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# Microtensile bond strength of a filled vs unfilled adhesive to dentin using self-etch and total-etch technique

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**KEYWORDS**
Filled adhesive;
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**Summary** *Objective*: The purpose of this study was to evaluate the effect of a filled adhesive (One-Step Plus; Bisco) versus an unfilled adhesive (One-Step; Bisco) on the microtensile bond strength (μTBS) to dentin using total-etch (Uni-etch; Bisco) and self-etch (Tyrian SPE; Bisco) techniques.
*Methods*: Twenty extracted human third molars were ground flat to expose occlusal dentin. After the dentin surfaces were polished with 600-grit SiC paper, the teeth were randomly assigned to four groups according to the bonding agent and technique being used. Dentin surfaces were bonded with One-Step Plus + total-etch; One-Step Plus + self-etch; One-Step + total-etch and One-Step + self-etch. Composite buildups were performed with Clearfil AP-X (Kuraray Medical). Following storage in distilled water at 37 °C for 24 h, the bonded specimens were serially sectioned into 0.7 mm-thick slabs and then trimmed to hour-glass shapes with a 1 $mm^2$ cross-sectional area ($n=20$). Microtensile bond strengths were determined using the EZ-test (Shimadzu) at a cross-head speed of 1 mm/min. Data were analyzed using two-way ANOVA and Tukey's post hoc test.
*Results*: There were no significant differences in the μTBS between One-Step Plus and One-Step adhesives when they were used with the total-etch and self-etch techniques ($p>0.05$). However with the total-etch technique both adhesives yielded significantly higher bond strength values than the self-etch technique ($p<0.001$).

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*Conclusion*: The filled adhesive One-Step Plus did not show any beneficial effect than the unfilled adhesive One-Step on the μTBS to dentin with total-etch and self-etch techniques. Irrespective from the adhesive type, self-etch technique revealed lower bond strengths than the total-etch technique.


## Introduction

Resin composites with adhesive materials have been available on the dental market for about four decades and are widely used for both anterior and posterior restorations due to the esthetic demands of patients, however they still have some undesirable properties. One is the polymerization shrinkage which produces contraction stresses generally concentrate at the bonding interface.[1] If these stresses exceed the bond strength to dentin, an interfacial gap will be formed, leading to bacterial infiltration, sensitivity, secondary caries and possible pulpal damage.[2]

Thicker adhesive layers or liners may act as an elastic intermediate layer (elastic cavity wall) between the cavity walls and the adjacent composite. That is, they could resist the polymerization shrinkage stress of the resin composites[1] and absorb the shock produced by occlusal loads and thermal cycling.[3] Using unfilled adhesives, thicker layers are not recommended because these materials have lower mechanical properties and usually provide no radioopacity which could mislead clinicians to interprete the adhesive radiotransparency as gap formation or recurrent caries at the margin of the restoration.[4] Based on this idea, filled adhesives have been introduced,[5-7] which have included various types of fillers; such as conventional glass, ion leachable glass, silica and nanometer-sized aerosil silica fillers.[8-10] They have been reported to improve marginal and internal seal of composite restorations[6,11-13] and have sufficient radioopacity to be discernible on dental X-ray films.[7]

Current adhesive systems employ two simplified application procedures to achieve the goal of micromechanical retention between resin and dentin. The first method attempts to remove the smear layer completely via acid etching and rinsing, followed by the application of an adhesive agent on a wet dentin surface; the total-etch technique.[14] The second category is the self-etch technique, which simultaneously demineralizes dentin and infiltrates it with adhesive monomers.[15] The strong versions of self-etch adhesives can completely dissolve or disperse smear layers, forming thick hybrid layers in intact dentin that approach those achieved with conventional total-etch technique. Conversely, intermediate strong and mild versions incorporate smear layers as part of the bonded interface, forming only thin hybrid layers.[16] Both total and self-etch approaches rely on the impregnation and polymerization of the monomers into the exposed collagen of the demineralized dentin surfaces, creating a hybrid layer and the stabilization of the hybrid layer was established by the adhesive.[17] Recently, in comparison to the total-etch adhesives two-step self-etch adhesives are becoming increasingly popular, because of the reduced post-operative[18] and technique sensitivity.[16] In addition to these, they are less likely to result in a discrepancy between the depth of demineralization and the depth of resin infiltration[19] since both processes occur simultaneously.[15] Using total-etch systems, fillers incorporated in adhesive resins may increase the adhesive viscosity, resulting in a reduction in adhesive penetration into the demineralized dentin and bonding to dentin.[20,21] There is however, less information on the effect of the filled adhesives on the bonding of two-step self-etch systems to dentin.

The purpose of this study was to evaluate the effect of a filled adhesive (One-Step Plus; Bisco) versus an unfilled adhesive (One-Step; Bisco) on the microtensile bond strength (μTBS) to dentin using total-etch (Uni-etch; Bisco) and self-etch (Tyrian SPE; Bisco) techniques.

## Material and methods

The materials and their compositions used in this study are listed in Table 1. Twenty non-carious extracted human third molars, stored in isotonic saline with thymol crystals at 4 °C, were ground flat using 180-grit silicon carbide (SiC) abrasive paper under running water to expose occlusal dentin. After the superficial dentin surfaces were polished with 600-grit SiC to standardize the smear layer, the teeth were randomly assigned to four groups according to the type of adhesive (One-Step Plus; One-Step) and technique (total-etch; self-etch) being used. Bonding procedures were performed according to the manufacturer's