

Original ARTICLE

Assessment of shear bond strength of composite resin to dentin, using newer dentin bonding agents: A comparative study

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ABSTRACT

Background: To incorporate or remove the smear layer in this interdiffusion zone, different adhesion strategies are followed to obtain a resin-dentin bond. These newer bonding agents reduce the clinical steps, can be placed inexpensively, provide adequate bonding to enamel and dentin, and, most importantly, ensure post-operative comfort for patients. Hence; the present study was undertaken for assessing shear bond strength of composite resin to dentin, using newer dentin bonding agents. **Materials & methods:** A total of 60 freshly extracted maxillary premolars were obtained and were out in normal saline for 24 hours. On a water-trimmer, occlusal surface of all the tooth specimens was grounded and was made flat upto a depth of 1.5 mm from the cuspal tip. All the specimens were broadly divided into three study groups depending upon the type of bonding agent as follows: Group A: Prime and Bond NT (Control Group) Total etch Self-Priming, Group B - Clearfil S3: One-step self-etch, and Group C - Clearfil Protect Bond: Two-step self-etch. Material was placed using a Teflon mold followed by curing for twenty seconds in all the tooth specimens. This was followed by mounting of the prepared specimen on metal cylinders. Transferring of all the specimens was done to universal force testing machine was shear bond strength was assessed. **Results:** mean shear bond strength among specimens of group A, group B and group C was found to be 25.13, 21.73 and 15.38 MPa respectively. While making intragroup comparison, significant results were obtained. Increasing order of shear bond strength among different study groups was found as follows: Group A > Group B > Group C. **Conclusion:** Shear bond strength was highest for total etch Self-Priming and lowest for two-step self-etch.

Key words: Shear bond strength, bonding agents

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INTRODUCTION

The introduction of bonding agents in restorative dentistry has made it possible to adhere restorative materials to tooth structure. Since bonded restorations were introduced by Buonocore in 1955, extensive research has been conducted to develop systems that bond equally effectively to enamel and dentin. Researchers have identified a micromechanical retention mechanism for the attachment of hydrophobic resin restorative materials to both enamel and dentin that works if appropriate conditioning or priming steps are applied. At the dentin site, the modes of action of current adhesive systems converge to create a resin-dentin interdiffusion zone between the deep dentin structures and the filling material.¹⁻³

To incorporate or remove the smear layer in this interdiffusion zone, different adhesion strategies are followed to obtain a resin-dentin bond. In the clinical situation, these modern dentin-bonding systems are more technique sensitive; the thickness of the

interface, its elastic capacity, the polymerization efficiency and initiation of the bonding agent, and, finally, the application technique used for the restorative material play an important role in the final result. The newer concepts of self etching primers and adhesives have proven to be good both scientifically and clinically. They reduce the clinical steps, can be placed inexpensively, provide adequate bonding to enamel and dentin, and, most importantly, ensure post-operative comfort for patients.⁴⁻⁶ Hence; the present study was undertaken for assessing shear bond strength of composite resin to dentin, using newer dentin bonding agents.

MATERIALS & METHODS

The present study was conducted with the aim of assessing the shear bond strength of composite resin to dentin, using newer dentin bonding agents. A total of 60 freshly extracted maxillary

premolars were obtained and were out in normal saline for 24 hours. Carious, deformed, cracked or tooth with restorations were excluded. On a water-trimmer, occlusal surface of all the tooth specimens was grounded and was made flat upto a depth of 1.5 mm from the cuspal tip. All the specimens were broadly divided into three study groups depending upon the type of bonding agent as follows:

Group A: Prime and Bond NT (Control Group) Total etch Self-Priming

Group B - Clearfil S3: One-step self-etch.

Group C - Clearfil Protect Bond: Two-step self-etch.

Material was placed using a Teflon mold followed by curing for twenty seconds in all the tooth specimens. This was followed by mounting of the prepared specimen on metal cylinders. Transferring of all the specimens was done to universal force testing machine was shear bond strength was assessed. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Chi-square test and student t test were used for evaluation of level of significance.

RESULTS

A total of 60 freshly extracted maxillary premolars were obtained and were out in normal saline for 24 hours. All the specimens were broadly divided into three study groups depending upon the type of bonding agent as follows: Group A: Prime and Bond NT (Control Group) Total etch Self-Priming, Group B - Clearfil S3: One-step self-etch, and Group C - Clearfil Protect Bond: Two-step self-etch. Mean shear bond strength among specimens of group A, group B and group C was found to be 25.13, 21.73 and 15.38 MPa respectively. While making intragroup comparison, significant results were obtained. Increasing order of shear bond strength among different study groups was found as follows:

Group A > Group B > Group C

Table 1: Mean shear bond strength

Group	Mean shear bond strength (MPa)	SD
A	25.13	0.68
B	21.76	0.98
C	15.38	0.76

Table 2: Intergroup comparison

Group Vs. Group	t- value	p- value
Group A Vs. Group B	10.12	0.00
Group B Vs. Group C	9.85	0.01
Group C Vs. Group A	10.82	0.00

DISCUSSION

Bonding of resin to enamel is due to the micromechanical bond between the resin bonding agent and the highly inorganic substrate of enamel, which is achieved by the acid etching procedure. However, bonding of composite resin to dentin is comparatively difficult due to the complex structure of dentin with a low inorganic content randomly arranged in an organic collagen matrix and the presence of dentinal fluid. Acid etching removes the supporting inorganic matrix of dentin, leaving the organic substance, but the collagen in the organic substance shrinks and collapses easily when it is dried with air syringe after being rinsed with water.⁷⁻⁹ Hence; the present study was

undertaken for assessing shear bond strength of composite resin to dentin, using newer dentin bonding agents.

In the present study, a total of 60 freshly extracted maxillary premolars were obtained and were out in normal saline for 24 hours. Mean shear bond strength among specimens of group A, group B and group C was found to be 25.13, 21.73 and 15.38 MPa respectively. Hegde MN et al assessed the shear bond strength of Total etch Prime and Bond NT and self etch newer dentin bonding agents Clearfil S3, Xeno III Bond, Clearfil Protect Bond and G Bond used to bond composite resin to dentin, and to compare the difference in the shear bond strengths of the self etch newer dentin bonding agents. Hundred freshly extracted noncarious human maxillary premolar teeth were selected. The occlusal surfaces of each tooth were ground to prepare flat dentin surfaces at a depth of 1.5 mm and were randomly grouped, with twenty specimens in each: Group I - Prime and Bond NT, Group II - Clearfil Protect Bond, Group III - Xeno III Bond, Group IV - Clearfil S3 Bond, Group V - G Bond. Each group was treated with its respective bonding agents, as per the manufacturers' instructions Clearfill – Kuraray, Japan, G bond – GC Tokyo, Japan, Xeno- De Trey Densply, Germany. Blocks or Cylinders of composite resin were built up using Teflon mold and cured. Shear bond strengths were tested using Instron Universal testing machine and recorded in Mpa. The total etch adhesive showed higher shear bond strength than self etching adhesives. They can be concluded that all the adhesive agents evaluated showed optimal shear bond strength 17-20 Mpa, except G bond. However, shear bond strength of composite resin to dentin is better with one bottle total etch adhesive than with the newer self etching bonding agents.¹⁰

In the present study, while making intragroup comparison, significant results were obtained. Increasing order of shear bond strength among different study groups was found as follows: Group A > Group B > Group C. Ravikumar N et al compared the shear bond strengths of two different dentin bonding agents with two different desensitizers. Eighty molars were taken which were ground to expose the dentin. The teeth were divided into two major groups. Each major group was subdivided into four subgroups of 10 samples each. Groups Ia and IIa were treated as dry bonding groups, groups Ib and IIb were treated as a moist bonding groups, groups Ic and IIc were rewetted with Gluma desensitizer, and groups Id and IId were rewetted with vivasens desensitizer. Major group I was treated with Gluma comfort bond and Charisma. Major group II was treated Prime and Bond NT and TPH. The samples were thermo cycled and shear bond test was performed using an Instron machine. The data were analyzed using one-way analysis of variance and Tukey's Honestly significant different test. The results revealed that the specimens rewetted with Gluma desensitizer showed the highest shear bond strength compared to all other groups, irrespective of the bonding agent or composite resin used. It can be concluded that rewetting with desensitizer provided better bond strength than the other groups.¹¹

CONCLUSION

From the above results, the authors conclude that shear bond strength was highest for total etch Self-Priming and lowest for two-step self-etch. However; further studies are recommended.

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