Enamel bond strengths of some self-etch adhesives were significantly reduced by 2 years of water storage.

**Objective:** To evaluate the effects of prolonged water storage on the microshear bond strength of 1 etch-and-rinse and 4 self-etch adhesive systems to ground enamel.

**Methods:** The materials tested in this study were the etch-and-rinse adhesive Admira Bond (which uses 36% phosphoric acid), the self-etch primer system Clearfil SE Bond, and the all-in-one self-etch adhesives Futurabond DC, Clearfil S Tri Bond, and Hybrid Bond. Sixty extracted human molars were sectioned into halves. The buccal and lingual surfaces were polished flat to 600-grit and then roughened with medium grit (100 µm) diamond rotary instruments. The adhesives were applied according to their manufacturers' directions, and composite was bonded to the treated surfaces. Microshear bond strength testing was performed using a universal testing machine following either 1 day or 2 years of storage in water. Fracture modes were examined using optical microscopy at 50x magnification. Additional enamel specimens were treated for scanning electron microscopy (SEM) evaluation.

**Results:** After 1 day of water storage, mean microshear bond strengths were in the range of 26 to 31 MPa. While the etch-and-rinse system had the highest mean, it was not significantly higher than that of the self-etch materials. After 2 years of water storage, the mean bond strength of each adhesive declined, but the reduction was significant only for Clearfil S Tri Bond and Hybrid Bond.

**Conclusions:** After 2 years of water storage, the enamel bond strengths of some self-etch adhesives were significantly reduced.

**Reviewer's Comments:** Even the most aggressive self-etch adhesive systems are relatively mild compared to phosphoric acid. Therefore, one of the limiting factors in the use of self-etch adhesives has been their questionable bond to enamel. The present study reported that all 3 of the self-etch materials tested had bond strengths similar to that of the etch-and-rinse control after short-term water storage. However, for 2 of the 3 all-in-one materials tested, the enamel bond decreased significantly during long-term water storage. In contrast, the 2-step system Clearfil SE Bond and the all-in-one material Futurabond DC retained bond strengths similar to that of the control. Each of the self-etch materials contains a resin monomer that should facilitate some chemical bonding to the enamel, but these were obviously more effective for some materials than for others. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Enamel Bonding, Self-Etch Adhesives

Print Tag: Refer to original journal article
Nanofilled and Packable Composites Perform Well in Class II Restorations

Two-Year Clinical Evaluation of Packable and Nanostructured Resin-Based Composites Placed With Two Techniques.

Monteiro PM, Manso MC, et al:

J Am Dent Assoc 2010; 141 (March): 319-329

There is no apparent benefit from using differing viscosities of composite resin to improve adaptation to cavity walls.

**Background:** Posterior direct composite restorations have become the most common restoration placed in class II situations. The longevity of these restorations is dependent on many factors, including the type of material and the placement technique. High-density resin composites, commonly called packable resins, have been suggested to allow easier placement and better proximal contact. Lower density resins have been used to line the walls in an effort to improve adaptation and perhaps provide a low elastic modulus buffer. Oblique incremental placement is commonly used in order to minimize the effect of polymerization shrinkage.

**Design/Objective:** This clinical trial aimed to evaluate the use of 2 densities of composite resins and 2 different incremental filling methods on the performance of class II resin restorations over a 2-year period.

**Methods:** Adult patients were selected with D3-level proximal carious lesions in premolars, no periodontal or pulpal disease, and the presence of occlusal and proximal contacts. Gender, age, homecare, and smoking status were noted. A total of 105 class II restorations were randomly assigned to 3 groups: Group A consisted of a nanohybrid composite (Ceram X mono – Dentsply) placed with the oblique incremental technique; Group B used the Ceram X mono, followed by a packable composite (SureFil – Dentsply) using a modified incremental technique, and Group C consisted of SureFil placed with the oblique incremental technique. The modified incremental technique involves placement of the nanohybrid material on the gingival floor, followed by a layer of the high viscosity composite in order to cause the initial layer to flow prior to polymerization. The restoration was then finished with a nanohybrid material. The restorations were evaluated using the modified U.S. Public Health Service criteria at baseline, 1 year, and 2 years.

**Results:** There were no statistically significant differences between the experimental groups regarding success, which ranged from 97% to 100%. Group B demonstrated slightly lower scores relative to cavosurface discoloration and marginal integrity at the 2-year timeframe. These findings were more pronounced among smokers.

**Conclusions:** Either material placed with the oblique incremental technique as well as both materials placed with a modified incremental technique perform satisfactorily after 2 years of clinical service in class II situations. The marginal integrity of the two viscosity, modified incremental placement group was reduced after 2 years.

**Reviewer’s Comments:** The concept of using a higher viscosity material to displace a lower viscosity material, much like the commonly practiced impression technique, intuitively makes sense in proximal box preparations. This study demonstrates that although all groups were satisfactory, this technique showed the weakest performance relative to marginal integrity and discoloration after 2 years. Given the increased complexity of using 2 materials in the same restoration with no significant improvement, and in fact, slightly lower performance, this study does not support this technique. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Clinical Trial, Incremental Placement, Nanofilled Resin, Packable Resin

Print Tag: Refer to original journal article
Reducing cusp inclination may result in more stress on the cortical bone and, consequently, bone loss.

**Objective:** To evaluate the influence of cusp inclination on stress distribution in implant-supported prostheses.

**Methods:** Three 3D models were created to simulate mandibular bone with an implant and a crown. A screw-retained crown was simulated using different cusp inclinations (10°, 20°, and 30°). The crowns were nickel-chromium alloy restorations layered with 2 mm of feldspathic porcelain. The models were transferred to finite element software. Structural properties were obtained from the literature and incorporated into the model. Materials were assumed to be linearly elastic, homogeneous, and isotropic. The load applied was also determined from the literature (200 N at 45°).

**Results:** The maximum stress values were noticed between the implant platform and first screw thread in all models. Stress concentration increased on the implant approximately 18% for every 10° of increasing cusp inclination. When the cortical bone was analyzed, stress was concentrated between the second and third implant threads with maximum stress located in the cortical bone surrounding the implant at the distal contour. Increasing the cusp inclination to 30° decreased the stress applied to the cortical bone by 20%. Low stress concentrations that were not different among groups (inclinations) were noticed at the trabecular bone surrounding the implant apex.

**Conclusions:** Increasing cusp inclination increases the stresses on the implant and decreases the stresses on the cortical bone.

**Reviewer’s Comments:** Even though high-stress concentrations were found on implants when increasing the cusp inclinations, these high-stress concentrations are unlikely to jeopardize osseointegration. As the authors described in the discussion, the increased stress is lower than the endurance limit of available implants. Based on the results of this study, increased cusp inclinations is the most effective biomechanical means to reduce cortical bone loss due to excessive stress. (Reviewer-Ricardo Walter, DDS, MS).

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Keywords: Implant, Occlusal Anatomy, Cusp Inclination, Stress

Print Tag: Refer to original journal article
While there are many post-and-core materials and techniques available, selection should be evaluated according to the specific clinical situation.

**Background:** Some sort of post-and-core system has been used for over 2 centuries. Cast post-and-cores replaced one-piece post crowns. Although requiring 2 appointments for fabrication and seating, they offered improved marginal fit, adaptation to different canal formations, and variation in angulation of the core. Causes of post-and-cores failure include recurrent caries, endodontic failure, periodontal problems, post dislodgement, cement failure, post-core separation, crown-core separation, loss of post or crown retention, core fracture, post distortion or fracture, tooth fracture, and root fracture. Metallic posts can corrode causing failure. Currently, there are a variety of systems available to fit specific situations.

**Objective:** This article discusses these available systems.

**Results:** Custom-cast dowel cores adapt well to asymmetrical canals and tend to require minimal tooth structure removal. Whether the patterns are formed directly or indirectly, the process requires 2 appointments. Their very high modulus of elasticity provides a more stable (but less esthetic) substrate for ceramic restorations, but it transmits occlusal forces that can result in loosening of the post or even root fracture. Prefabricated systems are classified as active (they engage dentinal walls) or passive (do not engage dentin). Posts may be a combination of tapered or parallel-sided with serrated, threaded, or smooth surfaces. Active posts are more retentive but create significant stress during placement. Parallel-sided serrated posts are the most retentive passive design. Prefabricated metal posts are made of various metal combinations. The most popular is titanium alloy. Non-metallic prefabricated posts include ceramic (zirconium oxide) and fiber-reinforced resin posts. Zirconium oxide posts exhibit high flexure strength, biocompatibility, and corrosion resistance, but they are difficult to prepare and to remove from canals if re-treatment is required. They require 1 appointment, have no corrosion and no root fracture, and they offer increased retention and good esthetic substrate. The ferrule effect design is critical for success. Complete crown preparation design for endodontically treated teeth should include a 1.0- to 2.0-mm collar around sound tooth structure apical to the post-and-core. This decreases the likelihood of fracture. Some research has shown fiber-reinforced systems are superior to prefabricated metal posts. These posts are adhesively bonded to dentinal walls thus strengthening the tooth-restorative interface. They possess a modulus of elasticity similar to dentin after bonding.

**Conclusions:** There are many post-and-core materials/techniques available. Selection should be evaluated according to the specific clinical situation.

**Reviewer’s Comments:** There has been a rush to use zirconium or fiber-reinforced resin post systems because they offer a more esthetic substrate and can be bonded. However, no system offers total advantage over all other systems. The post-and-core type that is best for the clinical situation should be chosen. No matter what the system, establishment of a good ferrule is the key to long-term success. (Reviewer-Thomas G. Berry, DDS).

© 2010, Oakstone Medical Publishing

Keywords: Post-and-Cores

Print Tag: Refer to original journal article
A remineralizing cream containing CPP-ACP significantly enhances the regression of white-spot lesions.

**Objective:** To test the hypothesis that more post-orthodontic white spot lesions would regress in participants using a casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) remineralizing cream than in those using a placebo cream.

**Participants/Methods:** Adolescent patients, ages 12 to 18 years (mean, 15.5 years), exhibiting at least 2 white-spot lesions and scheduled for bracket removal were invited to participate in this study. Forty-five patients were enrolled in the study and randomly assigned to experimental and control groups. The total number of white spots in each groups was slightly >200. Participants in the experimental group were given the remineralizing cream (known as MI Paste in the U.S.) and were instructed to apply 1 gram of the cream morning and night for 12 consecutive weeks. The 1 g amount was automatically dispensed. Subjects in the control group applied a similar cream without the active ingredient. All subjects used a fluoride dentifrice and used a 900-ppm fluoride mouth rinse under supervision at each recall evaluation (4, 8, and 12 weeks). Visual assessments were performed by 3 experienced clinicians, with tooth surfaces initially wet and then air-dried for 5 seconds. Severity and activity scores were assigned to each lesion. Transitions between evaluations were described as progressing, regressing, or stable.

**Results:** 92% of the white spot lesions were scored as 2 or 3. For these lesions, 31% more had regressed with the remineralizing cream than with the placebo at 12 weeks, which is a statistically significant difference.

**Conclusions:** The use of a remineralizing cream containing CPP-ACP significantly enhanced the regression of post-orthodontic white spot lesions.

**Reviewer's Comments:** ACP seems to be the "new fluoride" – that is, it's found in many products, including things like bleaching gels, and is touted as having almost magical effects on teeth. Therefore, I have always been skeptical of some of the claims. However, studies have shown that CPP-ACP paste can promote remineralization of subsurface enamel lesions and promote the formation of fluorapatite deep within those lesions. This ability to promote remineralization accounts for the reversal of white-spot lesions in the present study. The use of a product such as MI Paste either during or after orthodontics could prove to be very helpful in preventing or reversing white-spot lesions. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: White Spots, ACP

Print Tag: Refer to original journal article
Pretreatment With CHX Improves Long-Term Success of Dentin Bonds

Chlorhexidine Stabilizes the Adhesive Interface: A 2-Year in Vitro Study.

Breschi L, Mazzoni A, et al:


Strong consideration should be given to the use of 0.2% CHX as a primer prior to adhesive application.

**Background:** The longevity of the dentin-adhesive interface is important in the long-term success of composite restorations. This bond can be influenced by occlusal and thermal forces as well as chemical challenges. Due to the permeable nature of the hybrid zone, water sorption and hydrolysis can also challenge the bond. An additional mechanism of bond degradation involves enzymatic dissolution of the collagen fibrils at the bottom of the hybrid layer. These endogenous enzymes belong to the family of matrix metallo-proteinases (MMPs). Application of adhesive systems may activate these MMPs and begin the autolysis of the collagen. Chlorhexidine digluconate (CHX) has been shown to inactivate some of these enzymes and, therefore, has been suggested to stabilize this adhesive layer.

**Design/Objective:** This in vitro study aimed to examine the effect of CHX application on the long-term stability of adhesive-dentin bonds using an etch-and-rinse adhesive system.

**Methods:** 10 human molars were obtained, and the dentin ground to create dentin powder. The dentin powder was divided into 5 experimental groups. The aliquots were untreated, treated with phosphoric acid and adhesive (Adper Scotchbond 1XT – 3M-ESPE), or treated with 0.2 or 2% CHX prior to adhesive. After 24 hours of incubation, all specimens were rinsed with acetone and assayed for proteins. A total of 48 additional extracted molars were prepared with flattened dentin surfaces for microtensile bond strength testing. These specimens were either treated with adhesive alone or pretreated with either 0.2 or 2% CHX. The specimens were then sectioned and stored for either 24 hours or 2 years in artificial saliva and then tested in a universal testing machine until failure or examined for microleakage.

**Results:** The protein analysis demonstrates that MMP-2 activity is significantly increased by addition of the dentin adhesive. Pretreatment with CHX at either concentration inhibited the activity of these proteinases. There were no differences with immediate bond strengths between the experimental groups. After 2 years, the control group showed a 67% decrease in bond strength, while the 0.2% CHX group showed only a 16% decrease and the 2% CHX group showed a 30% decrease. Additionally, the 2-year CHX groups demonstrated less microleakage than the control groups.

**Conclusions:** The results support the use of CHX as primer to inhibit the activity of MMP-2 and thereby improve the durability of dentin bonding.

**Reviewer's Comments:** The current challenge with dentin adhesion is no longer initial bonding, but stable long-term bonds. This study presents 2 very interesting concepts; first, that endogenous enzymes activated by the application of adhesives may be involved in the long-term degradation of the hybrid layer and therefore the dissolution of the bond, and second, that the application of CHX may inhibit this enzymatic activity and therefore improve the long-term stability of the adhesive dentin bond. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Chlorhexidine, Bond Longevity, Hybrid Layer

Print Tag: Refer to original journal article
Drying a silane with warm air significantly improves the adhesion of resin to ceramic, possibly eliminating the need for hydrofluoric acid etching.

**Objective:** To determine whether post-silanation heat treatments can improve the bond of composite to ceramic such that hydrofluoric (HF) acid etching is unnecessary.

**Methods:** 24 leucite-reinforced pressed ceramic blocks (IPS Empress) were fabricated and polished to 600 grit. Surfaces were treated in 4 different ways. In the first group, the ceramic was etched in HF acid for 1 minute, rinsed, and air-dried; next, a silane coupling agent was applied for 1 minute and air-dried for 30 seconds. In the second group, the silane coupling agent was applied and air-dried without prior HF acid etching. The third group was the same as the first except that the silane was dried with warm air (100°C) for 1 minute. The fourth and final group was the same as the second group except that warm air-drying was used. A custom-made miniature blow dryer was used to supply the warm air. In all groups, a resin bonding agent was applied to the surface, and composite was placed and cured. Each bonded block was sectioned into small bars for microtensile bond strength (MTBS) testing, which was accomplished using a universal testing machine. Failure modes were evaluated using optical microscopy at 20x magnification.

**Results:** Mean MTBS values were 22.8 MPa for the HF etch group, 18.7 MPa for the silane group, 27.8 MPa for the HF-silane-warm air group, and 28.5 for the silane-warm air group. Mean bond strengths of the 2 warm air groups were significantly higher than those of the HF acid group. A large number of pretest failures occurred in the silane group. Most failures in the other groups were cohesive in the resin.

**Conclusions:** Drying the silane with warm air significantly improved the adhesion of resin to ceramic, possibly eliminating the need for HF acid etching.

**Reviewer’s Comments:** The standard method for bonding resin-based materials to feldspathic and leucite-reinforced ceramics involves etching with HF acid followed by application of a silane coupling agent. The present study suggests that the HF acid etching step could be eliminated if the silane is dried with warm air. Apparently, the warm air eliminates solvents such as water and alcohol and drives the reaction that chemically bonds the silane to the ceramic. This is a very interesting concept, but I would like to see additional research on it before eliminating the HF acid etching step. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Ceramics, Resin Bonding, Silane

Print Tag: Refer to original journal article
Prompt response and proper emergency treatment are essential in the management of dento-alveolar trauma.

**Objective:** To evaluate the time lapse and appropriateness of emergency treatment for children with dento-alveolar trauma.

**Methods:** 150 dento-alveolar trauma cases that took place within an 18-month period in 3 different locations in the U.K. were evaluated. Subjects were <16 years of age and had trauma to any permanent incisor. Data collection included demographic details, time lapse from the trauma, source of referral, whether any advice was sought by phone, tooth notation, nature of injury, and whether any initial treatment was provided prior to referral.

**Results:** 100 of the subjects were males and 50 were females; the mean age was 11.1 years. Almost 80% of the subjects reported seeing their regular dentist within the past 6 months. Nearly 50% of the subjects were referred to 1 of the 3 centers included in the study by a general practitioner, and almost 25% were self-referrals. The remaining cases were referred by accident and emergency medical services, community dental services, schools, and specialist practices. The mean time lapse from injury to provision of emergency dental care was 30.7 hours. Causes for the delays were reported as delay in accident and emergency response, general dentist not being available, parental availability for appointments, and time taken for the subject to be referred by the accident and emergency team. Nevertheless, nearly half of the cases were managed within 2 hours, with the majority being managed within 24 hours. Advice over the phone was sought in approximately 25% of the cases. Injuries involving 1 or 2 teeth combined for almost 90% of the cases. Three-quarters of the injuries occurred in upper centrals. Of the 263 teeth injured, 77 were enamel-dentin fractures, 42 had pulp involvement, and 38 were avulsions. More than 80% of the subjects received emergency care. Those were composite bandages, replanting and splinting, repositioning and splinting, glass ionomer bandages, elective root canal therapy, and replanting/repositioning with no splint. No treatment was provided to 26 subjects. Thirty-nine percent of the subjects received inadequate treatment. Those included incorrect pulp or dentin management/protection, prolonged time for reimplantation of avulsed teeth, and inadequate or lack of splinting.

**Conclusions:** Better training of the primary responder to dento-alveolar trauma is urged.

**Reviewer's Comments:** As with any emergency situation, the promptness of the response is critical for success. With dento-alveolar trauma, this response may start with a simple call to a dental office. In that occasion, the staff should be able to render valuable information to the patient. Training your staff and education of your patient population in regards to dental trauma may significantly help saving teeth. (Reviewer-Ricardo Walter, DDS, MS).

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Keywords: Dental Trauma, Avulsion, Fracture, Treatment

Print Tag: Refer to original journal article
What's the Best Way to Repair Composite?

Immediate Repair Bond Strengths of Microhybrid, Nanohybrid and Nanofilled Composites After Different Surface Treatments.

Rinastiti M, Özcan M, et al:


Silica coating improves the bond strength of composite to composite.

**Objective:** To evaluate the immediate repair bond strengths and failure modes of microhybrid, nanohybrid, and nanofilled composites with and without surface conditioning.

**Methods:** The composite materials used in this study were Quadrant Anterior Shine (a microhybrid not available in the U.S., to my knowledge), Grandio and Tetric Evo Ceram (nanohybrids), and Filtek Supreme XT (nanofill). Disc-shaped specimens of each material were formed in molds. Except in 1 control group, to prevent formation of an oxygen-inhibited layer, light-curing of the final composite layer was done with the material covered by a Mylar strip. In a second control group, the composite was covered with the Mylar strip during light-activation, and no treatments were applied. In a third group, an adhesive resin was applied, and in a fourth group, the composite surface was treated with the CoJet® Sand air-abrasion/silanation system before application of the adhesive resin. New composite was applied to the substrate surfaces, and shear bond strengths of the "repaired" specimens were determined using a universal testing machine. Fracture modes were evaluated at 40x magnification. Additional specimens of each material were fabricated for surface characterization using contact angle measurements, XPS (elemental analysis), SEM (scanning electron microscopy), and AFM (atomic force microscopy).

**Results:** Bond strengths ranged from 10.5 MPa to 27.4 MPa and varied by material and surface treatment. In general, the silica coating technique (CoJet-Sand) produced the highest bond strengths and exclusively cohesive failures. As would be expected, the CoJet treatment noticeably roughened the composite surfaces. Application of an adhesive resin provided little improvement in bond strengths.

**Conclusions:** Application of adhesive resin did not improve composite repair strengths, but a silica coating treatment did so.

**Reviewer's Comments:** This study shows that a silica coating technique (including silanation) can improve the bond of composite to composite. Strictly speaking, the study did not include a control group (ie, intact rather than "repaired" composite specimens) that would have provided more perspective of what the numbers really mean. Also, it would be interesting to know whether the results would be different if the substrate composite had been aged in some way before the repair procedures were done. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Composite Repair, Bond Strengths

Print Tag: Refer to original journal article
Visual Shade Selection Provides Limited Accuracy

Estimation of Visual Shade Matching Errors With 2 Shade Guides.
Oh W-S, Koh I-W, O'Brien WJ:

Quintessence Int 2009; 40 (10): 833-836

The Vitapan 3D Master shade guide yields more accurate results.

**Background:** Tooth shade is usually selected by visually matching to a color standard represented by an available shade guide. However, this selection is affected by the clinician's color perception, ambient light, the specific shade guide, and the background for the tooth. Studies clearly demonstrate this is an inexact method leading to frequent mismatches.

**Objective:** To compare agreement in visual shade matching between 2 prosthodontists.

**Methods:** The prosthodontists demonstrated high accuracy for assessing shades during a color calibration exercise. For this study, they matched the shade of the middle third of maxillary right centrals on 33 patients. Shade selection was performed using 2 shade guides, the Vitapan Classical shade guide with 16 tabs and the Vitapan 3D Master shade guide with 26 shade tabs. Classical tabs are arranged in value from lightest to darkest. Teeth were slightly moistened before shade selection under daylight-corrected fluorescent lighting. The prosthodontists first selected the best shade for each subject. Shade matching was rated as in agreement when observers selected the same best shade. The rate of agreement was calculated to reveal the proportion of interobserver consensus. Second best and third best shades were also selected. A common shade was then identified among the 3 tabs (first, second, and third choices for each patient). Shade matching was rated as in agreement when observers selected at least 1 common shade regardless of the rank order.

**Results:** Interobserver agreement of the prosthodontists was only 30% on best shade match and ≥85% for common shade match for both shade guides. There was a significant difference in agreement between best shade match and common shade match regardless of the shade guide used. No significant interobserver difference was noted for best shade match for both shade guides, but for common shade match, there were significant differences between the 2 guides. Vitapan 3D Master was superior to the Classical guide. Agreement was significantly higher for Vitapan Classical and 3D Master guides for selection of common shade than for best shade matches. Interobserver agreement on best shade match was only 30% using both shade guides. Use of 3D Master did lead to a higher level of agreement.

**Conclusions:** Interobserver agreement for shade matching was better using a method of selecting the common shade among the 3 closest matches chosen by the 2 prosthodontists. The Vitapan 3D Master shade guide resulted in better agreement than the Vitapan Classical shade guide.

**Reviewer's Comments:** This study emphasizes what we have all experienced. Use of shade guides yields inconsistent results in shade selection. The Vitapan 3D Master guide appears to offer more precise shade selection than older shade guide types. We are still waiting for a truly accurate and clinically practical spectrophotometer to give us precise shade selection. (Reviewer-Thomas G. Berry, DDS).

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Keywords: Shade Guide, Accuracy

Print Tag: Refer to original journal article
**Take Time to Listen to Patient’s Expectations**

*Patients' and Dentists' Perception of Dental Appearance.*

Mehl CJ, Harder S, et al:

Clin Oral Invest 2010; March (): epub ahead of print

Patients’ and not dentists’ expectations should drive treatment plans.

**Objective:** To compare patients’ and providers’ perception of aesthetics in oral rehabilitation cases. The potential influence of experience, age, and gender in the professional judgment were also evaluated.

**Participants/Methods:** 8 men and 8 women (mean age, 64 years) were enrolled as subjects in the study. They received either a fixed or removable restoration that included the upper anterior teeth. The treatment was rendered in a 4-month period during which subjects received oral rehabilitation by a dental student. The treatment included oral hygiene instructions and motivation, a provisional phase that lasted approximately 2 months, and a final recall session 4 weeks after finishing the rehabilitation. The cases were restored with fixed restorations (7 cases), removable partial dentures (7 cases), or full dentures (2 cases). None of the subjects were edentulous prior to initiation of treatment. To evaluate subjects' satisfaction, 2 questionnaires were filled out. Both questionnaires were completed before and 4 weeks after therapy. The first questionnaire was to evaluate the well-being of the subjects. (Subjects could not be in a euphoric or depressive state to be in the project.) The second questionnaire consisted of 11 questions that evaluated the satisfaction of the subject with the treatment rendered. A group of 42 dentists (30 men and 12 women), who were part of an advanced training program in dental aesthetics, evaluated the aesthetic appearance of the cases before and after treatment. These evaluations were based on photographs of the lips and teeth during strong smiling and teeth until first premolar with lips retracted. The dentists had 7 seconds to evaluate each photograph. The evaluation was measured using a visual analog scale with a length of 100 mm. The end points of this scale were considered absolutely unaesthetic and absolutely aesthetic.

**Results:** All subjects were in a normal well-being state. Both subjects and providers agreed that there were significant aesthetic improvements. However, there was no correlation between subjects' assessments and providers' evaluations. Age, gender, and experience had no significance in the results.

**Conclusions:** Patients are satisfied with dental aesthetics when their personal demands have been met. Professionals tend to judge the cases based on higher-ranking aesthetic guidelines that do not always correspond to patients’ demands.

**Reviewer's Comments:** Despite the limitation of using different scales for evaluation of the same outcome, this study reminds us of something. We dentists sometimes ignore our patients' desires and expectations about a given treatment and end up providing a treatment that satisfies us instead of the patient. To avoid that, a detailed interview, diagnostic wax-up, and intraoral photos are helpful. Assuming that we know what the patient is looking for does not always work. (Reviewer-Ricardo Walter, DDS, MS).

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Keywords: Esthetics, Rehabilitation, Perception, Dentist, Patient

Print Tag: Refer to original journal article
Resin cement has real advantages in appropriate situations.

**Background:** Indirect restorations are frequently placed over buildup materials in compromised teeth. These materials include cast post-and-cores, amalgam, composite, and glass ionomer retained by various means. Resin cements used with dentin bonding agents demonstrate increased crown retention compared to other cement types when bonding to metal, ceramic, or indirect composite. Etched all-ceramic crowns cemented with resin cement display significantly higher 16-year survival rates than nonadhesive cements. Moisture exposure, especially to acidic solutions, affects retention of luting resin to foundation materials.

**Objective:** To compare the shear bond strength of glass ionomer (GI), resin-modified glass ionomer (RMGI), and resin cement to 4 different foundation materials.

**Methods:** Standardized disks were made of amalgam (Tytin®), auto-polymerizing composite resin (CompCore), tri-polymerized RMGI (Vitremer™), and traditional GI (Ketac™ Molar) and stored 1 week at 37°C in 100% relative humidity. Surfaces were smoothed with 320-grit silicon carbide paper. Test cements luted to foundation materials were: resin cement (Calibra®), RMGI cement (RelyX™ Luting Plus), and traditional GI Cement (Ketac™ Cem). Twenty specimens of each foundation/cement pair were stored 24 hours at 37°C in 100% humidity. A second set of pairs was stored 24 hours at 37°C in lactate acid buffer solution (pH4). Next, a shearing force was applied to specimens until fracture occurred. Magnification examination was performed to discover whether fracture occurred within the cement or the foundation.

**Results:** Resin cement demonstrated stronger bond to all foundation materials than RMGI and GI cements. Bond between RMGI and GI cements and foundation materials was not significantly different. GI cement had the lowest bond strength to composite and GI foundation materials. RMGI cement achieved the strongest bond to GI foundation. Specimens immersed in lactate solution demonstrated significantly lower bond strengths. The greatest bond strength was between composite foundation and resin cement followed by RMGI foundation and resin cement. The lowest bond strengths were between amalgam and GI and GI foundation and GI cement. RMGI and GI bonded to composite foundation experience adhesive failures, but combination of composite foundation/resin cement had cohesive failures. Lactate solution eroded material and weakened the bond but not for the bond between composite foundation and resin cement, possibly because it leached out residual monomer.

**Conclusions:** Resin luting cement demonstrated the highest bond strength to most foundation substrates investigated. The bond between composite foundation and resin cement was also most durable with lactic acid immersion. GI cement showed low bond strengths to foundation substrates and was most susceptible to acidic breakdown.

**Reviewer's Comments:** Resin cement is likely our cement of the future. It has real advantages in appropriate situations. However, it has limitations depending on its ability to bond to the substrate and its film thickness can be a problem although that has improved. The relatively poor results with RMGI cement do not match some other studies, however. (Reviewer-Thomas G. Berry, DDS).
Double application does not improve the dentin bond strength of 2 self-etch all-in-one adhesives.

Objective: To determine whether double application of single-step self-etch adhesives affected their bond strengths or resin-dentin interfaces.

Methods: The adhesives tested in this study were Clearfil Tri-S Bond, G-BOND, and an experimental material from 3M ESPE coded EXL-683. Forty-two dentin slices were sectioned from extracted human molars. Thirty were used for microshear bond strength testing, 6 were used for a nanoindentation test, and 6 were used for scanning electron microscopy (SEM). All tooth slices were polished using #600 SiC paper to produce standardized smear layers. Single applications of the materials were performed according to manufacturers’ directions. The double applications were repeats of the single application without light-curing of the first application. For the microshear bond strength test, small pieces of composite were applied in molds and cured. The testing was done using a wire loop in a universal testing machine. Hardness at various points along the resin-dentin interfaces was measured using a nanoindentation device. SEM was used both to evaluate fracture modes of specimens in the bond strength test and the ultrastructure of the resin-dentin interfaces.

Results: Double application of the adhesive significantly improved mean bond strengths of the experimental adhesives. For Clearfil Tri-S Bond, the mean bond strengths with single and double application were 36.9 MPa and 40.2 MPa, respectively. For G-BOND, the respective means were 30.0 MPa and 32.2 MPa. The hardness of the adhesive layer and the resin-dentin interfacial layer was significantly improved for all 3 adhesives. The hybrid layers formed were very thin (<0.5 µm thick) regardless of the adhesive or application method used.

Conclusions: Double application did not improve the dentin bond strength of 2 self-etch all-in-one adhesives, but did significantly improve hardness of the resin-dentin interface.

Reviewer’s Comments: The increased hardness of the adhesive and interfacial layers suggests that double application of an all-in-one adhesive might improve the mechanical properties of the resin-dentin bond. However, any such improvement did not translate into higher bond strengths. This is not the first study to evaluate extra applications of adhesive and probably will not be the last. Unfortunately, these studies have provided no clear consensus on whether extra applications are worthwhile. The best advice remains to carefully follow the manufacturer’s directions for whichever adhesive you are using. (Reviewer: Edward J. Swift, Jr, DMD, MS).

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Keywords: Dentin Bonding, Microshear, Self-Etch Adhesives

Print Tag: Refer to original journal article
A minimum waiting period of 7 days after bleaching is complete should be observed prior to bonding procedures.

**Background:** Tooth lightening with hydrogen peroxide or its precursors is a ubiquitous procedure, both alone, and prior to further aesthetic dental procedures. It is very common to follow bleaching with replacement of older composite resin restorations due to the color mismatch. It is commonly stated that there should be a waiting time after bleaching procedures before the enamel and dentin is receptive to adhesive procedures. This is to allow residual oxygen forced into the enamel and dentin during the bleaching procedure to be eliminated. The literature comes to no consensus relative to the appropriate waiting period, with suggestions ranging from no wait to 2 weeks.

**Design/Objective:** This in situ study aimed to evaluate the waiting time necessary after bleaching with 35% hydrogen peroxide to obtain appropriate bond strengths.

**Methods:** 100 fragments of sound human enamel and 100 fragments of sound dentin were distributed randomly into 5 experimental groups. Five fragments each of enamel and dentin were bonded onto the molars and premolars in each of 20 participants. After 1 week of wearing the fragments, 1 fragment each of dentin and enamel was removed from each subject; these fragments were the nonbleaching control group. The participants were then subjected to in-office bleaching with 35% hydrogen peroxide with halogen light activation for 3 clinical sessions. After the third session, dentin and enamel fragments were obtained for the baseline time. Fragments were obtained after 7, 14, and 21 days. The patients were instructed to practice good home care with fluoride toothpaste during the study. Upon removal, the fragments were subjected to phosphoric acid etching, adhesive application (Adper Single Bond Plus-3M ESPE), and a resin composite bonded to allow shear bond strength testing. The testing was accomplished after 7 days of storage in a humid environment. Microscopic evaluation of failure mode was done as well.

**Results:** The immediate postbleaching specimens demonstrated significantly lower bond strengths than the control group. No statistically different values were noted when the control group was compared to the 7-, 14-, and 21-day groups. The vast majority of failures were adhesive in nature.

**Conclusions:** These results suggest that bond strengths are compromised immediately after bleaching with 35% hydrogen peroxide but return to values similar to nonbleached tooth tissue after 7 days.

**Reviewer's Comments:** This study design is the closest ethical substitute for a clinical trial, as the tooth structure exists in the oral environment allowing pellicle formation and interaction with saliva as well as topical fluorides. Since the initial bond strengths postbleaching were clearly compromised as compared to the other experimental groups, these results suggest that it is prudent to wait ≥7 days after the last bleaching session before placing an adhesive restoration. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Tooth Bleaching, Hydrogen Peroxide, Postbleaching Time, Shear Bond Strength

Print Tag: Refer to original journal article
Composite should not be cured in increments thicker than 2 mm, especially when the light guide is covered by a protective sheath.

**Objective:** To evaluate the effects of disposable transparent sheaths on the hardness of light-activated composite resin.

**Methods:** The composite used in this study was TPH Spectrum, a microhybrid. The light-curing devices used were an Elipar Trilight, which is a halogen unit, and the Elipar Freelight 2, which is an LED. The Trilight has an intensity of 800 mW/cm² and was used with 40-second exposures. The Freelight has an intensity of 400 mW/cm² and was used with 20-second exposures. Molds were designed so that composite thicknesses of up to 6 mm could be produced. Specimens were light-activated with or without a plastic sheath over the light guide. The Vickers hardness of the top and bottom surface of each specimen was measured. Hardness is an indirect measure of how well a composite has cured.

**Results:** Vickers hardness numbers (VHNs) were similar for all 4 groups (ie, 2 lights used with and without sheaths), in the range of 45.9 to 47.2. At a depth of 2 mm, hardness values decreased slightly (42.0 to 46.1) and continued to decrease with increasing depth. The lowest mean hardness value was observed at 5 mm using the LED with a sheath (VHN, 21.3). In comparison, at the same depth, the VHN of the halogen device without a sheath was 30.7.

**Conclusions:** Composite should not be cured in increments thicker than 2 mm, especially when the light guide is covered by a protective sheath.

**Reviewer's Comments:** Many dental practices use plastic sheaths over their curing light guides as part of their asepsis protocol. However, some studies have reported that these sheaths can reduce the light intensity, which could have an adverse effect on curing of the composite. The present study indicates that this might indeed be a problem, but only if the composite is placed in increments thicker than 2 mm. So the bottom line is that, with the exception of very few materials, we should continue to place and cure our composites in layers of 2 mm or less. It should be noted that the LED device tested in this study had a very low intensity by today's standards. (Reviewer-Educated J. Swift, Jr, DMD, MS).

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Keywords: Light-Curing, Hardness

Print Tag: Refer to original journal article
Objective: To compare the clinical performance over 3 years of fixed partial dentures made with zirconia-ceramic and metal-ceramic frameworks.

Design/Participants: This prospective, randomized, controlled trial involved 59 patients who needed a total of 76 posterior fixed partial dentures (FPDs).

Methods: The FPDs ranged from 3 to 6 units in length, with the majority being 3 units. Half of the FPD frameworks were metal-ceramic (DeguDent U and Duceram Plus), and half were zirconia-ceramic (milled Cercon and Cercon Ceram S). The type of FPD framework was randomly assigned. All patients were periodontally healthy and free of bruxism. The dentists were experienced in the use of both types of FPD frameworks. All FPDs were cemented with Panavia 21 TC. The patients were longitudinally followed up for an average of 40 months and were evaluated in various biologic (pockets, caries, bleeding on probing) and technical ways, including U.S. Public Health Service criteria (fracture, wear, margins, and anatomic form). Fifty-three patients and 67 FPDs (31 metal-ceramic and 36 zirconia-ceramic) were available for follow-up.

Results: FPD survival was 100% in both groups. Only one zirconia-ceramic FPD had extensive loss of the veneering ceramic, but minor ceramic chipping was seen in 19% of the metal-ceramic and 25% of the zirconia-ceramic FPDs. Marginal adaptation was found to be clinically unacceptable in 6% of the metal-ceramic and 16% of the zirconia-ceramic FPDs. There were no significant differences between groups in the various biologic factors.

Reviewer’s Comments: This is an important clinical study because it is the first published, head-to-head comparison of conventional metal-ceramic and zirconia-ceramic FPD. This study was carefully performed and has considerable credibility. It suggests that the framework strength of zirconia-ceramic and metal-ceramic FPDs is equal, at least over a 3-year observation period under real-world clinical conditions. While the strength of zirconia-ceramic framework is comparable to that of metal-ceramic, there appear to be more technical problems with the former. Both FPD types had minor chipping of the ceramic veneering material over the 3 years, which tended to occur during the later part of the observation period rather than at the beginning. A longer-term study would show if progressively more chipping would occur as service life increased. While the ceramic chipping and marginal adaptation problems are potentially repairable, it is important for both dentists and their patients to realize the potential limitations of both types of FPDs used in this study. (Reviewer-Charles B. Hermesch, DMD).

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Keywords: Zirconia-Ceramic, Metal-Ceramic

Print Tag: Refer to original journal article
Bonding to Laser-Etched Dentin Achieves Low Bond Strengths

Tensile Bond Strength of Dentin Adhesives on Acid- and Laser-Etched Dentin Surfaces.


Acid-etching the tooth structure still produces the most reliable conditioning.

**Background:** Er,Cr:YSGG laser is effective in etching enamel, but the Nd:YAG laser actually causes occlusion of dentin tubules. The Er,Cr:YSGG laser produces micro-irregularities and the absence of a smear layer. The solvent type of the bonding agent has not been shown to be related to the bond strength of composite to laser-treated enamel and dentin.

**Design/Objective:** This in vitro study evaluated bond strength and adaptation of acetone- and ethanol-containing bonding agents on Er,Cr:YSGG and Nd:YAG laser-irradiated versus acid-etched dentin.

**Methods:** Enamel was removed from 146 molars to expose a flat dentin surface. Specimens were divided into groups (n=40). Group 1 surfaces were irradiated 15 seconds with Er,Cr:YSGG at 3W pulse energy at a 90° angle. Group 2 surfaces were irradiated with Nd:YAG with pulse-wave for 15 seconds. Group 3 (control group) surfaces were etched with 37% phosphoric acid for 20 seconds, then rinsed and air-dried. Dentin bonding agents were either acetone based (Admira Bond) or ethanol based (OptiBond Solo Plus) and applied for 20 seconds to respective specimens. After 10 seconds, adhesive was air-thinned and light-cured. Composite rods (Admira Bond for Admira Bond adhesive or Prodigy for Optibond Solo Plus) were bonded to specimens. Specimens were stored 24 hours in distilled water before shear bond testing. Three specimens from each group were examined under SEM to determine fracture mode. Additional similarly prepared specimens were evaluated for alterations in calcium, phosphorus, magnesium, sulfur, calcium/phosphorus, and magnesium/calcium contents. Results for both Admira Bond and OptiBond Solo Plus specimens from the control group demonstrated greater mean tensile strengths followed by the Er,Cr:YSGG and Nd:YAG laser groups. SEM of Er,Cr:YSGG specimens revealed surface roughness and open tubules and no smear layer. Admira Bond showed better adaptation to Er,Cr:YSGG lased surfaces than OptiBond Solo Plus. Both adhesives formed resin tags. Nd:YAG irradiation created craters and surface melting without exposed tubules. Acid-etched surfaces exhibited no smear layer and open tubules. Bonding adhesives achieved better adaptation to etched surfaces than to laser-etched surfaces. SEM analysis revealed no significant differences in mineral content except that the sulfur was lower in laser-treated groups. Acetone-based bonding agents achieved significantly stronger bonds than ethanol-based agents on phosphoric acid-etched surfaces. No solvent-type effect was noted on bond strengths of laser-etched dentin.

**Conclusions:** Acetone-based agents achieved greater bond strengths than ethanol-based agents on acid-etched dentin. Solvent type did not affect bond strengths on laser-conditioned dentin. The acid-etched group demonstrated highest bond strengths for both bonding agents. Er,Cr:YSGG laser irradiation provided higher bonds than Nd:YAG laser treatment but was not sufficient for adequate conditioning.

**Reviewer's Comments:** Lasers have their role in dentistry, but their benefit in bonding to tooth structure is limited. Perhaps future developments will provide good dentin conditioning via the usage of lasers, but we are not that advanced yet. Traditional conditioning and bonding are still the most reliable. (Reviewer-Thomas G. Berry, DDS).

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Keywords: Etching to Acid-Etched Dentin, Laser-Treated Dentin, Effectiveness

Print Tag: Refer to original journal article
Do Dental Enzymes Contribute to Degradation of Resin-Dentin Bonds?

Inhibition of Enzymatic Degradation of Adhesive-Dentin Interfaces.
De Munck J, Van den Steen PE, et al:

J Dent Res 2009; 88 (December): 1101-1106

Etch-and-rinse adhesive systems can release dentinal enzymes that affect durability of the resin bond.

**Objective:** To evaluate the endogenous enzymatic bond degradation of a mild 2-step self-etch adhesive (Clearfil SE Bond) and a 3-step etch-and-rinse adhesive (OptiBond FL), and to determine whether endogenous enzyme inhibitors can arrest such degradation.

**Methods:** Small blocks of coronal dentin were sectioned from extracted human molars and were ground to a powder. Enzymes were extracted from the dentin using chemical techniques. Enzyme release was also assessed after mixing 35% phosphoric acid, the primer from the 3-step system, or the primer from the self-etch system. Mid-coronal dentin surfaces of other molars were prepared with medium-grit diamonds. Composite was bonded to these surfaces using the 2 adhesives, each according to its manufacturer's directions. The 2 adhesive primers were modified by mixing with chlorhexidine, which is a non-specific matrix metalloproteinase (MMP) inhibitor. Specimens were stored in water for 1 week, 3 months, 6 months, or 12 months before removal for microtensile bond strength (MTBS) testing.

**Results:** The mean MTBS of Clearfil SE Bond decreased significantly with time. The addition of chlorhexidine to the primer did not affect initial bond strength, but it also did not prevent the time-dependent reduction in bond strength. The mean MTBS of OptiBond FL also decreased with time. At 12 months, the bond strength of the chlorhexidine-modified material was higher than that of the unmodified material, but the difference was not statistically significant.

**Conclusions:** Etch-and-rinse adhesive systems can release dentinal enzymes that affect durability of the resin bond.

**Reviewer’s Comments:** Some of the methodology used in this study is far beyond my level of expertise; thus, I am sure I have missed some details of the study. However, I believe I can summarize the most clinically relevant points. We have now seen several studies showing that etch-and-rinse adhesives can release specific enzymes already present in the dentin and that those enzymes can contribute to deterioration of the resin bond over time. This is less of an issue with self-etch materials such as the Clearfil SE Bond evaluated in this study. Enzyme inhibitors such as chlorhexidine might inhibit the enzymes and help preserve bonds. (Reviewer—Edward J. Swift, Jr, DMD, MS).

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Keywords: Dentin Bonding, MMP

Print Tag: Refer to original journal article
Use of intermediate-length fiberglass posts may improve the fracture strength of restored teeth and have fewer complications than longer or shorter posts.

**Objective:** To compare the fracture strengths of mandibular incisors repaired with 3 different lengths of fiberglass posts.

**Methods:** The researchers collected 45 bovine incisors and removed the crowns such that 17 mm of root length remained. Conventional endodontic treatment with gutta percha and sealer was performed on the root canals, followed by storage in water for 36 hours. The roots were randomly assigned to 3 groups and the canals were prepared for placement of fiberglass posts of either 12-, 8-, or 4-mm lengths. The posts were adhesively bonded into the canals. Cores of composite resin were placed to restore the missing coronal tooth structure. The teeth were prepared in a standardized fashion for complete cast gold crowns of 1.5-mm thickness and with a ferrule of 2.0 mm. The crown contour simulated the shape of a human maxillary canine tooth. The teeth were cemented with zinc phosphate and stored in water for 72 hours. The crowns were fractured in a universal testing machine by loading the cingulum of the crowns at a 135-degree angle to the long axis of the tooth at a cross head speed of 0.5 mm/min.

**Results:** Mean fracture stress was calculated: 129 MPa for 12-mm length posts, 154 MPa for the 8-mm length, and 100 MPa for the 4-mm length. The means for the 12- and 8-mm posts were not statistically different from each other. The stress value for the 8-mm post group was statistically higher than that the 4-mm post group. The predominant type of fracture in the 8-mm post group was coronal fracture (93% of cases). Fractures involving the root occurred in 46% of cases in the 12-mm and 4-mm post groups.

**Conclusions:** “The post length influenced the fracture resistance of prosthetically restored roots.”

**Reviewer's Comments:** This study provides useful laboratory information about the fracture behavior of teeth restored with fiberglass posts. The results indicate that teeth can have fiberglass posts that are needlessly long. The fracture strength of teeth with the longer 12-mm long posts was not significantly improved over that of the 8-mm posts. Since the root is weakened by increasing the length and size of the post space, there are disadvantages to excessively long posts (more root fracture and less gutta percha to seal the apical area). Some caution in interpreting laboratory data is warranted. The teeth were loaded to simulate a single, catastrophic fracture event such as trauma or biting into a hard foreign object. The study was not designed for fatigue testing, which simulates the effects of chewing with small forces over thousands of cycles until fracture occurs. (Reviewer-Charles B. Hermesch, DMD).

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Keywords: Fiberglass Posts, Fracture Resistance

Print Tag: Refer to original journal article
Objective: To evaluate the immediate postoperative structural integrity and fracture mode of composite and ceramic crowns fabricated using CAD/CAM with minimal preparation designs.

Methods: 2 restorative materials were tested in this study: Paradigm MZ100 (a composite) and ProCAD (a leucite-reinforced glass ceramic). Forty maxillary first molar teeth were mounted in die stone and randomly assigned to 4 groups. In 2 groups, the teeth were prepared in the traditional manner for crowns (ie, 1.5-mm shoulder margin and 2-mm occlusal reduction, etc). Minimal preparations were done in the other 2 groups. For the composite, these involved a 0.4-mm chamfer margin and a 0.6-mm occlusal reduction. For the ceramic, the margin was a 0.8-mm rounded shoulder, and the occlusal reduction was 1.2 mm. Crowns were fabricated using the CEREC 3D CAD/CAM system. The composite crowns were bonded to the teeth using RelyX Unicem self-adhesive resin cement. The ceramic crowns were etched with hydrofluoric acid, silanated, and bonded to the teeth using the Syntac etch-and-rinse adhesive system and Variolink II resin cement. To test the fracture strength, the crowns were loaded to failure in a universal testing machine. The mode of failure was classified on a 5-point scale, ranging from minimal fracture or cracks in the crown to severe fracture of the tooth or crown.

Results: The mean fracture strengths of the composite crowns were 1682 N for the traditional crowns and 1751 N for the minimal pre-crowns. For the ceramic material, the respective fracture strengths were 1512 N and 1837 N. The differences for each material were not statistically significant. Fracture modes did not vary by type of preparation.

Conclusions: Minimally prepared resin-bonded CAD/CAM crowns have fracture strengths and fracture modes similar to those of crowns bonded to traditional preparations.

Reviewer's Comments: This interesting study suggests that bonded composite or ceramic crowns fabricated by CAD/CAM are very strong, even when the tooth has been prepared to a lesser extent than recommended. However, this is only a single study, and a laboratory one at that. Until more evidence is available to confirm these results, clinicians are best advised to follow the manufacturer’s recommendations when preparing teeth for these types of restorations. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: CAD/CAM, Crown Preparations, Fracture Strength

Print Tag: Refer to original journal article
Reattachment of Fractured Coronal Segments Is Valuable Procedure


Pusman E, Cehreli ZC, et al:

Dent Traumatol 2010; 26 (February): 9-15

The use of grooves may improve the fracture strength of a reattached segment of a fractured incisor.

Objective: To compare the fracture strengths of the incisal edges of mandibular incisors repaired by 3 different reattachment methods and 5 different adhesive systems.

Design: Laboratory study.

Methods: The researchers collected 350 mandibular incisors extracted from patients with advanced periodontal disease. The crowns of the teeth were fractured in a universal testing machine by loading the teeth perpendicular to the labial surface to simulate a tooth receiving trauma. The fractured portion of each tooth's crown was reattached via 1 of 3 protocols: (1) simple reattachment by bonding the fractured coronal fragment to the matching tooth; (2) over-contour preparation in which protocol #1 was followed by a double-bevel placed at the fracture line and restored with a slightly over-contoured composite resin restoration; or (3) internal dentin groove in which a 1-mm wide and 1-mm deep groove was prepped within both the fractured segment and the matching tooth. Composite resin was bonded in the grooves, and the fractured segment was positioned to the matching tooth and light cured. Within each of the 3 reattachment protocols, there were subgroups of 5 different adhesive systems: Prime&Bond NT, Adper Single Bond 2, Adper Prompt L-Pop, Clearfil S3 Bond, and G-Bond. One hybrid resin composite (Z250) was used in the study. After thermocycling, the teeth were again loaded to fracture in a testing machine.

Results/Conclusions: The reattachment fracture strength was reported as a percentage of each tooth's original fracture strength. The overall mean reattachment strength was 54% with the internal dentin groove protocol, 49% with the over-contour restoration protocol, and 32% with the simple reattachment protocol. The 3 protocols were statistically different from each other. With the internal dentin groove protocol, the use of Prime&Bond NT, Clearfil S3 Bond, and G-Bond yields significantly higher fracture strengths than Adper Single Bond 2 and Adper Prompt L-Pop.

Reviewer's Comments: This study shows that, with fragment reattachment, the overall percentage of recovery of the tooth's original strength ranged from 32% to 54%. These numbers are helpful in telling patients what to expect with a reattachment procedure on an incisor. The percentage of recovery is modest and should temper patient expectations. Nevertheless, reattachment of fractured coronal segments is a valuable procedure, particularly in preteen and teenage patients in whom it is desirable to postpone doing a crown. Laboratory studies such as this do not always simulate the real world and should be interpreted with some caution. (Reviewer-Charles B. Hermesch, DMD).

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Keywords: Tooth Fracture, Reattachment

Print Tag: Refer to original journal article
Fiber posts are weakened by water storage, but it may not be clinically significant.

**Background:** Water absorption adversely affects resin composites, but does that happen with fiber posts?  

**Objective:** To determine if fiber posts suffer from water absorption.  

**Methods:** DT Light Post, GC Post, and FRC Postec Plus were tested. Samples were soaked for 6 and 12 months in saline, mineral oil, or inside a root canal (but not bonded to the canal walls) immersed in saline.  

**Results:** Flexural strength of all 3 brands was unchanged from controls when the post was inside a root canal. Water storage had a large adverse effect on all 3 brands, with a reduction in flexural strength of approximately 40% for all 3 brands of posts.  

**Conclusions:** It is clear that water damages the posts with about 35% loss of flexural strength after 6 months and loss of another 5% between 6 and 12 months. When placed in the root canal space, this loss of strength does not occur.  

**Reviewer's Comments:** Gold posts, RPD framework metal posts, and stainless steel posts never showed much adverse effect from time in the mouth. Work hardening fracture of the post is the most common reason for post failure. This paper had 2 outcomes I did not predict. First, I really did not expect that water would have such a large effect on flexural strength. Second, I had no expectation that sitting passively in the root canal space would prevent the adverse effects of the water from occurring. The bottom line for this work is that it was "interesting" but probably not clinically important. We have a lot of clinical trials with fiber posts, and they are performing equally to metal posts. At times, the fiber posts are doing better than metal. If the fiber posts lose flexural strength in the mouth, they still appear to be strong enough to serve the patient well. Another interpretation is that, from a clinical perspective, there may be no significant difference in a flexural strength of 940 and 503 MPa. The numbers look different, but 503 MPa is more than we need, and 940 is overkill.  

(Reviewer-J.D. Overton, DDS).