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Assessment of impact 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 90 newly extracted premolars were bonded to 0.022 SS brackets and equally divided into two groups based on adhesive used: Transbond XT (light-cure adhesive, 3M Unitek.) and Rely-a-Bond (self-cure adhesive, Reliance Orthodontic Product,). Shear bond strength of orthodontic brackets was evaluated.

Results: Transbond XT (16.2 MPa) attained the highest bond strength. Self-etching adhesives (Transbond Plus, 12.7 MPa) showed clinically acceptable shear bond strength (SBS) values.

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

Keywords: Shear bond strength, adhesives, orthodontic brackets.

Introduction

The first and most popular bonding resins were chemical curing bonding systems. A major drawback of the self-cure adhesive systems is the inability to manipulate the setting time of the composite resin. In the direct bonding technique, the material is cured under metal-based brackets by direct illumination from different sides and by trans-illumination because the tooth structure transmits visible light. Rapid polymerization occurs when visible light is applied, producing a "command set" that is of great advantage; such setting "on demand" results in a nearly unlimited working time, allowing more accurate bracket placement.[1- 3] Newer self-etching adhesive materials have been introduced recently in orthodontics to simplify the bonding process by reducing the bonding steps and eliminating the need for etching and priming, thus lessening the risk of contamination and reducing the bonding time. These self-etching primers combine the conditioning and priming agents into one acidic solution and have shown advantages such as reduced loss of enamel, prevention of saliva contamination and less chair time. 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.[4- 6]

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Hence; the present study was conducted for assessing impact type of orthodontic adhesive on shear bond strength of orthodontic brackets.

Materials & methods

: A total of 90 newly extracted premolars were bonded to 0.022 SS brackets and equally divided into two groups based on adhesive used: Transbond XT (light-cure adhesive, 3M Unitek.) and Rely-a-Bond (self-cure adhesive, Reliance Orthodontic Product,). Shear bond strength of orthodontic brackets was evaluated. 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 (16.2 MPa) attained the highest bond strength. Self-etching adhesives (Transbond Plus, 12.7 MPa) showed clinically acceptable shear bond strength (SBS) values. The analysis of variance ($F = 11.85$, $P < 0.0001$) tests revealed significant differences among groups.

Table 1: Mean SBS values (MPa)

Groups	n	Mean	SD
I Rely- a- bond	30	11.7	1.7
II Transbond XT primer + adhesive	30	16.2	2.1
III Transbond plus primer + Transbond XT adhesive	30	12.7	1.9

Discussion

Contamination of etched tooth surface during orthodontic bonding procedure can result in poor bond strength hence control of moisture contamination is necessary. Saliva and blood contamination is major cause for bond failure. Many methods are used to maintain dry operatory filed such as saliva ejector, antisialagogue medicine, and cotton rolls. However, these methods are not adequate for bonding procedures during orthodontic treatment. The maintenance of dry field is required for orthodontic bonding since most of the primers and adhesives have hydrophobic components.[6- 9] Hence; the present study was conducted for assessing impact type of orthodontic adhesive on shear bond strength of orthodontic brackets. Transbond XT (16.2 MPa) attained the highest bond strength. Self-etching adhesives (Transbond Plus, 12.7 MPa) showed clinically acceptable shear bond strength (SBS) values. The analysis of variance ($F = 11.85$, $P < 0.0001$) tests revealed significant differences among groups. Shaik JA et al evaluated the shear bond strength of orthodontic brackets with different adhesives. 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. A shear force for deboning the bracket was done with universal testing machine. 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

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dry and 2.43 MPa with saliva contamination, respectively. Higher ARI score was found without contamination in both adhesives. Transbond Plus hydrophilic resin had good shear bond strength under both dry and contamination condition compared to hydrophobic Transbond XT resin material.[10]

Scougall Vilchis RJ, et al compared the shear bond strength (SBS) of orthodontic brackets bonded with 4 self-etching adhesives. A total of 175 extracted premolars were randomly divided into 5 groups (n = 35). Group I was the control, in which the enamel was etched with 37% phosphoric acid, and stainless steel brackets were bonded with Transbond XT (3M Unitek, Monrovia, Calif). In the remaining 4 groups, the enamel was conditioned with the following self-etching primers and adhesives: group II, Transbond Plus and Transbond XT (3M Unitek); group III, Clearfil Mega Bond FA and Kurasper F (Kuraray Medical, Tokyo, Japan); group IV, Primers A and B, and BeautyOrtho Bond (Shofu, Kyoto, Japan); and group V, AdheSE and Heliosit Orthodontic (Ivoclar Vivadent AG, Liechtenstein). The teeth were stored in distilled water at 37 degrees C for 24 hours and debonded with a universal testing machine. The adhesive remnant index (ARI) including enamel fracture score was also evaluated. Additionally, the conditioned enamel surfaces were observed under a scanning electron microscope. The SBS values of groups I (19.0 +/- 6.7 MPa) and II (16.6 +/- 7.3 MPa) were significantly higher than those of groups III (11.0 +/- 3.9 MPa), IV (10.1 +/- 3.7 MPa), and V (11.8 +/- 3.5 MPa). Fluoride-releasing adhesives (Kurasper F and BeautyOrtho Bond) showed clinically acceptable SBS values. Significant differences were found in the ARI and enamel fracture scores between groups I and II. The 4 self-etching adhesives yielded SBS values higher than the bond strength (5.9 to 7.8 MPa) suggested for routine clinical treatment, indicating that orthodontic brackets can be successfully bonded with any of these self-etching adhesives.[11]

Conclusion

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

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