Study Comparing the Shear Bond Forte of Ceramics with Metal Reinforcement to Unreinforced Ceramic Brackets

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ABSTRACT

Background: In an effort to address the growing need for more aesthetic appliances, ceramic brackets were introduced into orthodontics. The need for more aesthetic and less obvious appliances has risen as a result of adult orthodontic therapy. The notion of attaching various resins to enamel has found practical applications in all areas of dentistry, as well as the bonding of orthodontic brackets, with the advent of the acid etch bonding procedures1. In an effort to address the growing need for more aesthetic appliances, ceramic brackets were introduced into orthodontics. The need for more aesthetic and less obvious appliances has risen as a result of adult orthodontic therapy. The differences in adhesive remnant index (ARI) and shear bond strength will be useful for orthodontic participants as well as practitioners.

Methodology: This comparative study was conducted at Orthodontic Department, Bacha Khan College of Dentistry, Mardan from 1st July 2021 to 31st December 2022. A total of 150 brackets (75 reinforced ceramic brackets and 75 conventional ceramic brackets in each cluster) were enrolled. The first premolar teeth that had been pulled in their entirety for orthodontic treatment were chosen to be bonded. Only the first maxillary premolar teeth with undamaged surfaces that had recently been removed and preserved were used. Premolars that had broken down or decayed were eliminated. The first maxillary premolar teeth with undamaged surfaces that had recently been removed and preserved were used. Premolars that had broken down or decayed were eliminated. Patients who had ever received fixed orthodontic treatment were also disqualified. The study made use of the Clarity and Transcend 6000 brackets from 3M Unitek. Light-cured composite was used to attach 75 Clarity brackets and 75 Transcend 6000 brackets to teeth. For 42 hours, all bonded samples were maintained in normal saline at 37°C. Bonded teeth were preserved in synthetic saliva at 37°C for 24 hours after being unattended for 30 minutes. The synthetic saliva, which has been extensively used in caries exposure programs, was made from deionized distilled water and had the same ratios of H2O2 and CaCl2 as those found in human saliva. The enzymes found in normal saliva are absent from artificial saliva, yet it is uniform between samples and has a long ridge life. All samples were subjected to thermal cycling starting at 50°C. To evaluate the shear de-bonding strength, brackets were verified using the AGS-J Shimadzu machine. The Micro-Vu microscope was used to analyze bracket catastrophe spots after de-bonding in all of the teeth at a 30x magnification. The adhesive remnant index (ARI) was used to assess the quantity of enduring bonding following bracket elimination. The data was analyzed with SPSS-24. The Chi square test was used to see whether there were any variances amongst the two clusters.

RESULTS

The average values and assessment of the shear bond strengths of ceramic brackets made of Clarity and Transcend 6000. There was no statistically significant difference amongst the two brackets.
evaluated, according to an independent t-test associating the clarity and transcend 6000 ceramic brackets (P=0.345) [Table 1]. The ARI results for the de-bonded brackets. According to the results, there were no appreciable variations in the ARI scores for the two ranges. (P=0.201) (Table 2)

### Table 1: Mean values and comparison of the shear bond strengths of ceramic brackets made of Clarity and Transcend 6000

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Mean±SD</th>
<th>Variance</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarity</td>
<td>75</td>
<td>11.33</td>
<td>26.17</td>
<td>18.79±4.04</td>
<td>19.461</td>
<td>0.345</td>
</tr>
<tr>
<td>Transcend 6000</td>
<td>75</td>
<td>9.11</td>
<td>13.01</td>
<td>11.08±2.33</td>
<td>7.700</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2: After debonding, the Clarity and Transcend 6000 Ceramic brackets’ adhesive residual index (ARI)

<table>
<thead>
<tr>
<th>Brackets</th>
<th>N</th>
<th>Remnant Index Score I</th>
<th>Remnant Index Score II</th>
<th>Remnant Index Score III</th>
<th>Remnant Index Score IV</th>
<th>Remnant Index Score V</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarity</td>
<td>75</td>
<td>64</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>0.201</td>
</tr>
<tr>
<td>Transcend 6000</td>
<td>75</td>
<td>62</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

### DISCUSSION

It has been demonstrated that ceramic brackets without a polycarbonate foundation and new orthodontic brackets employing polycarbonate bases have equal bond strengths. In the current study, the shear bond force of traditional ceramic brackets & novel metal-lined ceramic brackets was compared. Clinicians are concerned about the potential for enamel fracture during debonding when ceramic brackets are bonded. As a result, several modifications to the strategy of ceramic brackets have been made in an effort to make the de-bonding process harmless. Although new metal lined ceramic brackets have some superior qualities, both types of ceramic brackets have mechanical retention characteristics. According to the manufacturer, metal-lined slots in clarity brackets help toughen the brackets so they can withstand normal orthodontic stresses as well as reduce enhanced friction caused by the arch wire striking porcelain.

The findings of several studies on the bonding strengths of various brackets vary substantially. When compared to adhesives with light filling, those that are extremely packed offer the strongest bond\textsuperscript{12}. Olsen et al\textsuperscript{13} compared the shear bond strengths of the ceramaflex bracket and the transcend 6000 ceramic bracket and came to the conclusion that the ceramaflex bracket’s mean shear bond strength was much lower than the transcend 6000 bracket’s. The bracket failure locations between the two types of brackets did not differ much, however the ceramaflex bracket showed a steadier bond failure position, especially among the polycarbonate base and ceramic bracket. As a result of less force being placed on the enamel surface during de-bonding, this is a more preferable position for a bond breakdown.

Both traditional ceramic brackets and clear brackets scored similarly on the ARI, i.e. all adhesive is still on the tooth surface. The findings of the current study concur with those made public by Alavi et al\textsuperscript{14} noted that the full bonding substance stayed on the tooth surface. Despite having high shear bond strength, accurate de-bonding of ceramic brackets without initiating enamel destruction was observed in the current study. It is advised to conduct more study to learn how clarity brackets de-bond when removed using tools made specifically for use. This in-vitro study gave useful data on 2 different bracket de-bonding behaviours. Additionally, similar research on human subjects and living animals is required.

### CONCLUSION

The differences in ARI ratings and shear bond strength between the Transcend 6000 ceramic and clarity were negligible.

**Conflict of interest:** Nothing to declare

### REFERENCES