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ORTHODONTIC ROOT RESORPTION OF ENDODONTICALLY TREATED TEETH VS VITAL TEETH - A SPLIT MOUTH STUDY

RESEARCH STUDY

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ABSTRACT

Objective : the objective of this study was to evaluate, radiographically, whether there is similarity in the apical root resorption found in endodontically treated teeth and vital teeth when they are subjected to orthodontic treatment

Materials &Methods : This selection involved review of 500 orthodontic records from 5 private orthodontic clinics, records of 16 patients were selected who had a maxillary central incisor treated endodontically before initiation of the orthodontic movement, and a vital homologous tooth (for control). Measurements were made by comparing the periapical radiographs taken before and after the orthodontic treatment.

Results : There was no statistically significant difference between apical root resorption in untreated teeth and endodontically treated teeth, although the vital teeth showed, on average, a slightly greater degree of mean apical root resorption.

Conclusion : there was no significant difference in apical root resorption found in maxillary central incisors treated endodontically and untreated counterpart submitted to orthodontic treatment.Further investigation using CBCT and welldesigned RCTs could be very useful.

Key Words : ARR- apical root resorption, Endodontics, Orthodontic treatment, Root resorption.

INTRODUCTION :

Root resorption of teeth is an undesirable, particularly complicated and nonreversible pathologic process, which is related to the external layers of cementum, the dentine of the root, or the apex [1,2]

Concern about apical root resorption (ARR) as a result of orthodontic treatment is justified by its high incidence levels. ARR, an irreversible orthodontic side effect, is typically identified by radiographic methods as the shortening of the root from the apex, brought about by clast cell activity.[3]Different degrees of severity, varying from mild to severe, can occur after orthodontic treatment. The most preoccupying is severe ARR, diagnosed as the loss of more than one-third of the original root length and which affects less than 5% of anterior teeth. Although ARR is multifactorial and not yet fully understood, many studies have tried to identify the risk factors which involve ARR during orthodontic treatment. In general, such factors can be classified as either mechanical or biological. Mechanical factors are related to the magnitude, direction, and duration of orthodontic force, while biological factors include a history of traumatic injury, follicle with ectopic tooth eruption, presence of periapical lesions, root morphologies, previous root resorption, individual susceptibility, and genetic predisposition.[4]

Although endodontically treated teeth respond similarly to vital teeth to the application of force during orthodontic therapy, the common sense of many professionals is that treated teeth are more susceptible to apical root resorption . This may perhaps be because of the scarcity of literature on the subject. Wickwire et al. [5] reported that devital teeth were subject to a greater degree of resorption than vital teeth undergoing orthodontic movement. Spurrier et al. [6] found the same, but noted that the mean difference was virtually undetectable at a clinical level; because of this, a major finding of their study was the absence of differences between vital and endodontically treated incisors. This point of view was confirmed by Huettner and Young [7], Mattison et al. and Mahet al.[8] who showed that there was no significant difference between external root resorption in vital and devital teeth during orthodontic therapy. In relation to orthodontic and endodontic matches, De Souza et al. [9]recently showed that orthodontic movement delays but does not affect healing of the apex process.

Recent systematic reviews [10,11] on this topic agree that the available literature is scarce and that rootfilled teeth do not increase the risk of ARR. On the other hand, evidence for less resorption in endodontically treated teeth following orthodontic treatment is not fully conclusive. Against this

background, the question of whether the isolated effect of endodontic treatment can influence the course of ARR during orthodontic treatment is real and relevant, Thus, the purpose of this study was to evaluate, radiographically, whether there is a significant difference in apical root resorption in vital and endodontically treated teeth that were submitted to orthodontic treatment.

MATERIAL & METHODS :

Sixteen patients were selected who had a vital maxillary central incisor (control) and an endodontically treated homolog, in which the periodontal ligament of the apical region was still intact. This selection involved review of 500 orthodontic records from 5 private orthodontic clinics. All the patients selected had undergone orthodontic movement with the use of brackets for a minimum period of 18 months, and the treated incisor had endodontic intervention at least 1 year before beginning the orthodontic treatment. Pre- and posttreatment periapical radiographs taken with the use of a positioner, and obtained from the initial and final records of the orthodontic treatments, were measured. All images were digitalized by the same scanner and then processed by the program (Corel, Ottawa, Ontario, Canada) where the images were enlarged 250% for better visualization. All the teeth were measured along their greatest length, from the incisal edge to the apex of the root, to compare the same tooth before and after orthodontic movement,evaluating the possible apical root resorption occurring after the orthodontic movement (Fig. 1A). To obtain standardized images, considering the possibility of distortions of the pre- and posttreatment radiograph, the greatest distance from the incisal edge to the amelo-cemental junction was also measured on all the radiographs (Fig. 1B). The patients who had crowns that changed in size because of restorative procedures were excluded from the study. All the measurements were repeated four times by three examiners at different intervals, and the arithmetic mean was calculated to determine the values to be used in the statistical calculations.

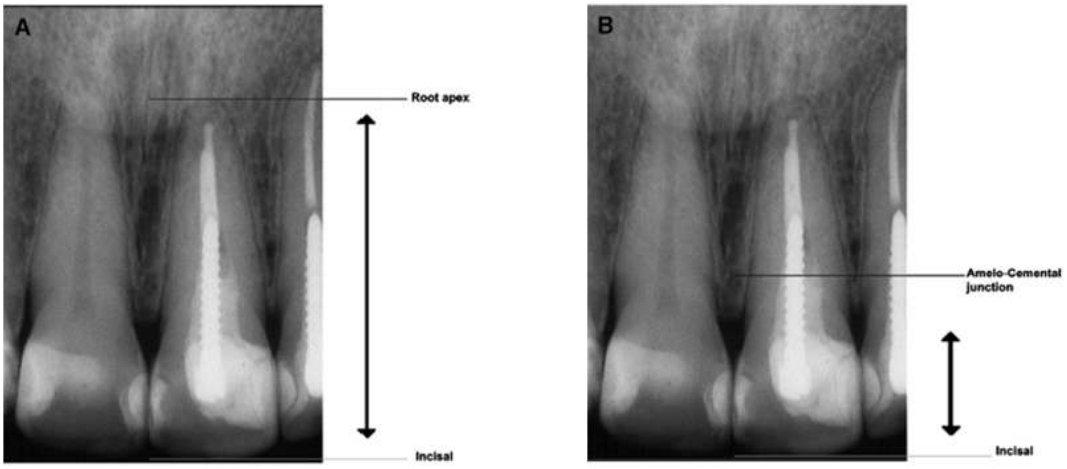

Figure 1. Radiographs illustrating the tooth measurements used. (*A*) Incisorapicaldistance used to calculate root resorption. (*B*) Incisor to enamel-cementum junction distance used to calculate the factor of radiographic shortening or lengthening.

RESULTS :

Table 1 shows the results for the degree of apical root resorption found, expressed in millimeters, after measuring the radiographs of all the individuals analyzed in this study. Eight patients (50%) showed a greater apical root resorption in the endodontically treated tooth compared to its vital counterpart, whereas the remaining eight showed more resorption in the vital tooth. The values of means, standard deviations, standard errors, and p (from Student's t test) are given in Table 2. Comparing the pretreatment radiographs (T1) with the posttreatment radiographs (T2), statistically significant apical root resorption was observed in both groups. There was no statistically significant difference ($p < 0.05$) between apical root resorption in untreated teeth and endodontically treated teeth, although the vital teeth showed, on average, a slightly greater degree of mean apical root resorption (0.22 mm).

Patients	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Endodontically Treated	0.41	0.63	3.07	0.30	0.22	4.41	0.70	0.99	0.16	0	0.34	0.57	0.80	0.3	0.3	0.3
Vital (Control)	0.31	0.63	2.80	0.9	0.12	1.70	0.1	1.24	3.5	0.4	0.2	0.4	1.7	0.4	1.5	1.5

TABLE 1. Apical root resorption (mm) Arithmetic mean of measurements

	Mean	SD*	Standard Error	p-value	Significance p <0.05
Endo T1T2 Vital T1T2	0.21	1.12	0.37	0.29	NS
Vital T1 to T2	1.05	1.00	0.22	0.0003	S
Endo T1 to T2	0.81	1.20	0.26	0.006	S

*SD = standard deviation.
T1 =before treatment; T2 = after treatment.

TABLE 2. Comparisons between the measurements (mm) of the radiographs of the vital and endodontically treated teeth (n_16)

DISCUSSION :

Root resorption as a result of orthodontic movement has been the subject of many experimental studies that mention the etiological factors of dental and bone anatomy, the amount of force applied and type of movement, among others. The results showed that there was no significant difference in apical root resorption, observed radiographically, in endodontictreated and untreated teeth subjected to orthodontic movement (Table 2). However, the apical root resorption found in the group of vital teeth was highly significant (p=0.0003), compared with the group of endodontictreated teeth (p=0.006) .Brezniak and Wasserstein[12] noted that in some cases of endodontically treated teeth, the degree of resorption was less, as if they were protected, possibly by a greater mineral density and a greater degree of hardness. Weiss[13] cited by Mattison[14], concluded that the lack ofvital pulp in an endodontically treated tooth does not predispose it to root resorption, even when it is submitted to orthodontic forces.

Other studies have shown no significant differences in root resorption between vital and root-filled teeth [15, 16, 17,18,19]. However, two of these studies [18,19] were conducted in animals, while one study[15] used teeth of all types (incisors, canines, premolars, molars), a fact that could be considered as a confounding factor, since maxillary incisors have been shown to exhibit a greater amount of root resorption during orthodontic treatment, compared to other tooth types[20, 21]. In contrast to the results of this investigation, two studies have shown loss of cementum to be greater in endodontically treated teeth, although there was no difference in radiographic root length between vital and root-filled teeth[22]. However, both of these studies were conducted in animals. One additional study found also a greater frequency of root resorption in the endodontically treated teeth compared to the vital controls; however, the majority of the cases included had received severe dental injury such as intrusion, extrusion, and replantation. It has been suggested that the dental pulp plays an important role in the processes of root resorption and remodeling of cementum is associated with orthodontic tooth movement[23]. The results of the present study comply with such a suggestion, but they do not offer direct evidence.

Bender et al.[24] presented two case reports and data from 43 private cases that showed more root resorption in vital pulp than in endodontically treated teeth after orthodontic treatment. The authors suggested that the role of vital pulp is yet undetermined, hypothesizing that pulpal neuropeptides in vital teeth and calcium hydroxide in the endodontic treatment might play some role in this event. The present study did not confirm their assumptions. Comparison between the pre- and post-treatment radiographs, taken with the use of a positioner, showed statistically significant differences in both the groups. These changes agree with data from the literature in which practically all teeth show some degree of external root resorption during dental movement. The use of some kind of specific positioner to take these periapical radiographs would be the ideal; however, this study was retrospective and therefore the use of this technique was limited. Also, a comparative evaluation of proportionality proposed by Spurrier et al.has been proposed in some studies to correct the distortions that may occur after the orthodontic movement, or occasionally as a fault of the radiographic positioner. In the present study, the adjacent upper central incisors underwent the same treatment time, as well as apex movement (as observed from cephalometric maxillary superimposition;). This could affect root resorption from pre- to posttreatment, which, in fact, showed a statistically significant increase in all groups. One could expect less root resorption in brief treatments and in those that require less movement of the incisor apex.

CONCLUSION :

It is also certain that split-mouth design studies do not guarantee similar conditions in relation to orthodontic tooth movement. There can be differences between the positions of the contralateral teeth themselves, and this requires asymmetric orthodontic biomechanics, which would contribute to the variation in the level of apical root resorption. CBCT is a reliable diagnostic tool that provides a more accurate image of root resorption, including posterior teeth measurements,than conventional radiographs. For this

reason, CBCT scans can be a more reliable indicator to identify different types of resorption along the root surface.

The results of this study showed that there was no significant difference in apical root resorption found in maxillary central incisors treatedendodontically and untreated counterpart subjected to orthodontic treatment. The investigation of root resorption of orthodontically treated root-filled teeth compared to vital teeth by welldesigned RCTs could be very useful. Such high-quality studies could produce strong evidence to further support the results of the current investigation.

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