

BRACKET DE-BONDING & BREAKAGE PREVALENCE IN ORTHODONTIC PATIENTS

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ABSTRACT

The aim of this study was to investigate the prevalence of orthodontic bracket breakage and de-bonding amongst orthodontic patients at Jinnah Medical & Dental College, Karachi. The study stretched over a 13-month period from April 2008 to May 2009. For this cross sectional study 470 routine patients undergoing fixed orthodontic treatment at the Department of Orthodontics were examined. The male to female ratio was 225: 245 with a mean age of 16.4 years.

The patients were divided into 4 age groups namely A (8-10 years), B (11-13 years), C (14-16 years) and D (>18 years) respectively. In this study, 150 patients had skeletal class I, 265 had skeletal class II division one and 55 had skeletal class II division two malocclusions, respectively.

All patients were bonded with 3M Transbond XT™ light cure orthodontic syringe adhesive system. Prior to bonding, the enamel was polished with 10-15 seconds slurry of pumice paste on slow-speed rotation rubber cup. The teeth were washed and dried, followed by 15-30 seconds enamel etch time per tooth with Coltene Whaledent Swiss-Tec™ 35% ortho-phosphoric acid gel.

The results of the present study demonstrated more mandibular dentition bracket de-bonding as compared to the maxillary dentition. Both sexes demonstrated greater lower buccal segment bracket breakage followed by the lower anterior segment, with males having slightly higher de-bonding rate as compared to their female counterparts. Furthermore, the lower age groups demonstrated greater breakage compared to older age groups.

It was concluded that both sexes had affinity for bracket de-bonding during active orthodontic treatment especially in the mandibular buccal segments. Teenage 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. However, further studies are required to investigate the reasons for bracket breakage and to compare chemically and light-cured composite systems in orthodontics.

Key words: Brackets, Breakage, De-bonding, Etching, Enamel, Orthodontics.

INTRODUCTION

Bracket debonding is a commonly encountered complication during routine orthodontic treatment. As the bonding procedure is technique-sensitive¹, even slight salivary contamination or lack of improper composite-primer application can lead to weaker bond

strength between enamel and bracket.² Other causes are excessive mechanical forces, occlusal interferences and hard sticky diet during treatment.²⁻³ Increased frictional forces encountered with heavy-gauge stainless steel wires during sliding mechanics have also been implicated in bracket breakage during treatment.⁴ Frequent bracket breakage causes delay in

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treatment time, enamel damage, lack of patient cooperation and improper finishing.⁵

Most recent investigators⁴⁻⁶ have studied the bond strength of different composites on various bracket materials. However, in our study, we investigated the prevalence of bracket breakage during active orthodontic treatment related to the oral segment and sex.

METHODOLOGY

In the present cross sectional study 470 routine patients undergoing fixed orthodontic treatment at the department of orthodontics, Jinnah Medical & Dental College, Karachi were examined. The male to female ratio was 225: 245 with a mean age of 16.4 years. The study stretched over a 13-month period from April 2008 to May 2009. None of the subjects suffered from any enamel defects such as fluorosis or amelogenesis imperfecta,

The patients were divided into 4 age groups namely A (8-10 years), B (11-13 years), C (14-16 years) and D (>18 years) respectively. In this study, 150 patients had skeletal class I, 265 had skeletal class II division one and 55 had skeletal class II division two malocclusions, respectively.

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 maxillary and mandibular dentition except for 1st permanent molars, which were cemented with molar bands. The debonding of brackets was noted during treatment. Furthermore, arches were divided into labial and buccal segments to verify de-bonding failure anterior-posteriorly. The stage of treatment and reason for debonding was not noted in the study.

All patients were bonded with 3M Transbond XTTM light cure orthodontic syringe adhesive system. In this study Light-emitting diode lamp was used for 15 seconds per tooth with wave-length of approximately 440-450 nm for photo-initiation. Ortho OrganizerTM 0.022 X 0.028" Roth Bracket Prescription was used. Proper isolation technique during bracket bonding was followed with cheek retractors and high-speed suction.

Prior to bonding, the enamel was polished with 10-15 seconds slurry of pumice paste on slow-speed rotation rubber cup. The teeth were washed and dried followed by 15-30 seconds enamel etch time per tooth with Coltene Whaledent Swiss-TecTM 35% ortho-phosphoric acid gel. The enamel surface was washed with water and dried with oil-free compressed air before bracket placement with direct-bonding technique.

STATISTICAL EVALUATION

SPSS 10.0 (Statistical Package for Social Sciences) version computer program was used and the mean values were obtained for each parameter. One-way ANOVA was utilized to obtain data. In the present study, $P < 0.05$ was considered statistically significant, while $P < 0.01$ was highly significant, followed by $P < 0.001$ as very highly significant.

RESULTS

1. Distribution of Bracket Debonding in Maxilla & Mandible Related to Sex: As noted in Fig 1, the mandibular dentition showed a higher affinity ($P < 0.01$) for bracket bonding failure (mean percentage 78.6) as compared to the maxillary dentition (mean percentage 21.4) during treatment. Furthermore, both males and females demonstrated greater mandibular bracket debonding as compared to the maxillary dentition. Males showed a mean percentage distribution value of 79.4 ($P < 0.05$) in the mandibular dentition as compared to a mean percentage distribution value of 20.6 in the maxillary dentition, whilst females showed a mandibular mean percentage distribution of 82.6 compared to the maxillary mean percentage distribution value of 17.4, respectively.

2. Distribution of Bracket Debonding Related to Age & Sex: As observed in Fig 2, lower age groups demonstrated greater bracket debonding prevalence ($P < 0.01$) as compared to the older age groups in both sexes. The 14-16 years age group demonstrated the highest debonding prevalence values males with 36.7 and females with 40.4, followed by the 17-19 years age group with 27.6 mean percentage value for males and 28.4 mean percentage value for females, respectively. Both sexes showed the least bracket debonding prevalence in the 25-30 years age group with males value of 17.2 followed by females with 12.5 mean percentage value.

3. Area Distribution of Bracket Debonding Related to Sex: As evident in Fig 3, the lower buccal segment demonstrated the highest bracket debonding prevalence ($P < 0.01$) in both the sexes, with males showing a mean percentage value of 32.0 compared with the female mean percentage value of 43.3, respectively. However, females demonstrated greater bracket debonding prevalence in the upper buccal segment (mean value 27.6) compared to the lower anterior segment (mean value 22.9), and showed the least values in the upper anterior segment (mean value 6.2), while males showed greater debonding mean value of 36.9 in the lower anterior region as compared to 17.3 in the upper buccal segment. Furthermore, males also showed the least bracket debonding mean percentage value of 13.8 in the upper anterior segment.

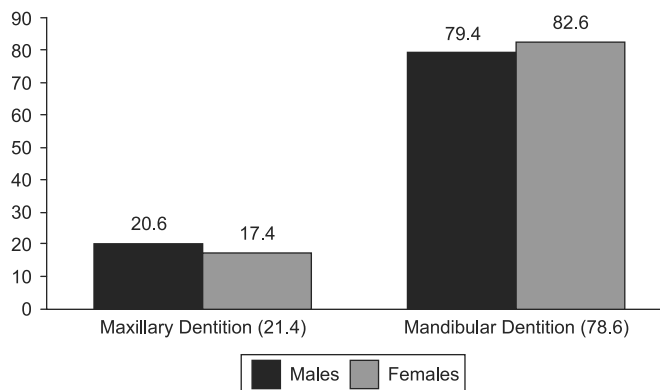


Fig 1: Mean Percentage Distribution of Bracket De-bonding in Maxilla and Mandible related to Sex

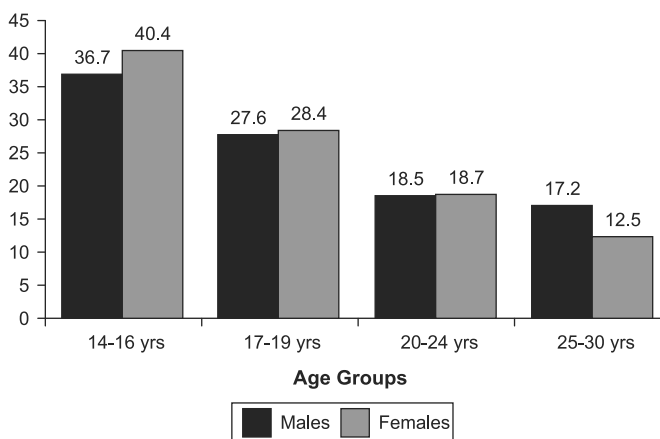


Fig 2: Mean Percentage Bracket De-bonding Prevalence Values related to Sex and Age Groups

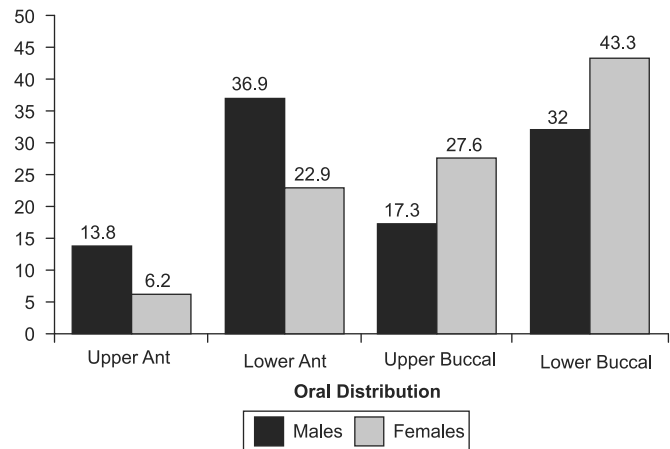


Fig 3: Mean Percentage Distribution of Bracket De-bonding in the dentition

DISCUSSION

The reasons of bracket breakage were not investigated in this study, only the prevalence according to location and sex were noted. It was observed that the mandibular dentition showed greater bracket bonding failure as compared to the maxillary dentition during treatment. The results of the present study agree with Pseiner BC and Freudenthaler J⁷ who also noted increased mandibular dentition bracket failure compared to the maxillary dentition. However, Marquezan M and Lau T⁸ has shown equal distribution of bracket failure in both upper and lower arches. Furthermore in this study, males and especially female subjects demonstrated greater bracket debonding in mandibular dentition. Previous studies by Hobson RS et al⁹ and Boyer DB and Bishara SE¹⁰ also concluded greater mandibular bracket failure in both sexes. Present study results also agree with the recent findings of Liu Z and McGrath CH¹¹ who has shown slightly higher bracket failure in females as compared to their male counterparts.

In this study, lower age groups demonstrated greater bracket debonding prevalence as compared to the older age groups in both sexes. The 14-16 years age group demonstrated the highest debonding prevalence values of males with 36.7 and females with 40.4, followed by the 17-19 years age group, respectively. Ammar MH and Ngan PN¹² and Yang IH and Park JR¹³ have also shown more bracket failure in lower age groups as compared to adults. This could be due to greater self-awareness and motivation in adults as compared to teenage groups. In our study, both sexes

showed the least bracket debonding prevalence in the 25-30 years age group with males value of 17.2 followed by females with 12.5 mean percentage value. A previous study by Le PT and Weinstein M¹⁴ has shown that self-motivated adult patients exhibit better oral hygiene during orthodontic treatment. Furthermore, recent studies¹⁵⁻¹⁶ have claimed that female orthodontic patients have more oral awareness and show greater interest in treatment as compared to their male counterparts.

New Ortho Organizer™ 0.022X0.028" Roth straight-wire bracket prescriptions with double mesh base was used in the present study for each patient. Previous investigators have concluded that fine mesh bases give the highest bond strength.¹⁷ No second-hand or recycled brackets were used on subjects under study. As noted by Coley-Smith A and Rock WP¹⁸ recycled brackets suffer from adverse corrosion changes and are not recommended widely. In this study, etch time was 15-30 seconds per tooth with Coltene Whaledent Swiss-Tec™ 35% ortho-phosphoric acid gel. Larmour CJ¹⁹ has recommended to modify the etch time as 60 seconds produces weaker bond as compared to 15 seconds. However, Bin Abdullah MS and Rock WP²⁰ have concluded that bond strength is similar at 15, 30 and 60 seconds. Furthermore, in the present study the teeth were pumiced prior to acid-etching to remove enamel pellicle. However, most authors do not recommend pumice prophylaxis with composite bonding adhesives.²¹⁻²²

In this study, the lower buccal segment demonstrated the highest bracket debonding prevalence in both the sexes, with males showing a mean percentage value of 32.0 compared with the female mean percentage value of 43.3, respectively. A recent study by Purmal K and Sukumaran P²³ also showed greater bracket debonding in the lower premolar and molar region. This could be attributed to lack of moisture control during bonding.²⁴ Other investigators²⁵ blame occlusal forces in the buccal region for bracket failure. However, in the present study premolar brackets with built-in gingival base offset were used, which claims 20 % reduction of bond failure in lower 2nd premolars due to occlusal interferences.²⁶ Furthermore, any occlusal interference was checked prior to bonding the lower premolars. By comparison, females demonstrated greater bracket debonding prevalence in the upper

buccal segment (mean value 27.6) compared to the lower anterior segment (mean value 22.9), and showed the least values in the upper anterior segment (mean value 6.2), while males showed greater debonding in the lower anterior region as compared to the upper buccal segment. Past studies²⁷⁻²⁸ have shown relationship between bracket failure and sex, however, they indicate greater bracket breakage in males as compared to the female subjects. Recently, Moninuola AE and Isiekwe MC²⁹ has shown equal distribution of bracket failure in males and females with more breakage in lower socio-economic groups. Some studies³⁰⁻³¹ investigating bracket bonding failure during treatment indicate greater distribution in the lower anterior region.

CONCLUSION

It was concluded that both sexes had affinity for bracket de-bonding during active orthodontic treatment in the lower anterior and mandibular buccal segments as compared to the maxillary dentition. Teenage 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. Further studies are required to investigate the reasons for bracket breakage and to compare chemically and light-cured composite systems in orthodontics.

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