

Soft-tissue management of labially positioned unerupted teeth

Robert L. Vanarsdall, D.D.S.,* and Herman Corn, D.D.S.**
Philadelphia, Pa.

Clinical orthodontists who have treated cases involving unerupted teeth have been faced with problems such as devitalization, re-exposure (uncovering) of the tooth, ankylosis, external root resorption, injury to adjacent teeth, marginal bone loss, and gingival recession. Invariably, these complications result in prolonged treatment time, esthetic deformities, and possible tooth loss. Most of these problems, particularly re-exposure (Fig. 1, *A* and *B*), gingival recession (Figs. 2 and 3), and bone loss (Fig. 4), can be prevented.

The existence of the unerupted or impacted tooth has been discussed in the literature for more than half a century.¹⁻³ During the past 5 years attention has been focused on the problems associated with unerupted teeth. The labial impaction has been indicated as the most difficult to manage.^{4, 5} However, in more than seventy-five cases in which direct bond attachments and an effective surgical approach were used, none of these problems has been experienced. The problems which accompany the repositioning of the unerupted tooth have been prevented after it has been uncovered surgically. It is apparent from an evaluation of the cases discussed in recent journals^{4, 6} and texts⁷⁻⁹ that, up to this point, the problems of gingival recession and concomitant marginal bone loss have not been solved.

Many authors⁸⁻¹¹ have reviewed the various etiologic factors that impede or delay eruption of labially or ectopically positioned teeth. This discussion is limited to eruption that has been delayed significantly beyond the time when normal dental development in a particular individual should have occurred. Naturally, it is preferable to create space and allow the tooth to erupt into the arch of its own accord, since it is generally agreed that natural eruption is the

*Assistant Professor of Orthodontics and Periodontics, University of Pennsylvania School of Dental Medicine.

**Adjunct Professor of Periodontics, University of Pennsylvania School of Dental Medicine.

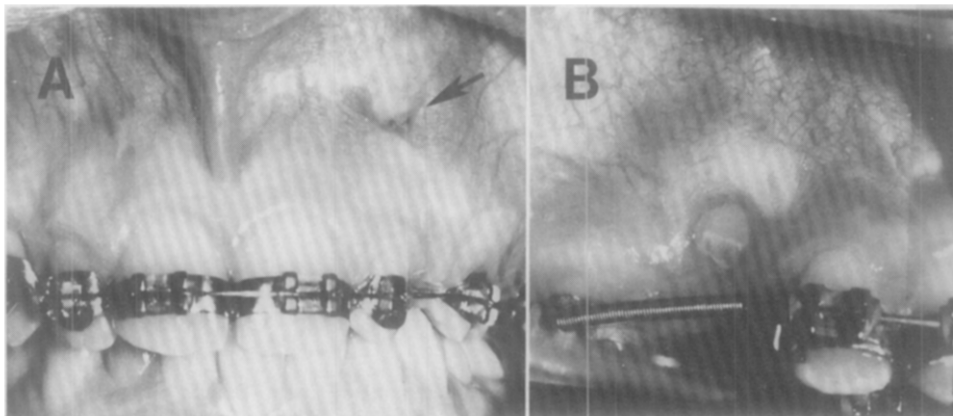


Fig. 1. A, The arrow indicates the small fistula in the alveolar mucosa which covers a maxillary left canine that had been uncovered and packed with different materials several times. However, the mucosa (with foreign body material placed around the crown) continued to cover the tooth completely, preventing the orthodontist from placing an attachment on the tooth. **B,** Another patient in whom the late-erupted maxillary canine had been uncovered on three previous occasions. Observe the absence of attached gingiva around the labial aspect of the partially exposed crown.

most physiologic type of tooth movement.^{10, 12} However, if a tooth fails to erupt or is unduly prolonging treatment time, then it should be uncovered.

Until now, the surgical technique of uncovering a tooth has been considered the "key" to repositioning these teeth. Generally, little attention has been focused on the soft-tissue management of the problem. The surgical approach¹⁴ called "simple complete exposure" appears to lack an appreciation of the histologic characteristics of the overlying soft tissues involved. Basic principles of oral surgery indicate that the surgeon go directly to the unexposed tooth. A review of oral surgery textbooks gives us some idea of why inadequate marginal tissue continues to be significant.

None of the texts^{13, 15, 16} makes any distinction between masticatory mucosa and alveolar mucosa as described by Orban and Sicher 30 years ago.¹⁷ It is well documented in the periodontal literature that alveolar mucosa does not function well as a marginal tissue. One of the purposes of attached gingiva is to provide an attachment to the tooth and bone to prevent the muscles of the face from detaching the marginal periodontal tissues from the tooth. Therefore, it would seem logical that the surgical procedure that is performed should predictably create a functional band of marginal tissue for the tooth that is uncovered, particularly when it will undergo extrusion.

From clinical periodontal experience, it has been learned that it is hazardous to move teeth in the presence of inflammation. Alveolar bone loss can be a sequela to such a procedure. When there is only alveolar mucosa surrounding a tooth, inflammation is generally present.²¹ Consequently, the surgical procedure should incorporate a means of providing attached gingiva over the tooth.

Other advantages of providing attached gingiva are as follows:

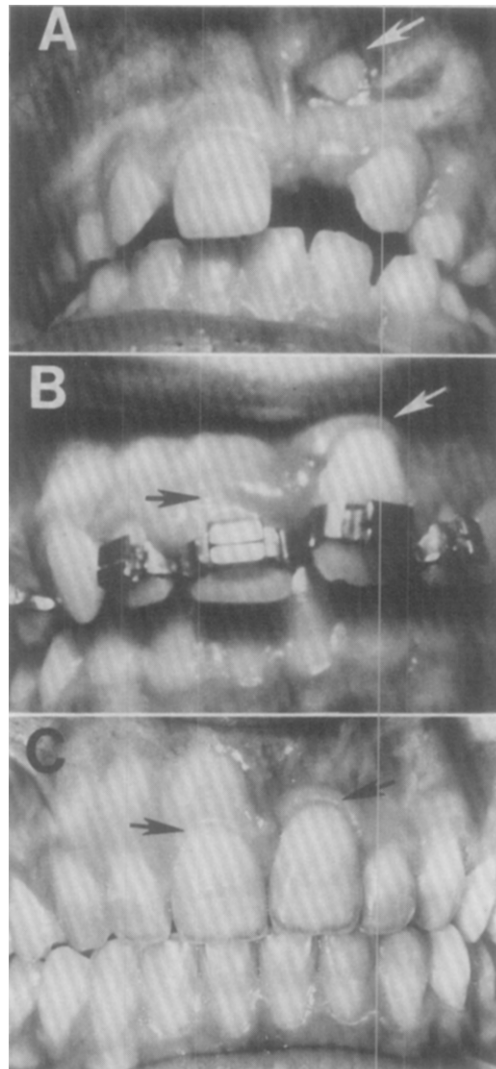


Fig. 2. A, The clinical appearance of the maxillary left central incisor after it had been uncovered several times by the surgeon. B, Gingival recession as the tooth is positioned into the arch. C, Six years later the patient remains disturbed by the obvious discrepancy in the gingival margins between the central incisors. A minimal zone of attached gingiva exists on the left central incisor, even though the tooth had received sufficient torque.

1. There is no need for a series of dressings or foreign objects to prevent the tooth from being covered by tissue again, even though the tooth may be located beyond the vestibular depth or mucobuccal fold.
2. The tooth will move more rapidly without soft-tissue obstruction.
3. The dentogingival attachment that is created helps to prevent the marginal bone loss and gingival recession encountered with impacted teeth.

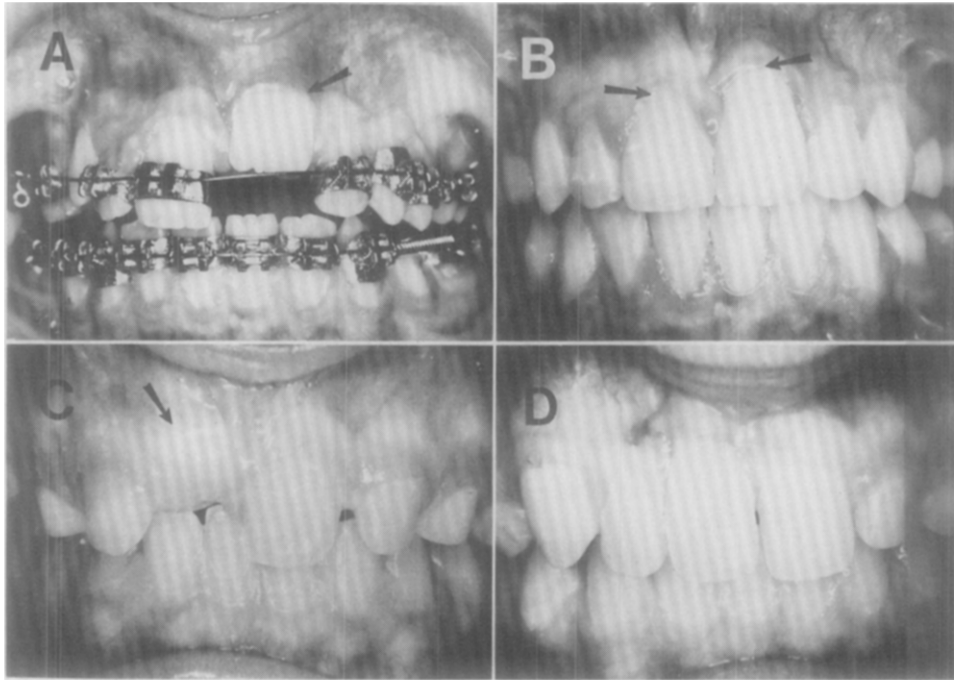


Fig. 3. **A**, After creation of space in the arch and a 9-month wait for natural eruption, the maxillary left central incisor was surgically uncovered. Notice the unnecessary resection (arrow) of masticatory mucosa over the left central incisor. **B**, The resultant disparity in gingival margin heights and remaining gingiva. **C**, Note abundant attached gingiva in area of unerupted maxillary right central incisor. **D**, Poor surgical management during exposure resulted in unesthetic crown length in the finished case.

Each of the current articles describing labial impactions^{4, 6, 18, 20} shows at least one case with mucogingival recession or a minimal zone of attached gingiva. Mucogingival problems, as seen in Figs. 1, 2, 3, and 4, are avoidable, provided that there is proper marginal tissue placement, lack of marginal inflammation, absence of excessive force, atraumatic surgery, and proper gingival attachment during tooth movement. If root planing and curettage are necessary to eliminate recurring marginal inflammation, they should not be done overzealously as this may cause an apical shift of the epithelial attachment. The marginal bone loss seen in Fig. 4, *B* should not occur.

Orthodontic considerations

Creating space in the arch prior to uncovering the tooth is recommended for two basic reasons. First, if space is not available, the tooth cannot effectively erupt or be positioned in the arch. Second, the edentulous space in the arch provides an adequate zone of attached gingiva to act as a donor site for a partial-thickness apically or laterally positioned flap. The surgical procedure may be a combination of both of these flap designs. Once the space has been created and closely approximated teeth have been moved (if they are in close proximity to the unerupted crown), the tooth can be uncovered.

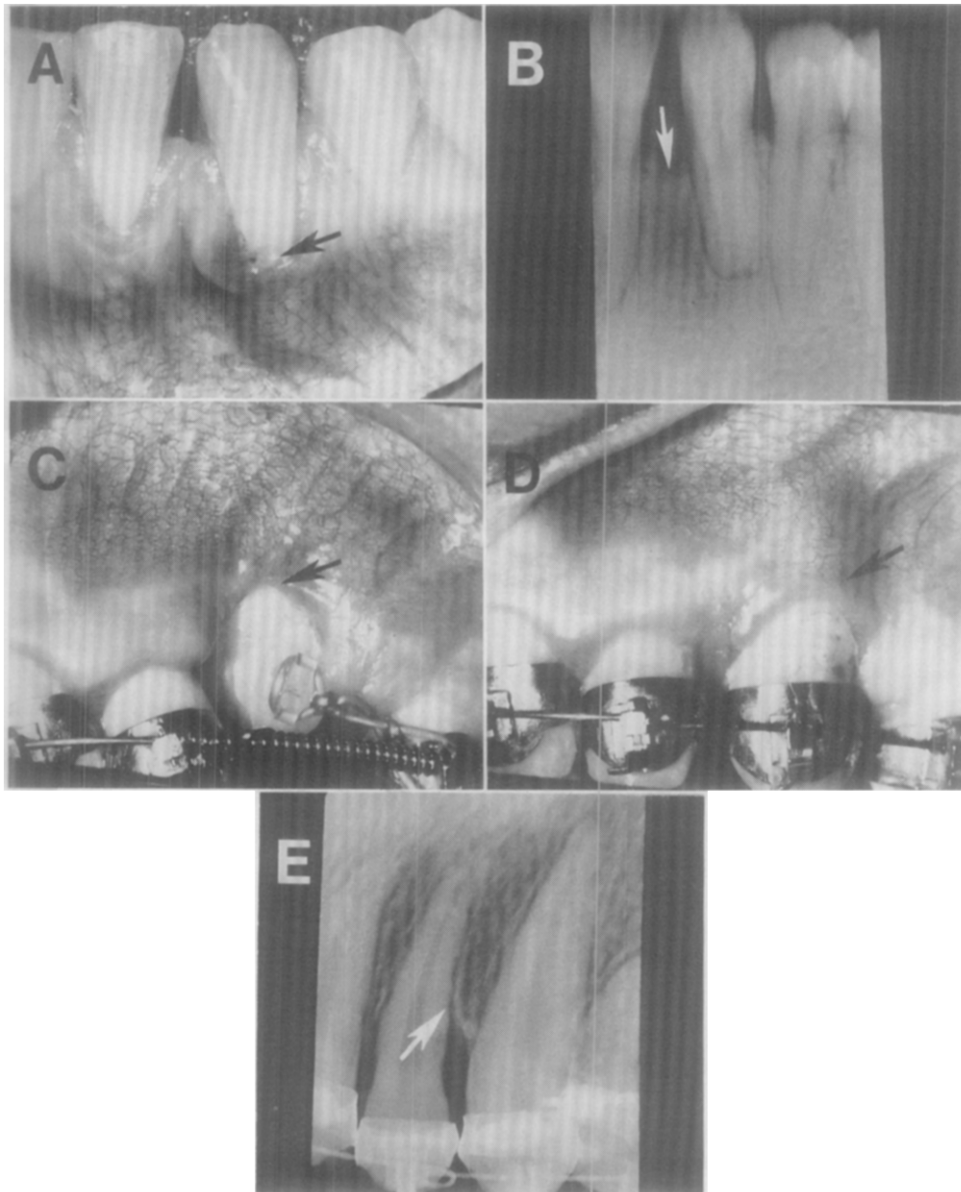


Fig. 4. **A**, A previously impacted, surgically uncovered, and orthodontically repositioned mandibular left canine. It is important to notice the inflammation and suppuration (arrow) associated with the absence of attached gingiva. **B**, Note marginal bone loss of one-third alveolar support. The degree of bone loss (white arrow) could have been avoided or reduced had movement been done without the presence of inflammation. **C**, Improper uncovering of the maxillary canine leaves unattached gingival margin. No functional attached gingiva is present. **D**, Following proper movement of the tooth into the arch no gingiva was created. Only the free gingival margin remains; no attached gingiva has been created. **E**, The eruption pattern of an impacted tooth can result in alveolar resorption on adjacent teeth. In this case, however, the surgical exposure inadvertently destroyed bone on the distal aspect of the lateral incisor.

Surgical procedure

Local infiltration anesthesia is given. An incision is made along the ridge area in the edentulous space. The incisogingival dimension to this keratinized band of tissue will be determined by the amount of attached gingiva that exists on the adjacent teeth or its antimere in the arch. Vertical releasing incisions are made, and the attached gingiva is freed. The connective tissue is removed from the labial aspect of the tooth, and bone is removed beyond the height of contour of the crown. Bone removal is not performed beyond the cemento-enamel junction (CEJ) area. The CEJ area is not disturbed because it is here that we would like to establish the dentogingival attachment to the tooth. This area has been pointed out as being critical with respect to the creation of gingival recession in monkeys.¹⁹

Placement of attached gingiva

It is essential that the graft be placed to cover the cemento-enamel junction area and 2 to 3 mm of the crown for three reasons:

1. This positioning makes possible establishment of the supra-alveolar connective tissue attachment to the radicular bone and cementum of the tooth.
2. The protection of the junctional epithelial seal provided by masticatory mucosa cannot be provided by alveolar mucosa.
3. The coronal positioning permits some apical movement of the marginal tissue (in long-distance movement), because tension develops in the collagenous gingival tissue during movement into the arch. Establishing attachment to the anatomic crown allows the marginal tissue to continue to protect the underlying bone (which is usually very thin on the buccal aspect of the labial impaction).

Sutures are placed into the connective tissue mucoperiosteal bed mesial and distal to the tooth to prevent displacement of the donor tissue when the dressing is placed. The dressing is retained in position for 7 to 10 days to afford the tissue time for reattachment to the tooth and for epithelization to occur in the area. Upon removal of the dressing, a direct bond bracket is attached to the tooth, and tooth movement is begun immediately with light force.

Discussion

This method of surgical exposure of a tooth offers several advantages when used in cases of retarded or delayed eruption.

It is probably not the bone that delays tooth movement, assuming that a tooth is not ankylosed. Observations have been that the rate of osseous turnover or remodeling of bone have been greater than that of the overlying soft tissue. Rather, it appears that the soft tissue often retards eruption²² and slows down tooth movement.

If a tooth has attached gingiva, there is less likelihood of marginal soft-tissue overgrowth. When the tooth remains uncovered and is not covered by soft tissue, more rapid repositioning occurs and treatment time is decreased. In fact, it has been observed clinically that the problem may be that the tooth will move too rapidly.

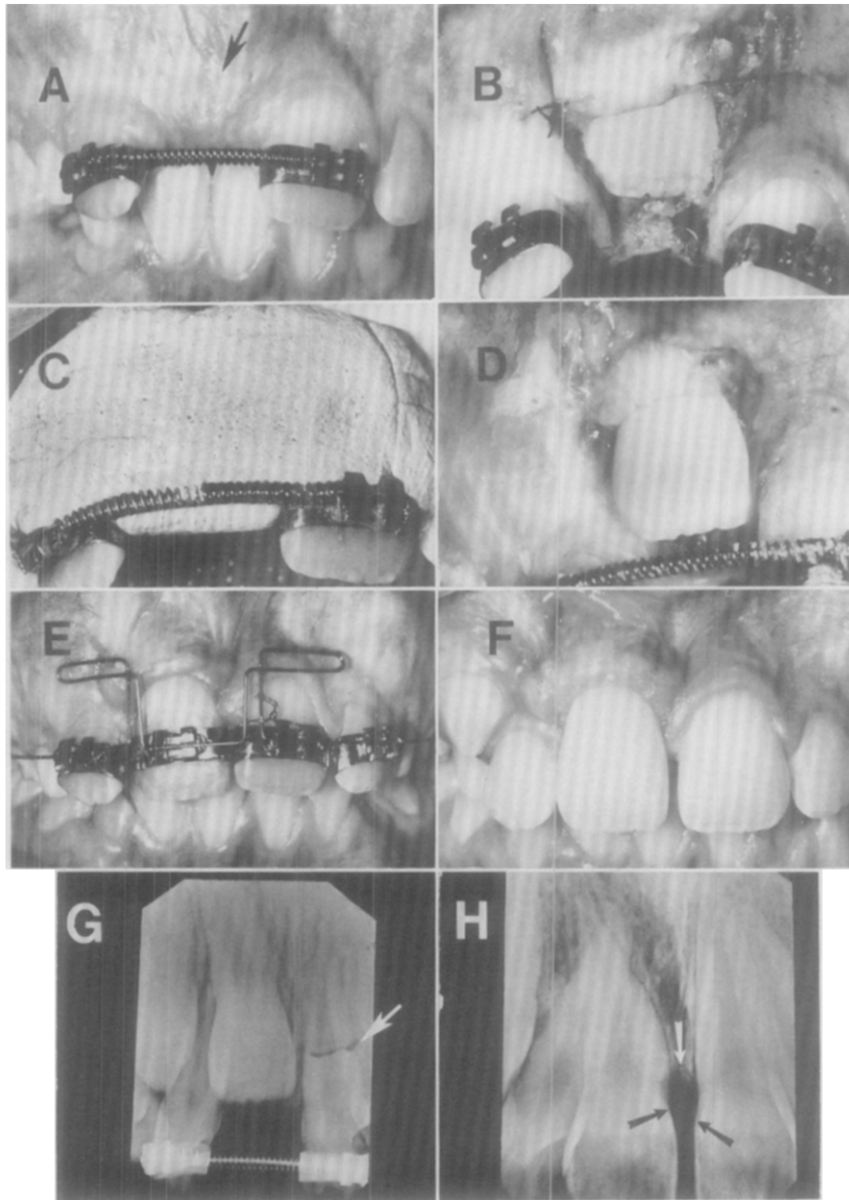


Fig. 5. **A,** As an initial stage of treatment for this 9-year-old patient, space was created for the unerupted right central incisor (arrow) which is covered by adequate donor gingival tissue. **B,** The apically positioned pedicle graft of gingiva is placed on the enamel to protect the marginal bone. **C,** Non-eugenol periodontal dressing is used to protect the area. **D,** Ten days postoperatively, the tooth remains uncovered and the transposed tissue is attached to the tooth. **E,** Tooth in position 4 months later. **F,** Note the gingival margin one year after completion of Stage 1 treatment. **G,** Pre-exposure radiograph. Arrow indicates developmental contact stain on radiograph. **H,** One year after completion of Stage 1 treatment, note disparity of the cementoenamel junctions (black arrows) and the associated angular crest (white arrow) which will obviously be corrected during Stage 2.

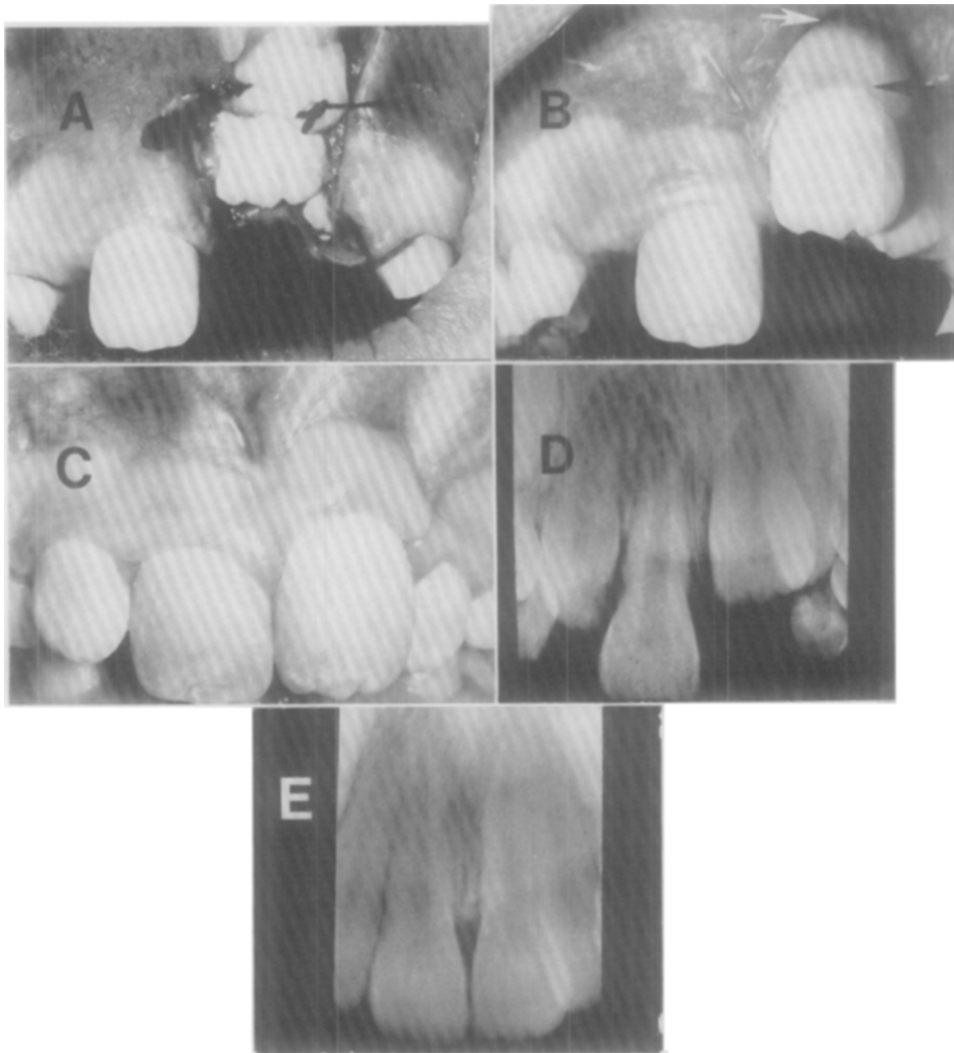


Fig. 6. **A**, Surgical exposure and apical transposition of attached gingiva on **delayed** erupting left central incisor of an 8-year-old patient. **B**, One month postoperatively, **note** eruption that has occurred without appliances. Had the exposure been accomplished on this labially positioned central incisor without the use of a graft, alveolar mucosa **would** have been the marginal tissue. (Arrows indicate the width of attached gingiva.) **Compare** with Fig. 1, **B**. **C**, One year after completion of stage 1 treatment. Note marginal **gingiva** disparity, which will be corrected during the leveling stage of treatment. **D**, **Preoperative** radiograph of impacted incisor. **E**, Radiograph taken 1 year postoperatively.

In a case in which a tooth must move a long distance in order to **take its** proper position in the arch, the soft tissue tends to “bunch up” as the **tooth is** moved. Excision may be appropriate to achieve proper tooth position and **post-retention** stability.

During any surgical procedure, there is hemorrhage which makes it **difficult** to maintain a dry field. Contrary to other approaches,²³ it is not necessary to **band**

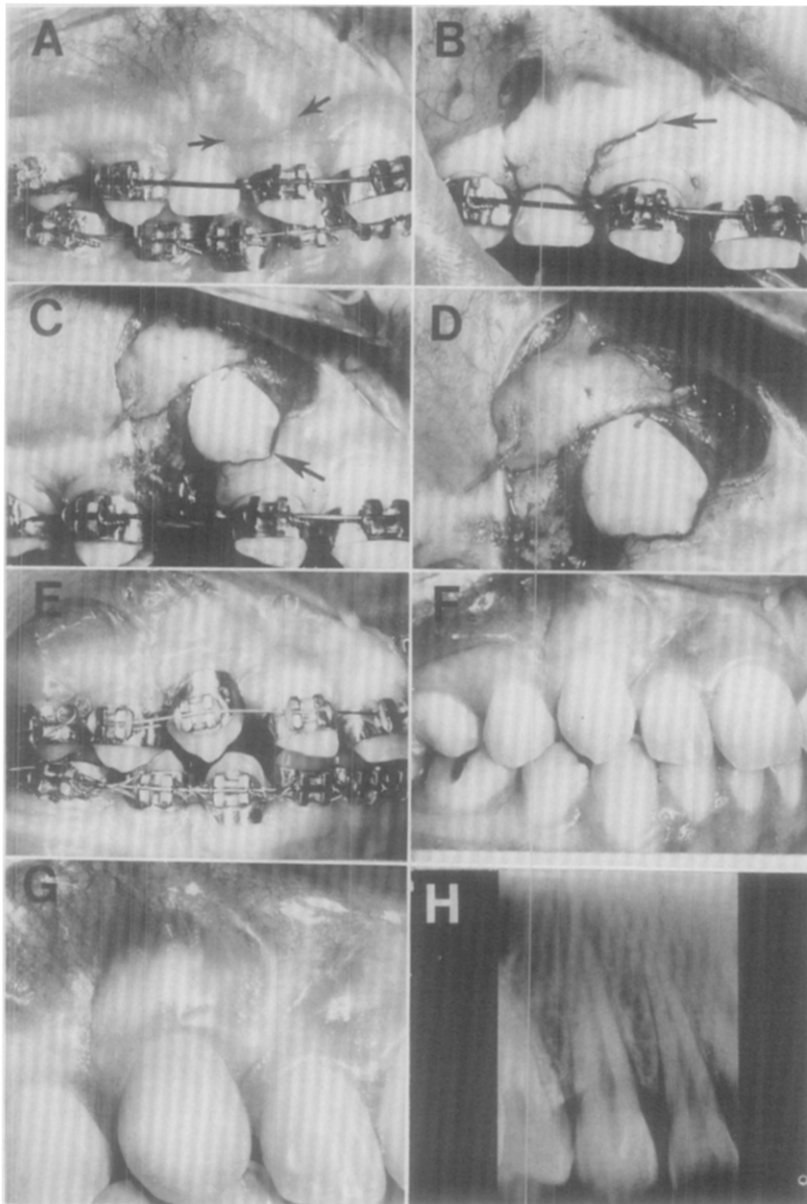


Fig. 7. **A,** The impacted maxillary canine (arrows) is positioned labial to the lateral incisor. **B,** Incisions and pedicle graft design of donor tissue from the deciduous canine area. **Note** that the mesial incision avoids removal of the marginal tissue on the lateral incisor. **C,** The gingiva over the lateral incisor (arrow) is tucked to the lingual aspect of the canine and suturing of the pedicle graft. **Notice** that the connective tissue covers the cervical portion of the crown. **D,** Close-up view of the graft in place. **E,** Five months later the gingiva follows the tooth as it is positioned into the arch. **F,** Two years later. **G,** Close-up of the marginal gingiva. **H,** Two-year follow-up radiograph demonstrating normal alveolar support. **Observe** widened periodontal ligament spaces due to retention of the case with a tooth positioner.

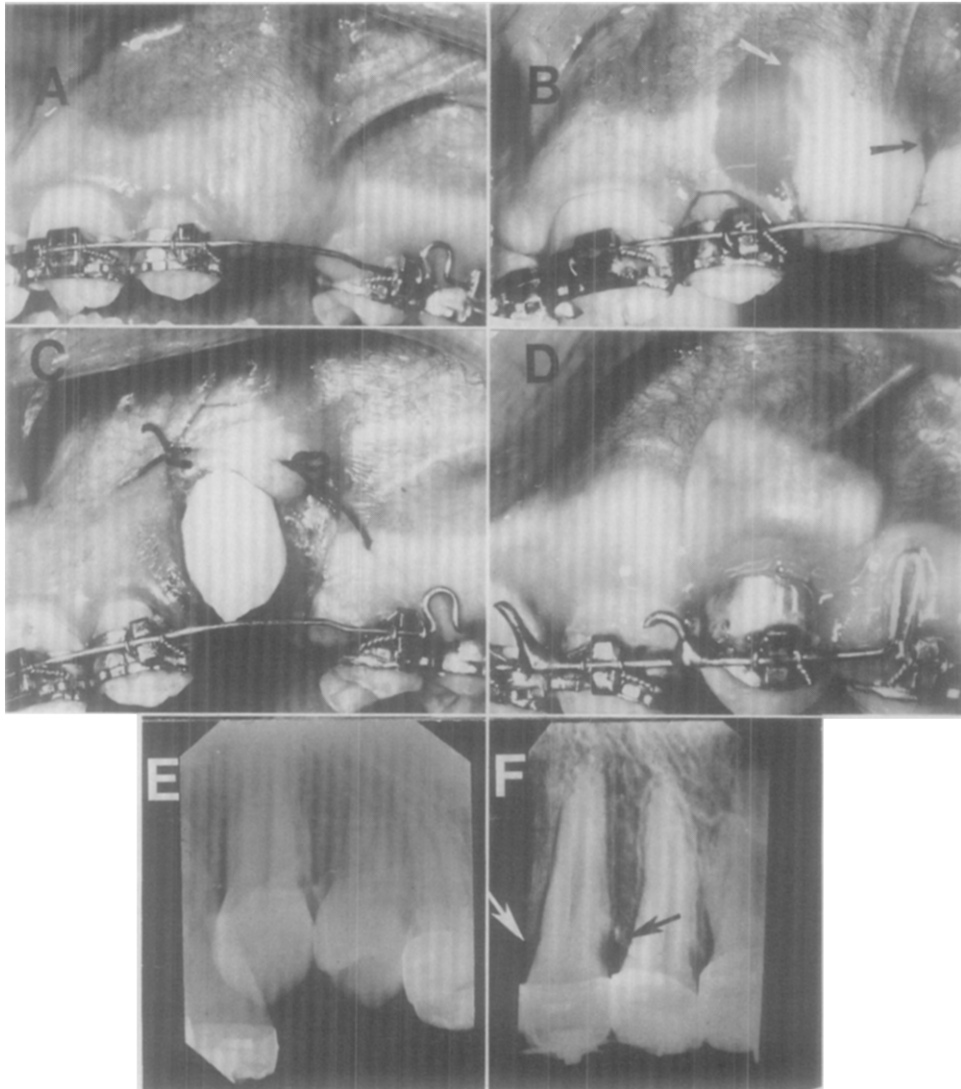


Fig. 8. **A**, This patient illustrates the ease with which a graft can be accomplished when the canine is located directly beneath the space in the arch. This impacted tooth had delayed treatment many months and was exposed as has been previously discussed. **B**, Incisions for the graft. **C**, Sutured graft. **D**, The tooth, having been brought into the arch, has an adequate gingival unit present. **E**, Pre-exposure radiograph. **F**, Note that as the tooth was positioned in the arch there was no loss of crestal bone (arrows).

or bond an attachment directly to the tooth during the surgical procedure. A dressing provides comfort for the patient and holds the tissue in position until attachment takes place. When the dressing is removed (after 7 to 10 days), sufficient healing has occurred to enable a direct bond attachment (preferably) to be placed in a dry field and the tooth movement is begun.

Clinical cases

Although the number of cases treated by the method described is not large (seventy-five), the repeated success of the procedure appears to warrant continuation of the clinical trial. The following cases were selected on a cross-sectional basis, not necessarily because they depicted the most attractive results.

Conclusion

We do not believe that all unerupted teeth can be salvaged. The prognosis may be poor, and certain impacted teeth (even canines) should be extracted. However, the number of successfully treated labially positioned teeth can be increased by proper management of the tissues attached to them. Fewer esthetic deformities and a more favorable long-term prognosis for these teeth would result from protecting the marginal integrity of the attachment apparatus and preventing an apical shift of the dentogingival junction.

The surgical approach that has been described should prevent soft-tissue recession and radicular bone loss on unerupted teeth with proper orthodontic, periodontic, and patient management. The question arises as to whether the oral surgeon should re-evaluate the current technique for uncovering unerupted teeth and place emphasis on the manipulation of the soft tissues. It is hoped that calling attention to this procedure will initiate research in the area so that a better understanding of the soft-tissue reactions to tooth movement can be achieved. The skill and finesse of the operator must be supplemented by an understanding of the biology of the tissues and their response. We cannot be assured of success until precise basic science information is established and verified. It is surprising how often these problems involving impacted teeth are observed clinically as well as in the literature. Each specialist should be encouraged to evaluate this problem in his cases.

A keener appreciation of biologic interactions in the interpretation of many recurring clinical problems should be a guide to future research.

The authors would like to thank Mr. David Sullivan for his assistance in preparing the photographs for this publication.

REFERENCES

1. Blum, T.: Malposed teeth: Their classification, pathology and treatment, *INT. J. ORTHOD.* **9**: 122, 1923.
2. Rohrer, Alfred: Displaced and impacted canines, *INT. J. ORTHOD.* **15**: 1003, 1929.
3. Cryer, M. H.: Pathologic changes in the jaws resulting in impacted teeth and other disturbances with special reference to the use of the x-ray in diagnosis, *Br. Dent. J.* **32**: 913, 1911.
4. von der Heydt, Karl: The surgical uncovering and orthodontic positioning of unerupted maxillary canines, *AM. J. ORTHOD.* **68**: 256-276, 1975.
5. Johnston, Wilbur, D.: Treatment of palatally impacted canine teeth, *AM. J. ORTHOD.* **56**: 589-596, 1969.
6. Lewis, Paul D.: Preorthodontic surgery in the treatment of impacted canines, *AM. J. ORTHOD.* **60**: 382-397, 1971.
7. Geiger, A., and Hirschfeld, L.: *Minor tooth movement in general practice*, ed. 3, St. Louis, 1974, The C. V. Mosby Company, pp. 235-337.

8. Graber, T. M.: *Orthodontics: Principles and practice*, ed. 3, Philadelphia, 1972, W. B. Saunders Company, p. 751.
9. Salzmann, J. A.: *Orthodontics in daily practice*, Philadelphia, 1974, J. B. Lippincott Company.
10. DiSalvo, Nicholas A.: Evaluation of unerupted teeth; orthodontic viewpoint, *J. Am. Dent. Assoc.* **82**: 829-835, 1971.
11. Dewel, B. F.: The upper cuspid: Its development and impaction, *Angle Orthod.* **19**: 79-90, 1949.
12. Amsterdam, M.: Periodontal prosthesis twenty-five years in retrospect, *Alpha Omegan* **67**: 36, December, 1974.
13. Thoma, Kurt H.: *Oral surgery*, ed. 5, St. Louis, 1969, The C. V. Mosby Company.
14. Clark, D.: The management of impacted canines: Free physiologic eruption, *J. Am. Dent. Assoc.* **82**: 838, 1971.
15. Kruger, G. O.: *Textbook of oral surgery*, ed. 4, St. Louis, 1974, The C. V. Mosby Company, pp. 84-98.
16. Archer, W. Harry: *Oral surgery*, ed. 4, Philadelphia, 1966, W. B. Saunders Company.
17. Orban, B., and Sicher, H.: The oral mucosa, *J. Dent. Educ.* **10**: 94-100, 163, 1946.
18. Bishara, S. E.: Treatment of unerupted incisors, *AM. J. ORTHOD.* **59**: 443-447, 1971.
19. Cohen, B.: A study of the periodontal epithelium, *Br. Dent. J.* **112**: 55-68, 1962.
20. Moss, James P.: An orthodontic approach to surgical problems, *AM. J. ORTHOD.* **68**: 363-390, 1975.
21. Lang, N. P., and Loe, Harold: The relationship between the width of keratinized gingiva and gingival health, *J. Periodont.* **43**: 623, 1972.
22. DiBiase, D. D.: Mucous membrane and delayed eruption, *Trans. Eur. Soc. Study Orthod.* **56**: 149-158, 1969-70.
23. Nielson, I. L., Paydso, U., and Winkler, T.: Direct bonding on impacted teeth, *AM. J. ORTHOD.* **68**: 666-670, 1975.

1601 Walnut St. (19103)

To extract an irregular Tooth would answer but little purpose, if no alteration could be made in the situation of the rest; but we find that the very principle upon which the teeth are made to grow irregularly is capable, if properly directed, of bringing them even again. This principle is the power which many parts (especially bones) have of moving out of the way of mechanical pressure. It is impossible to give absolute directions what tooth or teeth ought to be pulled out. That must be left to the judgment of the operator. (Hunter, John: *Natural History of Human Teeth*, ed. 1, London, 1771, J. Johnson.)