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The Evaluation of Molar Buccal Tubes Front and Back Openings Dimensions, Torsional Play Angle and Friction (An in vitro study)

A Thesis Submitted to the College of Dentistry, University of Baghdad in Partial Fulfillment of the Requirements for the Degree of Master of Science in Orthodontics

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Abstract

Buccal tubes are orthodontic attachments used on the posterior teeth instead of bands, so it is important to focus on the effect of their properties on orthodontic treatment.

The aims of the present in vitro study are to evaluate and compare the static frictional forces, tube opening dimensions and torsional play angle of upper first molar tubes belong to six brands.

Single bondable, non-convertible first molar buccal tubes were used in this study from six brands (Dentaurum, Forestadent, Ormco, 3M, American Orthodontics, and A-star). All the tubes had an MBT 0.022 prescription.

For tube opening dimension, ten buccal tubes of each brand were examined by an optical microscope. Each tube was fixed during examination using synthetic mud and oriented for observation of the front and back slot openings. A picture was taken for both tube openings and the result appeared on the computer's screen where width and height measurements were made.

While in torsional play angle, ten buccal tubes of each brand were used. Each tube was fixed on a metal block attached to a surveyor base. Then an L-shaped wire was inserted inside the front opening of the tube. Two photographs were taken, one with the wire in free fall position and the other with the wire elevated by a 10g weight with the same angle of shooting as the first photograph. Later, the two images were superimposed in Adobe Photoshop program, and an electronic MB-ruler Software was used to calculate the angle which represents the torsional play within each tube.

Regarding friction test, for each brand 12 steel blocks were prepared by using CNC machine. A hole was drilled in the center of each block and a steel rod was made by an electric metal turning lathe to fit loosely in the hole which allowed it to rotate. On each block three buccal tubes were adhered in one line,

the center one being on the rotating rod. A straight 0.019x0.025 stainless steel wire was passed through the three tubes and static friction was measured by a Universal Testing Machine (Instron) at a crosshead speed of 5 mm per minute. The test was repeated with a 100gm weight attached to the middle buccal tube's hook to rotate the steel rod and the middle buccal tube with it increasing friction. ANOVA and LSD tests were used to statistically analyze the results.

Results showed that there are marked differences between measured tube dimensions and the manufacturer stated dimensions with the front tube openings being generally larger than the back opening dimensions. Furthermore, the torsional play angle was highest in A-Star and smallest in Ormco's tubes. This angle was significantly correlated to the height of the tube front opening.

Higher frictional resistance force was noted with Ormco, 3M and American Orthodontics tubes, while the least values were observed with Forestadent tubes.

It can be concluded that the tube opening dimensions and frictional forces vary among the six brands tested.