

# FREQUENCY OF BRACKET BREAKAGE & BOND FAILURE IN PATIENTS, UNDERGOING FIXED ORTHODONTIC TREATMENT AT KHYBER COLLEGE OF DENTISTRY, PESHAWAR

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## ABSTRACT

*The aim of this cross sectional study was to investigate the prevalence of bracket breakage and bond failure amongst orthodontic patients. One hundred and eighty nine patients (78 male & 111 female) undergoing fixed orthodontic treatment at the Department of Orthodontics at Khyber College of Dentistry were included in the study. The patients were divided into two groups namely teens (ages 13-19 years) and adults (ages 20-30 years). In this study, 89 patients had skeletal class I, 87 Class II and 13 patients skeletal Class III malocclusions. All patients were bonded with Transbond XT (3M unitek) light cured dental adhesive system. The bond failure was noted after 4 weeks.*

*The results demonstrated more maxillary dentition bracket breakage as compared to the mandibular dentition. Both genders demonstrated greater upper buccal segment bracket breakage followed by the lower buccal segment, with females having higher failure rate as compared to males. Furthermore, the younger age group demonstrated greater breakage compared to the older age group ( $P > .05$ ). Bracket breakage is inevitable during orthodontic treatment and its frequency varies with age, gender, location and skeletal class.*

**Key Words:** Bracket breakage, Bond failure, Orthodontic treatment.

## INTRODUCTION

Orthodontic treatment usually requires three-dimensional control of teeth, for which the use of fixed appliances becomes imperative. These appliances incorporate attachments, are bonded directly to the tooth surface, and should survive until the end of active treatment. However, some bonds fail in service.<sup>1</sup>

Bonding of orthodontic bands and brackets to enamel has greatly simplified the provision of orthodontic treatment. Conventional orthodontic bonding systems involve the use of acid-etching of the enamel surface to aid the retention of the bonding agent. An unfilled composite resin is then applied as an intermediate bonding layer between the etched enamel and a

filled composite resin adhesive. Setting of this two-stage system can be done using a chemical-cure or light-cure initiation.<sup>2</sup>

The ideal bond strength of orthodontic attachments should be sufficient to withstand the typical intraoral forces that occur throughout the course of fixed appliance treatment, yet weak enough to facilitate de-bonding without damaging the tooth enamel. Majority of studies have recommended the use of 37% phosphoric acid and an etch time of 15 seconds, which appears to be sufficient to obtain a satisfactory bond for orthodontic attachments. By decreasing the concentrations and etchant times, the amount of superficial enamel loss and the depth of enamel penetration are reduced.<sup>3</sup>

Bracket breakage is a commonly encountered complication during routine orthodontic treatment.<sup>4</sup> Success rates depend on the bonding agent employed, bonding technique used, etching time, concentration of the etch, or characteristics of the bracket base.<sup>1</sup> Operator and patient factors are likely to influence the

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failure rate. Care in the clinical technique, choice of bonding material, even slight salivary contamination or lack of improper composite-primer application can lead to weaker bond strength between enamel and bracket and these factors are controlled by the operator.<sup>1,4</sup> Gender and age of the patient, the presenting malocclusion, hard sticky diet during treatment and care taken of the appliance are patient variables.<sup>1,4</sup> Other causes are excessive mechanical forces, occlusal interferences and increased frictional forces encountered with heavy-gauge stainless steel wires during sliding mechanics. Frequent bracket breakage causes delay in treatment time, enamel damage, lack of patient cooperation and improper finishing.<sup>4</sup>

Most recent investigators have studied the bond strength of different composites on various bracket materials. In this study, frequency of bracket breakage during active orthodontic treatment related to the oral segment, age and sex were studied.

## METHODOLOGY

In this cross-sectional study, 189 patients undergoing fixed orthodontic treatment at Orthodontic department of Khyber College of Dentistry, Peshawar were recruited in the study according to the following criteria.

### *Inclusion criteria*

- 1) Patients having full complement of teeth from first molar to first molar in both arches.
- 2) Patients with good oral hygien.

### *Exclusion criteria*

- 1) Teeth with congenital and developmental enamel defects / anomalies.
- 2) Morphologically abnormal teeth
- 3) Grossly carious or heavily filled teeth.

The patients were divided into 2 age groups namely teens and adults. Clinical naked-eye intra-oral examination was performed during active orthodontic treatment with dental mirrors and tweezers to confirm the absence or breakage of orthodontic brackets during treatment in the maxillary and mandibular dentition except for first permanent molars, which were ce-

mented with molar bands. The arches were divided into labial and buccal segments to verify bond failure antero-posteriorly. The stage of treatment and reason for de-bonding was not noted in the study.

Proper isolation technique during bracket bonding was followed with cheek retractors and cotton rolls. The teeth were washed and dried with oil-free compressed air followed by 15-30 seconds enamel etch time per tooth with 35% ortho-phosphoric acid gel. The enamel surface was then washed with water and again dried with oil-free compressed air before bracket placement with direct-bonding technique. All brackets were bonded with 3M Transbond XT (3M Unitek) light cure adhesive on the base of the bracket. The adhesive was cured using light polymerization for 30 seconds ( 15 seconds mesially and 15 seconds distally ) using a halogen curing light taking all the measures for eye protection.

Initial aligning archwires of either 0.012 NiTi or 0.014 NiTi was tied into the bracket slots with elastomeric 'O' rings after completion of bonding. The patients were given 4 weekly appointments for adjustment.

The date of bracketing was recorded for each patient. If a bond failed, the tooth on which the failure occurred and the date of failure was recorded. A failure was regarded as an all or none occurrence, and subsequent failures of bonding for the same tooth was not included in the failure rate. Failed brackets were replaced using the same adhesive and bonding technique.

## RESULT

The sample size in this study was a total of 189 patients, out of which 112 (59.3%) patients reported with broken brackets on their next appointment after bonding. The data analysis was done on the basis of areas of bracket breakages. The arches were divided

TABLE 1:

Jaw	Frequency	Percent %	P Value
MD	43	22.8	NS <sup>a</sup>
MX	69	36.5	
NONE	77	40.7	
Total	189	100.0	

<sup>a</sup> NS indicates nonsignificant.

TABLE 2:

Segment	Percent %	P Value
UA	21.4	NS <sup>a</sup>
LA	15.2	
UB	40.2	
LB	23.2	
Total	100.0	

<sup>a</sup> NS indicates nonsignificant.

TABLE 3:

AREA	FEMALE	MALE	TOTAL
LA	7(6.3%)	10(12.8%)	17(9%)
LB	17(15.3%)	8(10.3%)	25(13.2%)
UA	16(14.4%)	10(12.8%)	26(13.8%)
UB	26(23.4%)	18(23.1%)	44(23.3%)
NONE	45(40.5%)	32(41.0%)	77(40.7%)
TOTAL	111(100%)	78(100%)	189(100%)

Age	UA %	LA %	UB %	LB %	None %	Total %	P Value
Teens	11.4	12.6	26.5	12.6	36.9	100	NS
Adults	14	6	21	14	45	100	

<sup>a</sup> NS indicates nonsignificant.

	Mandible %	Maxilla %	None %	Total %	P Value
Teens	25.3	37.9	36.8	100	NS
Adults	20.0	35.0	45.0	100	

<sup>a</sup> NS indicates nonsignificant.

Skeletal Class	UA %	LA %	UB %	LB %	None %	Total %	P Value
I	8.9	13.3	17.8	12.2	47.8	100	NS
II	14.0	5.8	31.4	15.1	33.7	100	
III	7.7	7.7	23.1	15.4	46.1	100	

<sup>a</sup> NS indicates nonsignificant.

into two segments each, namely Upper Anterior and Upper Buccal in maxilla and Lower Anterior and Lower Buccal in the mandible.

In this study, bracket breakage was more common in maxilla (36.5%) than in mandible (22.8%) as shown in table 01.

Among the segments with bracket breakages, the upper buccal segment had more breakages than any other segment. The lower anterior segment had the lowest percentage of bracket breakage (Table 02).

## DISCUSSION

The reasons for bracket breakage were not investigated in this study, only the frequency according to location, gender, age and skeletal class were noted. It was observed that the maxillary dentition showed greater bracket bonding failure as compared to the mandibular dentition during treatment. The results of this study do not agree with Sukhia HR and Sukhia RH<sup>4</sup> and Pseiner BC and Freudenthaler J,<sup>11</sup> who noted

greater bracket breakage in the mandible than in the maxilla. Marquezan M and Lau T<sup>12</sup> have shown equal distribution of bracket failure in both upper and lower arches.

In the present study, female subjects demonstrated greater bracket breakage overall as well as in the maxillary dentition. Recent findings by Liu Z and McGrath CH<sup>13</sup> also indicate greater bracket failure in females as compared to males.

In this study, teens demonstrated greater bracket breakage prevalence as compared to adults. In the maxilla, teens showed 37.9% breakage as compared to 35.0% in adults. In the mandible, teens showed 25.3% breakage prevalence as compared to 20.0% in adults. Ammar MH and Ngan PN<sup>14</sup> and Yang IH and Park JR<sup>15</sup> have also shown more bracket breakage in teens as compared to adults. This could be due to greater self awareness and motivation in adults as compared to teens.

In the current study, the upper buccal segment demonstrated the greatest breakage in both sexes. Females showed 23.4% breakage, while males showed 23.1% in upper buccal segment. However, a recent study by Sukhia and Sukhia<sup>4</sup> and Purmal K and Sukumaran P<sup>16</sup> showed greater debonding frequency in the lower buccal segment. This could be attributed to lack of moisture control during bonding. After the upper buccal segment, females showed greater debonding frequency in the lower buccal (15.3%), upper anterior (14.4%) and lower anterior (6.3%) segments. After the upper buccal segment, males showed greater prevalence in the upper anterior (12.8%) and lower anterior (12.8%) segments, followed by the lower buccal (10.3%) segment.

## CONCLUSION

It was concluded that both genders showed bracket de-bonding during active orthodontic treatment especially in the maxillary buccal segments. Teen subjects had more bracket breakage compared to adults. This could be due to greater self-awareness, self-motivation and proper oral care in adults during treatment

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