Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies ***NLM ID:*** *101716117*

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Index Copernicus value = 91.86

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Effect of orthodontic brackets on pulp tissue

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ABSTRACT:
Background: To evaluate the effect of orthodontic brackets on pulp tissue. **Materials & methods:** A total of 100 cases were selected with age ranging from 15 to 25 years. The inclusion criteria for the selection of cases included panoramic radiographs (both pre- and post treatment) of patients who underwent orthodontic treatment without any extraction of maxillary and mandibular first and second premolar and molar treatments, and without any loss of these teeth due to caries lesions. A total of 1600 teeth of 100 subjects were studied. Required data was collected and analyzed by using SPSS software and chi-square test was done to find significant values with $p \leq 0.05$ and considered as a significant value. **Results:** In all, 11% of cases reported pulp stones before the commencement of the orthodontic treatment and 18% cases after completion of orthodontic treatment. 5.1% of total number of teeth were evaluated in both arches before orthodontic treatment and 6.4% of teeth after orthodontic treatment revealed the presence of pulp stones. Maxillary first molar was found to be teeth with maximum number of pulp stones before and after orthodontic treatment. **Conclusion:** The study showed the presence of pulp stones more in maxillary first molar and it was found to be teeth with maximum number of pulp stones before and after orthodontic treatment.
Keywords: orthodontic brackets, pulp, calcification.

Received: 12 November, 2021 Accepted: 17 December, 2021

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This article may be cited as: Singh K, Chaudhary R. Effect of orthodontic brackets on pulp tissue. J Adv Med Dent Scie Res 2022;10(1):204-207.

INTRODUCTION

The orthodontic tooth movement (OTM) could be defined as the results of tooth biological system response to the application of an externally force; all the biological responses that take place after force application lead to bone remodeling that is necessary for OTM. [1,2] The size of the biological response depends on the application time, force magnitude and force distribution in fact, different force distribution patterns could determine different type of tissue reactions. [3]

The prevalence of orthodontic treatment has increased among adults in recent years. The use of fixed orthodontic appliances such as brackets and wires can result in periodontal or endodontic diseases by increasing bacterial colonization. [4] Moreover, orthodontic movement is suggested as a predisposing factor for the initiation of endodontic problems such as root resorption. [5,6] In these clinical situations, when the dental pulp becomes necrotic, the root canal contents should be eliminated as soon as possible to prevent bacterial stimulation of the resorption lesions. However, the orthodontic apparatuses applied on teeth may sometimes complicate root canal treatment procedures. Type of the force application, duration and dimension of the force, age of the patients, and size of the apical foramen are among the contributory factors. [7] More pulpal changes have been observed in response to intrusive orthodontic forces. [8] Furthermore, higher incidence of irreversible pulpal reactions is usually expected in teeth with complete root formation. Pulp stones are a group of calcifications which can be found discrete or diffuse in the pulpal tissue of healthy, diseased, and even in teeth which are not yet erupted. Stones may be present either freely within the dental pulp or embedded in or attached to dentin. The size may vary from a small microscopic particle to a large mass obliterating the pulp chamber. [9] Hence, this study is to evaluate the effect of orthodontic treatment on pulp tissue.

MATERIALS & METHODS

A total of 100 cases were selected with age ranging from 15 to 25 years. The inclusion criteria for the

selection of cases included panoramic radiographs (both pre- and post treatment) of patients who underwent orthodontic treatment without any extraction of maxillary and mandibular first and second premolar and molar treatments, and without any loss of these teeth due to caries lesions. Any cases with poor-quality radiographs were excluded from the study. Any patients with a positive history of medical diseases were excluded from the study to prevent any bias due to systemic disorders. The panoramic radiographs of all the patients taken at the initiation of orthodontic treatment for the purpose of diagnostic records and at the completion of the orthodontic treatment were studied for analysis of pulp stones. Maxillary and mandibular first and second premolar and molar teeth were selected for the purpose of the study. A total of 1600 teeth of 100 subjects were studied. Required data was collected and analyzed by using SPSS software and chi-square test was done to find significant values with $p \leq 0.05$ and considered as a significant value.

RESULTS

The present study is done among 100 cases, 34 were male patients and 66 were female patients. 3 out of 34 (8.8%) male subjects were diagnosed with pulp stones before the orthodontic treatment and after completion of orthodontic treatment 6 out of 34 (17.6%) were found to have pulp stones. Among female patients, 8 out of 66 (12.1%) were diagnosed with pulp stones before the orthodontic treatment and after completion of orthodontic treatment, 12 out of 66 (18.2%) patients were found to have pulp stones. Among 100 cases, 11 (11%) cases reported pulp stones before the commencement of the orthodontic treatment and 18 in total (18%) cases after the completion of orthodontic treatment. Pulp stones were found in the age group 20 to 23 years.

On comparison of cases based on tooth- and archwise distribution, 52 (6.5%) out of 800 teeth showed the presence of pulp stones before orthodontic treatment, and 68 (8.5%) teeth showed the presence of pulp stones after orthodontic treatment in maxillary arch. 29 (3.7%) out of 800 teeth showed the presence of pulp stones before orthodontic treatment and 35 (4.4%) teeth showed the presence of pulp stones after orthodontic treatment in mandibular arch. Total of 1600 teeth were evaluated in both arches, before orthodontic treatment were 81 (5.1%) and 103 (6.4%) teeth after orthodontic treatment. Maxillary first molar was found to be teeth with maximum number of pulp stones before and after orthodontic treatment.

Table 1: presence of pulp stone before and after orthodontic treatment

Parameters	Number	Presence of pulp stones before orthodontic treatment	Presence of pulp stones after orthodontic treatment	p-value
Gender Male Female	 34 66	 3 (8.8%) 8 (12.1%)	 6 (17.6%) 12 (18.2%)	-
P- value	> 0.05			
Total number of patients	100	11 (11%)	18 (18%)	<0.06
Total number of teeth	1600	81 (5.1%)	103 (6.4%)	<0.06

Table2: arch wise and tooth wise comparison of pulp stones

Parameter	Number of teeth	Presence of pulp stones before orthodontic treatment	Presence of pulp stones after orthodontic treatment
Maxillary			
First premolar Second premolar First molar Second molar	200 200 200 200	2 (1%) 4 (2%) 34 (17%) 12 (6%)	2 (1%) 6 (3%) 42 (21%) 18 (9%)
Total number of teeth with presence of pulp stone in maxillary arch	800	52 (6.5%)	68 (8.5%)
Mandibular			
First premolar Second premolar First molar Second molar	200 200 200 200	1 (0.5%) 6 (3%) 14 (7%) 8 (4%)	1 (0.5%) 7 (3.5%) 18 (9%) 9 (4.5%)
Total number of teeth with presence of pulp stone in mandibular arch	800	29 (3.7%)	35 (4.4%)
Total number of teeth in both the arches	1600	81 (5.1%)	103 (6.4%)

DISCUSSION

It is widely accepted that orthodontic force often results in undesirable effects on the dentoalveolar complex; the dental pulp is one of the affected tissues. With the increased awareness about oral health, orthodontic treatment has gained increasing popularity among the children, adolescents, and adults to achieve optimal esthetics and improve the oral health-related quality of life. Maintaining oral hygiene and regular follow-ups are necessary during orthodontic treatment. However, most patients require periodontal, restorative or root canal treatments after orthodontic treatment. [(10)] Appropriate access to the root canal is desirable in root canal treatment, and calcified tissue in the root canal system is a challenge encountered during endodontic treatment. [(11)]

Pulp stones are calcified foci in the dental pulp, which need to be removed. Pulp stones may be either-true calcified tissues made up of dentin and lined by odontoblasts, or false calcified tissues formed by degenerated cells following pulp mineralization. [(12)] The exact cause of pulp stone formation is still unclear, but it may be caused by degenerative changes in the pulp, induction effect between pulp tissue and epithelium, and blood circulation problems. The risk factors for the pulp stones include aging, continuous stimulation of dental pulp due to caries, tooth restoration, or forces applied to the teeth, genetics, and idiopathic factors. [(13)]

In our present study, it is done among 100 cases, 34 were male patients and 66 were female patients. 3 out of 34 (8.8%) male subjects were diagnosed with pulp stones before the orthodontic treatment and after completion of orthodontic treatment 6 out of 34 (17.6%) were found to have pulp stones. Among female patients, 8 out of 66 (12.1%) were diagnosed with pulp stones before the orthodontic treatment and after completion of orthodontic treatment, 12 out of 66 (18.2%) patients were found to have pulp stones. Among 100 cases, 11 (11%) cases reported pulp stones before the commencement of the orthodontic treatment and 18 in total (18%) cases after the completion of orthodontic treatment. Pulp stones were found in the age group 20 to 23 years.

In one of the retrospective cross-sectional comparative study, 222 digital panoramic radiographs collected from private orthodontic offices in Rasht, were divided into two groups: radiographs of patients undergoing orthodontic and non-orthodontic treatment according to the inclusion criteria. The obtained data were analyzed by SPSS via the Wilcoxon and Mann-Whitney tests ($P<0.05$). The change in the number of pulp stones in the mandible ($P=0.001$) was significantly higher than that in the maxilla ($P=0.002$). This change was also greater in the left side ($P<0.0001$) than in the right side ($P=0.002$). The changes in the number of pulp stones was significant in females ($P=0.02$). Age had an insignificant effect on pulp stone formation ($P>0.05$). This study showed the effect of orthodontic treatment on the number of pulp stones. Further studies are required to clarify the underlying mechanisms for this increase and come up with strategies to prevent it. [(14)] On comparison of cases in our study, based on tooth- and archwise distribution, 52 (6.5%) out of 800 teeth showed the presence of pulp stones before orthodontic treatment, and 68 (8.5%) teeth showed the presence of pulp stones after orthodontic treatment in maxillary arch. 29 (3.7%) out of 800 teeth showed the presence of pulp stones before orthodontic treatment and 35 (4.4%) teeth showed the presence of pulp stones after orthodontic treatment in mandibular arch. Total of 1600 teeth were evaluated in both arches, before orthodontic treatment were 81 (5.1%) and 103 (6.4%) teeth after orthodontic treatment. Maxillary first molar was found to be teeth with maximum number of pulp stones before and after orthodontic treatment.

Another retrospective study was carried out among 200 patients who underwent nonextraction orthodontic treatment. Maxillary and mandibular first and second premolar and molar teeth were selected for the purpose of the study using panoramic radiographs. A total of 3200 teeth of 200 patients were studied for the presence of pulp stones. Statistical analysis of the obtained data was carried out using Statistical Package for Social the Sciences (SPSS) version 22.0. Chi-square test was applied to find the significant value and $p \leq 0.05$ was considered as a significant value. In all, 11.5% of cases reported pulp stones before the commencement of the orthodontic treatment and 15.5% cases after completion of orthodontic treatment. Overall, 4% increase in cases were found which was statistically significant. [(15)]

CONCLUSION

The study showed the presence of pulp stones more in maxillary first molar and it was found to be teeth with maximum number of pulp stones before and after orthodontic treatment.

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