Effect of Activation Mode on Shear Bond Strength of Metallic Brackets

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The aim of this study was to evaluate the shear bond strength (SBS) of metallic orthodontic brackets bonded to bovine teeth using light-activated or chemically activated composite resins. One hundred and twenty bovine mandibular incisors were divided into 6 groups (n=20), according to the bonding materials: Transbond XT (T); Enforce Dual (ED); Enforce chemical (EC); Enforce Light-activated (EL); Concise Orthodontic (C); and RelyX Unicem Capsule (UN). Metallic brackets were positioned and firmly bonded to the teeth. Light-activation for 1, ED, EL and UN was carried out with four exposures on each side of the bracket with 20 s total exposure times using XL2500 (3M ESPE). EC and C were chemically cured. Next, all specimens were stored in deionized water at 37 °C for 24 h. The shear bond strength was carried out at a crosshead speed of 1.0 mm/min. Data were subjected to one-way ANOVA and Tukey's test (α=0.05). The adhesive remnant index (ARI) was evaluated at 8x magnification. C (17.72±4.45) presented significantly higher SBS means (in MPa) than the other groups (p<0.05), followed by EC (11.97±5.77) and ED (10.57±3.32). EL (5.39±1.06) and UN (4.32±1.98) showed the lowest SBS means, while T (9.05±2.56) showed intermediate values. For ARI, there was a predominance of score 0 for EC, C and UN, and score 3 for T, ED and EL. In conclusion, the activation mode influenced the SBS.

Introduction

The light-cured composite resins are routinely used for bonding orthodontic brackets to the teeth (1,2). The advantage of light-cured composite is that the clinician has enough time to place the brackets in the correct position and easily remove any excess material before the light-activation and insertion of the orthodontic archwire (3).

The bonding strategies of brackets comprise a series of technique-sensitive steps. Failures with light-cured composite resins have been attributed to moisture contamination or incomplete polymerization when considering the light exposure time or limited depth polymerization (4), which varies with the light penetration into the material (5). This reduction in polymerization has been called depth of cure and has significant influence on physical (6) and biological properties of composite resins. Adequate polymerization is necessary for the bonding material. Dual-curing resin cements could be used for bonding orthodontic brackets to enamel especially when effective light-activation is not possible. They are used to ensure the polymerization of the resin cement, even below opaque and thick restorations, where the light is not able to reach (6).

Recently, in order to reduce the operative steps and decrease the sensitivity of dental techniques, self-adhesive resin cements have been introduced (6). These materials are based on new monomer, filler and initiation technology. They combine etchant, primer and adhesive resin in a single paste. This approach could reduce the saliva contamination, which is an undesirable event during bracket bonding (7). Thus, it would be interesting to use the self-adhesive cements for bracket bonding.

The aim of this study was to evaluate the shear bond strength of metallic orthodontic brackets bonded to bovine teeth using light-cured or chemically activated composite resins. The hypothesis tested was that there is no significant difference on the shear bond strength among composite resins with different activation modes.

Material and Methods

Preparation of Specimens

One hundred and twenty bovine mandibular incisors without cracks or surface defects were collected. The roots were sectioned with a water-cooled diamond saw (Isomet; Buehler Ltd., Lake Bluff, IL, USA) and the crowns were embedded in self-curing acrylic resin (Clásico Produtos Odontológicos, São Paulo, SP, Brazil) in polyvinyl chloride tubes, with the buccal face perpendicular to the tube. The vestibular faces of all teeth were cleaned with a rubber cup and non-fluoridated pumice-water slurry for 10 s, rinsed with air-water spray for 10 s and air-dried for 10 s.

The teeth were divided into 6 groups (n=20), according to bonding materials: Transbond XT (T - 3M Unitek, Monrovia, CA, USA), Enforce Dual (ED - Dentsply Caulk, Milford, DE, USA), Enforce Chemical (EC - Dentsply Caulk), Enforce Light-activated (EL - Dentsply Caulk), Concise