FRICIONAL CHARACTERISTICS OF A COBALT-CHROMIUM ORTHODONTIC BRACKET

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SUMMARY: The frictional characteristics of an orthodontic bracket can play an important role in the sliding mechanics of orthodontic treatment. While the frictional force is directly proportional to the normal force, the actual design and resulting contact stresses might also play an additional role in the net forces developed. A cast cobalt-chromium bracket, Nu-Edge® is compared with other competitive stainless steel brackets of similar design in this in-vitro friction study. While the designs were identical, the material and manufacturing methods for these brackets were different. The brackets were also compared against various orthodontic wires of different alloy composition and surface characteristics. The Nu-Edge cast cobalt-chromium bracket had the lowest friction under all test conditions.

Methods and Materials

Table 1 lists the materials and manufacturing method for each test bracket.

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<tbody>
<tr>
<td>Material</td>
<td>Cobalt-Chromium (ASTM F-75)</td>
<td>Stainless Steel</td>
<td>Stainless Steel</td>
<td>Stainless Steel</td>
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<tr>
<td>Method of Mfg.</td>
<td>Precision Casting</td>
<td>Machining</td>
<td>Machining</td>
<td>Casting</td>
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Frictional analysis was performed by using a specially designed apparatus mounted on an Instron mechanical testing machine. The archwire is retained within the bracket slot by an elastic ligature, applying a constant normal load. The archwire, which is attached to a swivel joint, is held stationary as the bracket is pulled along the length at a rate of 1cm/minute.

Each bracket is cemented to a metal cylinder, the face of which is inclined to 7° to negate any possible effects of torque. A different section of straight wire is used for each experimental set-up to avoid introducing any further variable in the test protocol. The frictional force is recorded as the height of the first peak on the force vs. displacement trace.

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The Nu-Edge bracket (ASTM F-75, made of surgical grade cobalt-chromium alloy, was compared against similar stainless steel brackets from Ormco, GAC and American Orthodontics.

Results and Discussions

Three commonly used wire types were used in conjunction with the four brackets, i.e., Bow-Flex high stiffness wire, TiMolium, a titanium alloy wire and Shiny Bright stainless steel. As shown in Figures 2, 3 and 4, the Nu-Edge bracket exhibits the lowest friction force in every test category, as compared to other brackets of different materials and manufacturing processes.

The clinical performance is a multi-factorial issue with some of the key parameters being design, material of construction and the manufacturing process. Based on the results of this study, which includes all of these test parameters, it can be concluded that the Nu-Edge bracket is superior to other brackets in clinical performance.

References

