Effect of Dentin Desensitizing Agents on Shear Bond Strength of Two Total-Etch Adhesive Systems

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ABSTRACT

Aim: it is to evaluate the effect of dentine desensitizing agents on shear bond strength of two totals-etch adhesive systems. Subjects and methods: Sixty human premolars free from caries or cracks were used in the study and randomly divided into six groups, group 1; Adper Single bond 2, group 2; Prime & Bond NT, Group 3; Adper Single Bond and Gluma desensitizing agent, group 4; Adper Single Bond 2 and Vivasens desensitizer, group 5; Prime & Bond NT and Gluma desensitizer, group 6; Prime & Bond and Vivasens, then Z250 XT nanohybrid composite resin was packed in the mould and cured, then shear bond strength was measured by INSRTON universal testing machine, One-way ANOVA and Turkey’s tests were used for statistical analysis (P value ≤ 0.05). Results: group 3 Adper single bond 2 and Gluma registered the highest mean shear bond strength value (12.806 ± 0.89), followed by group 1: Adper Single bond 2 registered (12.046 ± 0.84), group 2; Prime & Bond NT recorded (11.21 ±0.47), group 4, Adper Single bond 2 and Vivasens registered (11.1435 ± 0.54), group 5; Prime & Bond and Gluma registered (11.818 ± 0.56), and group 6, Prime & Bond and Vivasens recorded (11.0485 ± 0.54). Conclusion: Gluma improved shear bond strength with both tested total-etch adhesive systems.

INTRODUCTION

Composite resin restorations have been extensively used in both anterior and posterior restorations, in anterior teeth due its esthetic and mechanical properties and in posterior teeth because of its esthetic characteristics and improved mechanical properties it became an alternative to amalgam restorations in posterior teeth.

Bonding to enamel is depending on micromechanical retention between resin and inorganic structure of enamel, but bonding with dentine is comparatively difficult, that due to the complex structure of dentine and the lower content of inorganic structures than enamel and also presence of water in dentinal fluids. After acid etching of dentine and removal of the inorganic supporting structure leaving the collagen matrix easily shrinks and collapsed with air drying, so wet bonding...
technique was recommended to preserve the micro morphological integrity of collagen and many studies (2-3) supporting the wet bonding technique as it allowing penetration of resin to the matrix forming higher bond strength.

Post-operative sensitivity still forming complain to patients, so desensitizing agents appeared to decrease the post-operative sensitivity and rewetting the matrix after etching (4-6). The current study will evaluate the effect of desensitizing agents on shear bond strength of total etch bonding agents.

**Materials and Methods**

Sixty sound human premolars were collected during (2-3 weeks) for the current study. Patients average age was (35±5), the teeth were extracted periodontic and orthodontic reasons, and stored in distilled water till time of testing procedure.

Teeth were free from any caries or cracks, ultrasonic scaling to remove any debris and calculus. Teeth were randomly divided into 6 groups. Each tooth was embedded at cement-enamel junction in chemically cured acrylic resin block its dimension was 15 mm diameter and 20 mm height.

**Table (1): The used materials in the study**

<table>
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<th>Material</th>
<th>Type</th>
<th>Composition</th>
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| 1- Gluma | Desensitizing agent | • 36.1% HEMA (2-hydroxyl ethyl methacrylate).  
• 5.1% glutaraldehyde, water | Heraeus, Kulzer, Germany |
| 2-Vivasens | Desensitizing agent | • Ethanol, water, and hydroxypropyl cellulose with potassium fluoride, polyethylene glycol dimethacrylate. | Ivoclar Vivadent, Amherst, NY, USA |
| 3-Adper Single Bond 2 | 5th generation bonding agent | • BisGMA, HEMA, di-methacrylates, ethanol. Water, photoinitiator system methacrylate functional copolymers | 3M ESPE, Dental products, Paul, MN. USA |
| 4- Prime &Bond NT | 5th generation bonding agent | • PENTA (dipentaerythritol penta-acrylate monophosphorous acid ester  
• UDMA (urethane dimethacrylate  
• Butylated hydroxytoluene  
• 4-Ethyl dimethacrylate amino penzoate  
• Cetylamine hydroxyflouride  
• Silica nano filler  
• Camphorquinone  
• Solvent, Acetone. | Dentsply, Caulk USA |
| 5- Z250 XT | Nano-hybrid composite resin | Bis-GMA, UDMA, bis-EMA, PEGDMA, and TEGDMA resins, Nanohybrid | 3M ESPE, Dental products, Paul, MN. USA |
Horizontal sectioning by diamond disc (FIEFICO, Geneva city, Switzerland) with coolant below the dentinoenamel junction to expose dentine surface without any remnants of enamel on the occlusal surface of the specimens, the grouping of the specimens into six groups (n=10) as the following order, group 1; Adper Single bond (3M ESPE), 5th generation bonding agent as control group 1, group 2, Prime & Bond NT (Dentsply, Caulk, USA), 5th generation bonding agent control group 2. Group 3, Adper single bond and Gluma desensitizing agent (Heraeus, Kulzer, Germany), group 4, Prime & Bond and Vivasens desensitizing agent, group 5, Adper single bond and Vivasens, group 6, Prime & Bond and Vivasens.

Etching of dentine of all teeth for 15 seconds with 37% phosphoric acid Scotchbond etchant (3M ESPE), rinsing for 5 seconds and drying leaving dentin surface slightly wet, and in group 1, Adper Single Bond2 was placed by micro brush and cured for 20 seconds by LED curing unit (Woodpecker TM Freelight TM 2 St. Paul, MN, USA). in group 2, Prime and Bond NT was placed by microbrush and cured with LED curing unit (Woodpecker TM Freelight TM 2 St. Paul, MN, USA), in group 3 after etching and rinsing, dryness and Gluma applied to dentine surface by pumping motion using micro brush for 60 seconds, then Adper Single Bond application and curing for 20 seconds by LED curing unit, the same in group 4 with Vivasens desensitizing agent placed with by micro brush in pumping motion for 60 seconds, then Adper Single Bond2 placed by microbrush and cured for 20 seconds by LED curing unit.

In group 5, Gluma application by pumping motion for 60 seconds with microbrush for 60 seconds, then Prime & Bond NT is placed and curing for 20 seconds by LED curing unit, in group 6 similar to group 5 but using Prime & Bond NT and Vivasens desensitizing agent.

A plastic translucent tube was used as a mould (Henso Medical Co. Ltd. China) to pack composite resin inside it of dimension 4mm internal diameter and 2 mm height, Z250 XT nanohybrid composite was packed to fill the plastic mould and cured for 20 seconds by LED curing unit, then removal of plastic tube by scalpel No. 15, then measuring the shear bond strength by INSTRON universal testing machine (Limited, Birmingham city, England), Figure (1), the data is statistically analyzed by using One-way ANOVA test and Turkey’s Honest Difference (THD), (p ≤ 0.05).

Fig. (1) Specimen under INSTRON universal testing machine.

RESULTS

The mean value of shear bond strength revealed that Adper single bond registered the highest value when Gluma desensitizing agent added with slight difference than Adper single bond in control group without significant difference. In both control groups Adper Single Bond recorded significantly higher shear bond strength value than Prime & bond NT, Vivasens decreased mean value of shear bond strength in both Adper Single Bond and in Prime & Bond groups but with significant difference in Adper Single bond and without significant difference in Prime & Bond group. Gluma desensitizing agent could improve shear bond strength significantly with Prime & Bond NT groups, as shown in Table (2).
### DISCUSSION

Nowadays composite resin restorations are extensively used performing function and esthetic even in posterior teeth, total etch bonding procedures are very sensitive technique as after etching presence of over wetted dentin surface decreasing bond strength and dry bonding doesn’t permit sufficient penetration of resin to form hybrid layer, so desensitizing agents can added to rewet dentin surface after dryness and it decreases post-operative sensitivity\(^7\).

Many studies mentioned that bonding with dentin moist surface achieving higher shear bond strength, but the risk of over wetting is presence of excessive water which causing phases separation of hydrophilic and hydrophobic monomers components \(^3\) that leads to globule and blister formation at dentin-resin interface, so rewetting by desensitizing agent can improve shear bond strength as Gluma desensitizers improved shear bond strength of both Adper single bond and Prime & Bond NT that in agreement with Soares \(^8\), Ritter \(^9\-10\), and Banasal \(^11\). Vivasens gave slightly lower shear bond strength than control group that in agreement with Lehman and Degrange. HEMA in Gluma desensitizing agent improved adhesion between ester group and dentin collagen and decreased shrinkage of resin forming better shear bond strength and that explain Gluma positive effect in the current study.

The low effect of Vivadent on shear bond strength in this study in agreement with Lehmann\(^12\) it may due to blocking of dentinal orifices and inter-diffusion channels as it contains fluorides. It is clear that ethanol based bonding agents gave better results than acetone based because of acetone higher volatile property which reaching 200 mm Hg compared with only 54.1 mm Hg of ethanol\(^11\) and high concentration of acetone which reaching 70% so not permitting formation of a uniform film covering dentin surface.

### CONCLUSION

Ethanol based bonding systems give better shear bond strength, and Gluma can improve shear bond strength.

### REFERENCES


تأثير العوامل المانعة لتحسس العاج السني على قوة الرابط القصي لأثنين من أنظمة اللاصق كلى المعالجة

أحمد عمرو عبد الغني عبد العال

المؤلف: أحمد عمرو عبد الغني عبد العال

العنوان: تأثير العوامل المانعة لتحسس العاج السني على قوة الرابط القصي لأثنين من أنظمة اللاصق كلى المعالجة

النوات والأساليب: تم استخدام 60 سن ضاحك بشرى تقسيمهم إلى ست مجموعات عشرة أضراس بكل مجموعة وتم اختيار نوعين من الأنظمة كليتاً للعاج السني (أدبر سنجل بوند) و(فيفاسنس مانع تحسس العاج السني). وتم استخدام عشرين عناية لكل مجموعة من الأنظمة ولأثنين من أنظمة العناية (فيفاسنس مانع تحسس العاج السني) و(فيفاسنس مانع تحسس العاج السني) قبل نظام (أدبر سنجل بوند) و(فيفاسنس مانع تحسس العاج السني) قبل نظام (أدبر سنجل بوند)

النتائج: أظهرت النتائج أعلى قيمة ترابط قصي (12,8) ميجاباسكال للجروسو (آدبر سنجل بوند) و(فيفاسنس مانع تحسس العاج السني) و(فيفاسنس مانع تحسس العاج السني) قبل نظام (أدبر سنجل بوند) و(فيفاسنس مانع تحسس العاج السني) قبل نظام (أدبر سنجل بوند) و(فيفاسنس مانع تحسس العاج السني) قبل نظام (أدبر سنجل بوند) و(فيفاسنس مانع تحسس العاج السني) قبل نظام (أدبر سنجل بوند)

الخلاصة: إن مانعة التحسس حسنت قيمة الرابط القصي مع كل من أنظمة الأصدقاء للاصق كلي المعالجة

الكلمات المفتاحية: الرابط القصي، عاج السن، اللاصق الكلي، قوة اللاصق، حساسية العاج السنى