



## Oral Discomfort And Impaired Oral Function In The Fixed Lingual Orthodontic Treatment

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### Abstract

**Introduction:** Aesthetic consideration has become an important component for patients to decide the use of fixed orthodontic appliance, one of which is the fixed lingual orthodontic appliance. However, there are still many complaints about the discomfort felt by the patient that affects their compliance to the treatment. This paper aims to deliver the knowledge regarding oral discomfort and impaired oral function in the fixed lingual orthodontic treatment to be used as operator and patient education material. **Materials and Methods:** "lingual braces" was the sole keyword used in three journal databases (Google Scholar, ScienceDirect, and PubMed) resulted in 11 journals that was used in this paper. **Results:** complaints were mostly about speech disturbance (6 journals), discomfort on the tongue (5 journals), pain (1 journal), difficulty in cleaning the oral cavity (4 journals), difficulty in chewing and dietary changes (3 journals), and caries (2 journals). **Discussion:** discomfort arising during treatment was largely associated with the reduced space which was occupied by the tongue at rest. This resulted in the continuous contraction of the tongue muscles. The contraction increases discomfort and resulted in impaired oral functions such as speech and chewing. The use of bracket that is closer to the surface of the teeth can reduce complaints. **Conclusion:** the lingual orthodontic bracket position and type of the system used in the treatment affects the patient's comfort. Most of the discomfort appeared in the first 3 months of treatment and decreased with time.

Keywords: Fixed orthodontic appliance, Lingual braces, Oral discomfort

### Introduction

The orthodontic appliance is needed not only for functional purposes, such as improvement of oral function, improvement of periodontal tissue, preprosthetic therapy but also for esthetic reasons. Esthetic consideration have become one of principal component for patient to use fixed orthodontic appliances. For some adult patients, the aesthetic aspect is a necessity related to work and social status. Hence, it is not surprising that many patients are choosing transparent retainers or fixed lingual orthodontics for malocclusion<sup>1</sup>.

Modern fixed lingual orthodontic appliances were developed in the 1970s by Dr. Kinja Fujita. These appliances developed as an alternative for martial arts practitioners seeking orthodontic treatment. It is stated that this appliance can protect the hard and soft tissues of the oral cavity from the impact that may arise during this martial arts training. Fujita's fixed lingual orthodontic appliance started available on the market in 1978<sup>2</sup>.



In America, Dr. Craven Kurz made a plastic bracket attached to the lingual part of the patient's tooth, especially for those who worked in entertainment. Unfortunately, there were still many failures related to the bonding mechanism and the discomfort felt by patients. Currently, fixed lingual orthodontics are available from various manufacturers such as ORMCO (Alias® System), Dentsply (In-Ovation® L), American Orthodontics (Harmony®), and 3M (Incognito® System)<sup>2</sup>.

Recently the use of fixed lingual orthodontic appliances is increasing as an economical alternative to aesthetic orthodontic treatments. Nevertheless, orthodontic treatment certainly has some side effects on the patient, such as pain, speech impairment, mastication difficulties, and social problems. Patients need to get clear notification of the types of side effects that can arise during treatment<sup>5</sup>. Therefore, this paper aimed to provide an overview of the discomfort and oral dysfunction that may arise during treatment with lingual orthodontic appliances.

### Methods

This is a literature review with systematic review method. "Lingual braces" was included as key word in journal database such as Sciencedirect ([www.sciencedirect.com](http://www.sciencedirect.com)), Google Scholar ([scholar.google.co.id](http://scholar.google.co.id)), and NCBI ([ncbi.nlm.nih.gov](http://ncbi.nlm.nih.gov)) and yielding 528 studies. Furthermore, it used 15 years period to select these journals, and the results were 390 journals. From the result, only clinical studies, case reports, and literature reviews related to the side effect of treatment using lingual orthodontic appliances were included. The total number of journals used is 11 journals.

### Results

Hohoff (2003) conducted investigation on 23 patients treated with lingual orthodontic appliance. Objective acoustic evaluation was carried out using digital sonography by 10 speech experts, semi-objective evaluation was carried out by people close to the subject, and subjective evaluation by the subject himself. The measurement was taken before treatment, 24 hours after, and three months later. Speech difficulties were felt 24 hours after insertion and reduced in the subsequent evaluation. Subjects with BEST (Bonding With-Equalized-Specific-Thickness) insertion method were facing more difficulties compared with subjects with TOP (transfer optimized positioning) method<sup>6</sup>.



Caniklioglu (2005) reported their study involving 30 participants who were asked to fill a questionnaire regarding oral health status post-insertion. It was found that speech impairment and inflammation on the tongue were highest in the lingual orthodontic appliance group. About 76.7% of subjects in the lingual orthodontic appliance group are facing difficulty in cleansing the food. All problems resolved in 1 month, except speech disorder. Only 10% of subjects still reported it after three months.

Wiechmann (2008) investigated 21 female patients with an average of 24.8 years old who were asked to fill a questionnaire one day before and after insertion of lingual orthodontic appliance, regarding lesion on the tongue, change in tongue position, difficulty swallowing, and any tendency of avoiding conversation. Malocclusion was assessed by experienced orthodontists regardless of the results of the questionnaire. There is a relationship between the severity of the malocclusion and the discomfort. Patients with an SNB of less than 1 SD will experience more severe tongue space narrowing<sup>8</sup>.

Demling et al., (2009) stated that the use of fixed orthodontic appliances can cause an increase in oral biofilms, causing inflammation in the periodontal tissue. They used longitudinal analysis on ten adult patients, and assessed clinical parameters post insertion of the lingual bracket. The parameters are bleeding on probing (BOP), plaque index (PI), and pocket depth before insertion and 3 months after treatment. Clinical parameters showed significant results on the teeth with lingual bracket<sup>9</sup>.

Wu et al., (2009) compared pain experiences in Chinese adult patients who were treated using labial and lingual orthodontic appliances. Sixty patients were divided into two groups and assessed with a visual analog scale (VAS) in the first week, after one month, and three months post-insertion. There were no significant differences in pain in general. However, patients using fixed lingual orthodontics tend to feel pain on the tongue, whereas those who used fixed labial orthodontics tend to feel pain in the cheeks and lips<sup>10</sup>.

Van der Veen (2010) reported the formation of white spot lesions in patients using lingual orthodontics using the split-mouth technique (one buccal jaw, one lingual jaw) with a quantitative light-induced fluorescence (QLF) test. It was found that there were more lesions in buccal than labial orthodontic appliance users (4.8 times) and QLF results showed 10.6x fluorescence loss in lingual orthodontic appliance users<sup>11</sup>.

Wu (2011) conducted a study on 30 patients treated with a labial orthodontic appliance and 30 treated with a lingual orthodontic appliance. The mean patient age was 21.6 years with



a male: female ratio of 2: 1. The assessment included discomfort, chewing disturbances, speech disorders, social functioning disorders, and treatment satisfaction, with intervals of 1 week, 1 month, and 3 months. The complaints reported were changes in tongue position, reduced tongue space, changes in eating patterns, impaired ingestion, conscious speech disorders, speech disorders reported by others, avoidance of conversation, avoidance of eating out, and other activity disorders, all of which diminish over time<sup>12</sup>.

According to Khattab et al. (2013), a fixed lingual orthodontic appliance is more problematic than a fixed labial orthodontic appliance, especially articulation when speaking. A total of 34 patients with class I type 1 malocclusion of the maxilla were randomly divided into two groups, i.e. lingual and labial fixed orthodontic appliance. Speech ability was assessed using a spectrographic analysis of fricative. Difficulty in articulation occurred significantly after one month of lingual bracket placement. Also, irritation of the soft tissues and chewing difficulty 24 hours after bracket placement were significantly higher in lingual bracket users<sup>13</sup>.

Lombardo et al. (2013) compared oral hygiene and caries risk in patients using fixed labial and lingual orthodontics before bracket placement (T0), 4 weeks after bonding (T1), and 8 weeks after bonding (T3). This study was conducted on 20 patients aged 19 to 23 years who were divided into two groups, namely 10 patients using fixed labial orthodontics and 10 users of fixed lingual orthodontics. The results showed a significant value on the gingival bleeding index (GBI) of fixed orthodontic appliance users on T0 and T2, as well as the plaque index on T0 and T2 for fixed orthodontic appliance users. Also, the number of *S. mutans* in saliva among users of fixed lingual orthodontics increased significantly between T0 and T2. The difference in the number of *S. mutans* and *Lactobacillus sp.* in saliva among users of fixed orthodontic devices was not statistically significant, as well as the salivary flow rate and buffer capacity of the saliva in all intervals<sup>14</sup>.

Long et al. (2013) compared the side effects between the use of fixed and labial fixed orthodontic devices using a systematic review of the literature in articles published between January 1980 and December 2012. The results showed that patients using fixed lingual orthodontics felt more pain on the tongue and less pain in the cheeks and lips. However, the high difficulty in speaking is felt in patients who use fixed orthodontics. Feeding difficulties, oral hygiene, caries, and duration of treatment were not comparable in this paper<sup>15</sup>.

Ata-ali (2016) reported a literature study with a systemic review comparing research on pain, caries, eating disorders, speech disorders, and oral hygiene in users of lingual orthodontic



appliances. Eight articles were used in the study, five of them discussed pain and speech disorders, two discussed caries, three discussed oral hygiene. The most common complaints were pain, speech problems, and decreased oral hygiene. The fewest complaints found were caries and eating disorders<sup>16</sup>.

### Discussions

Six journals report speech disorders in users of lingual orthodontics appliance. Tongue discomfort was measured in 5 journals. Only 1 journal discusses the pain. The research subjects complained about difficulties in cleaning the oral cavity, especially in the lingual area. Three journals reported chewing difficulties and dietary changes were found in 3 journals. Caries and white spot lesions are mentioned in 2 journals<sup>7-12</sup>.

Speech disorders in users of lingual orthodontic appliances can be caused by alteration of tongue position while functioning. The most frequent disruption was found when the patient pronounced the letter / s /. Under normal conditions, the letter is pronounced by placing the tip of the tongue against the lingual incisors of the lower jaw and then exhaling. Lingual orthodontic appliance can hinder the process of forming this voice.

Patient discomfort was also caused by the reduction of the tongue-space in the resting position. The presence of a lingual orthodontic appliance reduces the tongue-space in a resting position. This affects the continuous contraction of the tongue muscles. However, the discomfort does not cause pain to the patient. Only one journal shows there is pain on lingual orthodontic users<sup>8,16</sup>.

Lingual orthodontic appliance users may encounter difficulty in cleaning the oral cavity. A limited visual view of an orthodontic appliance and a different way of brushing your teeth can increase the risk of plaque buildup. Complaints related to this include the formation of biofilms, an increase in the number of oral bacteria, and bleeding on probing during periodontal examinations<sup>9,14</sup>.

The decrease in OHI in some patients did not correlate with the incidence of caries. Fixed orthodontic appliances may lead to the formation of caries on the labial surface after the end of the treatment, which greatly affects the aesthetic appearance of the patient. The use of traditional fixed orthodontic appliance does not completely relieve the patient from resulting caries. However, the prevalence of caries and the possibility of caries in the facial part of the



teeth may be reduced, and increase the esthetic value of post-treatment with fixed orthodontic appliances<sup>11</sup>.

Mastication disorders in lingual orthodontic appliance users are caused by bite interference that makes chewing difficult and reduces food choice. It can be worsened if the patient is treated using a bite-plane or bite-block in open bite cases. A custom made lingual orthodontic appliance can reduce this distraction by placing it very close to the tooth<sup>13</sup>.

According to articles that have been studied, patients most often experienced complaints from the time after insertion to the first three months of treatment. Complaints decrease over time after the patient's body can adapt to the appliance.

### Conclusion

Research on fixed lingual orthodontic appliances has focused on several aspects such as oral discomfort, speech disturbances, oral hygiene index, chewing disorders, pain, and caries. Speech disorder is the most common complaint, followed by oral discomfort and decreased oral hygiene. Education to patients is needed before and during treatment about the side effects that may arise due to the use of lingual orthodontics to reduce existing complaints and increase the success of the treatment.

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