# Evaluation Of Changes In The Oral Environment With Lingual Orthodontic Appliances

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**Abstracts:** Background & Objective**:** Lingual orthodontics is gaining more popularity in orthodontic centers. The purpose of present study is to evaluate changes in the oral cavity with lingual orthodontic appliances. Methodology: The epidemiological study was conducted among 45 patients with lingual orthodontics. Before the start of orthodontic treatment all the patients received proper oral prophylaxis. The incidence of White Spot Lesions (WSLs), plaque accumulation and gingivitis were evaluated at the interval of one, six and twelve months using WSL index developed by Gorelick et al., (1982), Silness & Löe plaque index and Löe & Silness gingival index respectively. The Student's t test and ANOVA test were used with a significance level of 5%. Results: The frequency of WSLs increased with the procedure of lingual orthodontics from first month (3.2%) to six (6.7%) and twelve months (7.9%). A significant increase in the plaque index (PI) and gingival index (GI) was observed from month one to twelve months. Overall mean of PI and GI was 2.07±0.809 and 1.67±0.929 respectively among the patients. Conclusion: The occurrence of dental plaque and gingival inflammation was mostly noticed in lingual orthodontic cases as it is difficult to remove the plaque deposits around the brackets in the lingual side. [Singh K NJIRM 2015; 6(6):74-78]

**Key Words**: Dental plaque, Gingival inflammation, Lingual orthodontics, White spot lesions

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**Introduction:** Orthodontic treatment of malocclusions & craniofacial abnormalities, improves mastication, phonation, and facial aesthetics by ensuring appropriate alignment of dentition, occlusal and jaw relationship.[1]

Along with the advantages of braces, it also leads to many complications faced by the patients such as pain, food accumulation under brackets that ultimately results in gingivitis and periodontal diseases.[2, 3]

Orthodontic treatment raises the level of plaque on teeth surfaces and microorganisms causing caries are also raised in the oral cavity which lowers the pH of the preserved plaque on the teeth surface adjacent to orthodontic appliances delaying remineralization and ultimately leads to decalcification of tooth. [4] Researchers have also mentioned the prevalence of white spot lesions (WSLs) among orthodontic patients ranged from 0 to 97% in their data.[5-7]

Due to increasing concerns of esthetics among young patients during treatment, the indication for lingual orthodontics nowadays is extended to the adolescents and studies have also reported reduction in the enamel decalcification with lingual appliances.[8]

In the literature, there are numerous studies showing effects of labial orthodontic treatment on oral health, but only limited research has been done considering for the same with fixed lingual orthodontic appliances.[9-10]This study is conducted to evaluate the changes in the oral cavity with the placement of lingual orthodontic appliances.

**Material and Methods:** A total of 45 patients participated in the study in a private orthodontic clinic in Jammu, India during January 2014 to May 2015. Official permission was taken and a written informed consent was obtained from the participants.

Patients who had undergone comprehensive orthodontic treatment with lingual appliance and who were lesser than 18 years of age, and had no WSL on the lingual surfaces of the front teeth were included in the study. Those who had atypical enamel formation or any restorations before the start of were excluded from the study.

Before the start of treatment, all the patients received complete oral prophylaxis treatment. The study subjects received the standard bonding protocol treatment. A supplementary layer of a dual cure single component enamel-dentin bonding agent, which contains fluoride, was applied prior to the application of maximum Cure on the upper & lower anterior teeth surfaces. This bonding agent was placed on all lingual surfaces of the anterior teeth (right canine to left canine). At every visit to the orthodontic center, all the participants were advised to maintain proper oral

hygiene using an orthodontic toothbrush, an interdental brush, and dental floss.

The incidence of WSLs, plaque accumulation and gingivitis were evaluated at the interval of one, six and twelve months. The WSL index developed by Gorelick et al., (1982) was used for visual evaluation of anterior teeth, premolars, and first molars in both maxilla and mandible.[11]

The plaque and gingival parameters were scored by Silness and Löe plaque index (Table 1), Löe and Silness gingival index (Table 2).For both indices, each tooth was probed on four sites; 3 sites on buccal surface and one on lingual surface. Buccally/ labially the surfaces were checked as mesio-buccally, disto-buccally and mid buccal surface. The scores around each tooth are totalled and divided by four to obtain index score of the tooth. Then totalling all of the scores per tooth and dividing by the number of teeth examined provides the index score per person for both indices.[12]

**Table 1: Showing Plaque index scores**

| Scores | Criteria |
|---|---|
| 0 | No plaque |
| 1 | Plaque seen only by running probe along the gingival margin |
| 2 | Moderate accumulation of visible plaque |
| 3 | Abundance of plaque |

**Table 2: Showing Gingival index scores**

| Scores | Criteria |
|---|---|
| 0 | Absence of inflammation |
| 1 | Mild inflammation, slight change in color and texture |
| 2 | Moderate inflammation and bleeding on probing |
| 3 | Severe inflammation with spontaneous bleeding |

Data analysis: The SPSS version 16.0 software (SPSS, Chicago, IL, USA) was used for analysis of data. Frequency, Mean and Standard Deviation was calculated. The Student's t test and ANOVA test were used with a significance level of 5% ($p < 0.05$) to obtain the mean values. Pearson correlation was also used at significance level of 0.01.

**Results:** The average age for all patients at the start of treatment was 14.0 years (range of 11.7 - 17.1 years). Table 3 shows that mean value of White Spot Lesions (WSLs) was more among female participants where as the mean score of plaque and gingival index was higher in males. The frequency of WSLs increased with the procedure of lingual orthodontics from first month (3.2%) to six (6.7%) and twelve months (7.9%) as mentioned in Graph 1.

**Graph 1: Showing severity of White spot lesions (WSLs)**

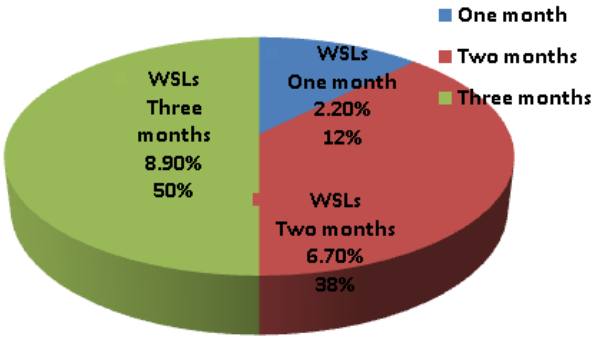


**Table 3: Mean difference in different parameters according to gender**

| | Gender | No | Mean | SD | Sig. |
|---|---|---|---|---|---|
| **WSLs** | Male | 25 | .16 | .500 | .500 |
| | Female | 20 | .20 | .444 | |
| **Plaque index** | Male | 25 | 2.16 | .850 | .496 |
| | Female | 20 | 1.95 | .759 | |
| **Gingival index** | Male | 25 | 2.00 | .866 | .703 |
| | Female | 20 | 1.25 | .851 | |

The present study showed the problems faced by study participants with lingual orthodontic appliances. A significant increase in the plaque index (PI) and gingival index (GI) was observed from month one to twelve months. Overall mean of PI and GI was 2.07±0.809 and 1.67±0.929 respectively among the patients (Table 4).

Table 5 showed a positive linear correlation of Plaque index and gingival index with duration of treatment but at the same time scores of White spot lesions were not showing any significant correlation with lingual orthodontics.

**Table 4: Mean difference in different parameters according to duration of therapy**

| | Duration | No | Mean | SD | f-value | Sig. |
|---|---|---|---|---|---|---|
| **WSLs** | One month | 19 | .05 | .419 | 1.929 | 0.158 |
| | Six months | 13 | .23 | .519 | | |
| | Twelve months | 13 | .31 | .506 | | |
| | Total | 45 | .33 | .477 | 11.546 | 0.000 |
| **Plaque index** | One month | 19 | 1.53 | .697 | | |
| | Six months | 13 | 2.31 | .630 | | |
| | Twelve months | 13 | 2.62 | .650 | | |
| | Total | 45 | 2.07 | .809 | | |
| **Gingi-val index** | One month | 19 | 1.16 | .765 | 6.383 | 0.004 |
| | Six months | 13 | 1.92 | .494 | | |
| | Twelve months | 13 | 2.15 | 1.144 | | |
| | Total | 45 | 1.67 | .929 | | |

SD: Standard Deviation

**Table 5: Showing correlation of duration of treatment with different parameters**

| | Duration | Plaque index | Gingival index | WSLs |
|---|---|---|---|---|
| Pearson Correlation | 1 | .580(**) | .465(**) | .214(*) |
| Sig. (2-tailed) | | .000 | .001 | .158 |

** Correlation is significant at the 0.01 level (2-tailed).

**Discussion:** The present study showed problems like white spot lesions, accumulation of plaque, gingivitis associated with lingual appliances. The intraoral site of biomaterials has an influence on in situ biofilm formation, in lingual sites.[10]Effects of lingual brackets structure on clinical subgingival plaque is a major aetiological factor in the beginning, progression and recurrence of periodontal disease.[13]

In present study, it was observed that amount of plaque and gingival inflammation significantly increased with time. Similarly Lombardo et al., discovered a statistically significant raise in plaque index score ($p < 0.05$) and gingival bleeding index scores ($p < 0.05$) in the group of patients treated with lingual appliance.[14]

In other longitudinal studies, measuring pocket depth in group of patients after 6 & 12 months of time is not reliable, if the patient is not maintaining oral hygiene properly. Studies suggested that presence of fixed appliances especially on lingual side with banded molars influences the inflammation which is obviously evident with increase in gingivitis.[15] Demlinga et al., mentioned in a study that insertion of fixed lingual appliances persuades an increase of plaque accumulation and gingival inflammation. These changes in oral environment are mainly restricted to the bonding sites.[10]Sinclair et al., also mentioned about the elevation of plaque accumulation in patients wearing lingual brackets.[16]

The findings of this study were higher as compared to other studies with fixed orthodontics on labial surfaces.[17, 18]It could be explained by the fact that plaque deposits on the lingual gingival margins are more difficult to remove with normal oral hygiene measures as compared to labial side. Longer duration of lingual appliances causes bacterial accumulationin the gingiva and leads to gingival inflammation.[19]

According to many retrospective[20,21]and prospective studies[19,22]of the literature, wider lingual brackets cause a reduced interbracket distance and make oral hygiene procedures very difficult with consequent risk for plaque accumulation and gingivitis.[23]Yun-Wah Lau et al.,[24]found that fixed orthodontic appliances make oral hygiene difficult and cause plaque retention even for the most motivated patients, and almost all of them experience some degree of gingival inflammation. The present findings also showed that the lingual group demonstrates more difficulty in removing food and plaque deposits around the brackets, as confirmed by the literature.[19,22]

In the present study, the incidence of white spot lesions were less as compared to the recent data where 73-95% of WSLs were observed with fixed orthodontic appliances on labial side.[25,26]Even the degree of severity of WSLs was less in comparison to Akin et al study showing that 35% of patients had mild WSLs, and the remaining WSLs were severely affected, either with severe WSL (25%) or with cavitation

(5%).[27]It might also be due to the application of supplementary layer of a dual cure single component enamel-dentin bonding agent, which contains fluoride. Van der Veen et al., in a randomized split-mouth trial, observed incidence of white spot lesions on labial brackets, to be five times more than on the lingual surfaces with lingual appliances.[6]

**Conclusion:** The incidence of plaque accumulation and gingival inflammation was comparatively more with lingual orthodontic appliances and it showed a significant increase with duration of treatment. However the occurrence of WSLs was less in case of patients with lingual appliances due to the effect of supplementary layer of a dual cure single bonding agent having fluoride in it.

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