Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2017;6:3:65-69.

Effect of Salivary Contamination on Shear Bond Strength of Universal Bonding System Used in Self Etch Pattern: An In Vitro Study

G Swetha Reddy[1*] Shibani Shetty[2] Jaya Lakshmi KB[3] Nithesh Rai[4] Prasanna Latha Nadig[5] Sujatha I[6]

[1]PG Student, Department of Conservative Dentistry and Endodontics, Krishnadevaraya College of Dental Sciences and Hospital, Bangalore, India.
[2]Reader, Department of Conservative Dentistry and Endodontics, Krishnadevaraya College of Dental Sciences and Hospital, Bangalore, India.
[3]Professor and Head, Department of Conservative Dentistry and Endodontics, Krishnadevaraya College of Dental Sciences and Hospital, Bangalore, India.
[4]Professor, Department of Conservative Dentistry and Endodontics, Krishnadevaraya College of Dental Sciences and Hospital, Bangalore, India.
[5]Professor, Department of Conservative Dentistry and Endodontics, Krishnadevaraya College of Dental Sciences and Hospital, Bangalore, India.
[6]Professor, Department of Conservative Dentistry and Endodontics, Krishnadevaraya College of Dental Sciences and Hospital, Bangalore, India.

ABSTRACT

Aim: Contamination of the operatory field is the major clinical problem that occur during restorative dental treatment. The aim of this study was to investigate the effect of salivary contamination at different stages of bonding on bond strength of a universal bonding agent when used in self-etch pattern to dentin.

Materials and Method: 30 freshly extracted teeth were decoronated 2mm from coronal tip of tooth and were randomly divided into 3 groups of 10 each. In group 1: No contamination, in group 2: Specimens were contaminated for 20 secs with saliva, followed by application of bonding agent. Group 3: Specimens were contaminated for 20 secs with saliva, after light curing the bonding agent. Specimens were tested for shear bond strength with universal testing machine at a crosshead speed of 1mm/min.

Results: Group 2 i.e. when contamination occurred prior to applying the bonding agent showed lesser bond strength than group 3 where contamination occurred following curing of the adhesive resin.

Conclusion: Under the limitation of the current study, Saliva contamination of the substrate had negative effect on the bond strength of the universal bonding system when used in self-etch strategy.

Keywords: Contamination, Self-etch pattern, Universal bonding agent, 10-MDP.

INTRODUCTION

In recent times, there is increased demand for esthetic restorations by both patients and clinical practitioners.[1] Dental composites and adhesives are vulnerable to contamination. Contamination of the operating field is the most common clinical problem that occurs during restorative procedures[2], especially in areas where placement of rubber dam is difficult. This might lead to reduction in bond strength. The extent of bond strength reduction may be related to the type of adhesive resin used, stage of bonding process and condition of the substratre.[1,3] Saliva can contaminate dental substrates during different stages of restorative procedure, i.e. before or after placing the adhesive and curing it. For this reason, understanding the influence of salivary

Received: Feb. 27, 2017: **Accepted:** May. 3, 2017
***Correspondence Dr. G Swetha Reddy.**
Department of Conservative Dentistry and Endodontics, Krishnadevaraya College of Dental Sciences and Hospital, Bangalore, India.
Email: drswethareddy12@gmail.com

pISSN 2278-0076
eISSN 2321-9270

contamination at different stages of bonding on the bond strength is of clinical relevance.

In Self etch strategy, there is no need of preliminary etching procedure on dental substrates. In this procedure, dentine demineralization and priming occur simultaneously.[4,5] The dissolved hydroxyapatite crystals and smear layer are incorporated in the hybrid layer.[4,6] The advantage of self etch strategy over etch and rinse method is that it is not associated with moist etched dentin, hence it is less technique sensitive . This advantage makes these materials suitable for areas where control of moisture is difficult, such as in posterior restorations. The results are material-dependent and controversial.[7]

Considering these differences, selection of adhesive strategy and number of steps depends on professional judgement. To overcome this, some manufacturers came up with more versatile adhesive systems called ‘‘Universal’’, ‘‘Multi-purpose’’ or ‘‘Multi-mode’’ adhesives.[7] Universal adhesives have broader applications than 7th generation adhesive systems. Universal adhesives have been described by some manufacturers as a single-bottle, no-mix, adhesive system that can be used in total-etch, self-etch, or selective-etch mode depending on the specific clinical situation and personal preferences of the operator. Manufacturers also stated that these adhesives can be used for the placement of both indirect and direct restorations and are also compatible with self-cure, light-cure, and dual-cure resin-based cements. They may be used not only to bond to dentin and enamel, but also as adhesive primers to substrates such as zirconia, noble and non-precious metals, composites, and various silica-based ceramics.[8]

All Bond Universal (Bisco, Schaumburg, 1L , USA) is a recently introduced universal adhesive . This adhesive is compatible with most of the self- and dual-cure resin cements without the use of a separately applied activator. There is limited information in the literature about the performance of this new class of universal adhesives when salivary contamination occurs.

The aim of this invitro study is to evaluate the effect of salivary contamination on different stages of bonding using a newly introduced universal adhesive when used following self etch pattern.

MATERIALS AND METHOD

30 freshly extracted, intact human premolars which were devoid of caries were selected for this study. After extraction, teeth were immediately placed under running water to remove blood, followed by curettage to remove soft tissue and subsequently stored in saline solution of 0.9% concentration at room temperature. All anatomical crowns of teeth were decoronated 2mm from coronal tip of tooth with rotary diamond disc at low speed under water coolant, perpendicular to the long axis of the tooth and dentin was exposed. The prepared specimens were mounted in metal cylinders with the help of dental stone. They were randomly divided into 3 groups of 10 each based on type of contamination.

Group 1: No contamination (control) – Apply 2 coats of adhesive by scrubbing the preparation with a microbrush for 10 - 15 sec per coat. Light polymerisation was not done between the coats. Excess solvent was thoroughly air dried with an air syringe for atleast 10 s, such that there was no visible movements of material and have a uniform glossy appearance. This is followed by light polymerising for 10s at 1200mW/cm^2.

Group 2: Specimens were contaminated for 20 sec with saliva, followed by application of bonding agent.

Group 3: Specimens were contaminated for 20 sec with saliva, after light curing the bonding agent.

Following the bonding agent application, Z350 composite resin was placed in increments using a Teflon mold of 2mm diameter. The specimens were kept in distilled water bath for 24 hrs at 37^{0}c. This is followed by testing the specimens for shear bond strength with universal testing machine at a crosshead speed of 1mm/min.

RESULTS

The data obtained in the present study was subjected to test of normality by shapirowilk and Kolmogorov-Smirnov test which revealed that the

Table 1: Comparison of group 1 and group 2.

	Group1, group2, group3	N	Mean	Std. Deviation	t value	P value
Shear Bond Strength	Group 1	10	28.14	3.43	4.279	<0.001
	Group 2	10	22.13	2.81		

Table 2: Comparison of group 1 and group 3.

	Group1, group2, group3	N	Mean	Std. Deviation	t value	P value
Shear Bond Strength	Group 1	10	28.140000	3.4355009	2.306	0.034
	Group 3	10	25.010000	2.5718346		

Table 3: Comparison of group 2 and group 3.

	Group1, group2, group3	N	Mean	Std. Deviation	Std. Error Mean	t-test for Equality of Means	P Value
Shear Bond Strength	Group 2	10	22.13	2.81	.890	-2.388	0.028*
	Group 3	10	25.01	2.57	.813	-2.388	

data was normally distributed. Statistical analysis was done by unpaired t test. The results were as follows: Control versus group 2 showed a greater reduction in bond strength than control versus group 3. (Table 1 and 2) When group 2 was compared to group 3, group 2 showed greater reduction in bond strength than group 3.(Table 3) The results showed statistical significance. ($p<0.005$)

The shear bond strength was greatly reduced following salivary contamination in both the groups. Contamination of the cured bonding agent showed more tolerance to salivary contamination and lesser reduction in the bond strength than where contamination occurred prior to application of bonding agent.

DISCUSSION

A true universal adhesive has a very specific and synergistic functional and cross-linking monomer that are usually multifunctional in nature. These adhesives should be able to react with different substrates, copolymerize with chemically compatible resin-based restoratives and cements, and have some hydrophilic character in order to properly "wet" dentin, yet at the same time be hydrophobic to prevent hydrolysis and water sorption of the polymerised resin over time.

In All Bond Universal bonding agent, phosphate ester is used as their primary adhesive functional monomer i.e 10-MDP (methacryloyloxydecyl- dihydrogen-phosphate). These monomers form an ionic bond with the calcium present in the hydroxyapatite leading to formation of non-soluble Ca++ salts.[9,10] The acidic nature of phosphate esters provides them the potential to etch and demineralize tooth tissues.[8]

In the present study, the influence of salivary contamination on shear bond strength during different stages of bonding to dentin following self etch strategy, using All Bond Universal is evaluated. Inadvertent contamination

of operating field with saliva is a frequently encountered problem especially in cases where rubber dam placement may be difficult or not possible. Hence it is desirable to have an adhesive which can bond effectively to dentin in spite of contamination.

In this study, statistically significant reduction in bond strength was seen in both the experimental groups which salivary contamination occurred. However the reduction in bond strength was greater when the contamination occurred before application of the adhesive rather than when it occurred following curing of the adhesive.

The greater reduction in bond strength when contamination occurred prior to application of adhesive may be attributed to the fact that Saliva contains glycoproteins which results in the decrease of dentinal permeability up to 65% [11]. Saliva also effects the degree of conversion and bond strength of the HEMA (Hydroxylethyl methacrylate) containing adhesives, because the hydrophilic HEMA molecules cannot take part in chain growth during polymerization due to water retention within the adhesive layer [12].

The study also showed that there was a decrease in Shear Bond Strength when the cured surfaces was contaminated with saliva. This could be due to poorly polymerized, air inhibited adhesive surface adsorbing glycoproteins. These adsorbed glycoproteins causes incomplete infiltration of the successive resin layer and inadequate co polymerization [13]. This can also be attributed to degradation of resin dentin bond because of non-collagen-bound Matrix metaloproteinases present in saliva [14]

When the comparision was made between the two experimental groups group 3(salivary contamination of the cured resin) showed more tolerance and better bond strength group ii salivary contamination before application of bonding agent. The higher bond strength could be attributed to the following reasons:- Presence of 10MDP in All Bond Universal has a partition coefficient of 4.1(partition coefficient is a measure of hydrophilic or hydrophobic property of a chemical substance). 10-MDP is the most hydrophobic of all the functional monomers used in dental adhesives. In addition to this, 10-MDP shows chemical bonding to the calcium of the residual hydroxyapatite. This may have prevented water sorption and protected the collagen against hydrolytic breakdown at the adhesive interface.[8]

CONCLUSION

Proper understanding of the adhesive interface is important for the predictable placement of many current dental restorations. Under the limitation of the current study, Saliva contamination of the operatory field has a negative effect on the bond strength of the universal bonding system to dentin when used in self etch strategy, especially when it occurs before the application of the adhesive resin.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Kermanshah H, Ghabraei S, Bitaraf T. Effect of salivary contamination during different bonding stages on shear dentin bond strength of one-step self-etch and total etch adhesive. Journal of dentistry (Tehran, Iran). 2010;7(3):132.

2. Guerriero LN, Vieira SN, Scaramucci T, Kawaguchi FA, Sobral MA, Matos AB. Effect of saliva contamination on the bond strength of an etch-and-rinse adhesive system to dentin. Revista Odonto Ciência. 2009 Aug 15;24(4):410-3.

3. Xie J , Powrs JM , M C Guckin RS . In vitro bond strength of two adhesives to enamel and dentin under normal and contaminated conditions . Dent .Mater 1993 : 9: 295-299.

4. De Munck JD, Van Landuyt K, Peumans M, Poitevin A, Lambrechts P, Braem M, Van Meerbeek B. A critical review of the durability of adhesion to tooth tissue: methods and results. Journal of dental research. 2005 Feb;84(2):118-32.

5. Miyazaki M, Onose H, Moore BK. Analysis of the dentin–resin interface by use of laser Raman

spectroscopy. dental materials. 2002 Dec 31;18(8):576-80.

6. Van Meerbeek B, De Munck J, Yoshida Y, Inoue S, Vargas M, Vijay P, Van Landuyt K, Lambrechts P, Vanherle G. Adhesion to enamel and dentin: current status and future challenges. OPERATIVE DENTISTRY-UNIVERSITY OF WASHINGTON-. 2003 May;28(3):215-35.

7. Muñoz MA, Luque I, Hass V, Reis A, Loguercio AD, Bombarda NH. Immediate bonding properties of universal adhesives to dentine. Journal of dentistry. 2013 May 31;41(5):404-11.

8. Alex G. Universal adhesives: the next evolution in adhesive dentistry. Compend Contin Educ Dent. 2015 Jan;36(1):15-26.

9. Sorensen JA, Engelman MJ, Torres TJ, Avera SP. Shear bond strength of composite resin to porcelain. International Journal of Prosthodontics. 1991 Jan 1;4(1).

10. Hussain MA, Bradford EW, Charlton G. Effect of etching on the strength of aluminous porcelain jacket crowns. British dental journal. 1979 Aug;147(4):89-90.

11. Newman GV, Snyder WH, Wilson Jr CE. Acrylic adhesives for bonding attachments to tooth surfaces. The Angle Orthodontist. 1968 Jan;38(1):12-8.

12. Kermanshah H, Ghabraei S, Bitaraf T. Effect of salivary contamination during different bonding stages on shear dentin bond strength of one-step self-etch and total etch adhesive. Journal of dentistry (Tehran, Iran). 2010;7(3):132.

13. Fritz UB, Finger WJ, Stean H. Salivary contamination during bonding procedures with a one-bottle adhesive system. Quintessence international. 1998 Sep 1;29(9).

14. Sulkala M, Wahlgren J, Larmas M, Sorsa T, Teronen O, Salo T, Tjäderhane L. The effects of MMP inhibitors on human salivary MMP activity and caries progression in rats. Journal of Dental Research. 2001 Jun;80(6):1545-9.