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Frequency and Cause of Root Canal Treatment in Patients Undergoing Orthodontic Treatment at Ayub Medical College, Abbottabad. A Retrospective-Study

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Abstract

Introduction: Orthodontic treatment can lead to various adverse effects, ranging from white lesions, caries periodontal damage, pain, and root resorption. Endodontists are primarily concerned about root resorption and periodontal/pulpal damage in orthodontic patients. The primary objective of this is to assess the frequency and reason for root canal treatment in patients going through orthodontic therapy in the defined population.

Material and Methods: This retrospective study was conducted at Dental Section, Ayub Medical College's Department of Orthodontics, which reviewed 180 orthodontic case files from 2019-2023. Inclusion criteria comprised patients aged 14 and above who consented to academic and research use. Excluded were those with prior orthodontic treatment, congenitally missing teeth, incomplete case records and those with systemic diseases. Data analysis involved demographic factors, tooth number, and indications for root canal treatment using SPSS 23 and chi-square tests ($p<0.05$) for significance.

Results: Among 180 patients, 112 were female (62.2%) and 68 were male (37.8%). 30% of patients received root canal treatment during orthodontics, while 70% did not. The most common cause for root canal treatment was pulpitis (51.85%), followed by necrosis (25.92%), with no statistically significant association between gender and root canal treatment receipt ($p>0.639$). However, there was a statistically significant relationship between the cause of root canal treatment and specific tooth numbers ($p<0.046$)

Conclusion: The study highlights that the mandibular first molar was the most common tooth to go under endodontic therapy and pulpitis was the cause for that, thereby emphasizing personalized dental care and early intervention.

Keywords: Endodontic treatment, Orthodontic treatment, Root canal treatment, Root resorption

Introduction

Orthodontic treatment can lead to various adverse effects, ranging from white lesions, caries periodontal damage, pain, and root resorption. Endodontists are concerned about root resorption and periodontal/pulpal damage in orthodontic patients. The frequency of patients requiring endodontic and orthodontic therapy has increased significantly over the last 2-3 decades.[1] This increase in both these dental modalities has separate reasons. For orthodontics, the most common complaint patients have to seek treatment for esthetics.[2] While for endodontics the chief reason was reported to be pain because of pulpal or

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periapical conditions of the tooth. As the probability of endodontics and orthodontics treatment increases for a population the correlation between both modalities becomes ever more important for their respective specialties.[3]

Similar to other medical or dental therapies, orthodontic therapy entails potential risks for the patient. It is ethically essential for the practitioner to know how these risks relate to each patient to guarantee that each will benefit net from treatment. Periodontal damage, pain, root resorption, temporal-mandibular-joint disorder, caries, speech issues, and enamel and pulpal tissue damage are among the side effects of orthodontic therapy.[4,5] For the endodontists root resorption and periodontal /pulpal damage are the primary concerns as both may warrant root canal therapy for an affected tooth. The orthodontic force that compresses the neurovascular bundle can alter pulpal blood flow. A recent assessment of the effects of orthodontic force on the pulp concluded that this field is still poorly known, even though several studies have indicated histological and inflammatory alterations in the pulp as a result of orthodontic forces. Clinically what is significant is that there is the possibility that a patient going under orthodontic treatment may present with a necrotic tooth or pain of pulpitis. [6, 7]

When teeth are repositioned during orthodontic therapy, cementum and dentine may resorb. This process has been referred to as "orthodontic-induced root resorption" (OIRR). Individual differences in OIRR susceptibility have been noted.5 OIRR has been linked to a wide range of patient-related factors, including age, tooth morphology, certain drugs, hormone deficiencies, hypothyroidism, hypopituitarism, alveolar bone density, root morphology, chronic alcoholism, gender, root proximity to the cortical bone, gender, and the severity and type of malocclusion, even though genetics account for more than half of this variation.[5,8] Various studies have reported various degrees of root resorption in orthodontic patients ranging from 48-66%. More than 4mm of root resorption or one-third of the length of the root resorbed is considered severe or clinically significant. The reason behind this is that endodontic treatment of such teeth may be warranted whether they be symptomatic or asymptomatic. Although endodontic treatment of teeth is an invasive treatment in itself the bigger concern of the tooth with OIRR needing endodontic treatment is the prognosis especially if orthodontic treatment is still to continue.[9,10] The latter has been documented in 14.5% of incisors and frequently happens during orthodontic treatment.[11,12] Endodontic treatment and anchorage consideration are other crucial orthodontic factors. Even though there is an opposing point of view on orthodontics and endodontically treated teeth. However, orthodontic stresses may affect endodontically treated teeth more than a contra lateral vital tooth.[13,14] What can be deducted from this literature review is that apart from caries progression leading to pulpitis and symptomatic treatment in the form of root canal treatment, other altercations of the tooth pulpal and anatomical structure during orthodontic treatment may warrant endodontic treatment and these need to be assessed.

At the time of the study, little national-level research on this topic was found. Hence this study is a must needed assessment of a literature-deficient topic with the utmost clinical significance. The primary objective of this is to assess the frequency and reason for root canal treatment in patients going through orthodontic therapy in the defined population.

Material and Methods

This retrospective observational study was conducted at the Department of Orthodontics, Dental Section, and Ayub Medical College. Once approval from the Institutes 'Ethical

Review Board (Approval Code/ref. No RC-EA-2023/157) was taken all orthodontic case files from the last 5 years i.e., 2019-2023 were made accessible. A sample size of 180 patients using a WHO sample calculator with a 95% significance level and taking an expected percentage of exposed outcome i.e., 13.53%.[15]

Inclusion:

- Every patient of both genders above the age of 14 has undergone orthodontic treatment in the last 5 years.
- Patients who had signed the consent form for orthodontic treatment and case record use for academic and research purposes.

Exclusion:

- Patients that had a previous history of orthodontic treatment, i.e., before enrollment in the present department.
- Patients with case records that showed that they had congenitally missing teeth.
- Patients with incomplete case records e.g., demographic details, and radiographic records.
- Patients with systemic disease or craniofacial syndrome that could be a result of bias e.g. hyperthyroidism, cleidocranial disease.

All the case files of the patients in the last 5 years were assessed manually by the combined effort of 04 teaching faculty members. Based on the individual case records the data collection forums were filled by the assessors. Apart from the demographic data, the highlights of the data collected were, which tooth had done under root canal treatment and what the indication for the procedure was. The most common causes/ diagnosis were given as options like necrosis, pulpitis, apical abscess, and root resorption. Any other cause was categorized as "Others".

Data Analysis:

Data was entered in SPSS 23. The data variables were patient age, gender, and tooth number. Descriptive statistics was used to calculate the mean values and standard deviation for quantitative variables, whereas the chi-square test was used to check the significance with p values (<0.05).

Results

Demographic representation in Figure 1 shows that out of 180 patients 68 were male and 112 were female. There were more female patients (62.2%) than male patients (37.8%) in the study.

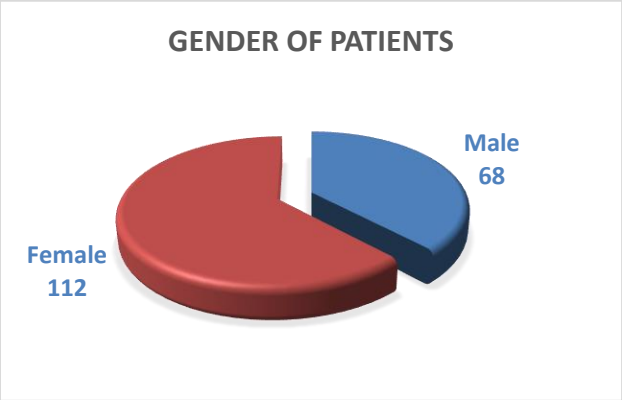

Figure 1: Gender distribution of patients

Figure 2 shows that 30% of the patients in the study underwent root canal treatment during orthodontics, while 70% did not.

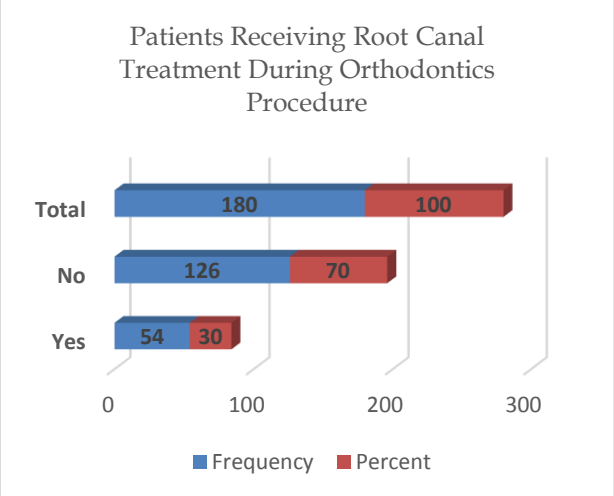

Figure 2: Patients receiving root canal treatment during orthodontics procedure

Table 1 shows the distribution of different causes, with pulpitis being the most common (51.85%), followed by necrosis (25.92%), and others.

S. No	Causes	Frequency	%
1.	Pulpitis	28	51.85
2.	Necrosis	14	25.92
3.	Periapical Pathosis	2	3.70
4.	Root Resorption	4	7.40
5.	Others	6	11.11
	Total	54	100

Table 1: Causes for which root canal treatment was advised

Table 2 provides information on which specific tooth required root canal treatment. It lists the frequency and percentage of cases for each tooth number. For example, tooth number 36 required RCT in 14 cases (25.92%) followed by tooth number 16 required RCT in 12 cases (22.22%).

FDI tooth numbering	Frequency	%
11	2	3.70
12	2	3.70
15	1	1.85
16	12	22.22
26	8	14.81
27	1	1.85
31	2	3.70
32	1	1.85
36	14	25.92
46	11	20.37
Total	54	100

Table 2: Distribution of teeth requiring root canal treatment

In Table 3 the results of the chi-squared test (0.046) indicate a statistically significant association between the causes of root canal treatment (RCT) and the specific tooth numbers where RCT was required. This means that the causes of RCT are not independent of tooth numbers; there is a relationship between the two. In practical terms, this could mean that certain causes of RCT are more likely to be associated with particular tooth numbers, and this association is not occurring by chance.

S. No	Causes of RCT	Tooth Number Require RCT										Total	df	χ^2
		11	12	15	16	26	27	31	32	36	46			
1.	Pulpitis	1	0	1	6	6	1	0	0	7	6	28	36	.046
2.	Necrosis	1	1	0	4	1	0	0	1	3	3	14		
3.	Periapical Pathosis	0	0	0	1	1	0	0	0	0	0	2		
4.	Root Resorption	0	1	0	1	0	0	2	0	0	0	4		
5.	Others	0	0	0	0	0	0	0	0	4	2	6		
	Total	2	2	1	12	8	1	2	1	14	11	54		

Table 3: Description of teeth according to cause

In Table 4 the results of the chi-squared test (0.639) do not show a statistically significant association between the gender of patients and the receipt of root canal treatment during orthodontics. In other words, there is no strong evidence to suggest that a patient's gender is related to whether they receive RCT during orthodontic treatment. The two variables, gender and RCT receipt, appear to be independent of each other in this dataset.

		Has the Patient Received Root Canal Treatment During the Orthodontics Procedure		Total	df	χ^2
		Yes	No			
Gender of Patients	Male	19	49	68	1	.639
	Female	35	77	112		
Total		54	126	180		

Table 4: Description of Root Canal Treatment according to Gender

Discussion

The study explored frequency and factors associated with root canal treatment (RCT) in patients undergoing orthodontic treatment. [16] Out of the total 54 (30.0%) of the patients in the study underwent root canal treatment during their orthodontic procedures, while the majority 126 (70.0%) did not require RCT. This result does not concur with other regional studies where the patients that required RCT while going under orthodontic therapy were only 13.5% [15] and 8.7% [17]. This major difference in results can be because of the demographics as well as methodology as in these studies, only the posterior teeth were assessed. A local observational study on the general population has concluded that the frequency of teeth (290) that required RCT in patients (320)[1] attending a local dental hospital was high in comparison to other regional and international study results. Deducting, that patients requiring root canal treatment are significantly higher in Pakistan and highlighting a generalized oral hygiene and dental education dilemma of the population. In the present study causes of RCT were also analyzed, revealing the following distribution: Pulpitis (51.87%), Necrosis (25.92%), Periapical Pathosis (3.70%), Root Resorption (7.30%), and other causes (11.11%). These results correspond with other national-level studies where 43.0% of cases went under root canal treatment for pulpitis and 22% because of necrotic pulps[18] but of the general population. A recent study conducted in Saudi Arabia on patients undergoing orthodontics found decay/caries (62.12%) to be the most common cause for root canal treatment followed by necrosis as the second most common reason identifying that caries progression and management is assessed vigilantly before and during orthodontic treatment.[15,19] This finding underscores the importance of follow-up visits for early diagnosis and management of pulp-related issues in dental patients whether it be for orthodontic treatment or not.

Another significant finding was that the mandibular first molar exhibited the highest need for RCT, accounting for 25.92% of cases, followed by the maxillary first molar. This finding also concurs with regional literature in which mandibular teeth more frequently require endodontics and specifically the first molar was found to be a common tooth.[20] Literature explains this on the basis the first mandibular molar is the first posterior tooth to erupt in the mouth along with a complex occlusal anatomy predisposing it to caries and eventually pulpal pathosis.[21] The analysis revealed a statistically significant (p-value = 0.046) association between the causes of RCT and the specific tooth requiring treatment. This finding indicates that certain causes of RCT are more likely to be associated with particular tooth numbers. Such insights can inform clinicians about the likelihood of specific teeth being affected by particular dental issues, aiding in early diagnosis and tailored treatment approaches. Gender and the receipt of RCT during orthodontics did not yield a statistically significant association. This suggests that gender does not appear to influence the likelihood of patients receiving RCT during orthodontic treatment.

This study has certain limitations that opens venues for future research. The study adopted a retrospective design, a prospective study might better relate the cause of RCT need with orthodontics treatment. Also endodontics need due to root resorption might be beter worked out. Additionally, the sample size was relatively small, potentially limiting the generalizability of the results to larger populations, and limited demographic information (e.g., age, socioeconomic status, and dental history) could not provide a more comprehensive understanding of the factors influencing RCT during orthodontics.

Conclusion

In conclusion, this study sheds light on the relationship of causes of RCT, and specific teeth affected in patients undergoing orthodontic treatment. It underscores the

importance of tailored dental care and early intervention to address the dental issues that may arise during orthodontics. Further research may delve into the underlying factors contributing to these findings, ultimately enhancing the quality of care provided to orthodontic patients.

Ethical Approval

The study was approved by the Institutional Ethical Review committee of Ayub Medical College, Abbottabad. (Approval Code/Ref. No.RC-EA-2023/157)

Disclaimer

No external funding.

Conflict of Interest

No conflict of interest

Authors' Contribution

AQ: Formulated and designed the study, was responsible for data collection, and helped in writing the manuscript.
WI: Analyzed and interpreted the data, and wrote the manuscript.
NI: Provided design, data collection, and analysis.
EN: Analyzed and interpreted the data, and helped in writing the manuscript.
AH: Provided design, data collection, and proofreading.
IKJ: Provided design, data collection, and proofreading.

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