

CASE REPORT

Restoration and retention of maxillary anteriors with severe root resorption

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Maxillary canines are the second most commonly impacted or displaced teeth, and impaction occurs in about 0.8 to 2.4 percent of the U.S. population.¹ Canine impaction is significantly more common in females than in males (about 2:1).¹⁻⁷ In more than 90 percent of the cases, impaction usually involves a single maxillary canine; however, impactions are bilateral in 8 percent of the patients.^{8,9} The majority of impacted canines are displaced toward the palatal aspect, but 20 percent occur toward the facial aspect.¹⁰

The conservative treatment approach resulted in beautiful esthetics that are difficult to reproduce with prosthetic options or canine substitution.

There are several reasons for the high incidence of maxillary canine impaction. They include crowding; a narrow maxillary arch; a Class II, division 2–incisor relationship; familial tendency; follicular disturbance of the canine; and pathology to the primary predecessors.^{1,11,12} Ectopic eruption of canines may cause severe root resorption of adjacent teeth.¹³

Early screening and diagnosis have been advocated, especially if the canine cannot be palpated into the correct position at 10 years of age.^{11,13} Since resorbed incisors are mostly free of pain, early detection by radiographic examination is essential to establish a proper diagnosis.⁷ The angle of the erupting canine relative to the lateral incisor may be important. A 25 percent increase in the angle (with the canine oriented more toward the lateral incisor and less parallel to it) increases the risk of resorption by 50 percent.¹⁰ If the

Background. The authors describe the treatment of three patients who had severe apical root resorption of maxillary lateral incisors caused by ectopically erupting canines. Ectopically erupting canines derive from a normal path of eruption and may cause resorption of the adjacent teeth.

Case Description. The authors present the three cases of severe root resorption caused by ectopically erupting canines. They then discuss various prosthetic options; the indications, advantages and disadvantages of various treatment modalities; the long-term retention and esthetic concerns of the patients; and the inherent limitations of restorative treatment.

Clinical Implications. Increased tooth mobility and long-term retention are significant concerns in cases of patients who have severe root resorption. Attaining stability with lingual splinting can cause esthetic problems. An interdisciplinary approach is necessary to provide optimal care for the patient.

primary canine is extracted early—before the permanent canine's root fully develops or is completely displaced—the permanent canine often will erupt in the correct position.^{9,14-16} Unfortunately, Rimes and colleagues² have shown that the problem often is diagnosed late, both in relation to the patient's age and the extent of resorption. They suggested that dental practitioners may underestimate the problem.

In this article, we present the cases of three patients who had advanced resorption of their maxillary lateral incisors that was associated with mesially migrating impacted maxillary canines. The root resorption was severe enough to question long-term retention of the teeth. Root resorption may have a genetic predisposition. Apajalahti and colleagues¹⁷ found in a study of eight families that the prevalence of ectopic canines was 33 percent, suggesting an autosomal dominant transmission in families with other dental anomalies. Research by Shellhart and colleagues⁵ also indicates a possible genetic origin for palatally displaced canines.

We relate the conservative treatment we coordinated with a team of specialists, as well

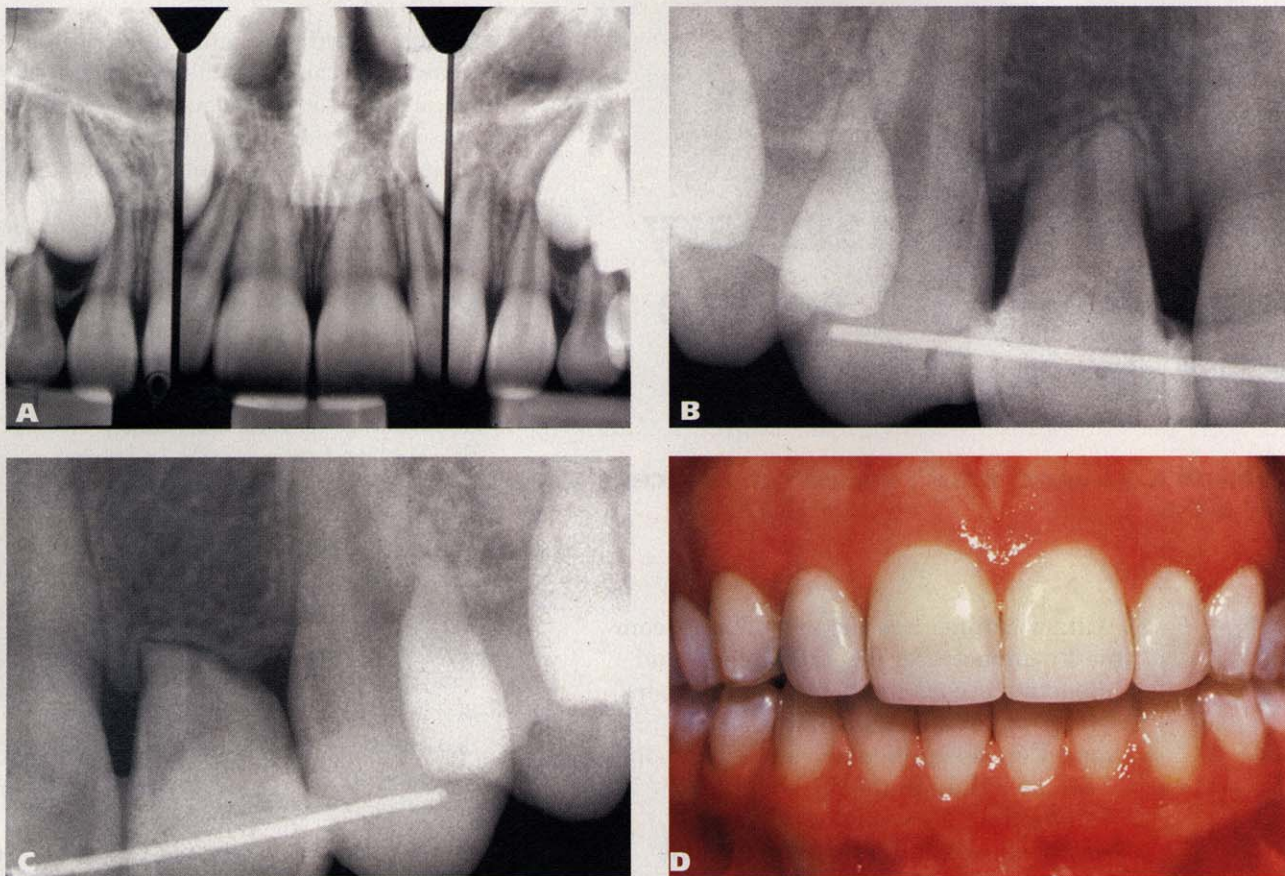


Figure 1. Periapical radiograph of the maxillary lateral incisors taken at the end of the first phase of treatment showed no root resorption (A). Radiographs of the lateral maxillary incisors five years after the orthodontic treatment, showed that the roots had not shortened any further (B,C). Photograph taken seven years after the second phase of orthodontic treatment showed that the lateral incisors still were in place and were not mobile (D).

as the ultimate placement of veneers for one patient. We also discuss the various prosthetic options, as well as the indications, advantages and disadvantages of various treatment modalities.

CASE REPORTS

Case 1. A 9-year-old patient had an early phase of orthodontic treatment to correct an excessive overjet that was completed in one year, at which time no root resorption had occurred (Figure 1A). When the patient was preparing for a second phase of orthodontic treatment at age 12 years, the orthodontist (V.G.K.) discovered extensive resorption of both maxillary lateral incisors' roots, which was caused by ectopically erupting maxillary canines. At that time, the orthodontist believed that the lateral incisors would not survive in the long term, so he initiated orthodontic treatment to move the canines into the best positions for replacing the lateral incisors.

The second phase of orthodontic treatment was

completed in about a year. At that time, the radiographs showed that no further root resorption had occurred, and the patient's parents wanted to delay extracting the lateral incisors. We stabilized the teeth with a wire on the lingual aspect and placed composite bonding on the teeth to cover the gray cast of the wire.

When the patient was ready for definitive restoration, five years had passed since the second phase of orthodontics with no further resorption (Figures 1B and 1C). We chose to place veneers on the anterior teeth to improve their color, retain the lingual arch wire, hold the spaces open, and maintain bone and tissue health as long as possible. The patient was very pleased with the esthetic result (Figure 1D).

Case 2. A young patient had ectopic eruption of the maxillary canines, resulting in severe root resorption of both maxillary lateral incisors. We initiated a phase of orthodontic treatment to reduce an excessive overjet and to create space so that the canines could erupt into a more normal

position. An oral surgeon extracted the primary canines, hoping that the teeth would erupt without continued root resorption. Unfortunately, this did not help. The erupting canines resorbed almost the entire lateral incisor root surface. The orthodontist decided to remove the patient's appliances. Periapical radiographs taken after the appliances were removed (Figure 2A) and one year later showed that further resorption of the lateral incisors had taken place. We assumed that the lateral incisors would exfoliate eventually.

Periapical radiographs taken three years after the canines erupted showed that the canines had diverted distally toward the lateral incisors after they had moved near the lateral incisors' cemento-enamel junction, or CEJ (Figure 2B). When this happened, the canines erupted toward the facial aspect. At that time, the orthodontist believed that the lateral incisors had a hopeless prognosis, but there was no reason to remove them. If the lateral incisors had been removed, the spaces would have required artificial teeth on the patient's orthodontic retainer.

When the remaining teeth had erupted five years later, we initiated a second phase of orthodontic treatment. Further resorption did not occur. The patient's teeth were mobile after we removed the orthodontic appliances but no more so than her other teeth. We placed a retainer in the patient's mouth and monitored her.

At the patient's two-year follow-up appointment after orthodontic treatment was completed, the resorbed lateral incisors were stable. The affected teeth, which were protected by a slightly open anterior occlusion, had normal mobility (Figure 2C).

Case 3. The patient had ectopic eruption of a maxillary canine and severe resorption of the adjacent lateral incisor. We monitored the patient for several years during mixed dentition. Radiographs showed that the ectopically erupting canine was eroding the lateral incisor root, but we did not extract the lateral incisor (Figures 3A and 3B).

We had to decide whether to extract the tooth, since the patient had a maxillary arch length deficiency. We could extract either the resorbed lateral incisor or the maxillary right first premolar. A radiograph showed that once the ectopic canine reached the CEJ of the lateral incisor, its eruption path diverted labially and distally. To maintain anterior esthetics, we extracted the

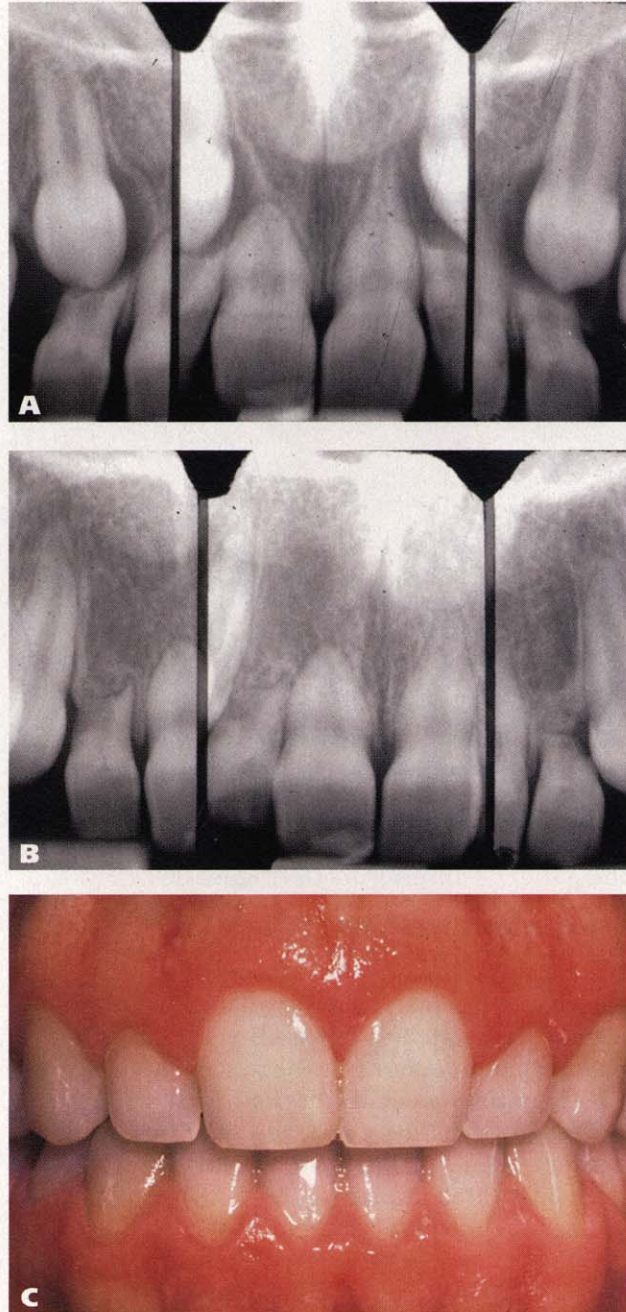


Figure 2. A periapical radiograph taken a year after the orthodontic appliances were removed showed further resorption of the lateral incisors (A). A periapical radiograph taken three years after the canines erupted showed that the canines had diverted distally toward the lateral incisors after they moved near the lateral incisors' cemento-enamel junction (B). Two years after the second phase of orthodontic treatment was completed the lateral incisors still were in place, and they looked acceptable (C).

first premolar and retained the lateral incisor.

At follow-up, the lateral incisor had not resorbed further, and it had normal mobility, providing the most natural esthetic appearance to

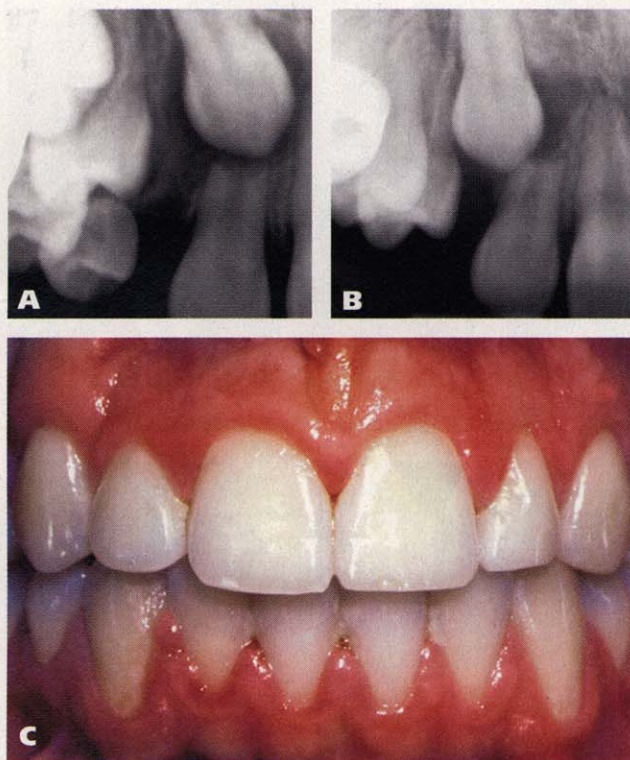


Figure 3. Radiographs showing that the maxillary right canine eroded the maxillary right lateral incisor root (A, B). Photograph showing that the maxillary right lateral incisor moved to its proper position (C).

the patient's anterior teeth (Figure 3C).

PROSTHODONTIC OPTIONS

If a patient has severe root resorption, there are various treatment options available. One is to extract the tooth and replace it with a prosthetic restoration. The four prosthodontic options available to replace missing anterior teeth are resin-bonded partial dentures, traditional fixed partial dentures, removable partial dentures and osseointegrated implants.

Resin-bonded Maryland partial dentures became popular in the 1980s. Their drawbacks are poor long-term stability, which is caused by debonding at the metal-composite-cement interface or at the enamel-composite-cement interface. The metal retainers must be about 4 millimeters thick for strength, and the metal can show through thinner teeth and create a gray cast.¹⁸ There also is a need for favorable occlusion to eliminate functional stresses.^{18,19} Direct resin-bonded, fiber-reinforced anterior partial dentures are a newer option; however, long-term clinical studies are not available for this type of restoration. Pin-ledge restorations can have beautiful results, but again there may be a graying effect

caused by the metal showing through thin, transparent teeth.

Removable partial dentures usually are used as a temporary restoration because of their bulkiness and movement. Traditional fixed partial dentures requires the removal of significant tooth structure. When teeth are extracted, significant ridge defects can result. The ridge defects may worsen over time because of the lack of support of the alveolus and surrounding tissues. This is especially detrimental in patients with high smile lines.

Osseointegrated implant restorations often are the treatment of choice to replace a missing tooth. Bone maintenance and proper gingival form development are critical to the long-term esthetic and functional results. Tissue contours and papilla architecture are more difficult to maintain in the case of multiple missing teeth, especially in the maxillary anterior region. There are limitations to the success of implants, especially in the anterior maxillary area. The available space is small, adjacent converging roots may limit space for the implant, and the implant site may require tissue or bone augmentation.

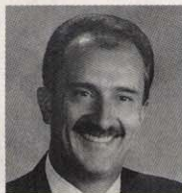
ORTHODONTIC OPTIONS

The two common orthodontic treatment options are creating a space opening for future restorations or using canines to replace the missing maxillary lateral incisors. When choosing between options, the first factor to analyze is the occlusion. If the patient has a Class II malocclusion with a good profile, then canine substitution is a good option. If the patient has a Class I malocclusion, this is not a good option, since it would mean removing mandibular premolars. The latter option is used best in patients who have full-lip profiles in which the anterior teeth are severely protruded or tipped labially. The major advantage of orthodontic space closure is the permanence of the finished result. The need for removable retainers until the prosthesis is completed and for the patient's dependence on a permanent restoration are avoided.²⁰

Unfortunately, achieving a good esthetic result is challenging with canine substitution. A profile analysis can predict the impact of closing the space with canines; the tooth size relationship should be analyzed first in a diagnostic setup. It is difficult to make a canine look like a lateral incisor, especially in a patient with a high smile line. The canine must be evaluated for its size,



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length, shape and color. A larger canine with a prominent lobe is not a good case for substitution. A canine that has extensive incisal wear or is a very dark color also is not a good case for substitution. The gingival level of canines usually is higher than that of lateral incisors, and therefore there may be a need to

erupt the canine to mimic the tissue levels of lateral incisors.

CONCLUSIONS

After considering the potential costs, risks and benefits of each option, the parents of all three patients chose the most conservative treatment plan to retain the severely resorbed lateral incisors. Long-term follow-up for all three patients revealed that we preserved their esthetic and functional occlusion. Long-term retention has been demonstrated in all three patients.

There is no question that patients demand a sophisticated level of restorative dentistry, in terms of both esthetics and function. The conservative treatment approach for all three cases maintained the natural gingival attachment to the root surface, resulting in beautiful esthetics that are difficult to reproduce with any of the prosthetic options or canine substitution. An

interdisciplinary team approach was critical to the success of all three cases. ■

1. Turner PJ, Bedi R. Combined orthodontic and restorative management of a case of bilateral ectopic canines and resorbed central incisors. *Br Dent J* 1996;180:67-72.
2. Rimes RJ, Mitchell CN, Willmot DR. Maxillary incisor root resorption in relation to the ectopic canine: a review of 26 patients. *Eur J Orthod* 1997;19:79-84.
3. Thilander B, Jakobsson SO. Local factors in impaction of maxillary canines. *Acta Odontol Scand* 1968;26:145-68.
4. Shah RM, Boyd MA, Wakil TF. Studies of permanent tooth anomalies in 7,886 Canadian individuals, 1: impacted teeth. *J Can Dent Assoc* 1978;44:262-4.
5. Shellhart WC, Jasper S, Abrams H, Wilson T. Case report: management of significant incisor root resorption associated with maxillary canine impaction. *Angle Orthod* 1998;68(2):187-92.
6. Rabie AB, Wong RW. Bilateral transposition of maxillary canines to the incisor region. *J Clin Orthod* 1999;33(11):651-5.
7. Sasakura H, Yoshida T, Murayama S, Hanada K, Nakajima T. Root resorption of upper permanent incisor caused by impacted canine. *Int J Oral Surg* 1984;13(4):299-306.
8. Bishara SE. Impacted maxillary canines: a review. *Am J Orthod Dentofacial Orthop* 1992;101:159-71.
9. Bruks A, Lennartsson B. The palatally displaced maxillary canine. *Swed Dent J* 1999;23:149-61.
10. Ericson S, Kurol J. Radiographic examination of ectopically erupting maxillary canines. *Am J Orthod Dentofacial Orthop* 1987;91:483-92.
11. Shapira Y, Mischler WA, Kuftevec MM. The displaced mandibular canine. *ASDC J Dent Child* 1982;49:362-4.
12. Ruprecht A, Batniji S, El-Newehi E. The incidence of transposition of teeth in dental patients. *J Pedod* 1985;9:244-9.
13. Postlethwaite KM. Resorption of premolar roots by ectopic canines. *Br Dent J* 1989;167(11):397-8.
14. Jacobs SG. Reducing the incidence of unerupted palatally displaced canines by extraction of deciduous canines: the history and application of this procedure with some case reports. *Aust Dent J* 1998;43(1):20-7.
15. Caminiti MF, Sandor GK, Giambattistini C, Tompson B. Outcomes of the surgical exposure, bonding and eruption of 82 impacted maxillary canines. *J Can Dent Assoc* 1998;64:572-9.
16. Becker A, Chaushu S. Dental age in maxillary canine ectopia. *Am J Orthod Dentofacial Orthop* 2000;117:657-62.
17. Apajalahti S, Arte S, Pirinen S. Short root anomaly in families and its association with other dental anomalies. *Eur J Oral Sci* 1999;107:97-101.
18. Sabri R. Management of missing maxillary lateral incisors. *JADA* 1999;130:80-4.
19. Culy G, Tyas M. Direct resin-bonded, fibre-reinforced anterior bridges: a clinical report. *Aust J Dent* 1998;43:1-4.
20. Tuverson DL. Orthodontic treatment using canines in place of missing maxillary lateral incisors. *Am J Orthod* 1970;58(2):109-27.