

FREQUENCY OF BRACKET BREAKAGE DURING ORTHODONTIC TREATMENT

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ABSTRACT

Aim of this study was to investigate the prevalence of orthodontic bracket breakage among orthodontic patients at Multan Medical and Dental College, Multan. This study stretched over 23 months period from January 2017 to December, 2018. For this study 147 patients (53males and 94females) routine patients undergoing orthodontic treatment were examined.

Keywords: Bracket breakage, Frequency, Orthodontic treatment.

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INTRODUCTION

Three dimensional control of orthodontic treatment is usually required, for which use of fixed appliance is imperative. Attachments are incorporated which are bonded directly to the tooth surface. This bonding procedure is technique sensitive,¹ slight salivary contamination or improper composite-primer application can lead to weaker bond strength.² These attachments should survive until the end of active treatment. However, some bonds fail in service.³ Mechanical forces, occlusal interferences and sticky food are also the causes of bracket breakage.^{3,4} Frequent bracket breakage causes delay in treatment time, enamel damage, lack of patient cooperation and improper finishing.⁵

Ideal bond strength should withstand the intraoral forces during fixed appliance treatment, yet weak enough to not damage the enamel during debonding. Most of the studies have recommended 37% phosphoric

acid and an etch time of 15 seconds, which is good enough for satisfactory bonding of orthodontic attachments. Quantity of loss of superficial enamel and depth of penetration of enamel are reduced by decreasing the concentration and etchant times.⁶ Unfilled resin is applied between etched enamel surface and filled composite resin adhesive, the setting of this 2 stage system can be done by using light cure initiation or chemical cure. During sliding mechanics, frictional forces due to stainless steel wire may also cause bracket breakage during treatment.⁷

Bracket breakage is considered as a common complication during orthodontic treatment.⁸ Unfilled resin is applied between etched enamel surface and filled composite resin adhesive, setting of this two stage system can be done by using a chemical cure or light cure initiation.⁹ Factors that have been involved in a successful bonding are good bonding agent, technique of bonding used, time for etching, concentration of the etch, and characteristics of bracket base³

Bond strength of different composites have been studied on various bracket materials by the most recent investigators.^{7,10} However, in our study we investigated, frequency of bracket breakage during active orthodontic treatment age, gender, oral segment and skeletal class of malocclusion.

METHODOLOGY

In this study, 147 patients undergoing fixed orthodontic treatment at Orthodontic Department of Multan Medical and Dental College, Multan were recruited in the study according to following criteria.

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Inclusion criteria

- 1 Having full complement of teeth from first molar to first molar in both arches.
- 2 Good oral hygiene.

Exclusion criteria

- 1 First premolars of both arches.
- 2 First permanent molars which were cemented with molar bands.
- 2 Teeth with congenital anomalies.
- 3 Heavily filled and grossly carious teeth.
- 4 Morphologically abnormal teeth.

The study stretched over 23 months period from January, 2017 to December, 2018. The patients were divided into two age groups namely teens and adults. Data was collected from patients files to confirm the orthodontic breakage during treatment in maxillary and mandibular dentition, except for first premolars and first molars of both arches. First premolars were extracted due to orthodontic treatment and bands were cemented on first molars. Reason for debonding and stage of treatment was not observed in the study. During bracket bonding, proper isolation technique was followed with cheek retractors and cotton rolls. Teeth were washed and then dried with oil free compressed

air followed by 15-30 seconds enamel etch time per tooth with 35% orthophosphoric acid gel. Enamel surface was then washed with water and again dried with oil free compressed air before bracket placement. All brackets were bonded with direct bonding technique with 3M Trans bond XT light cure adhesive on the base of the bracket. The adhesive was cured using light polymerization for 40 seconds (20 seconds mesially and 20 seconds distally) using a halogen curing light and all measures for eye protection were taken.

STATISTICAL ANALYSIS

SPSS 10.0 (Statistical Package for Social Sciences) version computer program was used and the mean value were obtained for each parameter.

RESULTS

For details see table 1 & 2.

DISCUSSION

In this study, the frequency according to location, gender, were noted. During treatment, it was observed that mandibular dentition showed greater bracket bonding failure as compared to maxillary dentition during treatment. The results of this study agrees with Sukhia RH⁸ and Pseiner BC and Freudenthaler J¹¹, who noted greater bracket breakage in mandible than in maxilla. It does not agree with Marquezan M and

TABLE 1: MAXILLARY TEETH WITH FREQUENCY OF DEBONDING AND BRACKET BREAKAGE

		Frequency	Percentage
Upper right central incisor	No	136	90.7
	Yes	9	6.0
	Twice	1	.7
	Thrice	1	.7
Upper right lateral incisor	No	131	87.3
	Yes	12	8.0
	Twice	3	2.0
	Thrice	1	.7
Upper right canine	No	133	88.7
	Yes	10	6.7
	Twice	3	2.0
	Thrice	1	.7
Upper right second premolar	No	126	84.0
	Yes	14	9.3
	Twice	4	2.7
	Thrice	1	.7
	4 times	2	1.3

Upper left central incisor	No	130	86.7
	Yes	12	8.0
	Twice	5	3.3
Upper left lateral incisor	No	135	90.0
	Yes	8	5.3
	Twice	3	2.0
	Thrice	1	.7
Upper left canine	No	129	86.0
	Yes	13	8.7
	Twice	4	2.7
	5 times	1	.7
Upper left second premolar	No	125	83.3
	Yes	14	9.3
	Twice	3	2.0
	Thrice	2	1.3
	4 times	2	1.3
	6 times	1	.7
Lower right central incisor	No	130	86.7
	Yes	12	8.0
	Twice	3	2.0
	Thrice	1	.7
	4 times	1	.7
Lower right lateral incisor	No	135	90.0
	Yes	9	6.0
	Twice	3	2.0
Lower right canine	No	125	83.3
	Yes	12	8.0
	Twice	5	3.3
	Thrice	2	1.3
	4 times	3	2.0
Lower right second premolar	No	117	78.0
	Yes	16	10.7
	Twice	10	6.7
	Thrice	3	2.0
	4 times	1	.7
Lower left central incisor	No	140	93.3
	Yes	6	4.0
	Thrice	1	.7
Lower left lateral incisor	No	136	90.7
	Yes	10	6.7
	Twice	1	.7

Lower left canine	No	124	82.7
	Yes	16	10.7
	Twice	3	2.0
	Thrice	2	1.3
	5 times	1	.7
	7 times	1	.7
	Lower left second premolar	No	115
Yes		23	15.3
Twice		8	5.3
6 times		1	.7

TABLE 2:

Teeth	Gender	N	Mean	Std. Deviation	P-value
upper right central incisor	Male	53	.1321	.39408	.384
	Female	94	.0753	.36821	.393
upper right lateral incisor	Male	53	.0566	.23330	.080
	Female	94	.1935	.53686	.035
upper right canine	Male	53	.1321	.44018	.968
	Female	94	.1290	.44784	.968
upper right second premolar	Male	53	.2075	.66096	.800
	Female	94	.2366	.66591	.800
upper left central incisor	Male	53	.2075	.45398	.245
	Female	94	.1183	.43861	.250
upper left lateral incisor	Male	53	.1698	.57965	.261
	Female	94	.0860	.31814	.334
upper left canine	Male	53	.1509	.45557	.673
	Female	94	.1935	.64703	.643
upper left second premolar	Male	53	.2453	.70454	.755
	Female	94	.2903	.90386	.739
lower right central incisor	Male	53	.2075	.49453	.553
	Female	94	.1505	.58878	.534
lower right lateral incisor	Male	53	.1132	.37521	.795
	Female	94	.0968	.36309	.797
lower right canine	Male	53	.2830	.66151	.916
	Female	94	.2688	.83588	.910
lower right second premolar	Male	53	.2453	.58526	.276
	Female	94	.3871	.83448	.232
lower left central incisor	Male	53	.0377	.19238	.492
	Female	94	.0753	.36821	.420
lower left lateral incisor	Male	53	.1321	.39408	.129
	Female	94	.0538	.22677	.189
lower left canine	Male	53	.3396	1.07316	.492
	Female	94	.2366	.72828	.536
lower left second premolar	Male	53	.4151	.96942	.182
	Female	94	.2473	.54486	.250

TABLE 3: FREQUENCY DISTRIBUTION OF BRACKET BREAKAGE

Area	Female	Male	Total
UR1	5(5.3%)	6(11.3%)	11(7.4%)
UR2	13(13.9%)	3(5.6%)	16(10.8%)
UR3	9(9.6%)	5(9.4%)	14(9.5%)
UR5	14(15%)	7(13.2%)	21(14.2%)
UL1	7(7.5%)	10(18.9%)	17(11.6%)
UL2	7(7.5%)	5(9.4%)	12(8.1%)
UL3	12(12.9%)	6(11.3%)	18(12.2%)
UL5	15(16.1%)	7(13.2%)	22(15%)
LR1	8(8.6%)	9(17%)	17(11.6%)
LR2	7(7.5%)	5(9.4%)	12(8.1%)
LR3	12(12.9%)	10(18.9%)	22(14.7%)
LR5	21(22.5%)	9(17%)	30(20.4%)
LL1	5(5.3%)	2(3.8%)	7(4.7%)
LL2	5(5.3%)	6(11.3%)	11(7.4%)
LL3	13(13.9%)	10(18.9%)	23(15.6%)
LL5	18(19.3%)	14(26.4%)	32(21.7%)

Lau T¹², where both upper and lower arches showed equal distribution of bracket failure.

Ammar MH and Ngan PN¹³ and Yang IH and Park JR¹⁴ showed more bracket breakage in teens as compared to adults. In orthodontic treatment efficient bonding and minimum failure rates are essential.¹⁵⁻¹⁷ In this study, out of total 2352 bonded brackets, 433 breakages were found so when these 433 were bonded again, total number of bonded brackets is 2785. In maxilla 192 bracket breakages were found whereas 241 in mandible. When bond failure occurs at the early period of time, it may be due to initial adaption period or lack of experience of young orthodontist.^{8,18-20} Mandibular left second premolar was found to have the maximum number of bracket breakages that is 45 times. This is in agreement with other studies which showed that posterior teeth experience more bonding failure than the anterior teeth.^{18,21-23} It has been said to be due to poor moisture control, excessive masticatory forces and presence of prismless enamel, it may affect micro retention of brackets.

This study showed that bracket breakage in the mandible was greater than the maxilla. This observation is in agreement with the study carried out in a similar setting²¹ but contrasts with other studies carried out in other parts of the world^{24,25} demonstrating greater failure rate in the maxilla. Other authors reported no significant difference between loss in the maxilla and the mandible.^{3,12,19,26,27}

Side of the jaw is indicated by masticatory habits.

In our patients, the left side of the jaws had a higher bonding failure rate than the right one which may be adducted to such habits.^{22,26,28} Masticatory forces which are influenced by diets are known to vary with facial type and culture.^{19,20,29}

Some researchers suggested that patient's gender, socioeconomic status, class of malocclusion, mechanics used during treatment and number of times bracket is handled may also influence the bond failure.^{6,19,24,28}

The relationship between bracket loss and gender is variable. This study did not find any significant difference between male and female in all teeth except upper right lateral incisor that is more in females. It might be because females are more conscious and keep on checking by placing finger on this, some of them are caught with the habit of putting pencil or pen while studying. This study except upper right lateral incisor is in agreement with other researches carried out in the same environment.^{3,30} Considering upper right lateral incisor in this study that shows greater bond failure of this tooth in females, it agrees with the researches showing greater bond failure in females.^{8,24,31}

Retention of brackets on the teeth for as long as the treatment is ongoing is so important for the satisfactory orthodontic treatment.¹⁶ Bonding brackets with adequate skill and expertise along with patient compliance is a key to successful orthodontic treatment.

CONCLUSION

Brackets placed on left mandibular premolars had

the highest failure rates. Therefore, we recommend that special attention be paid while bonding brackets on premolars.

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