



EVALUATION OF THE BOND STRENGTH OF REPAIRED COMPOSITE RESIN RESTORATION WITH SILANE APPLICATION AND UNIVERSAL BONDING AGENT

Dental Science

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ABSTRACT

Repair of old composite restorations poses challenges due to presence of very few reactive double bonds. The bond strength between the repaired composite and the old composite can be improved by physical and chemical surface treatments. Studies have shown effectiveness of silane coupling agent application to increase bond strength. Hence, the aim of this study is to evaluate the shear bond strength of repaired composite restoration, repaired using silane coupling agent and universal bonding agent. **METHODOLOGY:** 20 composite discs were prepared and randomly divided into 2 groups. In Group A silane coupling agent was applied and in Group B no surface treatment was done. Universal bonding agent was applied on both the groups and another cylindrical layer of composite was applied on both the groups and were light cured. Shear bond strength test was done using universal testing machine for all the samples. **RESULT:** The result shows increase in shear bond strength of repaired composite on application of silane coupling agent.

KEYWORDS

Silane coupling agent, Universal bonding agent, Composite repair

INTRODUCTION

Composite resins have added a whole new dimension to the advancing field of aesthetic dentistry. The introduction of newer generation of dentin bonding agents, newer wear resistant formulations, surface treatment systems and improved light curing have improved the clinical performance of composite materials.

Old composite restorations can fail due to secondary caries, fracture or discolouration. The treatment options for these kind of failed composite restorations include either total replacement of the old restoration or the repair of the existing restoration. Owing to its various shortcomings like increasing the cavity size and traumatizing the pulpal tissue, repair of the restoration is preferred over replacement. But, repair of old composite restoration poses challenge due to presence of very few reactive double bonds in the old composite for bonding to new composite.¹

Previous studies have shown good bond between the old and new composite resin.^{1,2} The bond strength between them can be variable and unpredictable, but can be improved by the means of physical and chemical surface treatments.^{1,3,4} Scientific researches have proved application of silane coupling agent can improve the bond strength of repaired composite. Hence, the aim of the current study was to evaluate the bond strength of composite resin repair with universal adhesive system with or without silane application.

MATERIALS AND METHODS:

Preparation of samples:

Twenty plastic moulds of internal diameter 6mm and 3mm length were prepared. Tetric N Ceram bulkfill (Ivoclar Vivadent) composite was compacted inside these moulds in a single increment to avoid any voids. Bluephase 20i (Ivoclar Vivadent) light curing unit was used to cure the composite discs for 10 seconds at high power mode. After this the composite discs were subjected to ageing procedure. The composite discs were stored in distilled water at 37°C for 48 hours. The samples were then boiled in distilled water for 8 hours and were then again stored in distilled water at 37°C for 3 weeks. Each of the twenty samples were then subjected to sandblasting procedure using 50µ aluminium oxide particles at 2 bars pressure for 10 seconds. Out of all the samples, ten samples were selected randomly and were subjected to treatment using a silane coupling agent. Monobond N (Ivoclar Vivadent) was applied on the surface of the randomly selected composite discs using microbrush and were left to dry for 60 seconds. The other ten samples underwent no such treatment. Thus all the samples were broadly divided into two groups each containing 10 samples-

Group A (Treated with silane coupling agent)
Group B (No treatment)



Materials used for the study (Fig:1)

(Table-1) Comparison of mean Shear bond strength (in Mpa) between 02 groups using Independent Student t Test

Groups	N	Mean	SD	Mean Diff	t	P-Value
Group A	10	23.10	4.73	5.60	2.588	0.02*
Group B	10	17.50	4.95			



Grouping of the prepared samples (Fig:2)

Tetric N Bond Universal bonding agent was applied on all the samples using a micro brush with gentle agitation, air thinned for 5 seconds and finally light cured for 10 seconds. Plastic moulds of internal diameter of 3mm and 4 mm length were placed on top of all the samples and were compacted with GC Solare Sculpt (GC) composite and light cured for 10 seconds at high power mode.

All the samples were subjected to the rmo cycling between 5-55°C for 300 cycles with a dwell time of 30 seconds and transfer time of 5 seconds.

Shear bond strength test:

After that all the samples were subjected to shear bond strength test using Universal Testing Machine at a head speed of 1mm/min.



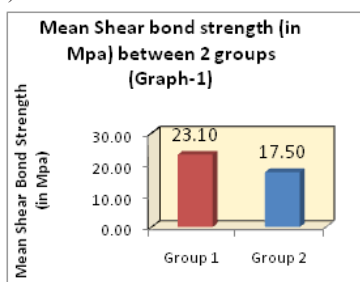
Shear bond strength test of the samples (Fig:3)

Statistical analysis:

Independent Student t Test was used to compare the mean Shear Bond Strength (in MPa) between 2 study groups. The level of significance [P-Value] was set at $P < 0.05$

RESULTS

The test results demonstrated Group 1 having significantly higher mean shear bond strength (23.10 ± 4.73) as compared to Group 2 (17.50 ± 4.95) at $P = 0.02$.



DISCUSSION

When repairing the old restorations, a frequently asked question is whether the repair material bonds adequately to the existing restorations. Composite repair often presents a different challenge; while there is no oxygen-inhibited layer, few unreacted double bonds remain in the old composites for bonding to the new composite. Thus, the potential for chemical bonding between old and fresh composite layers decreases over time.^{1,2,3,4,5}

50 μ aluminium oxide particles at 2 bars pressure was used to roughen the old composite surface.⁴

Monobond N is an universal primer mediating an adhesive bond between luting composites and all materials used for indirect restorations (glass and oxide ceramics, metal), composite resin, fibre reinforced composite. It is composed of alcohol solution of silane methacrylate, phosphoric acid methacrylate and sulphide methacrylate.¹

When silane is applied to the exposed filler particles following surface roughening of composite resin, it gets deposited on the filler. In the presence of water, methoxy groups of silane are hydrolyzed to silanol (-Si-OH) groups that can bond to other silanols by the formation of a siloxane bond (-Si-O-Si). Then the methacrylate group of silane form covalent bonds with repair resin when it is polymerized, thereby completing the coupling process.² Silane also enhances the wetting ability of the adhesive over the irregularities created by surface roughening.

Universal bonding agent, 8th generation bonding agent, is compatible with total-etch, self-etch and selective etch techniques providing excellent versatility. It perfectly adapts to all direct and indirect restorations and can also be used to repair glass and ceramic hybrid restoration in combination with a silane.³

CONCLUSION

The results indicated that silane coupling agent along with universal bonding agent increases the shear bond strength between the old composite and repaired composite significantly.

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