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Shear/peel bond strength of repositioned ceramic brackets

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ABSTRACT

Improper orthodontic bracket position may necessitate bracket removal and rebonding to establish correct bracket position. This procedure is necessary to use efficient orthodontic mechanics. The purpose of the study was to investigate (1) the amount of bonding resin remaining on single crystal bracket bases following electrothermal debonding, and (2) the bond strength of rebonded single crystal ceramic brackets under different treatment conditions. The bases of debonded, single crystal ceramic brackets (n=100) were inspected for resin, classified with an adaptation of the adhesive remnant index (ARI), and evenly assigned to four experimental groups (n=25). Groups were (1) silane coupling agent, (2) heat plus silane coupling agent, (3) hydrofluoric acid plus silane coupling agent, and (4) heat plus hydrofluoric acid plus silane coupling agent. An additional group of brackets not previously bonded was used as the control (n=25). The brackets were bonded to 125 fresh bovine teeth. A force was applied 1 mm from the bracket-resin interface by a testing machine. The force measured in this experiment was shear/peel and the ratio of shear to peel was 0.53. The ARI index showed 79% of the brackets had no resin on their bases. The shear/peel bond strength was significantly greater for the control group than all other groups ($P < 0.01$). Treatment of electrothermally debonded ceramic brackets with silane or heat plus silane resulted in bond strength greater than 9 MPa. The use of hydrofluoric acid significantly reduced the bond strength below 2 MPa.

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KEY WORDS: Shear/peel bond strength, Ceramic bracket, Electrothermal debonding, Bovine teeth, Silane coupling agent, Bracket repositioning.