Influence of saliva contamination on the shear bond strength of adhesives on enamel

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Objective: To evaluate shear bond strength of 3 adhesive systems (Single Bond, Transbond™ MIP and Transbond™ XT) applied on bovine enamel under saliva contamination condition.

Methods: One hundred and twenty enamel surfaces of bovine incisors were divided into 6 groups (n = 20) according to the adhesive system used (Transbond™ XT, Transbond™ MIP and Single Bond) with or without saliva contamination. For each adhesive system, there were two groups defined as no contamination group (NC): 37% H_3PO_4 conditioning for 30 seconds and two layers of adhesive systems; saliva contamination group (SC): After the first adhesive layer application, the examined areas were contaminated with saliva. Samples were mounted appropriately for testing and stored in deionized water at 37 °C for 7 days. Samples were then submitted to shear bond strength trials at a speed of 0.5 mm/min. The Adhesive Remnant Index (ARI) was evaluated under stereomicroscopy. Two-way analysis of variance and the Tukey test were used to compare mean values ($\alpha = 0.05$).

Results: Groups XT (NC) = 26.29 ± 7.23; MIP (NC) = 24.47 ± 7.52 and SB (NC) = 32.36 ± 4.14 XT (SC) = 19.59 ± 6.76; MIP (SC) = 18.08 ± 6.39 and SB (SC) = 18.18 ± 7.03 MPa. ARI 0 and 1 were the most prevalent scores in all study groups examined.

Conclusion: Saliva contamination significantly decreased bond strength of the three adhesive systems examined ($p < 0.05$). However, the comparison of groups with and without saliva contamination did not reveal any significant differences, and, therefore, the three systems may be considered equivalent.

Keywords: Enamel bonding. Saliva contamination. Shear bond strength.

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How to cite this article: Assad-Loss TF, Tostes M, Mucha JN. Influence of saliva contamination on the shear bond strength of adhesives on enamel. Dental Press J Orthod. 2012 Mar-Apr; 17(2):30-2.

Submitted: August 12, 2008 - **Revised and accepted:** November 24, 2008

» The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.

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Editor's abstract

Adhesive failures may occur during orthodontic bracket bonding due to saliva contamination. To minimize this problem, manufacturers developed hydrophilic primers that, maintain acceptable bond strength even when used in a moist environment. The authors evaluated bond strength to bovine enamel of an orthodontic composite sample bonded using an hydrophilic (Transbond™ MIP), a conventional (Transbond™ XT) and a dental (Single Bond) adhesive system. For that purpose, 120 bovine incisors were embedded in PVC cylinders filled with polystyrene resin. The enamel surfaces were polished for standardization. After that, enamel underwent prophylaxis with pumice and water, and the specimens were randomly divided into six groups (n=20). The specimens in the groups with no saliva contamination, XT(NC), MIP(NC) and SB(NC), underwent etching with 37% phosphoric acid for 30 seconds followed by the application of the Transbond™ XT, Transbond™ MIP and Single Bond adhesive systems. In the other 3 groups, XT (SC), MIP (SC) and SB (SC), the same procedures were made, but the enamel was contaminated with saliva, the excess was removed with gauze and air spraying, and another layer of the adhesive material was applied. Cylinders of the Transbond™ XT orthodontic composite resin were thus bonded to the center of the enamel surface for all samples. After 7 days, the specimens underwent shear bond strength trials followed by the evaluation of the adhesive remnant index (ARI). The results revealed a statistically significant reduction in bond strength for all adhesive systems tested when the enamel surface was contaminated with saliva. The SB(NC) group had the best results (32.36 ± 4.14), whereas the MIP (SC) group had the most deficient ones (18.08 ± 6.39). The authors concluded that saliva contamination reduced bond strength significantly in the three systems under tested. Moreover, results were equivalent for the three systems.

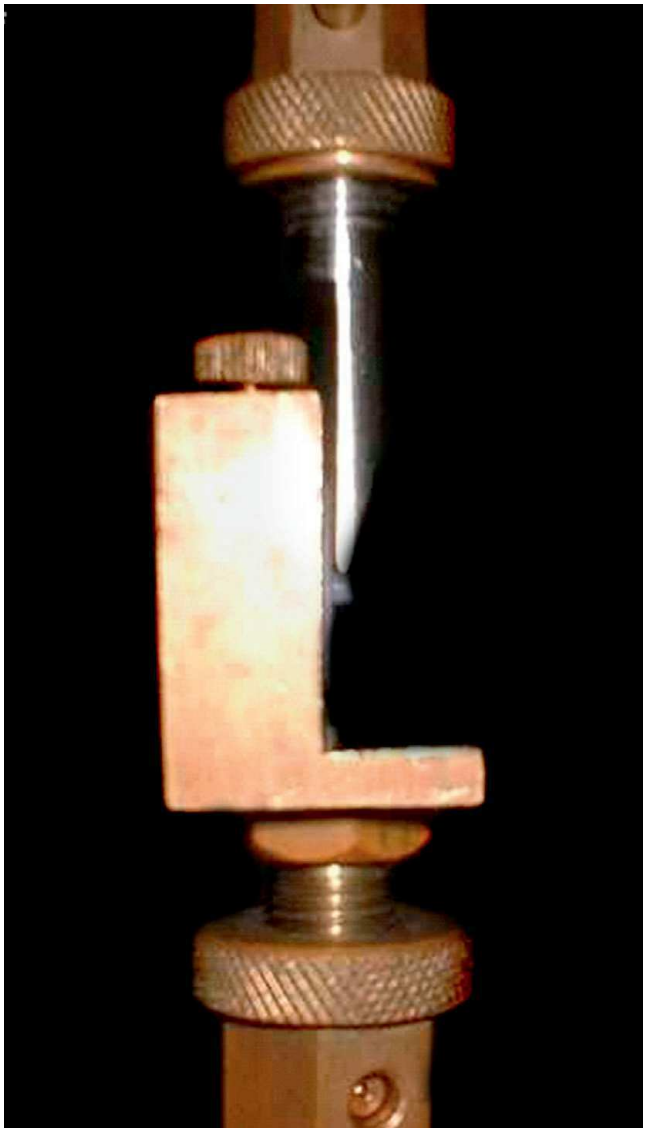

Figure 1 - Representation of specimen being submitted to shear bond strength trial (DL 10.000, EMIC, Curitiba, Brazil) at crosshead speed of 5 mm/min and 50 N load.

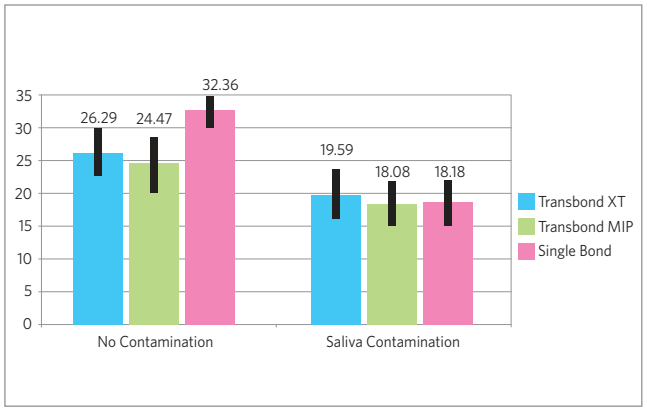

Figure 2 - Means and standard deviations of the 3 systems examined, with or without saliva contamination.

Questions to the authors

1) How can you explain the fact that the Single Bond dental adhesive system had results that were similar to those found for the Transbond MIP system, a product developed exclusively for use in moist environments?

The composition and hydrophilic characteristics of the materials affect the passage of fluids through them. Of the commercial adhesive systems available, the most hydrophilic ones have sorption and solubility performance, as well as a water diffusion coefficients, greater than those found for the less hydrophilic products. Although MIP has more than one hydrophilic monomer (2-hydroxy-1-3-dimethacryloxy propane), which has a polar hydroxyl group, its bonding strength in moist environments was not better than that of other materials.

2) Which of the materials under test had the best cost-benefit ratio for clinical use?

According to the method used, the Transbond MIP system caused the greatest debond -damage to enamel when bonded in a dry environment and should be, therefore, contraindicated for use under that condition. The use of the SB systems seems to have the best cost-benefit ratio, correlating adequate bond strength and lower enamel fracture risk in a dry or moist environment.

3) Do you plan to conduct further studies in the same line of investigation?

This study was conducted in vitro, and we plan to conduct other in vivo and in vitro studies to evaluate the behavior of these adhesive systems.