there is no contact with the second molar (Fig. 160), or where the contact is only slight, and the osseous tissue over the distal surface of the distal root is not very dense or extensive (Fig. 161), the tooth should be removed by cutting away with a fissure bur a part of the hard tissue over the distal root and from the buccal surface of the crown. The Lecluse elevator is then applied to the buccal surface of the crown, and the blade forced down and under the crown and brought mesially, after which pressure is exerted downward on the handle, which will raise the tooth (Fig. 162). When the tooth has been brought to this point, the second molar is used as a fulcrum to deliver the tooth from the socket.

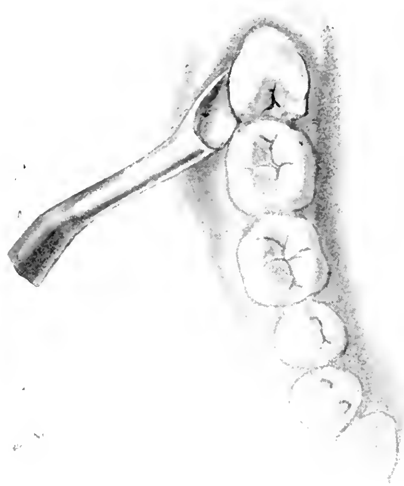


Fig. 162.—An impacted inferior third molar. Illustration shows the mesio-buccal application of the Lecluse elevator (Fig. 21) to the tooth.

Cases similar to the one described, but where the third molar has greater contact with the second molar, and where the osseous structure over the crown and distal root is more extensive and denser, with one or both of the roots directed upward at the apices, are shown in Fig. 163.

The method of operating in these cases is to cut away that part of the crown of the third molar that impinges on the distal surface of the second molar, and remove a part of the bony structure on the distal side of the third molar. The part that is in contact with the second molar is cut away with a fissure bur, as described

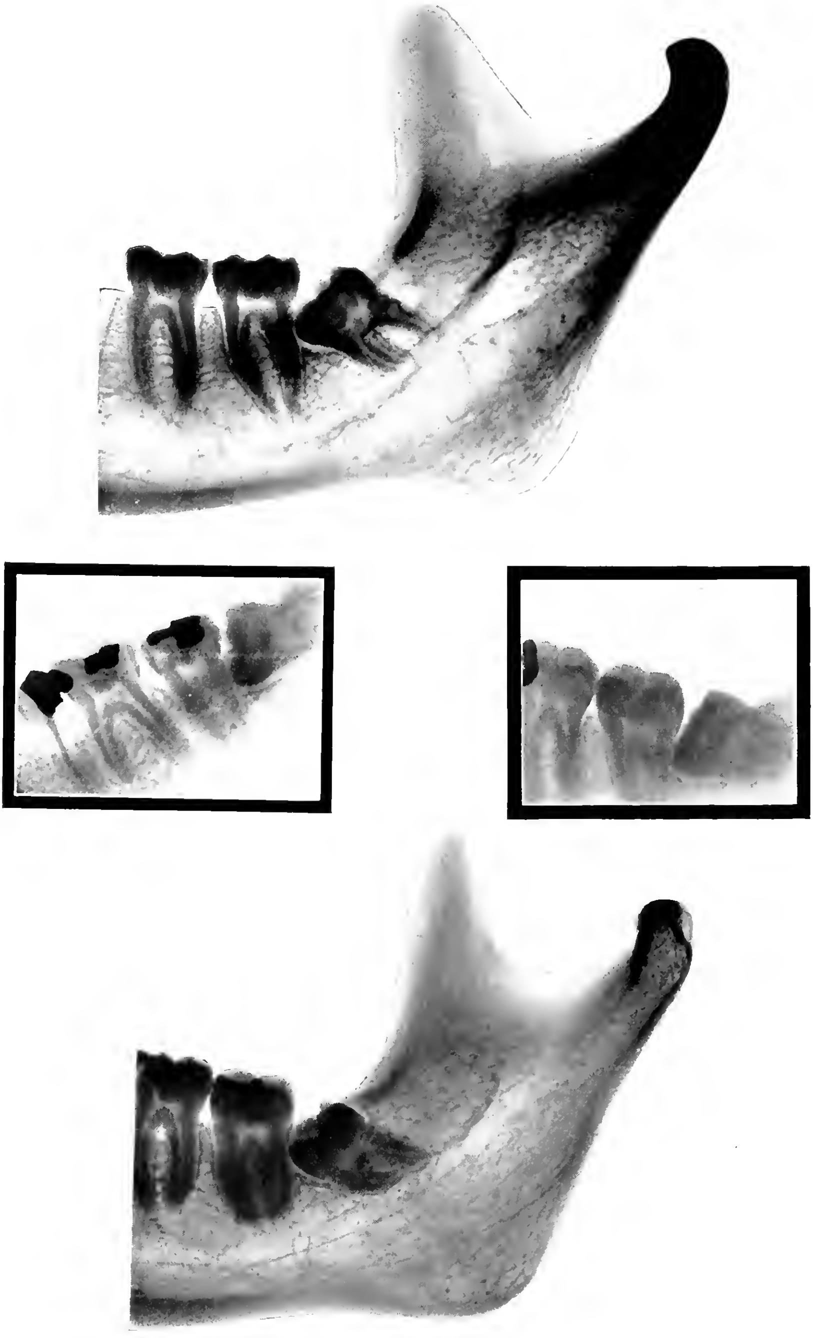


Fig. 163.—Radiographs of impacted inferior third molars. The third molar is inclined toward the second molar, with its mesio-occlusal surface in contact with the latter tooth. The osseous tissue is heavy on the distal side of the third molar.

and illustrated for such procedure in the case of partial impaction (page 291). The process is then burred away from over the distal surface of the third molar with a rose or fissure bur of

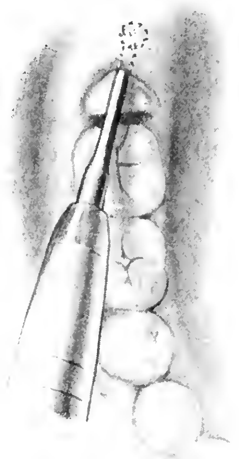


Fig. 164.—An impacted inferior third molar. Illustration shows the method of inserting the bur under the free margin of the gum to remove the process from over the distal surface of the tooth.

suitable size. If the soft tissue over the tooth is not very firmly attached, the bur can be passed under the free margin of the tissue (Fig. 164) to the margin of the alveolus; but, if the tissue

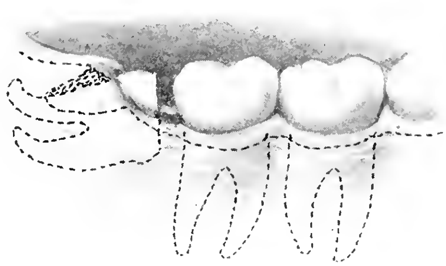


Fig. 165.—An impacted inferior third molar. Illustration shows the occlusal surface of the crown removed, and a part of the process over the distal surface of the tooth cut away.

is firmly attached, and this procedure is not practicable, an incision is made with a lancet and the tissue held back with the retractor (Fig. 40), so that the bur may be used without interference from this tissue. The bony tissue is then burred away from over the distal side of the tooth to about the extent shown by the dotted lines in Fig. 165, followed by removing a part of the process from the buccal side of the tooth. The Lecluse elevator is now applied and the point of the blade forced down on the

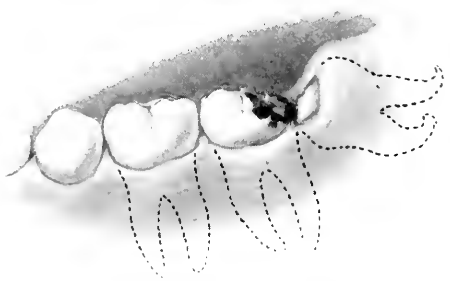


Fig. 166.—An impacted inferior third molar. The apices of the roots are directed upward, and the distal surface of the crown of the second molar is destroyed to such an extent that the latter tooth cannot be used as a fulcrum.

buccal surface of the crown, bringing the blade mesially, when the handle is pressed downward to raise the tooth to a point where the second molar can be used as a fulcrum and the tooth directed distally. After this has been done, the forceps are adjusted to complete the removal of the tooth, which is accom-

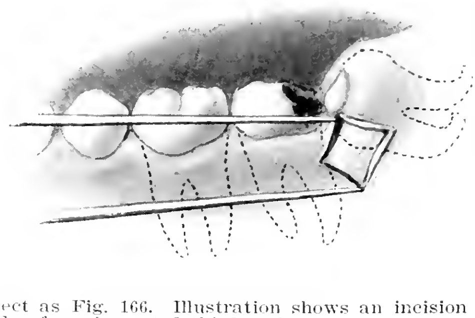


Fig. 167.—Same subject as Fig. 166. Illustration shows an incision of the gum tissue on the buccal side of an impacted third molar so as to expose the process, with the retractor holding apart the soft tissue.

plished by bringing it slightly to the lingual side and then upward and posteriorly, following the direction indicated by the inclination of its roots.

Where the second molar is attacked by caries on its distal surface, and the tooth cannot be used as a fulcrum for the elevator, the operation should be performed independent of that tooth. If the third molar is of a large size, and the roots are straight and markedly spread, with a heavy septum between them, the lingual plate is removed, as described on page 311, to release the tooth. If the tooth is of average size, and the apices of the roots are favorably inclined upward (Fig. 166), the bony structure on the buccal side may be used as the fulcrum and the tooth released with the Lecluse elevator. In this case an incision about half an inch in length is made in the gum tissue on the buccal side about in line with the mesial surface of the crown of the third molar, and to such a depth that, when the retractor is applied to hold the flaps apart, the bone is exposed (Fig. 167). The bony structure is then cut away from below the crown with a bur to the extent shown in Fig. 168, so that the blade of the elevator can be

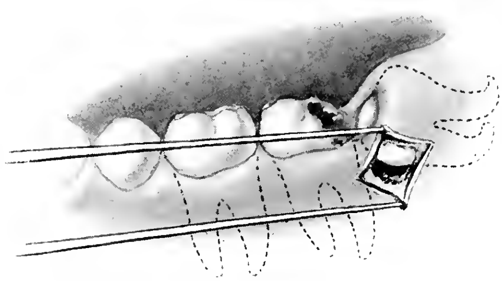


Fig. 168.—Same subject as Figs. 166, 167. Illustration shows the hard tissue burred from under the mesial surface of the impacted third molar, with the retractor holding apart the soft tissue.

adjusted to the mesial surface of the crown. When sufficient space has been obtained, the retractor is removed, the gum tissue over the crown is then incised if necessary, and enough of the osseous tissue over the distal side is removed to permit the delivery of the tooth. The contact of the tooth with the second molar having been relieved by decay, it is seldom necessary to remove any of the occlusal surface of the third molar. The elevator is now inserted in the space created for it on the mesial side or under the crown of the third molar, the alveolar ridge on the buccal side is used as a fulcrum, and a downward pressure is exerted on the handle of the elevator to prize the tooth upward. If this does not loosen the tooth, the blade of the elevator is sent further down below the crown and the prizing repeated. As soon as the tooth is loosened, it is raised from the socket by forc-

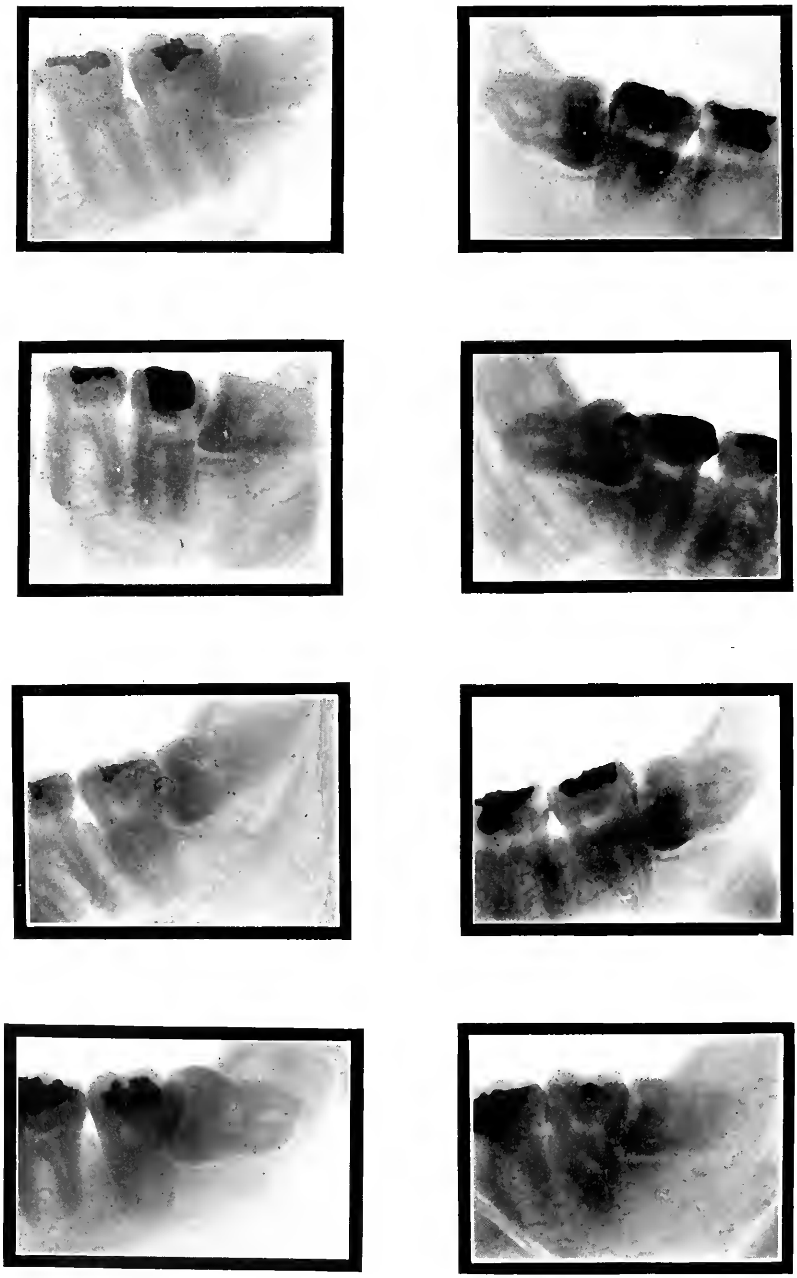


Fig. 169.—Radiographs of completely impacted inferior third molars. The teeth are in horizontal position, with all or nearly all of the occlusal surface of the crown of the third molar impinging on the second molar.

ing the blade of the elevator still further between the crown and bony wall, after which the tooth is seized with the forceps and the extraction completed.

Where all or nearly all of the occlusal surface of the crown of the third molar impinges on the second molar (Fig. 169); or where the osseous tissue over the distal surface of the crown and distal root is very dense (Fig. 170); or where the impingement of the third molar is on the neck or root of the second molar, and the roots are completely or nearly fused and have little curvature (Fig. 171); or where there is an impingement on the second molar, with the roots markedly spread or hooked (Figs. 172, 173, 174), the operation described for removing the process over the distal side of the tooth, and cutting away that part of the crown that impinges on the second molar, is not indicated.

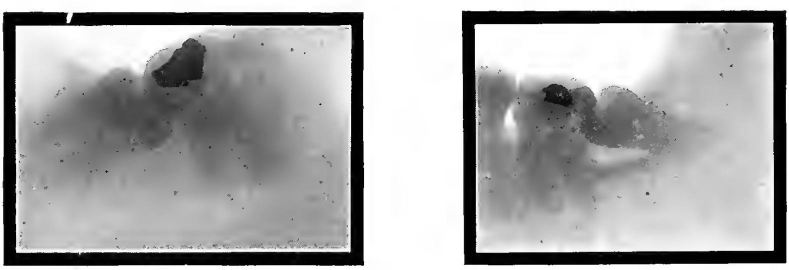
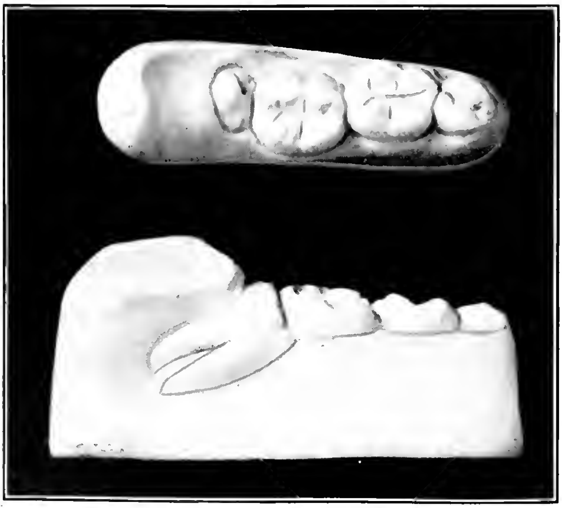


Fig. 170.—Radiographs of impacted inferior third molars. There is heavy osseous tissue over the distal surface of the crown or distal root of the molar.

Where these conditions exist, the preferred technic of operation is to remove the lingual plate. Impacted teeth of the character described have been extracted by the author in almost every conceivable manner that seemed at all rational, and the most heroic method adopted in any case was that of using splitting forceps, applying them so as to sever the tooth in half in order that first the crown and then the roots could be removed. The traumatic injuries that were, however, produced in all the methods that were used demonstrated the necessity of a less destructive operation, and efforts to develop a method of extraction in these extremely difficult cases that would be efficacious and also cause a minimum amount of destruction to the parts led to the procedure of removing the lingual plate of the alveolar process as the most satisfactory method of operating in a majority of such cases.

A



B

Fig. 171.—Radiograph and model of impacted inferior third molars. *A*, the mesio-occlusal surface of the third molar impinges on the neck of the second molar, the roots of the impacted tooth being partially fused; *B*, the occlusal surface of the third molar impinges on the neck and crown of the second molar, the roots of the impacted tooth being separated, with the septum between the roots.

Removing the Lingual Plate.—Figures 169 to 174 present conditions where the removal of the lingual plate is indicated. In these cases the occlusal surface of the crown of the third molar impinges on the second molar. The third molar is in many of these cases situated in a position that at first suggests the operation described for cutting away that portion of its crown that is in contact with the second molar and removing the bony structure over its distal surface as a preliminary to its extraction, but the roots of the third molar, being fused and not favorably in-

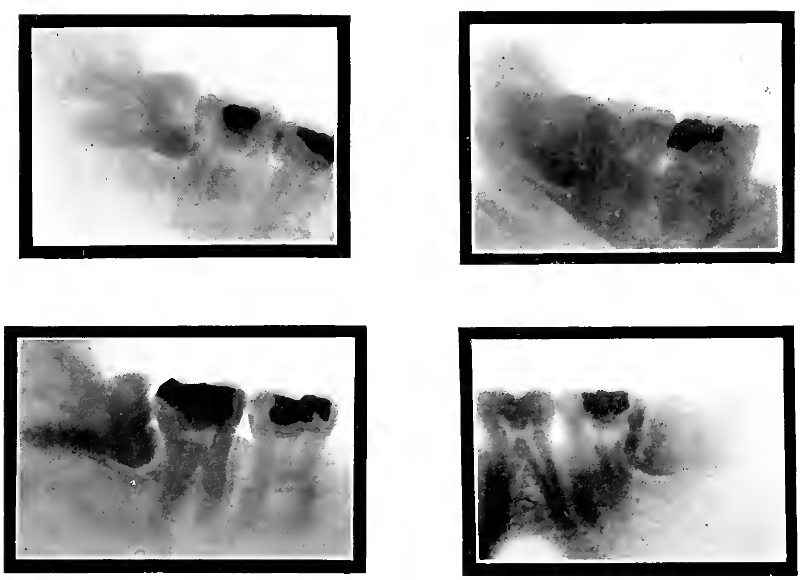


Fig. 172.—Radiographs of impacted inferior third molars. The occlusal surface of the third molar impinges on the second molar, with the roots of the impacted tooth markedly spread or hooked.

clined upward, and hooked or rather widely separated, with the septum between them heavy and dense, would interfere with the delivery of the tooth even if the process and contact points were removed. In addition to this interference, the large area of the occlusal surface of the third molar, which is composed of enamel, that is in contact with the second molar would cause the operation of cutting away the surface impinging on the second molar to consume too much time, and it is therefore advisable in these cases to remove the lingual plate for the delivery of the tooth.

An incision of the soft tissue, a little longer than the length of the roots of the third molar, as shown by a radiograph, is made over the lingual side of the tooth with curved scissors (Fig. 175), and

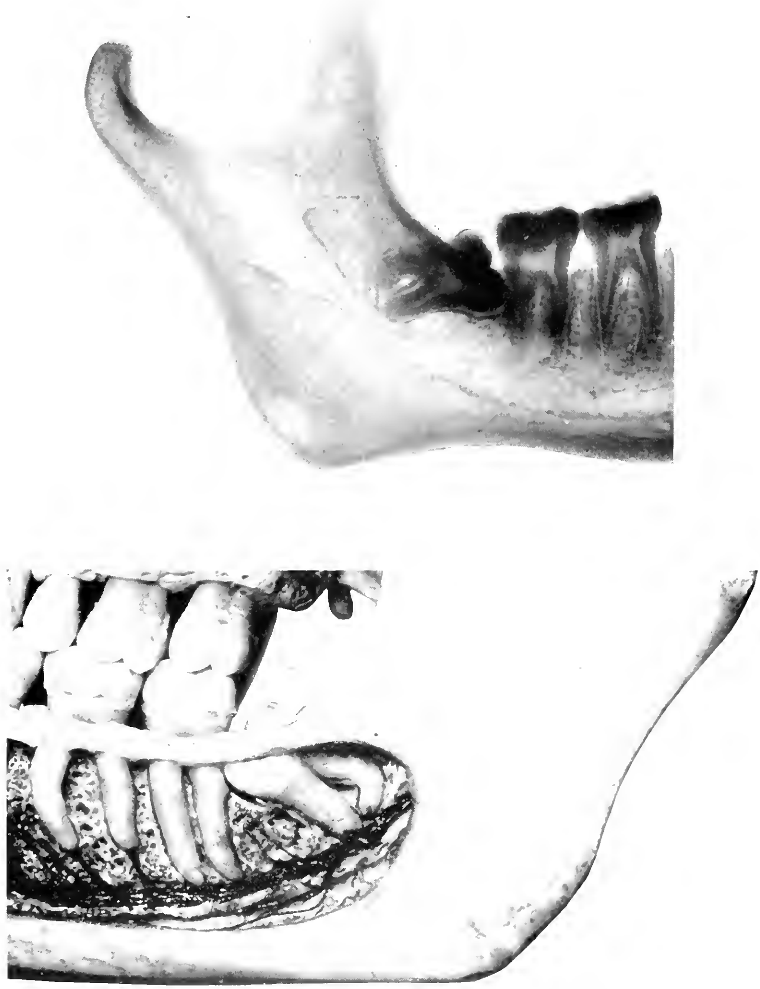


Fig. 173.—Impacted third molars. The occlusal surface of the third molar impinges on the second molar, with the roots of the impacted tooth markedly hooked.

the retractor (Fig. 40) is placed in position to hold back the flaps of this tissue, the instrument being held by the operator or his assistant. The blood from the incision is removed with gauze or

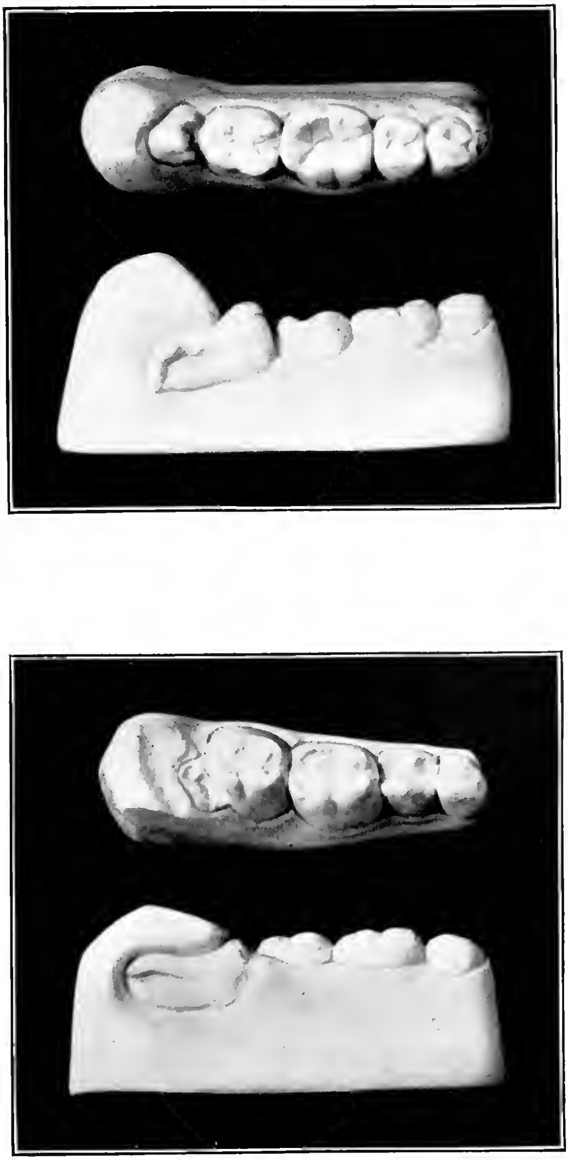


Fig. 174.—Models of impacted third molars. The occlusal surface of the third molar impinges on the second molar, with the roots of the impacted tooth markedly hooked.

absorbent cotton, as may be necessary, to keep clear the field of operation. A large bur, or one of Schamberg's surgical burs,

Fig. 175.—A completely impacted inferior third molar. Illustration shows the method of making an incision with curved scissors (Fig. 34) into the gum tissue on the lingual side of the tooth to expose the hard tissue.

which has been previously inserted in the hand-piece of the dental engine, is applied to the margin of the alveolus and the

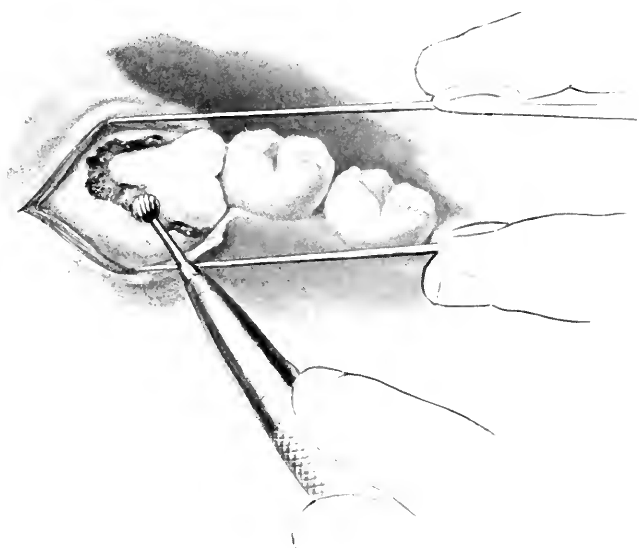


Fig. 176.—Same subject as Fig. 175. Illustration shows the gum tissue held apart with the retractor and the process being removed from the lingual side of the third molar.

process is cut away (Fig. 176), the cutting being continued toward the apices of the roots until the process over both roots is removed. With a rose or fissure bur of suitable size, in a right-angled hand-piece, the process between the roots is then removed, as its presence will interfere with the extraction of the tooth.

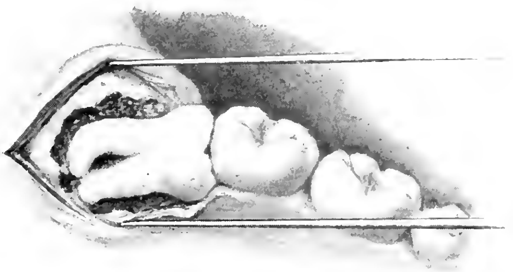


Fig. 177.—Same subject as Figs. 175, 176. Illustration shows the extent to which the lingual plate is removed before applying the elevator to the third molar.

When the alveolar process has been removed to the extent shown in Fig. 177, the retractor is detached and the Lecluse elevator is applied to the buccal surface of the tooth (Fig. 178) with sufficient

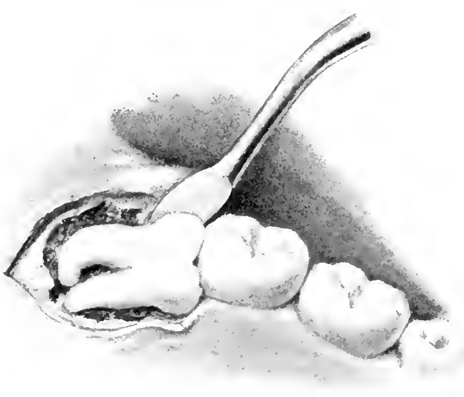


Fig. 178.—Same subject as Figs. 175, 176, 177. Illustration shows the application of the Lecluse elevator (Fig. 21) to the buccal surface of the third molar to dislodge it after the lingual plate has been removed.

pressure to force the tooth lingually through the space that has been created for its exit. It is advisable to remove enough of the lingual plate to permit unobstructed delivery of the tooth rather than attempt to force the tooth from its position by excessive force applied with the elevator.

CHAPTER XII.

DECIDUOUS AND SUPERNUMERARY TEETH.

Where there has been absorption of the root of a deciduous tooth, and it is very loosely attached to the gum tissue, extraction can often be performed by wrapping a piece of antiseptic gauze around the thumb and index finger, grasping with these two digits the tooth on the lingual and labial surfaces, and directing a pressure alternately labially and lingually until it is loosened from the tissue, when it is lifted from its position. This method does not tend to frighten the child, which is often alarmed when forceps are used. When this procedure is not practicable, it becomes necessary to use the elevator or forceps.

Supernumerary teeth should, as a rule, be extracted, as they are usually situated where they cause an unsightly appearance, or where their presence prevents a natural tooth from assuming its normal position; or they irritate the gum or other soft tissue, or prevent the proper cleansing of the normal teeth. Their removal is seldom a difficult operation, but should be accomplished in such a manner as not to disturb adjacent teeth.

DECIDUOUS TEETH.

Position of Patient and Operator.—The position of the patient and operator when extracting deciduous teeth is as described (page 99).

Anatomy.—Before the operator attempts any operation on deciduous teeth, he should possess a knowledge of their anatomy, of the order in which they will be replaced by the permanent teeth, and of the period of life at which they will likely be replaced. While the time of their loss varies greatly with individuals, a fair knowledge of such time may be obtained in each case by comparing with the age of the child the deciduous teeth that have been lost and those that remain, and any of the permanent teeth that may have erupted. The effect that the loss of a deciduous tooth will have on the position to be occupied by the permanent tooth, and the effect that this loss, if a premature one, will have on the development or lack of development of the arch, should be carefully prognosticated, and, if there is doubt concerning this probable effect, a competent orthodontist should be consulted.

Attitude of the Operator.—The operator should gain the confidence of the child by kindly persuasion if such course is necessary, not concealing the probability of a little pain, though giving assurance that he will be very gentle. No deception should be practiced or forcible extraction attempted, as otherwise it will be difficult to have the patient submit to subsequent operations, for such experiences are very vividly and indelibly fixed in the mind of the little patient.

Anesthetic.—If the extraction will cause severe pain, the administration of nitrous oxid and oxygen is advised. The little patient sometimes interferes with the operator, and it is just as important that he be anesthetized as an adult where conditions make it necessary, as the pain of extracting deciduous teeth is as great as that of extracting the permanent teeth when the age of the patient is considered. In addition to this condition, the deciduous molars normally have roots that are widely divergent, and may be quite as difficult to remove as the permanent teeth if absorption has not paved the way for their loss, and such cases are commonly presented for extraction. The little one has less reasoning capacity and less self-control than an adult, and will consequently resist a painful operation more strenuously, which may result in an accident, and the operator should always guard against interference from the hands or closure of the mouth.

Superior Incisors and Cuspids.—The extraction of the deciduous central, lateral, and cuspid teeth is a comparatively simple procedure, as their attachments to the supporting tissues are not very firm. Where the crown is intact and free of caries, Standard forceps No. 1 (Fig. 1) should be used. Usually the application of the beaks of these forceps on the tooth, with a slight amount of pressure, will detach the tooth. If any resistance is encountered, the tooth is moved alternately to the labial and lingual sides, and, if necessary, a slight rotatory movement may be made. If the crown is decayed and frail, and insufficient structure remains for Standard forceps No. 1 to be applied, Standard forceps No. 5 (Fig. 6) should be used, care being taken in their application that the beaks do not intrude on the permanent erupting tooth. If only a small part of the crown or root remains, the straight-shank or Cryer elevator (Figs. 15, 24) should be used and the blade applied in such manner that, when adjusted, a pressure of a pushing nature exerted labially will dislodge the remaining part. If the apex of a root protrudes through the gum tissue, the root should be extracted with the straight-shank elevator, adjusting it so that a downward pressure may be applied against the apex of the root, which will usually force the root from its socket.

Care must be exercised in the extraction of deciduous teeth, so that the gum tissue is not torn by the operation. If absorption has been rather complete, the soft tissue adheres more tenaciously to the necks of the deciduous than to the permanent teeth, and no tractile movement should be executed until this tissue has been detached from the tooth. Detaching the tissue is, however, a simple procedure if suitable forceps have been selected, as a judicious application of the beaks to the neck of the tooth, followed by a labio-lingual movement, will readily sever this tissue from the tooth.

Superior First and Second Molars.—Where the greater part of the crown of a deciduous superior first or second molar is intact, Standard forceps No. 4 (Fig. 5) should be used. The beaks are carefully adjusted to the tooth, and the extraction movements to be applied are similar to those described for releasing the permanent first molar (page 159). If the crown is extensively decayed, and Standard forceps No. 4 cannot be securely adjusted, but sufficient structure remains for Standard forceps No. 2 (Fig. 2) to be applied, the latter instrument is used and the same extraction movements are executed. If only the root remains and it is fragile, Standard forceps No. 5 (Fig. 6) are used, and should be carefully adjusted, so that the beaks do not come in contact with the erupting permanent tooth. If only the outer walls of the crown or part of the root remains, the Cryer elevator is used, adjusting the instrument so that the first application, which is made with a degree of pressure according to the size of the structure remaining and the firmness of its attachment, will release the parts.

Inferior Incisors and Cuspids.—The crowns and roots of the inferior deciduous incisors and cuspids are small. These teeth do not offer any appreciable resistance, and the extraction movements for their release are practically the same as those for the corresponding permanent teeth. Standard forceps No. 6 (Fig. 7) or Standard forceps No. 8 or No. 9 (hawksbill, Figs. 9, 10) may be applied, care being taken to obtain a good adjustment of the beaks and not to release an adjacent tooth by the operation.

Inferior First and Second Molars.—The extraction of the inferior deciduous first and second molars is usually performed with Standard forceps No. 7 (Fig. 8) when the greater part of the crown is intact and the tooth is still firmly attached to its tissue. If the application of the beaks of the forceps on the tooth does not release it, the extraction movements should be to sway the tooth alternately from the buccal to the lingual side to detach it, and then with a tractile movement upward carry it from its socket. If the crown is not firmly attached, or only the roots remain, the straight-shank elevator should be applied—to the buccal surface of the tooth when operating on the right side of the arch, and to the lingual surface when operating on the left side—and a pressure of a pushing nature is exerted to carry the root from its socket lingually in the former case and buccally in the latter. If only the roots remain, and they are small and firmly attached, the Cryer elevator is applied to release them.

Wedged Roots of Deciduous Teeth.—The roots of deciduous teeth often become wedged between the erupting crowns of permanent teeth, frequently making it difficult to gain access to the deciduous tooth for its extraction without endangering the permanent tooth. In such case the extraction can often be accomplished by employing as an elevator an ordinary enamel chisel. The instrument is applied in such manner that the root can be pushed from its attachment, access being gained from the most favorable angle, and pressure is exerted in the direction that will most readily permit the exit of the root without endangering the permanent tooth. If the parts remaining are of considerable size, the straight-shank elevator is used in the same manner as the chisel.

SUPERNUMERARY TEETH.

The general appearance of supernumerary teeth, which is most commonly the primary tooth form, or a grouping of these forms imperfectly bound together, is such that they cannot be mistaken for normal teeth (Fig. 179). If supernumerary teeth are present, they are usually located in the region of the ten superior anterior teeth, but are occasionally found in the region of the molar teeth. Supernumerary teeth usually cause irregularities, and often prevent the eruption of the permanent teeth.

Extraction Technic.—Where the crown of a supernumerary tooth approximates the size of a normal tooth, the extraction is made in the same manner as described for the corresponding normal tooth. Fig. 180 shows a supernumerary lateral incisor that is causing an irregularity, and its extraction would mate-

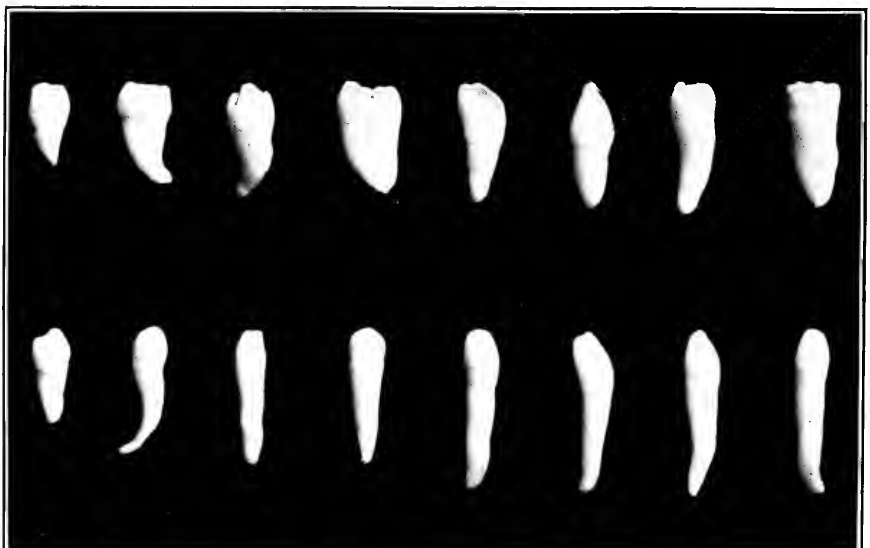


Fig. 179.—Types of supernumerary teeth.

rially help to correct the condition. In such case Standard forceps No. 1 should be applied, and the tooth extracted in the manner described for the extraction of the lateral incisor (page 122).

Peg-Shaped Crown.—Where the crown of a supernumerary tooth is of a peg-shape, forceps should be selected that will cover the major surface of that part of the crown projecting through the soft tissue, and the adjustment must be carefully made, as the crown may be extremely conical in shape. In such case the margin of the alveolus, if it extends over the base of the cone, should be cut away sufficiently from about the tooth with a fissure bur to allow a secure adjustment of the forceps, when the extraction movements should be made in the direction of least resistance. Care should be taken to avoid fracturing the crown, and, if firm resistance is encountered, more of the alveolus should be cut

Fig. 180.—A model showing a supernumerary tooth occupying the position of the superior right lateral incisor.

away and the beaks of the forceps sent further on the tooth to assist in releasing it by this extraction movement rather than fracture the tooth.

Supernumerary Teeth in the Vicinity of the Superior Bicuspids and Molars.—Small supernumerary teeth are occasionally located on the buccal side of the superior bicuspids and molars, and

Fig. 181.—Fusion of a supernumerary tooth with a bicuspid.

when so situated it is usually impracticable to apply the forceps for their removal, it often being difficult to adjust even the fine-beak Standard forceps No. 5 to them. When the latter forceps are not indicated, the Cryer elevator should be used. A supplemental cusp must not be confused with a supernumerary tooth, and where a supernumerary tooth is fused to a normal tooth, which is sometimes the case (Figs. 181, 182), such peculiarity must be noted, for, if this condition exists and is not observed, the normal tooth may be disturbed by the operation. The elevator is applied between the normal and supernumerary tooth, and, if the supernumerary tooth is loosened by this application, the blade of the elevator is sent further between the two teeth, and the procedure continued until the tooth is free from its attachment.

Where a supplemental cusp is present, or where there is a union of a supernumerary and normal tooth, resistance will be encountered, in which case the tooth is left undisturbed. The author has seen a number of cases where a supplemental cusp was mistaken for a supernumerary tooth and where a supernumerary tooth was fused to a permanent tooth, and the forcible

Fig. 182.—Superior left molar with a supernumerary tooth projecting from the middle third of the lingual root. The crown of the supernumerary tooth resembles a superior bicuspid.

extraction that had been attempted by adjusting the forceps to the cusp or to the supernumerary crown resulted in the loss of the permanent tooth.

Very Small Teeth.—Supernumerary teeth of a very small type are occasionally imbedded in the soft tissue over the crown of a permanent tooth and prevent its eruption. The removal of these small teeth can be best accomplished with Standard forceps No. 5 (Fig. 6) when located in the superior arch and with Standard forceps No. 6 (Fig. 7) when located in the inferior arch. Usually a firm adjustment of the beaks of these forceps, with a slight rotatory movement, will release them. When these teeth are deeply seated and are overlaid with the gum tissue, they should be extracted by making an incision of the soft tissue and applying the Cryer elevator to loosen them, after which they are delivered from their imbedded position with the Derenberg tweezers.

CHAPTER XIII.

HYPERCEMENTOSIS AND ARTIFICIAL COMPLICATIONS.

Occasionally the root of a tooth is affected by hypercementosis, an excessive development of the tooth cementum. The enlargement is usually at the apex of the root, but may extend from the apex to the neck and cover the entire root. No specific rule can be applied for the removal of a tooth so affected, as the procedure to be followed will depend on existing conditions. The technic of operation described for such cases is of average application, to be varied according to peculiar exigencies that may be present. Figure 183 shows a number of hypercementosed teeth, and attention is directed to the great variation in both the amount and form of the secondary deposit of cementum.

It is sometimes necessary to extract a tooth supporting some form of crown or serving as an abutment for a bridge, or to remove a root or an unerupted tooth situated below some part of a bridge, and such conditions are referred to as artificial complications.

Where a part of a tooth or an unerupted tooth below a bridge, a crowned tooth, or a tooth that serves as an abutment for a bridge, is to be extracted, the operator should devise such procedure as the peculiar conditions may indicate.

HYPERCEMENTOSIS.

Hypercementosis of the roots of teeth often greatly complicates their extraction. It is impossible to diagnose hypercementosis by an external examination, as the general appearance of a tooth does not give any evidence of this condition, and the discovery of its existence after the operation has begun is often a surprise to the operator. Resistance to the operation is the first indication of the probability of its presence, but undue resistance should not be relied on as a positive diagnosis of this condition, as abnormalities to which any tooth is subject may

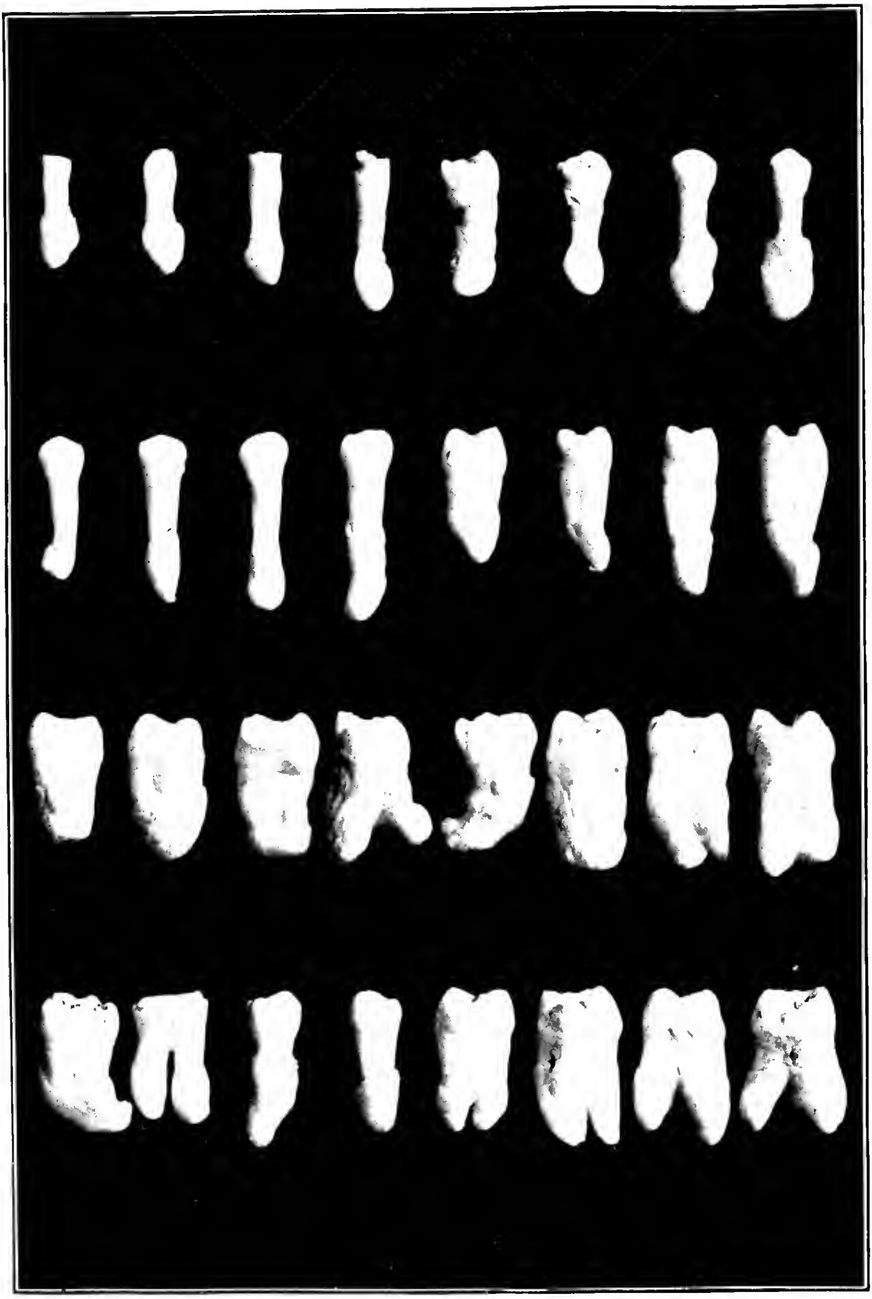


Fig. 183.—Hypercementosis. Types of hypercementosed teeth, showing various forms of excessive development of the cementum.

also cause unexpected resistance. Hypercementosis may be revealed by a radiograph, but even the radiograph will not always definitely outline this condition.

A radiograph of an interesting case of hypercementosis of the root of an inferior second bicuspid is shown in Fig. 184. This picture was not obtained for the purpose of diagnosing the hypercementosed condition, but to ascertain if any parts of the roots of the first molar remained in the intervening space between the second bicuspid and second molar.

Etiology.—Little is known of the etiology of this abnormal deposit of cementum. It is most frequently found on the roots of teeth that are in malocclusion and isolated. The inferior bicuspids and second molars are prone to this condition, but it may be found on any tooth or root that may remain in the

Fig. 184.—Radiograph of a hypercementosed inferior second bicuspid.

mouth, even if the root is badly broken down by caries. Occasionally, where the crown of a tooth has been destroyed by caries and the roots are left in position in the arch for some time, they are united throughout the greater part of their length by this deposit. It may cover the entire root rather uniformly or appear in irregular deposits on any part of a root, and it may be found only on one root of a tooth or on all of them, and occurs on one or a number of teeth in a mouth, but seldom on all of them.

Diagnosis.—Hypercementosis may be suspected by the operator, in the absence of a radiograph or where the condition is not shown by the radiograph, where greater resistance is encountered during the extraction than the diagnostic conditions of the particular tooth and its attachment would seem to indicate, or where resistance is met after the tooth has been completely loosened from its attachment, but cannot be released from its socket, the latter complication, when occurring with a single-rooted tooth, being possibly the most certain indication of hypercementosis. In these cases the apical end of the root is enlarged, and presents a greater diameter than the orifice through which it must pass in its exit from the socket.

Extraction Technic—*Anterior Teeth.*—Where the presence of hypercementosis on the root or roots of a tooth to be extracted has been diagnosed by a radiograph, the operation for its removal will depend on the amount of surface involved, the form which the secondary cementum has taken, and largely on the particular tooth affected. If it is in one of the ten superior or inferior anterior teeth, and the tooth is only slightly affected, the procedure should be the same as where this condition does not exist. If the affection is extensive, involving the entire length of the root, or if only the apical end is affected, causing an enlargement of the end of the root, as diagnosed by a radiograph or by a failure at extraction, enough of the process should be cut away from around the neck of the tooth to allow the forceps to be firmly adjusted well up on the root, when the extraction movements are made with the object of dilating the socket sufficiently to permit a release of the tooth. If by this procedure the tooth cannot be released without an undue application of force, or there is reason to conclude that a fracture of the alveolus is liable to occur, it is advisable to release the tooth and cut away the outer plate of the alveolar process sufficiently to allow the root to pass through the opening thus formed.

Molar Teeth.—Where hypercementosis exists on a molar tooth, only a faint outline of its presence is revealed by a radiograph. Where a superior or an inferior molar is hypercementosed, it is preferable to first attempt to extract the tooth by dilating the socket, and then bring the tooth in the direction of the weaker part of the alveolus surrounding it, applying the usual extraction movements. In such case the application of the maximum amount of force is permissible with the tractile movement, but so great a force as would fracture the process or tooth should not be applied. If, however, a fracture of the tooth occurs, it will usually take place at a point well up on the root or roots, and the removal of the remaining parts will be an extremely difficult procedure. If the tooth cannot be released by the method described, the crown should be fractured by exerting a heavy pressure on the beaks of the forceps while adjusted to the neck of the tooth. The roots of the tooth are then separated if the fracture has not already caused a separation, and the process is carefully removed from around each root with a fissure or rose bur sufficiently to allow the enlarged root to pass through the space created. The forceps are adjusted for the extraction, or the Cryer elevator is applied for that purpose if considered more practicable.

Inferior Third Molar.—Where the inferior third molar is slightly hypercementosed, it may be removed by dilating the socket as described for the molar teeth, but undue force should not be applied in its extraction, for, if the roots are small and the enlarged condition is confined to the apical ends of the roots, a fracture will be the result. Neither should the crown be fractured with the forceps preliminary to the separation and removal of the roots described under hypercementosed molar teeth (page 326), as the roots may be so shaped that the fracture will occur at some distance below the crown. If the condition is such that the tooth cannot be extracted by the method just described, or by a removal of the marginal ridges of the process preliminary to the application of the forceps or elevator, the procedure should be the removal of the lingual plate, as described in the case of impacted third molar (page 311).

A very rare case of hypercementosis, with a peculiar root formation, is reported by Professor Vorslund-Kjaer, a dentist of Copenhagen, Denmark, as follows:

"A patient, a professor of medicine in Copenhagen, presented himself several years ago at my office, suffering with a severe inflammation in the right mandible, caused by a third molar. The condition was such that he could only partly open his mouth. The tooth was very loose, the surrounding tissue was greatly swollen, and, on pressure, pus issued abundantly from the socket. Immediate extraction was advised, but during the extraction I felt a peculiar sensation as if the tooth were held by a very strong band at the apex of the root. The extraction was followed by a most severe hemorrhage, accompanied by excruciating pain, from which the patient suffered terribly. The socket was carefully packed with a tampon, but the hemorrhage continued for a considerable time. After the flow of blood was finally stopped, the patient still complained of severe pain along the whole course of the trigeminus nerve. On taking a glass to his lips in order to rinse his mouth, he exclaimed, 'What is the matter? Is the glass broken? I can feel only half of it!'

"The extracted tooth was of very unusual shape. The layer of pericementum was of enormous bulk, presenting almost the appearance of a single osteophyte, with an oval hole near the

Fig. 185.—Lower third molar with foraminal arrangement of roots, due to hypercementosis, causing inclusion of mandibular nerve and artery.

apex of the root (Fig. 185). Through this hole the nerve and the mandibular artery had passed, and had been torn asunder by the extraction, which accounted for the excessive hemorrhage, the intense pain, and the insensibility of the right half of the lip. In this case the pain, for the intensity of which I know but a single parallel in dental literature, lasted for a couple of days, but the insensibility was permanent. It was fortunate for me that the patient in this unparalleled case was a medical man, who thoroughly understood the situation, and who, up to this day, speaks of his experience with an impersonal interest."

ARTIFICIAL COMPLICATIONS.

In extracting a tooth with a porcelain crown, especially when operating under a general anesthetic, care must be exercised in order that parts of the crown are not detached and pass down the throat or into the trachea, for porcelain is subject to fracture under the application of the forceps. The same precaution should be observed in removing a tooth containing an inlay or a large metal filling.

Extracting a Root Supporting a Dowel Crown.—Where the root of a tooth supporting a dowel crown is to be extracted, a careful examination should be made, as stated in the chapter on examinations (page 85), by passing an exploring instrument below the base of the crown and where it comes in contact with the root, as the root may be destroyed by caries at this point. If the root is not so affected, the forceps are applied in the same manner as if the tooth had a natural crown; but the crown should not be relied on to support the beaks of the forceps unless the root is not firmly attached to the tissues. Where the root is involved by caries, the beaks of the forceps are sent well under the free margin of the gum, and, if necessary, an alveolar application is made to secure a firm adjustment on the root. The extraction movements should be the same as described for operating on a tooth with a natural crown. If the artificial crown is fractured, leaving the root intact and the dowel is in position in the root, the root possesses increased strength and will usually bear the application of the forceps, the liability of a fracture in such case being less than when extracting a root whose crown has been reduced by caries.

Utilizing a Post for the Extraction.—Occasionally a case requiring extraction, especially with the six superior anterior teeth, is presented where the root has supported a dowel crown and the crown has fractured, leaving the root of the tooth intact, with the post projecting and firmly cemented in the root canal. In such case extraction can often be performed by applying the beaks of Standard forceps No. 1 to the projecting pin, and, with a tractile movement executed in line with the axis of the root, extracting it in the same manner as a root is removed with the screw-porte inserted in the root canal.

Extracting a Tooth Supporting a Shell Crown.—Where the tooth to be extracted is supporting a shell crown, and the tooth is not firmly attached to the tissue, but the crown is securely cemented to the tooth, the forceps can often be applied to the crown and the tooth extracted in the same manner as if the tooth were not crowned, but a minimum amount of pressure should be exerted on the crown during the extraction.

If the tooth is firmly supported by the tissue and the crown is securely cemented to the tooth, too much reliance should not be placed on the crown to withstand the force of the extraction movements, as frequently roots supporting the crown are built up with amalgam or cement, and the pressure of the beaks of the forceps will release the crown from its abutment and fracture the remainder of the natural crown. In most of these cases the forceps should be adjusted well under the free margin of the gum to secure a firm application to the neck of the tooth, and, this having been obtained, the presence of the artificial crown is disregarded and the tooth extracted by the operative technic peculiar to its removal.

If the crown is loosely attached, or caries involves the gingival margin of the tooth, and the latter is firmly supported by its tissue, it is advisable to remove the crown before applying any instrument to extract the tooth, as the crown may interfere with the procedure and cause a fracture of the tooth.

Extracting a Bridge Abutment.—Where the roots of teeth that serve as abutments for a bridge are to be extracted, the technic to be applied for their removal will depend on the size and location of the bridge, the stability of the bridge abutments, and the firmness of the attachment of the teeth to the supporting tissues. It will, of course, be understood that if only one abutment is to be extracted, the bridge should be removed prior to the extraction by cutting it at such a point as will facilitate its removal without injury to the tooth that is left *in situ*. The extraction should be made by the method described for the same tooth when not serving as an abutment, observing the same preliminary procedure that is applicable to the artificial crown of which the abutment is a type.

If both abutments are to be extracted, and they are firmly fixed, the forceps should be applied first to the posterior abutment, loosening that tooth, and then applied to the anterior tooth, loosening it also, when a tractile movement with the forceps on one of the teeth will usually cause both teeth to leave their sockets. If, however, the examination indicates that both teeth cannot leave their sockets at the same time, the bridge should be severed prior to the extraction at a point that will best facilitate the operation.

If more than two abutments supporting the same bridge are to be extracted, they should be loosened separately as described above, after which the forceps are applied to one of the loosened abutments and the extraction movements made so that all will leave their sockets together, making the final extraction movements as near as possible in the line with the axes of the roots. Where the teeth are so situated that this procedure is not practicable, it will be necessary to cut the bridge at different points.

Extracting a Tooth or a Root Situated Below a Bridge.—Where a bridge is firmly cemented to one or more abutments, and a root or partially erupted tooth situated below some part of the bridge is causing a pathologic condition that requires its removal, the disturbing factor should be extracted, where possible, without removing the bridge. If a case of this character occurs in the inferior arch, and a root of considerable size is below the bridge, the technic described for using the hawksbill forceps for removing a tooth wedged between two adjacent teeth (page 216) can sometimes be applied, modifying the procedure to conform to the condition presented. Where such procedure is not practicable and only a small root or a tooth with a single root is the cause of the disturbance, the part can frequently be extracted by incising the gum tissue over it, applying the elevator at the most favorable point for an adjustment, and loosening the tooth or root, when it is forced from its position in the direction offering the least obstruction, using for this purpose an elevator, mastoid chisel, or ordinary enamel chisel. If the tooth possesses more than one root, or if the disturbing element is an unerupted tooth, and it appears that the extraction would endanger the bridge, the bridge should be removed before attempting the extraction.

CHAPTER XIV.

ACCIDENTS.

The operator should acquaint himself with the features of such accidents as are liable to occur in connection with the extraction of a tooth, and become familiar with the best methods designed to prevent them. Accidents may happen quite frequently with a beginner, and even an experienced practitioner is not exempt from occasional unfortunate occurrences. Every precaution should be taken to prevent an accident, but so many contingencies are liable to arise during extraction operations that sometimes an accident is unavoidable. If an accident occurs, the operator should maintain his equanimity and not be disconcerted, as a patient is usually quick to notice any confusion on the part of the operator and become apprehensive as to the outcome of the operation. In most cases the operation should be continued as if the accident were one of the contingencies that might be expected, but in some instances an explanation will give assurance to the patient.

FRACTURES OF THE TEETH.

Causes.—An accidental or unavoidable fracture of a tooth is the most common accident in connection with the operation for its extraction, and may result from a number of causes, of which the following are mentioned:

1. Failure to make a thorough preliminary examination.
2. Lack of knowledge of the anatomy of the tooth and of the tissues by which it is retained.
3. Not correctly estimating the inherent strength of the tooth or the resistance to be overcome by its extraction.
4. Use of an instrument not suited to the tooth to be extracted, either because the proper instrument has not been selected for the operation or the instrument is not correctly constructed.
5. Misapplication of forceps or elevator.
6. Improper execution of the extraction movements.
7. Closing the beaks of the forceps too tightly on the tooth.

8. Attempting the extraction movements too soon, or before completing the application of the instrument to the tooth.

9. Operating too rapidly, and thereby losing the sense of cultivated touch.

10. Lack of perfect control of the instrument throughout the operation.

11. Interference by the patient during the operation, either in consequence of pain or from any other cause.

12. Failure to properly observe the space through which the tooth is to pass—e. g., where the space between the teeth is so narrow that it is impossible to pass the tooth through it without fracturing the tooth that is being extracted or disturbing an adjacent tooth.

13. Failure to gauge the strength of the tooth where extensive caries has weakened the parts.

14. Abnormality of tooth.

15. Abnormality of supporting structures.

Informing Patient of Probable Fracture.—Where, on examination, conditions indicate that a fracture may occur during the operation, and a local anesthetic is to be employed, it is advisable to inform the patient of the probability of such fracture, so that, if a fracture occurs, the patient will not be disposed to doubt the ability of the operator and will permit the extraction to be completed without hesitancy. If in such case the operator neglects to intimate the probability of a fracture, the patient may not only refuse to submit to further procedure at the same sitting, but may be inclined not to return for the completion of the extraction.

There are also many cases presented where the dentine of the crown is destroyed, but the greater portion of the enamel walls is intact. These walls possess little strength, but should not be removed prior to the extraction, as they serve as an excellent guide in directing the beaks of the forceps to a correct position on the roots, although they will usually fracture at the beginning of the extraction movements. The patient should be informed of the nature of the cracking noise that will probably occur where this condition is presented, for, if this is not done, the impression will be that the tooth is fractured and will likely result in a sudden interference by the patient at the most critical time of the operation.

Resulting Shock.—Where a fracture has occurred in an attempted extraction and the patient is not under a general anesthetic, the resulting shock is often more severe than if the tooth had been extracted in its entirety, as the very thing that was most dreaded has actually occurred. If the shock is very mild and the remaining parts are accessible, the operation can usually be completed, but the judgment of the operator must be quick and decisive. If, however, the shock has been of such a nature that the operation cannot be completed, the patient is permitted to rest, stimulants are administered if necessary, and a glass of sterilized water is given to clear the mouth of any blood that may be present. As soon as practicable the parts are again examined, and, if the procedure is of a simple nature, the operation is completed. If conditions indicate that the operation to follow will necessarily be painful or difficult, it is advisable to administer a general anesthetic, as the patient often interferes at the moment the instrument touches the parts and before an adjustment can be made. Such interference delays the procedure, which increases the nervous tension, and frequently repeated attempts to secure an adjustment become necessary, or the tooth is again fractured by applying the extraction movements before a correct application has been made to the parts. This may result in an increased shock, and so aggravate the condition that the patient will not submit to the completion of the operation.

Under General Anesthetic.—Where a fracture occurs when operating under a general anesthetic and the remaining parts are accessible, the operation should be completed. If the operator observes, as the tooth leaves the socket, that a small portion of the apical end of the root is left *in situ*, he must quickly determine whether he shall attempt to remove the remaining part before allowing the patient to recover from the anesthetic, or allow it to remain temporarily until a correct diagnosis of the part remaining can be obtained. In the majority of these cases the effort to complete the extraction, especially if the remaining part is very small and the alveolus is in a normal state, will be made in an uncertain manner, as the hemorrhage soon fills the wound, and the attempt to locate the unextracted part will require considerable time, or will result in the tissue being lacerated. It is, therefore, occasionally preferable to permit the patient to recover and clear up the wound, after which the remaining part can be more readily located and extracted, again administering the anesthetic if the removal of the fractured part is considered a difficult operation.

Sometimes during the execution of the extraction movements, as the beaks of the forceps are being sent over the neck of the tooth with the required amount of pressure, the operator will experience a sudden delivery, and he may be in a quandary as to whether the tooth has been extracted or a fracture has occurred at its neck. In such case he must quickly ascertain if the condition requires a continuation of the extraction procedure. Whether the tooth or part released remains in the beaks, drops on the tongue, or leaves the mouth, an examination must be made at once to learn what has occurred; if it leaves the mouth and is picked up by the assistant, her training should enable her to determine whether the extraction is complete, and she should inform the operator accordingly. Unless the operator promptly learns whether the extraction is complete, an attempt may be made to reapply the forceps when there is an empty socket, or he may discontinue the operation only to discover some time afterward that a fracture has occurred and the remaining part is left *in situ*.

Operative Technic.—The procedure for extracting the remaining part of a tooth in case of fracture is described for each tooth under "Extraction Technic" (Chapters IX, X). Precaution should, however, be taken in all cases of fracture not to cause any additional complications by attempting to complete the extraction while operating under uncertainties, and, if the part is not accessible to the intrument that is being employed, repeated attempts to apply the instrument should not be made in an effort to force the issue, for in many instances the conditions after the fracture vary from those first presented, and should be treated as an entirely different case.

Often in the case of fracture, when repeated application of the forceps is made on account of a failure to deliver the remaining part, the alveolus instead of the tooth will be grasped, causing laceration of the soft tissue and repeated fracture of the tooth or process without the desired result, and, in addition, giving the patient a great deal of pain. Such procedure should be avoided, and where there is any doubt as to the location of the remaining part the area around the structure should be syringed with an antiseptic solution, the gum tissue retracted, an examination made to ascertain the amount of tooth remaining, and a method outlined for the removal of the part. If it is found that the tooth is deeply seated, and that the alveolus is very dense and protruding beyond the tooth, the process should be burred away to allow a secure grasp of the beaks of the forceps on the part before any further attempt is made to extract it. If, however, the forceps cannot be applied for extraction, a suitable elevator should be adjusted to release the remaining part of the tooth.

Hemorrhage.—Where, in the case of a fracture, a hemorrhage ensues, it is usually difficult to locate the unextracted part, as the blood from the wound obscures the field and makes a reapplication of the instrument of extraction uncertain. If the tissue is inflamed and there is continual oozing of blood or pus from the wound, the patient should be allowed to rest a few minutes, after which the socket is syringed with an antiseptic solution to clear up the wound; and, if this does not have the desired effect and if it is not a case of alveolitis, an application of a styptic or of pressure should be made.

If the fractured tooth is a superior first bicuspid or one of the molars, and one root has been extracted, the empty socket may be tightly packed with gauze, which will check the hemorrhage. The gauze dressing may be left in place until the completion of the operation, when it is removed.

Cases will, however, occur where the oozing of blood from the socket continues in spite of all efforts to check it, and it is desirable that the operation be completed at the present sitting. In such case the socket is filled with absorbent cotton, and the operator, holding the mouth mirror and explorer in position, directs the assistant to quickly remove the cotton with Derenberg tweezers, when the parts are examined before the blood obscures its location. If the wound fills with blood before the inspection has been completed, this procedure is repeated until a correct diagnosis of the condition of the remaining part of the tooth is obtained. If the condition is favorable for the application of forceps or elevator, the socket is again filled with absorbent cotton, and the operator, holding the instrument selected for the extraction in close proximity to the socket, has the assistant quickly remove the cotton and the application is made before blood again fills the wound.

FRACTURE OF THE ALVEOLAR PROCESS.

An accidental or unavoidable fracture of the external plate of the alveolar process may occur when the tooth undergoing extraction is being severed from its attachment. This accident may happen when every precaution has been taken to avoid it and the extraction has been correctly performed, but serious consequences seldom follow the accident. The treatment of such conditions is described under "Treatment After Extraction" (page 352).

FRACTURE OF THE MAXILLARY TUBEROSITY.

An accidental or unavoidable fracture of the maxillary tuberosity may occur when this structure is prominent and too great a force is applied against it during the extraction of a superior third molar. This accident may also happen if the forceps are improperly adjusted and the beaks seize the tuberosity instead of the tooth.

Great care should be taken not to disturb the maxillary tuberosity when extracting a superior third molar, especially if the tooth is isolated, extensively decayed, impacted, or its roots hypercementosed or divergent. The same degree of care should be exercised when extracting a superior second molar where the third molar is missing from the arch, although in such case there is less liability of endangering the tuberosity.

Injuries incident to a fracture of the tuberosity do not, as a rule, extend beyond that eminence. If the parts are not entirely severed, and there are indications that a union will again form, the wound is thoroughly syringed with a mild antiseptic solution to remove any small fractured fragments of tooth or process, and the parts are readjusted by pressing them back to their normal position. A light dressing of gauze is then inserted in the open wound and the tuberosity kept as immobile as possible for several days, care being taken to prevent infection by frequent and liberal use of a nonirritating antiseptic.

If the parts are fractured, being either carried away with the tooth or are so loosely attached that the periosteum is entirely severed, the fractured part is removed by holding the tuberosity with Derenberg tweezers and carefully dissecting the soft tissue from it with a lancet. The wound is then carefully syringed and packed with a light gauze dressing, the treatment being continued daily until healthy granulation has closed the wound.

EXTRACTION OF AN ADJACENT TOOTH.

The accidental extraction of a wrong tooth may occur by attempting to operate too rapidly and consequently misdirecting the forceps in making the application. An accident of this kind may happen also where the field of operation is obscured by

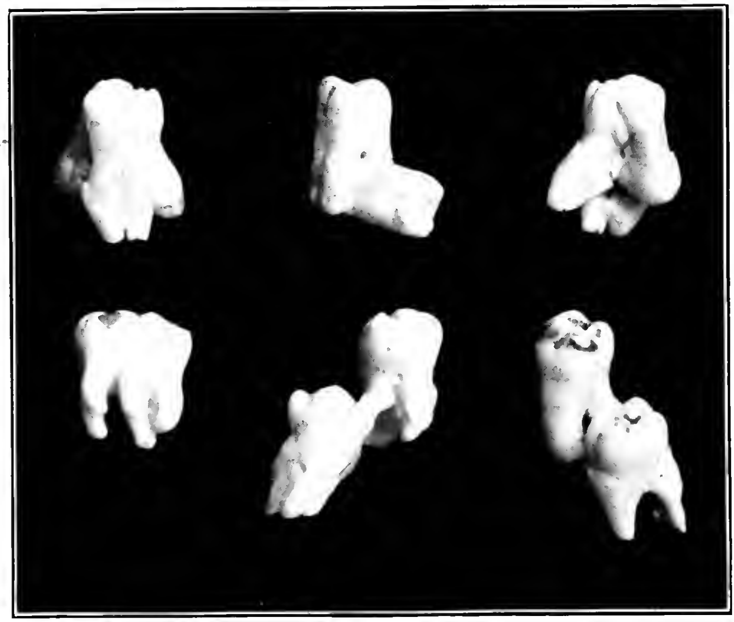


Fig. 186.—Teeth with fused roots. Illustration shows various forms of coalescence.

blood from wounds resulting from extraction of other teeth at the same sitting, especially when operating on the inferior arch; or where the case is of a complicated nature, and the operator endeavors to hurriedly complete the operation in order to relieve the patient as soon as possible.

The extraction of an adjacent tooth may also occur where a tooth is fused to one that is to be extracted, as it is seldom possible to diagnose this condition by an external examination. If such a fusion is suspected, it is advisable to procure a radiograph of the parts to satisfactorily determine the prevailing condition. Conditions of this character (Fig. 186) are, however, very rare, and accidents caused by operating too rapidly should not occur, and will not happen if the operator will not let his speed of operating overcome his precision in the application of the instruments for the extraction, and will always ascertain the location of the parts to be removed when in doubt.

In case of an extraction of an adjacent tooth, it should be immediately replanted and ligated to the most closely approximating teeth, taking the precaution to previously immerse the tooth in a weak solution of lysol to render it antiseptic if it has in any manner come in contact with any object not antiseptic. In most cases the tooth will again become attached to its supporting tissue, but the case should be under careful observation until a perfect coalescence is formed.

EXTRACTION OF OR INJURY TO AN UNERUPTED TOOTH.

Extracting or injuring an unerupted tooth is an accident that may occur when extracting a deciduous tooth and the forceps are applied with too great pressure, the beaks being directed beyond the deciduous tooth, and both permanent and deciduous teeth are seized.

The accidental extraction of an unerupted tooth is unavoidable where, in extracting a deciduous first or second molar, the roots of the deciduous tooth are firmly attached to the permanent bicuspid and both leave the sockets at the same time. Should such an accident occur, the treatment is the same as for the extraction of an adjacent tooth, described above.

FORCING A TOOTH INTO AN ABSCESS CAVITY.

Where an abscess area of considerable size exists, the tooth undergoing extraction may be accidentally or unavoidably forced quite a distance into the broken-down tissue. This accident occurs usually in the region of the superior laterals, first bicuspids, and buccal roots of the molars, and in the region of the inferior bicuspids and molars. Where a root or tooth that extends into an abscess cavity is supported by partially carious alveolar structure, which also supports the soft tissue over it, any pressure of the forceps on the part, unless it is firmly held by them, will often send it quite a distance into the cavity. The same kind of accident may occur when using the elevator, especially if the elevator is applied with too great a force and not in the right direction.

Where a tooth has been accidentally forced into an abscessed cavity, the wound should be thoroughly syringed with an antiseptic solution and the part located. By applying the thumb and index finger on the sides of the wound below the tooth, the latter may often be forced to the orifice. If the tooth cannot be forced from the cavity by this method, it is brought to the surface with an elevator, care being taken not to apply any additional pressure on the tooth while engaging it with the elevator, as that would tend to force it further into the cavity and open a larger area in the tissue than that already involved. After the removal of the tooth the wound should be treated for several days as described for like conditions under "Chronic Septic Pericementitis" (page 365).

FORCING A TOOTH INTO THE MAXILLARY SINUS.

Accidentally or unavoidably forcing a tooth into the maxillary sinus may occur when operating on a superior second bicuspid or first molar. Occasionally the bony structure over the roots of these teeth is carious to such an extent that the slightest pressure with an instrument will cause the root of a tooth to pass into the antral cavity, and cases are on record where the entire tooth has been pushed into this cavity.

In removing the pulp from a devitalized tooth the broach has been known to pass directly into the antral cavity, and, as abscessed roots often communicate directly with this cavity, forcing a broken-down root into the antrum is an accident that may occur unavoidably during an attempted extraction, as the condition of the structure about the roots cannot be previously determined.

Where a tooth or the root of a tooth has been forced into the maxillary sinus, the socket is thoroughly cleansed, the opening through which the tooth has escaped is enlarged, and the antrum is flushed with tepid water or a mild antiseptic solution, by which procedure the part may be flushed out of the sinus. If the part does not come out with the flushing, it is teased over the opening with an exploring instrument or Derenberg tweezers; or a loop of wire, attached to some convenient instrument, is inserted in the antrum, and the tooth caught in the loop, after which the loop is drawn tight and the tooth brought out. The socket and antrum are again flushed with a mild antiseptic, and then treated with antiseptic and stimulating remedies until the wound has healed. If this treatment does not effect a cure, some antral complication that requires surgical interference is usually present.

FORCING A TOOTH BETWEEN THE TISSUES.

Forcing a tooth between the soft tissues and alveolus may occur when operating on the inferior third molar where there has been a breaking down of the tissues caused by extensive suppuration or otherwise. Where such a condition exists, it is advisable to operate very cautiously in order to avoid, if possible, the occurrence of such an accident. The case usually requires the use of an elevator to assist in releasing the tooth, and the operator, after having loosened the tooth with that instrument and in attempting to apply the forceps to complete the extraction, discovers that the tooth is missing from its socket. In such case an examination may disclose the fact that the tooth has left its socket and passed between the soft tissues and the alveolar process. When this occurs, the tooth should be located at once, and, with the index finger placed below the tooth, it is carefully, but firmly, pressed to the orifice of the socket. As soon as the tooth reaches this point, it is grasped with Derenberg tweezers or forceps and carefully withdrawn from the mouth. If the tooth cannot be brought to the surface in the manner described, an incision is made at the most suitable point for the delivery of the tooth and it is released through the opening, a procedure that should be avoided where possible, but one that becomes necessary when the tooth cannot be forced back over the course it has traversed. After the tooth has been removed, the wound should be thoroughly syringed with an antiseptic solution, and, if the wound is large, it should be sutured, so that the flaps are held together. A gauze dressing is applied, a mouth wash prescribed, and the parts treated with stimulating antiseptics until healthy granulation is established.

LOOSENING AN ADJACENT TOOTH.

If an adjacent tooth is loosened during an extraction, it should be pressed back into position by pressure applied with the thumb to its occlusal surface; and if, after this has been done, it is found that the tooth remains elongated, a layer of cotton is placed on the occlusal surface and the patient directed to forcibly close the teeth, which will force the tooth back to its normal position. If the tooth is too loose to remain in position unsupported, it should be ligated to the adjacent teeth until it has again become firmly attached to the tissues.

DISTURBING ARTIFICIAL RESTORATIONS.

Cases will occur where a filling in an adjacent tooth will be accidentally or unavoidably disturbed during an extraction by the application of the forceps or elevator. If during the examination the operator observes that such an accident is liable to occur, it is advisable to inform the patient that the filling may be loosened or come out during the operation, but that disturbing the filling will not cause the loss of the tooth. If this precaution is not taken and such an accident occurs, the patient may be disposed to charge the operator with carelessness, if nothing worse. The disturbance of a filling is usually preferable to the fracture of the tooth to be extracted where it is necessary to choose between the two.

A porcelain crown may be accidentally fractured when the instrument used in the extraction comes in violent contact with the crown, and the accident may also occur where a wooden wedge or mouth-gag is inadvertently placed on such a crown. In all operations for the extraction of a tooth, no instrument should be permitted to come in contact with any porcelain restoration if it can possibly be avoided.

Occasionally the band of an artificial crown extends over a part of a tooth or a root to be extracted. This may be due to an improperly fitting band, to a tooth erupting against another tooth and the crown of the erupting tooth engaging the artificial band, or to a partial destruction by caries of the crowned tooth and the approximating tooth occupying the space created by the decay. Where possible, in such condition, the part should be extracted without disturbing the crown, but, if such an accident is liable to occur, the operator should not hesitate to protect himself by informing the patient of the probable result of the operation.

DISTURBING A TREATMENT IN AN ADJACENT TOOTH.

Where a tooth adjacent to the one to be extracted contains a treatment, retained by cotton, cement, or other means, the condition of the treatment should be carefully noted before the extraction, and care be taken not to disturb it during the extraction, especially if it is an arsenical treatment. If the retaining medium is disturbed, steps should be at once taken to prevent any of the medicinal agent entering the socket of the extracted tooth, and, if any of the agent enters the socket, it must be removed and the tissues thoroughly cleansed.

A case of this nature came to the knowledge of the author. An inferior second molar, containing a treatment that had been previously applied by another operator, was used as a fulcrum for the extraction of an inferior third molar. During the extraction the treatment was disturbed without being observed, and the patient was dismissed. Subsequently a decided case of arsenical necrosis developed, but the true nature of the condition was not learned until after every available remedy had been tried and the history of the second molar was obtained, which disclosed that the tooth previously contained a treatment of an arsenical compound.

BREAKING AN INSTRUMENT.

The breaking of a beak of the forceps or the blade of an elevator during the extraction movements is an accident that occasionally occurs, and, when it does occur, the broken part should be removed at once. No operator should ever court an accident of this kind by using an instrument of inferior material or improper construction. Instruments that must undergo the tests to which forceps and elevators in practical use are frequently subjected cannot possibly be too well constructed.

BRUISING THE LIP.

The accidental bruising of the lip may occur where the mouth is small, or where there is false ankylosis; or where the extraction is, for some reason, of a complicated nature; or where the patient, from nervousness or pain, interferes with the operator or suddenly closes the mouth. The accident may also occur where the patient, under a general anesthetic, disarranges the mouth-prop, making it necessary to use a mouth-gag or wooden wedge, and either of these instruments is not carefully inserted and impinges on the lip.

A root or tooth with very sharp edges should be carefully removed from the mouth after being detached from its socket, and should not be allowed to touch the lips, as laceration and infection may follow if contact occurs. A practicable method for protecting the lip in a case where it is liable to be bruised is to have the assistant hold a towel or napkin over the lip of the patient to protect it from the pressure of the forceps. If the lip is bruised, the injury is immediately noticeable, as the parts quickly become swollen and discolor. When the accident occurs, an ointment should be applied and the patient instructed to keep the parts protected; if the lip is cut, the parts should be compressed to check any hemorrhage, and an antiseptic dressing applied.

BRUISING THE CHEEK.

The lateral walls of the mouth may be accidentally wounded when the joints of the forceps, in consequence of not having been rounded, catch these tissues. This accident can, however, be avoided by having the joints of the forceps rounded, as described on page 9. The tissues of the cheek may also be wounded where the instrument used for extraction slips from its adjustment on the tooth during the application of the extraction movements. If any partly detached tissue results from either of these accidents, it should be trimmed away, the wound touched with tincture of iodin, and a nonirritating antiseptic mouth wash prescribed. The parts usually heal without causing any further trouble.

WOUNDING THE TONGUE.

Wounding the tongue or floor of the mouth is an accident that may occur when extracting an inferior tooth and the instrument is not securely adjusted, especially when the tooth is out of alignment and directed toward the tongue, or it may happen through carelessness or hasty operating. This accident is particularly liable to occur when the patient is under a general anesthetic and the forceps are inaccurately applied to an inferior tooth that is obscured by blood from freshly opened sockets, and involuntary movements of the patient while under the anesthetic may also cause the forceps to be misdirected.

If the wound to the tongue is an abrasion or a laceration that involves only the surface, any partially detached tissue is then trimmed away and a mouth wash prescribed; if the wound is more serious, the parts should be thoroughly cleansed, the hemorrhage checked by compression, tincture of iodin applied to the wound, and an antiseptic mouth wash prescribed; and if the injury is extensive, the tongue should be drawn forward and the injured parts ligated with catgut before applying the above treatment. If the lingual artery is severed, it should be compressed with artery forceps, and treatment should be continued until recovery is complete.

DISLOCATION OF THE MANDIBLE.

Dislocation of the lower jaw is more liable to occur with young women of delicate physique, and may happen during extraction when the jaws are fully distended and excessive pressure with the forceps is applied without the chin being supported, and when the mouth is forcibly opened with a gag.

The dislocation is usually forward of the normal position, with the condyle partially slipped out of the glenoid fossa anteriorly toward the interarticular cartilage, and may be bilateral or unilateral, the former being the most common. In bilateral dislocation the mouth cannot be closed, the inferior teeth protrude beyond the superior teeth, the face appears long and the chin distended, saliva flows from the mouth, and the pain is usually moderate, but the patient swallows and talks with difficulty. In unilateral dislocation the mouth is not open so far, and the jaw is displaced toward the nondislocated side.

Treatment.—The patient's head is placed comfortably in the head-rest of the operating chair. The operator, having wrapped his thumbs with gauze, takes a position in front of the patient, and places his thumbs on the inferior molar teeth, applying pressure downward and backward. The fingers that are free are used to support the jaw during the application of the pressure, and to raise the chin when the condyles are loosened. If this procedure fails to reduce the dislocation, a mouth-prop is placed between the molar teeth and pressure is applied under the chin. In unilateral dislocation the pressure with the thumbs is applied only on the dislocated side. After the reduction, if no difficulty has been encountered, the parts seldom give further trouble. If, however, the muscles or coronoid process has been affected, a bandage is properly applied, and the patient is placed on a liquid diet, being instructed to return for treatment until the inflammation has sufficiently subsided to permit the removal of the bandage.

FRACTURE OF THE JAW.

The treatment of a fracture of either maxilla from some traumatic injury does not come within the province of the exodontist, and reference is made to it here only as a possible contingency that may arise during an operation. Fracture of the jaw during extraction is very uncommon, but such accidents have occurred. Precaution should always be taken to avoid an accident of this character, especially where a previous fracture occurred from an injury, or where a pathologic condition involving the alveolus and maxilla has weakened these structures, or where their normal strength has been reduced by a surgical operation, or where they are weak from a congenital defect. Where more than ordinary resistance is encountered during the extraction movements, it is advisable not to attempt to overcome it by applying extreme force, as conditions may exist that militate against a forcible extraction. In such case a careful examination is to be made, and any interfering obstruction should be removed or treated in such manner as to allow a delivery of the tooth.

Symptoms.—In case of fracture the symptoms are rapid swelling of tissue over the fracture, hemorrhage over the lacerated parts, saliva flowing freely from the mouth, unnatural mobility, and crepitus.

Treatment.—The fractured parts are carefully adjusted so that the teeth are in their normal occlusion, hemorrhage is checked, and the wound is rendered aseptic. Fracture bands or some form of splints is then adjusted to immobilize the parts, a mouth wash is prescribed, and the patient placed on a liquid diet. The parts should coalesce in about four weeks.

TEETH LOOSENED OR DISPLACED BY ACCIDENT.

Cases are presented for extraction where teeth are loosened or driven from their position by accident. Such teeth should seldom be removed, but should be carefully placed in position and the wound treated, and, where necessary, they should be retained by suitable splints. If the operator is not in a position to construct suitable retaining appliances, the case is referred to a competent general dental practitioner for this purpose. An accident of this nature occurs more frequently with the superior central incisors, and these teeth, when such an injury happens by a fall of the patient or otherwise, are driven far into the soft tissue and alveolar process. In such a case a proper effort should be made to replace the teeth and retain them in normal alignment, but a careful examination, particularly observing the amount of alveolar structure that may be involved, should be made before any of the parts are treated. If the alveolus is destroyed to such an extent that the teeth can no longer be retained by this structure, they should be removed, preserving every tooth that can be retained and as much as possible of the process.

TOOTH PASSING BEYOND THE PHARYNX.

Such an accident may occur where the tooth slips from the forceps, or where the elevator is used and the operator loses control of the tooth. In case a tooth is swallowed, it readily passes through the alimentary canal. If, however, a tooth enters the air passages, tracheotomy may necessarily have to be performed to prevent death.

CHAPTER XV.

TREATMENT AFTER EXTRACTION.

The extraction of any tooth necessarily creates a wound, and every such wound, no matter how small, is a more or less fertile field for the propagation of pathogenic bacteria and a gateway for their entrance into the human system. This condition should, of itself, be sufficient reason for treatment after extraction, as an open wound of the character caused by the removal of a tooth from its supporting structures, however simple the case may be, would be considered serious if located on the external surface of the body, and no surgeon would cause a wound of a similar nature without due attention to sepsis.

Albuminous substances in a greater or less quantity are always present in the mouth, and their decomposition by the action of saprophytic fungi creates derivatives of albumin, many of which are toxic in effect. These substances, combined with pathogenic bacteria that are so often present even in a healthy mouth, and all of which are held in suspension by the saliva, render it a highly infectious fluid, and thus expose to contamination from these substances any abrasion that may be present in the oral cavity. If wounds existing in mouths that are kept in a state of cleanliness are thus exposed to infection, the degree of exposure in the average mouth must be much greater. Nearly every case of extraction is an infective lesion when presented, and in many cases there are infected lesions in other parts of the mouth. Unclean teeth and marginal gingivitis are the rule rather than the exception. Pyorrhea alveolaris, sending forth its daily supply of pus from numerous pockets, and frequently a sinus discharging toxins at irregular intervals, not to mention the infective pathologic conditions so often associated with the tooth to be extracted, are conditions only too often presented. Many forms of bacteria that cause specific diseases are frequently found in the mouth, among which is the pneumococcus, or bacterium pneumoniæ, and the serious nature of a wound infected by this organism should be fully realized.

In view of the many sources of infection to which a wound caused by an extraction may be subject, not all of which have been mentioned, and the fact that the location of the wound makes it impossible to maintain a perfect aseptic condition at all times during the healing process, the operator should not fail to adopt the necessary measures to properly treat such wound.

EXAMINATION.

Immediately after the operation the extracted tooth is examined to ascertain if it is intact, if a fracture has occurred, or if any gum tissue or alveolar process is attached to it, and any abnormalities of the root are noted.

The gum tissue is examined for any injuries that may have been caused by the application of the instrument, or that are the result of any difficulty that may have been encountered during extraction.

The margin, septum, and cortical plates of the alveolar process are examined for any injury that may have been caused by the removal of the tooth, and search is made in the socket if it is probable that any foreign body has entered the wound.

The adjacent teeth are examined to determine if any injury has occurred to their crowns, if their attachments have been disturbed, or if the surface of any tooth that may be extensively decayed has been fractured by the extraction, leaving sharp edges that will irritate the cheek or tongue. If the filling of an adjacent tooth is loosened or has come out, the patient should be advised of the fact.

The surrounding tissues are carefully examined, and any pathologic condition of the supporting structures is noted to determine the nature and extent of the involvement.

EXTRACTION WITHOUT COMPLICATIONS.

Where the patient is not afflicted with any systemic disturbances, where the oral cavity is in a prophylactic condition, and where there are no pathologic conditions involving any of its parts, except the crowns of the teeth, the field of operation for the removal of a tooth is as good as can be presented. In such case, if the extraction has been a comparatively simple operation —the tooth having been readily released from its supporting tissue and the tissue is in a healthy state—and no injury has occurred to the associated parts, save the contusion of the gum tissue and rupture of the peridental membrane necessarily caused by the separation of the tooth from its attachment, the extraction is one without complication, and the treatment to be followed is of the simplest nature.

Treatment.—The margins of the socket are flushed with an antiseptic solution to insure the removal of any debris that may have entered from around the neck of the tooth, and that could not be reached when these parts were cleansed preliminary to operating. The primary hemorrhage following the extraction usually ceases in a few minutes, and in the interim the patient is given a glass of sterilized water with which to clear the mouth of blood, but the water should not be used too freely. Any suction of the wound should be discouraged, and the patient should not be dismissed until the hemorrhage has subsided. (See Hemorrhage, page 371.)

The blood is permitted to coagulate in the socket, and the clot should not be disturbed, as it is impossible to apply any dressing that will protect the wound with the same efficacy that is afforded by the clot. The patient is instructed not to interfere with the clot by inserting the finger into the wound or by trying to apply a dressing of any kind. An antiseptic mouth wash is prescribed, which should be used freely and often. The frequent use of a mild, nonirritating wash is preferred to the occasional use of a stronger one that is irritating, as by a liberal use of the former all parts of the mouth can be cleansed and a better condition of asepsis maintained. As to choice of mouth washes, there is probably nothing better than a saturated solution of boric acid in water, or the Thiersch solution (salycilic acid, 15 grains; boric acid, 90 grains; distilled water, recently boiled, 16 ounces), which is very efficacious. There are a number of proprietary mouth washes that are good, and, when desirable, the one most agreeable to the patient may be prescribed.

The patient should be instructed to return in case there is increased pain or swelling of the parts after a lapse of thirty-six to forty-eight hours from the time of operating. Usually the cases that are treated in the manner indicated cause no further trouble, but proper precaution should always be exercised in order to prevent possible infection.

TRAUMATIC INJURY TO THE GUM TISSUE.

The gum tissue in the immediate region of the extracted tooth is often accidentally or unavoidably injured. Such an injury is not, as a rule, of an extensive nature, and is usually confined to the gingival margin and the septal tissue on either side of the tooth. Occasionally the injury extends beyond the margins of the socket, and there may be considerable laceration, or the loosening of quite an area of gum tissue from the alveolar process. Immediate attention given an injury to the gum tissue in such case will tend to reduce the liability of the wound becoming complicated.

Treatment.—Where the injury is confined to a contusion of the parts or the carrying away of a small amount of marginal or septal gum tissue, the treatment is the same as that given under "Extraction Without Complications" (page 349). Where there is laceration, leaving rough edges or small flaps of tissue in which the circulation will likely be arrested, the ragged parts should be removed with a pair of curved scissors; but where any considerable area of tissue has been loosened, it should be retained, if possible, in order to protect the alveolar process. The detached margins are carefully adjusted, and will usually remain in position without further support; but where the process does not afford the proper support, the parts can often be held in place by inserting a cone of sterilized gauze in the socket. The gauze is inserted very lightly, so as to allow the blood clot to fill as much as possible of the socket, and should be removed the following day, when the margins will usually remain in position without further support. Where, in case of extensive laceration or where the gum tissue has been loosened from the process, the parts cannot be retained in normal position by means of the gauze dressing, they should be retained by sutures. A mouth wash (page 350) is prescribed, and the patient should be seen on the second or third day, when the circulation in the loose parts and the antiseptic condition should be noted. If gangrenous areas are present, they should be removed; if granulation does not establish itself, it should be stimulated by cleansing the surface with a curet or by the application of tincture of iodin; and if sutures have been used, they should be removed as soon as the parts will retain their normal position without their support.

TRAUMATIC INJURY TO THE ALVEOLAR PROCESS.

The alveolar process is not, as a rule, injured where the extraction is a simple operation, but there are cases where it is impossible to remove the tooth without causing some traumatic injury to this tissue, and there are other cases where the injury is caused by accident.

Loose Spicula.

Treatment.—Any small fractured piece or loose spiculum of process should be washed away with the syringe or removed with tweezers. Where such piece is adherent to the gum tissue, it may be necessary to dissect it from this tissue before it can be removed, which is done by holding the fractured part with the tweezers and cutting it loose with a lancet. Detached pieces of process, if allowed to remain, will often irritate the parts for several weeks before they come to the surface and are removed, sometimes prompting a person who has had a tooth extracted to remark that at the time of the extraction a part of the jaw bone was broken and pieces of it came out several weeks afterward.

Sharp or Irregular Margins.

Treatment.—Where any part of the process, as the result of an extraction, has irregular or sharp edges, they should be cut away with forceps or with a bur in the manner described under "Exposed Process" (page 355), as such projection will often prove an irritant to the gum tissue, and thus delay the closure of the wound. As these projections are only gradually resorbed after the normal physiologic functions have been restored in the parts, their removal will often greatly shorten the time in which normal conditions are again established. This procedure is important where a number of teeth have been removed and their loss is to be replaced by artificial restoration.

Fractured Margin and Septum.

Treatment.—A fracture of the margin of the alveolar process or of the septum separating the roots is not an infrequent occurrence in the extraction of a multiple-rooted tooth, as the divergence of the roots is often so great as to prevent their release from the socket without such an accident; or it may be necessary to carry a tooth laterally to effect its release, which will often have the same result. Where the detached part is entirely carried away, no further attention need be given to it than to see that no sharp points are left unrounded. If the fractured part remains loosely attached to the gum tissues, it is seldom advisable to attempt to readjust it, but should be removed as described under "Loose Spicula" (page 352), as such removal will cause only a slight depression at the point of fracture and entail no permanent injury. Where the septum separating the extracted tooth from an adjoining tooth is fractured, but not entirely carried away, it should be carefully pressed back into position as a protection to the tooth that is to remain.

Extensive Fracture.

Treatment.—Where the fracture involves an extensive area of the process, but the part is not carried away with the tooth, it should be carefully pressed back into position, where it will usually be retained without further support. Wherever possible, the carrying away of a large area of process should be avoided, and, if during an operation it is observed that an extensive fracture of the process has occurred, the extraction should be discontinued and the process detached from the tooth, after which the extraction is completed. If quite an area of process is suddenly separated entirely from the bony structure during an extraction, of which accident a number of cases are shown in Fig. 187, the gum tissue should not be carried away with it, but the tooth should be released and the gum tissue carefully dissected from the fractured process, so as to avoid extensive laceration of the soft tissue and to retain as much of it as possible in order to protect the underlying bony structure, which would otherwise be exposed. Where, however, so much of the osseous tissue has been removed that the part remaining does not give adequate support to the soft tissue, the latter should not be permitted to fold over the process to such an extent as to entirely cover the space that was occupied by the extracted tooth, but provision should be made for drainage, which is done by inserting a gauze dressing lightly in the socket of the extracted tooth. The dressing should be removed the following day, and, where necessary,

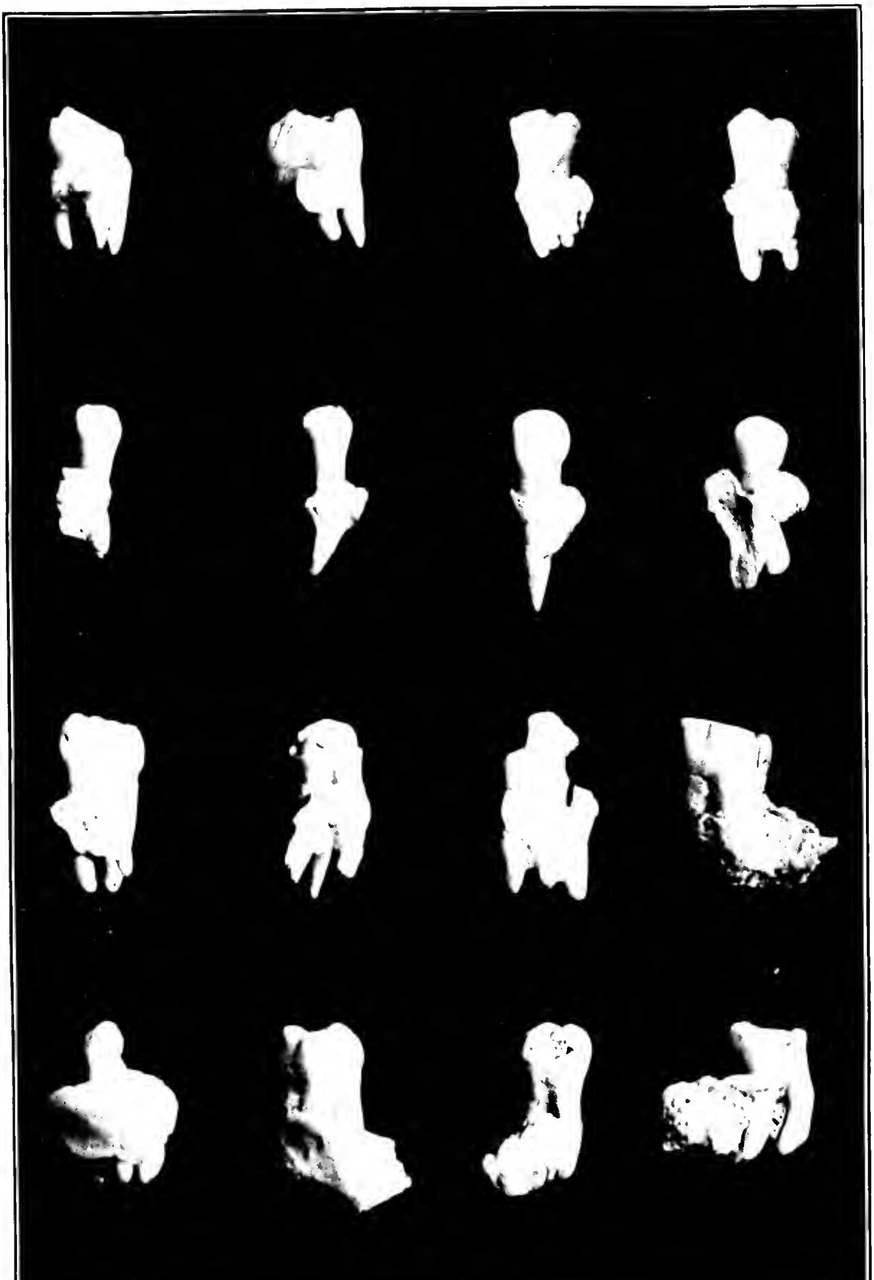


Fig. 187.—Fracture of the alveolar process. Illustration shows various cases of fracture of the process.

a new dressing applied daily until the tissue will remain in position without further support. The renewal of the dressing should be discontinued as soon as possible where the socket is further protected by stimulating a healthy blood clot.

In any treatment of a fractured process where an attempt has been made to retain the part detached, the progress of repair should be noted, and, where there is a failure in the establishment of an osseous union, the fractured part should be removed to prevent further irritation and possible necrosis.

Where the patient becomes aware that a fracture has occurred, it is advisable, to avoid alarm and possible misapprehension as to the gravity of the condition, to make an explanation of the nature of the fracture, which should be made in language commensurate with the intelligence of the patient. A dry specimen of the mandible from which a number of teeth were removed prior to death of the subject will serve to practically illustrate such a case and to more effectually disabuse the mind of the patient of the idea that the injury is of the jaw proper.

EXPOSED PROCESS.

Where, after extraction, there is not sufficient gum tissue to fold over and protect the alveolar process, the exposed surface, if allowed to remain unprotected, may become very painful and will often necrose. Such a condition may result from a number of causes—e. g., where repeated attempts have been made to apply the forceps to a root or tooth that is deeply seated; where the gum tissue is carried away with the extracted tooth; where approximating teeth are extracted at the same sitting, and the alveolar margins and interproximal alveolar septa are thick and dense, and project to such an extent that the soft tissues do not fold over and protect them (Fig. 188). This is not an uncommon condition presented after extraction in the case of advanced age, where there is more or less atrophy of the soft tissue around the necks of the teeth.

Treatment.—Where the process is exposed, the patient usually applies the tongue to it, and not infrequently thrusts a finger into the wound, with the remark that all of the tooth has not been extracted. The patient should be cautioned in an inoffending manner against such acts, and be advised as to the nature and function of this tissue, the explanation being made that its removal will assist nature's process of repairing the lesion.

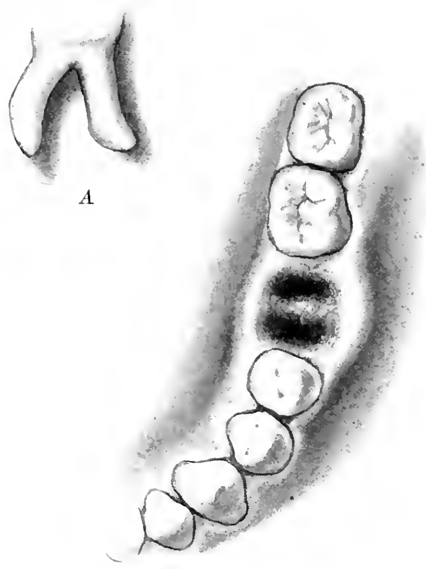
Where the gum tissue does not fold over the surface of the alveolus on the lingual or buccal margin of the socket, enough of the exposed area of process should be cut away to allow the gum tissue to cover the exposed part. The removal of the process is best accomplished with Standard forceps No. 2 (Fig. 2) in the superior arch and with Standard forceps No. 6 (Fig. 7) in the inferior arch. If the soft tissue is firmly adherent to the alveolus, the latter is cut away with a bur, care being taken not to lacerate the gum tissue. Where the septum that was between

Fig. 188.—Exposed process.

the roots of a molar tooth or that separated two teeth which have been extracted is very prominent, it also should be reduced by cutting, which can be readily accomplished with the forceps. The socket is flushed with an antiseptic solution to remove any fragments of bone, and a healthy blood clot is stimulated to protect the wound.

DILATED SOCKET.

A tooth that is not firmly attached to the alveolus, or has only short fused roots, can be removed from its position in the arch with very little, if any, dilatation of the socket, but it is impossible to extract a tooth with markedly divergent, crooked, or hypercementosed roots without dilating the socket. Where lack of space for the passage of a tooth necessitates its removal laterally, the socket will be dilated, and such condition occurs more frequently with the molar teeth. Fig. 189 illustrates a typical case of dilated socket, in which *A* shows an inferior first molar tooth with divergent roots, and *B* shows approximately the extent of dilatation of the socket caused by the extraction of such tooth. In the superior arch dilatation usually affects the buccal wall of the socket, while in the inferior arch both buccal and



A

B

Fig. 189.—Dilatation of the socket. *A*, markedly divergent roots of an inferior first molar; *B*, dilatation of the socket as the result of extracting a tooth with divergent roots.

lingual walls may be displaced, except in the case of the third molar, where the dilatation usually affects only the lingual wall.

Treatment.—A dilatation of the socket distends both the hard and soft tissues, and, if not reduced, will cause increased and prolonged inflammation, with accompanying pain. Where the socket is only slightly dilated, the injury is usually at the orifice, and the dilated parts are restored to their normal position with the index finger. The dilatation thus treated will cause little more disturbance than if it had not occurred.

Where the socket is extensively dilated, and the lingual and buccal walls of the socket are affected, they are pressed back into their normal position with the thumb and index finger (Fig. 190). Care should be taken not to press the walls too far, as this will cause as much injury as to leave them dilated. The operator, as he passes his finger over the sides of the socket, determines the amount of displacement, and the strength of the alveolus is conveyed to him by this touch. Pressing the affected walls back to their normal position is more or less painful, and should be done before the patient recovers where a general anesthetic has been administered. If the dilitation is in the region of the lingual

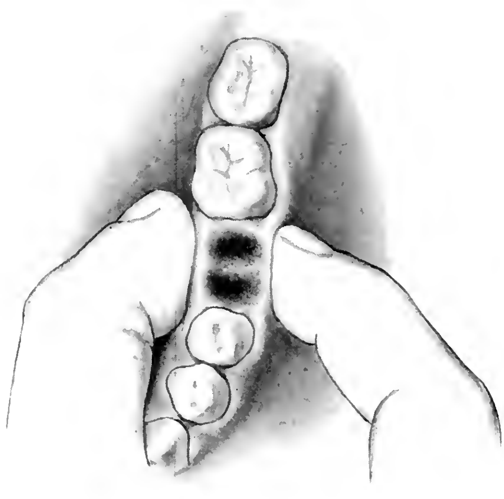


Fig. 190.—Same subject as Fig. 189. Method of applying the thumb and index finger to correct a dilated socket.

plate of the third molar, care should be taken to make a complete replacement. When the dilatation has been corrected, the socket is flushed and a healthy blood clot allowed to form for its protection.

In all cases of traumatic injury to the alveolar process caused by the extraction of a tooth, the cleansing of the mouth and the washing of the wound with antiseptics, as given under "Extraction Without Complications" (page 349), should be followed with increased vigilance, and any exposed surface that cannot be protected by a blood clot or by a gauze dressing should, in addition to the use of mild antiseptics, be touched lightly with a

10-percent solution of nitrate of silver every twenty-four hours until healthy granulation is established.

FOREIGN BODIES IN THE SOCKET.

Where a number of teeth are extracted at the same sitting, there is a greater probability that salivary calculi, fillings, or loose fragments of tooth may enter the socket of another tooth, and, if permitted to remain, become an irritant and delay the healing of the wound. This condition should be especially guarded against when extracting teeth in both the inferior and superior arches at the same sitting, as after the removal of the inferior teeth parts of a fractured tooth from the superior arch may drop into the mouth and enter a socket of one of the extracted inferior teeth.

Where a fragile root is extracted, parts of it will often remain attached to the gum tissue, and the fragments are frequently overlooked on completion of the operation. The operator may examine only the extracted root, and, not perceiving any positive fracture, will conclude that the root is intact and that nothing remains in the socket. Parts of the mesial and distal sides of the root, with which the beaks do not come in contact, may remain attached to the gum tissue, and, when this occurs and is not observed by the operator, the patient will usually call attention to the occurrence, being under the impression that the tooth has not been entirely extracted.

In view of the probability of foreign particles entering the wound or parts of a broken-down tooth remaining in the socket, it is advisable to carefully examine the socket and remove any foreign body that may be present by irrigating with an antiseptic solution, or take it out with tweezers or a probe. Where a part of the tooth remains, but is not firmly attached to the gum tissue, it is readily removed with the Derenberg tweezers. Where the remaining part is of considerable size and the union is firm, the part is held with Derenberg tweezers and separated from the soft tissue with the lancet.

ALVEOLITIS.

Alveolitis is an inflammation of the peridental membrane or of the membranous lining of the alveolus, and the term as here used applies to the various grades of pericemental disturbances where pus is not present. The term also includes pericementitis produced by nonseptic causes, among which are the following: traumatic pericementitis caused by external violence to a tooth by a blow, fall, or attempted extraction, the latter cause often having associated with it more or less injury of the alveolar margins; traumatic pericementitis caused by internal violence, such as the projection of a pivot wire, broach, or drill through the apical foramen; hypercementosis, with which there is occasionally associated mild inflammation, which is often greatly increased by the traumatic injury that cannot be avoided in the extraction; acute septic pericementitis in the initial stages and before the formation of pus.

In most cases of alveolitis where extraction is indicated the tooth is very sensitive to the slightest touch, and the application of an instrument causes excruciating pain. The tooth may be loosened and slightly extruded, which may assist the extraction, but should not be relied on, as it may be quite as difficult to separate the tooth from its attachment as would be the case if alveolitis were not present. In such case the operation should be performed, if at all practicable, under a general anesthetic.

Treatment.—The extraction of the tooth, which will relieve the pressure on the inflamed membrane, may cause the pain to subside, and usually has that effect if the extraction is followed by a rather profuse hemorrhage. When the bleeding is not free, it should be encouraged by a liberal use of warm water. If the pain continues after the extraction, the wound is irrigated with a mild antiseptic solution, and whatever fluids remain in it are taken up with absorbent cotton. Another piece of absorbent cotton, shaped to approximate the form of the root that has been removed, is then dipped into campho-phenique, quickly carried to the apex of the socket, and allowed to remain for several minutes. To make the treatment more effective, the parts should be kept free from moisture during the medication. After the removal of the dressing, the wound is sealed, when necessary, with a blood clot by touching the gum tissues with a sterilized instrument. A mouth wash, as given under "Extraction Without Complications" (page 349), is prescribed, and the patient is instructed to return for further treatment on the recurrence of pain or in case the inflammatory conditions do not subside.

Where the patient is affected with neurasthenia or other nervous disorder, potassium iodid in 10-grain doses, taken three times daily after meals, is a valuable adjunct to the local treatment, in addition to which the patient should avoid all forms of excitement and maintain as perfect rest as possible.

POST-OPERATIVE ALVEOLITIS.

This is a nonseptic inflammation of the tooth socket occurring some hours after the operation, and usually occurs in cases of difficult extraction, such as the removal of hypercementosed teeth, of superior or inferior molar teeth with divergent roots (which cause considerable dilatation of the socket), of inferior molar teeth with the roots curved around the septum separating them (the septum having been carried away with the tooth during the extraction), or any considerable traumatic injury to the alveolar process. Sometimes the cause is obscure, but may be due to the density of the blood clot or some systemic disease or idiosyncrasy.

Treatment.—The blood clot is removed by irrigation with warm water or carefully picked out with tweezers, after which the treatment is the same as in "Alveolitis" (page 359), except that in aggravated cases 95-percent phenol may be substituted for campho-phenique.

ACUTE SEPTIC PERICEMENTITIS.

The term acute septic pericementitis includes all forms of acute inflammatory conditions about the root of a tooth, due to the invasion of septic or pyogenic organisms, where the disease has advanced to the stage of pus formation. This condition is variously described as dento-alveolar abscess, acute alveolodental abscess, acute suppurative alveolitis, acute alveolar abscess, etc. The term embraces also osteitis—which develops very early in the pus formative period at the apex of a root—abscesses that occasionally develop at the gum margins or at some intermediate part of the pericementum, and abscesses that develop around impacted teeth or originate beneath the gum overlying an inferior third molar.

The advisability of extraction in acute septic pericementitis is frequently a moot question, but operation is favored wherever the general health of the patient will permit. The claim has been made that the continuation of pus formations after extraction and the possible infection of other tissues as a result render the condition worse than before the extraction, but, if such infection occurs, it will be due to the retention of pyogenic organisms beneath the blood clot or to a secondary infection from external organisms, both of which causes should be averted by the proper procedure before and after operating. The retention of the tooth will simply hold the pyogenic bacteria, and any metastatic infection that occurs after the extraction would undoubtedly take place if the tooth were retained. The removal of the tooth in such case opens the way to the seat of infection, establishes a means of exit for the pus, and allows cleansing and sterilization of the affected area, which latter should be judiciously done in the post-extraction treatment, at the same time protecting the wound from the invasion of any external microörganisms.

Treatment.—In acute septic pericementitis the pericementum is highly inflamed, the tissue much swollen, and the tooth extremely sensitive to the slightest touch. Local anesthetics are of little value when such conditions are present, and, wherever possible, the operation should be performed under a general anesthetic. In a majority of cases the patient has suffered pain, had loss of sleep, and, in addition, has worried with the thought of the "pain of the extraction" until there is a great loss of nervous force, the system being then in no condition to endure further pain.

Preliminary to the extraction, all parts of the mouth are thoroughly cleansed with an antiseptic, and the gum tissue and area about the tooth to be removed are irrigated with the same solution, in order that the oral cavity may be rendered as free as possible of pathogenic bacteria, as such organisms as bacillus pneumoniæ and bacillus diphtheriæ are not infrequently found in the mouths of even healthy individuals. Following the removal of the tooth, the pus is evacuated, and this should be done before the recovery from the anesthetic. The abscess is usually freely opened by the removal of the offending tooth, and in such case the pus is driven out by applying pressure on each side of the socket with the thumb and index finger. If the extraction does not afford a free vent for the pus, and it is retained in a recess burrowed in the process, a pointed but slightly curved lancet is directed to the apex of the socket and sufficient pressure applied to penetrate the alveolus, which will provide the necessary opening for drainage. Where the pus has burrowed through either plate of the process, but is retained beneath the periosteum or gum tissue, it is usually preferable to lance the gum at the point indicated by the pointing of the abscess than to try to force the pus through the opening created by the extraction of the tooth. The pus, as it leaves the socket, is not allowed to pass into the mouth, but is caught with absorbent cotton or gauze until the patient has recovered from the anesthetic. After the mouth has been rinsed with warm water to promote hemorrhage and to free it of blood and saliva, the socket is syringed with sterilized warm water, which is followed with an antiseptic wash used in the same manner. Potassium permanganate, 5 grains to 1 ounce of water, is an excellent antiseptic for this purpose, but has a disagreeable taste. Where this wash is objectionable, one of the mouth washes mentioned under "Extraction Without Complications" (page 349) may be used. After the application of the mouth wash, 95-percent phenol or full-strength lysol is introduced into the socket in the same manner as campho-phenique is applied in alveolitis (page 359), and allowed to remain from three to five minutes, when it is removed and a gauze dressing is applied. The gauze should be packed only firm enough in the socket to exclude foreign matter, as drainage must be maintained. A suitable mouth wash (page 350) is prescribed, which should be used often and freely. The gauze dressing should not remain longer than twenty-four hours, when it is removed and the previous treatment repeated. Where the inflammatory condition rapidly subsides, the application of 95-percent phenol may be omitted in the second treatment, and its use is seldom indicated in any case after the third treatment. The wound is dressed daily until healthy granulation is established, when it is protected with a healthy blood clot, and further treatment is discontinued, save the use of a mouth wash.

It will be understood that there can be no specific method for treating all forms of acute septic pericementitis, but the above treatment, modified to suit individual conditions, has proven very satisfactory, and will serve as a basis of operative procedure in this very prevalent ailment.

Any gangrenous tissue that may appear should be removed, and, where the acute inflammatory conditions are not mitigated by the time of the second treatment, the wound should be carefully examined to determine whether proper drainage has been maintained. Where the inflammation is diffused, as in lymphangitis, or where there is any febrile disturbance, constitutional treatment, as a precaution against possible toxemia or septicemia, should be administered and directed toward the elimination of any ptomaines that may have entered the circulation. For this purpose a saline purgative should be prescribed, and, where indicated, diuretics may also be taken. Aspirin in 5-grain doses, taken every three hours, or oftener if required, may be given where there is local pain, restlessness, or any marked nervous disturbances.

Where the acute inflammiatory conditions subside, but healthy granulation is not established within a reasonable time, the wound should be treated as given under "Chronic Septic Pericementitis" (page 365).

POST-OPERATIVE INFECTION.

Precautionary measures should always be taken to prevent infection of the affected parts after an operation, but, if such infection occurs and the patient comes under the care of another than the one who performed the operation, the case should, where possible, be referred to the former operator or he should be consulted, as it is presumed that he will be familiar with the original conditions and the treatment applied at the time. There should not be a disposition to attribute the cause of the disturbance to the use of unclean instruments, for, while instruments that have not been properly sterilized are sometimes used, it must be borne in mind that the site of an extraction is prone to infection and that the larger number of dental lesions are in a state of infection from the time of their origin, not to mention the probable neglect, on the part of the patient, of the treatment after extraction. To consider a wound created by the removal of a tooth as trivial is the general rule with patients, and this feeling of indifference usually leads to an utter disregard of instructions given for its subsequent care and treatment.

Treatment.—The treatment in post-operative infection is the same as for a similar condition at the time of operating.

TOXEMIA AND SEPTICEMIA.

Toxemia is caused by the products (toxins) of an abscess or of an infectious inflammation entering the circulation, and, where the organisms themselves enter, a general septic intoxication, or septicemia, may result. The effects of either form of poisoning on the general system do not differ greatly, except that the development of the disease in septicemia takes longer time, but, when developed, the condition is more aggravated and the prognosis is more uncertain.

The symptoms vary according to the nature of the toxins, or the kind and quantity of bacteria entering the system. The local symptoms of suppuration, redness, heat, pain, and swelling are usually aggravated. The general symptoms are fever, which is usually preceded by a chill, loss of appetite, headache, and depression, which may be followed by nausea, vomiting, muscular weakness, quick respiration, feeble pulse, and general prostration.

Treatment.—Medical coöperation should be obtained in order that every possible means may be afforded to effect a cure. The treatment for conditions that occur after the operation is the same as for a similar state that may be present at the time of the operation. The local treatment is to stop the source of the intoxication, if possible, by removing all foreign matter and gangrenous tissue, and thoroughly cleansing and sterilizing the parts. (For local treatment see "Acute Septic Pericementitis," page 361.) The general treatment consists in the administration of tonics, using stimulants in case of depression, and keeping the excretory organs active by the administration of diaphoretics, diuretics, and saline cathartics, as may be indicated.

CHRONIC SEPTIC PERICEMENTITIS.

This is a state in which pus is continuously formed at the sacrifice of the apical pericementum and contiguous parts. This condition is sometimes termed chronic apical abscess, and, if of long standing, there is usually considerable destruction of the tissue about the root or tooth affected (Fig. 191). The pocket that has formed may fill with pus, which is discharged through a root canal or through a fistula, and the treatment following the removal of the tooth is the same in either case, unless the fistula opens externally to the oral cavity or at some point remote from the abscess pocket. When the pocket is not filled with pus, it will contain a growth resembling a cyst, which is largely composed of accumulations of serum or degenerated pus. This formation is attached to the root, and, if small, it is usually carried away with the root at the time of extraction, but, when large, it is ruptured from the root and remains in the socket.

Treatment.—On removal of the tooth the area affected by the abscessed condition is curetted, using for this purpose, where necessary, a bur instead of a curet, and all broken-down or necrosed tissue is removed. Where the cystoid remains, a small curet (Fig. 37) is passed into the pocket containing the cystoid, when it is broken up and removed with the same instrument, or

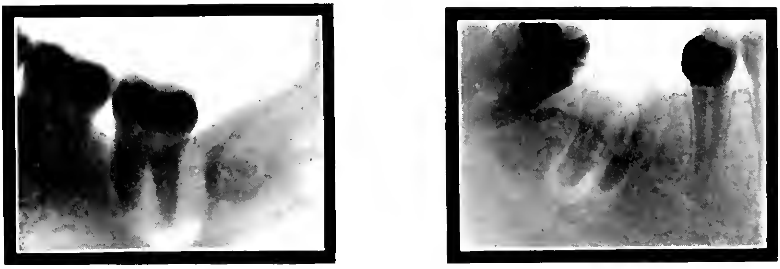


Fig. 191.—Radiographs of teeth showing the effect of chronic septic pericementitis about the roots.

the parts are flushed with a syringe. When operating under a general anesthetic, the curetting should be attended to before the recovery of the patient from the anesthetic, but, where no anesthetic has been administered, it may, by the exercise of a little care, be done without causing any considerable pain, as the parts are not acutely sensitive in this form of pericementitis.

After thoroughly irrigating the socket with an antiseptic solution to remove any broken-down tissue, silver nitrate in 10-percent solution is carefully applied to the parts of the socket that are affected by the inflammatory condition. To obtain the maximum efficiency of the medicament, the parts should be cleared of all moisture previous to the application, and kept in that condition until the socket has been packed with a gauze dressing. The dressing should be packed rather tightly into the socket in order to better protect it from the invasion of external microörganisms. If preferred, 10-percent zinc chlorid or 25-percent phenosulphonic acid may be used instead of the nitrate of silver. The gauze dressing is removed the following day, when the parts are carefully cleansed and the entire area occupied by the tooth, including all pockets and fistulas, are filled with bismuth paste, which is applied with a syringe made especially for the purpose (Fig. 36). (Bismuth paste, introduced by Dr. Emil Beck in 1907, consists of bismuth subnitrate, 30 parts; vaselin, 60 parts; paraffin, 5 parts; wax, 5 parts.) This dressing is allowed to remain from two to three days, and has the advantage of being better retained than gauze, more effectually protecting the parts, and stimulating a healthy granulation. The bismuth paste dressing may be repeated as often as indicated, but usually two or three applications will suffice. A mouth wash should be used several times daily until the wound is entirely healed.

SEPTIC PERICEMENTITIS WITH EXTERNAL FISTULA.

Occasionally the fistula leading from an abscessed area about the root of the tooth will discharge at some point remote from the affected tooth, or at a point external to the oral cavity. In such case, on removal of the tooth, communication is established between the two openings, where possible, by passing a soft blunt-pointed probe through the tract. The tract is then thoroughly irrigated throughout its entire course with sterilized warm water, which is followed by an antiseptic solution, such as potassium permanganate in proportion of 5 to 10 grains to 1 ounce of water. After this has been done, 95-percent phenol or 10- to 25-percent phenosulphonic acid is introduced into the tract through the tooth socket, and carried its entire length, or at least as far as the fistula passes through or along bony structures, which is best done by wrapping a soft medicator with plain gauze and carefully pumping the medicament into the tract. The socket is securely packed with antiseptic gauze, which should be introduced immediately after the cauterizing agent and before the fluids of the mouth have entered the wound. At the second treatment, which should be given not later than thirty-six hours after the first, the previous treatment is repeated, or instead, after irrigation, the entire tract may be filled with bismuth paste. The paste, if used, should be renewed every two to four days until the entire tract is healed. A tent of gauze may be retained in the external orifice of the fistula to prevent a premature sealing of this end of the tract, which should be the last part to close.

MULTIPLE EXTRACTIONS.

Where one of a number of teeth to be extracted is affected with acute septic pericementitis, the affected tooth should be removed first and the wound treated until a healthy condition of the affected area has been obtained, after which the remaining teeth are removed, as the pus from the abscess of the affected tooth may infect the wounds of the teeth not affected if all the teeth are extracted at the same sitting. If, when clearing the mouth of a number of teeth, some of them are affected by chronic septic pericementitis, while the tissue around the others is comparatively healthy, the diseased ones should be removed at the first sitting, and after the wounds from the diseased teeth have healed the remaining teeth are extracted. This method of operating in such case should be adopted as a precautionary measure, as it may prevent a possible contamination of healthy tissue with the pus from infected areas.

NECROSIS.

Where there is extensive necrosis about the root of an extracted tooth, whether of pathologic or chemical origin, all necrotic tissue should be removed with a curet or cut away with a bur. Where it is impossible to prevent the formation of a sequestrum, it should be removed as soon as exfoliation is complete. The subsequent treatment is to thoroughly sterilize the parts, stimulate healthy cell formation, and protect the lesion with suitable dressings. Tincture of iodin is very effective as a sterilizing agent, as it penetrates the osseous tissue for some distance, and thus sterilizes areas that could not be otherwise reached. The treatment applicable in cases of chronic septic pericementitis (page 365) applies also to necrosis about a tooth.

MAXILLARY SINUS.

For the treatment of pathologic conditions of the maxillary sinus, reference should be made to standard works on oral surgery. Where the extraction of a tooth causes an opening into a healthy antrum, which sometimes occurs, the treatment is to prevent the fluids of the mouth from passing into the sinus and to keep the wound aseptic. In washing the parts, the antiseptic solution should not be forced into the antrum, and, where the opening is too large to be sealed with the blood clot, it should be closed with one or more sutures.

POST-EXTRACTION PAIN.

Patients are, as a rule, under the impression that all pain should cease with the extraction of a tooth, but often the pain that follows an extraction is quite as severe as that which prevailed before the removal of the tooth. If post-extraction pain does not subside within a short time after the parts have been treated, and the operator has failed to explain the probable duration of such pain, the patient may conclude that the operation was not properly performed.

The treatment in any case will depend on the cause of the disturbance, and a majority of these disturbances are directly traceable to the pathologic conditions affecting the tooth at the time of its removal, or some traumatic injury to the parts may have occurred during the extraction. The treatment for these conditions has been given, and other conditions not heretofore mentioned that may sometimes cause severe after-pain are as follows:

(1) A very dense blood clot may cause severe pain in the parts some days after the operation. The pain is relieved by removing the clot, cleansing the socket, and stimulating a new clot.

(2) A fractured root left *in situ*, with a portion of the pulp tissue projecting above the root, will cause intense pain. Where it is not practicable to remove the root, the pain is relieved by the application of 95-percent phenol, or by the removal of the pulp tissue under a general or local anesthetic.

(3) The hemorrhage that should follow an extraction is, in some instances, almost entirely lacking. In such case there is very little membranous tissue separating the tooth from the alveolus, and, while there is no direct union of these two structures, the bony wall around the root under such circumstances is dense, very closely approximating the root which it supports. After the removal of the tooth, the socket remains free of blood, causing what is commonly termed "dry socket," a condition that

is often accompanied by severe post-extraction pain. Promoting a flow of blood by curettage, or even by the use of a bur on the walls of the socket, will usually relieve the pain and afford a clot to protect the wound.

(4) Among other causes of dental pain may be mentioned chronic malarial poisoning, lagrippe, syphilis, pain during pregnancy, diseases of the nervous system, etc., and, while in these cases temporary relief may be obtained by an analgesic, the patient afflicted with any of these ailments should be referred to the family physician for general treatment.

TUBERCULOSIS AND SYPHILIS.

Where tuberculosis or syphilis has caused oral lesions, a tooth should be extracted only after consultation with the attending physician, and the treatment of the wound following the removal of the tooth should be left in his care, or the local treatment may be conducted in conjunction with the physician's systemic treatment.

ORAL LESIONS OTHER THAN DENTAL.

The oral cavity is subject to numerous pathologic conditions that are not of dental origin. The most common of these ailments are some of the various forms of stomatitis. Gingivitis may be the accompaniment of such general disorders as malaria and rheumatism. The administration of lead, mercury, or iodin may produce dental disturbances. One of several forms of tumors, among which are cyst and carcinoma, is sometimes present. In addition to these conditions, some of the numerous lesions which so often occur in the oral cavity may indicate other bodily ailments. Where there is any lesion of the oral cavity whose pathologic condition may be aggravated by the removal of a tooth, or where the wound created by such removal may become contaminated by toxins from such pathologic condition, the operation should be performed only after consulting the patient's physician. The same course should be followed where the patient is afflicted with systemic diseases whose presence may greatly aggravate the after-effects of the extraction. By conducting the treatment of these cases in conjunction with the attending physician, the patient will receive the most advantageous service and be benefited accordingly.

CHAPTER XVI.

HEMORRHAGE.

By the term hemorrhage, as here used, is meant any loss of blood from a tooth socket or the surrounding tissue following an extraction. The character of such hemorrhage differs according to the vessel from which the blood escapes, being designated as arterial, venous, and capillary. The immediate hemorrhage, however, following an extraction is seldom confined to any one kind, and is more often a combination of the three kinds, but, if the bleeding continues, it may assume a more definite character. A flow of bright scarlet blood from the socket, which flow is usually rather profuse—but seldom in jets, owing to the small size of the vessel from which the blood is escaping and the depth of the vessel in the tissue—is indicative of arterial hemorrhage, while a less profuse supply of blood of a dark nature is a venous characteristic, and a capillary hemorrhage is marked by an oozing of the blood from the raw edges of the tooth socket, or from any part of the gum or alveolar tissue that may be injured.

The sources of hemorrhage following an extraction without any complications are the gum tissue, periosteum, peridental membrane, and arterial supply to the pulp of the tooth, all of which are more or less injured by the operation. In case of accident, abnormalities, or pathologic conditions the bleeding may come from sources that were, preceding the operation, apparently remote from the tooth.

Severe hemorrhage seldom follows the removal of a tooth, and when such hemorrhage does occur it is usually controlled by thrombosis. There are conditions, as in alveolar abscess, where the formation of a thrombus should be delayed by the administration of sterilized warm water, so that the congestion of the tissue may be more thoroughly relieved before the hemorrhage ceases. There are also other conditions where there is no hemorrhage, as in the case of "dry socket," in which condition the flow of blood is subsequently induced, if possible, by further surgical interference. In some instances, however, a post-extraction hemorrhage may be severe, and cases of a fatal termination have been reported. After an extraction the patient should not be dismissed until the flow of blood has stopped, or subsided sufficiently for the operator to feel satisfied that the hemorrhage will be controlled by natural conditions. This procedure will cause little delay, as only a few minutes are required for the formation of the clot in ordinary cases of extraction.

Hemorrhage following extractions that may require some artificial means for their control are classified according to the time of their occurrence, and are designated as primary, intermediary, and secondary.

PRIMARY HEMORRHAGE.

The immediate flow of blood from a wound is known as a primary hemorrhage. Where this flow continues for more than a few minutes following an extraction, it should be controlled by artificial means, unless the tissues are congested or the parts infiltrated and it is desirable to relieve the condition before the arrest of the hemorrhage.

Treatment.—Where possible, the hemorrhage should be controlled by some means that will promote the formation of a blood clot, as no artificial dressing can be applied that will so effectually seal the socket and protect the parts as a healthy clot. In ordinary routine, digital pressure is applied to each side and over the socket, which will usually check the flow and is frequently all that is necessary. If, however, this procedure does not suffice, it may be followed by holding hot water over the wound, the water having been previously sterilized by boiling or by the addition of enough phenol to render it aseptic. In this connection it may be stated that water as hot as can be tolerated in the mouth should be used, as warm water promotes the blood flow, while hot water acts as a hemostatic.

Certain chemical agents, known as styptics, may be used to check the flow of blood, and are applied locally. Among the first of these, alum may be mentioned, as it is harmless and is not unpleasant to the taste. Tannic acid is efficacious and harmless, and may be readily applied either in solution or as a powder, but possesses a disagreeable taste. Turpentine is a powerful styptic, but is seldom used on account of its objectionable odor and taste. The use of such agents as nitrate of silver and perchlorid of iron is not advised, as they are caustic, and, unless used with great care and in very small quantities, will cause a sloughing of the surfaces to which they are applied, possibly resulting in a secondary hemorrhage. Before the application of a styptic, the socket and affected parts should be thoroughly cleansed with a mild antiseptic solution applied with a syringe.

If the above methods of treatment fail to arrest the hemorrhage, resort should be had to pressure, which is effected by packing the socket in the manner that is most applicable to the particular case. (For various methods of packing see below.)

INTERMEDIARY HEMORRHAGE.

Bleeding that recurs within twenty-four hours of the operation is termed intermediary hemorrhage. Such hemorrhage may be induced by the use of stimulants, and any excitement or undue exercise that increases the heart's action may also cause it. It is most common with patients who bleed excessively, and usually occurs the night following the operation, being due to the reaction, favored by the recumbent position of the body. This is the most common form of hemorrhage with which the operator has to deal.

Treatment.—This form of hemorrhage is usually controlled by packing the socket, and, when carefully done, will control any case of post-extraction hemorrhage of the character that has come under the observation of the author. Having suitable instruments and all the materials in readiness, the socket is syringed with an antiseptic solution to remove any foreign material or blood clot that may be present. A piece of plain sterilized gauze, which has been previously cut to a suitable size, is seized near one end with tweezers and quickly carried to the apex of the socket, after which the succeeding portion is rapidly pressed into place until the entire area is tightly packed and the material is flush with the surface. A small amount of sandarac varnish is applied to its surface, which will render it impervious to moisture. The packing is held in position for a short time, and will usually remain where placed without additional support. If this procedure does not properly hold the packing, it may be retained by placing over it an extra piece of gauze and ligating the approximating teeth in figure-eight fashion, with the ligature crossing over the dressing; or, if there are no approximating teeth, the wound may be sutured by carrying a ligature through the labial and lingual gum tissue on each side of the socket and tying it over the packing. Usually one suture is enough, but, where necessary, a second one may be used. Another method of retention is to roll a cylinder of gauze of suitable size, place it on top of the packing, and have the patient close the mouth so as to bring the opposing arch tightly against this cylinder. The jaws must be held in the one position after they are closed, and, if the patient cannot be relied on to do this, they should be secured by the application of Barton's bandage. The latter method of retention is preferred, in most cases, to suturing, and is indicated where the bleeding is from more than one socket.

In packing the sockets of a multiple-rooted tooth, each socket must be packed separately, and, as the packing is a rather painful operation, every possible effort should be made to effectually seal the wound at the first attempt. If preferred, the gauze may be dipped into powdered alum or tannic acid before introducing it into the socket.

Where the hemorrhage is severe and difficult to control, and the gauze dressing cannot be retained in the socket without resorting to the methods described above, a plaster of paris dressing is advised. Sterilized gauze is saturated with the plaster, which has been mixed to a medium stiffness, rolled into a cone, and firmly pressed into the socket, being held there until it has hardened sufficiently to be retained in position. Or the socket may be filled with modeling compound that has been softened by heat, being chilled into hardness after it is in place, after which it is withdrawn and coated with beeswax or plaster of paris, when it is again inserted and held in position until the wax or plaster has hardened. This form of packing has the advantage of completely adapting itself to every part of the socket, thus effectually sealing every opening from which blood may escape, and its automatic retention obviates the necessity of suture or bandage.

There is a variation in the length of time that a socket should remain packed. In most cases the packing can safely be removed the following day, while in some cases it should remain for a longer period. Where the alveolus or maxillary tuberosity is fractured, and it is necessary to control the hemorrhage by a tampon of antiseptic gauze, the packing may be left in the wound for a greater length of time and then removed with care. In some cases it is advisable to remove only a portion of the gauze at a time, cutting off the part that is removed.

SECONDARY HEMORRHAGE.

This form of hemorrhage occurs after a lapse of at least twenty-four hours from the time of operating, and may occur after an interim of several days, being usually due to sepsis or infection.

Treatment.—The method of treating intermediary hemorrhage by pressure (page 373) applies also to secondary hemorrhage. Preliminary to packing the socket, the wound must be effectually cleansed. All broken-down tissue and blood clots are removed with tweezers, the parts carefully syringed with an antiseptic solution, and, where there is considerable putrefaction, it is advisable to touch the parts with a strong antiseptic. In secondary hemorrhage the dressing should never be allowed to remain longer than twenty-four hours, and in most cases should be removed in from ten to twelve hours. If there is a recurrence of bleeding, the wound is again cleansed, treated antiseptically, and packed.

INSTRUCTING THE PATIENT.

After an extraction where there is excessive bleeding or a tendency to hemorrhage, or after a post-extraction treatment for hemorrhage, the patient should be instructed to abstain from the undue use of stimulants, avoid excessive exercise, maintain an upright position as far as possible, and use a high pillow at night. The jaws should be kept at rest, and hot drinks or foods should not be taken. All forms of excitement should be avoided, and any fears arising from a former hemorrhage should be allayed.

Where the conditions indicate a tendency to hemorrhage, the suggestion should be made to operate in the morning, for, if the hemorrhage occurs, it can receive the necessary attention during the day, or the wound be packed immediately.

Where there is likely to be an oozing of blood from margins of the wound for some time after the operation, it is advisable to explain to the patient that a very small quantity of blood will discolor a large amount of saliva, and, unless there is quite a flow of blood, not to be alarmed at the apparently excessive bleeding.

EXCESSIVE BLEEDERS.

A history of excessive hemorrhage following a previous extraction should be carefully noted to ascertain whether it was caused by some general or local condition or by a tendency to abnormal bleeding. Inquiry may indicate constitutional predisposing causes to hemorrhage, such as diabetes, albuminuria, chronic interstitial nephritis, atheroma, a cardiac or pulmonary trouble, or, if a woman, to "vicarious menstruation." Local causes, as chronic gingivitis or acute inflammation, may have been the cause of the former trouble; or the operation may have caused considerable laceration of the tissues; or the former operation may have been regarded very lightly on the part of the patient, and followed by undue exercise or careless use of stimulants. Whatever may have been the cause of the hemorrhage on a former occasion, if the condition still exists, or the appearance of physical condition of the patient indicates excessive bleeding, it is advisable to defer the operation, and administer calcium lactate in 15-grain doses, three times a day, for a few days preceding the operation. In case there are a number of teeth to be removed, the mouth may be cleansed, one of the teeth extracted, and the results awaited; if no excessive hemorrhage occurs, the remainder may be removed at a subsequent time.

Where several loose teeth are to be extracted, and there is profuse bleeding following the removal of one of the teeth, which sometimes occurs, it is preferable to remove them at two or more sittings than to subject the patient to an unnecessary loss of blood.

HEMOPHILIA.

Hemophilia, or hemorrhagic diathesis, a persistent and uncontrollable tendency to bleeding, even from slight wounds, is congenital and hereditary, and the family history in these cases is always interesting. The disease is transmitted through the females to the males, the former often escaping the ailment. The pathologic cause of this affection has not been discovered, but it is likely associated with the blood itself, and not with the vessels, which are apparently normal.

Treatment.—Hemophilia will usually manifest itself early in life by trifling injuries causing extensive bruises, or by hemorrhage into the joints, resulting in their swelling, or by bleeding from mucous surfaces. This condition is rare, but, if the history indicates its probable presence, an operation should not be performed without a thorough investigation, and, when present, the simplest extraction should not be performed unless conditions make such course imperative. Where it is absolutely necessary to operate, a treatment directed toward correcting the constitutional defect should be instituted. The administration of calcium lactate in 10- to 15-grain doses, three times a day for three to four days preceding the operation, to promote coagulation and the formation of fibrin in the blood, is recommended. The removal of the tooth should be executed with a minimum amount of laceration, and the patient be carefully instructed as to the care of the wound and personal conduct for several days following the operation.

If the hemorrhage is severe, it may produce marked constitutional effects and death occur suddenly from syncope, but such cases rarely occur in the practice of exodontia. These grave effects are caused as much by the rapidity of the bleeding as by the total amount of blood lost. A patient can better sustain a gradual loss than a sudden escape of blood, and, as the bleeding following an extraction is usually from small vessels, a serious hemorrhage is not likely to occur suddenly; but, if such hemorrhage does take place, there will be sufficient time to summon medical aid, and it may be well for the operator to refer to works on general surgery for systemic treatment by transfusion, hypodermoclysis, or enema.

If a hemorrhage is gradual, but continuous, the patient may become weak and actually faint, which in such case is beneficial, as the occurrence will check the flow and promote coagulation, and the greater the loss of blood, up to one-half of the required amount of blood in the body, the more coagulable it becomes. During a continuous hemorrhage the blood pressure necessarily falls, but, unless a large volume is lost—about one-third of the entire amount in the body—the pressure quickly rises to the normal when the bleeding ceases.

CHAPTER XVII.

GENERAL AND LOCAL ANESTHESIA.

As this book is especially devoted to presenting the subject of extraction of teeth, it is not the intention to give extended space to the discussion of anesthesia. As, however, anesthesia is intimately connected with the extraction of teeth, being a most valuable adjunct to dental surgery, it is deemed proper that a brief summary of the evolution of anesthetics and a condensed reference to the most approved methods of inducing anesthesia be given, with the realization that the dental practitioner will prefer to consult special works on the various methods of inducing anesthesia for detailed information on that subject.

There are two kinds of anesthesia and two classes of anesthetics. The two kinds of anesthesia are general and local, and the two classes of anesthetics comprise agents that are used to induce respectively general and local anesthesia.

GENERAL ANESTHESIA.

By the term "general anesthesia" is meant a condition where a patient, by inhaling certain chemical agents either through the mouth or nose, or simultaneously through both mouth and nose, is rendered unconscious and insensible to pain. This condition is caused by the action of the agent on the central nervous system, the different agents affecting the centers of respiration and circulation in various degrees peculiar to their properties.

Early writings on the subject of surgery bear evidence that the ancients endeavored to prevent physical pain in the case of a patient subjected to surgical procedure. To produce the condition now referred to as anesthesia, such patient was rendered more or less unconscious and insensible to pain by the internal use of Indian hemp, the juice of the poppy, a preparation of mandragora, and other drugs possessing narcotic properties, by the inhalation of the fumes of Indian hemp, and by digital compression of the carotid arteries, the latter method causing a depletion of the cerebral circulation and consequent stupefaction. Alcohol in various forms was also used from an uncertain period for producing a condition of stupor approximating a loss of sensation.

Ether was discovered by Valerius Cordus in 1540, and, although Michael Faraday had in 1818 referred to the narcotic effect of ether, its anesthetic property in general surgery was not discovered until 1842 by Dr. Crawford W. Long, a physician, at Jackson, Ga. The anesthetic property of ether in dental surgery was determined by Dr. William T. G. Morton, a dentist, at Boston, Mass., in 1846. Dr. Morton had received the suggestion of the probable efficacy of ether as an anesthetic in dental surgery from Dr. Charles T. Jackson, a physician, of Boston, who was familiar with practical chemistry, without either of these persons being cognizant of the fact that the general anesthetic property of ether had been ascertained four years previous by Dr. Long, and Dr. Morton was credited at the time with the discovery of the anesthetic property of ether, which credit was proper so far as its general application in dentistry was concerned.

When Dr. Morton discovered in 1846 the general anesthetic property of ether, he gave it the name "letheon," from lethe, a word derived from the Greek, meaning "oblivion," "loss of memory," "unconsciousness." Dr. Oliver Wendell Holmes subsequently suggested the name "anesthetic," a combination of two words derived from the Greek—an (not) and esthetic (to perceive, to feel)—indicating the literal meaning of the word to be, "no perception," "no feeling," or, by implication, "no sensation." At the time that Dr. Holmes suggested the name "anesthetic" for the agent he also supplied the name "anesthesia" for the condition, a term derived from the same source as the word "anesthetic." By the term "general anesthesia" is, therefore, understood a condition where, by the introduction of certain agents into the system by inhalation, the mind loses consciousness and insensibility to pain is established.

Ethyl chlorid was discovered by Bouelle in 1759, and, although Pierre Flourens had in 1847 referred to the narcotic effect of ethyl chlorid, its anesthetic property in general surgery was not discovered until a year later (1848) by Heyfelder, but was not recognized as a general anesthetic until 1895.

Nitrous oxid was discovered by Joseph Priestley in 1776 by the action of nitric acid on moist iron filings, and was subsequently prepared by Pierre Laplace and after him by Claude Berthollet from ammonium nitrate, the source of the nitrous oxid in use at the present time. While Humphry Davy had in 1800 observed the narcotic effect of nitrous oxid, its anesthetic property in dental surgery was not discovered until 1844 by Horace Wells, a dentist, at Hartford, Conn.

Chloroform was discovered by Dr. Samuel Guthrie, at Sackett's Harbor, N. Y., in 1831, and its anesthetic property in general surgery was discovered by Dr. James Y. Simpson, at Edinburgh, Scotland, in 1847.

Mesmerism was introduced in 1778 by Mesmer, a German physician, who had previously practiced the treatment of disease with magnets. Mesmerism was a psychophysiologic process by which a person could be placed in a condition of somnolence, during which, it was claimed, pain could be averted while undergoing a surgical operation. This condition was later called hypnotism by Braid, a term that prevails to this day for that effect.

The method of administering ether with nitrous oxid was introduced by Clover in 1876, in which procedure the inhalation of nitrous oxid preceded that of ether, so that the patient did not experience the obnoxious odor and irritating effect of the latter.

The method of administering nitrous oxid with varying quantities of oxygen to obtain a nonasphyxial form of anesthesia was introduced by Dr. E. Andrews, of Chicago, in 1868, a procedure that improved the anesthetic effect.

The chronological order of the discoveries of the four principal anesthetic agents is: ether, 1540; ethyl chlorid, 1759; nitrous oxid, 1776; chloroform, 1831. The chronological order of discovering their anesthetic properties is: ether, 1842 (in dental surgery, 1846); nitrous oxid, 1844; chloroform, 1847; ethyl chlorid, 1848.

It appears remarkable that, although these agents were used, soon after their discovery, for chemical and experimental purposes, and in the case of ether and nitrous oxid served also the means of amusement, their anesthetic properties were not known until quite a number of years afterward. For example, the anesthetic property of ether was not known until 302 years after its discovery, and the anesthetic property of nitrous oxid was not known until 68 years after its discovery.

Although Dr. Wells received his suggestion of the probable anesthetic property of nitrous oxid while attending a lecture on chemistry and natural philosophy by Dr. Gardner Q. Colton, at Hartford, as early as 1844, on which occasion the peculiar mirthful effect of the inhalation of nitrous oxid as "laughing gas" was exhibited for the amusement of the audience, and Wells at once demonstrated that the "gas" did possess such property, it was not until a quarter of a century later that the agent was generally accepted as an anesthetic by the dental profession. The practical adoption of nitrous oxid as an anesthetic was delayed until 1863, when Dr. Colton, becoming convinced by numerous practical tests of the efficiency and safety of the agent as a general anesthetic, adopted its use as a preventive of pain in the extraction of teeth, and by 1868 it was used to a large extent by the dental profession. Since that time its popularity has increased until today, with the improved methods for its administration, it is considered the safest agent known for general anesthesia.

GENERAL ANESTHETICS.

The agents usually employed for general anesthesia in dental surgery are nitrous oxid, ether, and ethyl chlorid, and these may be used singly, in sequence, or in various combinations.

Nitrous Oxid.

Composition.—Nitrous oxid (N_2O) is prepared from ammonium nitrate crystals by gradual decomposition with heat. The apparatus for preparing nitrous oxid consists of a porcelain-lined iron retort, with which is connected with glass tubes a series of three wash bottles, a tube from the last bottle connecting with the storage tank. The three wash bottles contain respectively solution of ferrous sulphate, potassium hydroxid, and a weak solution of sulphuric acid or milk of lime for the purpose of removing impurities—chlorin, nitric oxid, ammonia, etc.—from the gas and to dry it. The ammonium nitrate crystals are placed in the retort and heat is applied, the ammonium decomposing at about 392° F. One pound of the ammonium nitrate will yield about thirty-two gallons of nitrous oxid gas. Nitrous oxid is a colorless gas, and has an agreeable odor and a slightly sweetish taste. The preparation of nitrous oxid is not supposed to be undertaken by a dental practitioner in his office unless he has occasion to use large quantities, as it can be readily obtained from dental supply houses in liquid form in steel cylinders of various sizes. These cylinders are painted black to distinguish them from cylinders of similar construction containing liquid oxygen, which are painted red.

Effect on the Organism.—Nitrous oxid is the most satisfactory anesthetic for the extraction of teeth. When nitrous oxid is properly administered, it presents no elements of danger, and there is a rapid return to consciousness, with no unpleasant after-effects. The admixture of a proper proportion of oxygen improves the anesthesia, and also permits a prolongation of an administration of the anesthetic. A safe and rapidly acting anesthetic is desired for brief dental operations.

Nitrous oxid as an anesthetic was originally administered with varying percentages of air, but experience has demonstrated that the admixture of pure oxygen instead of air materially changes and greatly improves the anesthesia produced. Nitrous oxid possesses the least toxicity of any agent for producing general anesthesia, and is the safest anesthetic used by either the dental or medical profession. It can be given longer and with less danger than any of the other general anesthetics. Oxygen improves the quality of the blood by increasing the red corpuscles, while the white corpuscles are not influenced, and is a respiratory and cardiac stimulant, being a specific in asphyxial manifestations.

The rate of absorption of nitrous oxid and oxygen by a patient will depend on the temperature and pressure of the gas, temperature of the blood, and rate and depth of respiration. The rate of elimination will depend on the freedom of the air tract and the depth and efficiency of respiration, the elimination taking place principally through the pulmonary blood stream and respiratory tract.

Nitrous oxid does not affect the blood, and for this reason a patient anesthetized with this agent has a higher immunity from shock and infection than one to whom ether has been administered. There is no post-anesthetic effect on the lungs or kidneys, and in fact no other part of the body seems to be subject to such effect. Nitrous oxid does not cause any degenerative changes in the cells of the body, and does not produce any harmful results in any organ of the system unless there has been improper technic of administration—such as administering cold or impure gases, or inducing and maintaining a marked degree of cyanosis —which can be avoided.

The Patient.—The operator should note the physical condition of the patient in order to determine whether he is robust or anemic, or whether he has good general health or presents symptoms of debility, and the pulse should be taken to test its strength and regularity. In some cases it may be advisable to ascertain whether the patient is under the effects of intoxicants, and to learn, if possible, whether he is addicted to a drug habit. If there is any doubt as to the patient tolerating the administration of the anesthetic, an opinion should be sought of the patient's physician, or a thorough examination should be made.

The age of a patient is not necessarily an important factor to be considered in an administration, as any person from youth to advanced years, if not affected with any organic trouble and not presenting any special contraindication, is acceptable for nitrous oxid. The health and vigor of the patient are more important factors than the matter of age. Even children, when controllable, are good subjects, and for them only a brief administration is required to induce complete anesthesia.

Preliminaries.—The apparatus for anesthetization should be in perfect working order, and all the required forceps and other accessories be within convenient reach, although not exposed, before the patient is seated in the chair. It is, of course, necessary for the operator to have a competent lady assistant, who should, in addition to being an attendant, be familiar with the management of the apparatus, so that the attention of the operator may not be distracted during the extraction movements.

While no special dietetic regimen is required for a patient previous to anesthetization, it is advisable to have at least two hours intervene between a meal and the administration of the anesthetic, as there is a tendency for the nitrous oxid to induce nausea if administered shortly after a meal.

The patient should be seated in a comfortable position well back in the chair, with the head in a line with the body. The muscles should be thoroughly relaxed, and there should be no evidence of restraint.

Previous to anesthetization an examination of the mouth should be made, not only to locate the affected tooth or teeth to be extracted, but also to note any abnormalities that may be present. The duration of anesthesia depends on the type of patient and the amount of nitrous oxid inhaled, and any number of teeth, if not presenting any special difficulties, may be extracted under a single administration in the case of adults. Children should not, however, be subjected to the removal of a large number of teeth under one administration, as they are not favorable subjects for prolonged anesthesia.

After an examination of the mouth, the prop is inserted, and the mouth or nose piece properly adjusted. A cord should be fixed to the prop, with the end of the cord hanging out of the mouth and fastened in such way as to prevent the prop from falling into the throat.

The Apparatus.—The principal requisite to obtain satisfactory results with nitrous oxid and oxygen as a general anesthetic in dental surgery is the apparatus. The construction of the apparatus should be as simple as possible, but should at the same time be so arranged as to meet the requirements of the various cases that may be presented. There should be means for administering nitrous oxid and oxygen through the mouth and nose simultaneously or through either of these organs separately. The inhaler should be of such construction that any variation of position of the patient's head will not interfere with administering the anesthetic. There should be also attachments for administering ether in sequence or combination, and the arrangement should be such that oxygen can be administered alone as well as in combination with the nitrous oxid or ether. An apparatus embodying the features mentioned may seem somewhat complicated to the uninitiated, but it will be found to be very simple in construction.

Quite a number of apparatus for administering nitrous oxid and oxygen are manufactured, and, without making any invidious comparisons of the various apparatus, it can be said that either the Clark, White, or Teter apparatus possesses the essential features for satisfactorily administering nitrous oxid and oxygen. The latter apparatus consists of a folding base, which supports a mixing chamber, to which are attached yokes bearing two nitrous oxid and two oxygen cylinders. On top of the mixing chamber is an attachment for administering ether, consisting of a volatilizing chamber and ether dropper. The dropper is accurately regulated by the operator, and the ether allowed to drop upon a cone, which distributes it around the gauze in the volatilizing chamber. Air passes through the gauze, taking up the ether, which then passes into the mixing chamber. This attachment is to be employed when it is desired to use the nitrous oxid and oxygen as a preliminary to ether anesthesia. The patient is anesthetized with nitrous oxid and oxygen, and gradually carried under the effects of the ether, a small percentage of oxygen with ether being considered beneficial. At the front of the mixing chamber is the vapor warmer, through which the gases pass before reaching the inhaler. The vapor warmer is filled with water, which is kept hot with an alcohol lamp, and the gases passing through the warmer are heated to about 180° F. This temperature of the agents is, of course, too hot to be inhaled, but, as they pass through a tube four feet long, they lose their temperature to such an extent that when they reach the inhaler their temperature is about 90° to 94° F. Connected with the apparatus is an attachment by the means of which ether can be mixed with nitrous oxid and oxygen in percentages varying from 1 to 18 percent. This attachment consists of valves and a glass jar containing ether, and by an arrangement of the valves the nitrous oxid and oxygen can be passed around the jar, or a part or all of the gases can be passed through the jar. By the proper use of this attachment the most obstinate patient to anesthetization can be completely relaxed, and usually a very small percentage of ether in addition to the nitrous oxid and oxygen is sufficient to produce this condition.

The tubing leading to inhalers is constructed with a view of being boiled, as this is the best method for its sterilization. The nitrous oxid bag is removable, and should also be sterilized by boiling. As the process of rebreathing is generally followed, it is of the utmost importance that the bag, tubing, and inhaler be sterilized, and boiling is the most practical method for sterilizing these articles.

The face inhaler consists of a celluloid form, with pneumatic rim, and is supplied with expiratory and pressure valves. The nasal inhaler is much smaller, and covers only the nose. By the use of the nasal inhaler a patient can be anesthetized with nitrous oxid and oxygen unless there is complete nasal obstruction, and continual anesthesia can be maintained indefinitely, even if the patient is inhaling and exhaling through the mouth.

Technic of Administration.—In order to obtain the best results from nitrous oxid and oxygen, the method of administration should be carefully studied and properly conducted, the essential features being, in addition to a perfect apparatus, warm gases, rebreathing, continuous and even flow of the gases, and positive pressure. The necessity for warming the nitrous oxid is that the gas becomes very cold in passing from the liquefied state to the gaseous state. The advantages of administering nitrous oxid and oxygen in a warm condition are: (1) a much smaller amount of nitrous oxid is required, there being a saving of from one-third to one-half; (2) anesthesia is much more quickly and quietly induced; (3) a more tranquil and deeper narcosis is produced, as a greater amount of the gases is taken up by the blood; (4) the irritating effects of cold vapors on the respiratory tract and lungs are avoided, thereby preventing the occasion of post-anesthetic bronchitis and pneumonia.

The proper amount of rebreathing of nitrous oxid is to be governed by the symptoms of each patient. A robust, active patient will tolerate only a small amount of rebreathing, and an anemic, frail patient will tolerate a large amount of rebreathing. An excessive amount of carbon dioxid will be manifested by forced respiratory efforts, followed by sweating, livid color, slowing of pulse, and cessation of respiration. Oxygen is added to prevent an excess of carbon dioxid, and fresh nitrous oxid must enter or narcosis will become light.

When the supply of gases is so arranged that an even flow can be obtained, it is a comparatively simple matter to induce and maintain an even narcosis. The nitrous oxid is allowed to flow continually during the administration, the amount needed depending on the type of patient, and, when a certain amount produces the desired result in a particular case, the amount need not be changed throughout the entire operation. A small stream of oxygen should also be flowing during the administration, and the least variation in the flow will affect the narcosis. An even or uneven flow of the oxygen will produce a corresponding even or uneven anesthetic state, and, in fact, a successful anesthesia will depend on the accurate judgment of the flow of oxygen.

Signs of Anesthesia and Recovery.—The usual signs of nitrous oxid anesthesia are: (1) color slightly dusky; (2) pupils dilated; (3) loss or impairment of conjunctival reflex; (4) stertor, or deep, regular breathing, accompanied by soft snoring; (5) jactitation—muscular twitching of the eyelids.

The return to consciousness is indicated by the return of natural color of the patient's face, the presence of voluntary movements of the eyes, and reaction of the pupil to light.

Indications and Contraindications.—All persons not afflicted with any organic trouble, from young adults to the aged, and children of a controllable temperament, are usually good subjects for the administration of nitrous oxid. In the case of the aged it is, of course, necessary to carefully observe all symptoms during the administration, with the object of maintaining a natural color and avoiding excessive blood pressure, as the effect of the anesthetic is very rapid in these cases. Extreme cyanosis should not, of course, be produced in any case on account of the greatly increased blood pressure that accompanies an extreme cyanotic condition.

Patients afflicted with slight nasal obstructions, or even having adenoids, may have nitrous oxid administered, as a flow of the agent will readily pass through the slightly restricted passage. Patients who are very stout are not good subjects for general anesthesia, as they rapidly become cyanosed and frequently suffer from shortness of breath.

Female patients anesthetized during a menstrual period are prone to excessive hemorrhage from the operation wound, and are also disposed to be demonstrative during the administration. Nitrous oxid may be administered during pregnancy, but in the later months of this condition sufficient oxygen must be admitted to avoid symptoms of asphyxiation. It is not advisable to administer a general anesthetic during lactation, as the secretive process of the milk may be impaired.

Ethyl Chlorid.

Composition.—Ethyl chlorid (C_2H_5Cl) is prepared by the action of hydrochloric acid on a boiling solution of chlorid of zinc in ethyl alcohol. Ethyl chlorid is a colorless, mobile liquid, and has an agreeable odor. It is very volatile, but its vapor is heavier than air. On account of its great volatility, it should be preserved in hermetically sealed glass or metallic tubes and kept in a cool, dark place.

Effect on the Organism.—A few inhalations of the vapor of ethyl chlorid will produce a feeling of pleasant exhilaration, and additional inhalations will rapidly cause unconsciousness. Ethyl chlorid is potentially one of the most lethal anesthetics, and has only a limited field of usefulness in dental surgery. The administration of ethyl chlorid requires so much precaution, and its contraindications are so numerous, that its use in dental operations is not advised.

Ether.

Composition.—Ether $(C_2H_5)_2O$ is prepared from ethylic alcohol by a process of dehydration produced by the action of sulphuric acid. Ether is a colorless, very volatile liquid, and has a pungent odor and burning, sweetish taste. It is very inflammable, and should be kept in tightly stoppered bottles in a cool, dark place.

Effect on the Organism.—Ether is a powerful cardiac and respiratory stimulant, and was for many years the usual anesthetic for dental operations in cases where a longer anesthetic was required than could be obtained from a single administration of nitrous oxid gas. In the course of time, however, the methods of prolonged anesthesia with nitrous oxid were perfected, and ether, for the purpose of general anesthesia in dental operations, is now used, when indicated, only in conjunction with nitrous oxid and oxygen.

Chloroform.

Composition.—Chloroform $(CHCl_3)$ is prepared by three methods—from ethylic alcohol, from methylated spirit, and from acetone—and is usually prepared by distilling a mixture of chlorinated lime and water with alcohol or acetone. It is a heavy, clear liquid, and has an ethereal odor and a burning taste. Chloroform is readily volatilized, but its vapor density is four times greater than air. It decomposes readily if exposed to sunlight and heat, and should be kept in a cool, dark place.

Effect on the Organism.—Chloroform posesses extremely lethal properties, and is prone to affect the heart action and cause cardiac failure. The preliminary dietetic regimen that is usually necessary before an administration of chloroform, the extreme precaution to be observed in its administration, and its many contraindications render it unsuitable for dental operations.

LOCAL ANESTHESIA.

By the term "local anesthesia" is meant a condition where, by the topical application of certain chemical agents—either by injection or application, the latter being direct or by means of a spray—insensibility to pain is produced in a circumscribed area while the patient is in possession of all his faculties, in which respect the method differs from "general anesthesia," where complete unconsciousness supervenes for the purpose of obtaining insensibility to pain at the affected part.

In addition to obtaining local anesthesia by injection and application, a local anesthetic effect can be produced by pressure, but this method of anesthesia is not applicable to tooth extraction.

While it is recorded that the ancients endeavored by various methods to prevent pain during surgical operations, it seems that their efforts to attain this object were directed more toward general than local anesthesia, although there is some evidence that the inunction of various narcotics was practiced for the purpose of obtaining a local anesthetic effect.

Up to the beginning of the year 1800 no definite method had been developed for inducing local anesthesia, but about this time James Moore announced that an obtunded area could be produced by compressing nerve trunks as well as by severing them.

In 1856 Richet discovered that local anesthesia could be produced by the evaporation of ether, but at that time no apparatus had been devised for properly conducting this procedure.

In 1866 Sir Benjamin W. Richardson had fair success in obtaining local anesthesia with ether spray, a method that was subsequently improved and is used to a limited extent at the present time.

In 1855 Gadeke isolated the alkaloid now known as cocain from the leaves of erythroxylon coca, and was by him called ethroxylene.

In 1859 Niemann, who had been investigating the properties of the coca plant, observed that the leaves produced a numbness of the tongue when applied to that organ.

In 1874 Hughes Bennett, who had been experimenting with cocain, demonstrated that it possessed anesthetic properties.

In 1880 Von Anrep, after carefully investigating the action of the drug, intimated that it might be prepared in such manner as to be used as a local anesthetic in general surgery.

In 1884 Koller, who had prosecuted a series of experiments with cocain on animals, demonstrated the extraordinary anesthetic property of cocain, and its injection for local anesthesia on the body surface and in the oral cavity became at once very popular. The method of application of the drug and its effect were not, however, sufficiently understood at the time, when it was injected pure near the seat of the irritation, and frequently unfortunate results followed the application.

In 1885 Halstedt introduced the method of conductive anesthesia (or regional anesthesia), by which procedure cocain was injected at the trunk of the inferior dental nerve instead of in the immediate area of the affected tooth.

Although the positive anesthetic property of cocain was readily admitted and appreciated, its toxicity was at the same time realized to be of such excessively diffusive strength that some method for its modification or an acceptable substitute became a study of the scientists interested in the development of practical local anesthesia.

In the efforts that were subsequently made to discover a substitute for cocain that would possess equal anesthetic power without its toxicity, such agents as eucain (alpha and beta), acoin, holocain, tropacocain, orthoform, nirvarin, stovain, novocain, alypin, and others were developed and presented with the expectation that they would meet the requirements.

Braun, in his efforts to ascertain the specific action of the various cocain substitutes on the tissues, found that the simultaneous vascular contraction at the seat of injection increased the intensity and duration of the anesthesia produced, and correspondingly reduced the amount of the anesthetic required for any particular case, without impairing its effectiveness. It was this discovery that prompted him to mix a suprarenal preparation with the anesthetic when making the injection. The solutions of the powdered suprarenal extract, made from the suprarenal glands of the sheep and ox, and known under the names of suprarenin, adrenalin, renoform, etc., have the property of actively contracting the blood vessels, and, when mixed with cocain or any adaptable substitute, have the effect of checking the diffusion of the anesthetic at the seat of the injection, thereby locally intensifying the action of the anesthetic and at the same time avoiding any organic disturbance. Suprarenin is now also prepared synthetically, and is said to be purer, less toxic, and more stable than the organic preparation.

In local anesthesia there is produced either mucous or conductive anesthesia. In mucous anesthesia only the terminal ramifications of the nerves in a definite area are affected, and the nerve endings are for a certain length of time incapacitated from receiving impressions. In conductive anesthesia a larger nerve trunk is intercepted directly at its base, and is prevented from conducting an impression.

In the administration of local anesthesia it is necessary to have a knowledge of the sensibility and nerve supply of the different tissues. The mucosa, periosteum, pericementum, as well as the pulp and dentin, are more sensitive to pain than the muscles, and the various degrees of sensitiveness of these parts should be understood.

The operator should be familiar with the technical methods of preventing pain by injection anesthesia, and should know the pharmacologic and physiologic properties of the solution to be used. He should be able to determine the general physical condition of a patient in order to treat him according to his peculiar requirement. Anemic, feeble, and hysterical patients should receive special attention, and the dose of the solution lessened in their case to correspond with their degree of toleration. The pulse and respiration should be carefully observed, so that any untoward symptoms may be recognized and counteracted by the necessary change in the procedure.

Besides realizing the importance of general health, the operator has to consider the local condition of the diseased area, which frequently determines the correct selection of the method to be employed for the prevention of pain.

Local anesthesia of the mucosa frequently causes severe pain on insertion of the needle and during injection if pericementitis or alveolar necrosis is present, and the operation under those conditions is usually distressing to the patient and annoying to the operator. Special care should be taken in injection anesthesia to maintain asepsis in all the affected parts, as this is necessary to insure a normal condition of the tissues after the operation.

LOCAL ANESTHETICS.

As previously stated, the great anesthetic property of cocain was immediately recognized on its introduction to the profession, but the deleterious effect of the undiluted drug on the organism was of such a nature that some modification of its strength or a substitute was eagerly sought. Both a modification of cocain and a number of substitutes have been found. Of the number of substitutes that have been formulated, novocain is the most acceptable as a practical injection anesthetic.

The local anesthetics used at the present time are organic chemical combinations that are applied either on the mucosa or injected into the tissues in properly proportioned solutions. For mucous surface anesthesia a high percentage cocain solution or a concentrated novocain solution is used, and for injection into the tissues a dilute solution of either of these agents is employed. In the application on the mucosa the lymphatics take up the salts of the solution as they penetrate the surface, and carry the anesthetic effect to underlying tissue.

The essential properties of an effective and satisfactory local anesthetic are: (1) its toxicity must not exceed the degree of toleration; (2) it must not cause any tissue lesion; (3) it must be soluble in water, and its solution must be sterilizable; (4) it must combine with suprarenal preparations.

Of no less importance than the anesthetic are the injection syringe and its accessories. There are different makes of syringes to be had, with varying claims of efficiency, but the essential features of a practical instrument are perfect adjustment and ease of operation. While all the parts should fit accurately to prevent the escape of fluid, these parts should be easily removable, so that they can be thoroughly sterilized, especially by boiling, as absolute asepsis must be preserved in all parts of the syringe in order to avoid the possibility of infecting the anesthetized area.

Cocain.

Cocain is the original injection anesthetic for local anesthesia, but on account of the excessive toxicity it has been found necessary to reduce its toxic effect in order to make it a practical anesthetic. This has been done by using it in dilute form and with the addition of suprarenin (suprarenal extract), the latter having the therapeutic action of causing the constriction of the blood vessels and thereby producing a high local blood pressure. The admixture of suprarenin thus prevents too rapid absorption of the anesthetic and prolongs the anesthesia.

The injection of the anesthetic into the mucosa infiltrates the tissue area surrounding the point of injection, and has the effect of paralyzing the functions of the nerves supplying the area to such an extent that an insensibility to pain is established. The paralyzation takes place within from two to ten minutes, depending on the strength of the solution employed, and lasts about half an hour, when the effect gradually subsides.

The technic of injection involves so many features—the manner of inserting the needle varying to some extent with the different teeth, and governed also by the physical condition of the parts affected, including the exercise of great care not to puncture an artery—that the space required for a comprehensive discussion of the technic would be too great for a place in this book, and the practitioner and student are therefore referred for detailed information on this matter to special works on this subject.

Novocain.

Of all the substitutes for cocain so far discovered, novocain is the most suitable agent for local anesthesia in dental surgery. It has the same effective action on the peripheral sensory nerves as cocain, without the toxicity of the latter, and, with a proper admixture of suprarenin, makes an ideal local anesthetic. As manufacturers are now furnishing a correctly proportioned preparation of these agents, known as novocain-suprarenin mixture, it can be conveniently and effectively applied with satisfactory results. The same observation as to the technic of injection of cocain, made above, applies to the injection of novocain.

Freezing.

Anesthesia by freezing is a process of depriving the tissues of as much heat as possible by the application of a congealing agent, and the ether chlorid spray is the method usually used for this purpose. The ethyl chlorid is supplied in glass and metal tubes, with stop cocks by which the operator can regulate the amount required.

After the preliminary preparations have been made, the spray is directed against the prescribed area, and the ethyl chlorid gas that is generated when the spray comes in contact with the warm surface of the mucous membrane penetrates the epithelial retiform interstices, tissue pores, and glands, this condition being accelerated by the high pressure caused by the elimination of heat. The parts subjected to the process become frozen and turn white, having the effect of making the nerves in the frozen area insensible to pain. As it is, however, difficult to properly direct the spray on the posterior part of the mouth, the application of this method is practically confined to the anterior teeth.

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GREAT DENTAL CAREER ENDS

FORTY CROWDED YEARS of dental life came abruptly to a close at the end of March when Doctor George B. Winter died suddenly in Saint Louis. Not only to those associated with him but to dentists in many countries, this news brought deep regret, for Doctor Winter's widening achievements had made friends for him throughout the world.

First in the field with his textbook of exodontia, published in 1913, Doctor Winter has long been recognized as the outstanding authority on this subject and as a pioneer in discovering a method of extraction for impacted third molars, one of the great contributions to dentistry. Invited to bring news of his discovery to other nations, he had traveled to England, France, and almost every South American country giving clinics and showing his three-reel motion film of his procedure. A former president of the dental associations of his city and state as well as of the American Dental Association, Doctor Winter was also the recipient of achievement medals and of honorary memberships in many foreign dental societies.