

Inhibition of Apical Root Resorption by Calcium Hydroxide During Orthodontic Treatment: A Case Report

Inibição da Reabsorção Radicular Apical pelo Hidróxido de Cálcio Durante o Tratamento Ortodôntico: Relato de um Caso

Cinthia Mara da Fonseca Pacheco¹, Daniela da Fonseca Pacheco^{1, 2}, Patrícia Gonçalves da Motta^{1, 2}

ABSTRACT

Apical root resorption is a common outcome of orthodontic treatment. The present article reports a case of absence of apical root resorption in a left maxillary lateral incisor filled with calcium hydroxide paste throughout orthodontic movement. After orthodontic treatment was completed the tooth was subsequently obturated with gutta-percha and the patient followed for 18 months. The presence of a periapical lesion and the properties of calcium hydroxide as a root resorption inhibitor were decisive for such an approach in the presented case. Also, the role played by the vital dental pulp in the resorptive process was discussed.

Key Words: Calcium hydroxide, apical root resorption, endodontic treatment, orthodontic treatment

INTRODUCTION

Periapical resorption of permanent incisors is an undesirable, but a common outcome of orthodontic treatment. Its incidence ranges from 19 to 31.4% in all or some of the anterior teeth¹. Studies have shown that maxillary teeth are more severely affected than mandibular teeth, incisors are more resorbed than canines within the arch, and the most severely resorbed teeth are maxillary lateral incisors, mainly because of the high incidence of their abnormal root shapes, which is been found to be a significant factor in root resorption².

Studies have demonstrated that different degrees of radiographic apical shortening occur only during active orthodontic movement and ceases after ending of treatment^{3,4}. In rare cases the resorption process may continue after active and retentive orthodontic treatment had been terminated⁵.

It remains still challenging the reason why teeth undergo periapical resorption after orthodontic treatment, and more intriguing, is the fact that during orthodontic movement, endodontically treated teeth appear to have less severe apical resorption than vital ones⁶. It is known that the vital pulp plays a key role in the resorptive process releasing inflammatory mediators such as neuropeptides⁷. Therefore, lesser severity of periapical resorption in endodontically treated teeth could be explained by the removal of the blood supply and innervations from the dental pulp, and consequently loss of these mediators.

On the other hand, calcium hydroxide has proved to be effective in preventing external inflammatory root resorption, as demonstrated by several authors^{8,9,10}. It is suggested that the role of calcium hydroxide in arresting root resorption, in addition to its antibacterial effect, may depend on its alkaline pH, which makes osteoclastic and cementoclastic activity impossible¹¹.

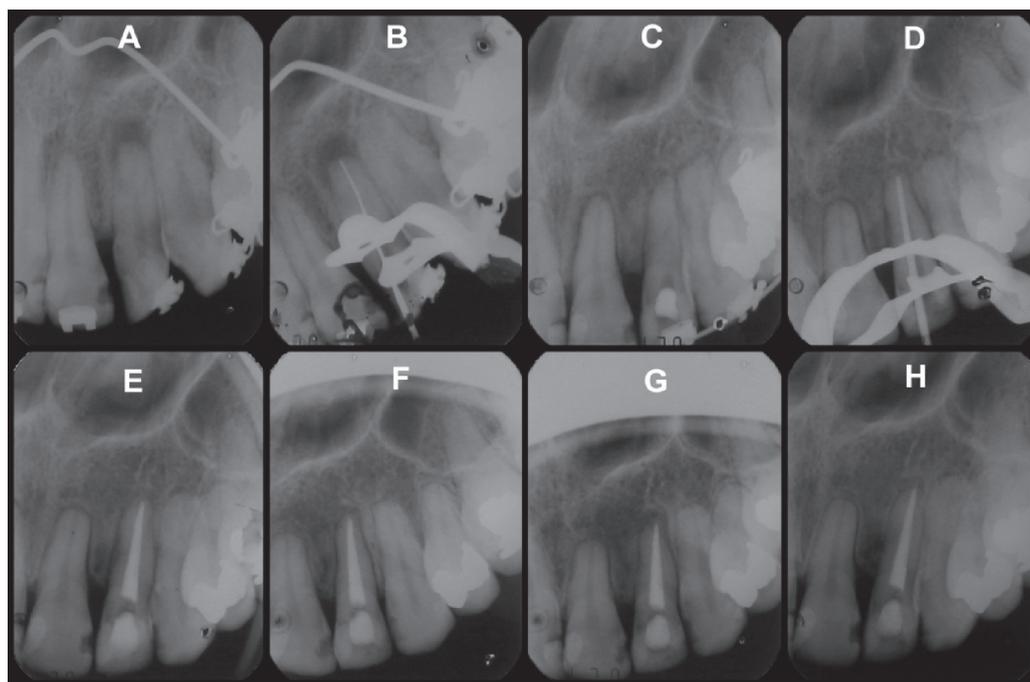
The purpose of the present article is to report a case of absence of apical root resorption in a maxillary lateral incisor filled with calcium hydroxide paste throughout the course of orthodontic movement.

¹Master in Pharmacology, PhD student of Pharmacology Department of Federal University of Minas Gerais, ²Private Endodontic Practice, Belo Horizonte, MG, Brazil

CASE REPORT

A 32-year-old white female came to the dental office in order to have her maxillary left lateral incisor evaluated by an endodontist before she started orthodontic movement. A clinical examination showed a rotation of the referred tooth, tumefaction of the buccal mucosa near its apex,

tenderness to percussion, and no responsiveness to electrical pulp testing. In a radiographic examination, periapical radiolucency could be observed (Figure 1-A). The diagnosis of the tooth was pulp necrosis. It was discussed with the patient the possibility of a combined orthodontic-endodontic therapy.



Endodontic therapy was initiated on January 9, 2002. After local anesthesia and rubber dam isolation, the access preparation was made and the working length established at 0.5 mm of the radiographic apex (Figure 1-B). The root canal preparation was accomplished using 2.5% sodium hypochlorite (Lenza Farm, Belo Horizonte, MG, Brazil) irrigation and hard instrumentation with K-type files (Dentsply, Ballalgues, Switzerland). After the completion of the chemo-mechanical root canal preparation, the root canal was dried with sterile paper points and filled with calcium hydroxide (Lenza Farm, Belo Horizonte, MG, Brazil) with a K-type file. The access cavity was sealed with zinc oxide eugenol cement (S.S. White, Rio de Janeiro, RJ, Brazil). By this time the orthodontist started the tooth movement.

Patient's next appointment was rescheduled for a month later when a radiograph was taken. At that time, the tooth was re-opened, a mild instrumentation was performed and the root re-filled with calcium hydroxide paste.

Next consult was on April 15, 2002. Another radiograph was taken in order to confirm the presence of calcium hydroxide.

On May 5, 2002, calcium hydroxide dressing was replaced and maintained for 3 months (Figure 1-C).

Subsequent appointments were scheduled with 3 months intervals. At each consult, clinical and radiographic exams were performed, old calcium hydroxide paste removed and the root re-filled with a new one. These procedures were made during a 14 months period.

On July 7, 2003 the patient finished her orthodontic treatment. After clinical and radiographic examinations, healing of periapical region was observed, which allowed the completion of endodontic treatment (Figures 1-D and 1-E). Briefly, the calcium hydroxide dressing was removed by irrigation with 2.5% sodium hypochlorite. The root canal was then irrigated with 17% ethylenediaminetetraacetic acid (EDTA; Lenza Farm, Belo Horizonte, MG, Brazil) solution

followed by 2.5% sodium hypochlorite solution, dried with paper points and filled by lateral condensation of gutta-percha points (Dentsply, Petrópolis, RJ, Brazil) and Endofill sealer (Herpo, Petrópolis, RJ, Brazil). Tooth was sealed with zinc oxide eugenol cement and the patient referred to a practitioner to perform a definite restoration. Three months later, the patient returned for her first evaluation (Figure 1-F).

On March 8, 2004 the patient returned for another evaluation. The tooth remained asymptomatic and a periapical radiograph revealed a healthy periapical region surrounding the left lateral incisor (Figure 1-G). Moreover, absence of apical root resorption of the endodontically treated tooth could be observed.

The last evaluation of the patient was on January 5, 2005. Radiographic examination did not show any alteration since her last consult 10 months earlier (Figure 1-H). The patient was once more advised to seek for a definite restoration in this tooth since it was still filled with temporary cement.

Discussion

Many studies have shown an association between root resorption and orthodontic treatment^{2,3,4}. However, the mechanisms involved in the resorptive processes are not well understood.

Several intriguing phenomena regarding apical root resorption can be observed. Firstly, vital teeth exhibits more severe and frequently root resorption than endodontic treated ones. Also, radiographic observations have shown that differences in healing between teeth that undergo orthodontic and endodontic treatment occur. Apical root resorption that follows pulp necrosis is usually followed, after endodontic treatment, by a reconstitution of the original resorbed root length with apical cementum. On the other hand, the apical resorbed root following orthodontic movement is never reconstituted⁷. Actually, it is interesting to observe that in the presented case, such phenomena did occur. In a first radiograph a periapical lesion could be observed in the lateral incisor as well as a slight resorption of its apical root. Eight months later, with the healing of periapical region, a reestablishment of root length could be seen. On the other hand, the vital teeth, central incisor and canine, did not show any recover of periapical root length after 18 months follow-up since the resorption was caused by orthodontic movement.

Many explanations have been offered to the cause of the apical root resorption in vital teeth. The literature supports the fact that orthodontic tooth movement can cause degenerative and/or inflammatory responses in the dental pulp with release of neurotransmitters such as substance P (SP) and calcitonin gene-related peptide (CGRP), which influence both blood flow and cellular metabolism to the pulp/periapical region⁷. The resulting increase in blood supply to these tissues during tooth movement impacts the availability of cells of haematopoietic origin (osteoclast precursors) that are capable, under local stimulatory factors, to differentiate into osteoclasts and influence the resorptive remodeling process of the teeth. The same activity may also occur with the cementoclast and therefore help to explain the apical resorption¹². Also, histological observations of human periapical root tissue showed an increased cementum activity along the inner root surface of the pulp in teeth subjected to orthodontic movement¹³.

As mentioned before, many studies have described that endodontically treated teeth exhibit less propensity for apical root resorption during orthodontic movement than vital teeth^{1,6}. In addition, it has been shown that introducing calcium hydroxide into the apical region of the root canal can enhance the arrest of resorption in endodontically treated teeth^{10,11}. In the case presented here it was chosen the therapy with temporary calcium hydroxide dressing during the course of tooth movement rather than immediate obturation with gutta-percha points. One of the reasons for this approach is that calcium hydroxide paste has proved to be efficient in preventing or inhibiting external inflammatory root resorption^{14,15}. Also, if root resorption had occurred, even a minor one, extravasation of gutta-percha points, with compromising of endodontic treatment, would had happened. Moreover, the main reason for the use of calcium hydroxide was that the tooth had a necrotic pulp and a periapical lesion. Although there is a recent controversy about the necessity of an antimicrobial intracanal dressing in these cases¹⁶, it has been described the advantages of calcium hydroxide in favoring healing process of periapical lesions¹⁷.

In conclusion, this report showed that therapy with calcium hydroxide was able to inhibit the apical root resorption during orthodontic movement as well as favored the healing of periapical region.

RESUMO

A reabsorção radicular apical é uma consequência comum do tratamento ortodôntico. O presente artigo relata um caso de ausência de reabsorção radicular apical em um incisivo lateral superior esquerdo preenchido com hidróxido de cálcio durante a movimentação ortodôntica. Após o término do tratamento ortodôntico, o dente foi obturado com gura-percha e o paciente acompanhado por um período de 18 meses. A presença de lesão periapical e as propriedades do hidróxido de cálcio como um inibidor de reabsorção radicular foram decisivas para tal conduta no presente caso. O papel desempenhado pela polpa dental nos processos de reabsorção radicular foi também discutido.

Descritores: hidróxido de cálcio, reabsorção radicular apical, tratamento endodôntico, tratamento ortodôntico.

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