

ORIGINAL RESEARCH

Assessment of effect of orthodontic treatment on dental pulp: An observational Study

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ABSTRACT:

Background: Orthodontic tooth movement (OTM) is a biologic event which is facilitated by remodeling of periodontal ligament (PDL) and alveolar bone in response to the applied mechanical stimuli. Hence; under the light of above mentioned data, the present study was undertaken for assessing the effect of orthodontic treatment on dental pulp. **Materials & methods:** A total of 50 patients who underwent orthodontic treatment during the study period were included in the present study. Complete demographic details of all the patients were obtained. Radiographs were taken during the pre-treatment phase and findings were recorded in separate Performa. CBCT was done both during pre-treatment phase and post-treatment phase. Prevalence of pre-treatment and post-treatment pulp stones was assessed using the radiological findings. Also, on doing CBCT analysis, mean volume of pulp tissue was assessed both during pre-treatment and post-treatment phase and were evaluated. **Results:** Incidence of pulp stones during the pre-treatment and post-treatment phase was found to be 24 percent and 38 percent respectively. Significant results were obtained while comparing the incidence pre-treatment and post-treatment pulp stones. In the present study, mean pre-treatment pulp volume of incisors was found to be 46.36 mm³ while mean post-treatment pulp volume of incisors was found to be 42.89 mm³ respectively. Mean pre-treatment pulp volume of canines was found to be 52.12 mm³ while mean post-treatment pulp volume of canines was found to be 49.36 mm³ respectively. While comparing the pre-treatment and post-treatment pulp volumes among incisors and canines, significant results were obtained. **Conclusion:** Dental pulp tissue is affected significantly under the effect of orthodontic forces.

Key words: Orthodontic treatment, Dental pulp.

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INTRODUCTION

Orthodontic tooth movement (OTM) is a biologic event which is facilitated by remodeling of periodontal ligament (PDL) and alveolar bone in response to the applied mechanical stimuli. The effects of orthodontic forces on the dental pulp showed histological changes mostly in pulpal blood flow and vascular tissue pressure. The pulp and periodontal tissues are richly cellularized, and their metabolic rates are adapted to their functional needs.¹ ² The structural and functional normality of these tissues seem to be influenced by local and systemic factors. Clinical detection of periodontal and pulp changes induced by local and systemic factors probably depend on the type, duration and intensity of the stimulus applied. Early studies have suggested that

vascular changes promoted by orthodontic movement might cause pulp necrosis. Histological examination is neither practical nor feasible in clinical situation. Therefore, application of pulp testing methods is suggested to provide additional diagnostic information.^{3- 5} Different pulp tests have been proposed and examined aiming at assisting the diagnosis and treatment planning for the clinician. Laser Doppler flow cytometry (LDF) is a proposed method for evaluating the blood flow in the dental pulp by investigating the vascular supply to the pulp.^{6- 8} Hence; under the light of above mentioned data, the present study was undertaken for assessing the effect of orthodontic treatment on dental pulp.

MATERIALS & METHODS

The present study was conducted with the aim of assessing the effect of orthodontic treatment on dental pulp. A total of 50 patients who underwent orthodontic treatment during the study period were included in the present study. Complete demographic details of all the patients were obtained. Radiographs were taken during the pre-treatment phase and findings were recorded in separate Performa. CBCT was done both during pre-treatment phase and post-treatment phase. Prevalence of pre-treatment and post-treatment pulp stones was assessed using the radiological findings. Also, on doing CBCT analysis, mean volume of pulp tissue was assessed both during pre-treatment and post-treatment phase and were evaluated. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. Chi-square test was used for assessment of level of significance.

RESULTS

In the present study, a total of 50 patients undergoing orthodontic treatment were analyzed. Mean age of the patients was found to be 19.6 years. There were 29 males and 21 females in the present study. Majority of the patients belonged to the age group of less than 20 years. Incidence of pulp stones during the pre-treatment and post-treatment phase was found to be 24 percent and 38 percent respectively. Significant results were obtained while comparing the incidence pre-treatment and post-treatment pulp stones. In the present study, mean pre-treatment pulp volume of incisors was found to be 46.36 mm³ while mean post-treatment pulp volume of incisors was found to be 42.89 mm³ respectively. Mean pre-treatment pulp volume of canines was found to be 52.12 mm³ while mean post-treatment pulp volume of canines was found to be 49.36 mm³ respectively. While comparing the pre-treatment and post-treatment pulp volumes among incisors and canines, significant results were obtained.

Table 1: Incidence of pre-treatment and post-treatment pulp stones

Pulp stones	Pre-treatment	Post-treatment
Number of patients	12	19
Percentage	24	38
p- value	0.00 (Significant)	

Table 2: Mean pulp volume pre-treatment and post-treatment

Tooth	Mean pre-treatment pulp volume (mm ³)	Mean post-treatment pulp volume (mm ³)	p- value
Incisors	46.36	42.89	0.00 (Sig.)
Canine	52.12	49.36	0.01 (Sig.)

DISCUSSION

The impact of orthodontic forces on the dental pulp tissue has become a matter of interest. Several studies have evaluated the impact of orthodontic forces on the dental pulp. However, the reported results in the literature are inconsistent and inconclusive, mostly due to the methodological limitations. Some studies have reported short term effects such as changes in tissue respiration, and others have reported long lasting consequences such as necrosis.⁷⁻⁹ Hence; under the light of above mentioned data, the present study was undertaken for assessing the effect of orthodontic treatment on dental pulp.

In the present study, a total of 50 patients undergoing orthodontic treatment were analyzed. Mean age of the patients was found to be 19.6 years. There were 29 males and 21 females in the present study. Majority of the patients belonged to the age group of less than 20 years. Incidence of pulp stones during the pre-treatment and post-treatment phase was found to be 24 percent and 38 percent respectively. Significant results were obtained while comparing the incidence pre-treatment and post-treatment pulp stones. Venkatesh S et al evaluated 3-dimensional pulp cavity changes during orthodontic treatment. Eighty-seven patients formed the study sample and were divided into an experimental group (48 patients) and a control group (39 patients). Cone-beam computed tomographic (CBCT) records were obtained before the start of the treatment (T0) and after space closure for the experimental group, whereas for the control group CBCT images were obtained approximately 17-18 months (T1) after obtaining the first image (T0). CBCT data were reconstructed with surface and volume rendering software (Mimics; Materialise, Leuven, Belgium), and the volumetric images were modified to display the teeth from various orientations. Six anterior teeth were segmented and their pulps isolated. Paired t test was used to check for statistical significance. The difference in the pulp volume was statistically significant at $P < .05$ for all the anterior teeth in the experimental group and at $P < .05$ for the right canine, $P < .05$ for the right and left lateral incisors, and $P < .05$ for the left central in the control group. Orthodontic treatment in the experimental group produced a significant decrease in the size of the pulp, which was statistically significant.¹⁰

In the present study, mean pre-treatment pulp volume of incisors was found to be 46.36 mm³ while mean post-treatment pulp volume of incisors was found to be 42.89 mm³ respectively. Mean pre-treatment pulp volume of canines was found to be 52.12 mm³ while mean post-treatment pulp volume of canines was found to be 49.36 mm³ respectively. While comparing the pre-treatment and post-treatment pulp volumes among incisors and canines, significant results were obtained. Abtahi M et al compared early and delayed histological effects of intrusive forces on dental pulp of adolescents and adults. They were assigned to adult

(25–32-year-old) and adolescent (13–18-year-old) Groups. A cantilever spring made of 16 × 22 steel wire was used to apply intrusive force to upper first premolars (11 teeth in adolescents and 11 teeth in adults) and the opposing teeth were considered as control group. In each group, 6 pairs of teeth were extracted after one week, and the remaining 5 pairs were extracted after one month of intrusion. Histologic changes were compared between the control and intrusive groups and also between the adults and adolescents after 7 days and 1 month. Significant difference was not found in any histological parameters between intrusive and control groups 1 week and 1 month after intrusion in adolescents and adults ($P > 0.05$). One month after intrusion, inflammatory cell response intensity ($P = 0.032$) and frequency of chronic inflammation ($P = 0.032$) were significantly higher in adults compared to adolescents. Mild intrusive force in closed apex teeth causes no significant histologic changes in adolescents and adults.¹¹ Cuoghi OA et al evaluated pulp and dentin under induced tooth movement (ITM) with different types of forces. The maxillary right first molars of rats were submitted to movement with continuous (CF), continuous interrupted (CIF) and intermittent (IF) forces during 5, 7 and 9 days with nickel-titanium (NiTi) closed-coil springs exerting 50cN force magnitude. The groups were histologically evaluated as for cellularity pattern, presence of dystrophic, hemodynamic alterations in the pulp as well dentin alterations. The main observed alterations were related to hemodynamic pulp characteristics, such as presence of thrombosis, vascular congestion and hemorrhages. There was no significant differences observed between groups in the different types of applied forces and duration of ITM (vascular congestion, $p=1.000$; hemorrhage, $p=0.305$; thrombosis, $p=1.000$). Pulp tissue alterations resulting from ITM were limited to hemodynamic events, without progressing to irreversible degeneration, regardless of the type of force applied.¹²

CONCLUSION

From the above results, the authors concluded that the dental pulp tissue is affected significantly under the effect of orthodontic forces. However; further studies are recommended.

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