

Effect of orthodontic forces on pulp tissues

Dr.Kishor B. Bagalkot¹,Dr. Akshay M. Dhewale²,Dr.PiyushGupta³,Dr.KavudaNagarjuna Prasad⁴,Dr.Anjali Pawan Kumar⁵,Dr.Faizan Ali Lone⁶

¹Consultant Orthodontist, DrKishorBagalkot Dental Orthodontic And Implant Centre, Hubli - 580029, Karnataka, India;

²BDS, MDS, Senior Lecturer, Department of conservative dentistry, VYWS Dental college & Hospital, Amravati, Maharashtra 444602;

³PG Resident, Department of Orthodontics and DentofacialOrthopaedics, Kalinga Institute of Dental Sciences, KIIT Deemed to be University, Bhubaneswar, Odisha, India;

⁴PG Resident, Department of Orthodontics and DentofacialOrthopaedics, Kalinga Institute of Dental Sciences, KIIT Deemed to be University, Bhubaneswar, Odisha, India;

⁵Reader, Department of Oral and Maxillofacial Surgery SMBT dental sciences and research,dhamangaonghoti;

⁶PG first year Orthodontics and dentofacial orthopedics, DeshBhagat Dental College, Mandigobindgarh

²E mail: akshaydhewale@gmail.com

ABSTRACT:

Background:Orthodontic forces are often followed by the biological response of dental pulp. The present study was conducted to assess effect of orthodontic forces on pulp tissues.

Materials & Methods: 58 patients required maxillary first premolar extraction for orthodontic purposes were treated with a cantilever spring made of 16 × 22 steel wire to apply intrusive force to upper first premolars (Group I) and the opposing teeth were considered as control group (Group II).

Results: Inflammation at 7 days in group I was none seen in 60% and mild in 40% 34% and in group II was none seen in 80% and mild in 20%. At 1 month was none seen in 100% in both groups. Fibrous tissue at 7 days was none seen in 100% teeth in both groups and at 1 month was none seen in 40% in group I and 100% in group II and mild in 60% in group II. Vascular dilatation at 7 days was none seen in 60% and moderate in 40% in group I and none in 55% and moderate in 45% in group II. Vascular dilatation at 1 month was none in 60% and mild in 40% in both groups. The difference was significant ($P < 0.05$).

Conclusion: Mild intrusive force in closed apex teeth causes no significant histologic changes in both groups.

Key words: Intrusive force, Orthodontic, Pulp

INTRODUCTION

Orthodontics is a field of dentistry that corrects the malposition of the jaw bones and teeth in order to optimize occlusion for functional and aesthetic purposes. Orthodontic forces are often followed by the biological response of dental pulp. The pulp's sensory role is important, but it has other roles as well. The pulp functions to form dentin, among other duties. It supplies

nutrients and moisture the surrounding areas of the tooth. When the nerve tissue is damaged, often bacteria begin to multiply in the pulp chamber, leading to infection. In fact, dental pulp maintains the biological and physiological vitality of the dentin. In addition, it has a highly responsive sensory nervous system that generates unbearable pain when the tooth is inflicted by mechanical trauma.

The relation between orthodontic force application and dental pulp tissue has been the subject of studies in the recent years. However, there is no conclusive evidence on the effect of orthodontic forces on pulpal tissue, and therefore, the issue has been studied for many years in human.¹

It is found that orthodontic forces had a negative effect on pulp tissue. The research result through a histological test showed that dental pulp was influenced by orthodontic dental movement, it was proven by pulp reaction i.e. disrupted blood circulation, and necrosis.⁴ Numerous researches on pulp tissue changes caused by orthodontic forces have been performed, among others are: pulp tissue respiration rate, pulp angiogenesis, pulp tissue response due to dental extrusion, aspartate aminotransferase and alkaline phosphatase enzyme activities and pulp micro vascular response.⁵ The present study was conducted to determine effect of orthodontic forces on pulp tissues.

MATERIALS & METHODS

The present study was conducted among 58 patients required maxillary first premolar extraction for orthodontic purposes. All were informed regarding the study and written consent was obtained before starting the study.

A cantilever spring made of 16 × 22 steel wire was used to apply intrusive force to upper first premolars (Group I) and the opposing teeth were considered as control group (Group II). 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 after 7 days and 1 month. Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 58		
Gender	Males	Females
Number	26	32

Table I, graph I shows that out of 58 patients, males were 16 and females were 32.

Graph I Distribution of patients**Table II Effect of orthodontic forces on pulp**

Effect	None	Mild	Moderate	Severe	P value
Inflammation at 7 days					
Group I	60%	40%	-	-	0.02
Group II	80%	20%	-	-	
Inflammation at 1 month					
Group I	100%	-	-	-	1
Group II	100%	-	-	-	
Fibrous tissue at 7 days					
Group I	100%	-	-	-	1
Group II	100%	-	-	-	
Fibrous tissue at 1 month					
Group I	40%	60%	-	-	0.03
Group II	100%	-	-	-	

Vascular dilatation at 7 days					
Group I	60%	-	40%	-	0.14
Group II	55%	-	45%	-	
Vascular dilatation at 1 month					
Group I	60%	40%	-	-	0.12
Group II	60%	40%	-	-	

Table II shows that inflammation at 7 days in group I was none seen in 60% and mild in 40% and in group II was none seen in 80% and mild in 20%. At 1 month was none seen in 100% in both groups. Fibrous tissue at 7 days was none seen in 100% teeth in both groups and at 1 month was none seen in 40% in group I and 100% in group II and mild in 60% in group II. Vascular dilatation at 7 days was none seen in 60% and moderate in 40% in group I and none in 55% and moderate in 45% in group II. Vascular dilatation at 1 month was none in 60% and mild in 40% in both groups. The difference was significant ($P < 0.05$).

DISCUSSION

Orthodontic forces are known to produce mechanical damage and inflammatory reactions in the periodontium, as well as cell damage, inflammatory changes, and circulatory disturbances in dental pulp. Orthodontic forces should produce periodontal inflammatory reactions but should not show effects beyond mild inflammation of human dental pulp. It is known that orthodontic forces are capable of stimulating the whole vascular system in the dental pulp. Several researchers believed that intrusive orthodontic force can harm microcirculation of the pulp. Intrusion or other dental movement can obstruct pulp inside circulation causing pulp damage.⁶ One of the researchers said that the use of light force interrupted by several breaks will definitely decrease pulpal iatrogenic process, therefore, it was advisable to give an orthodontic force not more than a capillary pressure of 20 mm/Hg, because blood constriction can be followed by necrosis.⁷ Excessive intrusion and extrusion will lead to necrotic pulp tissue without any odontoblast layer regeneration. It was noticed that teeth with open apical foramen was prone to receive the impact of dental intrusion.⁸ Statement in pertaining to the effect of apical foramen was still controversial, some researchers considered that the impact of intrusion depended on root forming stage. Teeth with opened apex had better prognosis. The majority of researchers stated that orthodontic force will cause hyperemi, diapedesis, white blood cell marginalization, and vacuoles forming on odontoblast layer.⁹ The present study was conducted to determine effect of orthodontic forces on pulp tissues.

In present study, out of 58 patients, males were 26 and females were 32. Abtahiet al¹⁰ compared early and delayed histological effects of intrusive forces on dental pulp of adolescents and adults. 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.

We observed that inflammation at 7 days in group I was none seen in 60% and mild in 40% 34% and in group II was none seen in 80% and mild in 20%. At 1 month was none seen in 100% in both groups. Fibrous tissue at 7 days was none seen in 100% teeth in both groups and at 1 month was none seen in 40% in group I and 100% in group II and mild in 60% in group II. Vascular dilatation at 7 days was none seen in 60% and moderate in 40% in group I and none in 55% and moderate in 45% in group II. Vascular dilatation at 1 month was none in 60% and mild in 40% in both groups. Some studies have demonstrated that hemodynamic changes are the first observable signs after orthodontic movements. However, there is a large controversy in this issue. Some studies have reported a considerable decrease of pulpal blood flow after intrusion, whereas Kvinnsland et al¹¹ have demonstrated an increase or no change.

Proffit et al¹² reported that light continuous forces have little or no effect on dental pulp. On the other hand, the reaction of dental pulp to orthodontic forces has been reported to vary from mild hyperemia to complete necrosis in the literature. 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. More pulpal changes have been observed in response to intrusive orthodontic forces. Furthermore, higher incidence of irreversible pulpal reactions is usually expected in teeth with complete root formation.

CONCLUSION

Authors found that mild intrusive force in closed apex teeth causes no significant histologic changes in both groups.

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