Distortion of Brackets by Conventional Debonding Technique

Yogesh Gupta, K Sadashiva Shetty, Chandresh Shukla

ABSTRACT

Introduction: Various debonding techniques have been suggested by several investigators which claim to remove brackets from the tooth with minimum distortion. The present study has been done to compare three conventional debonding techniques using debonding pliers.

Objective: To know the best method of debonding the brackets from the tooth surface with minimal distortion.

Materials and methods: The present study is done in vitro on extracted teeth. Thirty standard edgewise brackets with 0.022" × 0.028" were bonded on to the teeth. Three groups were made to compare three different techniques. Occlusal side 'A' and gingival side 'B' of the wings were marked. Optical profile projector with accuracy to 0.001 mm was used to measure the slot width and interwing distance accurately. An indigenous bracket debonding plier was used in three different ways for comparison.

Results: Slot width: The minimum mean decrease in slot width was 0.027 in group 3. Interwing distance on 'A' side: Group 1 showed significantly higher difference in interwing distance on 'A' side (0.061) as compared to groups 2 and 3 (0.019). Interwing distance on 'B' side: The minimum mean decrease in interwing distance on 'B' side was 0.012 with group 3.

Discussion: A number of studies have been done to describe the effects of conventional debonding techniques on the tooth surface. In most of the studies, different techniques were used with different bonding materials and different bracket system. This study has been evaluated in three ways: (i) change in slot width: The slot width got affected minimally when the brackets were deboned by holding them gingivoocclusally with archwire into the slot and rotate it gingivoocclusally; (ii) change in interwing distance on occlusal side: Bracket debonded by holding it gingivoocclusally and rotating it gingivoocclusally with or without holding archwire did not show any difference; (iii) change in interwing distance on gingival side: Brackets debonded by holding it gingivoocclusally and rotating it gingivoocclusally with or without holding archwire did not show much difference.

Conclusion: The brackets can be reused after recycling (provided they do not get distorted significantly). Among conventional debonding techniques (with bracket removing plier), the best method found was to debond bracket by holding it occlusogingivally with the archwire into the slot.

Keywords: Brackets, Debonding, Debonding plier, Optical profile projector, Slot width, Interwing distance.

INTRODUCTION

Man is always striving for the new things to make his work quick, comfortable and better. But at the same time, these things create some new problems which become a challenge to him.

On completion of active orthodontic treatment, the brackets are removed by different methods and after a reconditioning process they may be reused on subsequent patients. This has obvious economic advantages. M/s Esma Chemicals, Inc, Highland Park, Illinois, USA (Advertisement, AJO, 1987) has claimed an estimated saving of 5,000 Dollars per year per clinician.

In conventional debonding techniques, the bracket is debonded by debonding plier by holding it mesiodistally or occlusogingivally without or with archwire filled into the bracket slot or by force applied by the debonding plier or ligature cutter positioned at the enamel/composite or composite/bracket interface. The force necessary to break adhesive-bracket or adhesive-tooth interface is sufficient to cause deformation of the bracket. So, not all the brackets are suitable for reconditioning since they may become distorted during debonding procedure.

OBJECTIVE

This study was done to evaluate the best conventional method of debonding.

MATERIALS AND METHODS

Materials

Thirty extracted premolars of orthodontic patients were taken in this study irrespective of the quadrants. Teeth were divided into three groups. Each group had 10 teeth.

All the teeth were without caries, except two teeth of group A having Class I silver filling. Thirty standard edgewise 0.022" × 0.030" brackets with mesh base (80/linear inch) were taken.

No mix adhesive Ortho-one was used to bond brackets on to the teeth. An indigenous bracket debonding plier (resembling ETM made Direct Bond Attachment Remover No. 628-011) was used. Optical profile projector was used to measure slot size and interwing distance. A piece of 0.022" × 0.028" straight length stainless steel archwire was used to fill bracket slot. A 0.010 stainless steel ligature wire was used to tie the archwire to the bracket.

Methods
All the 30 teeth were cleaned and numbered from 1 to 30. Brackets numbered from 1 to 30 were bonded on to the teeth. Teeth were fixed in Plaster of Paris and separate plaster blocks were made to debond brackets by different methods. White correction fluid was used to put mark on one side of base to identify occlusal (A) side and gingival (B) side of the wings. The slot width and interwing distances were measured with the help of optical profile projector (Fig. 1). The teeth and brackets were divided into three groups as follows:

Group 1 (no. 1-10): Brackets was debonded by holding it mesiodistally at the base of the bracket and rotating it in anticlockwise direction (Fig. 2).

Group 2 (no. 11-20): Bracket was debonded by holding it gingivoocclusally and rotating it gingivoocclusally (without archwire into the slot (Fig. 3).

Group 3 (no. 21-30): Bracket slot was filled with archwire piece and then debonded by holding it gingivoocclusally and rotating it gingivoocclusally (Fig. 4).

The slot width and interwing distance were measured the same way as did before bonding.

RESULTS
A, B and C represent groups 1, 2 and 3 respectively. Tables 1 to 3 show slot widths, interwing distances on occlusal and gingival sides before bonding, after debonding and the differences after debonding. Results were evaluated individually after debonding.

1. Slot width: In group 1, the mean decrease in slot width after debonding was 0.049 mm. In group 2, the mean decrease was 0.033 mm. In group 3, the mean decrease was 0.027 mm.

2. Interwing distance on ‘A’ side: In group 1, the mean decrease in interwing distance on occlusal side was
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0.061 mm. In group 2, the mean decrease was 0.019 mm. In group 3, the mean decrease was 0.019 mm. Group 1 showed significantly higher difference in interwing distance on ‘A’ side as compared to groups 2 and 3.

3. Interwing distance on ‘B’ side: In group 1, the mean decrease in interwing distance on gingival side was 0.035 mm. In group 2, the mean decrease was 0.015. In group 3, the mean decrease in interwing distance on gingival side was 0.012 mm.

DISCUSSION

Scanning through the literature shows that studies have been done to describe the effects of several conventional methods of debonding on tooth surface and/or on bracket. A number of studies3-5 have been done to describe the effects of conventional debonding techniques on the tooth surface. Bennett et al in 1984,4 compared three techniques of bond removal and they concluded that the techniques of applying force to the outer wings of bracket at the resin bracket interface was the best as compared to the technique which removed bracket at enamel resin interface. Odegaard and Segner 19886 said that orthodontists want to remove the appliance at the end of treatment without exerting excessive forces. An extensive study was done by Oliver and Pal7 to evaluate the changes in slot size and interwing distance due to conventional debonding techniques. Oliver and Pal, in 1989, debonded 821 brackets from 98 subjects by using three different methods: (i) Mesial and distal wings of an edgewise twin brackets were squeezed together with pliers or by placing the pliers occlusally and gingivally; (ii) blades of the debonding pliers or ligature cutters positioned at the enamel/composite or composite/bracket interface; (iii) use of lift off debracketing instrument (LODI). They found least distortion of brackets by the use of LODI. Coley Smith A, Rock WP8 also recommended the use of LODI. Coley Smith suggested the use of archwire into the slot at the time of debonding to reduce distortion particularly when deboding pliers are used. Knosel et al9 compared four methods. They suggested that the use of the side cutter and the bracket removing plier would not be better than use of LODI and Coronaflex. The study of Eslamian10 cannot be compared with the present study as different methods were suggested for different types of brackets. This study has been done to evaluate the effect of conventional debonding technique (the use of debonding plier) on slot width and interwing distance of the brackets.

Change in Slot Width

After debonding by conventional debonding technique, the mean decrease in the slot widths of the brackets of groups 1, 2 and 3 were 0.049, 0.033 and 0.027 mm respectively (Table 1). In group 1, the value of mean difference of 0.049 mm was mainly because of gross distortion of bracket no. 6. Distortion of other brackets of group 1 (mean decrease in slot width of the rest of 9 brackets was 0.031 mm) was comparative to those of other groups. The results of this study cannot be compared fully with the results of the study of Oliver and Pal because they did not standardize instrument or technique to debond brackets in method A and B. Only the group 3 of the present study was compared with method C. With method C, there was increase in slot width by 0.016 mm and 0.001 to 0.005 mm in Rocky mountain bioprogressive brackets and unitek light square brackets respectively, when maxillary lateral incisor brackets and mandibular incisor brackets were studied. There was decrease in slot width by 0.052 mm (RM brackets) when maxillary central incisors were studied. In group 3 (present study), there was decrease in slot width by 0.027 mm. The investigator experienced a considerable heavier force to debond the brackets of group 1 than the brackets of groups 2 and 3. Among the three debonding techniques, the slot width got affected minimally when the brackets were deboned by holding them gingivoocclusally with archwire into the slot and rotate it gingivoocclusally.

### Table 1: Slot width before bonding, after debonding and comparison

<table>
<thead>
<tr>
<th>Slot width (in mm)</th>
<th>N</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>Std. error</th>
<th>95% confidence interval</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>10</td>
<td>0.049</td>
<td>0.058</td>
<td>0.018</td>
<td>0.008 - 0.090</td>
<td>0.008</td>
<td>0.210</td>
</tr>
<tr>
<td>Group 2</td>
<td>10</td>
<td>0.033</td>
<td>0.009</td>
<td>0.003</td>
<td>0.026 - 0.039</td>
<td>0.017</td>
<td>0.049</td>
</tr>
<tr>
<td>Group 3</td>
<td>10</td>
<td>0.027</td>
<td>0.005</td>
<td>0.002</td>
<td>0.023 - 0.031</td>
<td>0.021</td>
<td>0.038</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>0.036</td>
<td>0.034</td>
<td>0.006</td>
<td>0.024 - 0.049</td>
<td>0.008</td>
<td>0.210</td>
</tr>
</tbody>
</table>

Kruskal-Wallis ANOVA; p = 0.198; not significant

### Table 2: Interwing distance on ‘A’ side before bonding, after debonding and comparison

<table>
<thead>
<tr>
<th>Interwing A (in mm)</th>
<th>N</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>Std. error</th>
<th>95% confidence interval</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>10</td>
<td>0.051</td>
<td>0.060</td>
<td>0.019</td>
<td>0.008 - 0.094</td>
<td>0.005</td>
<td>0.214</td>
</tr>
<tr>
<td>Group 2</td>
<td>10</td>
<td>0.013</td>
<td>0.010</td>
<td>0.003</td>
<td>0.006 - 0.020</td>
<td>0.001</td>
<td>0.032</td>
</tr>
<tr>
<td>Group 3</td>
<td>10</td>
<td>0.013</td>
<td>0.009</td>
<td>0.003</td>
<td>0.006 - 0.019</td>
<td>0.002</td>
<td>0.029</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>0.026</td>
<td>0.039</td>
<td>0.007</td>
<td>0.011 - 0.040</td>
<td>0.001</td>
<td>0.214</td>
</tr>
</tbody>
</table>

Kruskal-Wallis ANOVA; p = 0.011; significant
Change in Interwing Distance on Occlusal Side

The maximum decrease in mean interwing distance was 0.061 mm in group 1, when the brackets were debonded by holding them mesiodistally and rotating in anticlockwise direction (Table 2). The decrease in interwing distances in groups 2 and 3 did not differ much with one another (0.019 and 0.019 mm respectively). Statistically only subgroup 1 was found different from all other three subgroups.

Change in Interwing Distance on Gingival Side

The decrease in mean interwing distance after debonding was maximum when the brackets were held mesiodistally and debonded by rotating them in anticlockwise direction (Table 3). There was not much difference in mean changes when groups 2 and 3 were compared (0.015 and 0.012 mm respectively).

When the brackets were held mesiodistally, the wings of each single bracket of a twin bracket came close together without changing slot width while in the cases when the brackets were held occlusogingivally, the wings on gingival side came close to those on occlusal side affecting slot width only without changing interwing distance.

Mean and standard deviation for the slot width and distance B was calculated. Data was checked for normality using Shapiro-Wilks test. Data did not follow the assumptions of normality. Thus nonparametric test, i.e. Kruskal-Wallis analysis of variance (ANOVA) was used to test the mean between the three groups.

Post hoc comparison was done using Mann-Whitney U test (Table 4). Bonferroni correction was done for the three comparisons. Thus, Bonferroni corrected alpha value was 0.0167. SPSS version 18.0 was used for statistical analysis.

CONCLUSION

After the active orthodontic treatment, the brackets are removed by various debonding techniques. The brackets can be reused after recycling (provided they do not get distorted significantly), although there may be some objection to their use on ethical grounds. Among conventional debonding techniques (with bracket removing plier), the best method found was to debond bracket by holding it occlusogingivally with the archwire into the slot.

ACKNOWLEDGMENT

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REFERENCES