

Association Of Root Canal Treated Teeth And Tooth Fracture

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ABSTRACT

Tooth fracture especially the vertical root fractures are more commonly associated with endodontically treated teeth. A tooth diagnosed for vertical fracture can be restored to function and not always have to be extracted. The aim of the study was to find the association of root canal treated teeth and tooth fractures and to compare them with non-root canal treated teeth and tooth fractures. This retrospective study included 86, 000 subjects who reported to the Dental Hospital during June 2019- March 2020 among which 147 subjects were recruited for the study who met the inclusion criteria. It was noted that tooth fracture was associated with root canal treated (53.7%) compared to non-root canal treated teeth (46.3%). Maxillary molars were the most common root canal treated teeth with fracture. Within the limits of this study, it is seen that tooth fracture is the more common in root canal treated teeth. Therefore, attempts to be made to reduce tooth fractures by eliminating the etiological agents.

Keywords: Association; Mandibular molars; Root canal treatment; Tooth fractures; Vertical fractures.

1. INTRODUCTION

Tooth fractures can be grouped into five major groups in terms of severity(1). This includes :craze lines; fractured cusp; cracked tooth; vertical root fracture; split tooth.

A fractured tooth is a tooth in which there is either a partial or complete cracking in the structure of the tooth(2).In a fractured tooth a stress plane commonly occurs. A stress plane occurs due to occlusal forces that are directly imposed on the tooth which during a masticatory cycle can cause an instance of higher stress to occur within the stress plane. This higher stress ultimately leads to fracture of the teeth. As the fracture plane expands, the rate of fracture of the stress plane also accelerates, due to proportionately increased stress being put on the remaining non fractured areas of the teeth.

According to literature, tooth fracture is the third most common reason for extraction of an endodontically treated teeth (3,4). Vertical root fracture is the most important threat to the tooth's prognosis during and after root canal therapy. However, the clinical scenario of vertical root fracture may resemble a periodontal disease or failed root canal treatment. Therefore prompt diagnosis is much necessary.

The greater the extension of the crack line/fracture line, the greater is the severity of trauma and damage to the tooth structure would be. If a tooth fracture occurs ,the main damage in Ellis class III fractures would be to the crown, where it is the root in Ellis class VI fractures. The etiology of tooth fracture can be due to some dental wedging forces, improper occlusion or some iatrogenic factors ^{5(5,6)}.

Evidence shows that root canal treated teeth and associated vertical fractures have a very poor prognosis especially on the maxillary and mandibular posterior teeth, in which the pulp chamber floor has a lower thickness and strength due to presence of furcation. In such teeth, crack propagation causes tooth splitting and exposure of periodontal ligament to oral microbial flora and saliva ^(7,8).Previously our team has a rich experience in working on various research projects across multiple disciplines The (9–11)(12–23).

Thus, aim of the study was to find the association of root canal treated teeth and tooth fractures and to compare them with non-root canal treated teeth and tooth fractures.

2. MATERIALS AND METHODS

1. Study Setting And Study Design

In this retrospective cross sectional study we reviewed case records of around 86,000 patients who reported to the dental hospital from June 2019 - March 2020 among which 147 patients who satisfied the inclusion criteria were recruited for the study. Digital database was used to retrieve the data. Ethical approval was obtained from the institutional ethical committee(Ethical approval number:SDC/SIHEC/2020/DIASDATA/0619-0320). Patients who visited the out patient department were chosen by a non-probability sampling method.This study included both males and females of the age group - 17 - 75 years of age. Patients who had symptomatic complete fracture of the tooth were included in the study.The exclusion criteria of this study was patients who had Ellis Class I/II/III fractures;patients who had any systemic illness.

2. Data Collection

Digital case records of all the patients were checked to identify teeth with root canal fracture. Radiographs of each patient were used to identify the fracture and status of root canal treatment done.IOPA and intra oral photographs were used to cross verify the data. Relevant data such as Age, gender, teeth involved were noted. Repeated and incomplete data records were excluded.

3.Statistical Analysis

Data was entered in Microsoft Excel Sheet and later exported to SPSS software(version 20.0) for statistical analysis. Variable definition process was done. Both descriptive (eg. Frequency) and inferential statistics was employed. Chi square test was employed for inferential statistics. Level of significance was set at $p < 0.05$ for this study.

3. RESULTS AND DISCUSSION

According to the results of the present study root canal treated teeth (53.7%) had the highest incidence of tooth fracture compared to non-root canal treated teeth (46.3%) [Table 1 and Figure 1].Tooth fracture was the highest in maxillary molars (38.1%) followed by mandibular molars (31.3%),maxillary premolars(14.3%). It was the least in mandibular anteriors(1.4%) [Table 2 and figure 2] . No statistical significant difference was found between fracture and type of

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teeth.(p = 0.35). Maxillary molars were the most common teeth fractured incase of both root canal treated and non root canal treated teeth.[Figure 3].Root canal treated teeth fractures were the most common among the age group 31- 60 years. No statistical significance between association of age and tooth fractures (p = 0.25). In patients of 17- 30 years and 61- 75 years age group non root canal treated teeth had the highest incidence of fractures.[Figure 4]

ROOT CANAL TREATMENT DONE	Frequency	Percent
YES	79	53.7
NO	68	46.3
Total	147	100

Table 1: Frequency and percentage of tooth fractures associated with root canal treatment. It shows that 53.7% of the fractured teeth were root canal treated whereas 46.3% of the fractured teeth had not undergone any root canal treatment.

TOOTH INVOLVED	Frequency	Percent
Maxillary anteriors	18	12.2
Maxillary premolars	21	14.3
Maxillary molars	56	38.1
Mandibular anteriors	2	1.4
Mandibular premolars	4	2.7
Mandibular molars	46	31.3
Total	147	100

Table 2: Frequency and percentage of tooth involved in fractures. It shows that the highest tooth fractures were seen in maxillary molars(38.1%) followed by mandibular molars(31.3%). It was the least in mandibular anteriors (1.4%)

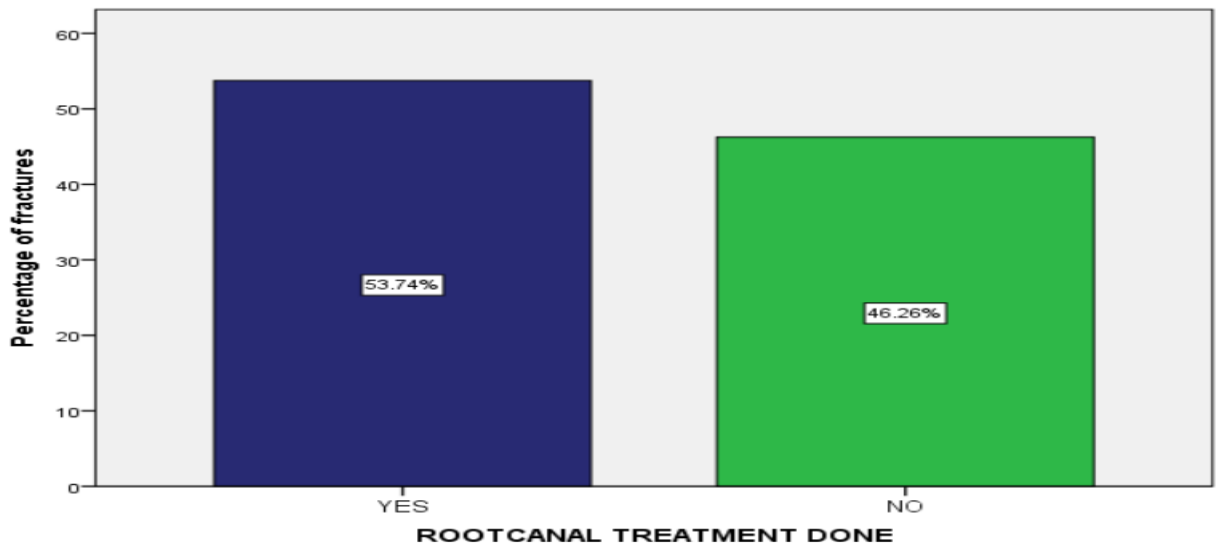


Figure 1: Bar graph depicting the percentage distribution of tooth fractures. X-axis denotes the root canal treatment and Y- axis denotes the percentage of tooth fractures. It shows that 53.7% of the fractured teeth were root canal treated whereas 46.3% of the fractured teeth had not undergone any root canal treatment .

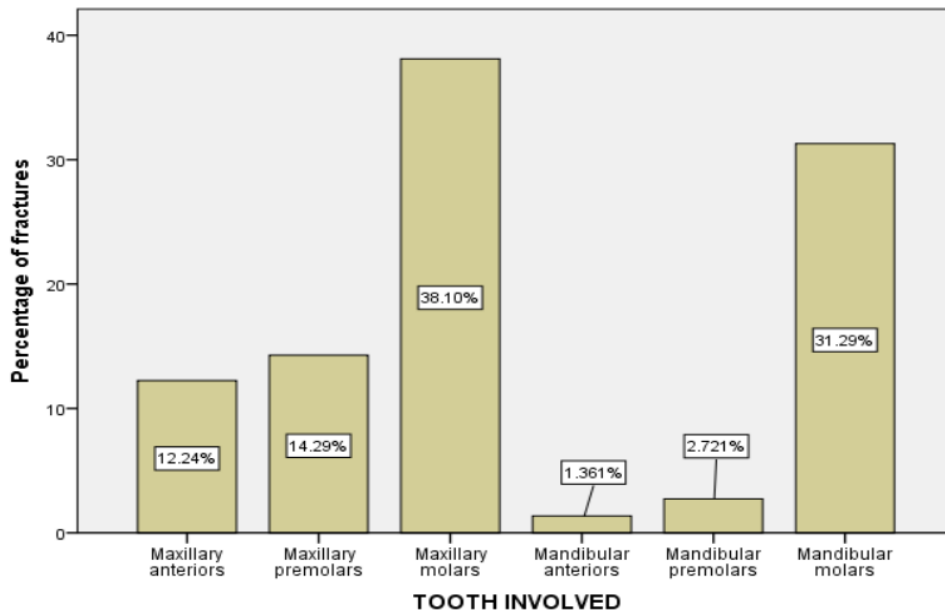


Figure 2: Bar graph depicting the percentage distribution of tooth fractures. X-axis denotes the tooth involved in fracture and Y- axis denotes the percentage of tooth fractures. It shows that the highest tooth fractures were seen in maxillary molars(38.1%) followed by mandibular molars(31.3%). It was the least in mandibular anteriors (1.4%)

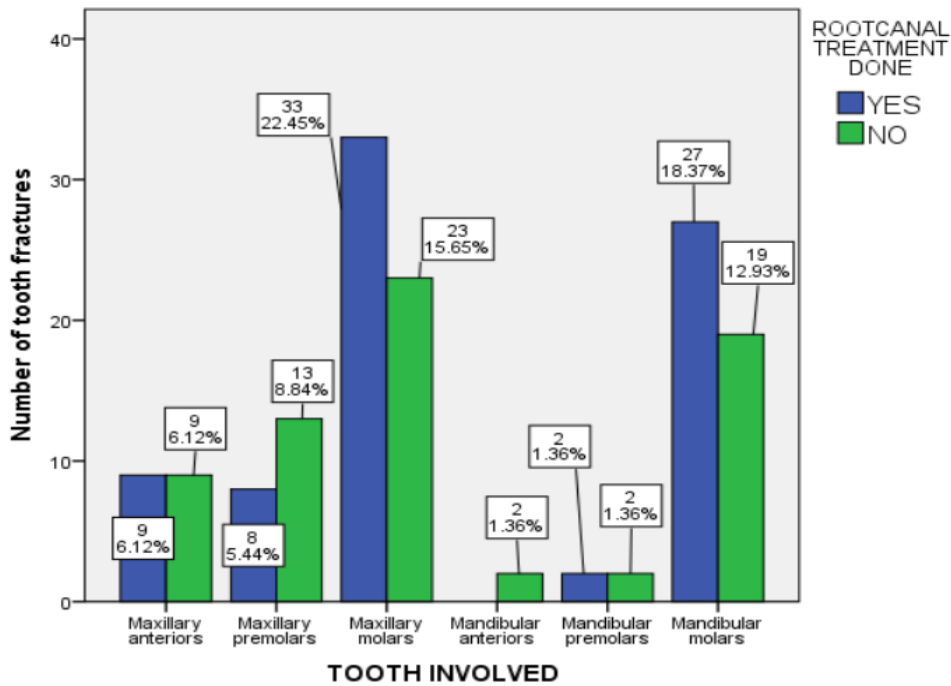


Figure 3 : Bar graph depicts the distribution of tooth fractures according to the tooth involved in fracture. X- axis denotes the tooth and Y- axis denotes the count of tooth fracture. Pearson chi square test; p value:0.35(>0.05)- not

significant. Maxillary molars were the most common teeth for tooth fracture in both root canal treated and non root canal treated teeth. Hence no significant association between tooth fractures and tooth involvement in fracture.

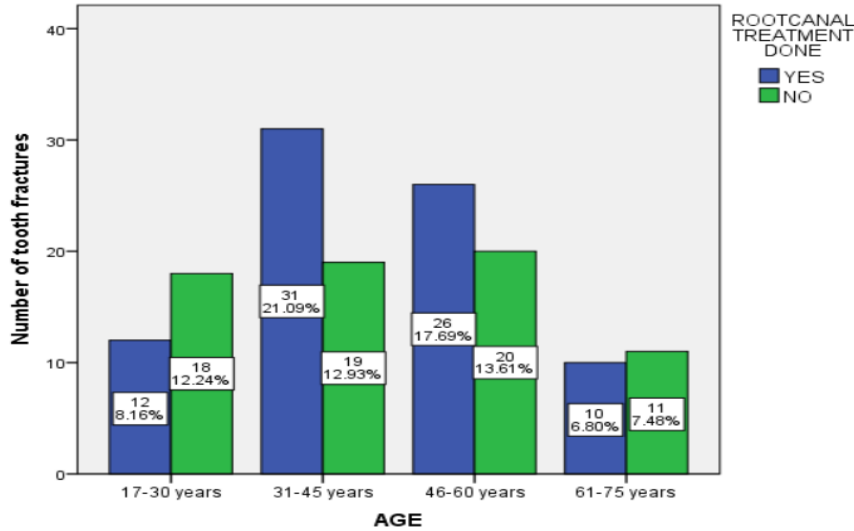


Figure 4: Bar graph depicts the distribution of tooth fractures according to age. X- axis denotes the age of the patient and Y- axis denotes the count of tooth fracture. Pearson chi square test ;p value:0.25(>0.05)- not significant. Root canal treated teeth fractures were the most common among the age 31- 45 years whereas it was the least among 61- 75 years of age. Hence no significant association between age and tooth fractures.

According to this study it was seen that tooth fracture was more prevalent in the tooth which has undergone root canal treatment (53.7%). Similar results were reported by Olcay et al and Tamse, (24,25) in their literature. Various studies have reported for the causes of vertical root fractures. The main factor is the changes in dentin characteristics. Dentin of pulpless teeth exhibit more plastic deformation than does that of normal teeth. This plastic deformation is attributed to the changes in collagen cross linking in root dentin (26)

Nevertheless, residual dentin thickness also plays an important role after removal of intracanal procedures. Excessive enlargement during coronal preparation or post space preparation can compromise dentin thickness (27–29). Long term calcium hydroxide as a root canal dressing may increase the risk of fracture.(30) In non-root canal treated teeth, root canal anatomy plays a pivotal role. Roots narrower in the mesiodistal direction, developmental depressions reduced curvature radius of roots, Root canal width to width of the total root influences the risk of root fractures (31)

Tooth fracture is common among the age group 31-45 years of age in root canal treated teeth according to this study. This is contradictory to the study done by Fuss et al (32) who reported that tooth fracture is most common above 40 years of age. According to Khasnis et al (33) tooth fractures are more common in root canal treated teeth than non-root canal treated teeth. This finding is in agreement with results of the current study. The teeth are more susceptible to fractures following endodontic treatment. Correct fabrication of post and cores;crowns etc. can help to decrease the frequency of tooth fractures and increase the success rate of root canal treated teeth.

Cone Beam Computed Tomography (34) has been used successfully for the early detection of root fracture in both endodontically and non-endodontically treated teeth as observed in many studies. It is more sensitive and accurate in the detection of vertical root fractures as compared to conventional and digital radiography. It has been shown that the presence of root canal filling does not significantly influence the accuracy but reduces specificity, in detection of vertical root fracture by CBCT. In an vitro study, CBCT has been used successfully for diagnosing simulated vertical root fractures of thicknesses 0.5 mm, 1 mm, 1.5 mm and 2 mm in extracted teeth. CBCT has been shown to be more accurate in vertical root fracture with thickness of 0 to 2 mm.(35) Early detection of vertical root fractures avoids unnecessary bone loss, which can result in difficulty in reconstructing a bone area, where implants are the treatment of choice in future. Our institution is passionate about high quality evidence based research and has excelled in various fields (36–46).

4. CONCLUSION

Within the limits of this study, it is seen that tooth fracture is the more common in root canal treated teeth. Tooth fractures are difficult to diagnose and treat. Though, many treatment options have been suggested by authors but none has been proved to be successful in the long run. Therefore attempts to reduce the tooth fractures associated with root canal treatment to be reduced by the elimination of etiological agents.

5. ACKNOWLEDGEMENT

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6. AUTHORS CONTRIBUTIONS

First author (Hemashree J) performed the analysis, and interpretation and wrote the manuscript. Second author (Dr. Iffat Nasim) contributed to conception, data design, analysis, interpretation and critically revised the manuscript. Third author (Dr. Manjari Chaudhary) participated in the study and revised the manuscript. All the three authors have discussed the results and contributed to the final manuscript.

7. CONFLICT OF INTEREST

None declared

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