FRICTIONAL CHARACTERISTICS OF A COBALT-CHROMIUM ORTHODONTIC BRACKET

Franklin Garcia-Godoy, DDS, MS*
Investigation Performed at the University of Texas Health Science Center, San Antonio, Texas

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.

Introduction

The bracket/archwire interface plays an important role in the translation of tooth movement along an archwire. The importance of the resultant frictional force at this junction on the sliding mechanics can be significant. In fact, this subject invokes such a great interest that the orthodontic literature is rich in friction studies from innumerable eminent authors. While published studies include varied subjects like comparison of various orthodontic wires against stainless steel brackets[1] and comparison of frictional forces during simulated canine retraction[2], the frictional characteristics of a bracket made of cobalt-chromium alloy has not been compared to a similar stainless steel bracket. While a cobalt-chromium wire has been shown to produce lower frictional forces in conjunction with beta titanium or nickel titanium wires[3] it is the object of this study to compare a Co-Cr Nu-Edge bracket (shown in Figure 1) against comparable stainless steel brackets in an in-vitro friction study.

Figure 1. Nu-Edge Cast Co-Cr Bracket

Methods and Materials

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

Table 1

Bracket Name & Mfr.	Nu-Edge TP LaPorte, IN	Mini Diamond Ormco Glendale, CA	Micro Arch GAC	Medium Twin Std. Am. Orthod.
Material	Cobalt-Chromium (ASTM F-75)	Stainless Steel	Stainless Steel	Stainless Steel
Method of Mfg.	Precision Casting	Machining	Machining	Casting

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 7º 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.

(continued)

*Dr. Garcia-Godoy is Professor and Director of the Clinical Materials Research Department of Restorative Dentistry at the Dental School of the University of Texas Health Science Center, 7703 Floyd Curl Drive, San Antonio, TX 78284-7890.

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.

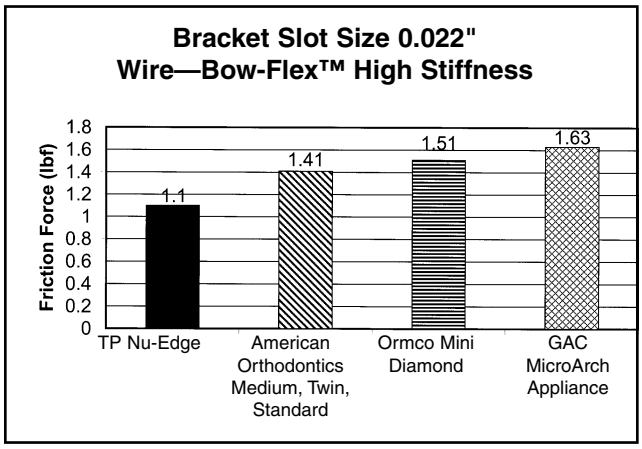

Figure 2

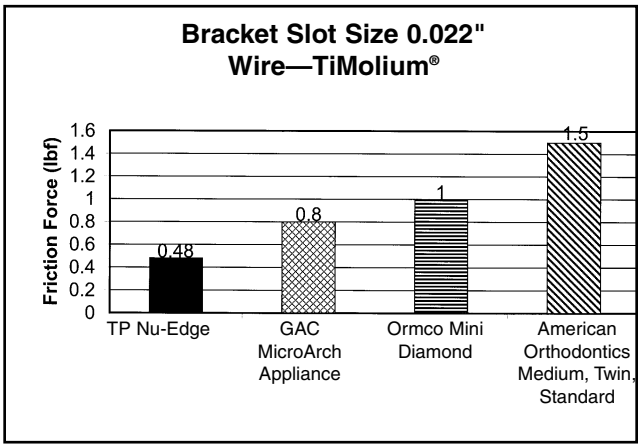

Figure 3

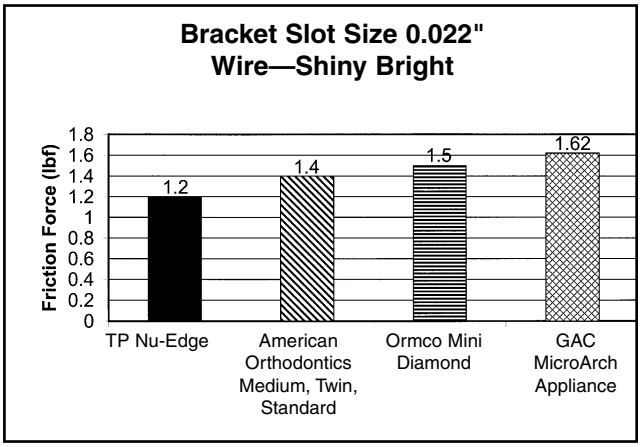

Figure 4

References

1. Stannard J., Gau J., Hanna M. Comparative friction of orthodontic wires under dry and wet conditions. Am J. Orthod. Vol 89, No 6, pp. 485-491, 1986.

2. Garner L.D., Allai W.W., Moore B.K. A comparison of frictional forces during simulated canine retraction of a continuous edgewise archwire. Am J. Orthod. Vol 90, No 5, pp. 199-203, 1986.

3. Vaughn J., Duncanson M., Nanda R., Currier G.F. Relative kinetic frictional forces between sintered stainless steel brackets and orthodontic wires. Am J. Orthod. Vol 107, No 1, pp. 20-27, 1995.

TP Orthodontics, Inc.
Business Solutions for the Orthodontic Practice

100 Center Plaza
La Porte, Indiana 46350-9672
Tel: 800-348-8856 or 219-785-2591 Fax: 219-324-3029
Internet: www.tportho.com