

## Gingival response to relief and non relief removable orthodontic appliances

**Alaa D Al-Dawoody**

BDS, MSc (Assist Lect)

**Ghada Dh Al-Sayagh**

BDS, MSc (Lect)

**Nada M Al-Sayagh**

BDS, MSc (Lect)

**Dept of Pedod, Orthod and Prev Dent**

College of Dentistry, University of Mosul

### ABSTRACT

The gingival state of thirty seven young patients (mean age 11.6 years) wearing simple removable orthodontic appliances was assessed and followed at monthly intervals for 3 months. For 17 of the patients, intentional relief of the appliance was carried out in the upper right area. Statistically, the plaque index levels were similar in both "relief" and "non relief" groups and reached a similar score at 2 and 3 months. The gingival index was significantly higher in the "relief" group.

**Key Words:** Removable orthodontic appliance, gingivitis, plaque.

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### INTRODUCTION

Orthodontic therapy is effective in producing improved functional and esthetic results. However, consideration must be given to the health of periodontium during active treatment. It has been maintained that orthodontic treatment may have some adverse effects on the gingival and periodontal tissues which may hasten or promote periodontal breakdown in later life.<sup>(1-3)</sup>

Bacterial plaque is the major etiological factor in the initiation and progression of inflammatory periodontal disease.<sup>(4)</sup> Effective removal or disruption of plaque by mechanical, chemical or a combination of the modalities has been shown to significantly reduce the occurrence and/or severity of the disease process.<sup>(5)</sup>

Removable orthodontic appliances, whether passive or active, present a dilemma to the clinician, since gingival reactions are at times a cause of concern. The

type of relationship between the appliance and the marginal gingiva is still a controversial issue.<sup>(6, 7)</sup> Considerable information may be extrapolated from the abundant literature on the subject of removable partial denture design.<sup>(8, 9)</sup> However, the special needs of the orthodontic removable appliance with respect to retention and provision of anchorage make many of the recommendations about relief and non coverage of margins difficult to apply. Bissada *et al.*<sup>(10)</sup> have concluded that when gingival margins are covered by partial dentures severe pathologic changes occur within a period of 12 months in areas covered without relief.

The aim of this study was to assess the gingival response in patients undergoing orthodontic therapy with removable appliances, with and without relief of acrylic resin base plate from the gingival margins.

**MATERIALS AND METHODS**

Fifty patients undergoing orthodontic treatment (25 males and 25 females) aged between 8–18 years, with a mean of 11.6 years, which were selected from Department of Pedodontics, Orthodontics and Preventive Dentistry in the College of Dentistry at the University of Mosul participated in this study. The subjects were randomly selected for study on the basis of their being treated by means of simple removable appliances, had no mouth breathing, tongue or digit habits and showed no visual abnormal hard or soft tissue morphology. All were screened to ensure that there was no history of recent orthodontic treatment and systemic disease.

The baseline level of dental health was established before the placement of the orthodontic appliance. Each patient received a thorough dental examination, prophylaxis and restorations as required.

At the time of appliance insertion, oral hygiene instructions were given. The patients were instructed to brush 3 times a day. In order not to influence measurement, disinfecting or fluoride-containing mouth rinsing solutions could not be applied.

The removable appliances used in this study were of Hawley type, in which an acrylic base, covering the palatal area of the maxillary arch, was retained by means of Adams clasps on the first molars and a labial bow on the anterior segment.<sup>(11)</sup> The active elements of these appliances were as follows: 1) A palatal spring<sup>(12)</sup> to correct the linguoversion of an incisor tooth; 2) an active labial bow to retract an increased overjet in an anteriorly spaced Angle Class I malocclusion. In this situation, the acrylic was cut away behind these teeth to allow the movement; and 3) an expansion screw in split plate, for slow expansion of

the dental arch,<sup>(13)</sup> in cases in which there was a unilateral dental cross bite of functional nature. These appliances were worn 24 hours/day and the forces were of light magnitude, conforming to the retention and anchorage limitations of such appliances.

Of the 50 patients, 25 were randomly selected and 2 to 3 mm of acrylic was removed from the gingival margin for relief. The area included the mesiolingual line angle of the upper right canine distal to the mesiolingual line angle of the last molar in the right upper quadrant. The width of the relief area was about 5 mm.<sup>(14)</sup> In the remaining 25 patients, no intervention was made in the gingival margin of acrylic base plate. So 2 groups were identified at time of insertion of removable orthodontic appliances: Relieved and non relieved groups rather than using a split-mouth approach, because of the difference in effectiveness of tooth brushing on each side of the mouth.

Plaque index<sup>(15)</sup> and gingival index<sup>(16)</sup> scores of the lingual and mesiolingual surfaces of the teeth from the upper right canine to the last molar present in the upper right quadrant were recorded for both groups before appliances were placed (baseline records) and again monthly interval for three successive months.

Thirteen of the 50 patients were excluded from the study because of incomplete records for monthly intervals due to changes in schedules at school or because of personal circumstances. So the total study subject with complete records was 37 patients, 20 non relieved group and 17 relieved group, as shown in Table (1).

Statistically, Z-test was used to analyse the data. The level of significance was at  $p \leq 0.05$ .

Table (1): Number and distribution of cases in two groups during study period

Experimental Period	No. of Patients	Relief Group	No Relief Group
Baseline Records	Male	25	13
	Female	25	12
	Total	50	25
Three Months	Male	20	9
	Female	17	8
	Total	37	17

**RESULTS**

For each of the two study groups (relief and non relief), plaque index scores at baseline, at 1 month, 2 months and 3 months follow-up examinations were presented in Table (2).

As shown in the Table, the plaque index of both groups started at a higher than 1 level, a condition common in this age group. Then the plaque scores decreased slightly for both groups at 1 month period without significant difference, reaching identical scores for both groups at the 2 and

3 months period.

Table (3) showed the gingival index scores during the experimental period for both relief and no relief groups. At baseline, the mean gingival index for relief group (1.341) was nearly identical to non relief group (1.355). The values of gingival index increased gradually in the subsequent visits for both relief and non relief groups. The values of relief group was significantly greater than the non relief group from the first month through the third month ( $p < 0.05$ ).

Table (2): Mean plaque index values before and along the study

Experimental Period	Relief Group	No Relief Group	Z-value
	Mean ± Standard Deviation	Mean ± Standard Deviation	
Baseline Records	1.377 ± 0.410	1.340 ± 0.435	-0.678*
First Month	1.247 ± 0.296	1.205 ± 0.280	-0.433*
Second Month	1.000 ± 1.000	1.000 ± 1.000	0.000*
Third Month	1.000 ± 1.000	1.000 ± 1.000	0.000*

\*  $p > 0.05$ ; Not significant.

Table (3): Mean gingival index scores before and along the study

Experimental Period	Relief Group	No Relief Group	Z-value
	Mean ± Standard Deviation	Mean ± Standard Deviation	
Baseline Records	1.341 ± 0.433	1.355 ± 0.402	-0.212*
First Month	1.659 ± 0.322	1.480 ± 0.330	-2.124**
Second Month	1.929 ± 0.229	1.560 ± 0.375	-3.174**
Third Month	2.124 ± 0.192	1.675 ± 0.369	-3.370**

\*  $p > 0.05$ ; Not significant.

\*\*  $p < 0.05$ ; Significant.

**DISCUSSION**

There seems to be an agreement among foremost periodontists that tissue-borne appliances have deleterious effects on the gingival health.<sup>(17)</sup> On the matter of the appliance-gingiva relationship, Waerhaug<sup>(18)</sup> stated “denture material, clasps, bars and teeth should be kept as far away from the gingival margin as possible”. The reasons for these deleterious effects have been summarized by McCracken<sup>(9)</sup> as: 1) Pressure; 2) uncleanliness; and 3) amount of time the appliance is worn.

The declining pattern of plaque scores observed throughout the present study period for both groups, in spite of appliance

placement, suggesting that the patients’ awareness and use of effective oral hygiene procedures had increased. These indicate that the reinforced oral hygiene program did have a favorable impact on patients with removable orthodontic appliances. The findings of this study come in accordance with those of many previous studies.<sup>(14, 19-21)</sup> Goultchin and Zilberman<sup>(14)</sup> concluded that the plaque index levels were similar in both “relief” and “non relief” groups and reached a similar score at 4 months. Onyeaso *et al.*<sup>(19)</sup> reported that plaque index scores for their test sample decreased from the baseline values during the course of active treatment and were of

the same order and less than their control. Glans *et al.*<sup>(20)</sup> observed a decline in plaque index scores for their test group after the initial placement of the appliance. Smith *et al.*<sup>(21)</sup> found that there were no significant differences in plaque accumulation during study period between relief and non relief groups.

The results showed an increase of gingival index scores during study period for both groups in spite of the reduction in dental plaque accumulation. This could be attributed to the chemical irritation of the gingiva caused by residual unreacted monomer of acrylic base plate.<sup>(22)</sup> The results of this study come in agreement with those of many previous studies.<sup>(14, 19, 23)</sup> Goultschin and Zilberman<sup>(14)</sup> found that gingival index scores for the "relief group" was 25% higher than "non relief group". Onyiaso *et al.*<sup>(19)</sup> reported a greater increase in the gingival index scores 1 to 2 months after the placement of the orthodontic appliance. Thereafter, gingival index scores showed increase at subsequent appointments throughout the active treatment phase. Lewis *et al.*<sup>(23)</sup> reported that gingivitis occurs in some patients in spite of excellent plaque control.

The results showed that areas covered with intentionally relieved acrylic resulted in a greater gingival response (gingival index values of 2.124 contrasting the 1.675 of the non relief group). An explanation of this phenomenon may be attributed to irritation of the exposed gingival margin by the microscopic film of food stuff that stagnated under the relieved acrylic base plate which hasten the gingival inflammation in the relieved side.

### CONCLUSION

The current study indicated that the plaque index scores in the relieved and non relieved removable orthodontic appliances decreased from the baseline records during the study period. The gingival index score in the relief group was significantly higher than the non relieved appliances. It could be concluded that coverage without relief would appear to be the least harmful, since gingival inflammation is inevitable when removable orthodontic applian-

ces are worn.

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