



Effect of Cissus Quadrangularis as an Antioxidant on the Bond Strength of Methacrylate Based Composite after Bleaching

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ABSTRACT

Aim: The aim of this study was to investigate the effect of Cissus Quadrangularis as an antioxidant on the bond strength of methacrylate based composite after bleaching.

Materials and Methodos: 40 extracted single rooted teeth were divided into 2 groups based on composite build up after bleaching. In group 1 (n=20) bleaching was followed by immediate composite buildup,

In group 2(n=20) bleaching was followed by composite buildup after 2 weeks. Both the groups were further subdivided into 2 subgroups (n=10) based on whether antioxidant

(Cissus Quadrangularis) is applied or not. In subgroup 1A / 2A no antioxidant was applied after bleaching. In subgroup 1B / 2B the antioxidant was applied after bleaching. Shear bond strength of all the specimens were tested under a universal testing machine at 1mm/min crosshead speed.

Statistical Analysis: One way ANOVA test was carried out to analyze the difference in mean shear bond strength between four groups. A post hoc Games-Howell test was performed to ascertain which pairs differ significantly from one another.

Results: Statistically significant difference was observed between all the groups. But significantly higher shear bond strength was observed in bleaching followed by

delayed composite buildup group (2A / 2B). Among all the groups antioxidant (Cissus Quadrangularis) applied groups showed higher shear bond strength (1B/2B).

Conclusion: Bleaching followed by antioxidant (Cissus Quadrangularis) application followed by delayed composite buildup with minimum of 2 weeks improves shear bond strength.

Keywords: Bleaching , cissus quadrangularis , composite buildup , shear bond strength

Introduction

Vital tooth bleaching generally involves application of hydrogen peroxide on the tooth surface in an in office technique or application of carbamide peroxide at home technique[1].Among bleaching agents, hydrogen peroxide is most commonly used.

Hydrogen peroxide has the following mechanism of action during bleaching. After application it breaks down into nascent oxygen, hydroxyl and per-hydroxyl group[2].These free radicals break down the macro pigmented molecules into small less pigmented molecules [3,5]

Drawback of bleaching followed by immediate composite buildup is that it reduces the bond strength of composite due to the presence of residual peroxide that releases oxygen which prevents the resin tag formation and resin polymerization[4,5]. Another reason for reduced

bond strength is due to modification of the organic substance, reduction of microhardness and calcium loss. [6,1]

Different methods have been suggested to overcome this problem immediately after bleaching. This includes the removal of superficial enamel, treatment of the bleached enamel with alcohol before bonding procedure, applying of acetone based adhesives and using antioxidants.[7,9].

The bond strength can be improved by delaying the bonding procedure for 24 hours to 4 weeks after bleaching [8,9].

The use of antioxidant agents after bleaching has been proposed to avoid compromising the bond strength [10]. Many herbs have antioxidant properties [11]. In the present study *Cissus Quadrangularis* was used as a new antioxidant to reverse the adverse effect of H₂O₂ on the enamel bond strength.

CISSUS QUADRANGULARIS (family Vitaceae) is a native medicinal plant of India. The plant has high amounts of vitamin C, carotene and anabolic steroid substances [12].

The chemical constituents of *Cissus quadrangularis* possess novel flavonoids and indanes, as well as phytosterols and keto-steroids which have shown to be powerful and efficient antioxidants[13]. An ethyl acetate extract of *Cissus quadrangularis* showed better antioxidant property than other extracts like methanol extract [12].

So the aim of the study was to investigate the effect of *Cissus Quadrangularis* as an antioxidant on the bond strength of methacrylate based composite after bleaching.

Materials and Methods

Preparation of an extract of *Cissus Quadrangularis*

The stem of *cissus qudrangularis* was collected and cut into multiple pieces after which it was dried in a hot air oven at 60°C and then it was ground into powder. The extract was prepared by cold extraction method using ethyl acetate solution. Finally the prepared extract was dissolved in 1L of dimethyl sulfoxide solution to make an extract of 100ml (**fig 1**).



FIG 1 : Preparation of *cissus quadrangularis* extract

Specimen preparation

Forty extracted single rooted teeth were selected for this study. Labial enamel surfaces were flattened with 600 grit silicon carbide paper and their roots were embedded in an acrylic resin block, keeping only the coronal portion exposed (fig 2). The labial enamel surfaces of 40 specimens were bleached with Pola Office (38% hydrogen peroxide gel) according to manufacturers' instructions (fig 3). The bleaching gel was completely rinsed off with water.



Fig 2 : Materials used



Fig 3 : Bleaching gel Application

The 40 bleached specimens were randomly divided into two groups of 20 teeth each based on the composite build up after bleaching. They were further subdivided into 2 subgroups based on the application of an antioxidant of ethyl acetate extract of *Cissus quadrangularis*.

Group 1 (n=20): bleaching followed by immediate composite buildup

Group 1A (n=10): bleaching followed by application of *Cissus quadrangularis* followed by immediate composite buildup

Group 1B (n=20): bleaching without application of *Cissus quadrangularis* followed by immediate composite buildup

Group 2 (n=20): bleaching followed by composite buildup after 2 weeks

Group 2A (n=10): bleaching followed by application of Cissus quadrangularis followed by composite buildup after 2 weeks

Group 2B (n=10): bleaching without application of Cissus quadrangularis followed by composite buildup after 2 weeks.

After the bleaching procedure teeth was dried, etchant (37% phosphoric acid) was applied followed by bonding agent and it was light cured. And then composite buildup was done on the labial surface for all the samples which was then light cured (fig 4,5,6)&(fig 7).



Fig 4,5,6: Etchant application, Bonding agent application, composite buildup



Fig 7: Light curing of composite

All specimens were stored in distilled water for 24 hours before shear bond strength (SBS) testing was performed in a universal testing machine.

Statistical Analysis

Statistical analysis was carried out using SPSS Version 17.0 software version. Descriptive statistics was performed. One way ANOVA test was carried out to analyze the difference in mean shear bond strength between four groups. A post hoc Games-Howell test was performed to ascertain which pairs differ significantly from one another. $p \leq 0.05$ was considered for statistical significance.

Results

Mean and standard deviation of shear bond strength (SBS) for all the study groups are shown in Table 1. Graphic representation of the comparison of mean SBS between groups is given in Figure 8.

					95% Confidence Interval For Mean			
	Mean	Std Deviation	Std. Error		Maximum	Lower Bound	Upper Bound	P Value
Group 1A	9.93	2.76	0.87	6.83	15.96	7.96	11.90	0.001*
Group 1B	19.28	4.39	1.39	14.32	29.22	16.14	22.42	
Group 2A	31.37	10.34	3.27	10.62	41.19	23.97	38.77	
Group 2B	58.71	11.30	3.57	38.62	70.05	50.62	66.79	

Table 1 :Mean and standard deviation of shear bond strength (SBS)

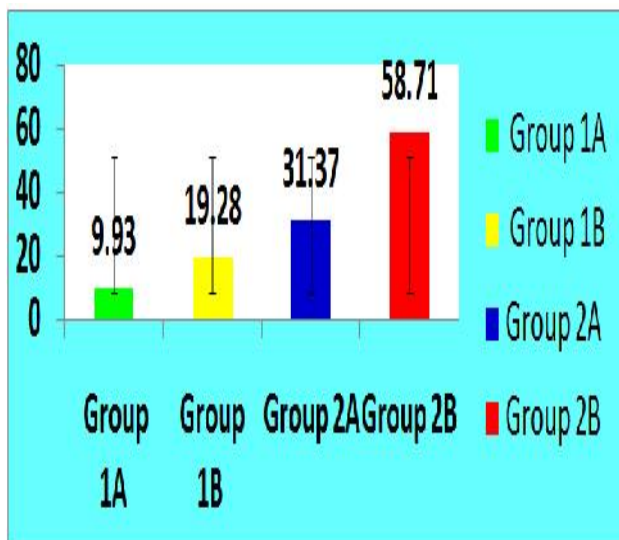


Fig 8 :Graphic representation of the comparison of mean SBS between groups

When comparing group 1A and group 1B (immediate composite buildup after bleaching) there was a statistically significant difference between both the subgroups . Among the subgroups, subgroup 1B (cissus quadrangularis was applied after bleaching) showed higher shear bond strength than the subgroup 1A (no antioxidant was applied after bleaching).

When comparing group 2A & group 2B (delayed composite buildup after bleaching) there was a statistically significant difference between both the subgroups . Among the subgroups, subgroup 2B (cissus quadrangularis was applied after bleaching) showed higher shear bond strength than the subgroup 2A (no antioxidant was applied after bleaching).

Post hoc pairwise comparison of shear bond strength between four groups using Games-Howell test is shown in Table 2.

(I) grps	(J) grps	Mean Difference (I-J)	Std. Error	95% Confidence Interval		p value
				Lower Bound	Upper Bound	
Grp 1A	Grp 1B	-9.35000*	1.64	-14.07	-4.63	0.001*
	Grp 2A	-21.43900*	3.39	-31.75	-11.13	0.001*
	Grp 2B	-48.77300*	3.68	-60.01	-37.53	0.001*
Grp 1B	Grp 1A	9.35000*	1.64	4.63	14.07	0.001*
	Grp 2A	-12.08900*	3.55	-22.62	-1.56	0.001*
	Grp 2B	-39.42300*	3.83	-50.86	-27.99	0.001*
Grp 2A	Grp 1A	21.43900*	3.39	11.13	31.75	0.001*
	Grp 1B	12.08900*	3.55	1.56	22.62	0.001*
	Grp 2B	-27.33400*	4.84	-41.04	-13.63	0.001*
Grp 2B	Grp 1A	48.77300*	3.68	37.53	60.01	0.001*
	Grp 1B	39.42300*	3.83	27.99	50.86	0.001*
	Grp 2A	27.33400*	4.84	13.63	41.04	0.001*

Table 2 :Post hoc pairwise comparison of shear bond strength between four groups using Games-Howell test .

Post hoc pairwise comparison of shear bond strength between four groups using Games-Howell test showed significant difference between all the groups. When comparing both the main groups (group 1 & groups 2), group 2 (delayed composite build up after bleaching) showed higher shear bond strength than group 1 (immediate composite build up after bleaching). When comparing all the 4 subgroups, cissus quadrangularis antioxidant applied groups ,subgroup 1B &subgroup 2B showed higher shear bond strength than the antioxidant which was not applied in the groups (subgroup 1A & subgroup 2A).

Discussion

Bleaching is one of the conservative treatments for managing discoloured teeth. For vital bleaching, hydrogen peroxide or carbamide peroxide are the bleaching agents for treating discoloured teeth. Hydrogen peroxide is used as a bleaching agent at a concentration of 30% - 35% [14].

Hydrogen peroxide penetrates the enamel due to its low molecular weight, and it is continuously leached from bleached enamel .It eventually breaks down into oxygen and water. The released oxygen from hydrogen peroxide prevents the polymerization of the adhesive. And also it may inhibit the infiltration of resin into enamel and dentin [15].

Deepti dabas et al observed that under SEM study interface between resin and unbleached enamel was different when compared with interface between resin and bleached enamel [6]. It was so in the bleached enamel, due to less number of resin tags with incomplete structure and with poor penetration ,which leads to more voids in resin enamel interface [3].

Oxygen released from H₂O₂ forms a spherical bubble like structure in resin enamel interface when viewed under SEM. These factors produce reduced bond strength in resin enamel interface [3].

Some authors observed that peroxide ions replace the hydroxyl apatite during the bleaching procedure with H₂O₂ and forms peroxide apatite [5,8]. But these substitutions are unstable and after 2 weeks again it was substituted by hydroxyl apatite [3,15]

In many studies, authors have discussed and investigated the effects of bleaching agent on the bond strength of enamel [15]. Many studies revealed that antioxidants were used to reverse the action of peroxide ions. Moreover many studies have used many natural and herbal antioxidants to reverse the adverse effects of the bleaching agent.

Oxidation is a chemical reaction that can release free radicals. These free radicals lead to chain

reactions that may cause cell damage. An antioxidant is a molecule which plays a pivotal role in preventing the oxidation of other molecules. Antioxidant vitamins are A, C, E which are found in vegetables, fruits, eggs, legumes and nuts. Plants with vitamins, flavanoids and polyphenols, possess high antioxidants[11].

Antioxidants are the substances which scavenge free radicals. It inhibits free radical-induced diseases by giving hydrogen radicals to the primary radicals. Further this free radical reduced into non-radical chemical compounds and again its converted into oxidize antioxidant radicals[13].

In some studies aloe vera and grape seed extract were used as a herbal antioxidant for improving the bond strength on bleached enamel. In this study *Cissus quadrangularis* was used as a new antioxidant for improving bond strength of composite in bleached teeth.

In this study, *Cissus quadrangularis* was applied for 10 minutes, as this duration is considered to be adequate and clinically desirable [15]. In a study conducted by Lai et al, he reported that the antioxidant should be applied for at least one-third of the time of application of the oxidizing bleaching agent. And also he stated that antioxidants might reverse the inclusion process of peroxide ions.[8].

The results of this study showed that the shear bond strength was significantly increased for the groups of specimens where *Cissus quadrangularis* was applied when compared to the specimens where the resin composite was directly applied without treating with *Cissus quadrangularis*.

Limitations

1. This study did not evaluate whether the bond failure is cohesive or adhesive.
2. As this is an in vitro study, clinical evaluation is necessary to determine the efficacy of *Cissus quadrangularis* as an antioxidant.
3. This study did not compare *Cissus quadrangularis* antioxidant with other proven effective antioxidants like proanthocyanidin and sodium ascorbate.

Conclusion

Within the limitations of this study, it was concluded that the application of ethyl acetate extract of *Cissus Quadrangularis* increased the bond strength of the enamel in all the tested groups. After vital bleaching procedures, the immediate application of this antioxidant can be helpful for increasing the bond strength of composite to enamel.

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