

CASE REPORTS

Orthodontic External Root Resorption—Endodontic Considerations

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External root resorption in posttreatment orthodontic patients, if severe, may jeopardize the retention of the tooth or teeth involved. Numerous studies (1–5) have been undertaken to determine the relationship between the frequency and severity of external root resorption and orthodontic movement. Some investigators found the incidence of root resorption to be low (6–9), while others found it to be much higher (10, 11). The general conclusion is that external root resorption occurs in nearly all patients undergoing the forces that accompany orthodontic treatment.

In recent years the use of calcium hydroxide pastes to inhibit inflammatory external root resorption has become an accepted treatment modality. Heithersay (12) and Andreasen (13) have shown that filling the instrumented root canal with calcium hydroxide can inhibit inflammatory resorptive processes. Burke (14) and Cvek (15) described the arrest of external root resorption in permanent incisors by using calcium hydroxide. These investigations suggest that calcium hydroxide has useful application in the management of a range of endodontic problems.

This case is of interest because a patient presented with a chief complaint of extreme mobility of the maxillary incisors. Upon examination of sequential periapical radiographs, it was found that external apical root resorption continued after active and retentive orthodontic treatment had been terminated. A method for inhibiting external root resorption and a technique for esthetically splinting anterior teeth are described.

CASE REPORT

A 24-yr-old white female presented to the dental clinic with a chief complaint of extreme mobility of the maxillary incisors. The patient's medical history was noncontributory. The patient's dental history revealed orthodontic treatment had been initiated in 1969, at age 12. Preorthodontic treatment radiographs of the maxillary incisors showed complete apexogenesis with

normal root length and an impacted canine (11) (Fig. 1). The intra-oral orthodontic examination revealed maxillary anterior crowding. Also evident was a deep overbite with a maxillary midline deviation of 2 mm to the right. Orthodontic analysis showed the maxillary right quadrant had a 5.8-mm deficit of space; the maxillary left quadrant a deficit of 4.8 mm; the mandibular left quadrant a 0.7-mm deficit; and the mandibular right quadrant a 2.3-mm space deficit. The occlusal diagnosis showed the patient had a class II, division I occlusion. Orthodontic treatment was initiated with the serial extractions of all first premolars. A modified Hawley appliance was constructed to open the bite, and an active appliance placed to realign the maxillary anteriors. A passive lingual arch wire was constructed for the mandibular arch as a space maintainer. The treatment for the impacted canine was observation for 1 yr. In June 1970, the impacted canine was surgically exposed. A 0.024 stainless steel wire loop was placed around the canine to guide the eruption of this tooth into proper occlusion. All orthodontic treatment, active and retentive, was terminated in 1974.

In 1976 a relapse of tooth 10 occurred and orthodontic treatment was reinitiated to correct the buccal displacement of this lateral incisor. Periapical radiographs 7 yr after the initial orthodontic treatment (1976) showed apical blunting with a general loss of 3 to 4 mm of root structure (Fig. 2). Also noted in this series of radiographs is an arch wire with a loop attached to tooth 11. This loop was attached to the canine in an attempt to reposition the canine distal buccally. This treatment was terminated 1 year later. Some abnormal mobility was observed by the patient at this time.

An increase in mobility with extreme discomfort upon chewing prompted the patient to seek dental care. She then came to the University of Louisville School of Dentistry, Department of Endodontics, in September 1980. Periapical radiographs showed con-

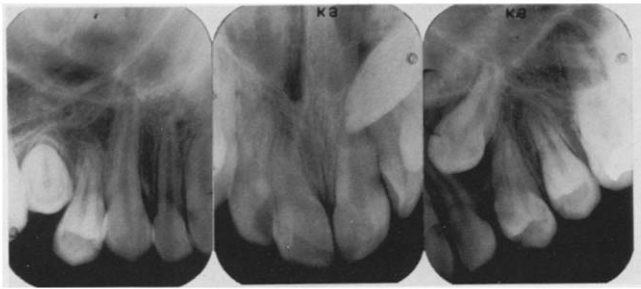


FIG 1. Radiographs of patient at age 12. Note normal development of maxillary incisors and canine impaction.

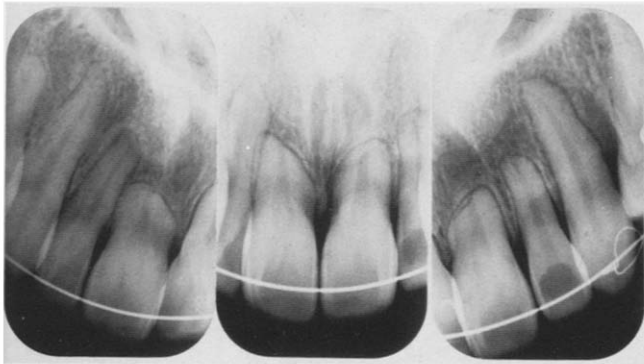


FIG 2. Seven years after initiation of orthodontic treatment (1976). Apical resorption of all incisors is apparent.



FIG 3. Continued apical root resorption is evident 11 yr after initiation of orthodontic therapy (1980).

tinued apical root resorption 3 yr after active and retentive orthodontic therapy had been terminated (Fig. 3). All maxillary incisors responded within normal limits when subjected to pulp vitality tests. It was decided to institute calcium hydroxide therapy on the maxillary incisors in an attempt to inhibit inflammatory apical root resorption and maintain the 1:1 crown root ratio. Simultaneously, a splint was to be fabricated and inserted to esthetically stabilize the teeth.

Accesses and biochemical preparations were completed at the first treatment appointment. The patient returned in 48 h for calcium hydroxide/sterile H₂O

placement (Fig. 4). Camphorated parachlorophenol was not used because the canals were vital and not infected. Included in this appointment was minor grooving of the lingual surfaces of the maxillary incisors followed by the adaptation and placement of a

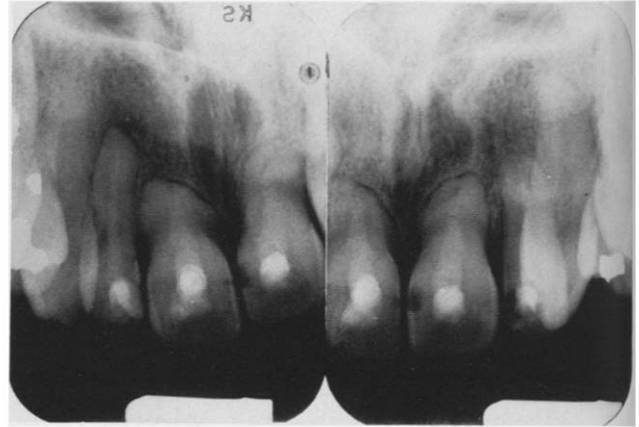


FIG 4. Radiographs showing calcium hydroxide placement in maxillary incisors.



FIG 5. Palatal view illustrating grooving of teeth and wire adaptation (mirror image).



FIG 6. Labial view showing esthetic qualities of splint.



FIG 7. Radiographs 1 yr after calcium hydroxide placement illustrating termination of apical root resorption. Gutta-percha fills have been completed.



FIG 8. One-year recall showing continued arrest of apical root resorption without ankylosis.

0.017- × 0.025-inch rectangular wire (Fig. 5). The grooves were acid etched and the splint was permanently placed with an anterior filling material. This form of splinting afforded good stabilization with excellent esthetics (Fig. 6). The patient was advised of the importance of good oral hygiene in maintaining the type of splint used.

The patient was seen at 3-month intervals for 1 year. At each interval the calcium hydroxide paste was replaced, the condition of the resorptive areas observed by periapical radiographs, and the splint and oral hygiene checked. After 1 yr of treatment and observation, radiographic indications of inflammatory root resorption had ceased. The instrumented root canals were obturated with gutta-percha and procosol sealer by means of lateral condensation (Fig. 7). Examination of 1-yr recall radiographs (Fig. 8) showed continued arrest of root resorption without concurrent ankylosis.

DISCUSSION

The literature is consistent in its findings of positive correlations between orthodontic tooth movement and

external root resorption. However, the nature and extent of the resorptive process subsequent to its initiation is anything but consistent.

Phillips (1) concluded that no detrimental effects of root resorption on the life span and function of the dentition resulted from orthodontic movement. Vanderhae (16) found that root resorption which was initiated during treatment did not continue once the orthodontic appliances were removed. He also found that mobility did not accompany root resorption. The conclusions of both of these studies are in direct conflict with this case report. There are many studies (4, 5, 17) that support the contention that once orthodontic treatment is stopped, root resorption ceases.

In any given case of root resorption, it is impossible to identify the major specific contributing factor. Other factors (17, 18) must be considered as etiological possibilities in external root resorption of orthodontically moved vital teeth. These factors include the magnitude of the orthodontic forces, the type of tooth movement, the patient's age and sex, dietary or systemic complications, character of the root cementum, idiopathic and immunological reactions, and excessive mobility. After considering all possible etiologies for apical root resorption, postorthodontic treatment, idiopathic external root resorption must be held accountable. No causative agent has been noted to account for the type of resorption called idiopathic. Newman (2) has identified maxillary incisors as one group of teeth demonstrating the greatest incidence of apical shortness of idiopathic root resorption. Resorption potential was a term associated with those patients exhibiting idiopathic root shortness. It is possible that genetic factors influenced this potential.

It is impossible to say that the forces involved in orthodontic treatment are the primary cause of the resorption of roots so frequently observed in treated cases. Because some injury to the root surface during orthodontic treatment is unavoidable, careful diagnosis before beginning treatment is critical.

There are many theories concerning the action of calcium hydroxide in inhibiting external root resorption. The theory that has the most validity is based on the assumption that calcium hydroxide will raise the pH of the microenvironment (20). In this study it was concluded that the introduction of calcium hydroxide into the instrumented canal would have an active influence on the local environment of the resorption area. The change in pH appears to have been beneficial in two ways. First, osteoclastic activity was inhibited, and, second, repair of tissues was stimulated. The alkalinity of calcium hydroxide has also been found to change the local environment from one of high acid phosphatase to one containing alkaline phosphatase, which in turn will terminate the inflammatory processes (12, 21, 22). It is impossible to say that the calcium hydroxide was totally responsible for the termination of the resorptive process. There are

two other possibilities that must be considered as factors that contributed to the success of this case. First, pulp removal and instrumentation of the involved teeth may have stopped the resorptive process. Second, the stabilization of the involved teeth resulted in decreased pressure and tension. This stabilization could have also been a contributing factor in terminating apical root resorption.

Many authors (21, 22) support the suggestion that calcium hydroxide should be left in the canal for at least 1 year before the final root canal fill and restoration.

According to Andreasen (23), the exact value and influence of splinting on pulpal and periapical tissue healing has not been determined. Splints that exert forces in a manner similar to those of orthodontic appliances should never be utilized. The forces caused by such splints as interdental wiring and arch bars ligated to teeth may cause tension and pressure between the root and alveolar bone, and may initiate more inflammatory resorption. Circumferential wires, when used for splinting, may create gingival irritation and difficulties in cleaning. The major shortcoming of the composite splints seems to be the occurrence of fractures between the composite material and the tooth. Rosenberg (24) has reported recently on a modification of the composite splint which utilizes an orthodontic grid bonded to the lingual surfaces of the teeth to be splinted. The problem with this form of splint would be that the wire mesh might become an area or reservoir for plaque accumulation. The intracoronary splint used in this case met all of the requirements for an acceptable splint (22, 23).

It has been theorized that teeth splinted for a period longer than 1 wk to 10 days would lead to ankylosis because of rigid fixation (13, 21–24). Radiographs of the maxillary incisors of the reported case suggested no signs of ankylosis after 1 yr of recall examinations. The absence of ankylosis may be explained by the fact that the splinted teeth may have had some mobility as a unit; i.e. there may have been slight group mobility of all incisors. Replacement resorption may begin after the calcium hydroxide is removed and the canal filled with gutta-percha. However, in many teeth treated like those in this report there is little replace-

ment resorption and the prognosis for permanent retention is excellent.

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