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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, group1; Adper Single bond 2, group 2; Prime & Bond NT, Group3; Adper Single Bond and Gluma desensitizing agent, group4,Adper Single Bond2 and Vivasens desensitizer, group5;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 Turhey's tests were used for statistical analysis (P value ≤ 0.05). **Results:** group 3 Adper single bond2 and Gluma registered the highest mean shear bond strength value **(**12.806 ± 0.89), followed by group 1: Adper Single bond2 registered (12.046 ± 0.84), group 2; Prime & Bond NT recorded (11.21 ±0.47), group 4, Adper Single bond2 and Gluma registered (11.1435 ± 0.54), group 5, Prime & Bond and Gluma registered (11.818 ± 0.56), and group 6, Primr & Bond and Vivasens recorded (11.0485 ± 0.54). **Conclusion:** Gluma improved shear bond strength with both tested total-etch adhesive systems.

KEYWORDS

Shear, Desensitizing Agents, Total Etch Adhesives, Dentine, Bond Strength.

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 [(1)] with air drying, so wet bonding

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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 scalling to remone 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*

Material	Type	Composition	Manufacturer
1- Gluma	Desensitizing agent	• 36.1% HEMA (2-hydroxyl ethyl methacrylate). • 5.1% glutraldehyde, 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	5thgeneration 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 singlebond and Vivasens, group 6, Prime & Bond and Vivasens .

Etching of dentine of all teeth for 15 seconds with 37 % phosphoric acid Scotchbond etchant (3 M 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 TMFreelightTM 2 St. Paul,MN, USA) . in group 2, Prime and Bond NT was placed by microbrush and cured with LED curing unit (Woodpecker TMFreelightTM 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), ($p \leq 0.05$).

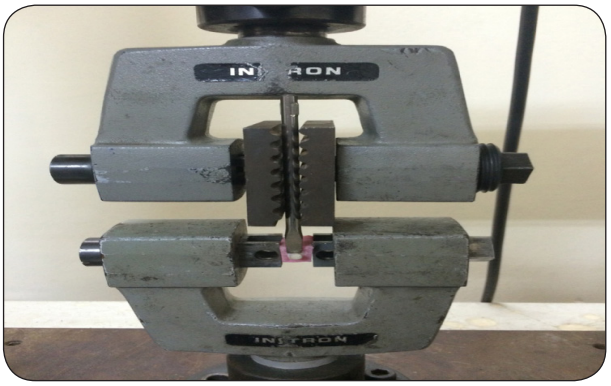

Fig. (1) Specimen under INSTRON universal testing machine.

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 signisicant 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).

Table (2): *The mean value of shear Bond strength (Mpa)*

	Control group	Gluma desensitizing agent	Vivasens desensitizing agent
Adper Single Bond	12.046[a] ±0.84	12.806[a] ±0.89	11.1435[b]±0.54
Prime & Bond NT	11.21[b]±0.47	11.818[a]±0.56	11.0485[b]±0.54

(P value ≤ 0.05)

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.

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تأثير العوامل المانعة لتحسس العاج السنى على قوة الرابط القصي لاثنين من أنظمة اللاصق كلى المعالجة

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الملخص:

الهدف : تهدف تلك الدراسة لتقييم تأثير العوامل المانعة لتحسس العاج السنى على قوة الرابط القصي لاثنين من أنظمة اللاصق كلى المعالجة .

المواد والاساليب: تم إستخدام 60 سن ضاحك بشرى وتقسيمهم إلى ست مجموعات عشرة أضراس بكل مجموعة وتم إختبار نوعين من الأنظمة كلية المعالجة (أدبر سنجل بوند), و (برايم وبوند ان تى). وكانت المجموعة الأولى والثانية فقط لأنظمة اللاصق بدون أي عوامل لمنع التحسس العاجي وكانت المجموعة الثالثة تشمل اضافة (جلوما مانع تحسس العاج السنى) قبل نظام (أدبر سنجل بوند). والمجموعة الرابعة تشمل إضافة(فيفاسنس مانع تحسس العاج) قبل نظام (أدبر سنجل بوند), بينما كانت المجموعة الخامسة تشمل إضافة (جلوما مانع تحسس العاج السنى) قبل(برايم وبوند ان تى), وكانت المجموعة السادسة تشمل اضافة (فيفاسنس مانع لتحسس العاج السنى قبل (برايم وبوند ان تى).

النتائج: أظهرت النتائج أعلى قيمة ترابط قصى (12,8) ميجاباسكال لمجموعة 3 (أدبـــر سنجل بوند وجلوما), بينما سجل (أدبرسنجل بوند) (12,04) ميجاباسكال للمجموعة 1, وسجل(برايم وبوند ان تى) (11,21) ميجاباسكال للمجموعة 2 بفرق جوهرى عن مجموعة 3,1, وتحسن بفارق ملحوظ قوة الرابط القصى عند اضافة (جلوما للبرايم وبوند ان تى) وسجل (11,818) ميجا باسكال, في حين سجل أقل قيمة مجموعة 6(فيفاسنس مع برايم وبوند ان تى) وسجل (11,04) ميجاباسكال.

الخلاصة: إن مانعة التحسس حسنت قيمة الرابط القصي مع كلا من النظامين المختبرين للاصق كلى المعالجة

الكلمات المفتاحية: الرابط القصي, عاج السنه , اللاصق الكلى, قوة اللاصق , تحسين العاج السنى