

## Retention for Class V Restorations?

### *Two-Year Clinical Effectiveness of Adhesives and Retention Form on Resin Composite Restorations of Non-Carious Cervical Lesions.*

Kim S-Y, Lee K-W, et al:

Oper Dent 2009; 34 (September-October): 507-515

Restorations of non-carious cervical lesions that incorporated mechanical retention form had less marginal discoloration than those placed without retention form.

**Objective:** To evaluate the clinical effectiveness of 3 resin-based adhesives in restoration of non-carious cervical lesions with or without retention form.

**Participants/Methods:** 39 patients who needed at least 2 cervical restorations in premolars were enrolled in the study. The total number of restorations placed was 150, divided into 6 equal groups based on type of adhesive used and presence or absence of retention form. Adhesives used were the 3-step etch-and-rinse material Scotchbond Multi-Purpose (MP), the all-in-1 material Adper Prompt, and an experimental 1-bottle adhesive. All restorations were done using the same hybrid composite. For restorations that had retention form, the occlusal enamel margin was beveled (0.5 mm) with a fine diamond. Also, a gingival retention groove and occlusal retention coves were prepared in the dentin using a #1/4 round bur. Restorations were evaluated blindly by 2 independent evaluators at baseline and 6, 12, and 24 months. A modified USPHS scale, including the typical criteria of retention, marginal adaptation, marginal discoloration, etc, was used.

**Results:** >80% of restorations were available for evaluation at the 2-year recall. The retention rate for Adper Prompt was 100%, regardless of retention form. For Scotchbond MP, the retention rate without retention form was 100%, which was slightly but not significantly less for restorations with retention form. For experimental material, the retention rate was 100.0% for restorations with retention form and only 71.4% (a significant difference) for those without. For all 3 adhesives, marginal discoloration was less common in restorations with retention form than in those without. The marginal adaptation of Scotchbond MP was significantly better than that of Adper Prompt.

**Conclusions:** Restorations of non-carious cervical lesions that incorporated mechanical retention form had less marginal discoloration than those placed without retention form.

**Reviewer's Comments:** I am not entirely sure what to make of this study. For example, I would have expected poorer performance from the Prompt material, particularly in the non-retentive group. However, the study does show that mechanical retention has some value. It significantly improved the retention of restorations placed using 1 of the adhesives, and it significantly improved the resistance to marginal staining of all 3. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Adhesives, Resin Composite Restorations, Non-Carious Cervical Lesions, Clinical Trial

Print Tag: Refer to original journal article

## Bioerodible Fluoridated Resin Improves Remineralization

*In Vitro Remineralization Associated With a Bioerodible Fluoridated Resin and a Fluoride Varnish.*

Lin R, Hildebrand T, Donly KJ:

Am J Dent 2009; 22 (August): 203-205

In the lab, bioerodible fluoridated resin was superior to fluoride varnish for remineralization.

**Objective:** To determine if new materials offer superior remineralization of enamel.

**Methods:** 36 extracted human premolars were coated with an acid-protective varnish with the exception of the test enamel. The teeth were suspended in an artificial caries solution, then sectioned in the demineralized area. Photographs were taken of the sections with polarized light microscopy, and sections were returned to the natural position of the tooth from which the section was removed. Twelve samples were treated with Duraflor fluoride varnish and 12 with an experimental bioerodible fluoridated resin. The remaining 12 were controls. Samples were placed in separate vials containing artificial saliva that was changed every 48 hours. Teeth were brushed for 1 minute each day with deionized water.

**Results:** After 30 days, the bioerodible fluoridated resin had 44% remineralization, while the fluoride varnish had 19% and the control had 2%.

**Reviewer's Comments:** While there are unanswered questions about the optimum frequency for fluoride varnish (once a month, 3 times a year, once a week for multiple weeks, etc), it is proven technology for clinical remineralization of enamel. I am uncertain about a lot of the test design used in this research project (vials of artificial saliva changed every 2 days, brushing with deionized water, etc). Will the bioerodible fluoridated resin have a disgusting taste or soak up pigment from red wine, or attract blobs of plaque when used intraorally? Probably not. What we, of course, need is a randomized controlled trial of high caries risk patients treated with either fluoride varnish or bioerodible fluoridated resin for 3 or 4 treatments in 3 or 4 months and then followed for 24 months to determine if there is a clinical difference in enamel loss or even better evidence of remineralization of enamel identified on bitewing radiographs. (Reviewer-J.D. Overton, DDS).

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Keywords: Remineralization, Bioerodible Fluoridated Resin, Fluoride Varnish

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## Diabetic Patients Can Be Successfully Treated With Implants

*Dental Implants in the Diabetic Patient: Systemic and Rehabilitative Considerations.*

Michaeli E, Weinberg I, Nahlieli O:

Quintessence Int 2009; 40 (September): 639-645

In diabetic patients receiving dental implants, the rate of healing is correlated with the severity and duration of the disease.

**Background:** Dental implant placement has become routine for replacement of missing teeth. However, health problems can comprise or contraindicate implant placement. Diabetes leads to greater tooth loss and can compromise the success of implants. Studies assessing implant success in diabetic patients demonstrate mixed success rates.

**Objective:** To review the disease of diabetes and rehabilitative factors to be considered prior to placing implants. **Summary:** Diabetes is the third highest cause of disability and morbidity in the Western world. There are 4 types of diabetes mellitus. Type 1 presents at an early age. Type 2 has late onset. Types 3 and 4 result from diseases/medications and gestational causes, respectively. Treatment goals involve control of blood glucose to minimize complications using lifestyle modifications and medications. Systemic complications include coronary and arterial disease, delayed wound healing, susceptibility to infection, and organ complications of retinopathy, nephropathy, and neuropathy. Oral complications include periodontitis and caries, xerostomia, opportunistic infections, and "burning mouth" syndrome. Studies show diabetes interferes with wound healing around implant sites. There is reduction in rates of bone-to-implant contact during healing. This correlates with the duration and severity of hyperglycemia. There are both reversible and irreversible interactions with glucose metabolites. The process forms advanced glycosylation end products (AGEs). These AGEs cause extracellular matrix component alteration and disturb cell adhesion, growth, and matrix accumulation. Hyperglycemia reduces clot quality by interfering with the protein involved in the process. Osteoclasts are fewer and less effective in absorbing bone surrounding the implant, and the bone formation and mineralization initiated by osteoblasts mediator proteins are reduced. Ultimately, bone remodeling achieves osseointegration but at a delayed rate. Important systemic factors include severity of the disease (type 1 presents the greatest concern), disease duration (longer duration allows more damage), and degree to which the disease is controlled (need for insulin control indicates more advanced diabetes). Good glucose control should be achieved before implant placement. Treatment of existing oral infections helps improve glucose control. Monitoring of systemic complications help measure the severity of the diabetes. History of impaired wound healing serves as warning of possible complications. Bone remodeling around implants is slower, so an additional 4 to 8 weeks delay beyond that expected for non-diabetic patients is needed before implant exposure is done.

**Conclusions:** Literature on implant success rates in diabetic patients is limited. More long-term studies relating disease severity to the implant design and subsequent restoration type are needed.

**Reviewer's Comments:** While disease control for diabetic patients has improved greatly over time, the disease still creates potential for significant problems. Certainly, a thorough medical history and careful assessment to determine the severity of disease is critical to planning and then providing implants for the patient. Patients must understand possible complications. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: Diabetes, Tissue Integration, Healing Around Implants

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## Have Pulp Capping Decisions to Make and Need Guidance?

*Keys to Clinical Success With Pulp Capping: A Review of the Literature.*

Hilton TJ:

Oper Dent 2009; 34 (September-October): 615-625

This review of the literature provides evidence-based recommendations to guide clinicians in decision-making about pulp capping procedures.

**Objective:** To review the literature on pulp capping. **Summary:** The literature review began with searches of the PubMed and Ovid databases for papers that contained information on such terms as "pulp capping," "sealed dental caries," etc. Drawing definitive conclusions from the pulp capping literature is made difficult by several inherent challenges. The first such challenge is that clinical pulp capping studies rarely reflect clinical reality. For example, studies frequently involve young patients with premolars being extracted for orthodontic reasons. Also, histologic pulp status cannot be determined by clinical signs and symptoms. In addition, outcomes in animal studies are not necessarily predictive of outcomes in humans. One of the crucial basic principles of pulp capping is that a well-sealed restoration is key to survival of the pulp after capping. The review covers both indirect and direct pulp capping. In regard to indirect pulp capping, several studies have shown that restored teeth with partial caries removal have equal success to those with complete caries removal. Also, in removing deep caries, partial caries removal significantly reduces the risk of pulp exposure. In regard to direct pulp capping, a number of factors have been identified as having an effect on success (including need for a well-sealed restoration). One key factor is control of bleeding with water, saline solution, sodium hypochlorite, or some other agent (but not ferric sulfate). A number of materials have been used or proposed as direct pulp capping agents. Calcium hydroxide has a long-term record of success. Mineral trioxide aggregate is a promising material but cannot match the track record of calcium hydroxide, at least not yet. Zinc oxide eugenol, glass ionomer, and resin-based adhesives are poor direct pulp capping agents.

**Conclusions:** This review of the literature provides evidence-based recommendations to guide clinicians in decision-making about pulp capping procedures.

**Reviewer's Comments:** This is a thorough and excellent review of the literature that provides valuable clinical information based on solid scientific evidence. It presents good evidence for partial caries removal in some situations and good recommendations for direct pulp capping methods. Key factors in direct pulp capping are hemorrhage control and use of an appropriate capping material. Current evidence continues to support calcium hydroxide as the gold standard for capping. In all cases, the importance of a well-sealed restoration cannot be overstated. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Pulp Capping, Success

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## Self-Cured Composite May Not Work With Your Bonding Agent

*Dentin Bonding of an Etch-and-Rinse Adhesive Using Self- and Light-Cured Composites.*

Walter R, Swift EJ Jr, et al:

Am J Dent 2009; 22 (August): 215-218

Chemically cured composites are not compatible with some bonding agents.

**Background:** Compatibility problems have been confirmed with select no-rinse bonding agents and chemically cured resin composites.

**Objective:** To determine if there compatibility problems with etch-and-rinse bonding agents.

**Methods:** 160 extracted bovine teeth were flattened to create superficial dentin surfaces for bonding. A new brand of bonding agent, MPa Direct, was compared to some familiar bonding agents. Shear bond testing was performed. *Results with light cure composite:* MPa Direct and OptiBond Solo Plus were similar. These were more retentive than Adper Single Bond Plus, One-Step Plus, and Prime & Bond NT. *Results with self-cured composite:* Prime & Bond NT had zero bond strength. The other 4 brands tested were statistically similar and significantly less well bonded than with the light cured composite. *Results with self-cured composite after the oxygen-inhibited layer was removed with a foam mini-sponge saturated with ethanol:* MPa Direct was better than either OptiBond Solo Plus or Prime & Bond NT, which were statistically similar. These 3 were all better after cleaning with ethanol than without the ethanol wipe. Adper Single Bond Plus and One-Step Plus were not tested in this arm of the study. *Results with self-cured plus the bonding agent chemical activator:* OptiBond Solo Plus and Prime & Bond NT were the only materials tested in this arm. Results were improved but were not very impressive.

**Reviewer's Comments:** I thought that only select no-wash bonding systems had compatibility problems with chemically cured core build-up materials. I did a literature search and found that some fourth- and fifth-generation bonding agents are in the same bad boat. It led me to question if we were certain that the core material we have for our students works well with the dentin bonding system we supply. In the current study, I thought it was interesting that if the adhesive surface after light curing was then cleaned with ethanol then bonds got a little better. It appears the most dependable plan would be to select directly compatible systems rather than count on the ethanol wipe. I confess that, for right now, I never use chemically cured composite for my cores at all. I find I can place light cured composite to crown preparation contours in the same amount of time without any worries about bond compatibility. The marketing guys must be very proud of getting the patent on "MPa" for their proprietary brand name of MPa Direct. "Megapascals" will never be the same. (Reviewer- J.D. Overton, DDS).

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Keywords: Bonding, Dentin, Etch-and-Rinse, Self-Cured Composite

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## Fluoride-Containing Adhesives May Result in More Durable Dentin Bonds

*Fluoride-Containing Adhesive: Durability on Dentin Bonding.*

Shinohara MS, De Goes MF, et al:

Dent Mater 2009; 25 (November): 1383-1391

Fluoride-containing adhesive for dentin bonding demonstrates improvement over traditional adhesives.

**Background:** A persistent problem with composite resin restorations is prevention of marginal microleakage and gap formation. Adhesive materials that have antibacterial properties and/or contain fluoride have been suggested in order to reduce the impact of recurrent caries. It is not well understood how these materials perform relative to bond strength and caries inhibition.

**Objective:** To evaluate the influence of a fluoride-containing adhesive on bond strength and degree of conversion, as well as caries inhibition performance after long-term water storage.

**Methods:** 30 human third molars were obtained and sectioned to expose a flat dentin surface and ground to form a standardized smear layer. The teeth were randomly distributed to 6 experimental groups. All specimens were etched, rinsed, and treated with a dentin primer from Scotchbond Multi-Purpose Plus (SBMP) and then with 1 of 3 adhesives: Scotchbond Multi-Purpose Plus, Clearfil SE Bond, or the fluoride-containing Clearfil Protect Bond. The adhesive application was followed by a resin composite, Filtek Z-250. Specimens were then stored in 37°C water for 24 hours or 3 months. Specimens were then sectioned and subjected to microtensile bond strength testing. Fractured samples were examined under scanning electron microscope to determine failure mode. Other sections of specimens were subjected to an artificial caries challenge and examined under polarized light microscopy. Specimens were also examined for degree of conversion.

**Results:** The 24-hour bond strengths were higher with the SBMP and the SE bond than the Protect Bond. The 3-month studies showed lower bond strengths for SBMP, stable bond strengths for SE, and significant improvement with the Protect Bond to yield the best overall bond strength. The 24-hour Protect Bond samples showed partial failure in the adhesive resin versus mixed failures in all other samples. Only Protect Bond specimens demonstrated an inhibition zone around the restoration when subjected to an artificial challenge using a demineralization solution. When the degree of conversion over time was examined, only the Protect Bond showed a significant increase between 24 hours and 1 month.

**Conclusions:** The fluoride-containing adhesive demonstrated increasing bond strengths over a 3-month period, possibly due to fluoride at the base of the hybrid layer decreasing the permeability of dentin and thus reducing bond degradation observed with other adhesives. This adhesive also demonstrated formation of a caries inhibition area adjacent to the restoration, as well as a continued improvement in the degree of conversion over a 1-month period.

**Reviewer's Comments:** This study demonstrates several attractive attributes of a fluoride-containing dental adhesive with no apparent reduction in bond performance. This could address some of the continued clinical deficiencies with composite restorations. As always, a clinical study would be welcome. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Dentin, Adhesive, Fluoride, Bond Longevity

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## Can Endodontically Treated Teeth Receive Veneers?

*Fracture Resistance and Deflection of Pulpless Anterior Teeth Restored With Composite or Porcelain Veneers.*

D'Arcangelo C, De Angelis F, et al:

J Endod 2010; 36 (January): 153-156

Porcelain and composite resin veneers may be an acceptable treatment option for root canal-treated teeth.

**Objective:** To evaluate the influence of indirect composite resin and porcelain veneers on fracture resistance and deflection of endodontically treated teeth.

**Methods:** 120 extracted human maxillary central incisors with similar dimensions were selected. The teeth were randomly divided into 1 control (intact teeth) and 7 experimental groups. The experimental groups were as follow: VP, veneer preparation only; CRV, composite resin veneer; E-CRV, endodontic therapy and composite resin veneer; E-FP-CRV, endodontic therapy, fiber post, and composite resin veneer; PV, porcelain veneer; E-PV, endodontic therapy and porcelain veneer; and E-FP-PV, endodontic therapy, fiber post, and porcelain veneer. Veneer preparations were standardized as follows: 0.5 mm facial reduction, 2.0 mm incisal reduction, and 0.5 to 1.0 mm interproximal reduction. Preparations had butt-joint margins, no sharp line angles, and cervical margin placed 1 mm incisal to the cemento-enamel junction. The composite resin used was Enamel Plus HRi (Micerium, Italy) and the feldspathic ceramic used was Omega 900 (VITA). Composite resin and porcelain veneers were air-abraded with 50  $\mu\text{m}$   $\text{Al}_2\text{O}_3$  and bonded with a 2-step etch-and-rinse adhesive (EnaBond, Micerium) and Enamel Plus HRi previously warmed up to 36°C. Porcelain veneers were also conditioned with 9.5% hydrofluoric acid for 90 seconds and silanated prior to bonding. The same composite resin used in the previous groups was used to restore pulp chambers in groups without fiber posts. Endodontically treated teeth had root canals enlarged to size 25 and filled with gutta-percha and endodontic sealer. Endo Light-Posts size 2 were bonded using XP Bond (Dentsply) and SelfCure Activator (Dentsply), with FluoroCore 2 (Dentsply) as the luting agent. The teeth were thermocycled and then submitted to fracture strength tests. The load was applied at 45° to the long axis of the teeth between the middle and cervical thirds on the palatal surface.

**Results:** Teeth that had veneers bonded showed the highest fracture strength. Those were higher than the control, VP, E-CRV, and E-PV. Groups with fiber posts showed intermediate values that did not differ from PV. Teeth prepared only for veneers showed the highest deflection values. No differences in deflection were noticed among other groups.

**Conclusions:** Veneer restorations seem to be a good treatment alternative for endodontically treated teeth, taken into account the remaining sound tooth structure.

**Reviewer's Comments:** Deflection of teeth prepared for veneers and not restored probably varies according to the amount of tooth structure removed. That can be explained by the modulus of elasticity of dentin being much higher than that of enamel. Endodontically treated teeth might benefit from placement of fiber posts, but this topic is greatly controversial. In summary, veneer restorations may be considered for endodontically treated teeth with intra-enamel preparations. (Reviewer-Ricardo Walter, DDS).

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Keywords: Composite Resin, Porcelain Veneers, Pulpless Anterior Teeth, Fracture, Deflection

Print Tag: Refer to original journal article

## Five Years of Porcelain Veneers -- Looking Good!

*Five-Year Clinical Evaluation of 300 Teeth Restored With Porcelain Laminate Veneers Using Total-Etch and a Modified Self-Etch Adhesive System.*

Aykor A, Ozel E:

Oper Dent 2009; 34 (September-October): 516-523

Porcelain veneers in this study provided successful clinical performance during the 5-year evaluation period, regardless of whether they were bonded using an etch-and-rinse or modified self-etch technique.

**Objective:** To compare the clinical performance of porcelain veneers luted with hybrid composite in combination with etch-and-rinse and modified self-etch adhesive systems.

**Participants/Methods:** 30 patients, each with 10 maxillary porcelain veneers, were included. Veneer preparations removed 0.75 mm of facial enamel, included butt-joint incisal edges, and were supragingival. Veneers were fabricated using IPS Empress 2, which was sandblasted, etched with hydrofluoric acid, and silanated. Veneers were bonded with Z100 composite resin. In 1 group (15 patients, 150 veneers), Scotchbond Multi-Purpose Plus adhesive was used; this system includes 35% phosphoric acid etchant, a primer, and a bonding agent. In the other group, enamel cavosurface margins were etched with 35% phosphoric acid. The AdheSE self-etch primer system was applied to enamel and any exposed dentin. One investigator performed evaluations at baseline, and at 1-, 2-, and 5-year recalls. Veneers were assessed according to modified USPHS criteria including marginal adaptation, marginal discoloration, gingival tissue response, etc.

**Results:** All veneers were evaluated at each recall period. In the etch-and-rinse group, only a couple of veneers received Bravo scores for marginal adaptation (indicating a crevice that could be penetrated by an explorer) or marginal discoloration at 5 years. Other criteria such as patient satisfaction and tissue response were excellent. Results were essentially identical in the modified self-etch group.

**Conclusions:** Porcelain veneers provided successful clinical performance during the 5-year evaluation period, regardless of whether they were bonded using an etch-and-rinse or modified self-etch technique.

**Reviewer's Comments:** The similar performance of the etch-and-rinse and modified self-etch adhesive systems in this study is not at all surprising, given that the "modification" was enamel etching with phosphoric acid. One of the keys to porcelain veneer durability is presence of adequate enamel and proper etching of that enamel. Several clinical studies of porcelain veneers have been reported in recent years and, like this one, have reported very good clinical performance. One interesting aspect of this study is that it used a highly filled restorative composite to bond the veneers, a technique that has been advocated by experts such as Dr Mark Friedman. The observed excellent marginal adaptation and stain resistance might be attributed at least partly to use of this composite as the luting medium. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Porcelain Laminate Veneers, Adhesives, Clinical Trial

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## Do You Hear, 'Can You Just Fill It?'

*Success With Composites in the "New Economy".*

Goldstein MB:

Dent Today 2009; 28 (November): 132-135

For patients who want to replace old amalgams with resin composites instead of placing a crown, a FenderWedge (combination of a wedge and segmental matrix) can be used to prevent rotary abuse of adjacent teeth when removing the amalgam.

**Objective:** To suggest that replacing a quadrant of amalgams with resin composite can be as profitable as doing a single unit crown while staying inside the limits of insurance coverage. **Description of Technique:** Removing old amalgams quickly is easy. The difficult part to do well quickly is placing 4 multi-surface posterior resin composites. The author uses a split dam to keep amalgam debris from getting in the mouth and a FenderWedge to protect the adjacent teeth from rotary abuse while removing amalgams. He cautions that, with this arrangement, removal of the FenderWedge will cause bleeding. A barrel-shaped diamond is used to bevel occlusal surfaces of the preparation. A diode laser is used to cauterize and trough away interdental papilla. The demonstration quadrant has mesial occlusal, mesio-occlusal-distal (MOD), and 2 distal occlusal restorations. All 4 teeth are etched and primed at the same time. The author selected the MOD #19 as the "anchor tooth" that will be done first to establish ideal outlines. MOD #19 is restored without any matrix using A-1 shade to improve depth of cure. The composite is warmed in a Calset Oven (AdDent) to improve flow. Tooth #18 is matrixed with the Composi-Tight Silver Plus ring system, while the Composi-Tight 3D system is used for #20 and #21. Only 1 tooth at a time is matrixed and restored. A fine-tapered flame carbide finishing bur is used to create the "floss groove," which is more commonly called the occlusal embrasure.

**Reviewer's Comments:** The author states in this paper that not all amalgams require replacement. Being old school, I certainly did not see that all 4 restorations in the case presented in the paper were failing at the same moment. A conventional rubber dam (holes for each tooth) would have allowed retraction of the interdental papilla and probably eliminated the need for the laser cautery. Like the author, I am a big advocate for very light-colored resin composite for posterior composites because of a superior depth of cure. While the color may appear too light under my ring flash, in the normal darkness of the mouth, the color is 100% acceptable to my patients. Several clinical trials of bevels on the occlusal surface of posterior composite preparations have come to the same conclusion that occlusal bevels are not indicated. (Reviewer-J.D. Overton, DDS).

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Keywords: Posterior Composite, Fender Wedge

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## Application Techniques for Self-Etch Primers

*Effect of Placement Agitation and Drying Time on Dentin Shear Bond Strength: An In Vivo Study.*

Tewari S, Goel A:

Oper Dent 2009; 34 (September-October): 524-530

Air drying and agitation of Clearfil SE Bond primer can affect dentin bond strengths.

**Objective:** To evaluate the effects of placement agitation and primer drying time on the shear bond strength of a self-etch material to dentin under in vivo conditions.

**Methods:** This study involved 60 premolars scheduled for orthodontic extraction. The entire occlusal surface was flattened using a diamond rotary instrument to a depth of 2 mm beyond the deepest fissure. All teeth were bonded using Clearfil SE Bond, but they were divided into 6 groups based on variations in the primer drying time and application method. The self-etch primer was applied for 20 seconds with or without agitation and was dried with compressed air for 0, 5, or 10 seconds. Occlusal surfaces were restored to the original height with a hybrid composite. Teeth were extracted after 1 week. Shear bond strengths were determined by applying a knife-edge rod to the resin-dentin interface in a universal testing machine.

**Results:** The effects of agitation, drying time, and their interaction were found to be statistically significant. However, the mean shear bond strength in 5 of the 6 groups was similar, at approximately 33 MPa. The only group that was significantly higher used the combination of agitation and a 5-second drying time.

**Conclusions:** Under in vivo conditions, air drying and agitation of Clearfil SE Bond primer can affect dentin bond strengths.

**Reviewer's Comments:** A number of in vitro studies have reported the effects of primer agitation and drying time on bond strengths of self-etch adhesive systems. However, the results have been inconsistent, especially regarding the length of time required for adequate drying. All self-etch primers contain water, so theoretically, it would be important to evaporate the water before applying the second step of the system, the bonding agent. The present study attempted to determine whether either primer agitation or drying time affected adhesion of Clearfil SE Bond. Surprisingly, neither factor generally had any effect. For example, with or without agitation, primer-drying times of 0 and 10 seconds resulted in similar bond strengths. The only exception was the combination of a 5-second drying time and primer agitation, which resulted in a much higher mean bond strength than any other combination. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Dentin Bonding, Self-Etch, Placement Agitation, Drying Time

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## Repair of Existing Composite Restorations Is Viable Option

*A Long-Term Evaluation of Alternative Treatments to Replacement of Resin-Based Composite Restorations: Results of a Seven-Year Study.*

Gordan VV, Garvan CW, et al:

J Am Dent Assoc 2009; 140 (December): 1476-1484

Repair or sealing of an existing composite should be given strong consideration prior to restoration replacement.

**Background:** The most ubiquitous restorative material in current dental practice is composite resin. The longevity of these restorations is commonly limited by marginal breakdown, leakage, secondary caries, and staining. Replacement of the restoration involves significant expense to the patient and potential enlargement of the cavity preparation as well as increased pulpal insult due to instrumentation of dentin. Alternatives to replacement include no treatment, sealing, refinishing, or repair. The clinical longevity of these various options has not been well established in longitudinal studies.

**Objective:** To assess the longevity of various alternatives to replacement of resin-composite restorations, as well as to categorize the main reasons that restorations are diagnosed as defective.

**Design:** Prospective cohort clinical study.

**Participants/Methods:** 37 patients with 88 diagnosed defective restorations were selected. Seven posterior restorations and 81 anterior restorations were included. Patients with severe medical complications, xerostomia, or restorations with defects that presented no option other than replacement were excluded. Restorations were scored prior to assignment according to the modified USPHS criteria. Restorations were assigned to 1 of 5 groups: margin sealing (Delton, Denstply), refinishing, repair of the defective area only, replacement, and observation (no treatment). Repairs and replacements were accomplished using Single Bond and Filtek Z250. Dental students provided care under faculty supervision. Restorations were examined using the same criteria at 6 months, 1 year, 2 years, and 7 years.

**Results:** The primary reasons that restorations were initially diagnosed as defective were marginal discoloration, marginal degradation, and color mismatch. Restorations in all categories demonstrated degradation. Restorations in the refinishing group had a significantly higher degree of degradation in the color match and luster categories. The number of failed restorations after 7 years was 0 in the repair and sealing groups, 18% in the refinishing group, 21% in the replacement cohort, and 23% in the no treatment group.

**Conclusions:** Clinicians most commonly deemed restorations defective due to marginal discoloration and marginal breakdown. Restorations in each experimental cohort demonstrated some degradation over time, with significantly higher failure rates in the refinishing, replacement, and observation groups. This 7-year study provided support for non-replacement restoration treatment strategies, particularly repair and margin sealing.

**Reviewer's Comments:** This study lends strong support to the notion of repairing composite resin restorations when appropriate, as this treatment modality demonstrated good performance over a 7-year time frame, thereby significantly increasing the service life of the initial restoration at a much lower cost and morbidity than replacement. Likewise, sealing of defective margins proved a viable option as well. Both of these options were more successful than observation (no treatment), refinishing, or, surprisingly, even replacement. Attempting these minimally invasive strategies should be strongly considered when an appropriate option. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Resin-Based Composite Restorations, Longevity, Repair, Minimally Invasive Dentistry

Print Tag: Refer to original journal article

## Different Cements May Affect Longevity of Cu-Al Cast Dowels

*Effect of Different Cements on the Biomechanical Behavior of Teeth Restored With Cast Dowel-and-Cores—In Vitro and FEA Analysis.*

Soares CJ, Raposo LH, et al:

J Prosthodont 2009; December 3 (): epub ahead of print

The type of material used to cement Cu-Al dowels influences fracture resistance, failure distribution, and stress pattern of endodontically treated teeth.

**Objective:** To evaluate the effect of different cements on fracture resistance, fracture mode, and stress distribution of single-rooted teeth restored with cast dowel.

**Methods:** Crowns of 40 bovine incisors were sectioned from roots 15 mm from the root apex. Root canals were prepared to a size 50 in association with 1% sodium hypochlorite and obturated with gutta-percha and endodontic sealer. Five millimeters of endodontic filling material were left in the apical third and the root canals were enlarged with a bur that was 1.5 mm in diameter. Treated roots were embedded in resin up to 2 mm below the cemento-enamel junction. The periodontal ligament was simulated with a 0.3-mm thick layer of Impregum F. Specimens were distributed into 4 groups where Cu-Al cast dowels were cemented with conventional glass-ionomer (Ketac CEM); resin-modified glass ionomer (RelyX luting); dual-cured resin cement (RelyX ARC); or zinc phosphate. RelyX ARC was used in conjunction with Scotchbond Multipurpose and light-cured after positioning of the cast dowel. All cements were placed with a lentulo drill. Specimens were mounted in a testing machine and loaded at a 135° angle to the long axis of the tooth at the center of the lingual surface. Representative models of each group were created for 2D finite element analysis (FEA).

**Results:** Fracture resistance values for RelyX ARC were the highest and were statistically different from RelyX luting and zinc phosphate. Those were not different between each other. Ketac CEM showed an intermediate mean that was not statistically different from any group. RelyX luting was the group presenting the highest number of debonding dowels (60%). RelyX ARC and Ketac CEM presented similar failure pattern with 80% of fractures at the cervical third of the root. Zinc phosphate specimens presented the highest number of unfavorable failures with 70% fractures at the cervical third and 20% fractures at the middle third of the roots. FEA showed a similar stress distribution along the dental structure for all groups. Ketac CEM and zinc phosphate showed higher stress levels at the cement line.

**Conclusions:** The type of material used to cement Cu-Al dowels influences fracture resistance, failure distribution, and stress pattern of endodontically treated teeth.

**Reviewer's Comments:** The low fracture resistance values for RelyX luting are in part explained by the high number of dowels displaced before fracture of the specimens. Maybe those values should not have been taken into account in the statistical analysis as there was no fracture. The reason for the high number of debonding in this group is not clear. Results should be carefully interpreted as the fracture resistance values for all groups seem to be higher than the values found clinically. (Reviewer-Ricardo Walter, DDS).

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Keywords: Laboratory Research, Fracture, Dowel, Post, Root Canal, Cement

Print Tag: Refer to original journal article

## Novel Combinations for Resin Composites

*Achieving Excellence Using an Advanced Biomaterial: Part 2.*

Terry DA, Leinfelder KE, Blatz MB:

Dent Today 2009; 28 (November): 69-80

Changing composite techniques might improve performance.

**Case Discussion:** In this report, Dr Terry discusses some of the theoretical advantages to nanohybrid composite resins. He notes that the nanoparticles are more nearly matched to the size of the nanoscopic tooth structure. The size match he suggests would give a boost to clinical performance over time. He presents a Class 1 resin composite preparation and restoration as a demonstration case. He reports that the preparation outline is controlled by the extent of the carious advance with the exception of the need to extend to bring margins beyond the functional occlusal stops. The high C-factor prep places the bonded walls at risk of failure when the resin composite shrinks. To fight bond stresses, he placed Fuji IX glass ionomer as a dentin replacement. He then prepared the walls, used a total etch dentin bonding agent, and incrementally filled the preparation (one enamel wall at a time) with a hybrid composite. The curing light was used in ramp curing mode. The second case involved a non-carious cervical lesion. He determined the etiology to be from a deflective occlusal contact. The novel aspects of his restoration consisted of combining a self-etch adhesive for the dentin and a total etch adhesive for the enamel margins. The sequence was self-etch of dentin, first layer of resin composite, enamel etch, bonding agent, and the remaining resin composite.

**Reviewer's Comments:** Resin composites of any particle size do not actually touch the tooth. The unfilled resin sits in the interface between the tooth and resin composite, so I do not anticipate that matching or mismatching filler sizes in the resin composite will have a clinically significant effect on longevity. We hold conclusive evidence that smaller preparations have better survival than wide preparations, so I am very reluctant to be an advocate for cutting a larger preparation to make certain the centric occlusion stops are not on a restoration margin. The author is very correct that Class 1 composite resins have a high C-factor with more strains on the bonded margins than any other cavity type. Only select bench studies, and no clinical studies to date, have had superior results with ramp curing. Ramp curing is an OK technique provided the final light exposure is sufficient to cure the composite. The theoretical improvement of clinical performance with the use of glass ionomer as a dentin replacement has been tested several times with clinical trials, but once again the performance was not superior to resin composite alone. Dr Terry has done a good job of referencing support for each step he discussed. I happen to read different literature that would lead me to make several choices different from those advocated for in this paper. (Reviewer-J.D. Overton, DDS).

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Keywords: Resin Composite, C-Factor, Abfracture

Print Tag: Refer to original journal article

## Periodontal "Plastic Surgery" Accomplishes More Than Esthetic Results

### *Gingival Augmentation.*

Horowitz RA:

Inside Dent 2009; 5 (October): 60-65

Gingival augmentation promotes better long-term periodontal health.

**Discussion:** Periodontal "plastic" surgery has become an integral part of consideration for good esthetic results as well as preserving the patient's periodontal health. This article discusses structural, maintenance, and cosmetic indications for enhancing the periodontal support around teeth. Patients required a 2-mm zone of keratinized tissue width to establish proper emergence profile and long-term maintenance of bone and gingival levels. Coronal flap repositioning alone has been shown as insufficient to predictably correct gingival recession around implants. Root coverage is often indicated to return the recession around implants. Root coverage is often indicated to return the facial gingival margin to the CEJ. Gingival augmentation success is related to proximal bone location and papilla height. These factors can limit blood supply to the mobilized flap and barrier or graft tissue. Smokers demonstrate more unpredictable root coverage and more gingival recession, likely due to a decrease in vascularity in the site. One gingival augmentation study concluded that smokers had more gingival recession, lower attachment levels, and more postoperative pocketing 2 years post-procedure than non-smokers. Free gingival grafts have been employed in pre-prosthetic surgery, frenum removal, vestibular deepening, and root coverage. Subepithelial connective tissue grafts result in decreased donor site trauma, better color match, and more predictable healing. Root coverage procedures performed with palatal connective tissue are effective, predictable, and have good color match. Allograft tissue can be used when palatal or tuberosity tissue is too thin to serve for a graft. Both autogenous and allograft tissues heal and form keratinized tissue in the recipient site. A key factor in its success is the placement of material between the periosteum or mucosal tissue and exposed root and bone or periosteum. This enables the graft to be stabilized and eliminates space between the graft and target site. It encourages faster perfusion when inserted between 2 blood supplies. When enamel matrix proteins are used in the surgical procedure, root coverage becomes more predictable. One allograft tissue is obtained from amnion tissue. Growth factors appear to enhance speed of healing.

**Conclusions:** Numerous options are available for treating root exposure. Early treatment may prevent furcation involvement and root caries. Biologically active grafts and/or enhancing factors may lead to true regeneration and structural reconstitution. Proper flap management optimizes results of the surgery. Good home care and smoking cessation encourage maintenance of periodontal health of the surgical site.

**Reviewer's Comments:** This article not only outlines the procedures and materials used for augmenting the gingival architecture, it also emphasizes the benefits of doing so. The benefits of better appearance in the esthetic zone, decreased tooth sensitivity, and the possible prevention of furcation involvement and root caries are all excellent reasons for providing this treatment. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: Gingival Architecture, Correction

Print Tag: Refer to original journal article



## Nanohybrid Composites -- Are They Different?

*Nanohybrid Resin Composites: Nanofiller Loaded Materials or Traditional Microhybrid Resins?*

de Moraes RR, Gonçalves LS, et al:

Oper Dent 2009; 34 (September-October): 551-557

This study found that nanohybrid composites generally had properties inferior to those of nanofilled composites but similar or slightly better than those of microhybrids.

**Objective:** To compare the properties of several nanohybrid composites with those of a nanofilled and microhybrid composite.

**Methods:** The nanohybrid composites tested were Concept Advanced, Grandio, Premise, and TPH3. The control materials were Filtek Supreme and Filtek Z250. To characterize the filler particles, unpolymerized resin was dissolved by immersing the composites in acetone and chloroform. The fillers were examined using scanning electron microscopy (SEM) and spectroscopy. Specimens of the materials were fabricated and tested for the properties of diametral tensile strength, toothbrush abrasion, hardness, water sorption, and solubility using standard test methods for each.

**Results:** The elemental composition of Filtek Supreme and Z250 was silica and zirconia. For the nanohybrid composites, the primary elements were barium and silica. The nanohybrid composites contained irregular filler particles. Diametral tensile strengths of Concept Advanced and Premise were lower than those of the other materials. Knoop Hardness (KHN) values varied widely, with Grandio having the highest KHN and Concept Advanced the lowest. Premise had the least toothbrush abrasion and Grandio had the most. Water solubility was similar for all of the materials.

**Conclusions:** Nanohybrid composites generally had properties inferior to those of the nanofilled composite, but similar or slightly better than those of microhybrids.

**Reviewer's Comments:** The authors stated that "under clinical conditions, nanohybrid resin composites may not perform comparable [sic] to nanofilled materials." However, I believe that this conclusion is not supported by their results. The observed differences between materials were generally slight, and even if statistically significant, probably are not clinically significant in most cases. Also, there is no evidence that properties such as diametral tensile strength accurately predict clinical performance. Very few physical properties measured in the laboratory do so, but properties such as fracture toughness and flexural strength would have been better choices. Some of the study's findings are not new. For example, we already know that Filtek Supreme and Z250 contain spherical silica and zirconia filler particles and that the nanohybrids contain barium glass filler particles. Despite the authors' conclusions concerning the potential inferiority of nanohybrid composites, chances are, if you are using a nanohybrid, it's probably a perfectly fine material. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Composite Resins, Physical Properties

Print Tag: Refer to original journal article

## Your Hygienist May Need a Polishing Triage

*Polishing Techniques for Beauty and Longevity.*

Jones T:

Dent Today 2009; 28 (October): 140-143

It is important to do your homework so that you do not inadvertently compromise the esthetically restored smile by using an inappropriate product.

**Discussion:** What should you make certain that your hygienist knows about polishing dental materials? Do you want her to use an abrasive prophy paste on porcelain veneers or anterior resin composites? This manuscript is written by a hygienist as a guideline for both dentists and hygienists about polishing compound choices used in the hygiene room when the patient has esthetic restorations in place. Abrasives are rank ordered with talc at level 1 and diamond at level 10. A second grading system is the relative dentin abrasion (RDA), which offers a useful breakdown with 0 to 70 being low, 70 to 100 medium, 100 to 150 high, and 150 to 250 as harmful. Patients have an expectation that the hygiene visit will include a prophy paste buff of the teeth at the end of the visit. Some of the grits of prophy paste will take the gloss away from porcelain or resin composite restorations. As expected, volume of abrasive, rotational speed of the prophy cup, and the pressure placed on the cup all contribute to the heat generated and volume of surface removed. The author shows a photo series in which the patient has noted staining at the margins of 6-year-old IPS Empress restorations. Proxylt paste coarse (RDA, 83) was used to remove the stain from the margins. Proxylt fine (RDA, 7) was used to restore the glass-like shine to the restorations. Other polish choices suggested were: CPR (ICCare), Softshine (Water Pik), and Nucare (Sunstar Butler). An abrasive-free paste, MI Paste by GC America is recommended to minimize sensitivity after polishing. There is a terrific set of tables in this paper: 1 = Relative Dentin Abrasion, 2 = Ranking System of Mohs as to Hardness Value, 3 = Materials in Dentistry in Relation to Mohs Hardness Values, 4 = Examples of Pastes, and 5 = Examples of Porcelain Polishing Kits.

**Reviewer's Comments:** I have been a little asleep at the wheel on what happens to my restorations in the hygiene room. This was a nice wake up call to work with the team to make certain we are leaving our patients better than we found them. We are consistently careful when working around implants, but that same level of concern needs to exist when cleaning around esthetic restorations. (Reviewer-J.D. Overton, DDS).

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Keywords: Polishing, Abrasive, Composite, Porcelain

Print Tag: Refer to original journal article

## How to Prevent Demineralization Associated With Bleaching

*Influence of Potentially Remineralizing Agents on Bleached Enamel Microhardness.*

Borges AB, Samezima LY, et al:

Oper Dent 2009; 34 (September-October): 593-597

Addition of calcium or fluoride to a hydrogen peroxide bleaching gel has the potential to reverse the demineralization caused by the peroxide gel.

**Objective:** To investigate the effects of a 35% hydrogen peroxide gel on surface and subsurface hardness of enamel when calcium and fluoride are added to the gel.

**Methods:** The crowns of 20 extracted third molars were sectioned into quarters, and the enamel surfaces were polished using 600-, 1200-, and 2400-grit aluminum oxide abrasive papers and 0.4- $\mu$ m alumina polishing paste. The specimens were divided into 4 groups, including an untreated control group. For the test groups, enamel was bleached using a 35.0% hydrogen peroxide gel or the same gel containing either 0.2% sodium fluoride or 0.2% calcium chloride. The bleaching agents were applied in a single 30-minute session, changing the gel every 10 minutes. The pH of each gel was measured and ranged from 6.15 to 6.48. Vickers microhardness of the enamel surfaces was tested using a microhardness tester. Subsurface hardness was determined after sectioning each specimen so that the Vickers hardness test could be done at 25- $\mu$ m intervals at depths up to 125  $\mu$ m.

**Results:** The mean surface hardness of the control group was 370. The mean hardness of the bleached enamel was significantly less at 302. With the fluoride-containing gel, the hardness was 341; it was 402 for the calcium-containing gel. The subsurface hardness values followed a similar pattern and were very similar to the surface hardness values for each treatment.

**Conclusions:** Addition of calcium or fluoride to a hydrogen peroxide bleaching gel has the potential to reverse the demineralization caused by the peroxide gel.

**Reviewer's Comments:** The pH of the 3 bleaching gels in this study was similar, so it is unlikely that the demineralization observed with the 35% hydrogen peroxide gel was caused by its pH. In fact, the pH of all 3 gels was nearly neutral. This is certainly not the first time that enamel demineralization by peroxide has been reported in the literature; in fact, far from it. Fortunately, many studies have shown that this demineralization can be reversed by exposure to saliva. The interesting part of this study is that simple addition of remineralizing agents such as calcium or fluoride has the potential to reduce or reverse demineralization also. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Bleaching, Remineralization

Print Tag: Refer to original journal article

## How to Better Bond Posts

*Compromised Bond Strength After Root Dentin Deproteinization Reversed With Ascorbic Acid.*

de Cunha LF, Furuse AY, et al:

J Endod 2010; 36 (January): 130-134

Ascorbic acid may improve the retention of fiber posts to root canal dentin.

**Objective:** To determine the bond strength of luting agents to sodium hypochlorite (NaOCl)-deproteinized root dentin after ascorbic acid treatment.

**Methods:** 45 extracted bovine incisors were used. Crowns were sectioned 17 mm from the apical end, resulting in 17-mm root specimens. Root canals were instrumented and obturated with gutta-percha and calcium hydroxide sealer (eugenol-free). The cervical third was sealed with glass-ionomer cement and the specimens stored in water at 37°C for 1 week. Post spaces were prepared to a depth of 13 mm and fiber posts were delivered with 3 resin cements after irrigation of the root canal dentin following 3 protocols. Root canals were irrigated with (1) saline for 10 minutes (control); (2) 5.25% NaOCl for 10 minutes; and (3) 5.25% NaOCl for 10 minutes, water, and 10.0% ascorbic acid for 10 minutes. The resin cements used were RelyX Unicem, Single Bond Plus, Clearfil SE Bond and RelyX ARC. The irrigation procedure for Single Bond Plus/RelyX ARC specimens was performed after conditioning the dentin with phosphoric acid. Posts were seated, the resin cements were light-cured, and the roots stored in water at 37°C for 24 hours until testing. Roots were sectioned perpendicular to the long axis of the teeth and the sections subjected to push-out test.

**Results:** Regardless of the resin cement used, bond strength values decreased toward the apical third. Irrigation of the root canal dentin with 5.25% NaOCl decreased bond strengths of all resin cements, which were restored to values similar to those of controls after ascorbic acid irrigation.

**Conclusions:** Ascorbic acid increases bond strength values of deproteinized root canal dentin to values of un-deproteinized dentin.

**Reviewer's Comments:** This manuscript presents an interesting approach for treatment of root canal dentin deproteinized by NaOCl. It would be interesting to compare this approach to other protocols currently in use, such as EDTA treatment after NaOCl. Be aware of the application time and concentration of the NaOCl irrigant in this study. The results presented may not apply to other application times and concentrations of that irrigant. (Reviewer-Ricardo Walter, DDS).

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Keywords: Laboratory Research, Sodium Hypochlorite, Ascorbic Acid, Resin Cement, Fiber Post, Bonding

Print Tag: Refer to original journal article

## Does Modifying Application Method Improve Bonding of All-in-1 Adhesives?

*Effect of Double Layering and Prolonged Application Time on MTBS of Water/Ethanol-Based Self-Etch Adhesives to Dentin.*

Erhardt MC, Osorio R, et al:

Oper Dent 2009; 34 (September-October): 571-577

Chemical composition issues with all-in-1 self-etch adhesives limit their efficacy and are not easily solved by changing the application method.

**Objective:** To determine the effects of increasing the number of coats or extending application times on the microtensile bond strength (MTBS) of self-etch adhesive systems to dentin.

**Methods:** 36 extracted third molars were ground to provide uniform 180-grit occlusal dentin smear layers. The dentin was treated using Clearfil SE Bond, Resulcin AquaPrime, Etch & Prime 3.0, or One-Up Bond F. The first 2 are self-etch primer systems; the latter 2 are all-in-1 self-etch adhesives. Each material was applied to dentin using either its manufacturer's directions, double application of the primer for self-etch primer systems or double application and light-curing of self-etch adhesives, and doubling the primer or adhesive application time. Composite was built up on the bonded surfaces and specimens were sectioned into beams for MTBS testing. Fractured specimens were examined at 40x magnification to determine the mode of failure. Representative specimens were examined using scanning electron microscopy.

**Results:** For Clearfil SE Bond, mean MTBS values ranged from 34.7 to 44.0 MPa, and did not vary significantly based on application method. Bond strengths of the other materials were significantly lower than those of Clearfil, but again generally did not vary with application method. Clearfil had the lowest proportion of adhesive failures.

**Conclusions:** Chemical composition issues with all-in-1 self-etch adhesives limit their efficacy and are not easily solved by changing the application method.

**Reviewer's Comments:** Various studies in the past have reported that bond strengths of adhesives – whether etch-and-rinse or self-etch – might be improved by modifying the application method, for example, by increasing the number of coats or lengthening the dwell time. However, this study found that neither doubling the number of coats nor doubling the application time had much effect on any of the self-etch materials tested. Not surprisingly, Clearfil SE Bond outperformed the 2 all-in-1 adhesives evaluated in this study. Clearfil contains a mildly acidic primer that might facilitate some chemical bonding to dentin. In contrast, the Resulcin system contains a more acidic primer and it performed less well in this study. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Dentin Bonding, Self-Etch, Application Method

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## NaOCl Concentration, Application Influence Dentin Strength

*Effects of Different Exposure Times and Concentrations of Sodium Hypochlorite/Ethylenediaminetetraacetic Acid on the Structural Integrity of Mineralized Dentin.*

Zhang K, Kim YK, et al:

J Endod 2010; 36 (January): 105-109

High concentrations and extended irrigation times of sodium hypochlorite should be avoided to prevent weakening of the tooth.

**Objective:** To evaluate the effects of different sodium hypochlorite (NaOCl)/ethylenediaminetetraacetic acid (EDTA) irrigation regimens on collagen integrity and flexural strength of dentin.

**Methods:** Dentin powder from 60 extracted human third molars was used. The dentin powder was divided into 16 groups of 50 mg each and immersed in 50 mL of 5.25% or 1.3% NaOCl for 10, 20, 30, 60, 120, 180, or 240 minutes. After being filtered, the aliquots were rinsed with 17% EDTA for 2 minutes and processed for Fourier transform infrared (FT-IR). Besides, 1 group was treated with 17% EDTA for 2 minutes without any NaOCl treatment and another was left untreated to serve as a control. In a second experiment, 80 extracted human third molars were used. In total, 160 beams were cut from the same area in each tooth and divided into 16 groups. Beams were treated as described in the previous experiment and tested in flexural strength using a 3-point flexure device.

**Results:** The apatite/collagen ratio (experiment #1) in the 17% EDTA and 120, 180, and 240 minutes of 5.25% NaOCl plus 17% EDTA groups were statistically different from the control group. There was less apatite than intact collagen within the dentin substrate in the EDTA group and more apatite than intact collagen within the dentin substrate in the 5.25% NaOCl/EDTA groups treated for longer times. Flexural strength results were in accordance with FT-IR results. Flexural strength was only affected when 5.25% NaOCl was used as initial irrigant for >60 minutes.

**Conclusions:** The reduction in flexural strength attributed to irrigation with NaOCl is concentration- and time-dependent, and is not associated with the final EDTA irrigant.

**Reviewer's Comments:** The results of this study suggest that prolonged use of high concentrations of NaOCl during endodontic therapy may weaken the tooth resulting in post-treatment coronal or root fracture. The reason for that would be the extensive removal of dentin collagen leaving the tooth more brittle. (Reviewer-Ricardo Walter, DDS).

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Keywords: Laboratory Research, Sodium Hypochlorite, EDTA, Flexural Strength, Dentin

Print Tag: Refer to original journal article



## Is Amalgam Hazardous to Dental Patients?

*The Release of Mercury From Amalgam Restorations and Its Health Effects: A Review.*

Roberts HW, Charlton DG:

Oper Dent 2009; 34 (September-October): 605-614

Although conclusive evidence is lacking that directly correlates amalgam with adverse health effects, clinicians should remain knowledgeable about mercury release from amalgam in order to intelligently address their patients' concerns.

**Objective:** To review the literature on mercury release from dental amalgam and to determine what, if any, hazards it presents to patients. **Summary:** Mercury exists in 3 forms: inorganic, organic, and elemental; these present varying degrees and types of hazards. A number of studies have shown that set dental amalgam releases mercury vapor, but quantification of the amount is difficult. Other studies have found that some of this is absorbed by the body; however, there is no evidence that increased mercury concentrations cause adverse health effects. The most well-known health hazard from mercury exposure is its adverse effects on neural tissue. Mercury can cross the blood/brain barrier and access the brain and central nervous system, resulting in all sorts of neurologic symptoms. However, neurologic testing has revealed no relationship between the presence or number of amalgam restorations and adverse neurologic effects. Similarly, no adverse effect on the immune system has been detected. "Amalgam illness" is the term used to describe a typically self-reported set of conditions attributed to mercury vapor intake from amalgam restorations. Symptoms are typically quite different from those observed with classic mercury toxicity and include fatigue, difficulty in concentrating, muscular pain, and immunologic disorders. One source lists as many as 400 symptoms allegedly associated with amalgam illness. A number of studies suggest that psychological disorders, not mercury, are responsible for these self-reported symptoms.

**Conclusions:** No evidence exists to show that amalgam is a hazard to patients.

**Reviewer's Comments:** The authors describe this paper as being "not all-inclusive" and presenting "only a small portion of the vast published literature on...the health effects of mercury in amalgam restorations." Nevertheless, it is a very nice review of the subject and presents plenty of evidence for the safety of amalgam based on many scientific studies. As the authors point out, amalgam has a long history of being a reliable and cost-effective restorative material. Despite that fact, the future of amalgam is uncertain because of concerns about patient safety and environmental issues. Fortunately, alternative materials have improved and will continue to improve. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Dental Amalgam, Safety

Print Tag: Refer to original journal article

## A Second Look at Tunnel Preparations Is in Order

*Strength of Tunnel-Restored Teeth With Different Materials and Marginal Ridge Height.*

Ji W, Chen Z, Frencken J:

Dent Mater 2009; 25 (November): 1363-1370

If a 2.5-mm marginal ridge dimension can be obtained, a tunnel preparation may be a viable consideration.

**Background:** Use of bonded composite resin has allowed us to consider cavity preparation designs that are significantly more conservative than conventional designs. One controversial preparation design is the tunnel preparation used to treat proximal caries in posterior teeth. Previous studies have demonstrated a higher failure rate of tunnel restorations than conventional class II composite or amalgam restorations. Failures were primarily due to marginal ridge fracture. These failures could be influenced by the height of the remaining marginal ridge and/or the choice of restorative materials.

**Objective:** To examine the strength of tunnel-restored teeth with different marginal ridge heights and contemporary glass-ionomer and composite resin materials.

**Design:** In vitro study.

**Methods:** 130 extracted human premolars were sorted into 3 groups according to their size. After stratification for tooth size, 4 test groups of 30 teeth were assigned. Each test group was further divided into 3 subgroups of 10 teeth each in order to study 3 different marginal ridge heights: 1.5 mm, 2.5 mm, and 3.5 mm. Preparation was accomplished with round burs and a drilling stand to standardize the preparation dimensions. The 4 materials used for the restorations were 2 high-viscosity glass-ionomer materials, a resin-reinforced glass-ionomer, and a giomer. Each combination of preparation dimension and material was examined. After 2 weeks of water storage, the marginal ridge strength was tested using a stepwise dynamic loading procedure in a universal testing machine until fracture. The maximum energy that the marginal ridge could endure was calculated. Unrestored teeth were tested as a control group.

**Results:** For all marginal ridge thicknesses, the strengths of the 2 glass-ionomer materials were statistically lower than the resin reinforced glass-ionomer and the giomer. The giomer demonstrated higher strength than the resin reinforced glass-ionomer at 2.5 and 3.5 mm. At 2.5 mm, the giomer was statistically similar to unrestored teeth.

**Conclusions:** Both remaining marginal ridge height and restorative material demonstrated statistically significant influence on strength. The most favorable combination was a remaining marginal height of 2.5 mm and a giomer material. Glass-ionomer materials demonstrated poorer performance, presumably due to their lower compressive strength. The strength with all materials was reduced at the 3.5-mm marginal ridge height, possibly due to the greater amount of dentin removal necessary to accomplish this preparation dimension.

**Reviewer's Comments:** Tunnel preparations offer a more conservative option and preclude the potential problems in recreating a proper contact. They are controversial in large part to older studies showing a higher rate of marginal ridge fracture. This newer understanding of preparation geometry effects and newer, possibly more appropriate materials suggests that a second look at this technique is warranted, particularly in terms of appropriate preparation geometry. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Tunnel Preparation Failure, Minimally Invasive Dentistry Prognosis

Print Tag: Refer to original journal article