# Changes in gingiva with orthodontically banded and bonded teeth

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## ABSTRACT

The aim of this study was to evaluate the effect of orthodontic bands and metal brackets on the gingival health. The sample was composed of 15 randomly selected patients (5 males and 10 females) 11 to 17 years old. All patients were treated with edgewise fixed orthodontic appliances. Bands were cemented to upper and lower first molars and rest of teeth were bonded with composite. The teeth included in the study were upper right and lower left central incisors, and upper left and lower right first molars. The plaque index, the gingival index and pocket depths were used to measure the oral hygiene of the patients during six months period of fixed orthodontic treatment. The results indicated that orthodontic bands will provoke more periodontal changes than brackets.

**Key Words:** Oral hygiene, fixed orthodontic treatment, gingivitis, plaque.

## الخلاصة

هدف الدراسة الحالية هو تقييم تأثير الأربطة التقويمية والحاصرات المعدنية على صحة اللثة. تكونت العينة من ١٥ مريضاً اختيروا عشوائياً (٥ ذكور و١٠ إناث) تراوحت أعمارهم بين (١١–١٧) سنة. تم علاج كل المرضى باستخدام جهاز التقويم الثابت (edgewise). تم ربط الطواحن العلوية والسفلية بأربطة تقويمية بينما ثُبِّتت حاصرات معدنية تقويمية على بقية الأسنان باستخدام (composite). وكانت الأسنان التي اختيرت في هذه الدراسة الطاحن العلوي السادس الأيمن والطاحن السفلي السادس الأيسر والقاطع العلوي الأيمن والقاطع السفلي الأيسر. استُخدم مؤشر الصفيحة الجرثومية ومؤشر اللثة وعمق جيوب اللثة لقياس الصحة الفموية للمرضى خلال فترة ستة أشهر من العلاج بالتقويم الثابت. أشارت النتائج أن الأربطة التقويمية تثير تغييرات أكثر من الحاصرات التقويمية بالنسبة لأغشية ما حول الأسنان.

## INTRODUCTION

Clinical and experimental studies have demonstrated that the most important etiological factor in the inflammatory periodontal diseases is the presence of bacterial plaque at the level or below the level of gingival margin. The introduction of fixed orthodontic appliances into the mouth increases the number of areas for potential plaque retention, and thus it will increase the possibility of progressing from a gingivitis to a periodontitis.[1]

Personal oral hygiene is difficult to perform when fixed orthodontic appliances are in place,[2, 3] and detrimental changes can occur in dental pH, carbohydrate content, and the adherent microbial fl-ora.[4, 5, 6]

Clinical studies have indicated that orthodontic treatment may be associated with a decrease in periodontal health.[1, 7, 8] Alexander[9] in his longitudinal study found that orthodontic attachments provoke moderate gingivitis and that the levels of

inflammation are lower in patients with bonded appliances, and once these appliances are removed the gingival condition becomes improved. Petti *et al*.[10] evaluated the microbiological and clinical changes occurring during orthodontic therapy with fixed and removable app-liances. They found that the only risk for gingivitis in the first six months was noticed associated with fixed appliance therapy.

On the other hand, other studies indicated no long–term effect of orthodontic therapy on the supporting tissues.[11] Feliu[12] found that orthodontic treatment improves in the oral hygiene of patients and this improvement can be expected to last beyond the period of orthodontic treatment. Sinclair *et al*.[13] found that after one year of fixed orthodontic therapy, no significant increase in plaque levels around the appliances, mild gingivitis particularly on the labial surface of bonded incisor and a small increase in pocket depths adjacent to brackets on incisors.

In clinically healthy gingiva in humans, a gingival sulcus of some depth can be found. The depth of this sulcus, as determined in histological sections, has been reported as 1.8 mm with variations of from 0 to 6 mm. Other studies have reported depth of 1.5 mm and 0.69 mm. The probing depth of a clinically normal gingival sulcus in humans is 2 to 3 mm. The periodontal pocket defined as a pathological deepened gingival sulcus, is one of the important clinical features of periodontal disease.[14]

The aim of the present study is to evaluate the changes in gingival health associated with fixed orthodontic appliances.

## MATERIALS AND METHODS

The study sample is comprised of 15 orthodontic patients (5 males and 10 females); all are Iraqis, ranging in age from 11–17 years at the start of orthodontic treatment. They are randomly selected without regard to the type of malocclusion. No sex discrimination is included in this study. They had no mouth breathing, no tongue or digit habits, had no abnormal hard or soft tissue morphology, no history of recent orthodontic treatment, systemic disease or a course of antibiotic therapy within the preceding one month.

All patients were treated with edgewise fixed orthodontic appliances. Bands were cemented with orthophosphate cement to upper and lower first molar teeth and rest of teeth were bonded with composite resin (Alfadent chemical cure composite resin, ADA) according to manufacturer's instruction.

Excess cement or resin was removed before patient dismissal so as not to provoke an immediate inflammatory response.

### Oral Hygiene Instruction

Two weeks before appliance construction, patients and their parents were instructed in conventional oral hygiene using modified Bass technique.

The patients were instructed in no other form of cleaning. No fluoride rinses or gels were used either before or during the study, to exclude their influence on the microbial flora in the gingival cervice.

### Assessment of Oral Hygiene

Baseline clinical data were recorded for upper right and lower left central incisors and upper left and lower right first molars teeth prior to the placement of orthodontic appliances.

Evaluation of oral hygiene was performed according to the criteria of:

- **Gingival Index** (Löe, 1967)[15]

The gingival index was calculated at six sites (3 buccal and 3 lingual) on each of the four teeth evaluated.

0: No sign of inflammation (gingival tissues appear firm, not glossy, margins not rolled).

1: Mild inflammatory gingival changes not extending around the tooth. There is evidence of edema, the gingival tissues may appear glossy, and margins may be rolled. Interproximal papilla may be enlarged.

2: Moderate gingivitis extending all around the teeth, redness, edema, bleeding the gum on probing.

3: Severe inflammation, marked redness and edema, ulceration and there is tendency for spontaneous bleeding.

- **Plaque Index** (Löe, 1967)[15]

The plaque index was measured at 6 sites (3 buccal and 3 lingual) on each of the four teeth.

0: No plaque.

1: A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque is seen only after passing the probe along the tooth surface.

2: Moderate accumulation of soft deposit within the gingival margin can be seen by the naked eye.

3: Abundance of soft matter within the gingival pocket and / or the tooth and gingival margin.

- **Pocket Depths**

Pocket depths were assessed using periodontal probe to nearest 0.5 mm at 6 sites (3 buccal and 3 lingual) on each of the four teeth evaluated.

After six months of fixed orthodontic treatment, a second set of data was collected on each patient for comparison with the pre–treatment values. The data collected were statistically examined with the SPSS packet program. Mean, standard deviation and student's t–test, and the level of significance of $p \leq 0.05$ was selected.

## RESULTS

Noticeable changes in oral health were observed over six months of fixed orthodontic treatment. The pre–treatment ($T_1$) and six months ($T_2$) supragingival plaque indices show significant (at $p \leq 0.05$) changes on both upper and lower first permanent molars, whereas no significant change noted on both upper and lower central incisors with the lower central incisor scores slightly higher plaque index than upper central incisor (Table 1).

The gingival scores showed a significant ($p \leq 0.05$) increase from $T_1$ to $T_2$ for the lower first molar, and non significant changes were found on the upper first molar and the upper and lower central incisors. However, the lower central incisor reveals slightly more increase in gingival scores than upper central incisor (Table 2).

The pocket depth measurements showed a significant (at $p \leq 0.05$) increase from $T_1$ to $T_2$ for the lower first molar. The pocket depth increases were small for the upper and lower central incisors and upper first molar teeth (Table 3).

Table (1): Plaque index scores

| Tooth | Mean ± SD | | Change $T_1 - T_2$ | *P** |
|---|---|---|---|---|
| | Time 1 | Time 2 | | |
| **Upper Right Central Incisor** | 0.47 ± 0.52 | 0.60 ± 0.72 | - 1.144 | NS |
| **Upper Left First Molar** | 1.00 ± 0.85 | 2.33 ± 0.69 | 1.999 | S |
| **Lower Left Central Incisor** | 0.47 ± 0.52 | 0.67 ± 0.70 | - 1.156 | NS |
| **Lower Right First Molar** | 1.00 ± 0.93 | 2.40 ± 0.51 | 1.972 | S |
| **Mean** | 0.74 ± 0.71 | 1.50 ± 0.66 | 0.344 | NS |

*$p \leq 0.05$, S = Significant, NS = Non significant.

SD: Standard deviation.

Table (2): Gingival index scores

| Tooth | Mean ± SD | | Change $T_1 - T_2$ | *p** |
|---|---|---|---|---|
| | Time 1 | Time 2 | | |
| **Upper Right Central Incisor** | 0.40 ± 0.51 | 0.67 ± 0.57 | - 1.710 | NS |
| **Upper Left First Molar** | 1.10 ± 0.88 | 2.40 ± 0.51 | 1.675 | NS |
| **Lower Left Central Incisor** | 0.40 ± 0.51 | 0.87 ± 0.52 | - 0.510 | NS |
| **Lower Right First Molar** | 1.00 ± 0.93 | 2.40 ± 0.51 | 1.972 | S |
| **Mean** | 0.73 ± 0.71 | 1.59 ± 0.53 | 0.343 | NS |

*$p \leq 0.05$, S = Significant, NS = Non significant, SD: Standard deviation.

Table (3): Pocket depth measurements

| Tooth | Mean ± SD | | Change $T_1 - T_2$ | *p** |
|---|---|---|---|---|
| | Time 1 | Time 2 | | |
| **Upper Right Central Incisor** | 1.00 ± 0.42 | 1.30 ± 0.23 | - 0.971 | NS |
| **Upper Left First Molar** | 1.30 ± 0.60 | 2.03 ± 0.44 | - 0.181 | NS |
| **Lower Left Central Incisor** | 1.00 ± 0.85 | 1.80 ± 0.60 | 0.041 | NS |
| **Lower Right First Molar** | 1.10 ± 0.88 | 2.30 ± 0.24 | 1.974 | S |
| **Mean** | 1.10 ± 0.69 | 1.87 ± 0.38 | 0.216 | NS |

*$p \leq 0.05$, S = Significant, NS = Non significant, SD: Standard deviation.

## DISCUSSION

Slight deterioration in oral hygiene status was found after 6 months of fixed orthodontic appliance treatment.

The mean plaque index for tested teeth after 6 months were slightly higher than the level observed before treatment. The level of supragingival plaque was greater for banded upper left and lower right first molar teeth than bonded upper right and lower left central incisor teeth. This is due to the presence of more surface area in bands than in brackets that might accumulate more plaque, and interfere with thorough brushing of the gingival area.[16]

The mean gingival index of the tested teeth after 6 months was slightly higher than level observed before treatment. The gingival changes were clinically but not statistically differ between $T_1$ and $T_2$ teeth for bonded incisor teeth and banded upper first molar but significant changes in gingiva were observed in lower first molar tooth.

The mean pocket depths for tested teeth after 6 months were clinically but not statistically differ from the level observed before treatment. The only significant change was in lower first molar.

It is logical to assume that the more distal attachments they are in the oral cavity, the more difficult it is to cleanse these areas adequately. This assumption is in agreement with the findings of Zachrisson and Zachrisson,[7] who reported

greater levels of gingivitis as described by plaque index, gingival index and pocket depths for molar teeth, and Alexander [9] who found that gingival changes are lower in patients with bonded appliances than patients with banded appliances.

More definitive information on the effect of orthodontic appliances on periodontal health could be derived from similar studies conducted over longer periods, evaluating the recovery of the tissues after the removal of orthodontic appliances. Also other studies could be conducted evaluating the speed of plaque accumulation related to different types of orthodontic appliances and / or different fixed orthodontic attachments.

## CONCLUSIONS

After six months of fixed orthodontic treatment, it was found:

1. Significant increase in plaque levels around the banded compared with bon-ded teeth.
2. Mild gingivitis around the bonded incisors adjacent to orthodontic attach-ments and moderate gingivitis around banded molars.
3. A small, but significant, increase in pocket depths adjacent to bands on lower first molar.

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***Received: 30/11/2002*** ***Accepted for Publication: 15/3/2003***