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Original Research

Association between orthodontic force and dental pulp

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ABSTRACT:
Background: To evaluate the association of orthodontic force on dental pulp. **Materials & methods:** A total of 50 cases were selected with age ranging from 15 to 25 years. Maxillary and mandibular first and second premolar and molar teeth were selected for the purpose of the study. A total of 800 teeth of 50 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:** 32 (8%) out of 400 teeth showed the presence of pulp stones before orthodontic treatment, and 42 (10.5%) teeth showed the presence of pulp stones after orthodontic treatment in maxillary arch. 20 (5%) out of 400 teeth showed the presence of pulp stones before orthodontic treatment and 22 (5.5%) teeth showed the presence of pulp stones after orthodontic treatment in mandibular arch. Total of 800 teeth were evaluated in both arches, before orthodontic treatment were 52 (6.5%) and 64 (8%) teeth after orthodontic treatment. 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 before and after orthodontic treatment.
Keywords: orthodontic force, pulp, calcification.

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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] In fact, different force distribution patterns could determine different type of tissue reactions. By that, several studies focused on evaluating tissue reaction to force appliance, and iatrogenic sequelae to orthodontic force have been detected.[4,5]

Orthodontic movement results from applying a force vector to a tooth for some time.[6] The establishment of pressure and tension zones along the periodontal ligament is one of the theories that explain orthodontic movement.[7] On the pressure side, the periodontal ligament undergoes disorganization and decreased production of fibers, in addition to a decrease in blood flow and cell replication. Simultaneously, on the tension side, the stimuli produced by stretching of the fiber bundles increase the cell replication rate and, consequently, enhance periodontal fiber production.

Pulp stones are foci of calcification in the pulp of tooth. Calcification can occur in the dental pulp as discrete calcified stones or as diffuse form that can occur freely in the pulp tissue or is attached to or embedded into dentin.[8] Depending on their microscopic structures, pulp stones have been classified into true or false form. They are not clinically apparent but are common radiographic findings.[9]

They have variable radiographic appearance; they may be radiopaque structure within the pulp chamber or in the root. They do not have uniform shape or number. They may be round or oval, and some pulp stones inhabit most of the pulp chamber. Some may be large as 2 or 3 mm in diameter. Only these large calcified concretions are radiographically discernible. Pulp stones occur most commonly in molars, although

they occur in all tooth types.[10] Healthy, deceased, and even unerupted teeth can have pulp stones. Hence, this study was conducted to evaluate the association of orthodontic force on dental pulp.

MATERIALS & METHODS

A total of 50 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. 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 800 teeth of 50 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 50 cases, 16 were male patients and 34 were female patients. 1 out of 16(6.3%) male subjects were diagnosed with pulp stones before the orthodontic treatment and after completion of orthodontic treatment 3 out of 16 (18.8%) were found to have pulp stones. Among female patients, 4 out of 34 (11.8%) were diagnosed with pulp stones before the orthodontic treatment and after completion of orthodontic treatment, 7 out of 34 (20.5%) patients were found to have pulp stones. Among 50 cases, 5 (10%) cases reported pulp stones before the commencement of the orthodontic treatment and 10 in total (20%) cases after the completion of orthodontic treatment. Pulp stones were found in the age group 20 to 24 years.

On comparison of cases based on tooth- and archwise distribution, 32 (8%) out of 400 teeth showed the presence of pulp stones before orthodontic treatment, and 42 (10.5%) teeth showed the presence of pulp stones after orthodontic treatment in maxillary arch. 20 (5%) out of 400 teeth showed the presence of pulp stones before orthodontic treatment and 22 (5.5%) teeth showed the presence of pulp stones after orthodontic treatment in mandibular arch. Total of 800 teeth were evaluated in both arches, before orthodontic treatment were 52 (6.5%) and 64 (8%) 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	16 34	 1 (6.3%) 4 (11.8%)	 3 (18.8%) 7 (20.5%)	-
P- value	> 0.05			
Total number of patients	50	5 (10%)	10 (20%)	<0.07
Total number of teeth	800	52 (6.5%)	64 (8%)	<0.07

Table 2: 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	100	1 (1%)	1 (1%)
Second premolar	100	5(5%)	6 (6%)
First molar	100	18 (18%)	26 (26%)
Second MOLAR	100	8 (8%)	9 (9%)
Total number of teeth with presence of pulp stone in maxillary arch	400	32(8%)	42 (10.5%)
Mandibular			
First premolar	100	0 (0%)	1 (1%)
Second premolar	100	4 (4%)	4 (4%)
First molar	100	10 (10%)	12 (12%)
Second molar	100	6 (6%)	5 (5%)
Total number of teeth with presence of pulp	400	20(5%)	22 (5.5%)

stone in mandibular arch			
Total number of teeth in both the arches	800	52(6.5%)	64 (8%)

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.[11] 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.[12]

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.[13] 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.[14] In the present study, among 50 cases, 16 were male patients and 34 were female patients. 1 out of 16(6.3%) male subjects were diagnosed with pulp stones before the orthodontic treatment and after completion of orthodontic treatment 3 out of 16 (18.8%) were found to have pulp stones. Among female patients, 4 out of 34 (11.8%) were diagnosed with pulp stones before the orthodontic treatment and after completion of orthodontic treatment, 7 out of 34 (20.5%) patients were found to have pulp stones. Among 50 cases, 5 (10%) cases reported pulp stones before the commencement of the orthodontic treatment and 10 in total (20%) cases after the completion of orthodontic treatment. Pulp stones were found in the age group 20 to 24 years.

In one of the study by Bains SK et al, 500 routine dental outpatients within age group of 18–67 years were involved in the study. Molar bitewing of left and right side of each patient was taken with XCP bitewing instrument and size 2 film. The presence or absence of pulp stones was recorded. Chi-square analysis was used to record the prevalence of pulp stones and to compare it with demographic and systemic factors. Overall prevalence of pulp stones was 41.8%. Pulp stones were significantly higher in maxilla (11.59%) than mandible (6.54%), left side than right side, and first molar than other molars. Higher numbers of pulp stones were recorded in patients with cardiovascular disease (38.89%) than with cholelithiasis and renal lithiasis. Conclusion. Pulp stones were higher in maxillary arch than mandibular arch and in females than males. Cardiovascular patients had higher number of pulp stones than other groups.[15] In our present study, on comparison of cases based on tooth- and archwise distribution, 32 (8%) out of 400 teeth showed the presence of pulp stones before orthodontic treatment, and 42 (10.5%) teeth showed the presence of pulp stones after orthodontic treatment in maxillary arch. 20 (5%) out of 400 teeth showed the presence of pulp stones before orthodontic treatment and 22 (5.5%) teeth showed the presence of pulp stones after orthodontic treatment in mandibular arch. Total of 800 teeth were evaluated in both arches, before orthodontic treatment were 52 (6.5%) and 64 (8%) 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 by Jena D et al, 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.[16]

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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