Efficient Management of Unerupted Teeth: A Time-Tested Treatment Modality

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The strategy for managing unerupted teeth has been debated for more than half a century. Duration of treatment, adverse responses, and type of surgical procedure and mechanotherapy to align ectopically positioned teeth has been analyzed, with disparate approaches endorsed. This report will describe the most frequent adverse problems encountered with management of unerupted teeth and suggest a means to prevent them. A recent study will be reviewed that will demonstrate a time-tested evidence-based approach that can prevent these commonly encountered adverse problems as well as reduce treatment time required to position the malposed tooth into the line of occlusion regardless of the patient's age. (Semin Orthod 2010;16:212-221.)

The authors of many studies have reported on the affect of treatment duration and adverse responses that may occur with various therapeutic approaches and different types of mechanotherapy to align ectopically positioned teeth properly.[1-4] This report will describe increasingly frequent complications observed with unerupted teeth, especially canines. This phenomenon of more frequent harmful sequelae may be attributed to the surgical technique used to uncover the tooth. Canines will be emphasized because they are the most frequently unerupted teeth that requires surgical exposure and orthodontic guidance into the arch. Obviously, the severity of the impaction as well as its labial or lingual location is critical to determine clinical management, surgical uncovering, and alignment.

Because of the more frequent occurrence of the palatally displaced cuspid, they have been given more attention in the literature than labially displaced teeth. It has been emphasized that labially displaced teeth are more challenging to manage without the occurrence of adverse periodontal problems, and suggestions have been made regarding proper management of the periodontal tissues.[5] Special attention has been given to surgical technique, marginal gingival placement, control of inflammation, absence of excessive force, atraumatic surgery, and proper gingival attachment. Unfortunately, reports and studies have failed to differentiate that the "open" technique is different from an apically positioned graft (Fig 1) approach, ie, open eruption (Fig 2) versus closed eruption (flap replacement; Fig 3). Figure 2A illustrates an exposed tooth left open to the oral cavity with lack of attention being given to overlying periodontal tissues. Figures 3 and 4 illustrate closed eruption versus labially positioned tissue (Fig 4) as a component of the exposure. Figure 4 illustrates decreased treatment time required when a tooth is exposed with a labial apically positioned graft. Obviously, there are conflicting reports in the literature regarding apically positioned keratinized tissue and closed eruption technique (flap replacement) used for uncovering ectopically positioned teeth.[4-7]

The many problems[8] with unerupted teeth reported in the past, such as reexposure, marginal bone loss, devitalization, prolonged treatment time, ankylosis, loss of teeth, and injury to

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Figure 1. (A) An apically positioned partial-thickness pedicle graft is placed on the cervical area of the anatomical crown of the right incisor. Observe no bone is exposed and bone is completely covered by mucoperiosteal tissue. Partial-thickness dissection ensures maximum postsurgical bone coverage. (B) Weeks later observe healing and inciso-labial eruption. (C) Note intact healthy gingival tissue covering right incisor 10 years posttreatment. (Color version of figure is available online.)

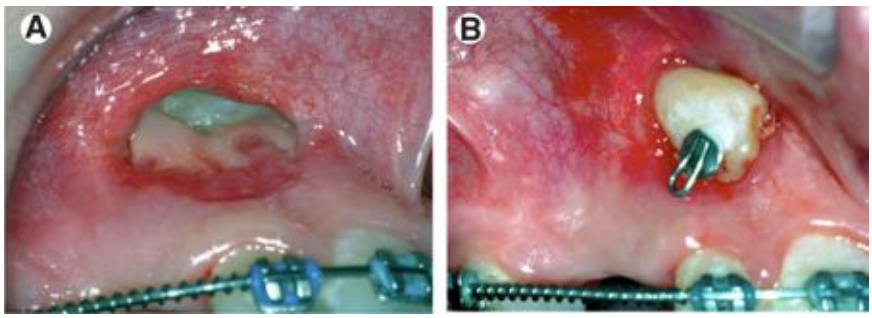


Figure 2. (A) "Open" eruption of a maxillary right cuspid. Note full-thickness mucogingival flap, exposed bone, the anatomical crown, and opening created by excision of the hard and soft tissues over the unerupted tooth. Due to exposed bone, patient experienced pain for several weeks. (Denudation procedures were discontinued in periodontics in the 1960's.) (B) Tooth was bonded and observe inadequate keratinized tissue around crown as the tooth was positioned labially. (Color version of figure is available online.)

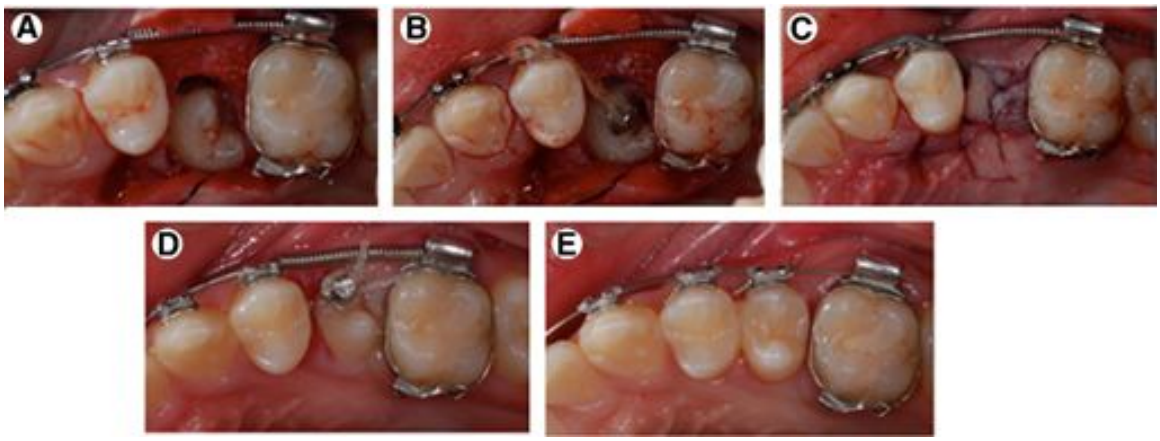


Figure 3. Closed eruption or flap replacement technique. (A) Full-thickness flap reflected, bone removed over second premolar. (B) Orthodontic attachment bonded to crown and activated with elastomeric thread. (C) Full-thickness flap is replaced to completely cover unerupted premolar. (D) As a result of flap replacement, one and a half months later tooth is still covered with tissue with diminished control of tooth movement. (E) Five and a half months were necessary to move the premolar to the occlusal level with closed eruption surgical procedure. (Prolonged treatment time.) (Color version of figure is available online.)

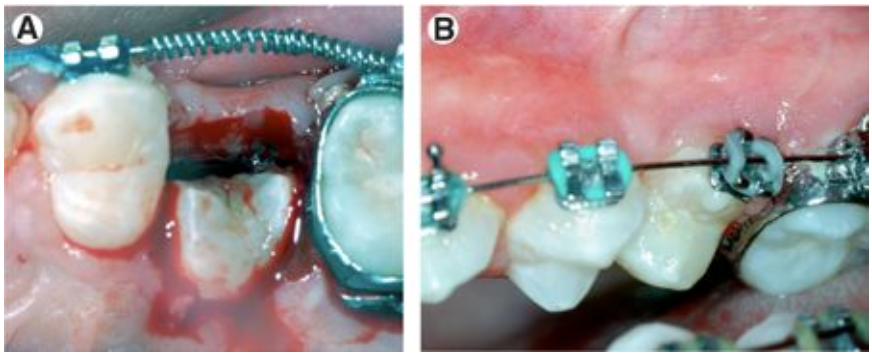


Figure 4. (A) Apically positioned labial flap was used to uncover second premolar in similar location and position as tooth in Fig 3. (B) Two months later (with better access and visualization) tooth is efficiently positioned to the occlusal plane with preservation of adequate labial gingiva. (Color version of figure is available online.)

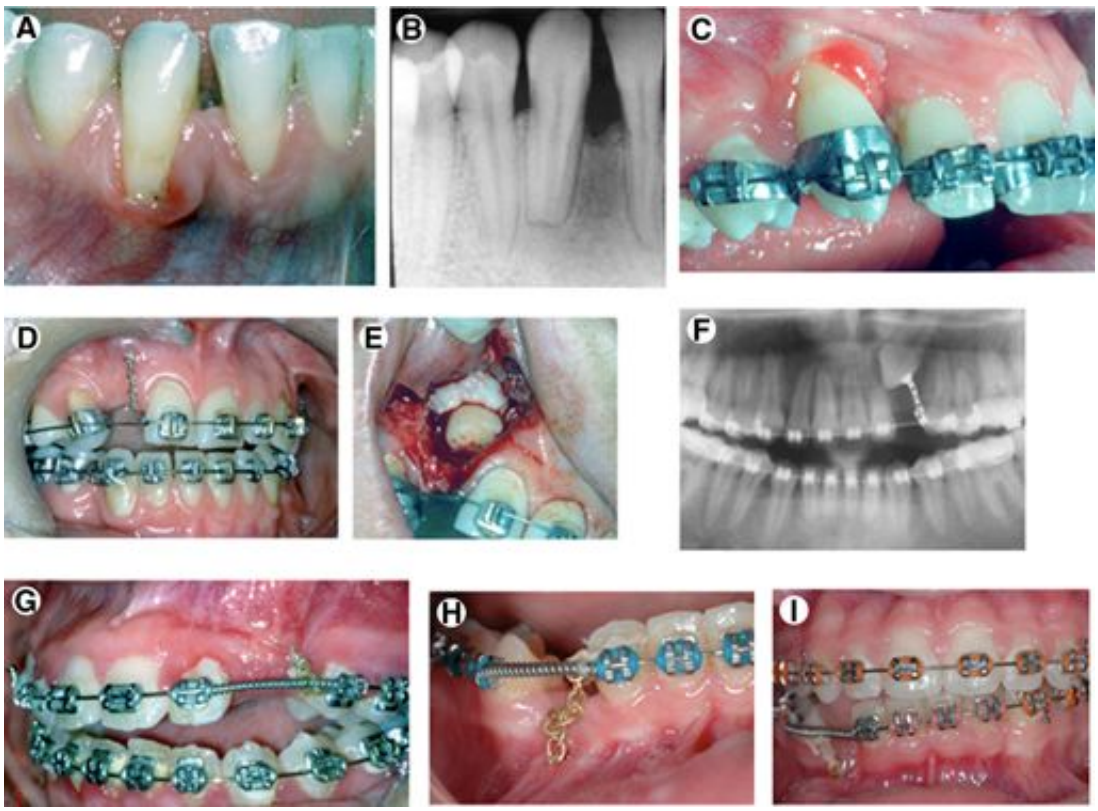


Figure 5. Latrogenic problems. (A) Lower canine with esthetic deformity, inadequate keratinized tissue. (B) Radiograph of canine shows marginal or crestal bone loss. (C) Maxillary right canine exhibits esthetic deformity, recession. (D) Closed eruption on a maxillary right cuspid. (E) Tooth in D has to be re-exposed with an apically repositioned graft to be positioned into the arch. (F) Panoramic radiograph of closed eruption surgical exposure. The tooth became ankylosed and caused intrusion of the maxillary arch and the anterior open bite. (G) Clinical view of F and the open bite with closed eruption and gold chain guidance device. (H) Gold chain to mandibular right canine. Gold chain and closed eruption technique frequently is associated with open bite as seen on patient's lower right side. (I) Frontal view of open bite created by ankylosed cuspid managed with closed eruption approach. (Color version of figure is available online.)

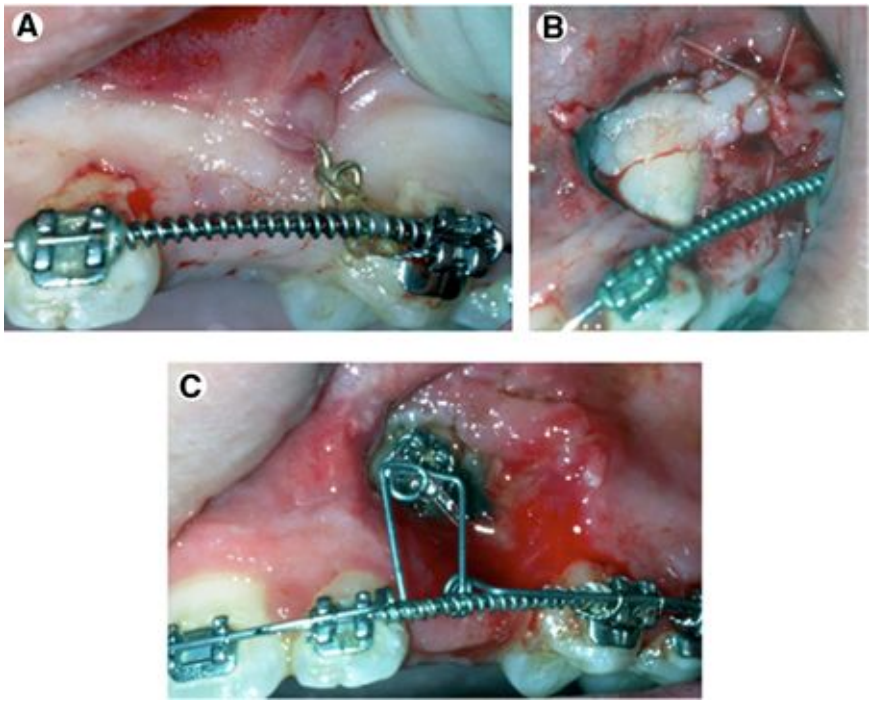


Figure 6. Additional surgical procedure with closed eruption and gold chain management of an upper left canine. (A) Tooth stopped moving and it was necessary to re-expose the tooth. (B) An apically position graft was used to gain access and to remove gold chain. (C) One week postsurgery a swinging gate and "piggy-back" wire was used to erupt the cuspid. (Color version of figure is available online.)

adjacent teeth have been more commonly encountered recently with the interdisciplinary treatment among the dental specialties of periodontics, oral surgery, and orthodontics. Although these increasing deleterious complications may be multifactorial, a closer assessment of iatrogenic problems is critical (Fig 5).

Numerous surgical procedures have been recommended for labial impactions, such as apically repositioned graft,[5] closed–flap and erup-

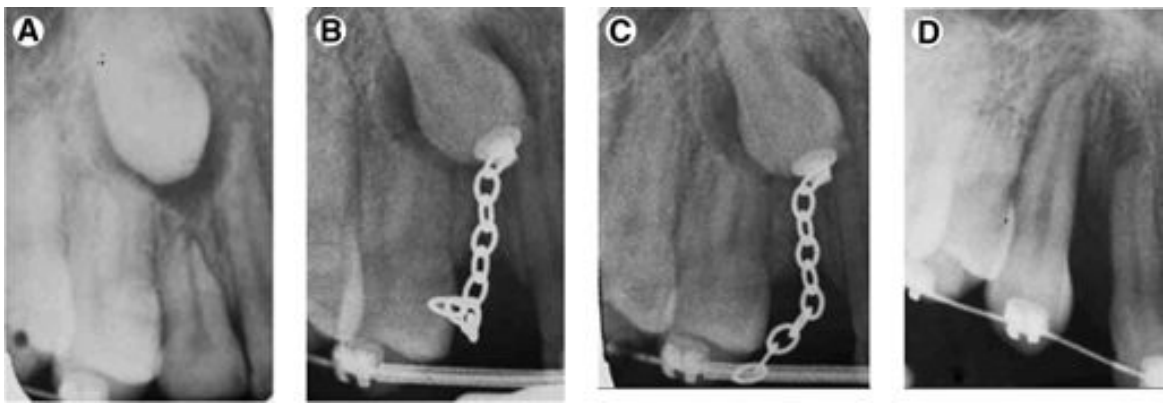


Figure 7. Loss of periodontal attachment from inflammatory dental follicle during eruption. (A) Pretreatment radiograph of mandible right canine in June 2004. (B) Closed eruption was used to place gold chain. Six months later observe cementoenamel junction area and apical radiolucency around the anatomical crown. (C) Seven months after surgery observe radiolucency increases apical to the cementoenamel junction area. (D) Ten months later note radiograph evidence of 50% bone loss caused by the follicular material. (This has never been observed in conjunction with the use of apical repositioned flap exposure.)

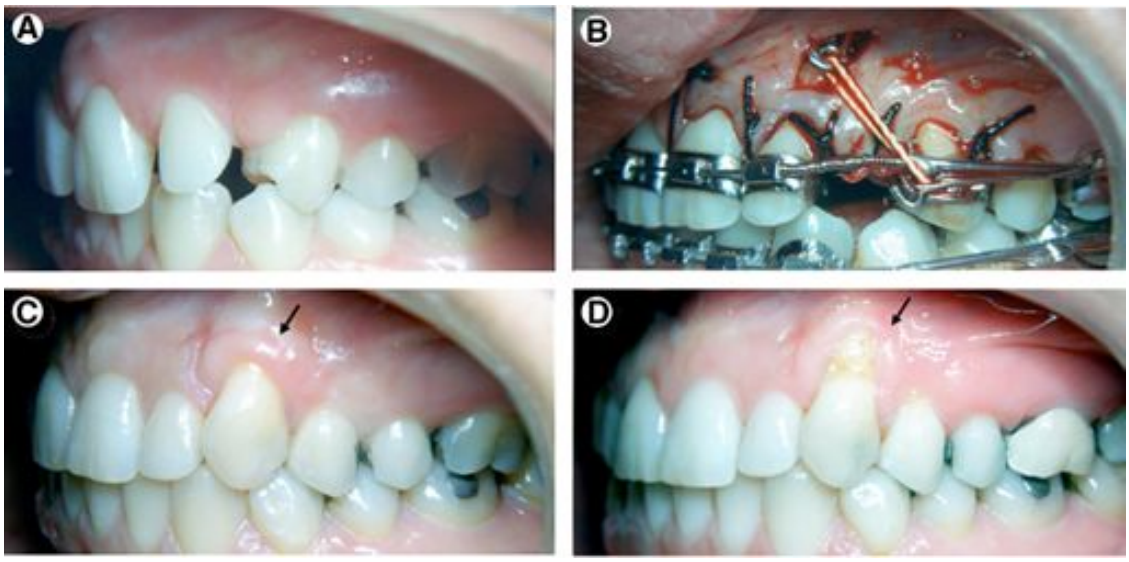


Figure 8. (A) Pretreatment of maxillary right cuspid. (B) Closed eruption used to replace flap over the tooth. Elastics were used to direct cuspid into the zone of keratinized tissue. (C) With the tooth covered with tissue it was difficult to guide the tooth into the labial zone of gingiva. Note root exposure and recession. (D) Ten years later observe recession where flap replacement procedure was used. (Color version of figure is available online.)

tion,[6] window approach excision of tissue, and tunnel traction. Closed eruption or flap replacement has tended to result in increased treatment time (Figs 3 and 4), additional surgical procedures (Fig 6), diminished control of tooth movement (Figs 6 and 7), as well as adverse periodontal responses (Figs 7 and 8). The problems of additional surgical procedures (reuncovering) (Figs 6 and 10), multiple debondings, increased pain to the patient when activating through

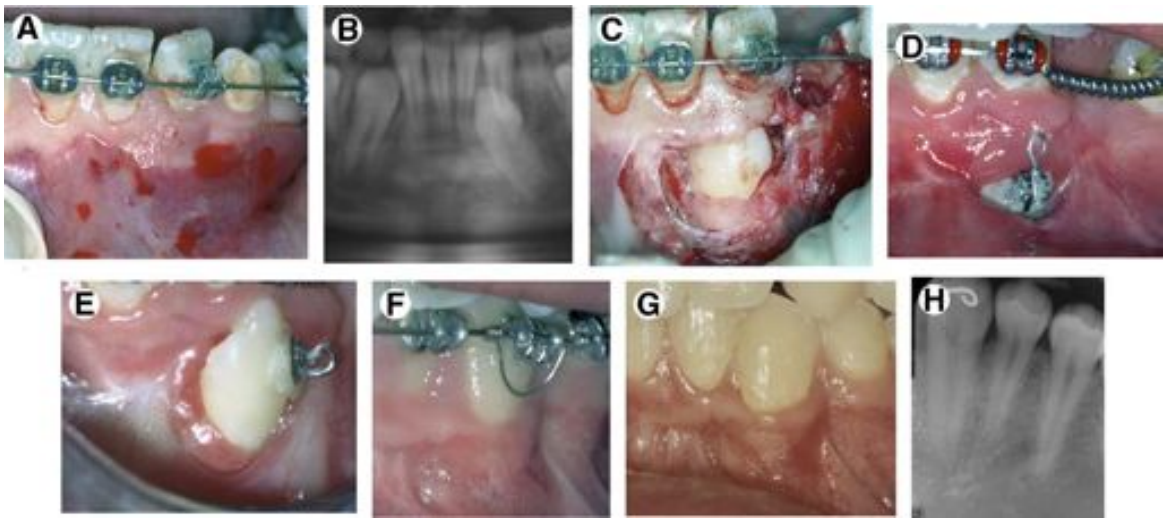


Figure 9. (A) Pretreatment view of lower left canine that was labial to central and lateral incisors. (B) Pretreatment radiograph of lower left canine. (C) Apically positioned graft placed over cervical area of the lower canine. (D) Tissue closes over crown as tooth is being brought into the arch. (E) Distal tipping as tooth is moved into position. (F) After the canine is positioned into the archwire a torquing auxiliary is used to place the root in proper position. (G) Clinical view of canine 5 years postoperative with good zone of gingiva, normal attachment. (H) Five year posttreatment radiograph of lower canine in proper position. (Color version of figure is available online.)

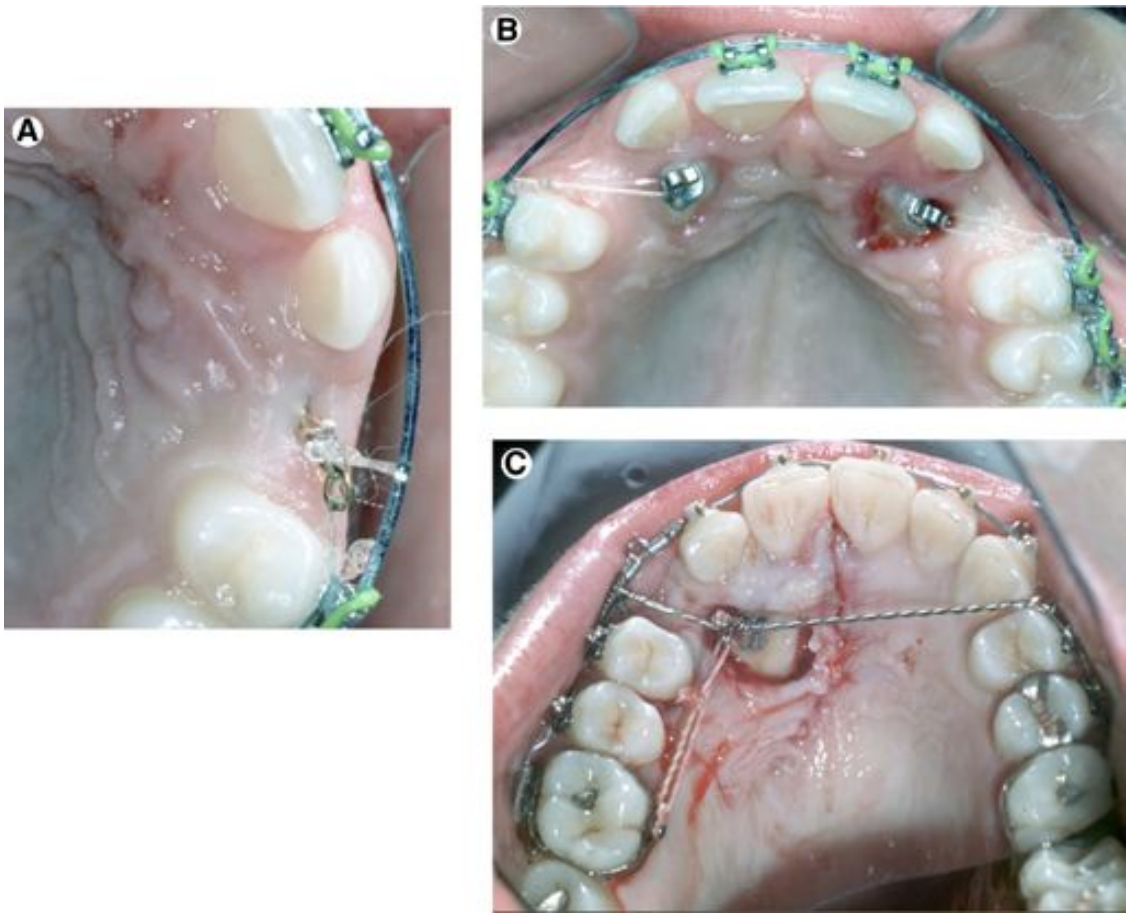
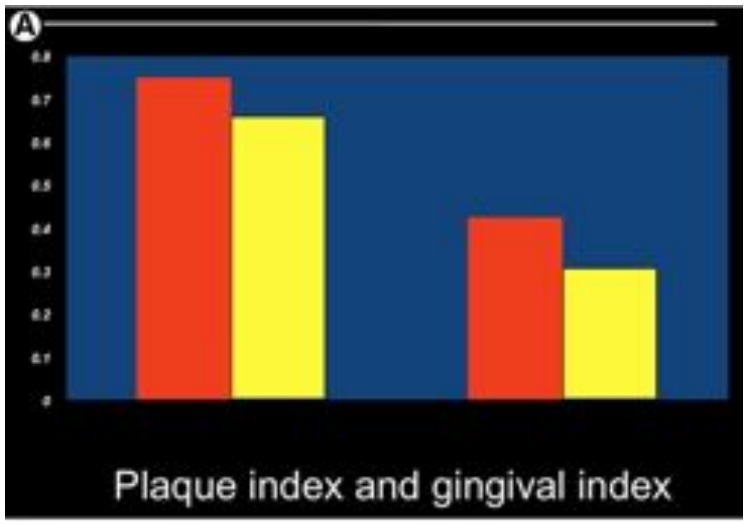


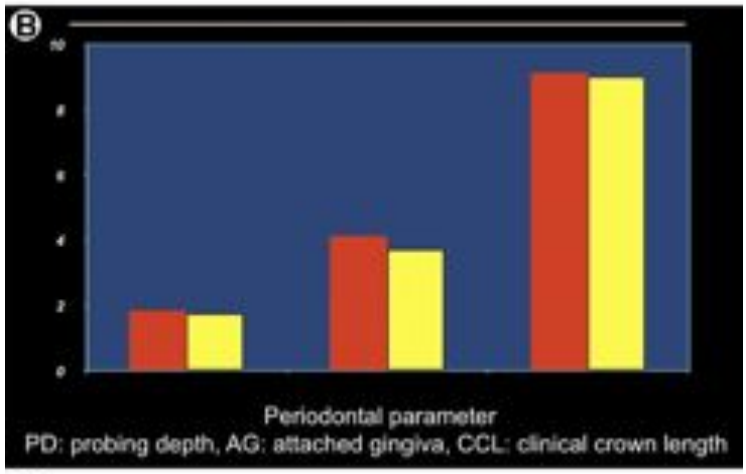
Figure 10. (A) Closed eruption was used on the palate and after several months the soft tissue stopped the tooth movement. (B) It was necessary to reuncover the tooth by removing the overlying soft tissue to allow for continued movement. (C) It is preferred to place the palatal tissue back in position with a soft tissue window leaving only the anatomic crown visible and bond the tooth one week later. The .012/.014 inch stainless steel wire placed across the palate is used to tie elastomeric thread to erupt the tooth to the level of the palatal vault. Treatment time is prolonged when palatal soft tissue is closed over the tooth. (Color version of figure is available online.)

overlying tissue, lack of visibility to change direction of pull, and elimination of the inflammatory dental follicle (Fig 7) can all be prevented. The authors of comparative studies have evaluated how long it will take to position an unerupted tooth into the arch and treatment time varies according to the therapeutic approach (Fig 9).

An evaluation of treatment outcomes of labially impacted maxillary canines with apically positioned grafts was performed with the use of panoramic radiography and reported only 4 to 5 months was required to position ectopically unerupted teeth into the arch even with severely displaced teeth.[9] Advantages of the apically positioned graft are that it is minimally invasive (only the anatomical crown of the tooth is left exposed to the oral cavity), tooth movement is more controlled (even high about the vestibular depth), and cystic follicles are prevented; in addition, delayed bonding for 1 week seems to prevent ankylosis. With palatal impactions it is critical to recognize that the entire palate is covered with specialized mucosa and a graft is not necessary (Fig 10) (Closed eruption exposure is contraindicated on the palate).

Flap replacement has been reported to be preferred for labially impacted teeth because it is more esthetic (less gingival scarring), and





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	Treated	Contralateral	P
Texture of gingiva			NS**
Good	23*	23	
Acceptable	0	0	
Not good	0	0	
Gingival scarring			NS**
No	18	23	
Slight	5	0	
Significant	0	0	
Discoloration	0	0	NS**
Recession	0	0	NS**

Esthetic Evaluation

Figure 11.

Figure 11. (Continued)

there is less clinical crown length and reduced vertical relapse[6] compared with apically positioned grafts. Vanarsdall and Corn[5] have considered the apically positioned graft approach synonymous with "radical" open technique, although management of the tissues around the anatomic crown, tissue preservation, and placement are critical to optimal periodontal and esthetic outcome.

A recent study by Kim et al[10] was completed on 20 subjects to evaluate the periodontal and esthetic outcomes of unerupted maxillary canines and incisors with the use of an apically positioned graft technique and a split-mouth comparison made on normally erupting contralateral teeth with each patient as their own control. Inclusive criteria included labially impacted teeth that were treated by apically positioned graft and a minimal recall period of 1 year. The clinical parameters for periodontal and esthetic outcomes included plaque index, gingival index, probing depth, width of attached gingiva, clinical crown length, texture of gingiva, scarring, recession, and discoloration. Radiographic evaluation included crestal alveolar bone levels, percent of bone support, bone defect, pulpal obliteration or radiolucency. Statistical analysis consists of two-tailed paired t tests to determine differences ($P < 0.05$) in the periodontal parameters, quality of texture of gingiva and bony support between the treated and contralateral control sides. χ^2 contingency tests were used to determine the significance of difference in the prevalence of irregular gingival contour, discoloration, pulp obliteration and periapical radiolucency between experimental and control teeth. The results are displayed in Figure 11.

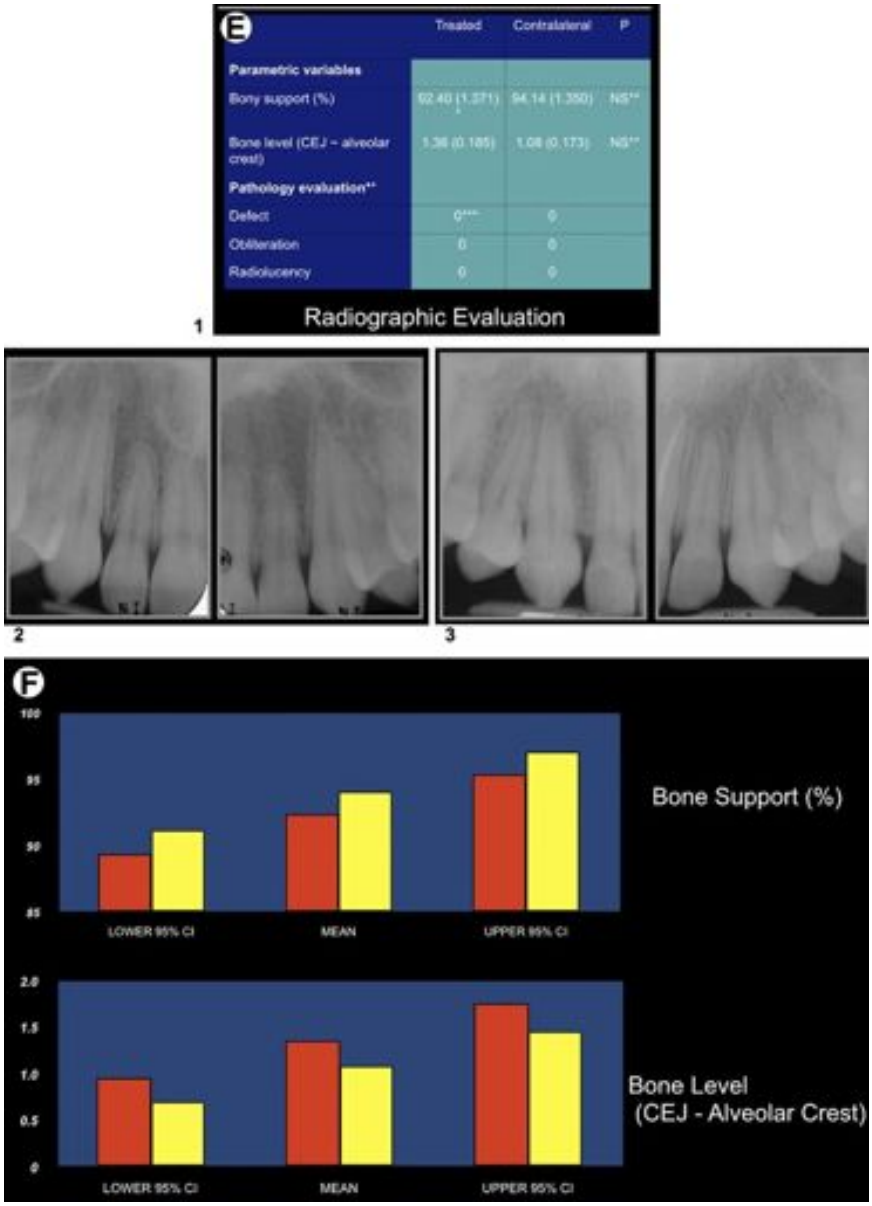

Figure 11. (Continued) Periodontal outcomes on unerupted canines after apically positioned flaps.[10] (A) Periodontal Index. The plaque index and gingival index for experimental teeth on the left and control teeth on the right showed no statistical differences. (B) Periodontal parameter. The pocket depth, width of attached gingiva and clinical crown length between treated teeth (left) and control teeth (right) showed no significant differences. (C) Esthetic evaluation. No difference in recession, scarring, texture of gingiva, discoloration or recession between treated and contralateral control teeth of the same patient. (D) Esthetic evaluation and clinical evaluation. Three patients (22 mos, 13 mos, 34 mos postsurgery). Photographs of previously labially impacted canine treated with ARF (left side), essentially indistinguishable from its control (right side) in terms of attached gingiva, clinical crown length and texture of gingiva. (E) 1. Radiographic evaluation. Bone support was calculated on the mesial side of each tooth from scanned periapical x-rays. Bone support and bone level differences were statistically insignificant. No teeth exhibited obliteration or radiolucency. 2 and 3. Two patients' periapical radiographs of previously labially impacted canines treated by ARF (left side) in comparison with its control (right side). None of the treated and control teeth demonstrate obliteration, bony defect or radiolucency. (F) Bone support (%) and Bone level (Cementoenamel Junction - Alveolar Crest). There were no statistical differences between treated and control teeth in percentage of bone support and crestal bone level value. (Color version of figure is available online.)

It was concluded that (1) periodontally, there was no significant difference in plaque index, gingival index, probing depth, width of attached gingiva and clinical crown length between treated teeth and contralateral control teeth; (2) esthetically, there was no difference between treated and control teeth in recession, scarring and texture of gingival; and (3) radiographically there were no significant differences in bone support, bone level, presence of bone defect, obliteration, or radiolucency.

Therefore, in evaluation of the esthetic, endodontic, and periodontal outcomes, there were no statistical differences between ectopically positioned teeth treated by apically repositioned flap exposure and orthodontically moved control teeth in the same patient. Examining the many problems that have been reviewed in this article, these adverse responses have not been found with labially uncovered teeth with grafts or palatal teeth that have been left open and activated a week later. In view of these findings, it would seem that surgical exposure with careful attention to the periodontal tissues and proper orthodontic alignment without intentional closing over with soft tissue could provide a more predictable result for patients who require interdisciplinary management of ectopically positioned teeth. The value of grafting is similar to going from a two-dimensional radiograph to a 3-dimensional cone beam computed tomography imaging for localization of ectopically positioned teeth.

The pedicle graft is necessary on the labial of the maxilla and the labial and lingual of the mandible. The gingivally repositioned procedure as described[5] has not been shown to create a compromised periodontal outcome, and treated teeth are indistinguishable from untreated sides. This evidence based data demonstrate that covering tissue over teeth with closed eruption surgical approaches (with the recent evidence of increased problems and prolonged treatment time created, etc.) is not justifiable.

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