Assessment of shear bond strength of brackets bonded by direct and indirect techniques: An *in vitro* study

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Objective: This in vitro study was designed to evaluate the shear bond strength (SBS) of orthodontic metal brackets bonded by direct and indirect techniques.

Methods: Thirty healthy human maxillary premolar teeth were used. The teeth were divided into three groups of 10 teeth each: Group I - Indirect bonding with Sondhi™ Rapid-Set system (3M/Unitek), Group II - Indirect bonding with Transbond™ XT adhesive system (3M/Unitek) and Group III - Direct bonding with Transbond™ XT Adhesive system (3M/Unitek). After bonding and obtaining the specimens for the study, the specimens were subjected to SBS testing in a universal testing machine (Emic, model DL – 500). The Kolmogorov-Smirnov test was applied to ascertain that the data had a normal distribution and the Bartlett test to check whether there was homogeneity of variance. One-factor analysis of variance was performed and, subsequently, Tukey's test for paired means. A 5% significance level was adopted.

Results: The results of Group I were 67.6 (N) and 5.9 (MPa), Group II, 68.9 (N) and 6.1 (MPa) and Group III (control) 92.5 (N) and 8.1 (MPa).

Conclusion: It can therefore be concluded that the means for Group III were significantly higher compared with groups I and II in both Newton (N) and Mega Pascal (MPa) values. The means attained by the indirect bonding technique used in Groups I and II, however, exhibited no statistically significant differences.

Key-words: Dental bonding. Dental debonding. Shear bond strength. Corrective Orthodontics.

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Editor's summary

Indirect bonding in Orthodontics presents some advantages compared to direct bonding of brackets, including greater precision, less need for accessory repositioning, reduced chair time and reduced patient discomfort. In contrast, this technique also presents some disadvantages, such as laboratory work time, higher cost, greater number of stages, and the interface between the bonding adhesive and the primer applied to the tooth, which may impair adhesion. The indirect bonding would have a similar resistance compared to the classic direct bonding? The objective of the authors was comparing the shear-bond strength of brackets in 3 groups of 10 teeth:

» Group I: Indirect bonding using Sondhi™ Rapid-Set system (3M/Unitek).

» Group II: Indirect bonding using Transbond™ XT adhesive system (3M/Unitek).

» Group III: Direct bonding using Transbond XT™ adhesive system (3M/Unitek).

Once the bracket was bonded to the tooth an elastic modulus was attached to the ASTS orthodontic wire. Then, the PVC pipes were filled with colorless acrylic resin (JET) as far as the upper edge. The samples were then subjected to SBS tests in a universal testing machine (EMIC brand, model DL-500, with a speed of 0.5 mm/min with 1kN (100 kgf) capacity, reading resolution of 0.1N (10gf), using recommended parameters for testing within a range between 20 and 1000 N. The chisel type working tip (developed for this purpose by the ODEME Company) was positioned in the occluso-gingival direction in contact with the bracket, between the tie-wing and the base, flush with the base (Fig 2). The breaking loads were measured in Newtons (N). The results are shown in Table 2 and indicated that the control group (direct bonding) had an increased shear-bond strength compared to the indirect bonding groups. Based on the present study, there was no need for using a primer especially designed for indirect bonding since the primer provided with the conventional Transbond™ XT Adhesive system offered an SBS value that was similar to that observed with the Sondhi™ Rapid-Set system. The authors considered that both direct and indirect bonding techniques can be considered satisfactory and similar to each other,[1,2,23] since shear bond strength values were found to be above the minimum recommended by the literature for clinical use, which validates both bracket bonding techniques.

Table 1 - Means and standard deviations (SD) of force in Newtons (N) and stress (MPa) showing force exerted between bracket and enamel when bonding performed using three different techniques.

	Values in Newtons (N)			Values in Mega Pascal (MPa)		
Techniques	Control (direct technique)	Sondhi Rapid-Set System	Transbond XT System	Control (direct technique)	Sondhi Rapid-Set System	Transbond XT System
Mean ± SD	92.5 ± 19.2	67.6 ± 25.6	68.9 ± 29.9	8.1 ± 1.7	5.9 ± 2.3	6.1 ± 2.6

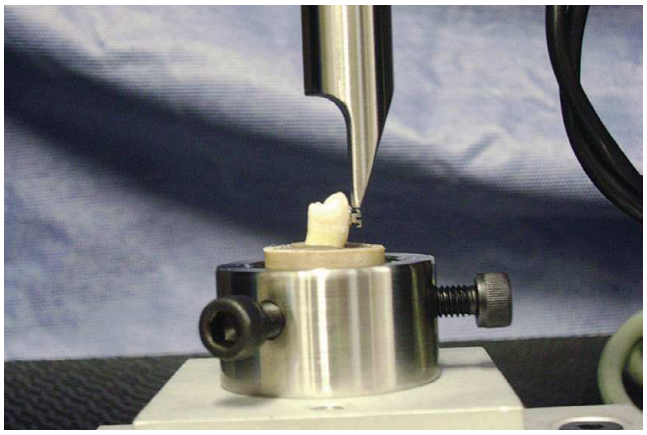

Figure 1 - Test system fitted and ready for shear bond test.

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