Comparative evaluation of tensile bond strength of 6th, 7th and 8th generation dentin bonding agents … Kamble SS et al

In vitro Comparative Evaluation of Tensile Bond Strength of 6th, 7th and 8th Generation Dentin Bonding Agents

Suresh S Kamble¹, Baburajan Kandasamy², Ranjani Thillaigovindan³, Nitin Kumar Goyal¹, Pratim Talukdar², Mukut Seal⁴

Contributors:
¹Professor, Department of Prosthodontics, Maharashtra Institute of Dental Science and Research Dental College, Latur, Maharashtra, India; ²Professor & Head, Department of Prosthodontics, Sri Venkateswara Dental College, Puducherry, India; ³Senior Lecturer, Department of Prosthodontics, Sri Venkateswara Dental College, Puducherry, India; ⁴Reader, Department of Orthodontics & Dentofacial Orthopedics, Ekalavya Dental College & Hospital, Kotputli, Rajasthan, India; ⁵Private Practitioner, Department of Prosthodontics, Guwahati, Assam; ⁶Senior Lecturer, Department of Conservative dentistry & Endodontics, FAA Medical College & Hospital, Barpeta, Assam, India.

Correspondence:
Dr. Goyal NK. Reader, Department of Orthodontics & Dentofacial Orthopedics, Ekalavya Dental College & Hospital, Kotputli, Rajasthan, India; drnittingoyal@gmail.com

How to cite the article:
Kamble SS, Kandasamy B, Thillaigovindan R, Goyal NK, Talukdar P, Seal M. In vitro comparative evaluation of tensile bond strength of 6th, 7th and 8th generation dentin bonding agents. J Int Oral Health 2015;7(5):41-43.

Abstract:
Background: Newer dentin bonding agents were developed to improve the quality of composite restoration and to reduce time consumption in its application. The aim of the present study was to evaluate tensile bond strength of 6th, 7th and 8th generation bonding agents by in vitro method.

Materials and Methods: Selected 60 permanent teeth were assigned into 20 in each group (Group I: 6th generation bonding agent-Adper SE plus 3M ESPE, Group II: 7th generation bonding agent-G-Bond GC Corp Japan and Group III: 8th generation dentin adhesives-FuturaBond DC, Voco, Germany). With high-speed diamond disc, coronal dentin was exposed, and selected dentin bonding agents were applied on exposed dentine surfaces according to manufacturer’s instructions. Teeth were divided into 20 in each group (Group I: 6th generation bonding agent-Adper SE plus 3M ESPE, Group II: 7th generation bonding agent-G-Bond GC Corp Japan and Group III: 8th generation dentin adhesives-FuturaBond DC, Voco Germany). With high-speed diamond disc, coronal dentin was exposed. The selected bonding agents were applied on exposed dentine surfaces according to manufacturer’s instructions, followed by composite...
restoration. Acrylic resin blocks were prepared on each study teeth. All teeth were saved in sterile saline for 24 h and using universal testing machine (KIC-3-050-C, Kalpak Instruments and controls) tensile bond strength was tested. Applied force (N) was divided by the stick cross-sectional area (mm²). The tensile force required to debond the specimen was calculated in MPa. The obtained data were recorded and ANOVA test was used to statistically analyze the data.

Results
For each group the mean tensile bond strength and slandered deviation were calculated. The mean tensile bond strength value for 6th generation bonding agent was 32.2465, for 7th generation was 31.6734, and for 8th generation bonding agent was 34.74431. The highest tensile bond strength was seen in 8th generation bonding agent, followed by 6th generation bonding agent while 7th generation bonding agent showed lowest bond strength (Table 1 and Graph 1).

Discussion
The main purpose of measuring the bond strength is to assess the bonding strength of a bonding agent to the dental hard structures. Development of newer dentin bonding agents aims to improve the bonding quality and to reduce the time consumption in application. However, polymerization shrinkage is still a major problem in bonding composite to tooth structure. Polymerization contraction occurs during the conversion of monomer molecules into a polymer network. Polymerization shrinkage leads to failure of composite tooth interface and micro-leakage, which ultimately results in postoperative sensitivity, secondary caries, micro-cracking and failure of restoration. 17-21 MPa bond strength has been estimated to withstand this stress of polymerization shrinkage of the composite restoration. Several factors can influence the in vitro bond strength to dentin surface such as; type of tooth, dentine surface, type of bond strength to be tested (shear or tensile), type of bonding agent used, storage media, composite restorative material, and testing procedure. 4

All the three tested dentine bonding agents (6th generation- Adper SE plus 3MESPE, 7th generation- G-Bond GC-Corp Japan and 8th generation- Futura Bond DC, Voco, Germany) used in the present in vitro study were self-etching adhesives. Self-etch adhesives need one step (7th generation) or two-step application (6th generation). They are mild and less aggressive compared to non-self-etch adhesive system. 8th generation an adhesive (Futurabond DC, Voco, Germany) contains nano-sized cross-linking silica particles and can be dual-cured.4

In the present study, the mean tensile bond strength value for 6th generation bonding agent was 32.2465, for 7th generation was 31.6734, and for 8th generation bonding agent was 34.74431. The highest tensile bond strength was seen in 8th generation bonding agent, followed by 6th generation bonding agent and lowest seen with 7th-generation adhesives (Table 1 and Graph 1). Tensile bond strength of 8th generation was more compared to 7th which is statistically significant (P > 0.005). This is similar to study by Joseph et al. 2013.6 Similarly, lower bond strength was observed by several researchers with 7th generation bonding agents compared to 5th or 6th generation1,6 whereas Burrow et al. observed good results with G-Bond.1 Possible reason for lower bond strength observed in 7th generation is due to less cross-linking monomers1 and are more hydrophilic (attract water) than 6th generation bonding agents. This results in to lower mechanical strength of 7th-generation adhesives because the evaporated water from bonded dentin rapidly diffuses back into adhesive.1

Nikhil et al. in 2011 compared three self-etching adhesives for tensile bond strength and found that Adper Easy one was superior to G-Bond and Xeno V system. They concluded that this difference in tensile bond strength was due to hydrophilic nature of Adper Easy one, which enhances adhesion.7 Yaseen and Subba Reddy observed lowest shear bond strength on primary teeth with 6th generation (Contax) bonding agent and highest with 7th generation (Clearfil S3) on permanent teeth3. Similarly, Nair et al. observed higher shear bond strength with 7th generation (Adper Easy one) compared to 6th generation (Adper SE plus) bonding agents.5 Shekhar et al observed highest shear bond strength with Prime and Bond NT (5th generation) compared to Adper SE plus (6th generation) and G-Bond (7th generation) bonding agents.5 Souza-Zaroni et al. observed better tensile bond strength with Clearfil Liner...
Bond 2V self-etching primer adhesive system compared to Prime and Bond NT. Poptani et al. after thermocycling didn’t find any difference between 5th and 7th generation bonding agent. Dhawan et al. found higher tensile bond strength with single bond (5th generation) conditioner as compared to Scotch bond multipurpose (4th generation) and Prompt-L-Pop (6th generation). Chopra et al. observed that multi-bottle bonding agents performed better than single bottle dentin adhesives. El-Kassas et al. found that disinfecting the dentine surface prior to application of bonding agents decreases the bond quality. Borsatto et al. concluded from their study that, application of the two-step self-etch bonding agent (Adper SE Plus) beneath the resin pit- and -fissure sealant placement resulted in a significantly higher bond strength for the Er:YAG laser-irradiated enamel.

In this study, highest mean tensile bond strength of 34.74431 MPa was observed in 8th generation dentine adhesives (Futurabond DC, Voco, Germany) compared to 6th and 7th generation adhesives, this may be due to its nano-sized cross-linking fillers.

Conclusion
From the present study, it can be conclude that 8th generation dentin adhesives (Futura DC, Voco, Germany) showed better tensile bond strength compared to 6th (Adper SE plus, 3M ESPE) and 7th generation (G-Bond) dentin bonding agents and appears to be more advantageous.

References
1. Deepa VL, Damaraju B, Priyadharsini BI, Subbarao VV, Raju KR. Comparative evaluation of microshear bond strength of 5th, 6th and 7th generation bonding agents to coronal dentin versus dentin at floor of pulp chamber: An in vitro Study. J Int Oral Health 2014;6(5):72-6.
2. Nikhil V, Singh V, Chaudhry S. Comparative evaluation of bond strength of three contemporary self-etch adhesives: An ex vivo study. Contemp Clin Dent 2011;2(2):94-7.
3. Yaseen SM, Subba Reddy VV. Comparative evaluation of shear bond strength of two self-etching adhesives (sixth and seventh generation) on dentin of primary and permanent teeth: An in vitro study. J Indian Soc Pedod Prev Dent 2009;27(1):33-8.
4. Joseph P, Yadav C, Satheesh K, Rahna R. Comparative evaluation of the bonding efficacy of sixth, seventh and eight generation bonding agents: An in vitro study. Int Res J Pharm 2013;4(9):143-7.
5. Pashley DH, Tay FR. Aggressiveness of contemporary self-etching adhesives. Part II: Etching effects on unground enamel. Dent Mater 2001;17(5):430-44.
6. Yazici AR, Celik C, Ozgunaltay G, Dayangac B. Bond strength of different adhesive systems to dental hard tissues. Oper Dent 2007;32(2):166-72.
7. Burrow MF, Kitasako Y, Thomas CD, Tagami J. Comparison of enamel and dentin microshear bond strengths of a two-step self-etching priming system with five all-in-one systems. Oper Dent 2008;33(4):456-60.
8. Nair M, Paul J, Kumar S, Chakravathy Y, Krishna V, Shivaprasad. Comparative evaluation of the bonding efficacy of sixth and seventh generation bonding agents: An in-vitro study. J Conserv Dent 2014;17(1):27-30.
9. Shekar R, Ponnappa KC, Mirdha N, Narula S. To evaluate and compare the shear bond strength of fifth (total etch) generation, sixth (two step, self-etch adhesive) generation and seventh (one step, self-etch adhesive) generation dentin bonding agents. Natl Res Denticon 2013;2(2):136-43.
10. Souza-Zaroni WC, Seixas LC, Ciccone-Nogueira JC, Chimello DT, Palma-Dibb RG. Tensile bond strength of different adhesive systems to enamel and dentin. Braz Dent J 2007;18(2):124-8.
11. Poptani B, Gohil KS, Ganjiwale J, Shukla M. Microtensile dentin bond strength of fifth with five seventh-generation dentin bonding agents after thermocycling: An in vitro study. J Conserv Dent 2008;2(2):36-41.
12. Chopra V, Sharma H, Prasad SD. A comparative evaluation of tensile bond strength and hybrid layer of three generation bonding agents by scanning electron microscope (an in-vitro study). J Oral Health Community Dent 2013;2(2):36-41.
13. El-Kassas DW, Fawzi EM, El Zohairy A. The effect of cavity disinfectants on the micro-shear bond strength of dentin adhesives. Eur J Dent 2014;8(2):184-90.
14. Borsatto MC, Giuntini Jde L, Contente MM, Gomes-Silva JM, Torres CP, Galo R. Self-etch bonding agent beneath sealant: Bond strength for laser-irradiated enamel. Eur J Dent 2013;7(3):289-95.