

Assessment of Responses of Pulp Sensibility Tests during Orthodontic Treatment

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ABSTRACT:

Background: Orthodontic teeth movement is based on application force to the teeth in a certain period of time which may vary between months and years. This movement inevitably causes biological reactions in periodontal ligament and pulp. The present study was conducted to assess responses of pulp sensibility tests during orthodontic treatment.

Materials & Methods: 45 subjects were divided into group I was orthodontic group and group II was control (non-orthodontic) group. Cold and electrical stimuli were applied to the maxillary incisors and canines immediately before and after the placement of fixed appliances and at regular intervals for both groups during active treatment and 12 months into retention.

Results: The mean response threshold in group I and II was 34.1 and 29.4, 42.3 and 29.9, 48.7 and 30.1, 50.2 and 31.2, 48.5 and 31.5, 47.2 and 30.5, 45.7 and 31.2, 43.6 and 30.6, 41.3 and 30.7, 38.6 and 31.1, 35.1 and 30.6 at time 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 respectively. The difference was significant ($P < 0.05$).

Conclusion: Thresholds to electric testing was higher for orthodontic group as compared to non- orthodontic group.

Key words: Electric testing, Orthodontic group, Pulp sensibility.

Introduction

The health and integrity of the dental pulp is of major importance for tooth survival. The diagnosis of orofacial pain is complicated in the orthodontic patient as treatment-induced alterations to pulpal physiology may result in altered responses to pulp sensibility tests.¹ Pulp testing, both electric and thermal, is an invaluable aid to the clinician in the assessment and diagnosis of pulpal pathosis, although false results may be obtained. Prior knowledge of the circumstances that are likely to produce unreliable results would be of great benefit.²

Orthodontic teeth movement is based on application force to the teeth in a certain period of time which may vary between months and years. This movement inevitably causes biological reactions in periodontal ligament and pulp.³ The clinical importance of pulpal alterations after orthodontic force depends on whether or not it will endanger the long-term vitality of the teeth.

Orthodontic force, which is called as controlled trauma, can damage the pulp because the lack of collateral circulation in the pulp makes pulp one of the most sensitive tissues of the body.⁴ The symptoms, which can be diagnosed earlier in the pulp tissues, after orthodontic force is applied are hemodynamic changes with the increase in the volume of blood vessels and circulatory disorders within the 1st hour.⁵ The present study was conducted to assess responses of pulp sensibility tests during orthodontic treatment.

Materials & Methods

The present study was conducted among 45 subjects who required fixed orthodontic appliances. Equal number of non-orthodontic subjects were also recruited. All were informed regarding the study and their written consent was obtained.

Data such as name, age, gender etc. was recorded. Subjects were divided into 2 groups. Group I was orthodontic group and group II was control (non-orthodontic) group. Cold and electrical stimuli were applied to the maxillary incisors and canines immediately before and after the placement of fixed appliances and at regular intervals for both groups during active treatment and 12 months into retention. The numbers of negative responses for each tooth at each time interval were recorded. The data were collected and tabulated, and chi-square tests were used. P value less than 0.05 was considered significant.

Results

Table I Distribution of subjects

Groups	Group I	Group II
Status	Orthodontic group	Non-orthodontic group
M:F	17:28	20:25

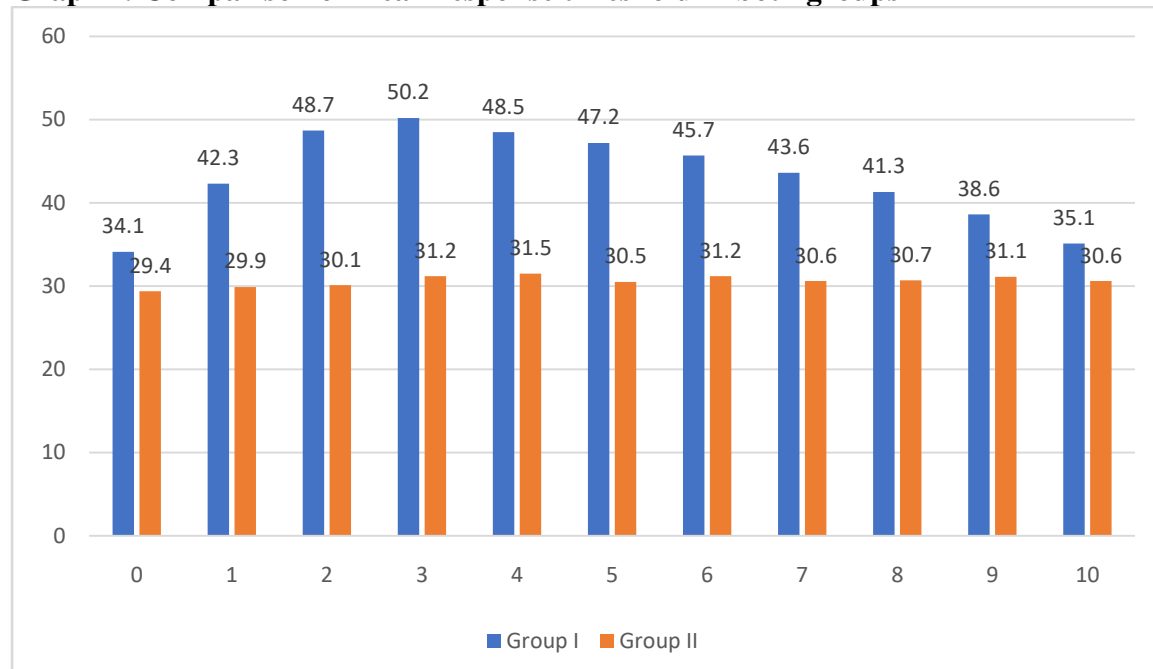
Table I shows that group I had 17 males and 28 females and group II had 20 males and 25 females.

Table II Comparison of mean response threshold in both groups

Time	Group I	Group II	P value
0	34.1	29.4	0.02
1	42.3	29.9	0.05
2	48.7	30.1	0.05
3	50.2	31.2	0.02
4	48.5	31.5	0.01
5	47.2	30.5	0.03
6	45.7	31.2	0.04
7	43.6	30.6	0.04
8	41.3	30.7	0.02
9	38.6	31.1	0.01
10	35.1	30.6	0.02

Table II, graph I shows that mean response threshold in group I and II was 34.1 and 29.4, 42.3 and 29.9, 48.7 and 30.1, 50.2 and 31.2, 48.5 and 31.5, 47.2 and 30.5, 45.7 and 31.2, 43.6 and 30.6, 41.3 and 30.7, 38.6 and 31.1, 35.1 and 30.6 at time 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 respectively. The difference was significant ($P < 0.05$).

Graph I: Comparison of mean response threshold in both groups



Discussion

When an orthodontic force is applied, pulp tissue reacts with pulp hyperemia at first, and degranulation of mast cells is characterized with cell damage and biochemical reactions.⁶ These are the features of classical acute inflammation in which acute inflammatory mediators such as vasodilatation, bradykinin, neuropeptides, prostaglandins and growth factors, vascular permeability, and histamine, which causes a rise in blood flow with edema, are released.⁷ An increasing neural activity and an increasing response threshold to electrical stimulation of pulp develop after a few days.⁸ Then, because of the alteration in the metabolism of pulp, which is stated with increased enzymatic activity, apoptosis, and necrosis of pulp cells increase. The changes in the tissue respiration and possible hypoxia, which develop during orthodontic treatment, cause increase in aspartate aminotransferase (AST) activity levels and affect dental pulp tissue by changing pulpal neural response.⁹ The presence of macrophages, the change of odontoblast layer, edema of connective tissue, and increase of progenitor cells and fibroblasts are the reports, which represent an adaptive process and inflammation of pulp tissue to the mechanic aggression caused by orthodontic force. Long-term studies show the decrease of some protein expressions which block the regeneration and restoration of pulp structure.¹⁰ The present study was conducted to assess responses of pulp sensibility tests during orthodontic treatment.

In present study, group I had had 17 males and 28 females and group II had 20 males and 25 females. Alomari et al¹¹ investigated the effect of orthodontic tooth movement involving the six maxillary anterior teeth on the pulp response to both thermal and electric stimuli during active orthodontic treatment and retention. Forty-seven subjects who required fixed orthodontic appliances were used as a study group with 23 non-orthodontic subjects recruited as a control group. Cold and electrical stimuli were applied to the maxillary incisors and canines immediately before and after the placement of fixed appliances and at regular

intervals for both groups during active treatment and 12 months into retention. In the control group, all teeth tested positively to the EPT and thermal pulp tests at all time intervals. In the orthodontic group, two teeth failed to respond to EPT and only one tooth to thermal testing at baseline (Time 0). After that, the number of negative responses to both tests increased gradually at each time interval reaching a peak after 2 months of active treatment (Time 3) and then declined gradually towards the end of observation period (Time 14). At baseline, response thresholds to electric testing were typically higher for orthodontic subjects, particularly for the maxillary lateral incisor tooth. For the control group, the response threshold over the study period was relatively constant. For the orthodontic group, application of force immediately increased the response threshold to EPT (Time 1), which peaked after 2 months (Time 3) and then gradually reduced. At the end of the active treatment, response thresholds remained elevated, but they returned to pre-treatment values towards the end of the retention phase.

We found that mean response threshold in group I and II was 34.1 and 29.4, 42.3 and 29.9, 48.7 and 30.1, 50.2 and 31.2, 48.5 and 31.5, 47.2 and 30.5, 45.7 and 31.2, 43.6 and 30.6, 41.3 and 30.7, 38.6 and 31.1, 35.1 and 30.6 at time 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 respectively. Lazzaretti et al¹² evaluated with split-mouth study design 34 maxillary first premolars of 17 patients, they applied intrusive force to the teeth in the experimental group for 21 days and examined the pulps histologically. Findings in the experimental group after orthodontic inclusion force showed certain changes in most of the teeth. Odontoblast aspiration, which is one of the first pulp reactions to external stimulus, was determined in 23.5% of the teeth in the experimental group. A dense connective tissue area (fibrous) was observed within the pulp. Vasodilatation was observed in most of the teeth in the experimental group. After 21 days, orthodontic intrusive force application caused vascular changes in the pulpal tissue and calcification number and presence of fibrosis in the pulp increased.

Conclusion

Authors found that thresholds to electric testing was higher for orthodontic group as compared to non- orthodontic group.

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