



Research Article

A COMPARATIVE EVALUATION OF SHEAR BOND STRENGTHS OF COMPOSITE BONDED TO DENTINE FOLLOWING TREATMENT WITH TWO DESENSITIZING TOOTHPASTES

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ABSTRACT

Aim: of this study is to determine whether brushing with Colgate sensitive plus toothpaste and vantej toothpaste can affect the shear bond strengths of composite to dentine surfaces.

Material and method: 18 premolar teeth were embedded in polymethylmethacrylate and occlusal surfaces were flattened to expose dentine. The teeth were randomly divided into 3 groups of 6 teeth each. One group served as control. Of the remaining 2 groups, 1 group was brushed with Colgate Sensitive Plus and 1 group brushed with Vantej Toothpaste. The dentine surfaces were brushed to simulate 2 weeks of twice-daily toothpaste use. The specimens in each of the control group and experimental groups were subjected to dentine bonding, and application of composite resin. A universal material testing machine was used to determine shear bond strengths.

Statistical analysis: One-way ANOVA and Post-Hoc tests were used.

Results: Mean shear bond strength ranged from 8.08 Mpa to 8.73MPa. Results showed that pretreatment with Colgate sensitive plus did not have any effect on shear bond strength of composite ($p > 0.05$). Vantej toothpaste showed statistically significant difference ($p < 0.05$) and showed increased bond strength.

Conclusions: Pretreatment with Vantej toothpaste increased the shear bond strength. However the shear bond strength was not significantly affected when pretreated with Colgate sensitive plus. Hence this desensitizing paste used for the treatment of eroded dentin would not affect restorations placed clinically.

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INTRODUCTION

Tooth surface loss is a common dental problem, which can be ascribed to various etiologies such as attrition, abfraction, abrasion and erosion. Rafeek *et al.* reported a prevalence rate of 72% for all types of wear and severity (mild, moderate and severe) whilst Smith *et al.* quoted prevalence rates of 62.2% for wear at the cervical aspect of teeth. The most common and first presenting symptom of tooth surface loss is dentine sensitivity.¹

Dentine Hypersensitivity (DH) Is defined as a short, sharp pain arising from exposed dentine, typically in response to chemical, thermal, tactile, evaporative or osmotic stimuli that cannot be ascribe to any other dental defect or pathology.²⁻⁴

The use of desensitizing agents to treat dentinal sensitivity has been advocated; the action of these agents is based on the occlusion of exposed dentinal tubules, which interrupts neural response to stimuli and thereby blocks the pain signal. An ideal dentin hypersensitivity treatment would mimic the natural desensitizing process, inducing changes in dentin that lead to rapid and lasting occlusion of dentin tubules.

Further, the treatment would be easy to apply, and would have no side effects.³⁻⁶

Arginine-calcium carbonate (Arg-CaCO₃) Containing desensitising paste can be used to seal exposed dentinal tubules effectively and provide reliable relief for hypersensitivity. Arginine and calcium carbonate from ArgCaCO₃-containing Paste can work together to accelerate natural occlusion mechanisms by depositing dentine-like minerals in dentinal tubules and by forming a protective layer on dentine surfaces.⁵

Clinical studies have demonstrated that toothpaste containing 8% arginine, calcium carbonate, and 1450 ppm fluoride, provides rapid and lasting reductions in dentin hypersensitivity and superior sensitivity relief to market-leading toothpaste containing 2% potassium ion. Clinical studies have also shown that an 8% arginine-calcium carbonate desensitizing prophylaxis paste provides in stantrelief when burnished directly on to as it that is sensitive, and that the sensitivity relief experienced following this single application is long-lasting.⁶

Another agent is vantej toothpaste which consists of calcium sodiumsulfate compound which has been recently launched. The mode of action of the material results from interactions

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with saliva. The active ingredient is a calcium sodium phosphate that reacts when exposed to aqueous media and provides calcium and phosphate ions that form a hydroxyl - carbonate apatite with time that is structurally and chemically similar to natural tooth mineral.⁷

An alternative approach to management of noncarious cervical lesions is composite resin restorations. According to Grippo, unrestored lesions promote further deterioration of the dental structure. It has been suggested that restoration of these lesions would reduce the concentration of tension in cervical exposed dentin and consequently halt the lesion progression. Bonding of materials to eroded substrate is achieved via the establishment of a hybrid layer.⁴Reliable bonding depends on the removal or modification of the smear layer and associated dentine plugs, increasing the surface energy of dentine and infiltration of resin adhesive into dentine tubules and between inter-fibrillar collagen spaces. The presence of dentine plug precipitates formed as result of prior toothpaste use, may resist the etching potential of phosphoric acid. This in turn may affect the strength of the bond between dentine and the overlying adhesive/ composite complex.¹

Hence the aim of the study is to compare the shear bond strength of composite bonded to dentine following treatment with Colgate sensitive plus and vantej toothpaste.

MATERIAL AND METHODS

Eighteen extracted single rooted mandibular premolars were selected for this study.. The occlusal surface of each tooth were ground flat using a water cooled airtor to create a flattened dentine surface in the occlusal third of the tooth, with care being taken not to expose pulpal anatomy. The specimens were returned to distilled water at 4°C for two weeks prior to the brushing regimen. The teeth will be randomly divided into three groups of 6 teeth each: 1) control group; 2) Colgate Sensitive Plus Group; 3) Vantej toothpaste. The control groups were brushed with flour pumice whilst the experimental groups were brushed with a pea sized amount of either the 8% arginine calcium carbonate toothpaste or the Vantej toothpaste for a total of 3 minutes four times a day for 7 days to simulate 14 days of toothpaste use twice daily. The specimens will be returned to distilled water storage for 1 day prior to the bonding procedure. The dentine surfaces were etched with 37% phosphoric acid etchant for 15 seconds and then thoroughly rinsed with distilled water and gently dried using compressed air to reveal frosty surfaces. The respective dentine-bonding agents were applied using microtips132wszx and gently thinned with compressed air and light cure for 10 seconds. A mold of internal diameter 6mm was stabilized in the middle of the dentine surface. A 2 mm increment of composite (Z250 Composite Shade A1, 3M ESPE, St Paul, MN, USA) was placed in the mold and light cured for 40 seconds by using a sweeping action around the mold. A universal material testing machine was used to determine shear bond strengths. The shear force was applied with a load cell of 500N to the interface at a crosshead speed of 0.5 mm/min until failure occurred.

Statistical Analysis

The obtained data was subjected to statistical analysis. Mean and Standard deviations were calculated for each group. One-way ANOVA and Post-Hoc tests were used.

RESULT

Mean shear bond strength ranged from 8.08 Mpa to 8.73MPa. The means and standard deviation are presented in table 1.

Table 1 mean shear bond strengths (Mpa)and standard deviations of composite bonded to dentine following treatment with pumice(control),colgate sensitive plus and vantej tooth paste.

The results of present	N	Mean	Std. Deviation
Control	6	8.083333	0.1940790
Colgate sensitive plus	6	8.185000	0.1447411
Vantej tooth paste	6	8.733333	0.1966384

The means of the shear bond strength are graphically represented in figure 1.

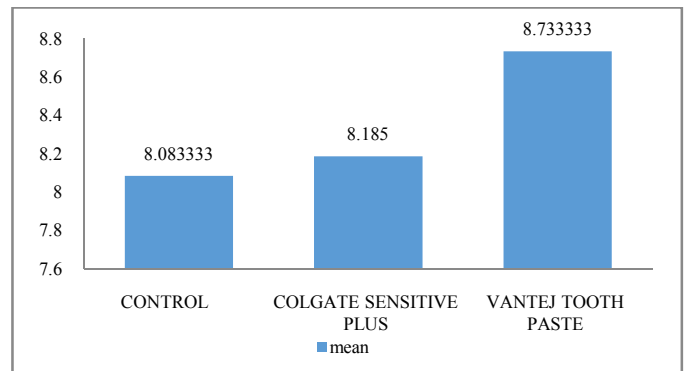


Figure 1 graphical representation of mean shear bond strength

Results showed that pretreatment with Colgate sensitive plus did not have any effect on shear bond strength of composite (p>0.05). Vantej toothpaste showed statistically significant difference (p<0.05) and showed increased bond strength.(table2)

Table 2 Post Hoc Tests Bonferroni

Variables	Mean Difference (I-J)	Sig.
control colgate sensitive plus	0.10167	1.00000
control vantej toothpaste	0.65	0.000046 <0.05
colgate sensitive plus vantej toothpaste	0.548333	0.00028 <0.05

DISCUSSION

The results of present study did not demonstrate that arginine - containing toothpaste had significant effect on the bond strength. This concurs with findings of canares *et al.*,who demonstrated that pre-treatment with desensitizing toothpaste containing 8% arginine had no effect on the bond strength.⁸ Anytoothpaste that forms precipitates on dentine surfaces could affect hybridization. It can be inferred that use of phosphoric acid in smear layer removal also resulted in the dissolution of any dentine precipitates formed as a result of toothpaste use.¹

A previous study using the 8.0% arginine and calcium carbonate desensitizing paste, reported no significant effect on the surfaces of the substrates tested (human enamel, gold, resin composite, amalgam, and porcelain). This study approves that the use of the paste is harmless to use as a polishing agent during dental prophylaxis. The use of the 8.0% arginine and calcium carbonate desensitizing paste may be favorable when performing prophylaxis previous to bonding procedures in

areas near dentin as it has been shown to produce desensitizing effects.¹¹

With respect to vantej toothpaste there was statistically significant difference demonstrating that bond strength increased after using the paste. According to the studies by Yang *et al.*, Ghani *et al.*, and Gupta *et al.*, increase in bond strength is because of the ability of bioactive glass to adhere with the living tissues. In aqueous environment of the tooth sodium ions from calcium sodium phosphosilicate particles rapidly exchange with hydrogen cations. This releases calcium and phosphate from the material. There is local rise of pH due to sodium ion release, this helps to release additional calcium and phosphate ions to create a precipitated calcium phosphate layer. This reaction continues and the layer crystallize into hydroxyapatite which chemically and structurally equivalent to naturally occurring biological apatite.^{5,7}

Arg-CaCO₃, Or Novamin Dissolved in residual water could reduce the liquid/vapour surface tension and increase the wettability of dentine surfaces, thereby creating a high energy surface and forming low contact angles, which are usually in favour of mechanical lock and adhesion. Furthermore, Collapsed collagen fibres (during polishing process) might be rehydrated and re-expanded by HEMA.⁹

The present study show that either desensitizing toothpaste that uses the mechanism of occlusion of open dentinal tubules in the preliminary management of tooth sensitivity does not have an adverse effect on future restorative treatment modalities.

CONCLUSION

Pretreatment with Vantej toothpaste increased the shear bond strength. However the shear bond strength was not significantly affected when pretreated with Colgate sensitive plus. Hence this desensitizing paste used for the treatment of eroded dentin would not affect restorations placed clinically.

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