Section A-Research paper

In vitro evaluation of shear bond strength of Orthodontic Brackets bonded with different adhesives

[1]Dr Garlapati Yugandhar, [2]Dr B.Rama Mohan Reddy, [3]Dr Kogila Jashva Vamsi, [4]Dr Sampath Krishna Veni, [5]Dr. Polisetty Siva Krishna, [6]Dr. C. Soundarya

[1]Professor And HOD, department of Orthodontics , GDCH, Kadapa

[2]AssociateProfessor, Department of Orthodontics, GDCH,Kadapa

[3]Assistant Professor, Department of Orthodontics , GDCH,kadapa.

[4]Assistant Professor, Department of Orthodontics ,GDCH,kadapa.

[5]Assistant Professor, Department of Orthodontics ,GDCH,Kadapa.

[6]Senior resident, Department of Orthodontics ,GDCH, Kadapa.

Corresponding author

Dr Garlapati Yugandhar, Professor And Hod, Department Of Orthodontics, GDCH,Kadapa

Abstract

Background: In order to endure the orthodontic forces used throughout treatment, the bond strength of bonded orthodontic brackets must be enough. with. Assessment of shear bond strength when bonding orthodontic brackets with various adhesives.

Materials & methods: overall 40 extracted premolars due to orthodontic treatment were included. They were split into four equal cohorts with various primers. With both adhesives, shear bond strength had been assessed with and without salivary contamination. SPSS

software was used to assess the outcomes. Consideration was given to statistical significance of P value of less than 0.05.

Results: Several groups' average bond strengths in MPa were assessed in both dry and contaminated saliva conditions. When it was dry, Transbond Plus demonstrated greater shear bond strength.

Conclusion: it was concluded that hydrophilic Transbond Plus resin outperformed hydrophobic Transbond XT resin in terms of shear bond strength under both situations.

Keywords: shear bond strength, brackets, adhesives.

Introduction

Direct bonding of orthodontic brackets had first been carried out by Newman in 1965, following the development of the acid etch bonding method by Buonocore in 1955.[1,2] As a result of this technology's quick expansion, the acid etch technique combined with light-cure composites is presently the most popular bonding system in orthodontics.[3] Achieving a proper bond strength is a crucial clinical goal because re-bonding brackets can be a time-consuming as well as difficult task.[4] There are four separate steps involved in the traditional bonding of orthodontic brackets with filled diacrylate adhesives. Initially, a slow speed hand piece is used to polish the enamel surface using a pumice slurry in water. After thirty seconds of conditioning with thirty seven percent phosphoric acid, it is washed with water and allowed to air dry until the enamel is icy white. The bracket is then positioned on the teeth, a primer is coated over the etched enamel, as well as the glue is allowed to set. A few of these steps may not be necessary, according to recent analyses. Due to the fact that pumicing has no impact on the rates of in vivo bond failure before conventional etching, it has been demonstrated to be unnecessary. According to laboratory tests on determined binding strength, a primer shows no impact on diacrylate which has been chemically or light-cured. Also recommended as a way to lessen enamel decalcification during therapy are sealants. While scientific research has shown that low-viscosity sealants, which are frequently utilized, are ineffective.[5,6] The first element that must be taken into consideration when bonding materials evolve is shear bond strength. The orthodontic bracket's bond strength should be

strong enough to withstand the forces used throughout orthodontic therapy. According to Reynolds, resistances of 5.9 to 7.8 MPa are adequate to resist masticatory forces.[7] The average bond strengths of an acidic primer as well as composite resin using a traditional adhesive system were 10.4 MPa and 11.8 MPa, correspondingly, according to Bishara et al.[8] Self-etching primers' SBSs may range from 2.8 to 16.6 MPa, which is a broad range. As a result, this research was carried out to assess the shear bond strength of several adhesives used to bond orthodontic brackets.

Materials & methods

Overall forty extracted premolars due to orthodontic treatment were included. They were split into four equal cohorts with various primers. Group (I): Transbond XT without saliva contamination and Transbond XT primer

Group (II) – Transbond XT primer and Transbond XT with saliva contamination

Group (III) – Transbond self-etching primer and Transbond Plus color without saliva contamination

Group (IV) – Transbond self-etching primer and Transbond Plus color with saliva contamination.

When upper premolar brackets were acid-etched, bonding on the buccal surfaces of all teeth was completed using various primers, accompanied by light curing. With both adhesives, shear bond strength was assessed with and without salivary contamination. Using a universal testing machine, a shear force was applied to deboning the bracket. The debonded samples were checked out. SPSS software was used to assess the outcomes. Consideration was given to statistical significance of P value of less than 0.05.

Results

There were 40 extracted premolars included, with ten in each cohort. Several groups' average bond strengths in MPa were assessed in both dry and contaminated saliva conditions. Transbond Plus demonstrated greater shear bond strength than Transbond XT, measuring 6.82 MPA under dry conditions and 2.05 MPA with saliva contamination, correspondingly.

Table 1: Bond strength among groups

Groups	Type of contamination	Type of resin	Mean (MPa)
I	Dry	Transbond XT	6.82
II	Saliva	Transbond XT	2.05
III	Dry	Transbond plus	7.84
IV	Saliva	Transbond plus	5.13

Discussion

Bond strength influences both the force applied as well as the length of the procedure.[9-11] Shear bond strength relies on numerous parameters like adhesive characteristics of the bonding materials, the attachment at the various interphases like the tooth to composite interphase as well as the composite to bracket interphase,as well as the polymerization of the composite bonding material.[10] Etching, coating of a primer solution, adhesive application, as well as composite application are all steps in the bonding process. To increase binding strength and shorten duration, various generations of adhesive had been created.[12] As a result, this research was carried out to assess the shear bond strength of several adhesives used to bond orthodontic brackets. Overall forty extracted premolars, ten in each cohort, were included in the current investigation. Several groups' average bond strengths in MPa were assessed in both dry and contaminated saliva conditions.

In a research by Shaik JA et al.[13], Transbond Plus demonstrated greater shear bond strength than Transbond XT, which was 8.92 MPa under dry conditions and 5.65 MPa with saliva contamination, respectively. In both adhesives, a higher ARI score was discovered without contamination. In comparison to hydrophobic Transbond XT resin, Transbond Plus hydrophilic resin demonstrated good shear bond strength under both dry as well as contamination conditions.

With a shear bond strength of 6.82 MPA when dry as well as 2.05 MPA when contaminated with saliva, Transbond Plus outperformed Transbond XT in the current investigation.

AELITE Aesthetic Enamel nano-composite, which was examined in a different research by Chalipa J. et al.[14], had an SBS figure of 8.442.09 MPa, that was greater than that of Transbond XT as well as Filtek TM Supreme XT. A considerable variation among groups II as well as III was discovered by statistical analysis. There was no discernible difference among groups I as well as III or I and II. Transbond XT left minimal adhesive remnants on teeth following debonding, according to analysis of ARI.

The strongest binding strength was reached by Sharma S. et al.[15] using Transbond XT. After debonding, self-etching adhesives displayed clinically acceptable SBS values and a nearly spotless enamel surface. Considerable variations between groups were shown using the analysis of variance and Chi-square tests.

Transbond XT, Rely-a-Bond, Transbond Plus with Transbond XT, as well as Xeno V with Xeno Ortho were shown to have the highest prevalence of ARI scores of 3. When an acid-etching procedure was applied to the surfaces of Rely-a-Bond and Transbond XT, enamel surfaces following debonding of the brackets showed porous under SEM, however with self-etching primers enamel surfaces presented smooth as well as nearly clean surfaces. All adhesives produced SBS results that were greater than the advised bond strength. The least quantity of adhesive residue was left on the enamel surface after debonding with the 7th generation self-etching primer Xeno V with Xeno Ortho. It is challenging to correlate the outcomes of multiple investigations on the binding strength of composites because they used adhesives with varying filler sizes and concentrations.[16] Different medians as well as thermocycling rounds additionally complicate this.[17] Bishara et al[8] illustrated that there was no considerable variation in SBS value of Transbond XT as well as a restorative nano-composite, and both materials were considered applicable in orthodontics.

Conclusion

In comparison to hydrophobic Transbond XT resin, Transbond Plus hydrophilic resin demonstrated good shear bond strength under both circumstances.

References

1. Buonocore MG. A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces. J Dent Res. 1955;34:849–53.
2. Newman GV, Snyder WH, Wilson CE, Jr, Hanesian D. Adhesives and orthodontic attachments (Preliminary investigation) J N J State Dent Soc. 1965;37:113–20.
3. Keim RG, Gottlieb EL, Nelson AH, Vogels DS. JCO study of orthodontic diagnosis and treatment procedures., Part 1, Results and trends. J Clin Orthod. 2002;36:553–68.
4. Zachrisson BU. Orthodontics current principals and technics. St Louis: Mosby; 2005. BT Bonding in orthodontics; p. 579.
5. Saito K, Sirirungrojying S, Meguro D, Hayakawa T, Kasai K. Bonding durability of using self-etching primer with 4-META/MMA-TBB resin cement to bond orthodontic brackets. Angle Orthod. 2005;75:260–5.
6. Daniel M, David W. Enamel loss due to orthodontic bonding with filled and unfilled resin using various clean up techniques. Am J Orthod. 1980;77:307–19.
7. Reynolds IR. A review of direct orthodontic bonding. Br J Orthod. 1975;2:171–8.
8. Bishara SE, Ajlouni R, Soliman MM, Oonsombat C, Laffoon JF, Warren J. Evaluation of a new nano-filled restorative material for bonding orthodontic brackets. World J Orthod. 2007;8:8–12.
9. Pillai AR, Gangadharan A, Kumar S, Ganagadharan J. Comparison in shear bond strength of orthodontic brackets between Biofix and conventional bonding systems: An in vitro study. J India Orthod Soc. 2014;48:461–5.
10. Banerjee S, Banerjee R. A comparative evaluation of the shear bond strength of five different orthodontic bonding agents polymerized using halogen and light-emitting diode curing lights: An in vitro investigation. Indian J Dent Res. 2011;22:731–2.
11. Ahamed MK. Evaluation of the shear bond strength of four orthodontic adhesive systems. Al Rafidain Dent J. 2007;7:66–70.
12. Sreedhara S, Savakkanavar MB, Rajesh RN, Ankireddy RK, Sanjay N, Girish KS, et al. Effect of self-etch primer-adhesive and conventional adhesive systems on the shear bond strength and bond failure of orthodontic brackets: A comparative study. J Contemp Dent Pract. 2015;16:130–4

13. Shaik JA, Reddy RK, Bhagyalakshmi K, Shah MJ, Madhavi O, Ramesh SV. In vitro Evaluation of Shear Bond Strength of Orthodontic Brackets Bonded with Different Adhesives. Contemp Clin Dent. 2018 Apr-Jun;9(2):289-292.
14. Chalipa J, Akhondi MS, Arab S, Kharrazifard MJ, Ahmadyar M. Evaluation of shear bond strength of orthodontic brackets bonded with nano-filled composites. J Dent (Tehran). 2013 Sep;10(5):461-5. Epub 2013 Sep 30.
15. Sharma S, Tandon P, Nagar A, Singh GP, Singh A, Chugh VK. A comparison of shear bond strength of orthodontic brackets bonded with four different orthodontic adhesives. J Orthod Sci. 2014 Apr;3(2):29-33.
16. Ostertag AJ, Dhuru VB, Ferguson DJ, Meyer RA., Jr Shear, torsional, and tensile bond strengths of ceramic brackets using three adhesive filler concentrations. Am J Orthod Dentofacial Orthop. 1991;100:251–8.
17. Jaffer S, Oesterle LJ, Newman SM. Storage media effect on bond strength of orthodontic brackets. Am J Orthod Dentofacial Orthop. 2009;136:83–6.