Original Article

Force to Debond Brackets from High-fusing and Low-fusing Porcelain Systems

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ABSTRACT
The purpose of this study was to test the hypothesis that porcelain surface finishing, ie, low- and high-fusing porcelain, has an effect on the amount of force required to debond orthodontic brackets. A total of 20 high-fusing and 20 low-fusing porcelain specimens were prepared, polished, and bonded with standard edgewise brackets using a suggested porcelain bonding protocol. The brackets were debonded with a universal testing machine at shear mode. Resin removal was performed using two methods: a multifiluted carbide bur with and without the use of Sof-Lex polishing discs. Representative specimens were studied under a scanning electron microscope before and after debonding to assess the surface morphology and potential surface damage. Statistical analysis with a t-test revealed that there was no difference between the two porcelain treatments on the force to debond values and no qualitative differences were observed on the porcelain surface between the two resin clean-up methods. From a clinical perspective, the practitioner can bond ceramic restorations without previous knowledge of the porcelain type used. (Angle Orthod 2006;76:278–281.)

KEY WORDS: Porcelain; Bond strength; Surface characteristics

INTRODUCTION

With the advent of new technologies in porcelain fabrication methods and the growing number of adult patients seeking orthodontic treatment, the likelihood of bonding orthodontic brackets to porcelain is increasing. The demand for highly esthetic restorations has generated the development of more advanced porcelain systems that can be used for both all-ceramic and porcelain-fused-to-metal restorations. The newest porcelains, made of low-fusing porcelain, provide many greater advantages vs traditional porcelains, including increased opalescence, the ability to polish chairside, and less abrasive wear on opposing teeth and materials. Conventional bonding systems typically give very low force to debond values, and companies have marketed products that use a stronger etchant and a silane-coupling agent to improve the amount of force to debond. Although many studies have addressed the issue of the force to debond brackets bonded to porcelain, there is a notable lack of evidence of investigations assessing the variability of the forces to debond among different porcelain types as well as failure mode of new porcelain systems. This issue receives greater importance considering that in most cases, the orthodontist is faced with the problem of bonding to a surface for which there is no information regarding its structure and type (traditional vs new).

Thus, the purpose of this study was to determine whether there is a difference in force to debond between two different porcelain systems as well as to determine the site of bond failure.

MATERIALS AND METHODS

A total of 40 porcelain facets were prepared and polished. The samples were divided into two groups...
of 20 on the basis of porcelain type. Group A was of a high-fusing, vitadur alpha dentine shade A3 porce-

The porcelain samples were stacked using a pre-

Representative samples from the two groups were

Shear bond testing

A universal testing machine (Monsanto Tensometer

Polishing

After debonding, the two porcelain groups were fur-

porcelain were examined under the SEM to assess the

Statistical analysis

A t-test was used to analyze the data collected for

RESULTS

The forces to debond for the high-fusing and low-

DISCUSSION

In this study, the results of force to debond testing

TABLE 1. Mean Force to Debond (Newtons)

<table>
<thead>
<tr>
<th>Porcelain Type</th>
<th>Grouping*</th>
<th>Number</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low fusing</td>
<td>A</td>
<td>15</td>
<td>79.489</td>
<td>11.985</td>
</tr>
<tr>
<td>High fusing</td>
<td>A</td>
<td>14</td>
<td>86.755</td>
<td>13.963</td>
</tr>
</tbody>
</table>

* Means with same letters are not significantly different at the 0.05 level of significance.

from being effectively approximated by the surface

From a compositional perspective, the main differ-

The addition of leucite raises the co-

Other contributing factors,
such as surface roughness and the bonding system used most likely play a role. Both porcelains were polished and bonded using the same methods. Visual inspection of the SEMs showed they had similar roughness, which possibly leads to similar forces to debond. The bonding provided surpassed the resin cohesive strength. The majority showed cohesive failures. Adhesive failures are rarely observed due to the difficulty of verifying that all the resin has remained on the enamel or porcelain surface, because even if small layers of adhesive may have been removed, it is not known how the resin looked like when it was intact.

From a clinical perspective, the results of this study suggest that it is not necessary for the practitioner to have previous knowledge of the type of porcelain that will be bonded, because no difference is expected with a standard bonding protocol.

The images obtained from the SEM showed that there was no surface damage to the porcelain. However, the porcelain surface appeared similar to the enamel after etching with hydrofluoric acid and debonding, and this may indicate the presence of resin tags. As has been reported in other studies, the presence of these resin tags will have an effect on the
surface characteristics of the porcelain.\textsuperscript{6,9} The method of polishing after debonding will also affect the surface topography and color characterization of the area that was bonded.\textsuperscript{6,9} Other polishing methods may provide different topographical patterns, and the alterations described in this study are only indicative of the effects of the specific polishing protocol used and should not be applied to any other resin-removal protocol. These are important considerations regarding the superior chairside polish ability of low-fusing porcelains.

**CONCLUSIONS**

- There is no difference in bond strength between low- and high-fusing porcelain restorations. From a clinical perspective, the operator can bond ceramic restorations without previous knowledge of the porcelain type.
- The SEM indicates that there was significant adhesive left on the porcelain surface and bracket, so the site of failure was cohesive rather than adhesive.

**REFERENCES**