A Surgico-Orthodontic Approach To The Treatment of Unerupted Teeth *

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INTRODUCTION

Teeth abnormally delayed in eruption pose a problem common to the general practitioner, orthodontist and oral surgeon. Early diagnosis can frequently obviate the need for surgical intervention. Sometimes obscure causal factors as well as lapse of time may create disorders which can be treated successfully only by the orthodontist or oral surgeon, or by both.

The purpose of this paper is to show that through the co-operation of the general practitioner, orthodontist and oral surgeon many of the unerupted teeth which previously were removed or treated casually can, if the proper techniques be applied, be brought into functional alignment with precision and dispatch.

THEORIES OF THE ETIOLOGY OF UNERUPTED TEETH

Hellman[9] attributed delayed eruption to insufficient growth of the jaws. Cryer[3] stated that any factor which interfered with foreward growth and with movement of teeth would cause delay. Thus, a condition characterized by a lack of inter-cuspal width may account for the unerupted cuspid. Mead[12] felt that evolutionary changes were responsible but Todd[22] stressed only environmental factors. Young[23] believed that the tooth germ became malposed prior to enamel deposition. Angle[11] blamed over-retained deciduous teeth. Dewel[5] discussed the maxillary cuspid and stressed such contributory factors as the density of bone and palatal mucosa and the distance the cuspid tooth germ must move in order to erupt fully. He mentioned the fact that the bud of the permanent cuspid lies between the nasal cavity and the maxillary sinus and is braced against the dense malar process in the young child.

INCIDENCE AND CHARACTERISTICS OF UNERUPTED CANINES

Blum[2] studied one hundred and ninety malposed maxillary teeth and found that ninety-nine or over fifty-one percent were canines.

Bohrer[16] observed that females exhibit a greater number of unerupted cuspids than males; that the impacted canine appears three times more frequently on the palate than in a labial or buccal position; that the oblique impaction is three times more frequent than the transverse; that the longitudinal rotation of the axis of the unerupted canine is almost always present to the extent of sixty to ninety degrees; and finally, that the impacted maxillary canine appears twenty times more fre-

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quently than the mandibular cuspid impaction.

Evaluation of Treatment Procedures of the Unerupted Cuspid

The earliest technique for bringing the maxillary cuspid into position involved simple exposure of the crown of the unerupted tooth and was followed by observation. Since many failures accompanied this procedure, Dewel[5] suggested gauze packing around the exposed crown and Gwinn[7] recommended a packing of zinc oxide paste. Sippel[18] used electrocautery and Hawley[8] used an iritating denture. These agents rarely contributed anything more than tissue irritation and the men subsequently suggested cementation of wires upon the crown to achieve movement. These techniques unfortunately relied on so-called "eruptive forces" which might have diminished and would, therefore, have to be supplemented by a second operation when the overlying mucosa regenerated to its original position.

The next refinement involved placing a wire or ligature about the cervical portion of the unerupted tooth in an attempt to exert traction. Reese[15], Dewel[5], Moffitt,[14] Lipscomb[11] and Taylor[21] attempted to cement coiled brass wire of .020 gauge to the crown of the cuspid with black copper cement. The danger here lies in the fact that the wires may become loose and another operation for the excision of the regenerated mucosa be required.

Mershon[13], Goldsmith[6] and Day[4] suggested that following the exposure of the crown a small cavity be drilled into the crown and a pin or platinum and iridium hook be cemented into the opening, the crypt area be packed and orthodontic pressure exerted. The objection to this technique is that it mars the enamel and may injure the large pulp.

Strock[19, 20] recommended the next refinement by exposing the crown and cementing a celluloid crown-form over the cuspid and also enlarging the crypt to create a channel or trough along which the cuspid would erupt. However, once again the pathway of eruption is left to chance and eruption would depend upon irritation. If the cuspid is impacted against another tooth, spontaneous eruption will not occur.

Movement of teeth is accompanied by resorbtion of bone in the path of movement and concomitant deposition of bone in the space evacuated by the tooth. Resorbtion and deposition exist in normal physiologic balance and one depends upon the other. If a great deal of bone is removed around the crown, this bone balance is disturbed and the tooth may become excessively loose. The orthodontist treating a surgically exposed unerupted tooth moves it slowly to prevent strangulation of the pulp and to give the bone a chance to be deposited. For these reasons the practice of channelizing bone is not indicated.

Diagnosis, Prognosis and Treatment Planning

A careful diagnosis, prognosis and treatment plan is established for the patient presenting with unerupted or impacted teeth. Diagnostic information is obtained from a complete x-ray series (intra-oral, occlusal and lateral plates), study models and clinical examination. The data is correlated with the stage of growth and development of the dentition and maxillae. The patient's chronological, bone and dental ages are valuable guides.

In most cases, a complex of local and systemic conditions may be responsible. Contributory factors, for example retarded growth and development, arrhythmic eruption and mechanical interferences, are considered. The effect of the unerupted tooth on functional

occlusion is important. Over a period of time severe malocclusions may develop. In addition the etiology of the unerupted or impacted tooth is determined, if possible. Some of the factors which have demonstrable etiologic significance in retarding eruption and which are illustrated in this paper include:

A. Lack of inter-cupal width (Case 1)
B. Malposed tooth germ (Case 2)
C. Over-retained deciduous teeth (Cases 3 & 4)
D. Ankylosis (Case 5)

Other factors not demonstrated are:

a. Supernumerary teeth
b. Curved roots.

The prognosis and treatment plan should be based on an evaluation of all the data. Is it possible to guide the unerupted or impacted tooth into functional alignment? Is observation necessary to allow for further growth, development and eruption? Should space be maintained or created? Is surgical or non-surgical intervention indicated?

A prerequisite for treatment planning is a knowledge of the biological principles of growth, development and eruption integrated with broad clinical experience and judgment.

Each case is subject to its individual characteristics. General principles only can be discussed. Certain unerupted teeth, presenting a favorable position of the apex and crown, may be treated by removing the mechanical interferences, as in the case of an over-retained deciduous tooth, maintaining or creating adequate space, thus permitting eruption to proceed without further complications.

Surgical intervention is indicated for unerupted and impacted teeth which, because of severe interfering conditions, are prevented from emerging into the oral cavity. In general a path of least resistance should be established and maintained.

Localization

1. Casette technique

It is imperative that the relative position of the apex and crown of the unerupted tooth be determined. The occlusal casette is an aid with its double intensifying screen and 2¼" x 3" film. In the case of maxillary impactions the casette is placed in the mouth against the occlusal surface of the upper teeth. The rays are directed from the top of the skull in a line parallel with the long axis of the anterior maxillary teeth.

2. Four-film technique

A reliable method involves the taking of four films for each unerupted cuspid[10]. The following case, figures 1 and 2, is unusual in that it demonstrates both labially and palatally unerupted cuspids. For localization of the right cuspid an occlusal film directed from about the inner canthus of the right eye at a ninety degree angle is taken for gross radiographic anatomy (Figure 1).

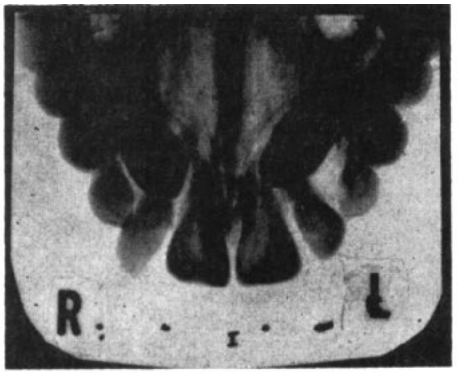

Fig. 1. Occlusal film of maxillary teeth showing impacted cuspids; the right cuspid is palatally located and the left is labial; see text and Fig. 2 for localization technic.

A set of three intra-oral films are taken of the right central, cuspid and bicuspid areas respectively (Fig. 2, No's. 2, 3 &

4). To localize the right cuspid, a point on the most mesial of the cuspid crown in the central incisor film is chosen and compared with an arbitrary point on the right central incisor root. Next compare the same point on the cuspid crown in the cuspid film to the arbitrary point on the central incisor root. Finally, compare the same point on the cuspid to the point on the central root in the bicuspid film. It will be noted that the selected point on the cuspid tooth moves distally with each successive posterior

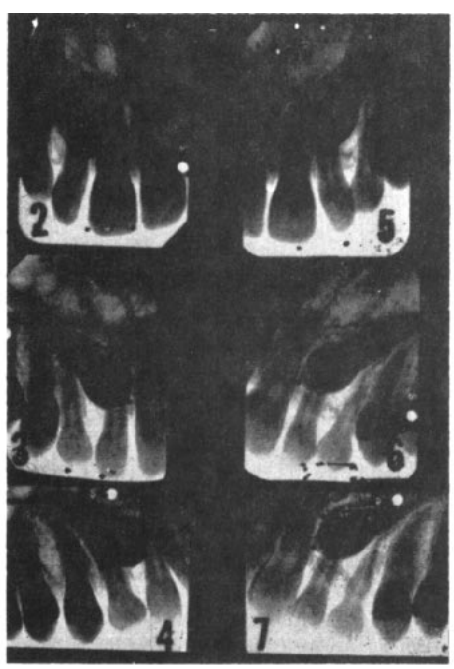

Fig. 2. Localizing technic with three dental X-ray films demonstrating palatal position of right cuspid (No's. 2, 3 and 4) and labial position of left cuspid (No's. 5, 6 and 7.)

film; the crown of the cuspid moves off the central incisor to appear over the lateral incisor. This indicates that the right cuspid crown lies palatally. Since no change in relationship between the two points is observed in the examination of the three films of the left cuspid, it may be assumed that the left cuspid crown lies labially or at the same level as the central and lateral incisors (Fig. 2, No's. 5, 6 and 7.)

Surgical and Orthodontic Procedures

Since unerupted teeth which require surgical treatment rarely erupt into normal position if their crowns are merely exposed and if they have lost their eruptive force, they ultimately require banding. Before surgical intervention the teeth of the arch are banded and treated orthodontically in order to create space for the reception of the unerupted tooth and to establish anchorage against which the surgically exposed tooth may be brought into proper alignment.

Before consulting with the oral surgeon, the following orthodontic plan of treatment is followed:

1. D. P. or colloid impressions for record models.
2. Intra-oral, occlusal and lateral x-rays.
3. Photographs.
4. Diagnostic set-up. This step consists of making duplicate models, cutting individual teeth from the models and re-setting the teeth (the unerupted cuspids can be carved in wax and placed on diagnostic models) in alignment with and over basal bone to help determine whether any extractions may be required.
5. Construction and cementation of necessary bands, acrylic splints[24] and other appliances.
6. Initiation of orthodontic treatment to provide necessary space, close unwanted spaces or complete any movement of teeth before surgical intervention. The edgewise arch was used in all cases and wherever possible all second molars were banded.

After localizing the unerupted tooth, the following surgical procedures are

performed:

Let us assume that we are dealing with an unerupted palatal cuspid such as seen in Figure 3.

1. Anesthesia — Either local infiltration or maxillary block injection or a general anesthetic may be utilized. Where general anesthesia is preferred, then the use of nasal-endotracheal anesthesia is indicated.

2. Flap Reflection (Figure 3A) — If only one cuspid is to be exposed, then the reflected flap should extend from the distal of the second bicuspid on the affected side to the distal of the cuspid on the unaffected side. If the case is bilateral, then the flap should extend from second bicuspid to second bicuspid. A suture may be used to hold the flap away.

3. Bone Removal Over Crown (Figure 3A) — The bone overlying the cuspid crown may be removed by the use of slowly revolving bone burs. Only sufficient bone is removed to secure an impression of the crown. Usually, the distal or mesial angle, part of the lingual or labial aspect of the crown and part of the incisal tip are sufficient area for impression. The presence of the follicular sac often aids in creating enough space around the crown of the cuspid. In certain cases the sac has disappeared and calcification around the crown makes exposure difficult.

4. Immediate Impression of Exposed Crown (Figure 3B) — A copper band is fitted and filled with Kerr's compound and impression of the crown is

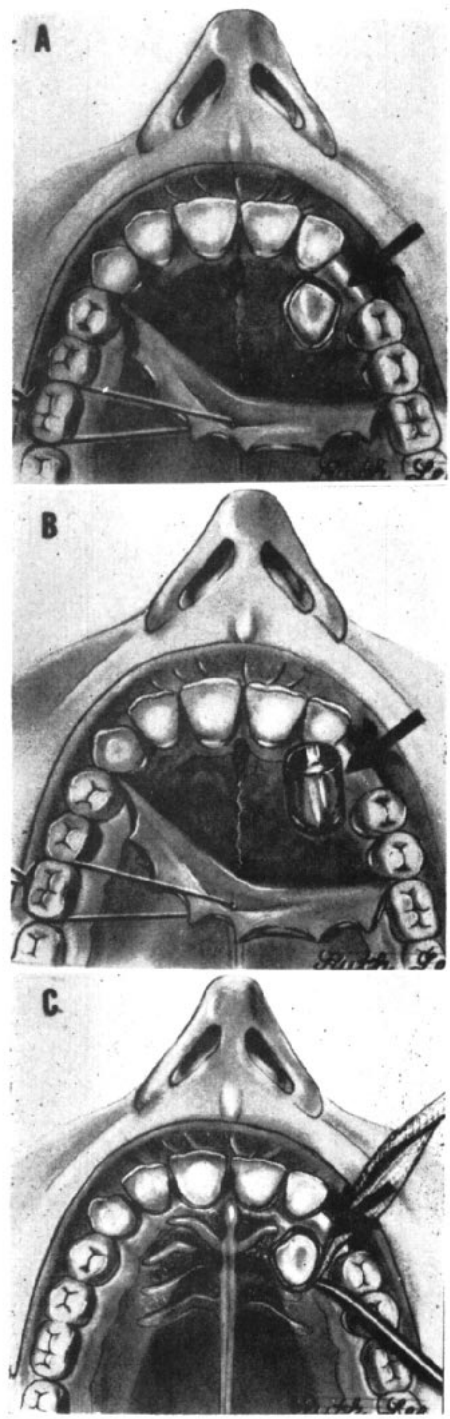

Fig. 3. Surgical procedures in exposing unerupted tooth. A, reflection of palatal flap and minimal removal of bone about the tooth; B, impression made with contoured copper band; C, the flap is sutured, the palatal mucosa overlying the tooth is excised and the wound is packed.

effected.

5. Excision of Mucosa Directly Over Exposed Crown — After the impression has been taken and the area debrided, the flap is replaced and with scalpel or scissors the mucosa overlying the exposed crown is excised. (Figure 3C)

6. Packing of Crypt Surrounding Exposed Crown (Figure 3,C) — One-quarter inch plain gauze impregnated with a loose mix of Ward's Wonderpak is pressure layered into the space between the exposed crown and surrounding bone and then laid over the crown and contoured to the palate.

7. Cementation of Casting — Within four to six days the Wonderpak gauze is removed. Under local anesthesia[18] the staining on the cuspid crown is removed by washing with a solution of green soap. The area is dried and the casting which was made from the impression of the crown is cemented immediately. The patient is now referred to the orthodontist.

Other unerupted teeth such as central incisors[17], bicuspids and molars are treated as described above for the cuspid. The same liberal flap and minimal bone exposure must be made and an impression taken for a casting at the time of surgical intervention.

Case 1

Age: 14

Etiology: Lack of inter-cuspal width.

Discussion: It is evident that insufficient space exists between the right central and the left lateral incisor to accommodate the left central. Consequently, orthodontic treatment to create space was begun and surgical opening to secure impression of the left central crown was accomplished. In addition to providing space for the impacted left central, the axial inclinations of all upper incisors and the center line needed correction. All teeth were banded in both arches. A push coil spring plus tip back bends and Class II elastics preceded the surgical opening. Treatment time: 14 months. (Figures 4 and 5)

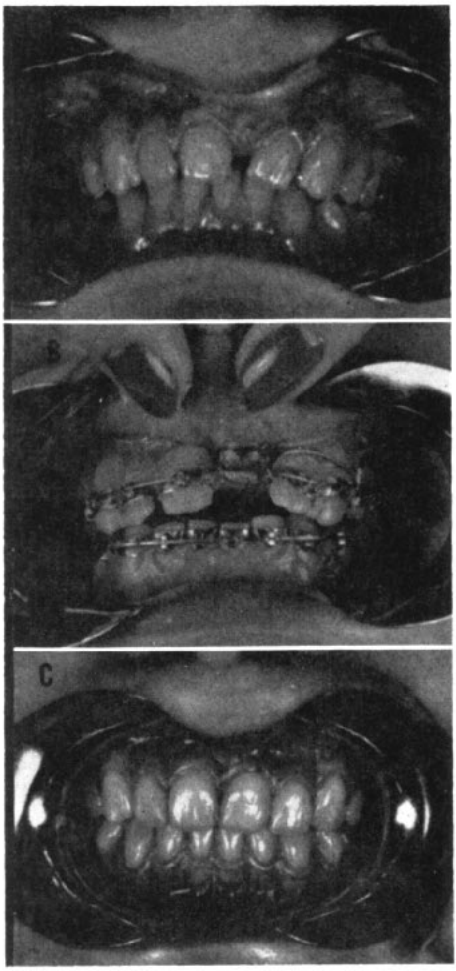

Fig. 4. Lack of space prevented eruption of the maxillary left central incisor. A, before treatment; B, casting cemented after creation of space by orthodontic treatment and surgical exposure; C, central incisor in position.

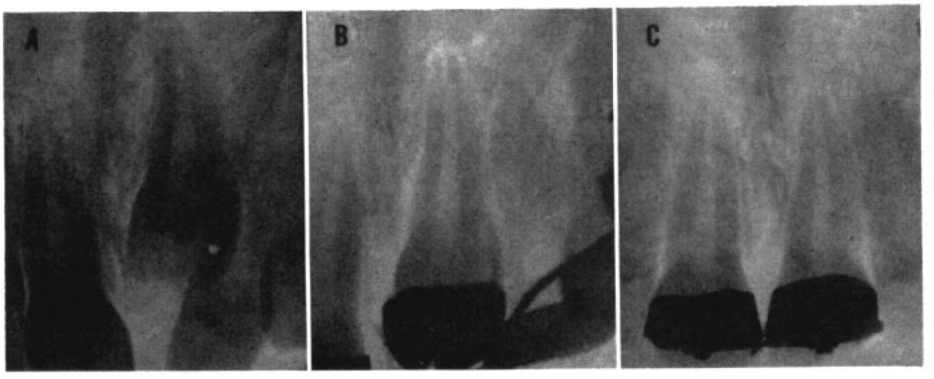

Fig. 5. X-rays of case I seen in Fig. 4. A, before treatment; B, casting cemented; C, at retention. Treatment time was fourteen months.

Case 2

Age: 14

Etiology: Malposed tooth germ.

Discussion: The lateral incisors were congenitally missing and there was sufficient space to accommodate the cuspid, yet eruption did not occur at age 14. (Fig. 6-A) It is valid to assume that this abnormal situation resulted because of the malposed tooth germ over the bicuspid. Since root resorption was evident on the left first bicuspid, it was extracted. Surgical exposure of the cuspid was then performed and a casting cemented. (Fig. 6-B) Treatment extended over a period of eighteen months. The central incisors were moved together and an artificial left lateral inserted. (Figs. 6-C and D)

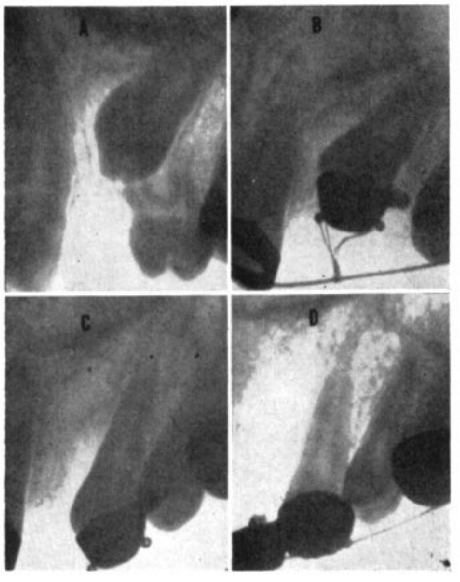

Fig. 6. Case 2: malposed tooth bud and congenital absence of lateral incisors. A, before treatment; B, casting cemented following removal of first bicuspid; C, tooth in position; D, restoration of left lateral incisor.

Case 3

Age: 11

Etiology: Over-retained deciduous tooth. (Observation case).

Discussion: This case demonstrates the fact that if the eruptive force is not lost and the over-retained deciduous tooth be removed in time, normal eruption may result without the use of surgery or orthodontic treatment, Figure 7-A shows original case, figure 7-B shows the tooth a year after the deciduous cuspid had been removed, and figure 7-C shows the tooth position three years later.

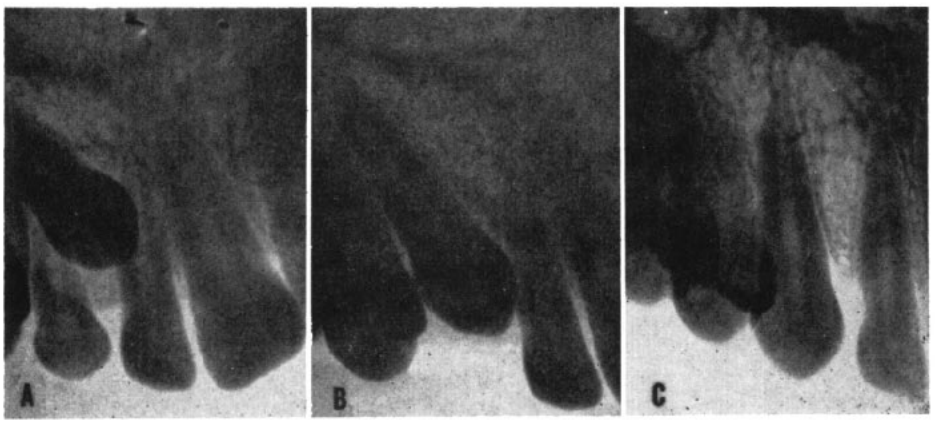

Fig. 7. Case 3: Over-retention of deciduous cuspid. A, original condition; B, spontaneous progress of permanent cuspid in twelve months following extraction of deciduous tooth; C, three years later.

Case 4

Age: 17

Etiology: Over-retained deciduous teeth (?)

Discussion: It is not certain whether over-retention of the deciduous cuspids caused the malposition of the permanent cuspid tooth germs or vice versa. In June 1947 the deciduous cuspids were removed but no eruption of the permanent cuspids was noted. In March 1948 surgery and orthodontia were performed and treatment was completed in two years. Note that the upper right second bicuspid is congenitally absent and the space was closed. Figure 8-A shows the problem on the right and left sides. Figure 8-B shows the case after removal of the deciduous cuspids. Figures 8-C and 8-D show the cuspids exposed, castings made and teeth brought into alignment.

Case 5

Age: 12

Etiology: Eruption prevented by ankylosis? (Submerged deciduous molar).[25]

Discussion: This case is still under treatment but in view of its interest it is here presented. An ankylosed deciduous second molar was removed which then brought into view an impacted second bicuspid. (Fig. 9-A) The space between the first bicuspid and first molar was maintained with a coil spring. (Fig. 9-B) Over a forty-five month period the second bicuspid moved somewhat into position. (Fig. 9-C) About September 1950 no change in status had been noted and it was planned to expose surgically the crown of the bicuspid, take an impression and cement a casting to bring the tooth into position. This was not done previously because the patient had been ill. Figures indicate the sequence of eruption.

Conclusion

A careful diagnosis, prognosis and treatment plan should be established for the patient presenting with unerupted or impacted teeth.

The data obtained should be correlated with the stage of growth and development of the dentition and maxillae. If it is possible to guide the tooth into functional alignment, the following methods may be adopted: (1) nonsurgical intervention; (2) surgical inter-

Fig. 8. Case 4: impaction of both maxillary cuspids. A, before treatment; B, nine months after removal of deciduous cuspids; C, castings cemented and orthodontic treatment started; D, the cuspids in their final positions.

vention. Prerequisite for treatment planning is a knowledge of the biological principles of growth, development and eruption integrated with broad clinical experience and judgment.

A technique for exposing and bringing unerupted and impacted teeth into functional position has been described. It is obvious that no strict rule of procedure can be proposed. Many teeth under our observation have been sucessfully treated by this method rather than by the procedures of exposing, packing or placing a celluloid crown. In our hands local anesthesia is the method of choice.

The surgical operation demands a certain amount of skill. Localization may be very difficult at times; the palatal bone may be very dense. Also, the crown of the cuspid may lie close to or contiguous with the lateral incisor. Occasionally the crown of the cuspid is situated palatally to the lateral incisor root. The root of the cuspid may be labial to the first bicuspid root. These contingencies must be anticipated. Impression of the crown is not difficult when the crypt is large. However, where calcification of the crypt has occurred and where the surgically

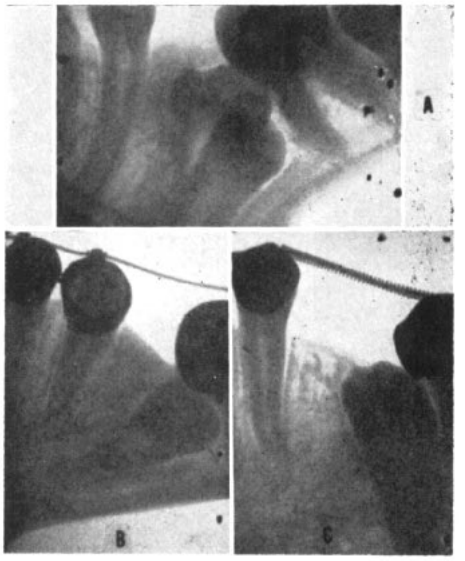

Fig. 9. Case 5: Ankylosed deciduous molar and impacted second bicuspid. A, original condition; B, following removal of deciduous molar; C, minor change of bicuspid position during subsequent forty-five months. Case currently under treatment (1951) to position bicuspid by methods outlined here.

exposed tooth lies adjacent to another tooth, impression may be very difficult.

Excision of bone around the crown of the surgically treated tooth should be minimized. If too much bone is removed and a channel created, the tooth may move into an empty space, become quite mobile, and possibly be lost. Conservation of bone as well as reliance on slow orthodontic treatment with gentle forces should be the rule.

Packing after surgical exposure is important since it acts as an analgesic, dries the area, minimizes hemorrhage and prepares the crown for cementation of the casting.

The casting is made of twenty-six gauge Kerr's blue wax. It should be very thin and should have the necessary loops, staples and brackets soldered in strategic positions to facilitate proper movement of the tooth.

Immediately following surgery and cementation of the casting it is important that no orthodontic pressure be applied. In about a week, light traction or light spring pressure can be instituted to start movement. It should be mentioned that many cuspids which erupt deep on the palate eventually are locked in lingual occlusion and can be brought into proper alignment by using molar acrylic splints,[24] cemented to molar teeth, on both sides, thus opening the bite and removing occlusal interference.

The general practitioner should x-ray the entire mouth routinely and be suspicious where the deciduous teeth are retained after the age of twelve or where permanent teeth are missing.

It is our contention that surgical exposure may result in eruption if the eruptive force is present and if there is no interference, but the cuspid may appear in an atypical position on the palate or labial aspect or may not erupt. Thus, in order to save time, and to prevent another surgical procedure if eruption does not occur, it is judicious to take a copper band impression at the first operation and cement a casting shortly afterwards. This technique has proved effective when there has been co-operation between the general practitioner, orthodontist and oral surgeon.

Medical Tower

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