

# Assessment of Failure Rates between Cemented Molar Bands and Bondable Molar Tubes during the Complete Orthodontic Treatment

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## ABSTRACT

**Introduction:** The main components of modern fixed appliances are bands, tubes, brackets and arch wires. Metal bands are cemented to molars while tubes made of metal have a mesh at the base for bonding to molars.

**Objective:** The objective of the study was to assess the highest failure rate of cemented molar bands vs bonded molar tubes, also to determine the tooth which has maximum times of failure with both molar bands and tubes or in individual.

**Materials and Method:** A total of 178 patients meeting the inclusion criteria were selected for the study in which 712 bands and 712 tubes were assessed for breakage during the complete orthodontic treatment.

**Result:** All the molars showed failure, the mean breakage of both bands and tubes of molars were different. The maximum times the bond failure was seen with 17. Fifty six bond failures were recorded with a mean of 0.62 failure rate, while the most frequently the failures of both banding and bonding was seen with the mean of  $0.67 \pm 2.6$  in 36. The mean breakage of 16 with both bands and tubes was  $0.54 \pm 1.2$ , 17 was  $0.61 \pm 1.3$ , 26 was  $0.62 \pm 1.9$ , 27 was  $0.66 \pm 2.0$ , 36 was  $0.67 \pm 2.6$ , 37 was  $0.57 \pm 2.7$  respectively. Ultimately tubes breakages were comparatively more than bands failure.

**Conclusion:** Though cementing molar band is a time consuming process, failure with cemented molar bands were comparatively lower than bonded molar tubes.

**Keywords:** Failure rate; molar bands; molar tubes.

## INTRODUCTION

The main components of modern fixed appliances are bands, tubes, brackets and arch wires. Metal bands are cemented to molars which provide attachment to other auxiliaries. Preformed steel bands came into widespread use during the 1960s and are now available in anatomically correct shapes for all the teeth. After the introduction of acid etching of enamel by Buonocore in 1955, direct bonding of orthodontic brackets to incisors, canines, and premolars is now carried out routinely

as part of fixed appliance treatment.<sup>1</sup> However, bands remain the most common means of attaching components to molars compared to bonding of buccal tubes. The decision to band or bond a molar may be influenced by several factors. Bonding rather than banding molars however reduces chairside time and leads to less plaque accumulation and gingival inflammation, thereby reducing the risk of enamel demineralisation.<sup>2</sup> Bonding of attachments to molars, rather than banding, is a less frequently adopted practice.<sup>3</sup> Gingival inflammation and hyperplasia may occur quickly after the placement

of orthodontic bands.<sup>4</sup> However we have both options of bonding and banding despite of their advantages and disadvantages, the objective of the study was to assess the high failure rates between the bands and tubes.

## MATERIALS AND METHOD

A cohort study was conducted on 178 orthodontic patients. The study was done as part of ongoing orthodontic treatment. A convenience sampling technique was employed for selection of cases. Patients were informed about the research. Written consent was obtained prior to the start of the study keeping in mind ethical principles for research conducted among humans as per Declaration of Helsinki. Fifty patients who had undergone treatment in the Department of Orthodontics in Kedia Dental College, Birgunj and 128 patients from a private clinic were randomly selected for the study. Out of which in 89 patients the molar bands were cemented and in 89 patients molar tubes were bonded. A total of 712 bands and 712 tubes were assessed for failure in 2 years from January 2015 to January 2017. The record files of patients completing fixed appliance orthodontic treatment at this unit were examined. The inclusion criteria were: Patients between 13 to 35 years with stable mental health condition; the cases where both first and second molars banded and bonded; only the cases of bidental protrusion where all the four first premolars were extracted; treatment duration ranging from 16 to 24 months; only one orthodontist was responsible for bonding the molar tube, and cementing the bands. The exclusion criteria were: Treatment extending more than 24 months and cases involving head gears or functional appliances.

The choice of cement used for band cementation selected by the clinician undertaking orthodontic treatment was glass ionomer cement Type I (GC Fuji, GC Corporation, Tokyo, Japan). The band used were Molar 3M series bands pre-welded with tube (3M Oral care, 3M Canada), same time the 3M (3M Oral care, 3M Canada) bondable tubes were used. The etchant used was of 3M ESPE. Adhesive was 3M ESPE, the light cure resin adhesive used

was 3M Unitek Transbond XT Adhesive, curing unit was of Dentsply (USA).

Verbal instructions regarding appliance care was given to every patient. Each patient was rechecked at the interval of 4-6 weeks. Every time the patient was being checked, band failures or debonded tubes were verified and if discovered was recorded in the patient file. Only the bands which were broken or damaged were replaced, identified loosened band with no damage to the band were cleaned and recemented, whereas the tubes which was adhered to the molars when broken were replaced. For the statistical analysis, Shapiro-Wilk test was used to check normality of data. Mann Whitney U test was used to compare mean breakage among groups. Significance was set at  $p < 0.05$ . All statistical analysis was performed using SPSS version 18.

## RESULT

Shapiro-Wilk test indicated the variables were skewed in distribution. Non parametric tests (Mann Whitney U test) of significance were used for comparison. No patient dropped out of the treatment during the study period. The failure rate of bonded molars was statistically different from that of banded molars. All the first and second molars were assessed for failure during the complete orthodontic treatment. All the teeth showed failure whether banded or bonded. The maximum times the bond failure was seen with 17, among 89 patients, 56 bond failures were recorded with a mean of 0.62 failure rate, while the most frequently the failures of both banding and bonding was seen with the mean of  $0.67 \pm 2.6$  in 36.

The mean breakage of 16 with both bands and tubes was  $0.54 \pm 1.2$ , 17 was  $0.61 \pm 1.3$ , 26 was  $0.62 \pm 1.9$ , 27 was  $0.66 \pm 2.0$ , 36 was  $0.67 \pm 2.6$ , 37 was  $0.57 \pm 2.7$  respectively. The mean breakage of 16 with both bands and tubes was  $0.54 \pm 1.2$ , 17 was  $0.61 \pm 1.3$ , 26 was  $0.62 \pm 1.9$ , 27 was  $0.66 \pm 2.0$ , 36 was  $0.67 \pm 2.6$ , 37 was  $0.57 \pm 2.7$  respectively.

The mean breakage in 16 with bands was 0.37 while in tubes were 0.53, tube breakage was more.

**Table 1: Mean breakage according to teeth.**

Tooth	16	17	26	27	36	37	46	47
Mean $\pm$	0.54 $\pm$	0.61 $\pm$	0.62 $\pm$	0.66 $\pm$	0.67 $\pm$	0.57 $\pm$	0.66 $\pm$	0.57 $\pm$
SD	1.2	1.3	1.9	2.0	2.6	2.7	2.1	2.6

**Table 2: Mean breakage of bands vs. tubes.**

Tooth	parameters	Mean	Std. Deviation	P value
16	bands	0.37	0.485	0.025
	tubes	0.53	0.502	
17	bands	0.42	0.497	0.007
	tubes	0.62	0.488	
26	bands	0.36	0.481	0.001
	tubes	0.60	0.493	
27	bands	0.42	0.497	0.017
	tubes	0.60	0.493	
36	bands	0.40	0.493	0.037
	tubes	0.56	0.500	
37	bands	0.28	0.450	0.014
	tubes	0.46	0.501	
46	bands	0.40	0.493	0.012
	tubes	0.60	0.493	
47	bands	0.27	0.450	0.015
	tubes	0.46	0.501	

The mean breakage in 17 with bands was 0.42, while in tubes was 0.62, in 26 band breakage was 0.36 and tube breakage was 0.60, in 27 the mean breakage with bands was shown as 0.42 with tubes was 0.60, in 36 the mean breakage with bands was 0.40 and tubes was 0.56, in 37 breakage with bands was 0.28 with tubes was 0.46, in 46 with bands was 0.40, with tubes was 0.60, in 47 with band was 0.27, with tube was 0.46.

Ultimately the tubes failures were comparatively more than bands failure.

## DISCUSSION

The effectiveness of the orthodontic treatment is based on optimized clinical chairside time, patient comfort and preserved integrity of dental structure. A recent study showed 30% of difference in treatment time was related to appliance failure, hence frequent rebonding and re-cementation affects the orthodontic mechanics and increases the treatment time.<sup>5,6</sup>

The advantages of bonding attachments for posteriors were aesthetics, lower risk of periodontal problems and bacteremia, reduced clinical time. The main focus on the failure of the appliance was the properties of the materials used for bonding tubes to molar teeth.<sup>7,8</sup>

Pandis et al (2005)<sup>9</sup> reported on failure of molar tubes. In their study, second molars had the highest

rate of failure, which is different from this study. In our study, comparison was done between failure of band and tubes which showed more failure on the tubes than bands. There was no significant difference on failure rate between first and second molars. More failures with tubes could be possibly because of moisture contamination, heavy forces during cinching of the wire, poor adaptation on the buccal surface of the tooth, heavy occlusal force or occlusal interference of the opposing tooth.

The roles of dental assistant and patient in bond failures was shown by Roelofs et al (2017), while the failure rate of the appliance was greater in posterior segment. The failures of bonded tubes were more than bonded brackets on premolars, canine and incisors. There was no significant differences in bond failure between first and second molar which is also same with the present study,<sup>10</sup> this study showed bond failure was greater than bands, tubes debonding was greater in 17 and 26, whereas band failure was greater in 17 and 27.

A twelve month assessment of bracket and tubes by Jung showed higher amount of bond failure in molars and insignificant difference between failures between first and second molar. This similar to our study where only the posterior first and second molars were assessed.<sup>11</sup> The reported incidence of bracket bond failure is higher with posterior teeth.<sup>12,13</sup> There may be some other reasons for bracket bond failure of posterior teeth. Which include different

etching patterns produced on different teeth by acid conditioning,<sup>14</sup> moisture contamination (gingival fluid, saliva)<sup>15</sup> and inadequate adaptation of the bracket to the tooth surface due to attrition by malocclusion and the diverse morphology of buccal grooves.<sup>16</sup>

Male to female band and tubes failure were not assessed. Gender difference was shown in the study of Millet and Gordon<sup>17</sup> but not in other studies.<sup>18,19</sup> The greater bite force in male patient can contribute to gender difference in failure rate.<sup>20</sup>

The average range in the study was taken into consideration. The sample was not differentiated between young patient and old patient. Some study

showed breakage were more in young patient (equal or lesser than 18 years age),<sup>11</sup> which was not accountable in this study.

## CONCLUSION

The study was done to compare the failure rates of cemented molar bands and bonded molar tubes in all first and second molars. Both the bands and tubes showed breakage. Though cementing a molar band is a time consuming process, the failure or breakage with cemented molar bands were comparatively lower than bonded molar tubes. Molar bonding may be a better option as against molar banding to reduce the risk of caries and gingival diseases around the orthodontic appliances.

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