

Original Article

Root Canal Treatment in Posterior Teeth: Implications for Orthodontic Mechanics and Stability

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ABSTRACT

This study was conducted to determine the frequency of posterior teeth with root canal therapy in orthodontic patients and to focus on the orthodontics consequences. This retrospective study evaluated 550 OPGs for posterior teeth that had received endodontic treatment. A comprehensive online electronic database provided the data. In orthodontic patients, cross-validation was performed using the clinical data for RC treated posteriorly. 8.7% of the orthodontic population had posteriors that had undergone endodontic treatment. The maxillary first molar, followed by mandibular first molars made up approximately 46% of all root-canal-treated posterior teeth. Males and females with and without posteriors treated with RC differed significantly. Compared to women, men have more posteriors that have had endodontic treatment ($P > 0.1$). Many orthodontic patients have posteriors that have undergone RC treatment. The frequently managed posterior teeth with endodontic therapy are mandibular first molars. Because anchoring needs are high on treated posterior teeth, they must be thoroughly evaluated before orthodontic treatment. To achieve physiologic and effective therapy, treatment mechanics should be modified and treatment protocols should be integrated.

Keywords: Endodontically treated teeth, RCT, Orthodontic patients, Prevalence, Posterior teeth

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Introduction

Orthodontics and root canal therapy have long been associated. The effectiveness of root canal therapy has been the subject of ongoing discussions and controversies. According to the literature, applying orthodontic force to the tooth or teeth that have had endodontic treatment may increase the risk of root resorption [1-3].

The relationship between orthodontic variables and root resorption in teeth that have undergone endodontic treatment is not well documented in the literature. There are two ways that orthodontics can cause external root resorption: a) on the surface through

cementum loss, and b) shortening of a tooth or blunting of the root are signs that this surface is the apical end of the root [4, 5]. Numerous investigations have documented EARR levels in orthodontic patients ranging from 48 to 66% [4-6].

Root resorption can be classified as either mild or clinically negligible (less than 2 mm) or severe or clinically noteworthy (greater than 4 mm or more than one-third of the root length resorbed). The latter has been documented in 14.5% of incisors and commonly happens during orthodontic treatment [7-9].

We still don't fully understand the cause of external apical root resorption [10-12]. Several reasons may be

held accountable for EARR [13], including individual vulnerability, genetic predisposition [14], anatomical aspects, and orthodontic treatment mechanics. It's unclear and debatable how much these factors influence root resorption.

When it comes to orthodontic therapy, posterior teeth—particularly molars—are crucial. Molars and premolars are examples of posterior teeth that function as a significant anchoring unit [15].

Caries can occur in molars and premolars because of their wide contact surfaces, occlusal pits, and fissures [16, 17]. If treatment is delayed, the tooth's structure may become severely affected; therefore, endodontic therapy is necessary to save the tooth.

Important orthodontic issues include endodontic therapy and anchorage consideration [3]. Even though opinions about orthodontics and teeth that have had endodontic treatment are divided. Orthodontic stresses may, however, cause excessive root resorption in endodontically treated teeth more often than in a contralateral healthy tooth [2].

The prevalence of posterior teeth treated with endodontics, particularly in the orthodontic population, is mostly unknown. This study was conducted to determine the frequency of posterior teeth with root canal therapy in orthodontic patients and to concentrate on the consequences for orthodontics.

Materials and Methods

The Department of Orthodontics at Saveetha Dental College and Hospital carried out this retrospective investigation.

Patient selection

All patients who underwent orthodontic treatment during the pre-treatment orthopantomograms between June 2019 and March 2021 were qualified to be taken into the evaluation. The G*power program was used to determine the sample size of 550 based on estimates from earlier research [18]. First molars, second molars, first premolars, and second premolars were the teeth in the permanent maxillary and mandibular region that were examined.

Inclusion and exclusion criteria

Patients above the age of twelve (indicating the emergence of all permanent interiors in the upper and lower arch) and those pursuing orthodontic correction were the inclusion standard.

Any participant who had (i) had their posterior teeth extracted owing to caries, trauma, or prior orthodontic treatment, or (ii) had molars and premolars that were congenitally absent, was disqualified.

Data collection

The data was extracted using the hospital's comprehensive online electronic database software. Each patient's clinical state and dental history were gathered and tallied. OPGs were obtained separately from each patient's radiography record.

Data assessment

Following data collection, all patient information was tallied, OPGs were evaluated, and any posterior teeth that had received endodontic treatment were examined by cross-referencing the clinical data. Records of the patient's dental histories were used to assess root canal therapy. After the data was gathered, IBM SPSS Statistics Software (version 23) was used to analyze it. In the orthodontic population, the prevalence of endodontically treated posteriors was reported using descriptive analysis. A chi-square test was used to see if the patient's gender and the posterior teeth that had RC treatment were related.

Results and Discussion

The orthodontic population's prevalence of endodontically treated posterior teeth was 8.7% (Figure 1).

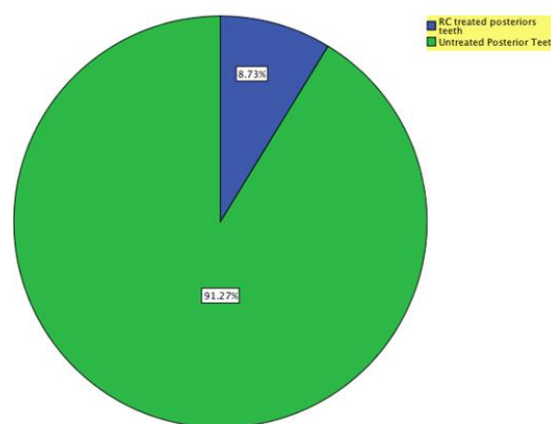


Figure 1. The pie chart displays the distribution of orthodontic patients who have or have not had their posterior teeth root canal treated. 8.73% of orthodontic patients received root canal treatment posteriorly, whereas 91.27% of the population had no endodontically treated posterior.

Individually, the most common condition was Mandibular Permanent First Molars (46.3%), followed by Maxillary Permanent First Molars (29.6%). The incidence of both mandibular second molars is 7.41%. The prevalence of maxillary first and second premolars, maxillary second molars, and mandibular second premolars was 3.7% each. At a frequency of

1.85%, the Mandibular First Premolar was the least afflicted posterior (**Figure 2**).

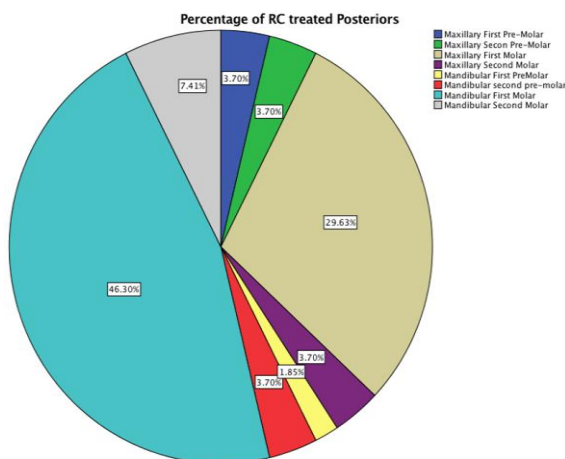


Figure 2. This pie chart depicts the proportion of Root Canal Treated Posteriors in the Orthodontic Population. Light blue signifies Mandibular First Molars with the highest RC treatment percentage, 46.3%. The beige color signifies Maxillary First Molars, of which 29.63% are RC treated. Gray signifies mandibular second molars, that undergo treatment with root canals in 7.41% of all patients. Maxillary First Premolars (Dark Blue), Maxillary Second Premolars (Green), Maxillary Second Molars (Purple), and Mandibular Second Premolars (Red) each received endodontic treatment in 3.7% of instances. The mandibular first premolar (yellow) was the least treated, with 1.85% of the total root canal treated posteriorly.

There were substantially more posterior teeth with root canal therapy in men than in women ($P = 0.06$, $P < 0.1$) (**Figure 3**).

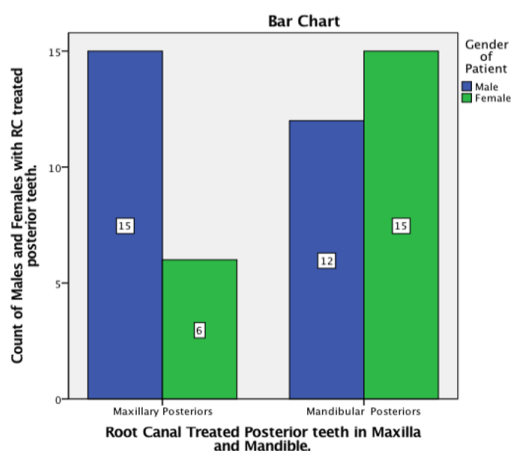


Figure 3. Male and female orthodontic patients' associations with RC-treated posteriors are shown in a bar chart. The Y-axis shows how many posterior teeth in males and females have received

root canal therapy, while the X-axis shows the number of posterior teeth in the maxilla and mandible that have received this treatment. The green hue indicates female orthodontic patients, whereas blue represents male orthodontic patients. Males showed a considerably larger proportion of root canal-treated posterior teeth than females. (Chi-square test; P -value = -0.06, P -value > 0.1 —significant)

The current study's findings indicate a noteworthy prevalence rate of posteriors treated with endodontics of 8.7%. Out of the 550 OPGs evaluated, 54 patients had posterior root canal therapy; several of these patients received multiple posterior endodontic treatments.

In a study by Lupi-Pegurier *et al.* [18], a prevalence rate of 18.9% of total root canal-filled teeth was found, higher than the current study. The inclusion of both anterior and posterior root canal-treated teeth and the fact that the study was carried out on a general population may be the explanation for this. Additionally, they found that fewer men than women had teeth that had received RC treatment. Males had a considerably larger number of posterior teeth that have had root canal therapy, which contrasts with the current research. They claimed that Maxillary First Premolar had the largest proportion of RC treated, which is again inconsistent with the current study's findings that Maxillary First Molar had the highest incidence of RC therapy.

According to research by Gulsahi *et al.* [19] on the Turkish population, 3.3% of people had teeth having root canals, with a noticeably greater percentage of females. This contrasts with our findings, which show that men had a much greater number of posteriors after root canal therapy.

The prevalence of anterior and posterior root canal-treated teeth in the general population was 2.8% in earlier research studies by Cleen *et al.* [20] on the Dutch population, which is lower than the findings of the current study. The age-based differences in the sample population may be the cause of this. Additionally, our study evaluated the proportion of posteriors that were exclusively endodontically treated. Additionally, they observed a higher prevalence rate of 11.3% for Mandibular First Permanent Molars, which is consistent with the findings of the current study, which showed a greater prevalence of mandibular molars treated with RC.

A comparable research by Eriksen *et al.* [21] on the Norwegian population revealed a frequency of 3.4% of teeth with endodontic treatment. According to research

conducted on Japanese people, 87% of the participants received root canal therapy [22].

Prevalence rates range from 2.8 to 87%, with the majority of earlier studies reporting rates of about 3%. According to our study, which was limited to orthodontic patients, the prevalence rate is greater. There have been no prior studies that have examined the orthodontic consequences of these teeth from an endodontic standpoint. The prevalence of posterior teeth with root canals in the orthodontic population is the subject of the first study, which is currently underway.

Molars are significant because they are often banded or bonded, they carry a lot of masticatory power, and they have a greater need for anchoring. Crowns on molars and premolars can make bonding and banding, two fundamental orthodontic techniques, more difficult. For the metal crown, bonding is no longer a possibility, and hydrofluoric acid, a separate etching agent, is needed for the ceramic crown. Sometimes, because the pre-formed bands might not fit, the band finds that the heavier crowns also become a problem. In these cases, the only way to extend chairside time is to employ bespoke bands.

In terms of anchorage, molars are under more pressure to retract their interiors, particularly in type A anchorage cases; in type B and C, the posteriors move 50-75% of the total distance to close the space; numerous orthodontic forces, including intrusion, increase the risk of external apical root resorption [23, 24]. The risk of resorption rises as the distance traveled increases.

Maintaining the tooth movement rate as physiologic as feasible is essential. Applying strong pressures in an attempt to move teeth more quickly might raise the incidence of EARR in posteriors who have had endodontic treatment.

It is necessary to thoroughly assess the endodontic treatment's quality before starting orthodontic therapy. The likelihood of resorption and recurrent infection may rise with a subpar root canal procedure [25]. This might result in orthodontic therapy being stopped, which would lengthen the course of treatment. Additionally, if the teeth become increasingly resorbed, fractured, or infectious over time, the entire course of therapy must be changed.

As orthodontists, it is our responsibility to make sure that the treatment plan causes the least amount of tooth discord and that orthodontic tooth movement does not worsen the state of teeth that have received endodontic treatment [26, 27]. Therefore, when treating a patient with RC-treated interiors, more physiologic therapy mechanics must be used. The interiors are often the

ones that need to be withdrawn furthest. To guarantee proper bone and tooth remodeling, a step-by-step treatment plan needs to be adhered to [28]. It is necessary to take precautions and educate these individuals about receiving orthodontic treatment [29].

Conclusion

Based on the results, the prevalence of endodontically treated posterior teeth was 8.7%, with mandibular first molars accounting for a major percentage amongst all posteriors. Alternative anchorage methods must be considered to decrease further load demands on endodontically treated molars. As an orthodontist, you must thoroughly assess these teeth before beginning therapy. Increased awareness of possible side effects and available treatments in these situations is necessary. Increased physiologic treatment plans and treatment mechanics will be possible with an improved understanding of the epidemiological data on root canal-filled posteriors in the orthodontic population.

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