Comparison of Lingual And Buccal Orthodontic Therapy on Microbial Parameters And Periodontal Status

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DOI: 10.15520/jmbas.v7i1.175

Accepted 15/01/2019; Received 20/12/2018; Publish Online 17/01/2019

Reviewed By: Dr. Daniel V
Department: Reviewer, Journal of Medical Biomedical and Applied Sciences

ABSTRACT
Objective: To compare the periodontal condition and the microbiological status between the vestibular group (VG), lingual group (LG) and control group (CG).

Material and Methods: 18 patients (mean age: experimental group: 32 years old; control group: 25 years old): 6 treated with vestibular fixed appliance, 6 with lingual appliance and 6 subjects in the control group who did not receive orthodontic treatment. A periodontal exam was performed before placing braces (T0) and after 4 weeks (T1). The gingival index (GI), plaque index (PI), Bleeding on probing (BOP) and periodontal pocket depth (PPD) was evaluated. Through PCR was detected the presence or absence of Eikenellacorrodens (Ec), Fusobacterium nucleatum (Fn), Agregatibacter actinomycetemcomitans (Aa), Porphyromonas gingivalis (Pg), Tannerella forsythensis (Tf), Terponemadenticolla (Td), and Prevotella intermedia (Pi).

Results: It was found a significant increased in the plaque index and gingival index. No significant changes were found according to BOP and PPD. The microbiological results show significant differences between the control group and the experimental groups in Aa, Tf, Pi, Fn and a tendency to an increase of Pg, Td in both experimental groups.

Conclusions: There’s a direct relation between the placement of fixed appliance (vestibular and lingual) and the increase of plaque index and gingival index. Also, the growth of periodontopathogens in subgingival plaque is promoted.

Clinical Relevance: This study stresses the importance of monitoring orthodontic patients. Vestibular orthodontic appliance seems to be better than the lingual in terms of less worsening condition during time.

1 INTRODUCTION
The most important etiological factor in periodontal disease is the bacterial plaque. [1] The evolution of periodontal disease depends on bacteria-host interaction [2–12].

It is well established that the patients who undergo orthodontic treatment have a high susceptibility to present plaque accumulation on their teeth because of the presence of brackets, wires and/or other orthodontic elements on the teeth surfaces with which the oral hygiene procedures might be more difficult [13].

Clinical studies have indicated that orthodontic treatment may be associated with a decrease in periodontal health [2–9, 14, 15] whereas other studies indicate no long-term effect on the supporting tissues. Patient with fixed orthodontic appliances tend to exhibit signs of gingivitis and gingival enlargement with false pockets [2, 3, 9, 10, 16–18]. These changes are resolved when the appliances are removed [2, 3, 14, 16, 19, 20]. Other studies have demonstrated a slightly increased loss of periodontal attachment and alveolar bone in orthodontic patients [21, 22].

A recent systematic review selected 13 studies which analyse four periodontal pathogens, including Aggregatibacter actinomycetemcomitans (Aa), Porphyromonas gingivalis (Pg), Prevotella intermedia (Pi) and Tannerella forsythia (Tf) They concluded that the levels of subgingival pathogens presented temporary increased after orthodontic appliance placement, and appeared to return to pretreatment levels several months later [23].

Placement of orthodontic brackets influences the accumulation and composition of the supragingival and subgingival micro biota. New oral environmental condition might favor pathogenic microbiota [4, 10, 24–28]. Special hygiene care should be given to orthodontic patients to help prevent periodontal disease during active treatment [13, 29].
Comparison of lingual and buccal orthodontic therapy on microbial parameters and periodontal status

In the literature, there are numerous reports about the periodontal and microbial effects of labial orthodontic treatment, but only a limited research has been performed considering this question with respect to fixed lingual appliances [30-33].

Due to increasing esthetic demands of patients the indication of lingual orthodontic treatment it’s growing [34].

One of the characteristics of lingual appliances is the reduced distance between brackets and the proximity to the gingival margin. Previous studies showed that plaque control and demineralization were not detected by the patient [5, 17, 30, 31].

The purpose of the present study was to perform an analysis of the short-term influence of fixed lingual appliances in adult patients on the periodontal status and micro flora and compare it with buccal appliances.

2 MATERIAL

This prospective study was approved by the Ethics Committee of Universitat Internacional de Catalunya (CEIC nº F-17-APP-10). The examination was performed with the understanding and written consent of each subject.

The study included 30 patients consecutively selected from the “Clínica Universitària de la Universitat Internacional de Catalunya” and from the exclusive orthodontic office which was approved by the Ethics Committee of Universitat Internacional de Catalunya (CEIC nº F-17-APP-10).

The patients fulfilled the following inclusion criteria: older than 18 years old. No previous periodontal treatment.

The following exclusion criteria were defined: pregnancy, systemic illness, periodontal disease, prosthetic restorations, antibiotic therapy 3 months before the beginning of the study and during the study and no usage of anti-plaque and oral antiseptic solutions during the entire investigation.

The patients were divided in 3 groups. The experimental group (EG) comprised subjects who were to receive orthodontic treatment (4 man and 8 women). 6 were treated with lingual appliances and 6 with buccal appliances. The control group (CG) was composed of 6 patients who did not receive orthodontic treatment (5 man and 1 women).

3 METHODS

3.1 Periodontal analysis

The health of periodontal tissues was determined by using periodontal index.

3.1.1 Plaque index system

as described by Silness and Löe 1964, was carried out with eritrosin.

3.1.2 Gingival index

as described by Löe and Silness 1967.

3.2 Microbiological analysis

Subgingival microbial samples were taken from the teeth 4.6, 4.2, 3.2, 3.6.

The subgingival plaque sample were collected in dry field conditions by inserting three sterile paper points to the bottom of the periodontal sulcus and kept in place during 60 seconds. Before sampling, supragingival plaque was removed from the sample site with cotton rolls. After insertion, paper points were dropped into a vial and immediately transported to Origen Laboratory where evaluated the presence or absence of Eikenellacorrodens (Ec) Fusobacterium nucleatum (Fnu) Aggregatibacter actinomycetemcomitans (Aa) Porphyromonas gingivalis (Pg) Tannerella forsythensis (Tf) Treponemadenticolla (Td) Prevotellaintermedia (Pi). A polymerase chain reaction (PCR) method was used to determine the presence of bacterias.

The same examiner, who previously was calibrated, performed clinical examinations and microbiologic samplings in all the patients.

After clinical and microbiologic examinations, the patients received fixed orthodontic appliances.

Further oral hygiene instructions were given to the subjects. The instructions included how to perform and effective tooth cleaning with the orthodontic appliances.

Clinical examinations and microbiologic samplings were repeated in the same sites after 4 weeks placing orthodontic appliances.

3.3 Statistical analysis

Documentation and evaluation of the data were performed using Statgraphics Centurion®.

3.3.1 Intraoperator analysis

The reproducibility of the results obtained by the same operator was evaluated comparing the results of the control group in T0 and T1. A regression curve was performed in which the correlation coefficient was 1.

3.3.2 Comparison between groups

Two-way ANOVA was used to assess if there were differences between the three groups throughout the treatment.

3.3.3 Changes during treatment

A one-way ANOVA was used to study the progression of each group.

Journal of Medical Biomedical and Applied Sciences, Vol 7 Iss 1, 202–207 (2019)
4 RESULTS

Results of periodontal examination are shown in Figure 1.

![Figure 1](image)

**Figure 1.** Results of periodontal examination. Plaque index, gingival index, bleeding and probing pocket depth.

At baseline, the mean values were similar for all periodontal parameters and control sites. Four weeks after insertion of fixed appliances, gingival index and plaque index increased significantly at testing sites, whereas no changes of these parameters were found at control sites. Probing pocket depth and bleeding did not increase at test and control sites during the observation period.

Results of microbiological analysis are summarized in Figure 2.

![Figure 2](image)

**Figure 2.** Results of microbiological analysis. Eikenellacorrodens (Ec), Fusobacteriumnucleatum (Fn), Aggregatibacteractinomyctemcomitans (Aa), Porphyromonasgingivalis (Pg), Tannerella forsythia (Tf), Treponemadenticolla (Td) and Prevotellaintermedia (Pi).

5 DISCUSSION

The results of the present study have to be considered as data of a preliminary study, due to the size of the sample and short-term study.

In this study we compared the influence of lingual appliances with vestibular appliances on the periodontal and microbiological status because there aren’t any articles where compare both groups.

We selected periodontal index described by Silness and Löe because it is simple and reproducible [1].

The determination of periodontal parameters entails risk of interobserver differences. Therefore the same clinician examined all the patients.

Microbiological sample was carried out by the Socransky protocol [35]. The DNA techniques working with DNA of both live and dead pathogens are non-demanding methods in terms of sample collection and transport [36].

The mere presence of a specific microorganism does not mean that the patient has periodontal disease, but it depends on a complex bacteria-host interaction that modulates the host’s response leading to the inflammation and further loss of attachment [37]. However, if a slight inflammation is not controlled and plaque accumulation continues, this could have a detrimental impact on the patient’s periodontum.

The gingiva is healthy before the brackets were placed. This is important because several studies reported increased plaque accumulation in the presence of gingival inflammation. Standarized oral hygiene instructions were repeated and improved during every visit.

This clinical and microbiological study has shown that placement of orthodontic appliances will result in a increase
in the plaque index, gingival index and shifts in the micro-
bial composition of the subgingival plaque.

Results of periodontal examination showed a significant
difference of gingival index and plaque index and an in-
crease of bleeding and pocket probing depth but it wasn’t
significant. Several authors have reported deterioration
of the gingival conditions during orthodontic treatment with
fixed appliances.

These results are comparable with the study of Naranjo
who concluded that bracket placement influences the accu-
mulation of plaque and the colonization of important peri-
odontopathic and superinfecting bacteria, resulting in more
inflammation and bleeding [10].

The same results where found by Demling who demon-
strated that the insertion of fixed lingual appliances induces
an increase of plaque accumulation and gingival inflamma-
tion in the short term. These changes are restricted to bond-
ing sites [17].

In 2011 Sfondrini et al studied the short-term differences
of BOP, PPD and microbiological values between vestibular
and lingual fixed appliances. They didn’t found differences
between groups in terms of periodontal parameters [38].

Ristic observed clinical and microbiological changes and
they were dynamic, reaching the maximum values 3 months
after the beginning of fixed therapy. The decrease in all clin-
ical and microbiological parameters at 6 months of treat-
ment, without the removal of the brackets, could be ex-
plained by reestablishment of host–microorganisms balance.
These changes do not have a destructive effect on periodon-
tal tissues because of their transition and limitation during
time [9–19].

These results are similar to other long term studies [4,
13, 16].

On the other hand some studies have shown that in
presence of gingival inflammation during orthodontic tooth
movement augment alveolar crest resorption [21, 22]. The
orthodontic patients showed significantly more alveolar
bone loss. It’s important that in these studies patients didn’t
receive oral hygiene instructions [21].

Some studies have shown that if an adequate oral hy-
giene program has been performed before active orthodont-
ictreatment then only minimal increases in plaque scores
could be achieved after the placement of fixed appli-
cated [4, 9, 10, 24–26, 39–43] However during orthodontic
treatment an increase in gingival index is almost encoun-
tered.

With microbiology development many studies have
demonstrated specific changes in subgingival micro biota
during orthodontic treatment.

In our study compared composition of subgingival plaque
before and 4 weeks after placement brackets. We just stud-
ied bonded sites and we didn’t study bonded sites.

The result shows that subgingival plaque changes in a
short term with appliances.

A slight bacterial shift was observed 4 weeks after bracket
bonding. We have reported a significantly higher occurrence
of Treponemadenticollae. There were differences in frequency
of occurrence of Aggregatibacteractinomy cetcomitans,
Tannerellaforsythen sis, Prevotella intermedia y Fusobac-
teriumnucleatum compared to the control group. There is a
tendency of higher occurrence of Porphyromonas gingivalis,
Tannerella forsythenis denticollae and Campylobacter rec-
tus. The same results where found by Demling who demon-
strated clinical and microbiological changes and
they were dynamic, reaching the maximum values 3 months
after the beginning of fixed therapy. The decrease in all clin-
ical and microbiological parameters at 6 months of treat-
ment, without the removal of the brackets, could be ex-
plained by reestablishment of host–microorganisms balance.
These changes do not have a destructive effect on periodon-
tal tissues because of their transition and limitation during
time [9–19].

In previous studies, some authors showed a signifi-
cant increase of Aggregatibacteractinomy cetcomitans af-
after placement of fixed appliance. It was maintained during
all the treatment since the appliance was removed [41–43].

Dimianti-kipioti confirmed an increase of Bacteroidesin-
termedius at 4–7 weeks of vestibular orthodontic treat-
ment [4].

Also Lee et al found a significant higher amount of
Treponemadenticollae, Tannerellafor sythen sis, Campylo-
bater rectus and Prevotella intermedia in patients after 3
months of treatment [25].

As well as Ristic et al that confirm the presence of periodontal pathogens as PrevotellaIntermedia, Porphy-
romonas gingivalis, Aggregatibacter actinomycetecomitans
and Fusobacterium nucleatum achieving the maximum
concentration at 3 months of treatment [1, 9]. This changes
didn’t cause damage in periodontal tissues as reported
Sadowsky and Polson [6, 14].

Moreover, Lombardo in 2013, reported a higher amount of Streptococcus mutans after 8 weeks of wearing lin-
gual orthodontics comparing with vestibular appliance, but
the concentration of Lactobacillus was the same in both
groups [44].

These microorganisms are more associated with cari-
ogenic activity than periodontal, that’s the reason why
weren’t added in this study. It concludes the importance
of monitoring these patients.

These clinical studies demonstrate that periodontal
pathogens play an important role not only for peri-
odontal disease but also for the patient’s general health.
Orthodontic treatment with fixed appliance creates favor-
able conditions for colonization of subgingival plaque with
periodontal pathogens. [45]

This present study stresses the importance of dental pro-
phyaxis even in lingual or buccal orthodontics to avoid pe-
riodontal side effects.

6 CONCLUSIONS

1. After insertion of orthodontic appliances (lingual or buc-
cal) there is an increase of plaque index (from 1,6 to 2,5) and
the gingival index in lingual group increased from 1,3 to 2,5
and in the buccal group increased from 1 to 2,3 and there
weren’t changes in control group. There is a relationship in
plaque accumulation and gingival inflammation.
2. There were no changes in pocket probing depth and bleeding in the short-term evaluation.

3. A slight bacterial shift toward a periodontopathogenic microflora was observed for *T* erponemadenticolla, *F* usobacterium nucleatum and campylobacter rectusin subgingival plaque.

4. No significant differences were found between buccal and lingual group.

5. If the inflammation is not controlled and plaque accumulation persist, could develop periodontal problems.

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