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Shear Bond Strength of Orthodontic Buccal Tube Bonded to Zirconia Crown (An in Vitro Study)

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By

Sally Saad Ali Ihsan

B.D.S.

Supervised by

Assist. Prof. Dr. Shahbaa A. Mohammed

B.D.S., M.Sc. (Orthodontics)

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Abstract

The use of zirconia in cosmetic dentistry expanded obviously coincided with a new trend of adult orthodontics; therefore it is very important to find an accepted method and material of bonding orthodontic appliances affectively to zirconia surface.

The present study was carried out to evaluate and compare the shear bond strength of buccal tube bonded to monolithic zirconia crown after using, three different 10-methacryloyloxydecyl dihydrogen phosphates (10-MDP)-containing adhesive systems, and study the mode of bond failure.

The sample composed of 40 monolithic CAD/CAM zirconia crowns of lower right first molar. All crowns were treated first by sandblasting with aluminum oxide particle 50 μ m, then they were divided into four group (n=10). According to the type of the adhesive system used; conventional light cure orthodontic bonding system (Transbond™ XT Primer/Transbond™ XT composite resin) was used in the control group, while three different (10-MDP)-containing adhesive systems (Z-Prime Plus primer/Transbond™ XT composite resin, Single Bond Universal adhesive/ Transbond™ XT composite resin, TheraCem dual-cured self-adhesive resin cement) were used in the test groups. Buccal tube of lower right first molar was bonded on the buccal surface of zirconia crown in each group using one of these adhesive systems.

Shear bond strength was measured using Tinius Olsen universal testing machine at crosshead speed of 1mm/min. After debonding, each tube base and zirconia surface were inspected under a stereomicroscope (10X) and adhesive remnant index was recorded. The difference in shear bond strength between main groups was analyzed using ANOVA test.

The result revealed that Single Bond Universal group had the highest mean value of shear bond strength (16.299 ± 2.201 MPa), followed by TheraCem group (15.373 ± 1.575 Mpa), then Z-Prime Plus group ($12.176 \pm$

1.411Mpa) , while the control group had the least value (5.337 ± 1.274 Mpa). Cohesive failure within the adhesive itself score (II) was the predominant in Z-Prime Plus and TheraCem groups, and failure at the adhesive-buccal tube base interface Score (I) was the predominant in Single Bond Universal group, while score (III) failure at zirconia-adhesive interface was the predominant in the control group.

In conclusion, all three types of (10-MDP)-containing adhesive systems provide good value of shear bond strength for buccal tubes bonded to zirconia surfaces, however Single Bond Universal adhesive/composite resin showed the highest bond strength.