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**Institution**
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**Title**
Sealing properties of a self-etching primer system to normal caries-affected and caries-infected dentin.

**Source**

**Abstract**

**PURPOSE:** To compare the ability of an experimental antibacterial self-etching primer adhesive system to seal exposure sites in normal, caries-affected and caries-infected human dentin. **METHODS:** 30 extracted human third molars were used within 1 month of extraction. 10 intact normal teeth comprised the normal group. 20 teeth with occlusal caries that radiographically extended halfway to the pulp were excavated using caries-detector solution (CDS) and a #4 round carbide bur in a slow speed handpiece. Half of those teeth were fully excavated free of CDS-stained material without exposing the pulp, and were designated as the caries-affected dentin group. The remaining 10 teeth were excavated as close to the pulp as possible without obtaining an exposure, but whose dentin continued to stain red with CDS; this group was designated as the caries-infected dentin group. The remaining dentin thickness in all of the specimens in the other two groups was then reduced to the same extent as the caries-infected group. Direct exposures of the pulp chamber were made with a 1/4 round bur in the normal dentin or a 25 gauge needle in the other two groups. After measuring the fluid flow through the exposure, the sites were then sealed with an experimental antibacterial fluoride-containing self-etching primer adhesive systems (ABF). Fluid conductance was remeasured every week for 16 weeks. **RESULTS:** The fluid conductance through the exposure fell 99% in all groups following resin sealing. The seals of normal and caries-affected dentin remained relatively stable over the 16 weeks, while the seals of caries-infected dentin gradually deteriorated, reaching significance at 8 weeks. TEM examination revealed very thin (ca. 0.5 mm) hybrid layers in normal dentin, 3-4 microm thick hybrid layers in caries-affected dentin and 40 microm thick hybrid layers in caries-infected dentin. The tubules of caries-infected dentin were enlarged and filled with bacteria. Resin tags passed around these bacteria in the top 20-40 microm thereby encapsulating them in resin.
Authors
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Title
Ultra-morphology of self-etching adhesives on ground enamel: a high resolution SEM study.

Source

Abstract
PURPOSE: To evaluate the effect of different commercial self-etching agents on enamel morphology using high-resolution in-lens scanning electron microscopy (FEISEM). METHODS: The bonding systems selected for the study were: Prime & Bond NT (no-etch technique), Prime & Bond 2.1 (no-etch technique), NRC/Prime and Bond NT, Syntac Single Component, Prompt L-Pop, F2000, and Clearfil SE Bond. The positive control group was prepared with Single Bond upon etching enamel with the proprietary 35% phosphoric acid gel. 24 extracted human molars were equally and randomly assigned to the experimental and control groups. All bonding materials were applied on enamel following the manufacturers' instructions. A thin layer of composite was applied on the polymerized adhesive agent, after which the enamel was dissolved to obtain replicas that were observed under a FEISEM. RESULTS: Observations revealed different morphological features brought about by the adhesive systems. A relationship between the morphological appearance and the pH of the adhesive solutions was found. Three different groups of self etching were identified: Group 1 showed no or little evidence of modifications on the enamel surface (Prime & Bond NT and Prime & Bond 2.1, no-etch technique), Group 2 revealed major aggressive properties that were able to disclose the prism morphology (Syntac Single Component, F2000, Clearfil SE Bond), and Group 3 (NRC/Prime & Bond NT and Prompt L-Pop) revealed morphological features similar to those obtained with Single Bond after etching with phosphoric acid (control group).


This study tested the null hypothesis that there no difference between two-step and one-step self-etch adhesives in their compatibility with these composites. The microtensile bond strengths (microTBS) of two two-step systems (Clearfil SE Bond, Kuraray and Tyrian SPE/One-Step Plus, BISCO) were compared with two one-step systems (Xeno III, Dentsply DeTrey and Brush&Bond, Parkell) for their coupling to a dual-cured composite. Silver tracer penetration of the four adhesives bonded to a light-cured or a chemical-cured composite was examined using TEM.

Significant differences in microTBSs between composite curing modes were seen only in the one-step adhesives. For one-step self-etch adhesives bonded to the chemical-cured composite, TEM revealed signs of frank composite uncoupling along the adhesive-composite interface, which may be attributed to the adverse chemical interaction between the acidic adhesive and the composite. In addition, "water trees" that represent channels of increased permeability with the polymerized adhesive layer were also observed in the one-step adhesives. Both features were absent along the resin-dentin interfaces when chemical-cured composites were coupled to the two-step self-etch adhesives.
Title
The influence of the dentin smear layer on adhesion: a self-etching primer vs. a total-etch system.

Source

Abstract
OBJECTIVE: To determine the effect of dentin smear layers created by various abrasives on the adhesion of a self-etching primer (SE) and total-etch (SB) bonding systems. METHODS: Polished human dentin disks were further abraded with 0.05 micro m alumina slurry, 240-, 320- or 600-grit abrasive papers, # 245 carbide, # 250.9 F diamond or # 250.9 C diamond burs. Shear bond strength (SBS) was evaluated by single-plane lap shear, after bonding with SE or SB and with a restorative composite. Smear layers were characterized by thickness, using SEM; surface roughness using AFM; and reaction to the conditioners, based on the percentage of open tubules, using SEM. RESULTS: Overall, SBS was lower when SB was used than when SE was used. SBS decreased with increasing coarseness of the abrasive in the SE group. Among burs, the carbide group had the highest SBS, and 320- and 240-grit papers had SBS close to the carbide group. Surface roughness and smear layer thickness varied strongly with coarseness. After conditioning with SE primer, the tubule openness of specimens abraded by carbide bur did not differ from 240- or 320-grit paper, but did differ from the 600-grit. SIGNIFICANCE: Even though affected by different surface preparation methods, SE yielded higher SBS than SB. The higher SBS and thin smear layer of the carbide bur group, suggests its use when self-etching materials are used in vivo. Overall, the 320-grit abrasive paper surface finish yielded results closer to that of the carbide bur and its use is recommended in vitro as a clinical simulator when using the SE material.

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Title
Clinical evaluation of an 'all-in-one' bonding system to non-carious cervical lesions--results at one year.

Source

Abstract
BACKGROUND: The recent trend in using dentine adhesives is to simplify the number of steps required for bonding. The simplest are now the so-called 'all-in-one' products which combine the etching, priming and bonding steps into a single application. However, few clinical trials have been reported using this type of material. The current study reports the one-year results of a clinical trial with One-Up Bond F and Palfique Estilite resin composite. METHODS: Fifty-one non-undercut non-carious cervical lesions were restored with One-Up Bond F and Palfique Estilite in 15 patients (mean age 57.5 years). Restorations were evaluated at six months and one year for presence or absence and for marginal staining using standardized colour photographs for comparison. RESULTS: At one year, 42 restorations could be evaluated and all were intact. Slight marginal staining was observed around three restorations but was considered to be of no clinical significance. CONCLUSIONS: One-Up Bond F with Palfique Estelite shows good promise for the restoration of non-carious cervical lesions.

Authors
Turkun SL.
Title
Clinical evaluation of a self-etching and a one-bottle adhesive system at two years.

Source

Abstract
OBJECTIVES: The clinical performances of a self-etching adhesive system, Clearfil SE Bond, and a one-bottle adhesive system, Prime&Bond NT, were evaluated in non-curious Class V restorations for a period of two years.

METHODS: Ninety-eight restorations were made by one operator for 32 patients. The resin composite used to restore the teeth were Clearfil AP-X and Spectrum TPH for Clearfil SE Bond and Prime&Bond NT, respectively. Two clinicians at the baseline, 6th, 12th and 24th months evaluated the posterior composites according to the modified Ryge criteria’s. For this, color match, marginal discoloration, marginal adaptation, recurrent caries, anatomic form, postoperative sensitivity and retention rates were considered. The changes across time and across groups were evaluated statistically. RESULTS: At two years, 88 restorations were reviewed in 28 patients. The retention rates for Clearfil SE Bond were 93 and 91% for Prime&Bond NT. The percentages of the retention rates of both adhesive systems were not found to be different when calculating the failure rates. Recurrent caries, anatomic form and postoperative sensitivity were scored as Alpha for all restorations. Two cases of both adhesive systems showed slight marginal discoloration problems. Three restorations of Prime&Bond NT and one of Clearfil SE Bond had marginal adaptation problems at two years. One case for each adhesive system had slight color change after the same period. CONCLUSION: We can conclude that both adhesive systems tested exhibited very good clinical performance at the end of two years.

Authors
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Institution
Title
An ex vivo assessment of a bonding technique using a self-etching primer.

Source

Abstract

OBJECTIVE: This study assessed a new self-etch/priming system for use in orthodontic bonding. SETTING: An ex vivo study. METHOD: Three groups of 20 extracted premolar teeth were bonded with metal orthodontic brackets. Group 1 was bonded with Transbond using the conventional technique (control). Group 2 was bonded using the new Transbond-Plus combined etch/primer system to wet enamel and Group 3 to dry enamel. The teeth were debonded using an Instron Universal Testing Machine. The mean debond force was calculated for each group and compared statistically. The teeth were examined under the stereomicroscope to assess the site of debond and adhesive remnant index.

RESULTS: Group 2 (etch/primer on wet enamel) had the lowest mean debond value at 5.2 MPa. ANOVA and Tukey tests confirmed that the bond strength results of Group 2 were significantly lower than Groups 1 (P < 0.01) and 3 (P < 0.05). The enamel/resin interface was the commonest site of bond failure for both etch/primer groups (Groups 2 and 3). They had less retained resin and significantly (P < 0.001) lower ARI scores compared with Group 1 (control).

CONCLUSIONS: The results of this ex vivo study suggest that the self-etch primer should achieve adequate bond strengths when applied to dry enamel surfaces. In addition there should be less retained resin requiring removal at debond.
Title
Influence of load cycling on marginal microleakage with two self-etching and two one-bottle dentin adhesive systems in dentin.

Source

Abstract
PURPOSE: To evaluate the influence of occlusal load cycling on cervical microleakage of proximal slot restorations located in dentin, using two self-etching and two one-bottle dentin adhesive systems. MATERIALS AND METHODS: 240 proximal slot cavities were prepared in 120 bovine teeth and divided into two groups, one with load cycling and one without. The groups were then subdivided into four subgroups according to the adhesive system used (Experimental EXL 547 Self-etching 3M, Clearfil SE Bond, Single Bond, and Optibond Solo Plus) and restored following the manufacturers' instructions. The teeth were then submitted to mechanical load cycling with a force of 80 N and a frequency of 5 Hz, simultaneously over both restorations of each tooth, for a total of 50,000 cycles per specimen. All specimens were subsequently immersed in a 2% methylene blue solution (pH 7.0), and sectioned to examine the extent of dye penetration under a stereomicroscope (40X). RESULTS: There was no statistically significant difference (p = 0.00002) between the loaded and unloaded teeth. However, a statistically significant difference was observed between the adhesive systems used. The experimental self-etching EXL 547 presented the lowest mean microleakage, but was only statistically significantly different from the Single Bond loaded and unloaded groups and the Clearfil SE Bond unloaded group. CONCLUSION: The application of 50,000 loading cycles did not affect the microleakage of the two self-etching and the two one-bottle adhesive systems evaluated. In vitro mechanical load cycling is an important factor to consider when evaluating the performance of adhesive systems under simulated masticatory conditions.
OBJECTIVES: To evaluate the microtensile bond strength of total-etch or self-etch adhesives to caries-affected versus normal dentine, and to correlate these bond strengths with DIAGNOdent laser fluorescence and Knoop microhardness (KH) measurements of the substrates. METHODS: Extracted carious human molars were ground to expose flat surfaces where the caries lesion was surrounded by normal dentine. Surfaces were bonded with either Prime & Bond NT, Scotchbond 1, Clearfil SE Bond or Prompt L-Pop, according to manufacturers’ recommendations. A crown was built up using resin composite (Tetric Ceram). After storage in water (37 degrees C, 24 h), teeth were vertically serially sectioned into 0.7 mm thick slabs and trimmed to yield 1 mm(2) test area that contained either caries-affected or normal dentine. Samples were tested in tension in an Instron machine at 1 mm/min. The quality of the dentine just beneath each fractured specimen was measured by laser fluorescence and KH.

RESULTS: Total-etch adhesives yielded higher bond strengths than self-etching systems. Significantly lower results were obtained with Prompt L-Pop. All the adhesives attained higher strengths in normal than in caries-affected dentine, but the differences were only significant for Prime & Bond NT and Clearfil SE Bond. Higher laser fluorescence values and lower KH (p<0.001) were recorded in caries-affected dentine compared to normal dentine. CONCLUSIONS: The total-etch adhesives evaluated produced higher bond strengths to normal and caries-affected dentine than self-etching systems. Laser fluorescence measurements discriminated caries-affected dentine from normal dentine, and were strongly correlated with KH. However, laser fluorescence and KH did not permit high correlations with resin-dentine bond strengths in caries-affected dentine.
Title
Clinical trial of a self-etching adhesive for sealant application: success at 24 months with Prompt L-Pop.

Source

Abstract
PURPOSE: To evaluate the 2-year clinical sealant success when using Prompt L-Pop (3M-ESPE), the first self-etching adhesive, as the sole etching and adhesive step prior to sealant placement. METHODS: Patients ages 7-13 years with matched pairs of permanent molars needing sealants were enrolled into an ongoing clinical study of sealant success. First and/or second permanent molars were randomly assigned to control (sealant only after phosphoric acid etch) or Prompt plus sealant groups in a split-mouth, matched pair study design. Standard methods were used for sealant (Delton, Dentsply) placement, except for the Prompt group in which the self-etching adhesive was brushed on the surface, air thinned, followed by immediate placement of the sealant and polymerization. All sealants were placed using appropriate cotton-roll isolation and a dental assistant. Sealant scoring was done at 24 months using strict clinical criteria for failure, previously published, and photos of the sealed surfaces were archived on video. RESULTS: Percentages of sealants scored as successful (no significant loss of material or need for repair) through 24 months were: (a) Occlusal sealants: Control = 61%, versus Prompt = 61%; (b) Bu/Lingual sealants: Control = 54%, versus Prompt = 62%; McNemar's Chi Square tests indicate no difference in success between the Prompt sealants and their matched controls (P > 0.80). Time of placement for sealants, timed from start of the etch step through polymerization, averaged 3.1 minutes for Control and 1.8 minutes for Prompt. We conclude that Prompt L-Pop self-etching adhesive is effective in bonding sealant to enamel and that the simplified method dramatically shortens treatment time and treatment complexity.
Factors affecting in vitro bond strength of bonding agents to human dentin.

[Review] [23 refs]

Odontology/The Society of the Nippon Dental University. 91(1):1-6, 2003 Sep.

Four generations of total-etch (fourth, fifth) and self-etching (sixth, seventh) bonding agents for use with resin composites are commercially available in the United States. Innovations in bonding agents include: filled systems, release of fluoride and other agents, unit dose, self-cured catalyst, option of etching with either phosphoric acid or self-etching primer, and pH indicators. Factors that can affect in vitro bond strength to human dentin include substrate (superficial dentin, deep dentin; permanent versus primary teeth; artificial carious dentin), phosphoric acid versus acidic primers, preparation by air abrasion and laser, moisture, contaminants, desensitizing agents, astringents, and self-cured restorative materials. This article reviews studies conducted at the Houston Biomaterials Research Center from 1993 to 2003. Results show that in vitro bond strengths can be reduced by more than 50% when bonding conditions are not ideal.

[References: 23]
Hashimoto M, Ohno H, Yoshida E, Hori M, Sano H, Kaga M, Oguchi H.

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Title
Resin-enamel bonds made with self-etching primers on ground enamel.

Source

Abstract
Self-etching primer adhesives have recently been introduced to simplify bonding. However, the fundamental bonding mechanism of self-etching primers to enamel is not yet fully understood. This study aimed to investigate resin-enamel bonds of self-etching primer adhesives on ground enamel. Two self-etching primer adhesives (Clearfil Liner Bond 2 V and Clearfil SE Bond) were used in this study. A total-etch adhesive (One-Step) was used as a control. Resin-enamel beams were subjected to the microtensile bond test. Subsequently, the failure modes of all specimens were quantified using image analysis. Undemineralized and demineralized ultrathin sections of the resin-enamel bonded specimens were examined using transmission electron microscopy. The bond strengths of Clearfil SE Bond (39.8 +/- 11.9 MPa) and One-Step (46.2 +/- 12.7 MPa) were significantly greater than that of Clearfil Liner Bond 2V (30.4 +/- 6.2 MPa). Scanning electron microscopy of the fractured surfaces revealed the failure direction and weakest portion within each bond. Transmission electron microscopy showed a thin hybridized complex of resin in enamel produced by the self-etching primers without the usual micrometer-sized resin tags seen in resin-enamel bonds produced using the total-etch adhesive. The morphological features of the resin-enamel bonds produced by two self-etching primers tested were different from that created with the total-etch adhesive.

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Title
Immediate and 24-hour bond strengths of two dental adhesive systems to three tooth substrates. [Review] [17 refs]

Source

Abstract
Bond strengths of bonded composite resins to tooth substrates vary depending on when they were measured. Most bond strengths reported in the literature are a result of one hour, 24-hour, or longer periods of time that do not simulate actual clinical practice when occlusal adjustment and finishing and polishing procedures are performed within seconds after restoration placement. There are many different ways to measure the bond strength of direct esthetic restorations to various dental substrates. This research uses a method published previously that compares immediate and 24-hour bond strengths of a single-bottle dental adhesive and a self-etching primer adhesive to prepared enamel, unprepared enamel, and prepared dentin substrates. Significant differences were found between immediate and 24-hour bond strengths, but there were essentially no differences between substrates or adhesives. [References: 17]

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Title
Bond strengths of Dyract AP compomer material to dentin of permanent and primary molars: phosphoric acid versus non-rinse conditioner.

Source

Abstract
PURPOSE: The purpose of this in vitro study was to determine the shear bond strengths (SBS) of Non-Rinse Conditioner (NRC, Dentsply) combined with Prime & Bond NT (PBNT, Dentsply), a 1-bottle adhesive. The null hypothesis tested was that the use of NRC with PBNT would not result in SBS different from those obtained with conventional phosphoric acid (PA) etching and bonding application to permanent and primary dentin. METHODS: Extracted human third molars and primary molars were mounted length-wise in acrylic resin. The occlusal surfaces were ground to expose a flat dentin surface, and then polished to 600 grit silicon carbide paper to create smear layers similar to those created with high-speed burs. The teeth were randomly assigned to 4 groups (N = 10) according to the etchant/conditioner (PA vs NRC) and dentin (permanent vs primary) used: (Group I: permanent dentin, PA, PBNT; Group II: primary dentin, PA, PBNT; Group III: permanent dentin, NRC, PBNT; Group IV: primary dentin, NRC, PBNT). Specimens were then secured in a split mold, having a 5 mm diameter opening and a polyacid-modified resin composite (Dyract AP, Dentsply) were inserted and light cured incrementally onto the treated dentin surfaces. All specimens were stored in water for 24 hours prior to shear strength testing using a Franell testing machine at a crosshead speed of 0.8 mm/minute.

RESULTS: The mean dentin SBS values (MPa) for the groups were: Group I (13.32 +/- 6.6); Group II (15.21 +/- 5.25); Group III (8.87 +/- 3.12); and Group IV (7.42 +/- 2.98). Analysis of variance and Duncan's multiple range tests indicated significant differences among groups at P < 0.05. CONCLUSIONS: In general, the SBS were remarkably greater in the 2 groups etched with PA in comparison with the 2 groups conditioned with NRC. However, the type of dentin tissue did not influence SBS.
Authors
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Institution
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Title
Microtensile bond strength of total-etch and self-etching adhesives to caries-affected dentine.

Source

Abstract
OBJECTIVES: To evaluate the microtensile bond strength of total-etch or self-etch adhesives to caries-affected versus normal dentine, and to correlate these bond strengths with DIAGNOdent laser fluorescence and Knoop microhardness (KH) measurements of the substrates. METHODS: Extracted carious human molars were ground to expose flat surfaces where the caries lesion was surrounded by normal dentine. Surfaces were bonded with either Prime & Bond NT, Scotchbond 1, Clearfil SE Bond or Prompt L-Pop, according to manufacturers' recommendations. A crown was built up using resin composite (Tetric Ceram). After storage in water (37 degrees C, 24 h), teeth were vertically serially sectioned into 0.7 mm thick slabs and trimmed to yield 1 mm(2) test area that contained either caries-affected or normal dentine. Samples were tested in tension in an Instron machine at 1 mm/min. The quality of the dentine just beneath each fractured specimen was measured by laser fluorescence and KH. RESULTS: Total-etch adhesives yielded higher bond strengths than self-etching systems. Significantly lower results were obtained with Prompt L-Pop. All the adhesives attained higher strengths in normal than in caries-affected dentine, but the differences were only significant for Prime & Bond NT and Clearfil SE Bond. Higher laser fluorescence values and lower KH (p<0.001) were recorded in caries-affected dentine compared to normal dentine. CONCLUSIONS: The total-etch adhesives evaluated produced higher bond strengths to normal and caries-affected dentine than self-etching systems. Laser fluorescence measurements discriminated caries-affected dentine from normal dentine, and were strongly correlated with KH. However, laser fluorescence and KH did not permit high correlations with resin-dentine bond strengths in caries-affected dentine.

Citation
2.

Link to...

Unique Identifier
11699738

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Title
Influence of self-etching primer on the resin adhesion to enamel and dentin.

Source

Abstract

**PURPOSE:** To evaluate the shear bond strength of resin-based composite to dentin and enamel using three adhesive systems, two of them containing self-etchant primers. Wettability (contact angle measurements) of the primers of these three adhesive systems was also evaluated on superficial and deep dentin.

**MATERIAL AND METHODS:** Contact angle measurements were performed on 30 caries-free extracted human third molars; specimens were sectioned parallel to the occlusal surface to expose superficial and deep dentin. Dentin was ground flat (600-grit SiC) under water to provide uniform surfaces. Contact angle measurements were performed to assess wettability using the Axisymmetric Drop Shape Analysis technique. In order to test the enamel bond strength, 30 extracted bovine incisors were embedded in acrylic resin and ground flat to 800-grit. The adhesives and composite resins were applied following the manufacturers' instructions. All the specimens were stored in water for 24 hrs at 37 degrees C and thermocycled (500x). Shear bond strengths were determined using a universal testing machine and the Watanabe device. For dentin bond strength testing, superficial and deep dentin was exposed in 60 third molars, by sectioning the occlusal surface immediately under the enamel-dentin junction or close to the pulp chamber. After grinding (500 grit SiC), the dentin surfaces were assigned to three groups: (1) Clearfil SE Bond (CSEB)/Clearfil AP-X resin composite. (2) Etch & Prime (E&P)/Degufill mineral resin composite. (3) Scotchbond Multi-Purpose Plus (SBMP)/Z100 resin composite. **RESULTS:** One-way ANOVA and Student-Newman-Keuls multiple comparisons tests showed that no differences were found between contact angles on superficial and deep dentin. CSEB and E&P, without significant differences between them, had greater mean contact angle than SBMP. On enamel, Etch & Prime resulted in the lowest bond strength, but no significant differences existed with Scotchbond Multi-Purpose were found. On dentin, Clearfil SE Bond resulted in the significantly highest bond strength; no significant differences exist between Etch & Prime and Scotchbond Multi-Purpose.
PURPOSE: To compare the ability of an experimental antibacterial self-etching primer adhesive system to seal exposure sites in normal, caries-affected and caries-infected human dentin. METHODS: 30 extracted human third molars were used within 1 month of extraction. 10 intact normal teeth comprised the normal group. 20 teeth with occlusal caries that radiographically extended halfway to the pulp were excavated using caries-detector solution (CDS) and a #4 round carbide bur in a slow-speed handpiece. Half of those teeth were fully excavated free of CDS-stained material without exposing the pulp, and were designated as the caries-affected dentin group. The remaining 10 teeth were excavated as close to the pulp as possible without obtaining an exposure, but whose dentin continued to stain red with CDS; this group was designated as the caries-infected dentin group. The remaining dentin thickness in all of the specimens in the other two groups was then reduced to the same extent as the caries-infected group. Direct exposures of the pulp chamber were made with a 1/4 round bur in the normal dentin or a 25 gauge needle in the other two groups. After measuring the fluid flow through the exposure, the sites were then sealed with an experimental antibacterial fluoride-containing self-etching primer adhesive systems (ABF). Fluid conductance was remeasured every week for 16 weeks. RESULTS: The fluid conductance through the exposure fell 99% in all groups following resin sealing. The seals of normal and caries-affected dentin remained relatively stable over the 16 weeks, while the seals of caries-infected dentin gradually deteriorated, reaching significance at 8 weeks. TEM examination revealed very thin (ca. 0.5 mm) hybrid layers in normal dentin, 3-4 microm thick hybrid layers in caries-affected dentin and 40 microm thick hybrid layers in caries-infected dentin. The tubules of caries-infected dentin were enlarged and filled with bacteria. Resin tags passed around these bacteria in the top 20-40 microm thereby encapsulating them in resin.
Unique Identifier
14653290

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Title

Source

Abstract
This study tested the null hypothesis that there no difference between two-step and one-step self-etch adhesives in their compatibility with these composites. The microtensile bond strengths (microTBS) of two two-step systems (Clearfil SE Bond, Kuraray and Tyrian SPE/One-Step Plus, BISCO) were compared with two one-step systems (Xeno III, Dentsply DeTrey and Brush&Bond, Parkell) for their coupling to a dual-cured composite. Silver tracer penetration of the four adhesives bonded to a light-cured or a chemical-cured composite was examined using TEM. Significant differences in microTBSs between composite curing modes were seen only in the one-step adhesives. For one-step self-etch adhesives bonded to the chemical-cured composite, TEM revealed signs of frank composite uncoupling along the adhesive-composite interface, which may be attributed to the adverse chemical interaction between the acidic adhesive and the composite. In addition, "water trees" that represent channels of increased permeability with the polymerized adhesive layer were also observed in the one-step adhesives. Both features were absent along the resin-dentin interfaces when chemical-cured composites were coupled to the two-step self-etch adhesives.

Citation
3.

Unique Identifier
12147747

Authors
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Title
Bonding of self-etch and total-etch adhesives to carious dentin.
Carious dentin is partially demineralized and contains mineral crystals in the tubules. This may permit the deeper etching of intertubular dentin but prevent resin tag formation during bonding. We hypothesize that resin adhesives will produce lower bond strengths to caries-infected and caries-affected dentin compared with normal dentin. We tested this by measuring the microtensile bond strength of a total-etch adhesive and an experimental self-etching adhesive (ABF) to caries-infected, caries-affected, and sound dentin and by correlating those results with ultrastructural observations. The bond strengths of both adhesives to sound dentin were significantly (p < 0.05) higher than those to caries-affected dentin, which, in turn were significantly (p < 0.05) higher than those to caries-infected dentin. For both adhesives, hybrid layers in caries-affected dentin were thicker but more porous than those in sound dentin. The lower bond strengths may be due to the lower tensile strength of caries-affected dentin. Clinically, this may not be a problem, since such lesions are normally surrounded by normal dentin or enamel.

OBJECTIVES: The aggressiveness of three self-etching adhesives on unground enamel was investigated. Ultrastructural features and microtensile bond strength were examined, first using these adhesives as both the etching and resin-infiltration components, and then examining their etching efficacy alone through substitution of the proprietary resins with the same control resins. METHODS: For SEM examination, buccal, mid-coronal, unground enamel from human extracted bicuspids were etched with either Clearfil Mega Bond (Kuraray), Non-
Rinse Conditioner (NRC; Dentsply DeTrey) or Prompt L-Pop (ESPE). Those in the control group were etched with 32% phosphoric acid (Bisco) for 15s. They were all rinsed off prior to examination of the etching efficacy. For TEM examination, the self-etching adhesives were used as recommended. Unground enamel treated with NRC were further bonded using Prime&Bond NT (Dentsply), while those in the etched, control group were bonded using All-Bond 2 (Bisco). Completely demineralized, resin replicas were embedded in epoxy resin for examination of the extent of resin infiltration. For microtensile bond strength evaluation, specimens were first etched and bonded using the self-etching adhesives. A second group of specimens were etched with the self-etching adhesives, rinsed but bonded using a control adhesive. Following restoration with Z100 (3M Dental Products), they were sectioned into beams of uniform cross-sectional areas and stressed to failure. RESULTS: Etching patterns of aprismatic enamel, as revealed by SEM, and the subsurface hybrid layer morphology, as revealed by TEM, varied according to the aggressiveness of the self-etching adhesives. Clearfil Mega Bond exhibited the mildest etching patterns, while Prompt L-Pop produced an etching effect that approached that of the total-etch control group. Microtensile bond strength of the three experimental groups were all significantly lower than the control group, but not different from one another. When the self-etching adhesives were replaced with the control adhesive after etching, bond strengths of NRC/Prime&Bond NT and Prompt L-Pop were not significantly different from that of the control group, but were significantly higher than that of Clearfil Mega Bond. SIGNIFICANCE: Both etching efficacy and strength of the resins are important contributing factors in bonding of self-etching adhesives to unground enamel.
OBJECTIVE: This study examined, with the use of transmission electron microscopy (TEM), the aggressiveness of three self-etching adhesive systems in penetrating dentin smear layers of different thickness. METHODS: Dentin disks were produced from extracted human third molars. For the control group, the middle dentin surface was cryo-fractured to create a bonding surface that was devoid of a smear layer. The experimental teeth were polished with wet 600 or 60-grit SiC paper to produce bonding surfaces with thin and thick smear layers. They were bonded using one of the three self-etching systems: Clearfil Mega Bond (Kuraray), Non-Rinse Conditioner and Prime&Bond NT (Dentsply DeTrey) and Prompt L-Pop (ESPE). Bonded specimens were then demineralized and embedded in epoxy resin for TEM examination. RESULTS: For Mega Bond, thin authentic hybrid layers between 0.4-0.5 microm were found. Smear layer and smear plugs were retained as part of the hybridized complex. For Non-Rinse Conditioner/Prime&Bond NT, the authentic hybrid layers were between 1.2-2.2 microm thick. Smear layer and smear plugs were completely dissolved in dentin with thin smear layers, but were partially retained as part of the hybridized complex in those with thick smear layers. For Prompt L-Pop, authentic hybrid layers were 2.5-5 microm thick and smear layer and smear plugs were completely dissolved even in dentin with thick smear layers. SIGNIFICANCE: Contemporary self-etching systems may be classified as mild, moderate and aggressive based on their ability to penetrate dentin smear layers and their depth of demineralization into the subsurface dentin. The more aggressive system completely solubilized the smear layer and smear plugs and formed hybrid layers with a thickness approaching those of phosphoric acid conditioned dentin.
PURPOSE: The objectives of this study were 1) to examine the ultrastructural features of the resin-sclerotic dentin interface following the application of Clearfil Liner Bond II sigma to natural cervical wedge-shaped lesions, and 2) to evaluate the regional tensile bond strength of this self-etching primer at different locations on natural and artificially-created cervical lesions. MATERIALS AND METHODS: Deep cervical natural lesions were bonded using the self-etching primer. Micromorphology of the bonded interface at different locations within the lesions were examined using scanning electron microscopy (SEM), transmission electron microscopy (TEM) and scanning transmission electron microscopy/energy dispersive x-ray analysis (STEM/EDX). Ultrastructural features were further compared with the use of the same self-etching primer on artificial lesions created in sound cervical dentin. A nontrimming technique was used to evaluate the regional tensile bond strength from the occlusal, gingival, and the deepest central part of both natural and artificial cervical lesions. Beams with a mean area of 0.46 +/- 0.03 mm² were prepared and were pulled to failure using a Bencor Multi-T testing device attached to an Instron universal tester. Bond strength results were evaluated using a two-way ANOVA design. RESULTS: A hypermineralized layer devoid of intact, banded collagen was invariably present on the surface of the natural lesions. Depending upon its thickness at different locations of the lesion, the action of a self-etching primer may be limited to this surface layer alone, producing a hybridized hypermineralized surface layer. Penetration of the self-etching primer into the underlying sclerotic dentin produced a hybridized complex containing a hybridized hypermineralized surface layer as well as a subsurface layer of hybridized intertubular dentin. Bacterial colonization of the lesion surface resulted in the formation of an additional zone of hybridized intermicrobial matrix over the surface of the lesions. Dentinal tubules remained blocked with sclerotic casts, and resin tags were rarely observed. Regional tensile bond strength results showed that the overall bond strength to natural sclerotic dentin was about 20% lower than sound cervical dentin, but was independent of the different locations within the lesions from which bond strength was evaluated. CONCLUSION: There were four factors that may have influenced the overall decrease in bond strength in natural cervical sclerotic lesions: a) the presence of a hybridized intermicrobial matrix together with entrapped bacteria may have weakened the bonds, b) inability of a self-etching primer to etch through a thick, hypermineralized surface layer, c) presence of a layer of possibly remineralized, denatured collagen at the base of the hypermineralized surface layer, and d) retention of acid-resistant sclerotic casts that obliterate the tubular lumina and prevent effective resin tag formation.
Abstract

PURPOSE: The objective of this work was to evaluate the effect of the absence and presence of smear layers on bonds made to dentin using a self-etching primer system, Clearfil SE Bond. MATERIALS AND METHODS: Dentin surfaces with different smear layer thickness were created from mid-coronal sound dentin in extracted, human third molars. The control group was cryofractured to create a bonding surface that was devoid of a smear layer. The experimental teeth were ground with wet 60-, 180- or 600-grit SiC paper. They were bonded using SE Bond, followed by resin composite buildups. After 1 day, bonded specimens were sectioned into multiple 1- x 1-mm beams. Microtensile bond strengths were determined and the results analyzed with ANOVA and the Student Neuman Keuls test. Fractographic study of cross sections of failed interfaces from the dentin side of representative beams was performed using both SEM and TEM. RESULTS: SE Bond produced high bond strengths (ca 50 MPa) to both smear layer-free and smear layer-covered dentin. SEM examination was inadequate to define the exact nature of interfacial failures. TEM observations demonstrated a thin (ca 400 to 500 nm) hybrid layer in the fractured dentin and thicker (ca 1 to 4 microns) hybrid layers on smear layer-covered dentin. This included a thick, hybridized smear layer and a thin, underlying true hybrid layer in the intact dentin. Separation of the two hybrid layers was not evident in interfacial failures. CONCLUSION: Self-etching primers create thin hybrid layers that incorporate the smear layer. This study shows that formation of true hybrid layers occurs irrespective of smear layer thickness and that both hybrid layers may function as a unit during loading without separation. Identification of secondary cracks from TEM fractographic analysis exemplifies the complex reaction to tensile stresses in multilayered joint systems that comprise materials of variable compliance.
Institution
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Title
An ultrastructural study of the influence of acidity of self-etching primers and smear layer thickness on bonding to intact dentin.

Source

Abstract
PURPOSE: The objectives of this study were (1) to determine the depth of demineralization into intact dentin using several self-etching primer systems with different pH values, and (2) to evaluate whether hybridization of intact dentin in Clearfil SE Bond may be affected by variation in the thickness of the smear layers. MATERIALS AND METHODS: Dentin disks were created from mid-coronal dentin in extracted, human third molars. Three self-etching primer systems (Clearfil Liner Bond II, Liner Bond 2V, and SE Bond) were applied separately to these disks to evaluate how deep self-etching systems penetrate through smear layers into intact dentin. Dentin treated with All-Bond 2 using the "no-etch" technique was used as a control group. In the second part of the study, dentin disks with different smear-layer thicknesses were produced. The cryofractured control group was devoid of a smear layer. The experimental teeth were ground with 60-, 180-, or 600-grit SiC paper and bonded using SE Bond. Dentin disks were bonded together and examined with TEM. RESULTS: All-Bond 2 did not etch beyond the smear layer. The three self-etching primers etched beyond the smear layer to form true hybrid layers within intact dentin. This layer was thickest with Liner Bond 2 (ca 1.2 to 1.4 microns), but very thin (0.5 micron) using both Liner Bond 2V and SE Bond. Application of SE Bond to dentin of different surface roughness produced hybridized smear layers of variable thickness. However, the thickness of the underlying true hybrid remained consistent for the four groups (ca 0.4 to 0.5 micron). CONCLUSION: Self-etching primers create thin hybrid layers that incorporate the smear layer. The suspicion that thick smear layers may interfere with the diffusion of self-etching primers into the underlying intact dentin was not confirmed.