Textbook of Oral and Maxillofacial Surgery

Gustav O Kruger

(The C V Mosby Company, St Louis, Toronto, London, 1979)

Fifth Edition

Chapter 6

Impacted teeth

Gustav O Kruger

Anthropologists state that the constantly increasing cerebration of man enlarges his brain case at the expense of his jaws. The prepituitary line that sloped forward from receded forehead to protruded jaw in prehuman forms has become almost vertical in modern man as the number of teeth has decreased. A softer and more refined diet that requires less chewing enhances this trend, making a powerful masticatory apparatus unnecessary. Greater numbers of people have impacted teeth for this as well as other reasons. Eventually all third molars will be lost to man, followed eons later by the impaction and subsequent loss of the lateral incisors.

All teeth that do not assume their proper position and function in the arch should be considered for removal. There are exceptions to this general statement, but they are rare. For example, the youth who must lose all of his teeth for full dentures should not lose the unerupted maxillary third molars, since the eruption of these teeth will help to form the tuberosity. The denture can be made over the unerupted teeth if the patient is made cognizant of the situation so that the teeth can be removed later when they appear beneath the mucosa.

In the older individual, discretion may be the better part of valor. A tooth that has not erupted for 50 years is sometimes ankylosed, often has an atrophied periodontal membrane separating tooth and bone, and is always encased in inelastic, heavily mineralized bone. Unerupted teeth can and should be removed to ensure success for the denture, but in an occasional instance, removal may not be feasible.

Preliminary Considerations

Presence of infection. Infection in the form of a pericoronitis should be treated before surgery. An acute pericoronitis around a mandibular third molar usually responds to the extraction of the maxillary third molar if the latter is impinging on the infected mandibular tissues. Probing with a sterile silver probe under the flap on the buccal side for the release of pus, subsequent irrigation, and antibiotic therapy may aid in treatment. Occasionally a tissue or high-level impaction can be removed as soon as a satisfactory antibiotic level has been established. If surgical complications arise, the fractured root can be allowed to remain undisturbed for a few days before removal. The removal of the crown will allow the pericoronitis to subside.

When no infection exists, oral or parenteral antibiotic therapy is unnecessary.

Premedication and preparation of patient. Premedication is helpful when impacted teeth are removed under local anesthesia. Orally an average dose for an outpatient is 0.1 Gm pentobarbital sodium. However, 1 to 2 mL of pentobarbital sodium can be given intravenously. The patient remains ambulatory but requires someone to accompany him home. Many other drugs or combinations of drugs can be given intravenously or intramuscularly. One of the most popular regimens today consists of diazepam titrated intravenously in dosages from 3 to 20 mg to achieve Verrill's sign. This may be supplemented with meperidine (Demerol) or nitrous oxide-oxygen.

Music, quiet surroundings, and interesting talk by the operator help to establish a favorable atmosphere. General anesthesia is preferred by many patients and operators.

Preparation of the patient starts with a mouthwash of any suitable antiseptic agent to reduce the intraoral bacterial count.

Draping. Drapes in the form of sterile towels will provide a sterile field as well as cover the eyes, thereby reducing psychological trauma. A sterile towel is placed under the patient's head, brought forward over the nose and eyes, and fastened by a sterile towel clip or safety pin. Exposed portions of the face and chin are washed with an antiseptic solution. A sterile towel is placed over the patient's chest. Another sterile towel can be clipped over the chest of the operator. Sterile gloves may be worn. This draping, incidentally, does not represent too much attention to detail, since the incidence of dry socket is reduced considerably by its use.

Chair position. The chair position should be low enough that the operator's righ elbow is opposite the patient's right shoulder.

Sponges. A curtain sponge is placed to isolate the field of operation if the chisel technique is used. A 7.6 by 7.6 cm exodontic gauze sponge is placed with one corner near the mandibular incisors and another corner under the tongue on the side of the operation. The sponge keeps saliva from the field and fragments and blood from the throat and eliminates time loss associated with expectoration. The heavy, stringy, "sympathetic" type of saliva often encountered in surgery patients is difficult to remove from the mouth. By changing the sponge if it becomes wet, expectoration is eliminated and time is saved.

Retractors. The assistant should be trained to hold the retractor in the right hand. The edge of the gauze on the lingual side is held under the tip of the retractor, which in turn is held against the lingual plate when the practitioner is operating on the patient's right side. The tongue is not held toward the midline. When operating on the patient's left side, the tip of the retractor is held under the mucoperiosteal flap against bone. Heavy pulling on the flap by the assistant will cause excessive postoperative lymphoedema. Sponging and malleting can be accomplished by the left hand. If suction is used, another assistant is helpful.

Armamentarium. The chisels are re-sharpened after each use, and they are changed frequently during the course of an operation. Many operators prefer to use burs. Attention must be given to the sterility of the handpiece and burs if this technique is used.

Principle of removal of mandibular impacted teeth. The underlying principle in the removal of mandibular impacted teeth is a sectioning technique. Bone is removed to expose the crown. The tooth is split with a fresh sharp chisel so that a good portion of the crown is separated from the tooth. When this portion is removed, space is obtained so that the

remainder of the tooth can be elevated into the defect. Before this technique was developed, space for elevation was obtained by more extensive bone removal and consequently more trauma.

Classification of mandibular impacted teeth. The classification of mandibular impacted teeth may be stated simply as (1) mesioangular, (2) horizontal, (3) vertical, and (4) distoangular. In addition, the tooth may be displaced to the buccal or to the lingual. Furthermore, it may be located at a high occlusal level (near the ridge surface) or a low occlusal level.

A tooth in any basic class is more easily removed if it is displaced to a buccal position and more difficult to remove if it is situated near the lingual plate or even directly behind the second molar. A tooth at a high occlusal level is easier to remove. A tooth may be prevented from erupting by the presence of bone (bone block), by the presence of an adjacent tooth (tooth block), or by both.

Preoperative evaluation. Careful preoperative evaluation will permit adequate planning for the subsequent surgery. The radiograph should be studied carefully to localize the impaction and to determine the shape, number, and inclination of the roots. Frequently, a root will be directed toward or away from the observer rather than mesially or distally. Small roots often are superimposed and can be missed in the radiographic diagnosis. The relationship of the tooth to the mandibular canal should be noted so that the patient may be warned of a possible postoperative paresthesia. The presence of a large restoration, particularly an old amalgam filling, on the second molar should be cause for warning the patient that the operator is aware of the situation and will attempt to save the restoration from inadvertent damage during the surgery.

Mandibular Mesioangular Impaction

A typical mesioangular impaction, low level, with bone and tooth block is presented. Prior to removal of the impaction, the patient and the field of operation have been prepared adequately as described previously and a local anesthetic has been administered.

A curtaining sponge is placed in the mouth to isolate the operative site. Another sponge is used to dry exposed oral mucous mebranes. Pressure over the area with a small Molt curet (No 5) combined with positive statement rather than negative questions will ascertain the depth of anesthesia.

An incision is made into the tissues distal to the second molar with the scalpel. It is important to palpate the tissues before incision to keep the incision over bone. The vertical ramus of the mandible flares outward, and therefore a straight distal incision might extend into tissues medial to the mandible that contain important anatomical structures. A safe rule to follow is to place the incision back of the buccal cusp of the second molar, following the underlying bone, which may flare laterally.

The second arm of the incision is made vertically from the first incision at its junction with the distobuccal cusp, extending downward and forward to the buccal tissues over the mesial root of the second molar.

Variations in flap design include the technique of detaching the buccal free gingival fibers around all the teeth forward to include the first molar and separating the large flap

buccally. It is claimed that this flap is easier to suture, that it is less painful in the postoperative period, and that there is less distortion in healing. Another variation is the placing of the slanting vertical incision mesial to the second molar rather than mesial to the third molar.

The mucoperiosteal flap is raised carefully with a sharp No 4 Molt curet, starting in the vertical incision where the periosteum is not attached to bone. The instrument is worked posteriorly and toward the alveolar ridge. When the operative site is widely exposed, a suitable retractor is placed under the flap and held against bone.

Ossisection is started in a vertical fashion parallel to and just back of the distal root of the second molar. The bone incision should be one, two, or three chisel widths long, depending on the depth necessary to get under the enamel crown of the impacted tooth as determined on the preoperative radiograph. The chisel then is turned to face posteriorly, placed in the bottom of the first cut, and directed slightly toward the alveolar crest. Most of the buccal plate will be removed in one piece, which is desirable.

Further horizontal cuts are made as necessary to expose the crown. In a wide mandible with a heavy cortical plate, the impacted tooth can be exposed further by angling one edge of the chisel toward the tooth in making a horizontal cut to create a "ditch" in the spongiosa between the tooth and the cortical plate.

Two points are checked with the small curet. The bone over the distal or top surface of the impaction should be removed so that the crown can be removed after splitting. The bone at the junction of the vertical and horizontal cuts should be removed sufficiently to allow the curet to enter the spongiosa under the impacted crown. If either of these two check points is unsatisfactory, further bone is removed.

The tooth then is sectioned. A new chisel is placed in the buccal groove, directed distally toward the distal anatomical neck of the tooth (not lingually, which may fracture the lingual cortical plate), and struck sharply. This blow should be a glancing blow with no "follow-through". The tooth will often split on the first attempt. The sectioned distal portion of the crown is lifted from the wound.

A binangled spearpoint elevator such as the Krogh elevator is placed under the crown, and upward motion is made. The upper edge of this elevator is the portion of the instrument that lifts the tooth. To obtain a better purchase on the tooth, the leading (upper) edge is turned slightly distalward toward the tooth. The handle of the instrument is moved in a straight vertical plane. It is not rotated at this time.

When the tooth moves, it will be forced to move in an arc. When it has moved upward and distally to the point where the instrument can no longer maintain contact with it, the instrument is rotated so that the inferior edge completes the tooth removal. Earlier rotation sometimes will fracture the root and may endanger the second molar.

Often the tooth will move upward far enough to clear the second molar, but it will not rotate distally. It is now in a vertical position, separated from the second molar far enough to lose the mechanical advantage of the elevator placed between the teeth. A long Winter elevator (No 14) placed in the root bifurcation, with the buccal cortical plate utilized as a fulcrum, will elevate this tooth out of the wound.

Bone fragments are lifted from the wound with a small curet. Particular attention is given to chips that lodge under the flap buccal to the second molar. The soft tissue remnants in the socket (for example, granulation tissue, eruption follicle) are removed carefully by means of sharp or blunt dissection. Heavy curettage is avoided in the depths of the wound where the inferior alveolar nerve and vessels lie. Edges of the bony wound are smoothed with the curet. A small fragment of a sulfonamide tabled is placed in the wound if preoperative questioning indicated no sensitivity to the drug, or a Gelfoam wedge that has been soaked previously in an antibiotic solution and allowed to dry without losing its sterility is used by some oral surgeons.

A suture is placed over the socket from lingual to buccal. This violates a surgical rule to suture the free flap to the fixed flap, but it seems to be simpler here because the retractor is not removed from the wound until the needle is recovered in the depth of the wound. A 1/12-inch round cutting needle and No 3-0 silk is usedm, although No 3-0 catgut does not have to be removed. One suture is usually sufficient. The vertical cut is almost never closed. No drain is placed. A gauze sponge is placed over the area.

Mandibular Horizontal Impaction

The horizontal impaction situated at a low occlusal level requires a deep vertical bone cut, often extending almost to the level of the second molar apex. The horizontal cuts should be sufficient to expose the anatomical neck of the tooth. The classic description of the removal of this tooth includes a split at the anatomical neck to divide the crown from the root. This can be accomplished with a sharp chisel. However, the bur is especially efficient for this procedure, provided that a sterile bur and handpiece are available.

An alternate method involves placing the chisel in the buccal groove, directing it backward and upward and as little lingually as the access allows. The distal portion of the crown can be split off and removed. The chisel then is placed at the same site directed backward and downward. This will split the mesial (lower) portion of the crown, which cannot be removed at this time. If the angles of the sections have been wide enough, there may be enough clearance to remove the impaction, provided that sufficient bone over the crest of the ridge has been removed. Attention is directed to this area now. If all the ossisection is accomplished before the sectioning is attempted, the tooth may be loosened slightly, and a tooth loose in its bed is difficult to split. The sectioning is accomplished as soon as access to the crown is obtained, even though the parts cannot be removed, and then further ossisection is accomplished.

A further split in a near vertical (downward) direction can be made at this time. The exposed dentin surface can be split more easily than enamel, and, if the pulpal chamber is exposed, it is even easier to obtain a split.

The various superficial tooth fragments are removed. If the vertical bone cut has been made deep enough for elevator access and sufficient alveolar crest bone has been removed, the root portion can be removed with the No 14 elevator, with or without further root sectioning. Heavy pressure should not be used. Further tooth sectioning or ossisetion should be carried out until the impaction can be removed with relative ease. The mesial portion of the crown is removed last. Primary closure is effected after careful debridement.

Mandibular Vertical Impaction

The removal of the vertical impaction is one of the more difficult operations because of the difficulty in placing an instrument between the second molar and the closely adjacent impacted third molar. This space is too small for adequate bone removal.

The area is exposed to view under a large mucoperiosteal flap. A long, vertical bone cut is made to expose at least the anatomical neck of the impaction. Bone is removed well behind (distal to) the impaction and over its occlusal surface as well. A long, almost vertical split is obtained from the buccal groove through the distal portion of the tooth below the anatomical neck. This portion is removed. A thin spear-point elevator is forced between the teeth if possible, and the tooth is elevated. If access is not possible, a No 14 elevator can engage the area of bifurcation on the buccal side, and force straight upward can be exerted.

Mandibular Distoangular Impaction

The distoangular impaction is difficult to remove because its bulk lies in the vertical ramus. The crown of the impaction is situated away from the second molar, affording no mechanical advantage to the elevator.

A generous mucoperiosteal flap is raised, and the usual vertical and horizontal bone cuts are made. The tooth is sectioned in a vertical direction. Depending on the curvature of the roots, the mesial bulk of the tooth first is moved upward by the spearpoint elevator placed on the mesial side of the tooth or by the No 14 elevator placed in the area of bifurcation. At times the distal sectioned crown portion may be dissected out of the bone first. The tooth then is rotated distally into the space created. It is often helpful to section the crown from the root in the distoangular impaction, remove the crown, split the root if feasible, and remove the separate root portions.

***

Several points of caution in the operations for the removal of mandibular impactions should be noted. Force applied with elevators should always be controlled force, and it should be minimal. Greater than normal force is necessary in a few special situations, especially in forcing an elevator between two closely placed teeth. Some operators use more force than others. However, it is best to obtain multiple sections of the tooth and to clearly remove the bone blocks before attempting to elevate the tooth. A good many properly prepared impactions, even at low level, can be removed with a small curet rather than a heavy elevator.

Bone that has become traumatized excessively should be removed with a sharp chisel or bur after the tooth has been removed.

Bur Technique

The high-speed surgical drill is employed extensively for the removal of impacted teeth and root tips. The technique has several advantages.

The first advantage is of special significance when dealing with the unsedated patient. The placement of the handpiece in the patient's mouth is a familiar experience, common to everyone who has occupied the dental chair, as contrasted to the use of the chisel and mallet.

The second advantage is that the physical blows and pressures associated with the chisel and mallet techniques are eliminated.

The third advantage is that since the surgical handpiece technique eliminates the need for an assistant to do the malleting, fewer personnel are required in the operatory.

The fourth advantage is related to the need to irrigate the surgical field in order to reduce heat caused by the bur. This creates a continuously washed surgical field in which to work.

The fifth advantage is that the operator has the ability to trench around the impaction in a delicate and controlled fashion in order to remove osseous tissue so that an instrument purchase can be obtained. This feature of the bur technique is particularly useful for the recovery of the mandibular canal and maxillary root tips lying close to the maxillary sinus. This eliminates apically directed forces such as occur in the case of an elevator purchase under or next to the impacted fragment. The instrument purchase can be enhanced when a notch is made with the bur on the remaining portion of the tooth, allowing an elevator to engage it more fully.

Early attempts to develop an effective technique for the removal of impacted teeth resulted in the establishment of two fundamental techniques. The first technique involved removal of the intact tooth after sufficient bone had been removed, and the second technique involved sectioning of the tooth so that less bone would have to be removed for its delivery. Present day techniques employ various combinations of these two fundamental procedures. The introduction of the air turbine drill, with rotating speeds in excess of 300.000 rpm, has brought about a marked increase in the use of the high-speed bur for the removal of impacted teeth.

Before description of the methods used to remove impacted teeth by the bur technique is begun, it must be emphasized that it is imperative that only on autoclavable handpiece and bur be used. The communication of the surgical site with the fascial spaces increases the possibility of serious complications resulting from instrumentation with less than sterile techniques. The use of the standard handpiece employed by the general practitioner for tooth preparation is absolutely contraindicated for the removal of impacted teeth.

Furthermore, irrigation of the surgical wound during and after the procedure cannot be emphasized enough. Copious amounts of coolant spray are crucial in minimizing osseous necrosis caused by heat generated by the bur. Irrigation serves also to cleanse the crypt and areas beneath the flap of bony debris, tooth fragments, and blood.

Techniques that combine certain advantages of the chisel and the bur methods and eliminate some of the disadvantages of both are finding increased acceptance. The flap design, reflection, and retraction for bur removal of impacted teeth is the same as for their removal by chisel.

The basic points of the high-speed bur-chisel technique are:

1. Dense bone is removed with a high-speed bur. The chisel is used to remove thin layers of relatively soft bone that commonly are encountered in the removal of maxillary third molars.

2. The use of a chisel in tooth division is usually limited to a single split along natural cleavage lines. Additional sectioning is carried out with a high-speed bur, usually in dentin.

3. Dense bone adjacent to the crown, which is to be sectioned with the chisel, frequently is removed not only to provide a path of delivary but also to aid in splitting the tooth.

Mandibular Third Molar

Elevation of the mandibular third molar impaction usually is impeded by one or more of the following factors: (1) overlying bone, (2) anterior border of the ascending ramus, (3) adjacent second molar, and (4) unfavorable root formation. Proximity to the inferior alveolar nerve, thin lingual plate, lack of visibility, restricted access, and abnormal bone formation, as well as other surgical and anatomical problems, may be encountered.

Vertical impaction

Bone removal is begun at the mesiobuccal line angle of the third molar. The initial bone cut is made vertically down to expose the height of convexity of the third molar. The bur is passed distally at this depth to the distobuccal line angle and then lingually around the distal surface of the tooth. This frequently results in a fragment of bone that can be flicked away and removed from the surgical site. A mallet and chisel are then employed to section the distal third from the crown. Usually this is sufficient preparation to enable elevation of the tooth. Surgical experience and judgment will determine whether additional sectioning or bone removal is necessary. If the vertical impaction is not easily delivered at this juncture. the high-speed bur is used to increase the depth of ossisection to the level of the bifurcation. Starting at the bifurcation a deep groove is cut into the distal root of the impaction. Separation of the coronal segment from the distal root is completed with an exolever. The coronal segment and mesial root are removed as a single element prior to elevation of the distal root.

Mesioangular impaction

Ossisection is carried out in a manner similar to that for the vertical impaction to widen the pericoronal space and eliminate the bone overlying the height of contour. The depth of ossisection is increased to the level of the bifurcation and the chisel employed to section the distal half of the crown of the third molar or to section vertically through its bifurcation if indicated. The distal crown segment, or distal crown segment and attached root, are thenremoved as a single element. In those cases in which the mesial portion is tightly wedged under the second molar, the bur can be used to cut a deep groove in teh mesial root beginning in the pulp chamber so an exolever can split crown from root. They are then removed as separate units.

Horizontal impaction

The anatomical neck of the tooth is exposed by bur technique as previously described, reducing the height of the buccal plate to the buccal groove of the tooth. A chisel is employed to section the distal third of the crown and expose the pulp chamber. The high-speed bur is employed to expose the labial surface of the clinical crown without further reduction of the height of the buccal plate by "ditching".

As is demonstrated, starting in the exposed pulp chamber, a T-shaped groove is cut with a high-speed bur. Two large segments of the clinical crown are split and removed as separate units. Two deep grooves are cut with the bur to facilitate separation of mesial root from distal root. Alternate techniques include bur division of the crown at the cervix and removal of the sectioned elements as separate entities.

Distoangular Impaction

Variations of the surgical techniques previously described for mandibular third molar impactions are utilized for distoangular impactions. The vertical ramus presents a formidable obstruction to delivery of this type of impaction. Following bur removal of buccal bone to expose the tooth's height of contour, the bur is used to remove distobuccal bone. The distal portion of the tooth is then sectioned or the tooth divided through its bifurcation. Alternate approaches include bur division of the tooth in half or section of the crown from the roots followed by division of mesial root from distal root and removal of the separate elements.

Maxillary Mesioangular Impaction

The maxillary impacted tooth usually is removed at the same sitting as the mandibular tooth on that side. An anesthetic is administered concomitantly with the mandibular anesthetic. The curtain sponge is replaced quickly with a dry gauze sponge. The buccal fold is dried, and the operator holds the buccal retractor.

Incision is made over the crest of the ridge, extending from the tuberosity to the second molar, and a vertical component is slanted upward and forward to end over the mesiobuccal root of the second molar. The mucoperiosteal flap is raised with a No 4 Molt curet.

In the chisel technique, a new chisel is placed for a vertical cut parallel to the distal root of the second molar. Light malleting will afford penetration into the soft spongiosa, and the enamel crown often is felt soon after entrance. The light cortical plate is raised slightly over the buccal aspect of the tooth, or, in a heavy impaction, it should be removed altogether. In the bur technique, bone is removed rapidly around the impacted tooth. A small curet is used to ascertain if access exists between the second molar and the impacted third molar. In some cases it does not exist. Further bone removal between the two teeth is almost impossible, and considerable controlled elevator pressure is necessary to force the point of the instrument into the interdental space. Distal bone should be removed in such an instance.

The tooth is removed with a spearpoint elevator, a No 34 elevator, or a No 14 elevator. The point of the elevator is forced between the teeth into the area of ossisection, and a straight donward and buccal force is applied. The point and the inferior edge of the elevator make contact with the anatomical neck of the tooth and elevate it downward with these vantage points. Care is exercised in turning the elevator distally (backward), since to do so increases the possibility of fracturing the tuberosity.

The area is debrided for extraneous soft and hard tissue material, and bone edges are smoothed with the curet. A suture is placed across the crest incision, and another is placed across the vertical incision.

The curtain sponge is removed. Another sponge, slightly moistened in water, is placed over the wound (mostly to the buccal), and the patient is directed to bite down on it with

pressure. A few minutes later postoperative radiographs are made, and another sponge is placed between the jaws to remain until the patient has returned home. An ice bag to be placed on the face is ordered, on 10 minutes and off 10 minutes, for the remainder of the day. A therapeutic level of an analgesic drug is established, with the administration of the first dose on arrival home, before the effect of the local anesthetic has disappeared.

Maxillary Vertical Impaction

The maxillary vertical impaction, particularly if the crown rests close to the anatomical neck of the second molar, permits no access between the teeth for ossisection or for purchase by an instrument.

A verticalbone cut is made parallel to the mesial edge of the impacted tooth. The thin bone overlying the buccal surface of the tooth is removed carefully or sometimes separated from the tooth and bent 1 to 2 mm buccally. The chisel or bur is introduced carefully back of the distal surface to create space for backward movement.

A thin-bladed instrument of any kind described previously is introduced between the teeth. Since the removal of bone has not been possible in this space, considerable force is necessary. As soon as the instrument can be pushed into this space, the tooth can be removed easily. Occasionally it will move downward so rapidly that it may be swallowed or aspirated if a suitable gauze curtain does not cover the oropharynx.

If the instrument cannot be introduced into the space and considerable bone surrounding the tooth has been removed, a driving chisel can be placed on the buccal surface of the enamel in a vertical direction and gently tapped downward. If a bur is available, a hole is drilled into the buccal surface of the impaction to allow purchase by a sharp elevator to move the tooth downward and backward.

Maxillary Distoangular Impaction

The distoangular impaction, a rare situation, requires a larger surgical flap and extensive removal of surrounding bone. A midcrest incision is made, extending from the second molar to the tuberosity curvature, and vertical extensions to the buccal and lingual are made distal to the second molar. This flap exposes the entire bony tuberosity.

A vertical bone incision is made distal to the second molar to the area of the apex. Buccal and alveolar crest bone is removed. The area distal to the impaction is carefully exposed with a chisel, mainly by hand pressure, or by bur.

The tooth is elevated from a purchase on the mesial side as near to the apex as access will allow. The tooth can be pushed into the antrum or into the tissues back of the tuberosity. A second instrument (No 5 Molt curet) occasionally is placed simultaneously on the distal surface to guide the tooth downward. Several alternate methods can be used. If the tooth is in severe disto-angular position, a No 14 elevator may be used on the distal (superior) crown surface to bring the tooth downward and forward. At times the tooth should be dissected extensively and removed with forceps. Gelfoam may be used to fill an extensive defect, and the wound should be closed tightly with multiple interrupted sutures.

Maxillary Canine Impaction

Impactions of the maxillary canine are classified as labial, palatal, and intermediate. Localization is important, since the surgical techniques for removal of the three types vary so much that they are almost unrelated operations. Intraoral radiographs can be read to determine the form of the tooth as well as its location (Clark's rule, buccal object rule). The true occlusal view made with an intraoral cassette and extraoralviews often are necessary. Clinical palpation on the labial side is not reliable, since the bulge felt may be either the impacted tooth or the labially displaced root of the incisor or premolar.

Palatal canine position. The palatal position is the most frequent situation. Incision is made in the palatal interdental spaces, beginning with the space between the premolars on the one side and around the palatal free gingival fibers and interdental spaces to the premolar area on the other side. The heavy mucoperiosteal flap is stripped from the bone with the No 4 Molt curet. The contents of the incisive foramen are divided by scalpel where they enter the flap.

If bone is removed with the chisel, removal is started with a small rectangle back of the incisor that appears nearest to the impaction on the radiograph (unless an obvious protuberance locates the tooth). The rectangle is one chisel width in size initially, and it is enlarged as soon as the enamel crown is located. Care must be taken in dissecting anteriorly in the region of the incisors, and a 1 to 2 mm margin of bone around their sockets should be maintained. When one half to two thirds of the tooth is exposed, a split is made at the anatomical neck. If the crown is near the incisors so that its tip lies in an undercut, a second split is immediately made 3 mm toward the apex from the first cut. The small piece is removed, the crown is backed into the space created and removed and the root is teased out with a No 34 elevator or a Molt curet.

Maxillary canine impactions are especially amenable to removal by the bur technique. A wiping motion is used until a portion of the impacted tooth is encountered. Further ossisection is made by creating grooves in the bone adjacent to the tooth is exposed. The bur is excellent for sectioning the tooth, especially since the width of the bur creates space for maneuvering the parts.

Bone chips and debris are removed, edges of the bony wound are smoothed with a curet, and the wound is closed by means of three or four sutures through the interdental spaces, tying on the labial aspect. Pressure on a large wad of gauze over the palate for 15 minutes helps to prevent formation of a gross hematoma. To support the palatal flap against bone, a preformed clear acrylic palatal splint is useful. A stab incision and rubber drain through the palatal mucosa is used by some operators to prevent formation of a dependent hematoma.

Labial canine position. After the impaction has been localized, a large semilunar incision is made extending from the labial frenum to the premolar area, with the curvature pointing toward the gingival margin. Labial bone is removed in the usual fashion until the tooth is located; it may be high on the facial surface of the maxilla. Sufficient dissection is accomplished until the tooth can be elevated with suitable instruments.

Intermediate canine position. The usual position for an intermediate impaction is the crown on the palate and the root lying over the apices of the premolar teeth near the buccal

cortex. Even if the condition is not diagnosed preoperatively, it should be suspected when difficulty arises in the removal of the root portion of any palatally placed canine.

The palatal exposure is made in the usual manner, and the crown is removed. A separate buccal flap is made in the region suggested by the radiographic and clinical findings, usually above and between the premolars on the same side. Careful bone removal will uncover the root end of the impaction, which can be pushed from the buccal opening into the palatal wound. The two operative sites are closed.

Supernumerary Tooth Impaction

Although supernumeraty teeth may be found impacted in any area of the alveolar ridges, the most common ones occur in the maxillary anterior region. They may occur singly between the central incisors (mesiodens), or they may be double (mesiodentes).

Under ordinary circumstances, removal of mesiodentes is not scheduled until the apices of the permanent incisors have closed, since then there is less danger of damaging the growing mesenchymal portion of the permanent teeth. Sometimes the permanent incisors will not erupt because of interference by the supernumerary teeth. The operation is complicated by the difficulty in locating, identifying, and removing the supernumerary tooth without damaging the permanent tooth.

Supernumerary anterior maxillary teeth usually are removed by a palatal approach. When radiographs are inconclusive in establishing the location of the supernumerary teeth anterior or posterior to the normal teeth, a palatal approach is made, since few are located in an anterior position.

The technique for removal is similar to that used for removal of the palatally impacted canine. An incision is made around the necks of the teeth on the palate from first premolar to first premolar, and a palatal flap is raised. If no identifying protuberances are found on the bone surface, ossisection is started behind the central incisor, back of the incisive foramen. A collar of bone is left around the central incisor. Dissection is carried upward and backward until enamel is encountered. If the permanent central incisors have not erupted, the tooth encountered must be differentiated from the unerupted permanent central incisor by its anatomy. Sufficient bone is removed to deliver the tooth. When bilateral impactions occur, the second tooth often will be less difficult to find because of the experience gained in locating the first one. The wound is treated and closed in the usual manner.

Impacted mandibular supernumerary premolars are difficult to remove because of the presence of compact bone and vital structures such as the contents of the mental foramen on the buccal side and salivary gland and neurovascular structures on the lingual side. Occlusal radiographs will locate the tooth as being on the buccal side or on the lingual side or midway between the plates (the last is most frequent).

A double flap is made on the buccal side, consisting of two vertical components some distance apart joined by an incision around the necks of the teeth. Unless the tooth has erupted through the lingual plate, it is difficult and hazardous to make a lingual approach. Buccal bone over the tooth to be removed is removed through a square window until it is dissected out. If instrumentation is difficult because of narrow access between the erupted teeth, a thin instrument, such as a broken Molt curet, can be placed between the teeth to engage the impacted premolar and tapped with a mallet. A bur hole on the surface of the

impaction will enhance purchase and prevent slippage. If the supernumerary tooth is not fully formed, it is easier to remove (with a curet) than if it is completečly formed. After removal, antibiotic-containing Gelfoamis placed in the wound and all borders of the incision are approximated with sutures.

Molar supernumerary teeth are managed much like an impacted third molar, since the supernumerary tooth occurs at the end of the molar series.