

Original Research

Evaluation of effect of type of orthodontic adhesive on shear bond strength of orthodontic brackets

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ABSTRACT:

Background: To evaluate the effect of type of orthodontic adhesive on shear bond strength of orthodontic brackets. **Materials & methods:** A total of 60 newly extracted premolars were bonded to 0.022 SS brackets and equally divided into two groups based on adhesive used: (1) Rely-a-Bond (self-cure adhesive, Reliance Orthodontic Product,) (2) Transbond XT (light-cure adhesive, 3M Unitek.) **Results:** Transbond XT (15.36 MPa) attained the highest bond strength. Self-etching adhesives (Transbond Plus, 11.41 MPa) showed clinically acceptable SBS values. **Conclusion:** All adhesives yielded SBS values higher than the recommended shear bond strength.

Keywords: Shear bond strength, adhesives, orthodontic brackets.

Received: 18 March, 2022

Accepted: 22 April, 2022

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This article may be cited as: Singh K, Chaudhary R. Evaluation of effect of type of orthodontic adhesive on shear bond strength of orthodontic brackets. Int J Res Health Allied Sci 2022; 8(3):35-37.

INTRODUCTION

After the introduction of the acid etches technique in 1955 by Buonocore un-esthetic procedure with the multiband appliance has been virtually discarded. Newman's attempt in 1965 to bond orthodontic attachment to teeth using an epoxy resin opened a new horizon in orthodontics and era of bandless treatment was born. ^(1,2)

Conventional bonding of orthodontics brackets with filled diacrylate adhesives involves 4 distinct stages. First, the enamel surface is polished with slurry of pumice in water with a slow speed hand piece. It is then conditioned with 37% of phosphoric acid for 30 s, followed by washing with water and air-drying until the enamel is frosty white. Finally, a primer is painted on the etch enamel, the bracket is placed on the teeth, and the adhesive is cured. Recent studies have questioned the need for some of these stages. Pumicing has been shown to be unnecessary because it has no effect on in vivo bond failure rates before conventional etching. Laboratory studies on measured bond strength. have found that a primer has no effect with either chemically cured or light-cured diacrylate. Sealants have also been suggested as a means of reducing enamel decalcification during treatment.

Although clinical studies have found that commonly used low-viscosity sealants have no effect. ^(3,4)

Shear bond strength (SBS) is the main factor, which has to be concerned in the evolution of bonding materials. The bond strength of the orthodontic bracket must be able to withstand the forces applied during the orthodontic treatment. Some stated that 5.9–7.8 MPa resistances are sufficient to withstand masticatory forces ^(5,6) Comparing bond strengths of an acidic primer and composite resin with a conventional adhesive system and found mean bond strengths of 10.4 and 11.8 MPa, respectively. The SBSs of self-etching primers can vary widely, ranging from 2.8 to 16.6 MPa.[5] An ideal orthodontic adhesive should have adequate bond strength while maintaining unblemished enamel after debonding. Therefore, researchers have been working hard to achieve the best quality and gentlest procedures for bonding orthodontic brackets. ⁽⁷⁾

MATERIALS & METHODS

A total of 60 newly extracted premolars were bonded to 0.022 SS brackets and equally divided into two groups based on adhesive used: (1) Rely-a-Bond (self-cure adhesive, Reliance Orthodontic Product,) (2)

Transbond XT (light-cure adhesive, 3M Unitek.) Evaluation of effect of type of orthodontic adhesive on shear bond strength of orthodontic brackets were considered and compared. For evaluation, SPSS software was used.

RESULTS

Transbond XT (15.36 MPa) attained the highest bond strength. Self-etching adhesives (Transbond Plus, 11.41 MPa) showed clinically acceptable SBS values and almost clean enamel surface after debonding. The analysis of variance ($F = 11.85$, $P < 0.0001$) tests revealed significant differences among groups.

Table 1: orthodontic adhesives used in study

Groups	Etchant	Primer	Adhesive
I	37% Phosphoric acid	Rely- a- bond primer	Rely- a- bond
II	37% phosphoric acid	Transbond XT primer	Transbond XT composite paste
III	Self- etching primer Transbond plus	-	Transbond XT composite paste

Table 2: Mean SBS values (MPa)

Groups	n	Mean	SD
I Rely- a- bond	20	11.90	1.33
II Transbond XT primer + adhesive	20	15.36	2.43
III Transbond plus primer + Transbond XT adhesive	20	11.41	1.55

DISCUSSION

Enamel bonding for orthodontic applications was introduced in 1965 and is considered a significant milestone in orthodontic treatment. As reported, direct bonding of orthodontic brackets to enamel was made a reality by some researchers. These researchers were instrumental in developing procedures and materials that have led to present-day standards in orthodontic adhesives. Acid-etching, self-cure composite resins, glass ionomer cements, and visible light-curing adhesives have evolved from these early efforts. New technologies using novel materials are constantly evolving to improve the quality of the bond between the brackets and tooth or artificial subjects.^(8,9,10) In this study, Transbond XT (15.36 MPa) attained the highest bond strength. Self-etching adhesives (Transbond Plus, 11.41 MPa) showed clinically acceptable SBS values and almost clean enamel surface after debonding. The analysis of variance ($F = 11.85$, $P < 0.0001$) tests revealed significant differences among groups.

There is necessary of dry operating field for bonding of orthodontic brackets. The presence of moisture can alter the bond strength. Hence, the aim of the present study was to evaluate the shear bond strength of orthodontic brackets with different adhesives. In this in vitro study, a total of 100 orthodontically extracted premolars with sound crown structure were divided into 4 equal groups of different primers. Bonding on the buccal surface of all teeth was done after acid etching with upper premolar brackets using different primers followed by light curing. Shear bond strength was evaluated with or without salivary contamination with both adhesives. The obtained data were statistically evaluated using SPSS 20 for Windows (SPSS Inc., Chicago, IL, USA) using ANOVA, statistical significance of $P < 0.05$. Transbond Plus showed higher shear bond strength of 8.92 MPa under dry and 5.65 MPa with saliva contamination over Transbond XT of 7.24 MPa under dry and 2.43 MPa

with saliva contamination, respectively. Higher ARI score was found without contamination in both adhesives.⁽¹¹⁾

Several studies have been carried which proved that the shear bond strength of self-etching primer and resin system was significantly quite similar or more than the conventional system.⁽¹²⁾ Another study evaluated a higher bond failure rate (10.99%) with the self-etching primer as compared to the control conventional etch and priming group (4.95%) other evaluated the mean shear bond strength of the two-step acid-etch primer/adhesive was 5.9 ± 2.7 MPa and the mean for the one-step system was 3.1 ± 1.7 MPa in his research with $P = 0.001$ which was more significant.^(13,14)

CONCLUSION

All adhesives yielded SBS values higher than the recommended shear bond strength.

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