

Oral Health Status in Patients with Fixed Orthodontic Appliance with Molar Bands and Bonded Tubes

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ABSTRACT

Introduction: Studies on effect of orthodontic treatment on oral health are found in ample and have demonstrated a cause-effect relationship. Many comparative studies on molar bands and bonded tubes have shown that, former are detrimental for periodontal health. However there are evidences of bonded molar tubes with high failure rates and causative of gingivitis.

Objective: To assess the effect of molar bands and bonded tubes on periodontal health of the Nepalese orthodontic patients.

Materials & Method: A total of 112 orthodontic patients aged between 13-30 years were assessed for Plaque Index, Gingival Index, Calculus Index and pocket depth on upper first molars with cemented bands and bondable tubes. Statistical analysis was done using Chi-square test to find the association between cemented molar bands and bonded molar tubes to periodontal status. Level of significance was set at $p < 0.05$.

Result: Very few orthodontic patients showed poor plaque accumulation sore, severe gingivitis and calculus deposits. Contrarily, 17% patients showed deeper periodontal pockets. The Gingival Index showed significant association between cemented molar band and bonded molar tube groups ($p = 0.001$).

Conclusion: Oral health is an important concern in fixed orthodontic patients. Use of both molar band and molar tube can cause progression of gingivitis. There is no significant change in periodontal health parameters in using cemented bands or bonded tubes when the oral hygiene is controlled.

Keywords: bonded tube, fixed orthodontic treatment, molar band, periodontal health

INTRODUCTION

Orthodontic tooth movement occurs through the series of events in periodontium.¹ There is direct relationship between orthodontic therapy and oral health. Studies on periodontal effect due to orthodontic treatment have depicted variable results.²⁻⁹ The plaque accumulation enhanced by orthodontic appliances result in the adverse changes in microflora hence developing gingivitis.¹⁰⁻¹² The effect of altered bacterial ecosystem is unpredictable, with gingivitis not always progressing to periodontitis. Thus the periodontal disease progression also depends on various other factors such as age, hormone, immune response and nutrition.¹³ Besides, oral hygiene is a crucial determining factor for periodontal health in orthodontic patients.¹⁴ The presence of orthodontic band, bracket, wire and other auxiliaries create profound challenge for hygiene maintenance and interproximal dental care becomes more difficult;¹⁵ especially in posterior region.¹⁶ Many studies compared the effect of cemented molar bands

and bonded molar tubes on periodontal health. The possible reasons for increased gingival inflammation associated with orthodontic bands are:¹³

1. Mechanical injury/irritation to the gingival tissues
2. Chemical irritation due to the cement used to retain the band
3. Greater risk of food impaction
4. Patients may have the tendency to clean anterior teeth more effectively than the posterior teeth which seat molar bands.

Proper oral hygiene can counter gingival inflammation caused by orthodontic appliance; while the injury to gingiva can be reduced by using well fitting appliance.¹⁷ Presence of subgingival plaque and specific pathogens remain the cause for gingival inflammation and cytotoxic effect of dental cement material can contribute to the gingivitis.¹⁸ The use of bondable molar tubes can as well be culpable to moderate gingivitis. The high failure rate of these attachment

tubes increase the treatment time decreasing the treatment efficiency;¹⁹ causing detrimental effect on the periodontium in long term.¹³

The aim of the study was to assess the periodontal status in fixed orthodontic patients with cemented molar bands and bonded molar tubes in Nepalese adolescent and adult patients.

MATERIALS AND METHOD

A cross sectional observational study was done on a total of 112 patients randomly selected from the Department of Orthodontics, Kantipur Dental College & Hospital. The study was conducted during October to December 2015 after receiving ethical clearance from the Institutional Review Committee. Patients with ongoing fixed orthodontic treatment on both dental arches or at least on upper arch with the minimum duration of three months were included in the study. Written consent was obtained from all participants or that of their parent/guardian in case of those below 16 years of age. Only the motivated patients were selected for the study.

The exclusion criteria were: patients with missing maxillary first molars, missing molar band/ bondable tube on maxillary first molars, use of auxiliary orthodontic appliance which could interfere with the oral hygiene, patients with systemic diseases, and patients on antibiotics within 3 months.

Single examiner (AKS) assessed all clinical examinations to avoid the inter-examiner variability. Each subjects were assessed for Plaque Index, Gingival Index,²⁰ Calculus Index²¹ and pocket depth on maxillary first molars in clinical set-up under sterile condition using mouth mirror, William's probe and No. 23 explorer. The scoring criteria for each assessment are explained below:

Plaque Index: (Silness & Loe 1964)

Score 0: No plaque.

Score 1: Good - A film of plaque adhering to free gingival margin and adjacent area of the tooth. The plaque is felt only by running a probe across the tooth surface.

Score 2: Fair - Moderate accumulation of soft deposits without the gingival pocket on the gingival margin and/or adjacent tooth surface which can be seen by naked eye.

Score 3: Poor - Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface.

Gingival Index: (Loe & Silness 1963)

Score 0: Absence of inflammation/normal gingiva.

Score 1: Mild inflammation, slight change in color, slight edema, no bleeding on probing.

Score 2: Moderate inflammation, moderate glazing, redness, edema and hypertrophy, bleeding on probing.

Score 3: Severe inflammation, marked redness and hypertrophy, ulceration, spontaneous bleeding.

Calculus Index: (Green & Vermillion 1964)

Score 0: No calculus present.

Score 1: Supragingival calculus covering less than one third of the tooth surface.

Score 2: Supragingival calculus covering more than one third to two third of tooth surface or presence of individual flecks of subgingival calculus around the cervical portion.

Score 3: Supragingival calculus covering more than two third of tooth surface or a continuous heavy band of subgingival calculus around the cervical portion.

Plaque Index was graded as good, fair and poor; and Gingival Index was graded as mild, moderate and severe gingivitis depending on the score. The pocket depth was measured on the maxillary right and left first molars at three points i.e. mesiobuccal, midbuccal and distobuccal portions. The highest reading among all three recordings was determined. Pocket depth up to 3mm was considered normal; reading more than 3mm was considered deep and abnormal. All measurements were determined as nearest to millimeter scale. Statistical analysis was done using Chi-square test to find the association between periodontal status of fixed orthodontic patients with cemented molar bands and bonded molar tubes. Level of significance was set at $p < 0.05$.

RESULT

Among the total of 112 orthodontic patients; 78(69.6%) were male and 34(30.4%) were female subjects. The mean age of the patients was 20.71 years (SD 4.81). The frequencies of patients with cemented molar band were 53(47.3%) and bonded molar tube were 59(52.7%).

Out of total patients assessed; almost all subjects had good or fair plaque accumulation score with comparable frequencies between cemented molar band and bonded molar tube groups. Very few subjects with bonded tube had poor score according to Plaque Index. There was no association between the groups in Plaque Index scores ($p < 0.05$) (Table 1).

According to the Gingival Index scores; mild gingivitis was common in bonded tube group (73.9%), while moderate gingivitis was frequent in molar band group (63.5%). Severe gingivitis was very rare in both groups. The gingival status of orthodontic patients showed statistically significant

Table 1: Plaque Index among fixed orthodontic patients

Score	Treatment group		Total (N=112)	p-Value
	Cemented molar band (N=53)	Bonded molar tube (N=59)		
Good (0.1-0.9)	27(49%)	28(50.9.4%)	55	0.249 (NS)
Fair (1.0-1.9)	26(48.1%)	28(51.9%)	54	
Poor (2.0-3.0)	0	3(100%)	3	

NS: not significant

Table 2: Gingival Index among fixed orthodontic patients

Score	Treatment group		Total	p-Value
	Cemented molar band	Bonded molar tube		
Mild gingivitis (0.1 - 1)	12(26.1%)	34(73.9%)	46	.001*
Moderate gingivitis (1.1 - 2)	40(63.5%)	23(36.5%)	63	
Severe gingivitis (2.1 - 3)	1(33.3%)	2(66.7%)	3	

*Significant at $p < 0.05$

Table 3: Calculus Index among fixed orthodontic patients

Score	Treatment group		Total	p-Value
	Cemented molar band	Bonded molar tube		
Score 0	47(44.8%)	58(55.2%)	105	0.098 (NS)
Score 1	2(100%)	0	2	
Score 2	4(80%)	1(20%)	5	
Score 3	0	0	0	

*Significant at $p < 0.05$

Table 4: Pocket depth of fixed orthodontic patients

Score	Treatment group		Total	p-Value
	Cemented molar band	Bonded molar tube		
0-3 mm	41(44.1%)	52(55.9%)	93	0.129 (NS)
>3mm	12(63.2%)	7(36.8%)	19	

association between cemented molar band and bonded molar tube groups ($p=0.001$) (Table 2).

Calculus was rarely present in orthodontic patients with both banded and bonded molar groups. 93.7% of orthodontic patients examined were devoid of calculus according to the present study. There was no association between the groups according to the Calculus Index scores (Table 3).

The periodontal pocket depth was within the normal limit i.e. up to 3mm in 83% of the total orthodontic patients examined. Approximately 17% subjects showed pocket depth greater than 3mm. More number of subjects with cemented molar band group showed the occurrence of periodontal pocket as compared bonded tube group. However there was no significant association between the groups ($p < 0.05$) (Table 4).

DISCUSSION

Fixed orthodontic treatment is directly related to periodontium through the effect of induced bone remodeling and increased plaque retention on tooth surfaces that may jeopardize the long term periodontal health. Studies showed that the periodontal damage were only partly reversible after appliance removal.²²

Detrimental changes are expected in teeth which are banded rather than bonded due to their subgingival impingement which may violate the biological width.²³⁻²⁵ In the present study, the clinical occurrence of moderate gingivitis and deep pocket were greater in banded cases. The maintenance of oral hygiene in banded area is difficult owing to the fact that the readymade bands may not fit properly resulting to the

gap between tooth and the band surface. The band cement may disintegrate due to the accumulation of debris harboring the microbes eventually developing periodontal disease or dental caries.¹³

The present study explored oral health status of Nepalese orthodontic patients particularly of the periodontal health using Plaque Index, Gingival Index, Calculus Index and pocket depth. The periodontal disease and dental caries are the major indicators of oral health status. Dhami *et al*²⁶ reported periodontal status of Nepalese orthodontic patients using CPITN Index and Shrestha *et al*²⁷ reported status of dental caries among Nepalese orthodontic patients using DMFT Index.

In the present study, both cemented band and bonded tube groups showed similar level of plaque accumulation score among orthodontic patients. However, there was significant association in gingivitis scores between the groups. There was more occurrence of mild gingivitis in bonded tube group, while more occurrence of moderate gingivitis in cemented band group. Likewise, higher calculus scores and greater pocket depths were clinically apparent in more patients with molar bands. Thus it may be evident that the type of orthodontic appliance influence the periodontal status. Saud reported that the molar bands are associated with greater periodontal inflammation compared to molar bands during first three months of orthodontic treatment.²³ Alexander also found increased inflammatory activity in cemented bands compared to bands.²⁴ Similar study by Boyd and Baumrind also found that banded molars showed significantly greater gingival inflammation and plaque accumulation than the bonded molars.²⁵

The pocket depth above 3mm is considered pathologic; in the present study molar band group showed the occurrence of

periodontal pocket in 63.2% as compared to 36.8% in bonded tube among the 19 subjects detected with deep pockets. This fact may depict clinically important condition of progression of gingivitis that may lead to periodontal invasion in banded cases. Huser *et al* observed increased microbial colonization and tissue destruction in patients with orthodontic bands.¹⁰

Though there are clinical differences in occurrence in plaque accumulation, calculus deposition and deep periodontal pockets between molar band and bonded tube groups; there were no statistically significant association. Studies by Poison *et al* concluded that, there are no detrimental long-term effect of orthodontic treatment on plaque accumulation, gingivitis, loss of attachment, pocket depth and alveolar crest level.^{6,28}

CONCLUSION

Periodontal health is an important consideration in fixed orthodontic treatment. Careful oral hygiene maintenance and periodic periodontal consultation are essential for orthodontic patients. Clinical findings suggest that, placement of molar bands could be more detrimental to periodontal health than the bonded tubes. Thus, the use of properly fitting molar bands with proper cementation are recommended when molar bands are selected.

The use of both molar band and molar tube could be associated with progression of gingivitis. However, there is no remarkable changes on periodontal parameters in plaque accumulation score, calculus score and pocket depth between the cemented molar band and bonded molar tube groups.

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