**Background:** As more hydrophilic self-etching bonding agents are developed in an effort to reduce technique sensitivity, concerns have arisen relative to the longevity of the bonds due to water sorption and hydrolysis. The one-bottle systems, in particular, are more hydrophilic, allowing less attention to wet-dry conditions during application. The question is how much this simplified application protocol compromises the long-term performance of these materials.

**Objective:** To investigate the water sorption and solubility of self-etching adhesive systems.

**Design:** In vitro study.

**Methods:** 1 two-step self-etching adhesive (Fluoro Bond II [Shofu]) and 3 one-step adhesives (Absolute 2 [Dentsply], Clearfil Tri-S Bond [Kuraray], Fluoro Bond Shake One [Shofu]) were examined in this study. Each was tested for rate of monomer conversion. Forty microliters of unpolymerized adhesive were placed on pre-weighed slides and then again immediately weighed. The specimens were either placed in a dark room for 60 minutes to allow spontaneous evaporation of solvent or subjected to an air-stream to evaporate the solvents. The specimens were reweighed at 1-minute intervals to measure the quantity of evaporated solvent. Once this time was known, new specimens were created and exposed to an air-stream for 30 minutes and photopolymerized. The specimens were then stored in distilled water, and the water sorption was measured daily for 10 days. Parallel samples were stored in hexadecane (a water-free environment) and measured for sorption daily as controls. Finally the microtensile bond strength of each adhesive was measured on human dentin with adhesive applied according to manufacturer’s instructions. The specimens were stored in water for 24 hours prior to bond testing.

**Results:** All of the one-step adhesives lost 20% to 30% of their weight in the evaporation studies, while the two-step material lost no weight. In the water sorption studies, the sorption was highest for the Absolute 2 followed by Fluoro Bond Shake One, Clearfil 3S, and finally, Fluoro Bond II. The bond strengths were highest for Clearfil 3S, followed by Fluoro Bond II, Shake One, and Absolute 2. There was no correlation between conversion rate and water sorption.

**Conclusions:** One-step self-etching adhesives exhibited higher water sorption and solubility than the two-step adhesive. For this reason, they would be expected to have lower performance over time.

**Reviewer’s Comments:** This is a very technical, in vitro study, and extrapolation of these results to clinical situations is difficult due to the vast difference in experimental design and clinical application. The bond strength portion of this study was done according to normal clinical protocol and represents 24-hour measurements and, therefore, does not speak to longevity. This study does echo others that indicate that adhesives with more simplified application protocols may suffer from reduced performance due to water sorption. Additionally, evaporation of solvents remains important in all adhesives. There remains, no free lunch. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Water Sorption Bond Longevity Self-Etching Adhesives

Print Tag: Refer to original journal article
The high failure rate expected in high C-factor Class I restorations associated with polymerization shrinkage stress is not observed.

**Objective:** To evaluate the durability of posterior composite restorations in Class I cavities with high C-factors.

**Methods:** 90 Class I molar and premolar restorations were placed in matched pairs in 29 patients. For each pair of restorations, 1 was restored using a sandwich technique (base of poly-acid modified composite or compomer) and the other with a standard composite resin technique. The materials used were Prime & Bond 2.1 etch-and-rinse adhesive, Dyract compomer, and TPH composite. The composite was placed and cured in oblique increments. The incremental placement technique included light-activation of composite through the tooth and with direct exposure. Restorative procedures were performed with cotton roll isolation. The treating dentist evaluated all restorations at baseline, at 6 months after placement, and annually for most patients during the following 12 years. At different recalls, 2 other examiners, blinded to restoration type, evaluated the restorations. Modified United States Public Health Service (USPHS) criteria were used in the evaluations, including specific items, such as anatomic form, marginal adaptation, marginal discoloration, surface roughness, color match, and recurrent caries.

**Results:** At 12 years, 76 of the original restorations (38 of each type) were available for evaluation. Nearly all of these were considered acceptable, and the USPHS ratings were largely unchanged from the 6-month recall. The overall performance of the 2 types of restorations was similar.

**Conclusions:** The high failure rate expected in high C-factor Class I restorations associated with polymerization shrinkage and shrinkage stress was not observed.

**Reviewer’s Comments:** The obvious limitation of this study is that all of the restorations were placed by a single dentist. Regardless, it is an interesting study simply because of its duration. Two techniques were used to limit the effects of the C-factor. The composite was placed in increments and was cured using a modified soft-start technique. The oblique increments of composite were activated through the adjacent tooth structure (which reduces the light intensity) and then were final cured by direct light exposure. It is not clear whether either the placement or curing method contributed to restoration durability, however, as bulk placement and high-intensity curing methods were not included in the study as controls. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Posterior Composites, Clinical Trial, C-Factor, Shrinkage Stress, Resin Composite

Print Tag: Refer to original journal article
Objective: To test the effect of stepwise excavation versus direct complete excavation of caries and direct capping versus partial pulpotomy in caries pulpal exposures.

Participants/Methods: In the first trial, stepwise excavation and direct complete excavation were compared. Consecutive patients referred to Danish and Swedish centers were enrolled. Patients had to be ≥18 years of age, have a primary caries lesion involving at least 75% of the dentin, and have a radiodense zone between the caries lesion and the pulp. Prolonged unbearable pain and/or disturbing sleep, no response to cold and electrical tests, attachment loss >5 mm, and apical radiolucency were part of the exclusion criteria. After radiographic evaluation of the lesion, the bulk of the peripheral carious dentin was removed with rotary instruments and further excavated using hand instruments (stepwise excavation group). Soft, wet, and discolored dentin on the pulpal floor was left. Calcium hydroxide (Dycal, Dentsply) was applied over the remaining carious dentin, and the cavity was temporarily restored with glass ionomer (Ketac Molar, 3M ESPE). Lesions were re-entered after 8 to 12 weeks, with the final excavation leaving sound dentin only. Dycal was again applied, and the tooth restored with OptiBond Solo Plus (Kerr) and Herculite XRV (Kerr). Caries excavation in the direct complete excavation group was done until no caries was present. Similar temporary and permanent procedures were performed. Differently, Dycal was not removed when the lesion was re-entered. In case of pulp exposure, the patient was referred to the pulp capping trial. Exclusion criteria for the second trial were prolonged unbearable pain and/or disturbing sleep and draining from the exposed pulp. Pulp exposures were treated with direct pulp capping or pulpotomy. At that time, rubber dam was placed; the tooth was cleaned with alcohol/chlorhexidine and irrigated with sterile saline. Dycal was applied after hemostasis and covered with Ketac Molar. In the second visit, a thin layer of temporary material was left prior to final restoration. When pulpotomy was necessary, 1 to 1.5 mm of pulp tissue was removed using high-speed rotary instruments. Cases were evaluated 1 year later.

Results: 314 patients were included. The stepwise excavation group had a higher proportion of success (74% vs 62%). Pulp exposure happened in 18% of the cases with the stepwise excavation versus 29% of the cases with direct complete excavation. Patients with pretreatment pain and >50 years of age were more likely to have a negative outcome. No other differences were present.

Conclusions: Stepwise excavation is preferable for the management of deep caries lesions.

Reviewer’s Comments: The use of Dycal when no exposure is present and removal of the entire temporary when re-entering the tooth may not be necessary. (Reviewer-Ricardo Walter, DDS, MS)
In this in vitro study, dentin fracture toughness decreased over time when it was exposed to bleaching gel.

**Objective:** To determine whether a correlation exists between bleaching application time and dentin fracture toughness.

**Methods:** Slices of mid-coronal dentin, 1.6- to 2.0-mm thick, were sectioned from extracted human molars. These were shaped into 4.5-mm x 4.6-mm blocks using carbide burs and Sof-Lex discs. Two cylindrical holes were drilled into each specimen to prepare for later mounting in an Instron universal testing machine. Also, a central notch was cut into each specimen to prepare it for later fracture toughness testing. Specimens were assigned into 5 groups for application of 10% carbamide peroxide gel for 0 (control), 54, 168, 252, or 336 hours. For bleaching, the specimens were placed in custom bleaching trays filled with peroxide or placebo gel and were immersed in artificial saliva. After 6 hours, the specimens were removed, the gel was rinsed off, and the process was repeated until the assigned total bleaching time was reached. Following 24 hours in artificial saliva, the specimens were tested for fracture toughness.

**Results:** The fracture toughness of the control group was 3.3 (I am omitting units because they are very complex). For the bleached specimens, the mean fracture toughness values were 3.2, 3.1, 2.3, and 2.4 for 54, 168, 252, and 336 hours contact time, respectively. Statistical analysis revealed that the fracture toughness of dentin exposed to 10% carbamide peroxide for periods of 252 or 336 hours was significantly less than that of the control group or dentin bleached for 84 hours.

**Conclusions:** A significant correlation was found between bleaching time and fracture toughness, with dentin fracture toughness decreasing over time of bleaching.

**Reviewer’s Comments:** At least 1 other study has reported that bleaching can reduce the fracture toughness of dentin. However, I am not aware of any clinical evidence that this reduction in fracture toughness, if it indeed occurs, results in increased chipping, cracking, or fractures. I would like to see this type of study done in a more clinically relevant way. For example, immerse specimens in saliva for 18 hours between the 6-hour bleaching treatments. Also, measure fracture toughness at some later time (eg, 2 to 3 weeks after treatment), which would provide more exposure to saliva. (Reviewer-Erward J. Swift, Jr, DMD, MS).

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Keywords: Bleaching, Dentin, Fracture Toughness

Print Tag: Refer to original journal article
Fiber posts combined with gold onlays appears to improve fracture resistance of restored teeth.

**Background:** Full coverage restorations are generally recommended to protect endodontically treated teeth. This is especially true if ≥1 walls are missing. More conservative treatment using onlays can also provide protection if there are no missing walls. Many preparation designs and materials are used to increase fracture resistance, including gold, all-ceramic, and indirect composite. Fiber-reinforced composite (FRC) posts achieve higher fracture resistance for endodontically treated teeth.

**Objective:** To compare fracture resistance and failure modes of endodontically treated molars restored with different types of onlay restorations and the influence of fiber posts on their performance.

**Methods:** Extracted mandibular molars were treated with gutta percha points and endodontic sealer. After treatment, teeth were coated with a thin layer of impression material to simulate a periodontal ligament and then placed into an acrylic mold. Standardized mesio-occluso-distal (MOD) cavities with a 1.5-mm cusp reduction were prepared. The 60 teeth were divided into subgroups according to whether posts were placed and according to which material was used to treat the specimens. Flowable composite was cured across the pulpal floor in specimens not receiving a post. Specimens were restored with 1 of the following: gold platinum onlays; glass ceramic (Empress I); or micro-filled hybrid composite (Gradia Direct). Composite was cured in layers. The fracture strength of 10 unprepared teeth and 10 prepared, but unrestored, teeth served as controls. The gold and ceramic restorations were luted with dual-cure Calibra resin cement. Specimens were then placed under pressure directed in the tooth’s long axis until fracture.

**Results:** As expected, unprepared teeth had the highest fracture resistance and prepared, unrestored teeth had the lowest. The presence of fiber posts achieved significant improvement in fracture resistance for gold onlay-restored teeth. For all specimens, the presence of posts was associated with a higher percentage of restorable fractures. With gold onlays, supporting tooth structure, rather than the onlay, fractured. The onlays for all-ceramic and composite onlay specimens tended to fail rather than the supporting tooth structure.

**Conclusions:** Fiber posts improved fracture resistance for gold onlay restored teeth but not significantly for ceramic and composite onlay restored teeth. Posts did increase the likelihood of allowing the fractured tooth to be successfully repaired. Restoration of endodontically treated molars with composite and fiber posts achieves clinically acceptable results. Fiber posts combined with gold onlays appear to improve fracture resistance of restored teeth. Fracture resistance of all study combinations was greater than reported chewing load pressures.

**Reviewer’s Comments:** Since fiber posts allow flexion to match that of the tooth, there were fewer root fractures than tended to occur with metal posts. It is not surprising that the gold onlays did not fracture. The study’s real finding is that the fiber posts improved the tooth’s ability to withstand forces. Fiber posts are the treatment of choice. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: Endodontics, Mandibular Molars, Glass Fiber Posts, Failure, Fracture Resistance

Print Tag: Refer to original journal article
No moving, no bending, and no thin needle probably means no needle fracture.

**Background:** The invention of disposable needles, scientific advances in metallurgy, and better training in anesthesia have resulted in significant reduction of needle fractures since the 1960's. Nowadays, fractures occur mainly because of inappropriate technique or choosing the wrong needle.

**Design/Objective:** This article is a literature overview on broken hypodermic needle cases over the past 50 years. Guidelines for treatment and prevention are also suggested.

**Methods:** Several databases were searched for articles in English, French, Dutch, and German. Inclusion criteria were information about needle size, location of the fracture, method of location of the fractured needle, therapeutic measures, and complications.

**Results:** 26 articles published since 1965 fulfilled the inclusion criteria and were all case reports. Forty-five of 64 incidents reported were during inferior alveolar nerve blocks. Twelve incidents occurred in the buccal area (maxilla or mandible), 1 incident was in the lingual mandibular area, and 5 incidents were during intraosseous anesthesia. The cause for the fracture was reported for 7 incidents only. Patients' unexpected movements were considered the cause in 6 of the 7 incidents. Of those, 4 patients were <10 years of age. In 1 case, the dentist made an abrupt movement that resulted in the fracture. In 23 of 34 patients, the fractured needles were 30G and were used for an inferior alveolar nerve block. Three fractures were during infiltration with 30G and 8 fractures were during inferior alveolar nerve blocks using 27G. Conventional x-rays and CT scans (since 2002) were used for location of needle fragments. Forty-seven of 64 fragments were removed within 2 days, 15 fragments were removed from 3 to 1,080 days after the incident, and 2 patients did not have the fragment removed. Infection in the area required removal of 1 of the fragments. Complications were not frequent and included mild trismus and dysphagia. One patient suffered from facial palsy after surgery.

**Conclusions:** Needle fracture occurs due to inadequate technique or the use of thin needles in inferior alveolar nerve blocks.

**Reviewer's Comments:** As the authors discussed, needle fractures are rare, but the number of cases is certainly underestimated in this review, considering the number of unreported cases. Material defect does not seem to be a problem anymore. Precautions to prevent needle fracture include avoiding abrupt movements, avoiding change of syringe angulation, using proper needle (dimension), and avoiding bending the needle prior to penetrating the tissue (especially at the hub). In the event of a fracture, immediate removal is recommended. (Reviewer-Ricardo Walter, DDS, MS).

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Keywords: Needle Fracture, Inferior Alveolar Nerve Block, Infiltration

Print Tag: Refer to original journal article
Nanocomposites Reduce Polymerization Shrinkage

Update on Dental Nanocomposites.

Chen M-H:

J Dent Res 2010; 89 (June): 549-560

Nanocomposites allow for increased filler loading and decreased resin matrix, thus reducing polymerization shrinkage while providing aesthetics and strength.

**Objective:** To review recent studies of the development of dental nanocomposites and their clinical applications.

**Results:** Dental composites contain synthetic polymers, inorganic filler particles, silane coupling agents, initiators, and activators. Most use the Bis-GMA monomer as the organic matrix, but other monomers, such as triethylene glycol dimethacrylate (TEGDMA), urethane dimethacrylate (UDMA), and ethoxylated bisphenol-A-dimethacrylate (Bis-EMA) are used in commercial composites. For example, TEGDMA is used to reduce the high viscosity of Bis-GMA (2,2-bis[4-(2-hydroxy-3-methacryloxypropoxy)phenyl]propane). Fillers such as glass, silica, and quartz improve the physical properties and reduce polymerization shrinkage. Silanes are used to provide a covalent bond between inorganic fillers and the organic matrix. Nanotechnology is defined as the creation of functional materials and structures in the dimension of 0.1 to 100 nm. For dental composites, nanofillers can be prepared by various techniques. Particle packing of nanofillers can increase the filler load of a composite material, reducing its shrinkage and improving its physical properties. The first commercial nanocomposite in dentistry was Filtek Supreme. Supreme contains both dispersed and clustered nanofiller particles of silica and zirconia and has a filler load of 58% to 60% by volume. A second nanocomposite, Premise, incorporates silica nanofillers along with pre-polymerized and barium glass fillers. By volume, its filler loading is 69%. A third nanocomposite, Ceram-X, contains glass filler particles but also contains silica nanofillers and has a unique matrix chemistry. Modification of composites by the addition of specific nanofillers has the potential to improve mechanical properties or deliver ions (e.g., fluoride) to the tooth.

**Conclusions:** Nanocomposites allow for increased filler loading and decreased volume of resin matrix, thus reducing polymerization shrinkage while providing aesthetics and strength.

**Reviewer’s Comments:** The first part of this article is an interesting review of composite chemistry and the characteristics of commercially available nanocomposites. However, the rest of the paper is geared more to researchers with a strong background in chemistry. The authors do mention a potential problem with nanocomposites, stating that a couple of studies have reported a substantial loss of strength with relatively short (2-month) immersion in water. However, I am aware of no clinical studies that have reported any problems that might be related to loss of strength. (Reviewer—Edward J. Swift, Jr, DMD, MS).

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Keywords: Nanocomposites, Clinical Applications, Polymerization

Print Tag: Refer to original journal article
Nanocomposites Show No Loss of Hardness During Tooth Whitening

Effect of Hydrogen Peroxide on Microhardness and Color Change of Resin Nanocomposites.

Kwon YH, Shin D-H, et al:

Am J Dent 2010; 23 (February): 19-22

Tooth whitening does not significantly affect nanocomposites.

Background: Studies examining the effect of whitening agents on resin composites reveal microhardness decreased, surface roughness increased, and a slight color change. These changes are not observed in all studies, however. New nanofilled materials have higher filler content, so the effect of whitening agents may be different.

Objective: To examine the effect of hydrogen peroxide on microhardness and color change of resin nanocomposites. Carbamide peroxide and distilled water were used for comparison.

Methods: The 3 nanocomposites used in the study were: Ceram X (CX); Grandio (GD); and Z350 (Z3). Three different shades of each composite were used. The composite was placed in a mold and cured 40 seconds. After 24 hours in a dark chamber at 37°C, specimens were treated as follows: (1) 15% carbamide peroxide (CP) gel for 7 hours/day followed by 17 hours/day in distilled water (DW); (2) 1 hour/week treatment with 35% hydrogen peroxide plus immersion in DW for the rest of the week; and (3) immersion in DW 24 hours/day. Protocols were continued for 3 weeks under 100% humidity. After 24 hours post-treatment, surface microhardness was measured and compared to microhardness of specimens prior to the treatment. Color was measured prior to treatment and after treatment using a spectrophotometer. Color differences were then calculated.

Results: Each composite demonstrated an 8.1% to 10.7% decrease in microhardness from the original microhardness. GD showed the highest microhardness among the specimens. The 3-week DW treatment resulted in an 8.3% to 11.5% decrease in microhardness. Specimens demonstrated similar microhardness, regardless of test agent used. GD underwent the lowest color change, regardless of shade. CX and Z3 showed a noticeable color change. The slight decrease in surface hardness could be attributed to the water treatment; it does not appear that concentration of the agents was a factor. The tested resin nanocomposites provided color stability or only a slow color change due to hydrogen peroxide. Color stability has also been observed in composites not composed of nanofillers.

Conclusions: Changes in microhardness and color of nanocomposites after treatment with 15% CP and 35% hydrogen peroxide were similar to results of immersing specimens in DW.

Reviewer's Comments: After much laboratory and clinical testing, we know that whitening agents have a minimal effect on resin composites, including the newer nanofilled materials. We can continue to prescribe tooth whitening to our patients without concern about any ill effects for the composite restorations in the mouth. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: Resin Nanocomposites, Hydrogen Peroxide, Microhardness, Color Changes

Print Tag: Refer to original journal article
Background: Flowable composites have reduced filler load and/or an increase in diluent so they will flow more easily than traditional composites. However, they possess less favorable mechanical properties, demonstrate increased wear, and undergo greater polymerization shrinkage.

Objective: To evaluate the 3-year clinical performance and acceptability of 2 flowable composites used as occlusal restorative materials.

Methods: A total of 63 restorations were placed in 23 patients. Patients with unstable occlusion or bruxism were excluded from the study. Measurements of each preparation were made to compare surface areas. Thirty-two Esthet-X Flow and 31 Tetric Flow restorations were placed following manufacturers’ directions. Prime & Bond NT was used as the bonding agent. Recall periods were conducted at baseline and at 3, 6, 12, and 36 months. Restorations were evaluated for retention, color match, marginal adaptation, anatomical form, marginal discoloration, polishability, and secondary caries. Ratings were scored as Alfa (clinically good), Bravo (clinically acceptable), and Charlie (needs replacement).

Results: By the 36-month recall, both Esthet-X Flow and Tetric Flow recorded only 86.2% that were rated as Alfa (good) for color match. Marginal adaptation significantly deteriorated starting at 6 months. By 36 months, only 51.7% of the Tetric Flow restorations and 65.5% of the Esthet-X Flow restorations were rated Alfa. Ratings for polishability began to worsen through the 36 months. There was no significant deterioration in retention, anatomical form, and secondary caries. A correlation was noted between restoration size and the decrease in quality. Larger restorations worsen more rapidly in color match. Overall, there was no significant difference between the 2 materials at 36 months, except for color match. Both materials demonstrated lower quality of the restorations at 3 years, especially for marginal adaptation and polishability. However, the majority of the restorations were still acceptable after 36 months.

Conclusions: Flowable composite resins can function successfully short term as Class I restorations. Long-term success is questionable because these flowable materials deteriorate in a relatively short time. Clinicians should be cautious in using flowable composite resin in Class I situations, except in very narrow preparations.

Reviewer’s Comments: This study clearly points out some shortcomings with flowable composite. Lower filler content/more diluent are what make it more flowable, but they are also what make it less wear resistant and subject to polymerization shrinkage. Flowable composite is a good adjunct to the regular composite we use, but clear understanding of its benefits and its weaknesses is necessary to avoid failure of our restorations. It should be used only in protected areas and, even then, in limited amounts. The potential for better initial marginal adaptation is offset to some degree by greater shrinkage during polymerization. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: Flowable Composites, Clinical Performance

Print Tag: Refer to original journal article
Surface damage due to grinding or alumina particle abrasion could contribute to failure of zirconia restorations by creating fracture initiation sites.

**Objective:** To examine the effects of 2 routinely used surface modification techniques, grinding and alumina abrasion, on the performance of yttria-stabilized tetragonal zirconia polycrystal (Y-TZP) on composite substrates.

**Methods:** Zirconia plates were fabricated from pre-sintered Y-TZP blocks (IPS e.max ZirCAD) using the Cerec InLAB CAD/CAM unit. These were fully sintered in a high temperature furnace according to manufacturer's instructions. The top surface was ground flat and parallel using diamond disks in a grinding machine, with a final thickness of 0.5 mm. The surface was subsequently polished with successive grits to a 1-µm finish. The cementation surfaces of the zirconia plates were either untreated (control), ground with 600-grit diamond disks, or abraded with 50-µm alumina particles. A metal primer was applied in all groups, and the primed ceramic surfaces were bonded to Z100 composite blocks using Panavia 21 resin cement. The bonded specimens were subjected to cyclic loading with application of various stress levels in an electrodynamic testing machine in water. At the end of each load-cycling period, the specimens were inspected for failure using a polarized light microscope. The amount of monoclinic phase after various surface treatments was determined using an x-ray diffractometer (XRD).

**Results:** The single-load-to-failure mean values were 446 N for the control group, 328 N for the ground group, and 315 N for the alumina-abraded group. A Weibull statistical analysis showed that the fatigue reliability of the control group was greater than that of the 2 test groups. Radial cracks on the cementation surface of the zirconia plates were the prevalent mode of failure in the test groups. The amount of phase transformation in the treated groups was relatively small.

**Conclusions:** Surface damage due to grinding or alumina particle abrasion could contribute to failure of zirconia restorations by creating fracture initiation sites.

**Reviewer's Comments:** This study was done by a group that is performing extensive research on dental zirconia ceramics. It is a fairly complex study, but its potential clinical relevance is obvious. The results suggest that mechanical grinding or airborne particle abrasion of intaglio surfaces could create tiny flaws in zirconia that could serve as initiation sites for fractures, eventually causing failure of a restoration. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Zirconia, Strength, Surface Treatment, Fatigue Reliability, Cone Fx

Print Tag: Refer to original journal article
Background: The restoration ability to brace solid tooth structure is crucial when restoring teeth that have suffered significant structure loss. In other words, the extension of the ferrule seems to determine the success of the restoration, if that is the treatment of option.

Design/Objective: This manuscript is a literature review on the ferrule effect that classifies the different clinical presentations of teeth severely damaged. This review also suggests guidelines for treatment of such teeth (only included in audio review).

Methods: The parameters used are not disclosed in the manuscript but this seems to have been a very thorough review of the current literature.

Results: The minimal acceptable ferrule height recommended seems to be 1 mm. Nevertheless, the greater the ferrule, the better the fracture resistance. More than 1 mm seems to be needed in order to prevent fractures. As for the height, the greater the width, the better the outcome. In regard to the number of walls and ferrule location, uniform, all-around ferrule appears to be superior to partial ferrules, which in turn is better than no ferrule at all. While posterior teeth are mainly loaded in an occluso-gingival direction, anterior teeth are loaded non-axially. Lateral forces are more likely to damage the tooth-restoration complex than axial loads. Other factors, such as deep bite situations, parafunctional and dietary habits, and occlusal scheme patterns, should be considered when designing the restoration (ferrule). For instance, a good palatal ferrule may be as effective as an all-around ferrule in a maxillary incisor. Appropriate ferrule is more important than the type of post. In compromised teeth, it might be better to use a bonded rather than a metal post. Cast posts would be another option in such situations. There is no consensus on the topic of core materials. It is believed that resin-based bonded materials are not able to improve the prognosis of structurally compromised teeth. This review also classified the ferrule according to risk. The height and thickness of remaining dentin, as well as the number of remaining walls, were considered. Teeth with all-around walls that are higher than 2 mm and thicker than 1 mm were classified as having no anticipated risk for failure. Teeth where no ferrule can be established were considered nonrestorable.

Conclusions: Ferrule height and width, the number and location of remaining walls, and the degree of lateral load placed on the tooth are important when treatment planning severely compromised teeth.

Reviewer's Comments: Limited literature is available evaluating the ferrule effect clinically. Most of the information in this review is from bench studies. Even so, it gives a good indication of what is needed to be successful. (Reviewer-Ricardo Walter, DDS, MS).

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Keywords: Ferrule, Treatment Planning, Height, Width, Location, Post

Print Tag: Refer to original journal article
A commonly performed aesthetic procedure, bleaching, may be helpful in improving the oral health of special-needs patients.

**Background:** Carbamide peroxide (CP) has been used for many years as a tooth-whitening agent. The positive effect on plaque accumulation and gingival health has been documented in previous studies but is not commonly suggested for this purpose. There is a large special needs population that, for a variety of reasons, is unable to practice sufficient oral hygiene care. These patients are prone to caries and other oral disease that often overwhelm the dentist's best efforts to control the ravages of dental caries. Previous studies have demonstrated that the use of a hydrogen peroxide rinse results in a reduction of gingival and plaque indices in hospital and nursing home patients. One could reason that the higher resulting concentration of hydrogen peroxide and longer contact time with tray delivery could yield better results.

**Objective:** To explore the evidence for use of CP as a means to reduce plaque and caries and to improve gingival health in patients with special care needs.

**Design:** Literature review and position paper.

**Methods:** The literature was reviewed relative to the antibacterial properties of CP, as well as its effects on plaque, gingival health, and caries rate. Application techniques and protocols are reviewed.

**Results:** The literature repeatedly demonstrates the effectiveness of 10% CP on inhibition of bacterial growth, even within carious fissures. In vivo studies have demonstrated a reduction of salivary levels of lactobacillus. The ammonia liberated from CP breakdown has been shown to increase the salivary and plaque pH, with this elevated pH remaining for the 2-hour duration of tray wear. It is important to realize that this elevation in the pH is a product of the CP breakdown and is not noted in hydrogen peroxide alone. These salivary changes, as well as alteration of plaque microflora and debridement provided by the peroxide, have been suggested as the reason that a lower caries rate has been documented in special-needs populations treated with CP. The authors propose that 10% CP delivered by tray be considered in special-care populations as a primary means to improve oral health. A tray constructed with at least several millimeters of gingival coverage will allow access of the bleaching agent to the gingival sulcus. The authors suggest full-arch, dual-arch trays with alginate substitute polyvinyl siloxane to limit gagging and reduce time in special-needs patients.

**Conclusions:** The application of 10% CP can suppress plaque and help in caries control in special-needs populations.

**Reviewer's Comments:** This article does not describe a cosmetic procedure, rather a primary health care use for a commonly performed cosmetic procedure. We have all anecdotally observed improved gingival health among our patients subjected to whitening procedures. This procedure is now suggested as a primary disease control measure in elderly and special-care populations. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Carbamide Peroxide, Special Needs, At-Home Bleaching

Print Tag: Refer to original journal article
Bonding to Primary Teeth -- Evaluating Different Adhesives

Primary Dentin Etching Time, Bond Strength and Ultra-Structure Characterization of Dentin Surfaces.
Osorio R, Aquilera FS, et al:

J Dent 2010; 38 (March): 222-231

Objective: To investigate the effects of reduced conditioning time on roughness, microhardness, and bond strength of 3 adhesives to primary tooth dentin.

Methods: The adhesives evaluated in this study were Single Bond (etch-and-rinse 2-step system), Clearfil SE Bond (self-etch primer), and One-Up Bond F (all-in-one). Each adhesive was used according to the manufacturer's directions and half the recommended conditioning time (eg, etching for 7 seconds as well as the recommended 15 seconds for Single Bond). Sections of primary dentin taken from the crowns of freshly extracted primary teeth were used as the substrate. Surface roughness and microhardness of conditioned specimens were evaluated using atomic force microscopy (AFM) and a Knoop hardness tester, respectively. Microtensile bond strengths (MTBS) were measured using an Instron universal testing machine.

Results: Phosphoric acid etching created the greatest surface roughness and was somewhat higher with the shorter etching time. Clearfil SE Bond primer, which is only mildly acidic, created the least roughness. All of the conditioning steps reduced dentin hardness. Mean MTBS values of the 3 adhesives, using standard and reduced conditioning times, respectively, were 29.4 and 42.0 MPa for Single Bond, 29.3 and 27.4 MPa for Clearfil SE Bond, and 11.7 and 18.0 MPa for One-Up Bond F. Bond failures were adhesive or mixed in nature; no purely cohesive failures were seen.

Conclusions: When bonding to primary dentin, reducing the etching time of Single Bond or the application time of One-Up Bond F is recommended.

Reviewer's Comments: This study is not directly related to "cosmetic dentistry," but it is interesting for clinicians who might frequently or even occasionally place bonded restorations in primary teeth. As the authors point out, manufacturers do not recommend different bonding protocols for permanent and primary teeth, but the latter might respond differently to bonding procedures. Their bond strength results suggest that bonding to primary teeth might be improved by reducing the acid-etching time for etch-and-rinse adhesives or the application time of all-in-one adhesives. Also, the bond strength of the self-etch primer system was not reduced by a shorter primer application. The roughness and microhardness tests of this study probably have little relevance to the clinician. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Dentin Bonding, Primary Teeth

Print Tag: Refer to original journal article
Objective: To compare the effects of 2 dentifrices containing 1450 and 5000 parts per million (ppm) sodium fluoride (NaF) on caries incidence, increment, and progression in adolescents over 2 years.

Design: Prospective, single-blind, randomized, clinical trial.

Participants/Methods: 279 healthy adolescents (aged 14 to 16 years) were randomly assigned to 2 dentifrice treatment groups. The adolescents were caries active and were selected based on having at least ≥5 existing decayed, missing, or filled surfaces in their dentition at the beginning of the study. The assigned toothpastes were Duraphat 5000 ppm F and Pepsodent Superfluor 1450 ppm F, both NaF based. The study site was Varberg, a small Swedish town that has a low level (0.1 ppm) of fluoride in the drinking water. Almost all adolescents in the town receive their regular dental care at one public dental service clinic, and the subjects were recruited from this clinic. Twice-daily brushing with the assigned dentifrice was recommended and encouraged, but all toothbrushing was unsupervised. During the 2-year study, the subjects were examined annually with digital bitewing radiographs and clinically by one dentist who was blind to the dentifrice group assignment. Subjects continued to receive normal preventive services during the study (which included annual fluoride varnish applications); 76% of the adolescents were available for the final 2-year evaluation. At the end of the study, the adolescents completed a written questionnaire rating their compliance with the recommended twice-daily brushing and use of their assigned dentifrice. Based on self-reported use, the researchers considered 90% of subjects as being compliant and 10% as noncompliant with the toothbrushing protocol.

Results: The overall caries incidence (defined as the number of decayed enamel and dentin lesions and filled surfaces) of the 5000 ppm F group was not significantly lower than the 1450 ppm F group (15.18 vs 16.34) after 2 years. The overall caries progression for enamel lesions to dentin lesions during the 2 years was significantly lower in the 5000 ppm F group than in the 1450 ppm F group (1.28 vs 2.13). The overall beneficial treatment effect of the 5000 ppm F toothpaste over the 1450 ppm F toothpaste was 23% for caries incidence and 40% for caries progression.

Reviewer's Comments: This study supports the strategy of using 5000 ppm F dentifrice to reduce the progression of enamel to dentin caries in caries-active adolescents. Dentists know that 5000 ppm F toothpastes are not recommended by the manufacturers for use in children aged <6 years. However, children with high caries risk and with newly erupted teeth are suitable patients for once-daily brushing with 5000 ppm F (NaF) toothpaste. In prescribing the high-fluoride toothpaste for home use, dentists should caution that it be stored safely away from young family members. (Reviewer-Charles B. Hermesch, DMD).

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Keywords: High-Fluoride Toothpaste, Caries-Active Adolescents

Print Tag: Refer to original journal article
The clinical performance of a 2-step self-etch adhesive in Class III restorations was acceptable at 3 years, and marginal quality was improved by etching the enamel margins.

**Objective:** To evaluate the effect of enamel etching on the 3-year clinical performance of Class III restorations bonded using a mild 2-step self-etch adhesive system (Clearfil SE Bond).

**Methods:** This was a clinical study involving 38 patients with a total of 102 Class III restorations. All restorations were done with the same composite material, Clearfil AP-X following application of Clearfil SE Bond. Clearfil was used according to its manufacturer's directions or with those directions preceded by a 15-second etch of enamel margins with 35% phosphoric acid. All of the restorations were placed by a single operator, and rubber dam isolation was used. The restorations were examined by 2 other dentists at baseline and after 6 months, 1 year, 2 years, and 3 years of clinical service. They were rated using modified USPHS criteria for retention, marginal adaptation, marginal discoloration, postoperative sensitivity, and recurrent caries.

**Results:** 80 of the original 102 restorations were available for recall at 3 years, for a 78% recall rate. The restoration retention rate was 100%. None of the restorations had recurrent caries or postoperative sensitivity. Marginal adaptation and marginal discoloration were significantly better in the etch group, with 90% of the restorations receiving the highest ratings in that group versus approximately 65% in the non-etch group. The large differences in margin quality were not evident until the 3-year recall, as both groups were fairly similar at 2 years.

**Conclusions:** The clinical performance of a 2-step self-etch adhesive in Class III restorations was acceptable at 3 years, and marginal quality was improved by etching the enamel margins.

**Reviewer's Comments:** In their discussion, the authors note that the observed marginal defects were small and the marginal discoloration was superficial, concluding that these problems were not critical to the overall performance of the adhesive system. In other words, Clearfil worked well regardless of whether the enamel was pre-etched. However, it is worth noting that the marginal quality of the non-etched restorations deteriorated more over time. Therefore, when enamel margins are involved, the clinician should consider etching those margins with phosphoric acid. As much as possible, the etching gel should be confined to the enamel, as various in vitro studies have reported a decrease in bond strengths when dentin is etched before application of a self-etch adhesive. (Reviewer-Ernest J. Swift, Jr, DMD, MS).

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Keywords: Dentin Bonding, Enamel, Clinical Trial

Print Tag: Refer to original journal article
There is significant variability in the marginal fit and the internal adaptation of zirconia fixed partial dentures.

**Objective/Design:** The authors used the MEDLINE (PubMed) database and hand searching of journals to find all the published English scientific studies through the end of 2009 dealing with the marginal fit of zirconia fixed partial dentures (FPD). The search yielded 115 articles, of which the authors culled out those that did not specifically address marginal adaptation and internal adaptation. The remaining 15 articles were reviewed in depth and consisted of 12 laboratory and 3 clinical studies.

**Methods:** The total sample size of the combined 15 studies was 346 FPDs and involved spans of 3 to 5 units. To compare the various study findings, the absolute marginal adaptation was defined as the linear distance between the cavosurface margin of the preparation and the restoration. The internal adaptation was defined as the distances between the restoration and the axial and occlusal walls of the preparation.

**Results:** The 15 studies involved 9 different zirconia systems and found considerable variability in the results between the studies, even within the same system. The variability made it impossible to rank the various zirconia systems in terms of adaptation accuracy. The authors averaged the data from all the studies, both laboratory and clinical, and found the following mean absolute marginal discrepancy value in microns (and range from lowest to highest) for the various systems: Cercon, 106.5 μm (80 to 189); Cerec InLab, 80.7 μm (53 to 182); DCS, 66.5 μm (32 to 86); Digident, 57.9 μm (one study); Everest, 148.8 μm (112 to 206); Etkon, 29.1 μm (one study); Lava, 31.4 μm (15 to 91); Procera, 24.7 μm (9 to 89); and Xawex, 113.4 to 147.3 μm (one study). When considering just the data from the 3 clinical studies, the internal adaptations for the cemented FPDs were 98 to 132 μm for the axial and 202 to 215 μm for the occlusal in the Lava system. For the Cercon system, the axial was 140 μm and the occlusal was 192 μm.

**Reviewer's Comments:** The combined data from the 15 studies in this paper should not be interpreted too literally or serve as the sole source of information in choosing a zirconia system. The studies were all designed differently, and it is hazardous to lump all the data together. Nevertheless, the data do shine some scientific light to approximate the degree of fit of a zirconia FPD to prepared abutments. The variability in the adaptation values testifies to the technical sensitivity of zirconia systems. While I don't expect the fit of zirconia to equal that of cast gold FPD, some of the lower adaptation values are impressive. However, the 200 μm adaptation values are not acceptable and suggest that further improvements in the scanning, designing, and manufacturing of zirconia FPDs are needed. (Reviewer-Charles B. Hermesch, DMD).

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Keywords: Zirconia, Fixed Partial Denture, CAD, CAM, Marginal Fit, Internal Fit

Print Tag: Refer to original journal article
Be Aware of Bruxism Triad

The Bruxism Triad: Sleep Bruxism, Sleep Disturbance, and Sleep-Related GERD.
Rouse JS:

Inside Dent 2010; 6 (May): 32-40

Reducing sleep apnea and sleep arousals limits bruxism.

**Bruxism:** Bruxism produces significant damage to the dentition of those who suffer from it. Sleep bruxism (SB) refers to grinding or clenching teeth during sleep. This activity is associated with sleep arousals triggered by neurochemistry and the autonomic system. Much wear likely occurs from erosion rather than from attrition. Attrition and erosion are interwoven in the triad. A decrease in saliva and its lubricating effect increases this tooth wear. Because salivary flow is distinctly lower at night, there is reduced lubrication. Erosion, friction, and contact time play significant roles in wear during sleep bruxism. **Sleep Disturbance:** Micro-arousals (MAs) are a shift in sleep during deeper sleep periods. More destructive bruxers experience more MA episodes and bruxism time during REM sleep. Respiratory disturbances contribute to these problems. Upper airway resistance syndrome (UARS) increases the MAs and is linked to increased bruxism, headaches, and temporomandibular dysfunction. SB is proportional to increases in these sleep apnea-induced arousals. Obstructive sleep apnea is thought to be the highest risk factor for SB. **Gastroesophageal Reflux Disorder (GERD):** To this is added GERD, which is a leakage of stomach contents into the esophagus. Stomach acid with a pH of 1 to 2 damages the palatal surfaces of maxillary molars. Lack of saliva, paired with the acid-roughened tooth surfaces, subjects the tooth to wear during sleep bruxism. **Bruxism Triad:** The bruxism triad is composed of arousal-induced grinding, airway-associated sleep disorders, and sleep-related GERD. This correlation requires careful evaluation of each patient. Reducing apnea by some means (eg, continuous, positive air flow and mandibular advancement) is helpful. Occlusal stabilizing splints may actually worsen SB because they prevent holding the mandible in a protruded position. Reduction of GERD reduces SB occurrences. Dentists should recognize the bruxism triad at all stages. Signs and symptoms may be specific to the patient's age, but one diagnostic sign of the bruxism triad is continually having to adjust the patient's splint.

**Conclusions:** The use of an anterior repositioning device, fabricated at 40% of the patient's maximum protrusion, will successfully open the patient's airway and halt bruxism. A majority of patients present with some tooth wear, but bruxism produces significant loss of tooth structure. This is exacerbated by the loss of saliva lubrication and the roughened tooth surfaces. Medical evaluation may be indicated, followed by medication, as treatment options.

**Reviewer's Comments:** Dr Rouse discusses an important concern for the dentist in the evaluation of the patient's condition. Too often, the dentist sees tooth wear and thinks immediately about prescribing a bite splint/occlusal guard to prevent future wear. Many patients have a more complex problem than merely grinding teeth during sleep. The dentist needs to carefully evaluate all factors involved in the etiology and then treat or refer for medical evaluation, as indicated. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: Bruxism, Treatment, GERD

Print Tag: Refer to original journal article
Does Saliva Contamination Affect Self-Etch Adhesives?

Effect of Saliva Contamination and Decontamination on Bovine Enamel Bond Strength of Four Self-Etching Adhesives.

Jiang Q, Pan H, et al:

Oper Dent 2010; 35 (March-April): 194-202

Saliva contamination significantly reduces the enamel bond strength of self-etch adhesives.

Objective: To investigate the effect of saliva contamination on enamel bond strengths of different self-etch adhesives.

Methods: The adhesives evaluated in this study were Clearfil SE Bond, FL-BOND II, Frog, and Xeno III. The first 3 agents are self-etch primer systems, and Xeno III is an all-in-one, self-etch adhesive. The labial surfaces of 40 bovine incisors were ground flat and were polished to 1200 grit. As a control, each adhesive was used according to its manufacturer's instructions, and a composite material was applied. Two methods were used to contaminate the bonding procedure: fresh whole saliva from a single volunteer was applied either to enamel surfaces before adhesive application or to the specimens after adhesives were applied but before they were cured. For decontamination, the contaminated surfaces were rinsed for 30 seconds and then air dried. After 24-hour water storage, the bonded specimens were sectioned for microtensile bond strength testing (MTBS), which was accomplished using a BISCO testing device. Additional specimens were prepared for evaluation with atomic force microscopy (AFM).

Results: Mean MTBS values of the controls were in the range of 22.4 to 28.5 MPa. Contamination of enamel surfaces before adhesive application reduced the means to 11.5 to 18.2 MPa. A similar decrease was observed when the contamination occurred after adhesive application. The rinsing procedure returned bond strengths to a normal level only for Clearfil SE Bond. AFM showed the presence of protein deposits on contaminated enamel surfaces, and some of those clearly remained after rinsing.

Conclusions: Saliva contamination significantly reduced the enamel bond strength of self-etch adhesives.

Reviewer's Comments: This study is somewhat confusing, because it is not clear whether the one saliva contamination procedure was done after primer or bonding agent application for the 2-step systems. Regardless, the findings are pretty clear—saliva contamination should be avoided with bonding procedures using self-etch adhesive systems. Even fairly aggressive rinsing did not effectively remove saliva contamination, except for Clearfil SE Bond. Clearfil contains a special adhesive monomer not found in the other materials tested, and the monomer has been shown to form a chemical bond with tooth structure, which could account for its performance in this study. (Reviewer—Edward J. Swift, Jr, DMD, MS).

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Keywords: Enamel Bonding, Self-Etch, Saliva

Print Tag: Refer to original journal article
A positive correlation has been observed between surface roughness of restorative materials and bacterial adhesion.

**Objective:** To evaluate the surface roughness of and bacterial adhesion to 4 restorative materials modified by various finishing and polishing methods.

**Methods:** The restorative materials used in this study included 2 indirect composite resins (neither of which would be familiar to an American audience), Tetric Evo-Ceram composite, and VITABLOCS Mark II ceramic. The latter is a CAD/CAM ceramic. Specimens of each material were fabricated and were finished and polished using 4 different methods: (1) fine and extra-fine diamonds; (2) coarse, medium, and fine Sof-Lex discs; (3) white stone followed by a series of 3 rubber polishing points; and (4) polishing with a diamond paste. Surface roughness was measured using a profilometer. To evaluate bacterial adhesion, test specimens were covered with artificial saliva and mucin suspension to form a pellicle. Specimens were placed onto petri dishes, and a suspension of *Streptococcus mutans* bacteria and 5% sucrose was added to cover the specimens. After 24 hours, bacterial adhesion was evaluated by examining specimens with a confocal laser scanning microscope and image analysis software.

**Results:** Surface roughness followed a similar pattern for each material; from roughest to smoothest, the finishing and polishing procedures were diamond rotary instruments, diamond paste, white stone plus rubber polishers, and Sof-Lex discs. Differences between materials were very slight, although one of the indirect composites with very high filler content tended to be rougher than the other materials. In regard to bacterial adhesion, the ceramic material had less than the composite materials. Differences between finishing method and interactions between the type of restorative material and finishing method were not significant. There was a correlation between surface roughness and bacterial adhesion.

**Conclusions:** A positive correlation was observed between surface roughness of restorative materials and adhesion of *S. mutans* bacteria.

**Reviewer’s Comments:** There is nothing particularly earth-shaking in this study. As would be expected, different finishing and polishing techniques result in different degrees of surface roughness on composite and ceramic restorative materials. Also, bacterial adhesion to the surfaces increased with surface roughness. Of the 4 restorative materials tested, the ceramic material had the least amount of bacterial adhesion. (Reviewer: Edward J. Swift, Jr, DMD, MS).

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Keywords: Finishing & Polishing, Surface Roughness, Bacteria

Print Tag: Refer to original journal article
The application of a metal primer may improve bonding to a sandblasted zirconia surface but is not sufficient alone.

**Background:** Increasingly, zirconia-based all-ceramic restorations have become a mainstay of the contemporary aesthetic dental practice. They offer a unique combination of durability and aesthetics. A continuing concern is the ability of resin cements to adequately adhere to the zirconia material. Traditional hydrofluoric acid and silane treatment is ineffective, and air abrasion may induce micro-cracks in the material. The quest for a noninvasive method to adhere to these materials continues. Metal primers have been considered, with or without air abrasion, to enhance the bond between resin cements and zirconia.

**Design/Objective:** The purpose of this in vitro study was to evaluate the performance of metal primers on the bond strength between resin cements and zirconia, both alone and in conjunction with air abrasion.

**Methods:** 120 specimens were fabricated from Y-TZP ceramic and imbedded in PTFE moulds, with one zirconia surface left exposed for bonding. The zirconia surface was finished with 1200-grit silicone abrasive and ultrasonically cleaned in distilled water. The specimens were divided into 12 groups. Half of the groups were air abraded and rinsed, and the other half were untreated. Three resin cements with or without their companion metal primer were applied to both abraded and nonabraded samples. The resin cements were Panavia F 2.0 with Alloy primer (Kuraray), Superbond C&B with V-primer (Sun Medical), and M bond with Metaltite (Tokuyama Dental). The bonded specimens were stored in water for 24 hours and subjected to thermocycling. The specimens were then subjected to shear bond strength testing in a universal testing machine. The fractured specimens were examined by scanning electron microscopy for the mode of fracture.

**Results:** The Panavia F 2.0 treated with air abrasion and metal primer demonstrated significantly higher bond strengths than did the other subgroups. The other 2 resin cements performed better with air abrasion, but the metal primer application did not result in significant improvement in bond strength. The primer only groups exhibited failure primarily at the ceramic-resin interface, while the combined air abrasion/primer groups demonstrated a higher rate of cohesive cement failures.

**Conclusions:** Metal primers alone are not effective in terms of bond strength improvement, but may improve strengths when combined with air abrasion, at least with respect to Panavia F 2.0.

**Reviewer's Comments:** This study does not lead us to change current protocols. Air abrasion is still necessary in order to obtain the best bond performance. Metal primers alone did not provide sufficient bond strength and failed adhesively. Air abrasion still has the potential of subcritical crack propagation. The quest for a noninvasive cementation protocol for zirconia-based restorations continues. Most studies support air abrasion or tribochemical silica abrasion followed by resin cement as the most reliable cementation protocol for zirconia-based restorations. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Zirconia, Air Abrasion, Metal Primer

Print Tag: Refer to original journal article
All of the hand and ultrasonic scaling instruments evaluated in this study significantly roughened the surface of zirconia ceramic.

**Objective:** To evaluate changes in the roughness of zirconia surfaces treated by various scaling methods.

**Methods:** 140 circular zirconia disks (10 mm diameter, 2 mm thick) were fabricated using the Lava system. On one side of each specimen, an adhesive ring was attached to delineate an area for scaling. The specimens were divided into 7 groups, including a control group that was not scaled. Scaling was done in the other groups using a stainless steel curette, a plastic curette, a titanium curette, and 3 types of ultrasonic scalers. All scaling procedures were accomplished using standardized methods and force. After scaling, the surface roughness of each specimen was evaluated using a profilometer. Selected specimens from each group were prepared for scanning electron microscopy (SEM) evaluation.

**Results:** Surface roughness was reported as roughness profiles (Ra values). The mean Ra value of the untreated control group was 0.08. The mean Ra values for the stainless steel, plastic, and titanium curettes were 0.29, 0.33, and 0.37, respectively. Ra values for the ultrasonic scalers were 0.40, 0.42, and 0.50. SEM images showed that ultrasonic scalers produced deeper scratches than the curettes. The stainless steel curette produced significantly less surface roughness than any of the other methods.

**Conclusions:** All of the scaling instruments significantly roughened the surface of zirconia ceramic, although the magnitude of the effect varied among the different instruments.

**Reviewer’s Comments:** Zirconia ceramics are becoming more popular in restorative dentistry as crowns, fixed partial dentures, and even some implant abutments. In most instances (eg, a single-unit crown), the zirconia is completely covered with a veneering porcelain. The present study would have no relevance in such cases. However, it would have some relevance to implant abutments, for example. All of the scaling instruments significantly roughened zirconia surfaces, and the ultrasonic instruments were worse than the hand instruments. The direct clinical relevance of this study is not completely clear. However, it certainly makes sense to minimize roughening of any restorative surface, whether zirconia or some other material. Bacterial adhesion is more likely on rougher than on smoother surfaces. (Reviewer—Edward J. Swift, Jr, DMD, MS).

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Keywords: Zirconia, Surface Roughness

Print Tag: Refer to original journal article
How to Transport Avulsed Teeth

Effect of Storage Media on Human Periodontal Ligament Cell Apoptosis.
Chamorro MM, Regan JD, et al:

Dent Traumatol 2008; 24 (February): 11-16

Do not use Gatorade to transport an avulsed tooth.

Objective: To determine the effects of various transport media on the viability of human periodontal ligament (PDL) cells.

Design: Laboratory study.

Methods: The researchers collected human PDL cells from freshly extracted human teeth and grew them in tissue culture for testing various storage media. The PDL cells were plated into culture plates and then exposed for 1 hour to 1 of 4 storage media: 2% milk, Hank's balanced salt solution (HBSS), Soft Wear contact lens solution, or Gatorade to simulate transporting an avulsed tooth to the dentist for replantation in the alveolar socket. The exposure to the storage media was done at room temperature and on ice. The number of cell deaths at 1, 2, and 3 days were assayed with the TUNEL apoptosis technique. Apoptosis is cell death that occurs as a result of DNA alterations and is commonly known as programmed cell death. The TUNEL test quantifies the number of cells that die from DNA alterations.

Results: The percentage of apoptotic cell deaths at 24 hours for the various media at room temperature was negligible for the control media, milk, and HBSS but was considerably higher for the Soft Wear contact lens solution (42%) and Gatorade (100%). Under ice temperature conditions, the Gatorade had 99% cell death, and this was negligible for the other 3 storage media.

Conclusions: “Apoptosis plays a major role in cell death in cells treated with Gatorade and contact lens solution in comparison to other storage solutions…and storage on ice can inhibit programmed cell death.”

Reviewer’s Comments: Despite this not being a recent paper (publication date is 2008), it is a relevant report because it is the first reported study to look at the apoptotic aspect of PDL cell death in a model that attempts to simulate transporting an avulsed tooth. There are 2 known types of cell death: necrosis and apoptosis. Cell necrosis results from crushing, starvation, desiccation, overheating, freezing, etc. Apoptosis cell death results from processes under DNA control. As clinical dentists, we know that the following are critical to the success of replantation: (1) minimizing the time between avulsion and replantation; (2) minimizing damage to the PDL; and (3) appropriate transport of an avulsed tooth. The findings of this study would negate the use of Gatorade as a transport media since it triggered significant apoptotic cell death. This is unfortunate considering Gatorade is more available at sporting events than milk or HBSS. Since PDL cell survival on the tooth root during transportation to the dentist is important, this study supports the use of 2% milk or HBSS, preferably chilled. Other studies have documented that avulsed teeth can be successfully replanted up to 3 hours, if stored in an appropriate media. Other studies have also shown that milk is a better transport media than saliva. HBSS is the transport medium in the Save-A-Tooth product, but it is usually not available in drug stores. (Reviewer-Charles B. Hermesch, DMD).

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Keywords: Avulsed Teeth, Transporting

Print Tag: Refer to original journal article