

Full Length Research Paper

Determining the relationship between the application of fixed appliances and periodontal conditions

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The aim of this work was to study the relationship between the use of fixed appliances and periodontal conditions during orthodontic treatment. A Historical Cohort study design was used. The treatment group consisted of 30 patients undergoing fixed orthodontic treatment and 30 patients were used as controls. Both patient groups had no background of trauma resulting from bracket which might affect the gingival status and the control group had no history of previous orthodontic treatment. Periodontal condition of both groups was evaluated and assessed with bleeding index and periodontal hyperplasia. Exact Fisher test was used for statistical analysis. The mean age for the treatment group and the control group was 15.1±1.5 years and 14.7 ± 2.4 years, respectively. Gingival bleeding was 50 and 76.7%, while gingival recession was 3.3 and 0% in control and treatment groups (P<0.3; P<0.9), respectively. 13.3% of gingival hyperplasia was seen in the control group and 46.4% in the treatment group (P<0.005). Fixed appliances for orthodontic treatment increased the potential of gingival bleeding and Hyperplasia.

Key words: Fixed orthodontic appliances, periodontal disease, gingival bleeding, gingival recession, gingival hyperplasia.

INTRODUCTION

Periodontal disease is one of the major problem and concern during orthodontic treatment. Periodontal disease is not a single pathologic entity but comprises of a number of inflammatory and degenerative process of the periodontal supporting structures including gingivitis, gingival recession, gingival bleeding and gingival hyperplasia. It has very high prevalence among children and adults (Carranza et al., 1996; Nagwa et al., 1987). A number of studies have shown that periodontitis is a

result of bacteria activity on the tooth surfaces (Nagwa et al., 1987; Jenkins et al., 1971). Without investigating etiologies and factors, any treatment will end up with failure. Considering the fact that in some articles, these symptoms have been reported as the result of further development like loss of periodontal support (Theilade and Theilade, 1976), and some medical problems such as cardiac disease (Mercado and Marshall, 2001), it is imperative to know the other effective factors that initiate periodontal problems including fixed orthodontic appliances application (Travess et al., 2004; Shaw et al., 1991; Lau et al., 2006) which is one of the researches preferences in our study. Different opinions have shown the role of this factor in creating these symptoms, as in

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Abbreviations: A.R, Relative risk; C.I, confidence interval.

Table 1. Distribution of studied groups according to age and periodontal symptoms using fixed orthodontic appliances.

Group	Mean age	Gingival bleeding		Gingival recession		Gingival hyperplasia	
		No	Yes	No	Yes	No	Yes
Control (N1 = 30)	15.14 ± 1.46	15 (50%)	15 (50%)	29 (96.7%)	1 (3.3%)	26 (86.6%)	4 (13.3%)
Cases (N2 = 30)	14.73 ± 2.39	7 (23.3%)	23 (76.7%)	30 (100%)	0	16 (53.3%)	14 (46.6%)
Test result		P<0.03		P<0.9		P<0.005	

some articles it has been implicated as a major factor (Shaw et al., 1991; Lau et al., 2006; Zachrisson and Zachrisson, 1972; Kloehn and Pfeier, 1974; Tuncer and Baylas, 1990; Dieedrich et al., 2001) and in some, it has not been observed to be of any significance and in yet another group of articles, its role has been insignificant (Turkkahraman et al., 2005; Ristic et al., 2007).

Therefore, this research aimed to study the relationship between gingival problem and periodontal symptoms which is correlated with fixed orthodontic appliances application in patients under treatment, and control group among patients of a private orthodontic clinic in 2008.

MATERIALS AND METHODS

The research design was Historical Cohort. To collect data, interview and observation technique was used to complete two pages of data questionnaire. All patients were under fixed orthodontic treatment for at least six months and had no history of debonding and bracket replacement which might affect the gingival status. Matching group was selected from the orthodontically treated group of class and school mates with similar age and environmental conditions. Control group was matched with the study group with least variables. Individual characteristics, age, gender, fixed orthodontic treatment duration and degree of cooperation were studied and registered in data form questionnaire No. 1. These cases formed the study group. Each of the experimental group was asked about the area where they were living, where they were studying and what grade they were. Students with no orthodontic treatment and no periodontal problem from the same class and school agreed to cooperate with research conscientiously and were considered as control group and data form questionnaire No. 1 was recorded. Before starting the study, the parents were invited and the objective of research was discussed and consent forms were signed in this regards. An approval letter was issued by the ethical committee of the research deputy of the school. This study was conducted in the first stage (leveling and aligning) of the orthodontic treatment. The appliance was edgewise 18*22 slot with upper and lower molars with edge wise 18*22 tube, upper molars tube had 0.45 head gear tube.3M adhesive material with fluoride which was used for bonding for 15 s with led light curing system. Ring elastics without fluoride were used to hold the wire in the slot of brackets.

The leveling (first stage of the orthodontic treatment) was initiated by 0.0155 twisted flex, 0.0175 twisted flex and 0.016 round stainless steel. All the patients that participated in the study were female, Caucasian, which had similar economic and cultural condition, they were from middle class of the society and had no history of smoking.

A pilot study was carried out with 10 patients in the study group and a matched control group of 10 patients. 91% of study group had shown gingival recession, and 54% of the control group had

symptoms. Confidence level was 95% and the power of statistical test was 90%. With the data from the pilot study, sample size was calculated. Each group included 30 samples from a total of 60 patients studied. Sampling was performed by goal-based approach. Periodontal status, including gingival recession, gingival bleeding and gingival hyperplasia of the study group and the control group were studied by a trained dental intern who had a reliability level of 90% in a previous experimental study. The assessment was performed under the supervision of an orthodontist and a periodontist. These indices together with patient code were registered in form No. 2. At the end of the research, data of forms 1 and 2 were categorized and extracted, and relationship of periodontal problems was judged statistically by T-test and Chi square, and Fisher's exact test and relative risk (R.R.) and attributable risk (A.R.) were determined for the sample and confidence interval (C.I.) was estimated with a probability of 95%.

RESULTS

The research was performed with 30 cases undergoing fixed orthodontic treatment and 30 cases as the control group. Periodontal symptoms in the study and control groups are shown in Table 1. According to obtained results in the study group, 23 patients (76.7%) complained of gingival bleeding, 16 patients (53.3%) showed gingival hyperplasia of grade 1 and less, and 14 persons (46.6%) showed gingival hyperplasia of grade 2 and more. Gingival recession was not observed in any of the patients of the study group. The significance of gingival bleeding is $p<0.03$ and gingival hyperplasia is $p<0.005$, using fixed orthodontic appliances, whereas there is no significant relationship between gingival recession and the application fixed orthodontic appliances ($p<0.9$). The amount of relative risk of gingival bleeding in study group is 1.53 times more than the control group and the amount of attributable risk of gingival bleeding of the study group as compared to the control group is 26.7%. The amount of relative risk of gingival recession in the study group as compared to the control group was zero. The amount of attributable risk of recession in the study group as compared to the control group was zero. The amount of relative risk of gingival enlargement (grade 1 and less) in the study group was 3 times more than that in the control group. The amount of attributable risk of gingival enlargement (grade 1 and less) in the study group was 33.3% as compared to the control group. The amount of relative risk of gingival enlargement (grade 2 and more) in the study group was 3.5 times more than that in the

control group. The amount of attributable risk of gingival enlargement (grade 2 and more) in the study group was 33.3% as compared to the control group.

DISCUSSION

According to the results of the experimental group, 23 persons (76.6%) complained of gingival bleeding, 16 persons (53.3%) showed grade 1 gingival hyperplasia and less, and 14 persons (46.6%) showed grade 2 gingival hyperplasia and more, and gingival recession was not observed in any of the experimental groups. There is a significant relationship between gingival bleeding ($p < 0.03$) and gingival hyperplasia ($p < 0.005$) with orthodontic fixed appliances, whereas there is no significant relationship between gingival recession and application of orthodontic fixed appliances. Most researches of this field confirmed our results, these include Ristic and colleagues in 2007 in the paper titled "The clinical and microbiological effects of fixed orthodontic appliances on periodontal tissues in youngsters" (Ristic et al., 2007). The study was carried out on 32 youngsters (including 13 boys and 19 girls) who were undergoing orthodontic treatment for three years and found that treatment with fixed orthodontic appliances probably showed increase in periodontal indices and stimulated the pathogenic bacteria of periodontium in youngsters, but does not leave long term destruction on deep periodontal tissues (Janson et al., 1998). In our study in which patients received six months of treatment, symptoms of periodontal disease were evident within this time period. The number of samples in the study by Rustic et al. (2007) was not enough and hence the results lacked reliability to be generalized to a larger population. Our study considered persons with and without fixed appliances and the control group was similar to the experimental group in all aspects to ensure that no other variable influenced the incidence of periodontal problems during fixed orthodontic treatment. In 2005, Turkkahraman and colleagues carried out a research to determine if the variations created in microbial flora produced consequent changes in periodontal status and enamel after bonding and to determine if two different techniques of arch wires left an impression on these variations or not (Turkkahraman et al., 2007). In this article, 21 cases were selected from patients undergoing fixed orthodontic treatment with mean age of 15.3 years (minimum 11.6 and maximum 25.7). In all samples, significant difference between total number of bacteria and *Streptococcus mutans* was observed. Significant correlation between anaerobic and aerobic lactobacillus involved in incidence of enamel demineralization and dental caries was also seen (Turkkahraman et al., 2005). The study of oral microbial flora resulted in demineralization and dental caries during orthodontic treatment and the measuring criteria such as

gingival index, etc. are reliable and standard laboratory conditions which are some of positive points of the project. Definitely, the sample size is small to generalize the research results to a larger population. The criteria to define good oral hygiene are not specific and the study period considered is insufficient and will reduce the validity of research results. Hence, in addition to an experimental group, it would be better to consider a group without appliance as a control one.

In 2007, a research was done by Gursoy and colleagues to study the role of nickel in fixed appliances to create gingival hyperplasia; in this research, nickel concentration in gingival tissue with normal morphology and with overgrowth, histology and proliferative response of epithelial cells to different concentrations of nickel were analyzed. This research was performed on 10 patients with a mean age of 15.4 years.

Significant difference was not seen between nickel concentration in gingival tissue of experimental sample and control individuals, but histopathologic analysis showed significant increase in proliferation of epithelial cells in response to low doses of nickel and therefore, it is probable that continuous release of low doses of nickel on epithelium is the starter factor in gingival hyperplasia that is created during orthodontic treatment (Gursoy et al., 2007). The objective of this research was to study the role of nickel in fixed orthodontic appliances as starter factor for gingival hyperplasia during orthodontic treatment. The number of samples is insufficient and the study has not considered a specific and common time for patients under treatment to include samples in the research. Gingival samples without overgrowth have been selected from patients undergoing orthodontic treatment who are in contact with nickel, whereas, it would be better to select from individuals without fixed orthodontic appliance. Finally, it should be noticed that most performed researches, have been looking for histopathologic reasons for variations of periodontal status in patients under orthodontic treatment. Most studies have been performed using cross sectional method and have not considered matched control groups. In our study, to overcome these shortcomings, we used more samples together with a matched control group. Fixed orthodontic appliances make oral hygiene difficult for patients, thereby inducing periodontal problems in these patients. Approximately, all patients under treatment have shown some degree of gingivitis including gingival recession, gingival bleeding and gingival hyperplasia, and the absence of these symptoms in the control group shows the role of fixed appliances (wires and brackets) in the incidence of these symptoms. The results emphasize the need to educate patients undergoing fixed orthodontic treatment on how to control and maintain oral hygiene and to have frequent examination of gingival condition by a periodontist, and if severe problems are observed, necessary steps to improve oral hygiene have to be taken to remove potential

causes and prevent possible progress of the periodontal problem.

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