Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2018;9:1:149-153.

Comparative Evaluation of Prevalence of White Spot Lesions Between Labial and Lingual Fixed Orthodontic Appliances

Muhasin Essa[1*] Balakrishna Shetty[2] Goutham Reddy[3] Sunil Muddaiah[4] Sanju Somaiah[5] Justin Jolly[6]

[1]PG Student, Department of Orthodontics and Dentofacial Orthopaedics, Coorg Institute of Dental Sciences, Coorg, Karnataka, India.
[2]Professor, Department of Orthodontics and Dentofacial Orthopaedics, Coorg Institute of Dental Sciences, Coorg, Karnataka, India.
[3]Professor & Head, Department of Orthodontics and Dentofacial Orthopaedics, Coorg Institute of Dental Sciences, Coorg, Karnataka, India.
[4]Dean & Professor, Department of Orthodontics and Dentofacial Orthopaedics, Coorg Institute of Dental Sciences, Coorg, Karnataka, India.
[5]Professor, Department of Orthodontics and Dentofacial Orthopaedics, Coorg Institute of Dental Sciences, Coorg, Karnataka, India.
[6]PG Student, Department of Orthodontics and Dentofacial Orthopaedics, Coorg Institute of Dental Sciences, Coorg, Karnataka, India.

ABSTRACT

Background: Fixed orthodontic appliances are associated with increased risk of white spot lesions following debonding. The objective of this study was to validate the relationship between the brackets being used on the prevalence of white spot lesions.

Materials and Methods: The sample size comprised of 16 subjects (age 15-35years) divided equally into 2 groups. Immediately after debonding, pumicing for a few seconds and drying with a stream of compressed air for 10-20 seconds the carious state of the vestibular enamel of incisors, canines, premolars and first molars in both jaws were recorded under direct illumination from a dental lamp. A modification of the scoring system proposed by Gorlick et al (1982) was used for assessment of the extension of carious white spots. The number of teeth with carious white spots regardless of localization, opacity and extension, was calculated for each person. Chi-square test was used to determine any statistically significant differences among the groups in distribution of patients with teeth affected by carious white spots.

Results: Both the appliances showed prevalence of white spots at the time of debonding with least number of lesions in the lingual appliances. Molars were the most affected teeth with WSLs in both the groups, with more severe lesions among mandibular (MBT) arches.

Conclusion: Thus, it was concluded from the present study that WSL incidences in both maxillary and mandibular arches in subjects treated with the lingual STB appliance were distinctly reduced compared with enamel decalcification after conventional labial MBT treatment.

Keywords: WSL, MBT, Lingual STB.

INTRODUCTION

Dental caries starts on an enamel surface when there is a shift in equilibrium between demineralization and remineralization. The formation of incipient caries, commonly called white spot lesions (WSLs) is an unaesthetic, common side effect of orthodontic treatment with fixed appliances. White spot lesion is defined as sub-surface enamel porosity from carious demineralization that presents itself as milky-white opacity when located on smooth surfaces. White spot lesions have been termed as the most important iatrogenic effects of orthodontic fixed appliance therapy. The number of plaque retention sites increases because of banding and bonding of orthodontic appliances to teeth, due to which oral

Received: Sept. 14, 2018: **Accepted**: Oct. 26, 2018
***Correspondence Dr. Muhasin Essa.**
Department of Orthodontics and Dentofacial Orthopaedics, Coorg Institute of Dental Sciences, Coorg, Karnataka, India.
Email: Not Disclosed

pISSN 2278-0076
eISSN 2321-9270

hygiene becomes more difficult to carry out. The reduced pH of plaque surrounding orthodontic bands causes hindrance in the remineralization process of enamel and thus decalcification takes place. Thus, the presence of white spots is caused by changes in the optical properties of the enamel due to subsurface demineralization.[1]

Carious decalcification occurs when the pH drops below the threshold for remineralization and creates an alteration in the appearance of the enamel surface which is visualized as WSL, which can be clinically noticed within 4 weeks. WSL makes the affected area softer than the surrounding sound enamel, making the tooth more prone to caries. Fast developing white spots may demineralize almost completely within a few weeks of the removal of the cariogenic challenge. However, lesions that develop slowly take a longer period to remineralize. Preexisting white demineralization may be present in orthodontic patients, but not all white lesions are carious or are demineralization-related lesions.[2]

Micro-leakage around orthodontic brackets can be another cause for the formation of WSL. The teeth expand and contract when they are heated and cooled by the ingestion of hot or cold foods. The linear thermal coefficient of expansion of enamel, ceramic/ metal brackets and the adhesive systems do not match. This repeated expansion and contraction at different coefficients results in fluids being sucked in and pushed out at the margins of the brackets. Metal brackets contract and expand more than ceramic brackets, enamel , or the adhesive systems, producing micro gaps between the bracket and the adhesive system causing leakage of oral fluids and bacteria beneath the brackets, leading to the formation of WSL. Despite the general tendency of WSL surfaces to remineralize and harden after debonding, the esthetic aspect in maxillary anterior teeth affected by WSLs and decalcifications remains highly problematic.[3] Tufekci et al. concluded in his clinical study that a sharp increase in the number of WSLs occurred during the first 6 months of treatment and continued to rise at a slower rate to 12 months, thus in the initial months of the treatment critical evaluation of oral hygiene is recommended.[10]

AIMS AND OBJECTIVES

The present study was conducted with the following aims and objectives:

1. To evaluate the prevalence of white spot lesions following fixed labial appliances.
2. To evaluate the prevalence of white spot lesions following fixed lingual appliances.
3. To compare the prevalence of white spot lesions between labial and lingual appliances.
4. To draw the clinical inferences from the above.

MATERIALS AND METHODS

Source of data

The subjects were selected from patients reporting to the Department of Orthodontics and Dentofacial Orthopedics, Coorg Institute of Dental Sciences, seeking fixed orthodontic treatment.

Method of collection of data

The study sample included sixteen patients who underwent fixed orthodontic treatment for a period of approximately 2 years. They were divided into two groups; each group consisted of 8 patients. Group A: Patients who were treated using conventional MBT brackets. Group B: Patients who were treated using lingual STB appliance.

Inclusion criteria:

1. Patients who had received orthodontic treatment for a period of approximately 2 years
2. Male and female patients between the age group of 15 and 35 years.

Exclusion criteria:

1. Facial restorations on the crowns of teeth being evaluated.
2. Patients residing in areas where water is fluoridated.
3. Patients with previous history of fixed orthodontic treatment.
4. Patients with gingival inflammation.
5. Patients with periodontal diseases.

Procedure

Immediately after debonding, pumicing for a few seconds and drying with a stream of compressed air

for 10-20 seconds the carious state of the vestibular enamel of incisors, canines, premolars and first molars in both jaws were recorded under direct illumination. A modification of the scoring system proposed by Gorlick et al (1982)[6] was used for assessment of the extension of carious white spots. The criteria followed were:

Score 0: No white spot lesion.

Score 1: White spot lesions involving less than one third of the vestibular enamel surface area outside the area covered by bracket and bonding material during treatment.

Score 2: White spot lesions involving more than one third but less than two thirds of the vestibular enamel surface area in question.

Score 3: White spot lesions involving more than two thirds of the vestibular enamel surface area in question.

Scorings were performed on mesial, distal, gingival and incisal aspects of each vestibular tooth surface.

The subjects underwent a professional teeth cleaning prior to start of treatment, i.e. on their first appointment. No professional cleaning was carried out during the duration of the study and oral hygiene instructions were imparted to the subjects at each appointment. The results were statistically determined using SPSS (version 20.0) software.

RESULTS

In the present study, it was seen that there was a considerable increase of WSLs with fixed MBT brackets than lingual STB appliance. This can be attributed to the fact that the lingual STB appliances accumulate lesser amount of plaque because of the larger size of brackets. MBT brackets had a higher incidence of white spots probably due to the presence of elastomeric modules which cause more adhesion of biofilm and plaque.

Of the 16 central incisors compared among the labial maxillary group (Fig 1), seven teeth showed no evidence of WSL and nine teeth (56.3%) showed white spot lesions. Among the lateral incisors examined, majority has scored 1 (50%). Canines showed more number of WSLs (62.6%) compared to first premolars. Least number of WSLs was found on maxillary second premolars (75%) whereas only one tooth showed absence of white spots in molars. The remaining teeth showed equal distribution of score 1 and 2 contributing the most number of teeth in the maxillary region to exhibit WSLs.

In the mandibular labial arch, all the molars showed white spot lesions with a maximum score of 3 in five out sixteen teeth (31.3%). Canines showed less severity of WSL (43.8%). Both the first and second premolars showed equal distribution of score 1, but first premolar were less severe. 68.8% of the central incisors showed score 1 and lateral incisors showed slight increase in WSL compared to central incisors (Fig 2).

Lingual appliances in the maxillary arch showed 93.7% of molars with WSLs, out of which two teeth showed score 3 (lesions involving more than two third surface), contributing to the most affected (Fig 3). 37.5% of the central incisors exhibited white spot lesions with least score of 1. Both the lateral incisors and second premolars had equal distribution of presence and absence of white spot lesions. Canines and first premolars were almost equally affected with score 0 percentage of 62.5 and 68.8 respectively.

All teeth in the mandibular arch (lingual appliance) showed slight increase in prevalence of WSLs compared to maxillary arch (Fig 4). Distribution of lesions was more in molars (87.5%), followed by second premolars. Canines and first premolars showed equal amount of WSLs among all the teeth. Although central and lateral incisors showed similar scores, laterals were slightly more affected (50%).

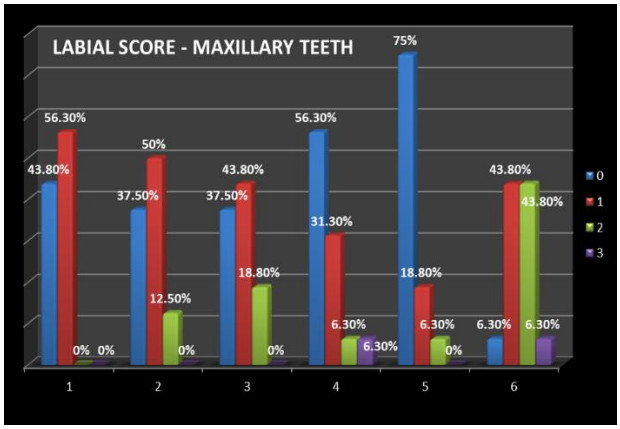

Fig 1: Illustrates the WSL scores following MBT brackets in maxilla.

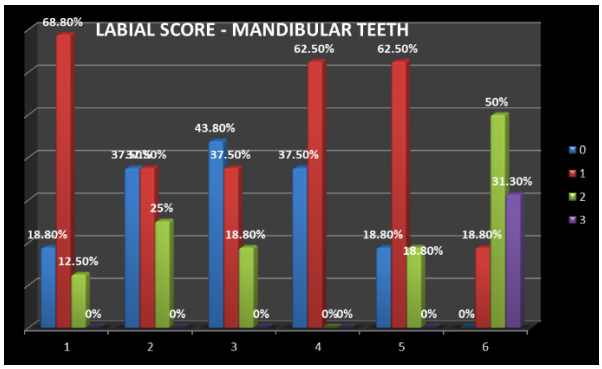

Fig 2: Illustrates the WSL scores following MBT brackets in mandible

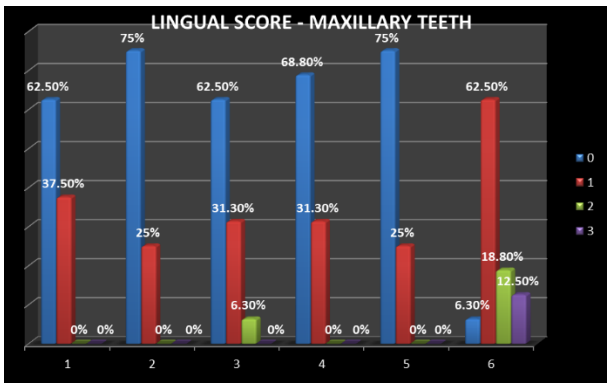

Fig 3: Illustrates the WSL scores following Lingual STB appliance in maxilla.

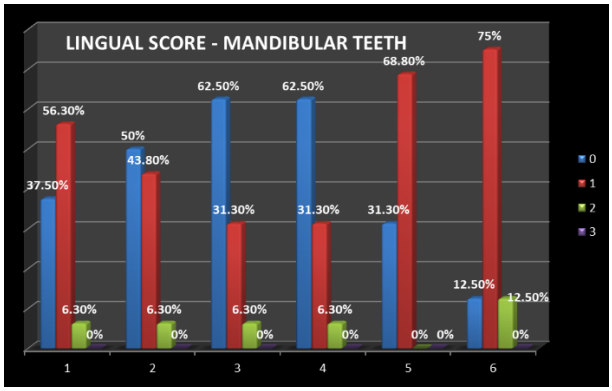

Fig 4: Illustrates the WSL scores following Lingual STB appliance in mandible.

DISCUSSION

In a healthy oral cavity, the microorganisms coexist in a balanced state with their host. When changes occur in normal oral environment, the balanced flora alters. The introduction of orthodontic brackets is one such change. The brackets and ligatures have a negative effect on natural cleaning by creating retention areas for plaques, making the mechanical cleaning of the teeth and gingiva by the tongue and lips more difficult and increasing the viscosity of the saliva.

Fig 5: Post debonding following Labial MBT appliance (Frontal).

Fig 6: Post debonding following Lingual STB appliance (Lower).

In the conventional brackets, the elastomeric rings gives a retentive area for growing of the microcrystalline deposits which are mainly composed of potassium, sodium, chlorine, phosphorus and sulphur. The development of these deposits is associated with growth of crystal which helps in biofilm formation, leading to formation of plaque, and resulting in more number of associations of microorganisms.

Since the advent of lingual orthodontic appliances in the 1970s, the recent years have witnessed a marked increase in the demand for lingual orthodontic appliances among orthodontic patients seeking esthetic improvement. ‘‘Invisible’’ orthodontic treatment can be provided by using fixed lingual bracket systems. Several seminal studies indicated that lingual appliances can provide treatment outcomes comparable to those achieved with labial appliances. Lingual orthodontic appliances enjoy esthetic advantages over

conventional labial orthodontic however the bacterial adhesion is considered the same.[10]

In lingual STB appliances, the association of white spot lesions was lesser compared to conventional MBT brackets. Also the lingual brackets showed a decreased risk of cavitation. These brackets can be considered because of its lesser risk of deterioration of enamel when esthetics is preferred. When MBT brackets are being used special care should be taken by the operator to provide proper oral hygiene instructions to the patient and professional cleaning can be advised to the patient during treatment. The formation of WSLs can ultimately lead to caries and related esthetics thus compromising the long-term oral health of orthodontic patients.

CONCLUSION

Prevention of fixed orthodontic appliances induced enamel demineralization and incipient caries is still a critical issue in orthodontics. Based on our findings and their comparisons, the following conclusions were drawn.

1. WSL incidences in both maxillary and mandibular arches in subjects treated with the lingual STB appliance were distinctly reduced compared with enamel decalcification after conventional labial MBT treatment.

2. In addition, severities of the lesions were also reduced among lingual appliances compared to labial appliances.

3. Orthodontic treatment with customized lingual fixed appliances can significantly reduce incipient caries lesions.

4. Lingual WSLs do not compromise smile esthetics.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Derrick Willmot. White spot lesions after orthodontic treatment. Seminars in Orthodontics 2008; 14:209-219.

2. Jon Artun and Bjorn O. Brobakken. Prevalence of carious white spots after orthodontic treatment with multibonded appliances. European Journal of Orthodontics 1986;8:229-234.

3. Dirk Wiechmann, Elisabeth Klang,Hans-Joachim Helms,and Michael Knosel.Lingual appliances reduce the incidence of white spot lesions during orthodontic multibracket treatment.Am J Orthod Dentofacial Orthop 2015;148:414-22.

4. Josua A.Chapman,W.Eugene Roberts,George J.Eckert,Katherine S. Kula, and Carlos Gonzalez-Cabezas.Risk factors for incidence and severity of white spot lesions during treatment with fixed orthodontic appliances.Am J Orthod Dentofacial Orthop 2010;138:188-94.

5. Van der Veen MH, Attin R et al.Caries outcomes after orthodontic treatment with fixed appliances:do lingual brackets make a difference?.European Journal of Oral Science 2010;118:298-303.

6. Leonard Gorelick, Arnold M. Geiger, and A. John Gwinett. Incidence of white spot formation after bonding and banding. Am J Orthod Dentofacial Orthop 1982; 81:93-98.

7. Jon Artun.A post treatment evaluation of multibonded lingual appliances in orthodontics.European journal of Orthodontics 1987; 9:204-210.

8. Eliakim Mizrahi.Surface distribution of enamel opacities following orthodontic treatment.Am J Orthod Dentofacial Orthop 1983; 84:323-331.

9. Lombardo L, ztürk Y,et al .Changes in the oral environment after placement of lingual and labial orthodontic appliances.Progress in Orthodontics 2013, 14:28.

10. Demling A, Demling C, Schwestka-Polly R, Stiesch M, Heuer W. Short-term influence of lingual orthodontic therapy on microbial parameters and periodontal status: a preliminary study. Angle Orthodontist. 2010 May; 80(3):480-4.