Objective: To familiarize the reader with the material characteristics of and indications for lithium disilicate ceramic. Summary: This paper is part of the Journal's "Masters of Esthetic Dentistry" feature. Lithium disilicate is a glass ceramic material that can be used to form restorations using either a lost-wax hot pressing technique or CAD/CAM milling procedures. Although the pressable and milled forms of the material are manufactured differently, both contain approximately 70% lithium disilicate crystals embedded in a glassy matrix. Clinical trials of lithium disilicate restorations have been in progress for 4 years, with the restorations either adhesively bonded or conventionally cemented. In addition, research at New York University, using a mechanical mouth simulator, has found that lithium disilicate crowns are strong and durable. Based on those results, little fracture or chipping would be expected clinically. In vitro wear rates are similar to those of human enamel. The pressable lithium disilicate has a variety of clinical indications, including inlays, onlays, thin veneers, crowns, and small bridges. The veneers can be pressed as thin as 0.3 mm. The milled form of the material can be used for similar indications, except for the ultra-thin veneers and bridges. Posterior crowns fabricated to full contour ("monolithic") using CAD/CAM are very strong. The paper illustrates the use of lithium disilicate in 4 clinical cases—thin veneers, three-quarter veneers, full-mouth rehabilitation with crowns, and inlays. Each case is illustrated with a series of clinical photos.

Conclusions: The latest ceramic materials able to resist masticatory forces are zirconia and lithium disilicate, and the latter has the advantage of forming restorations that do not require a veneering porcelain.

Reviewer's Comments: This paper is a nice overview of lithium disilicate ceramics, which are known to most clinicians by their trade name, eMax. eMax has become very popular in the last couple of years, and early clinical results have been quite good. The other prominent all-ceramic material is zirconia, which is available from many sources under various trade names, with 3M ESPE's Lava being the most popular. Chipping of veneering porcelain from zirconia cores has been reported, and this problem is one reason for the increasing popularity of eMax. However, it appears that improper firing and cooling cycles account for veneer porcelain chipping, and the incidence of chipping seems to be decreasing as labs have adjusted their techniques. (Reviewer-Eduard J. Swift, Jr, DMD, MS)

Keywords: Ceramic-Lithium Disilicate, Uses

Print Tag: Refer to original journal article
Clinical Shade Matching Is Still a Conundrum

Shade Compatibility of Esthetic Restorative Materials—A Review.

Dent Mater 2010; 26 (December): 1119-1126

Inconsistencies between shade guides and products must be considered by the dentist when selecting shades clinically.

**Background:** Creating esthetic restorations requires, among other things, excellent shade control. Historically, practitioners have done this with the assistance of shade guides and subjective evaluation. Recently, several instruments have become available to assist in color measurement with the promise of more objective evaluation. These instruments generally utilize the CIELAB system allowing the calculation of differences in color. A color difference value of 1.6 deltaE*<sub>ab</sub> is considered the threshold below which color is clinically indistinguishable.

**Design/Objective:** This review article focuses on the relationship between common shade guides and restorative materials.

**Methods:** The dental literature was reviewed relative to color ranges and the relationship to shade guides and natural teeth, color differences between materials and guides, and between different materials with the same shade designation.

**Results:** Among the 3 common shade guides (Vita Classic, Chromascop, and VITA 3D-Master), the VITA 3D demonstrated the best agreement with natural tooth shade distribution, with the Vita Classic and Chromascop guides showing significantly less coverage of natural tooth shades. The VITA 3D guide also demonstrated more uniform spacing between shades, and chromaticity more consistent with natural teeth, resulting in superior subjective evaluation as compared with the other 2 guides. When resin composites of several brands with the same shade designation were compared, the CIELAB figures varied considerably by brand. Shade is generally evaluated by lightness, hue, and chroma, and it would logically follow that shade guides should be arranged in this order; only the VITA 3D guide is setup in this sequence. Shade guides provided with composite resins are generally not made of the same materials; studies indicate that all of these guides have perceptible differences with other guides, as well as with their own and other composite resins. When identically labeled shades of different restorative resins were evaluated, the agreement was poor overall. A2 shade pairs demonstrated the best color match followed by C2, B2, and opaque A2. Likewise, the overall color distribution of shades varied by brands. Instrumental measurement of shade demonstrates inconsistencies clinically due to the curved surfaces of teeth, as well as variation among different instruments.

**Conclusions:** The authors note that the preponderance of literature points out the general lack of agreement between shade guides and natural teeth relative to color distribution and dental materials, even within the same manufacturer.

**Reviewer’s Comments:** This review is flawed relative to the lack of a systematic approach to the literature selected for review. It does point out the significant inconsistencies with all of the shade guides and manufacturers shade designations for their materials. Several studies show the superiority of the VITA 3D guide, yet there remains a great challenge in separating from the other, long used guides, due to their familiarity and habit. Effective shade matching still requires individually developed internal systems and communications with individual labs. (Reviewer-Daniel E. Wilson, DDS).

Keywords: Shade Guides, Color Harmonization, Esthetic Restorative Materials

Print Tag: Refer to original journal article
Does the Firing Cycle Affect Chipping of Zirconia Crowns?

Effect of Firing Protocols on Cohesive Failure of All-Ceramic Crowns.

Rues S, Kröger E, et al:

J Dent 2010; 38 (December): 987-994

Objective: To investigate the effect of different cooling procedures on the incidence of cohesive failures and ultimate load of veneered ceramic crowns on maxillary central incisors.

Methods: A crown preparation die was duplicated in a metal alloy. Zirconia cores (Cercon) were fabricated to fit the metal dies with a thickness of 0.4 mm. The zirconia cores were veneered with 2 different porcelains to a thickness of 2 mm at the incisal edge. For each veneering ceramic, 3 different firing protocols were used: conventional firing with no extra cooling time; extra cooling time only after the glaze firing; and extra cooling time after both the dentin layer and glaze firings. Crowns were bonded to metal dies using Panavia resin cement. Fracture loads were applied using a Zwick universal testing machine. This test was applied only to the first and third types of firing/cooling cycles. Additional specimens were aged using thermocycling and chewing simulation. Crowns that survived the aging process were subject to the same fracture testing procedure.

Results: For the conventionally fired crowns, first damage occurred at a mean load of 314 N, with ultimate failure occurring at 481 N. For the crowns that had the extra cooling cycles, the loads were 410 and 641 N, respectively. For aged specimens, those processed with additional cooling time tended to fail at higher loads than those processed using the conventional firing method. However, this was statistically significant for only 1 of the 2 veneering porcelains.

Conclusions: Modified firing of zirconia-core crowns, specifically a longer cooling phase at the end of glaze firing, can improve their fracture resistance.

Reviewer's Comments: A clinical problem that has been observed with some zirconia core crowns is chipping or even fracture of the veneering porcelain. One theory proposes that this problem is related to firing and cooling cycles because zirconia and metal substructures have different thermal conductance, so they would have different effects on porcelain applied over them. The present study is fairly complicated for anyone who (like me) is not particularly familiar with the details of ceramic processing. However, its results suggest that the firing and cooling cycles used for the veneer porcelain could definitely have some influence on the fracture resistance of zirconia restorations. (Reviewer-Edward J. Swift, Jr, DMD, MS).

Keywords: Zirconia, Fracture Resistance

Print Tag: Refer to original journal article
Coffee is especially bad with regard to tooth staining, even on newer nanofilled composites.

**Background:** Nanofilled composites have increased filler content to increase their strength and durability. The small nanofillers tend to scatter or absorb the less visible light, which can increase the material's translucency and improve the esthetic results. However, discoloration can diminish the esthetic results. It can result from incomplete polymerization allowing unreacted monomers to discolor as they age. It also can result from coloring agents in the patient's food and drink that are absorbed over time.

**Objective:** To test the effect of various staining solutions on the discoloration of nanofilled composite resins.

**Methods:** 3 nanofilled composite materials were tested: Ceram X (CX), Grandio (GD), and Filtek Z350 (Z3). Standardized specimens of each material were prepared and light-cured 40 seconds at 1000 mW/cm². Specimens were aged 24 hours in a dark chamber at 37°C before placing into 1 of 4 test solutions: distilled water (DW); coffee (CF); green tea (GT); and 50% alcohol (50ET). Five specimens of each material were tested in each of the 3 solutions. Color readings were made using a spectrophotometer before immersion and then again after immersion in the respective staining test solutions for 7 hours/day. Each 7-hour immersion period was followed by placing the specimens in distilled water for the next 17 hours. This test regimen was followed for 3 weeks. Specimens were then rinsed with running water and blotted dry. Spectrophotometer readings were again made.

**Results:** Specimens immersed in DW, 50ET, and GT appeared slightly brighter/whiter. The CF specimens increased in $L^*$ value (grayness). Only the CF made the specimens more yellow. Grandio showed the greatest change in the blue-yellow range. CF produced significant color change in all 3 materials, while none of the other solutions produced a significant change. Green tea does not contain a significant amount of tannin, which can stain.

**Conclusions:** Only coffee resulted in a marked color change in the nanofilled composites tested in this study. The filler loading and the copolymer of the monomers appeared to have no significant influence on the color change.

**Reviewer's Comments:** This study is only one of a very few published over the past year on staining of nanocomposites. Although the results are not really unexpected, as it is known that coffee stains teeth and tooth-colored restorations, clinicians need to make certain that patients really understand this. They should know that the shade of the restorations will likely deteriorate over time, especially for the heavy coffee drinker. (Reviewer-Thomas G. Berry, DDS, MA).

Keywords: Resin Nanocomposites, Staining, Discoloration

Print Tag: Refer to original journal article
Low-Shrinkage Composites Do Not Necessarily Result in Lower Polymerization Stress

Polymerization Stress, Shrinkage and Elastic Modulus of Current Low-Shrinkage Restorative Composites.
Boaro LCC, Gonçalves F, et al:

Dent Mater 2010; 26 (December): 1144-1150

With the current crop of materials, polymerization shrinkage is not the primary factor in selection of a composite resin.

**Background:** Resin composite materials have become the workhorse of modern dentistry. One persistent concern with these materials is polymerization shrinkage and the resultant stresses brought to bear on the bonds to tooth structure. This stress may lead to gap formation, microleakage, and cuspal deflection. In addition to technique innovations such as incremental placement, new materials have been developed and marketed as low-shrinkage composite resins. This has been achieved by increased filler content or changes in the chemistry of the material itself. Stress development is a complex process related to polymerization shrinkage (pre- and post-gel), reaction rate, placement protocol, cavity configuration, and elastic modulus. Post-gel shrinkage is generally more likely to induce stresses than pre-gel shrinkage. Questions persist relative to whether these materials indeed reduce stresses in resin composite restorations.

**Design/Objective:** This in-vitro study compared conventional microfilled and microhybrid resin-composites with new low-shrinkage composite systems relative to polymerization stress, shrinkage, and modulus of elasticity.

**Methods:** 10 composite resins (5 conventional and 5 low shrinkage resins) were tested in vitro for polymerization stress by measuring force development over 5 minutes in a universal testing machine. Pre- and post-gel shrinkage were calculated. Total volumetric shrinkage for each material was determined over 5 minutes to determine reaction speed as well. Flexural modulus was determined by subjecting bars of each material to a 3-point bending test in the universal testing machine. The data were subjected to regression analysis, with polymerization stress as the dependent variable and total shrinkage, post-gel shrinkage, reaction rate, and elastic modulus as independent variables.

**Results:** The microfilled composite demonstrated the lowest stress. There was no correlation between polymerization stress and total shrinkage, flexural modulus, or reaction rate. There was a positive correlation with post-gel shrinkage. In addition, a positive correlation was noted between filler content and elastic modulus.

**Conclusions:** In order to demonstrate a reduction in polymerization stress, low post-gel polymerization shrinkage must be combined to a lower elastic modulus. Current low-shrinkage composites do not necessarily provide the lowest stress. There was no one material that performed universally better.

**Reviewer’s Comments:** Some of the materials marketed as ‘low shrinkage” materials did not show lower shrinkage or lower stresses than the conventional composite resins. It is clear that lower polymerization shrinkage measurements alone are not enough to consider a material superior in this regard. Final stress development in clinical restorations is a very complex process with post-gel shrinkage, elastic modulus, filler content, cavity configuration, and application technique. The development of lower shrinkage composites is a worthy goal. However, from a practical viewpoint, a claim of lower shrinkage alone is not the most critical factor in composite resin selection and certainly does not support a change in placement protocol at this time. (Reviewer-Daniel E. Wilson, DDS).

Keywords: Polymerization Stress, Composites, Elastic Modulus

Print Tag: Refer to original journal article
The application of chlorhexidine after etching improves the stability of dentin bond strengths.

**Objective:** To evaluate the effects of chlorhexidine (CHX), using different application methods, on microtensile bond strengths (MTBS) to dentin in Class I preparations.

**Methods:** Occlusal surfaces of 50 extracted human molars were ground to expose flat dentin surfaces, which were polished to 600-grit. Standardized preparations (2 mm deep) were made in the dentin using high-speed diamond rotary instruments. All of the preparations were restored using the etch-and-rinse adhesive Single Bond and Z-350 composite (which I believe is Filtek Supreme under a different name). Except in the control group, a 2% CHX solution (Consepsis) was incorporated into the restorative procedure. It was applied either before or after phosphoric acid etching and was either rinsed off or not, thus resulting in 4 different application techniques. After the teeth were restored, they were either stored in water for 24 hours or thermocycled 10,000 times; then they were sectioned into small beams for MTBS, which was accomplished using an EZ-Test tabletop device.

**Results:** Thermocycling had a significant effect on bond strengths in the control group, as the mean decreased from 29.4 to 19.1 MPa. Thermocycling reduced bond strengths in the other groups also, but not significantly when CHX was applied after etching. Without thermocycling, means were in the 29- to 31-MPa range; with thermocycling, they were 26 to 27 MPa.

**Conclusions:** Application of CHX after etching improves the stability of dentin bond strengths.

**Reviewer's Comments:** In reality, the results of this study suggest that CHX has a positive effect on dentin bond strengths regardless of whether it is applied before or after etching or whether it is rinsed off or left on the surface. However, it does make the most sense to use the CHX solution after etching. Some clinicians have used CHX as a disinfectant in their preps, but I am not sure whether that has any clinical value or not. However, evidence is mounting that CHX can improve the stability of resin-dentin bonds by inhibiting matrix metalloproteinases (MMPs). MMPs are intrinsic dentin enzymes released by etching and degrade collagen that is not encapsulated by resin, which can cause breakdown of the bonding interface. (Reviewer-Erward J. Swift, Jr, DMD, MS).

**Keywords:** Dentin Bonding, Chlorhexidine

**Print Tag:** Refer to original journal article
Fabrication Technique of Crown Affects Marginal Fit

In Vitro Evaluation of Marginal Adaptation in Five Ceramic Restoration Fabricating Techniques.

Ural Ç, Burgaz Y, Saraç D:

Quintessence Int 2010; 41 (July/August): 585-590

The CAD/CAM technique for ceramic crowns may produce the best marginal adaptation.

Background: Several methods of fabricating ceramic restorations are currently used. Strength and marginal fit are two important factors in determining success of all-ceramic restorations. Studies have indicated a wide range in marginal openings with some gaps up to 155 µm.

Design/Objective: This in vitro study compared pre- and postcementation marginal adaptation of 4 all-ceramic fabricating techniques and 1 conventional technique.

Methods: Steel models of molar crown preparations were made with 6° taper and 1.2 mm shoulders. Cerec-3 and Cercon crowns were made with a CAD/CAM technique, In-Ceram crowns were made with a glass-infiltration (slip-casting) process, IPS Empress 2 crowns with the heat-press technique, and porcelain-fused-to-metal (PFM) crowns by the lost-wax technique. Marginal discrepancies were measured using a scanning electron microscope. After marginal discrepancy measurements were made on all the fabricated crowns, the crowns were cemented under static pressure using phosphate monomer-modified composite resin (Panavia F2.0, Kuraray). Measurements of marginal discrepancies were again made and compared to measurements made on the uncemented crowns.

Results: Prior to cementation, the lowest mean marginal opening values were demonstrated for the Cerec-3 group and were significantly different from the other groups. The PFM group exhibited the highest mean marginal openings. After cementation, mean values of the Cerec-3 group were the lowest and significantly better than the other groups. The highest post-cementation discrepancy values were recorded for the PFM group. There was no significant difference between the Cercon and IPS groups. Cementation increased discrepancy gaps between 16.46 and 21.0 µm. Cerec-3 crowns do not require an impression and die process, so no dimensional changes take place during those processes. Because Cercon crowns do require an impression to form a working cast, some dimensional change can take place, although the rest of the process is similar to Cerec-3. Techniques requiring wax patterns can result in 0.4% shrinkage, and another 0.2% can occur with thermal shrinkage after casting a ceramic coping. In-Ceram crowns use a condensation and glass-infiltration process resulting in 0.21% shrinkage at substructure during sintering and 15.95% shrinkage at investment procedure.

Conclusions: Although there were definite differences between the crowns made with the different techniques, mean marginal adaptation values for all specimens precementation were within clinically acceptable limits. However, cementation negatively affected marginal adaptation values. Differences in adaptation values result from differences in fabrication techniques.

Reviewer’s Comments: Although each system has some advantages in material toughness, esthetic values, or other factors, marginal fit does vary as indicated by this study. This study demonstrates that CAD/CAM systems are very accurate. Cementation always decreases marginal fit. It is imperative to have excellent fit precementation, and the cementing agent must have low film thickness and excellent flow. Ideal cements would demonstrate great resistance to wear and lack of solubility. (Reviewer-Thomas G. Berry, DDS, MA).

Keywords: Restoration Fabricating, Marginal Adaptation

Print Tag: Refer to original journal article
Surface Preparation Affects Bond of Resin Cements

Effect of Surface Preparation on Bond Strength of Resin Luting Cements to Dentin.

Peerzada F, Yiu CKY, et al:

Oper Dent 2010; 35 (November-December): 624-633

The type of instrument used to prepare the dentin surface might affect bond strengths of resin cements that use a self-etch primer.

Objective: To evaluate the effect of preparing dentin with diamond rotary instruments and tungsten carbide burs on the microtensile bond strength (MTBS) of 3 resin luting cements to dentin.

Methods: Flat dentin surfaces were created on proximal surfaces of 45 extracted human molars. These dentin surfaces were further prepared using medium-grit diamond rotary instruments, carbide burs, or 600-grit silicon carbide abrasive paper (control). Laboratory-processed composite blocks were fabricated, roughened with 180-grit abrasive paper, etched, and coated with a mixture of Clearfil SE Primer Porcelain Bond Activator. They were bonded to dentin using RelyX ARC, Panavia F2.0, or RelyX Unicem following manufacturer's directions for each material. After 24-hour storage in water, the specimens were sectioned into small beams for microtensile bond strength (MTBS) testing, which was accomplished using an Instron universal testing machine. In addition, scanning electron microscopy (SEM) was used to evaluate treated dentin surfaces and failures of the MTBS specimens.

Results: Bond strengths of RelyX ARC were not affected by surface preparation. This was not the case with the other two resin cements. For Panavia, the mean bond strength for the control was 20.6 MPa. Using the carbide bur, it was 19.0 MPa, but was significantly lower (14.8 MPa) with the diamond. For RelyX Unicem, the mean bond strengths of the control, carbide, and diamond groups were 18.9, 17.8, and 15.6 MPa, respectively. The type of rotary instrument used to prepare the surface did not significantly affect Unicem. SEM showed that diamond rotary instruments produced the thickest smear layer, and it was unevenly removed by the self-etch primer used with Panavia.

Conclusions: The type of instrument used to prepare the dentin surface might affect bond strengths of resin cements that use a self-etch primer.

Reviewer's Comments: The results of this study are not particularly surprising, as earlier studies have reported that bonding of self-etch adhesive systems might be affected by the type of rotary instrument used to prepare dentin. Specifically, diamonds (which produce thicker smear layers than carbide burs, particularly with coarser grits) can reduce bond strengths. That was the case in the present study for Panavia, which includes a mild self-etch primer. However, I must say that the reduction in bond strength, while statistically significant, may or may not be clinically significant. (Reviewer-Edward J. Swift, Jr, DMD, MS).

Keywords: Resin Cements, Dentin Bond

Print Tag: Refer to original journal article
High-intensity light-emitting diode units do not seem to allow for shorter polymerization time of composite resins.

Background: The quality of polymerization of composite resin restoratives depends on factors such as the light curing unit (LCU), irradiation time and technique, formulation of the material, and irradiance and spectrum. With all of these factors considered, recommendations on the polymerization time are made based on the reciprocity relationship between irradiation and irradiation time. According to that, the application time is proportionally decreased if the irradiation is increased. Improvements in the diode technology and consequently in the LCUs irradiation have led manufacturers to recommend polymerization times as short as 5 seconds.

Objective: To compare the efficiency of current light-emitting diode (LED) units with short polymerization times in simulated deep cavities.

Methods: Filtek Supreme XT (3M ESPE) and Filtek Z250 (3M ESPE) were the composite resins used. They were polymerized for 5, 10, and 20 seconds using 3 commercially available and another prototype LED units: Freelight 2 (3M ESPE), Demi (Kerr), SmartLite PS (Dentsply), and the prototype Elipar™ S10 (3M ESPE). Mechanical properties were measured in a simulated deep preparation, which was done by filling a mold in 3 consecutive 2-mm increments, each one being light-cured by positioning the LCU tip at the top of the 6-mm high mold.

Results: For all LCUs, the irradiance decreased as the distance from the tip of the LCU to the composite resin increased. The highest irradiance was produced by Elipar S10, followed by Freelight 2, Demi, and SmartLite PS. No difference at the composite resin surface in regard to modulus of elasticity and hardness was noticed as a function of curing time and unit. Modulus of elasticity and hardness were significantly higher for the microhybrid composite resin Filtek Z250. At the 2-mm depth, the modulus of elasticity of Filtek Supreme XT when cured with Elipar S10 and of Filtek Z250 when cured with Demi and Freelight 2 were higher after 20 seconds compared to 5 seconds of polymerization. At the 6-mm depth, decreased modulus of elasticity and hardness were measured for all LCUs and curing times when comparing the surface and bottom of the specimens.

Conclusions: Polymerization time of at least 20 seconds is recommended for adequate setting 2 mm beyond composite resin surfaces.

Reviewer’s Comments: This is an interesting study demonstrating differences among LED units. Important to note is that increments were polymerized one at a time to mimic clinical application. Still, there was a difference in mechanical properties between top and bottom of the specimens, regardless of the curing times. It would have been interesting to see the results of this investigation compared to a halogen light-curing unit. (Reviewer-Ricardo Walter, DDS, MS).

Keywords: LED Units, Micro-Mechanical Properties, Degree of Cure

Print Tag: Refer to original journal article
In this study, 2 years after bleaching, teeth remained significantly lighter than they were before treatment.

**Objective:** To evaluate the whitening effect of at-home tooth bleaching with 10% or 16% carbamide peroxide at 2 years after treatment.

**Design/Participants:** Double-blind clinical trial involving 92 adult patients.

**Methods:** Randomly assigned to 2 groups, the patients bleached their teeth for 2 hours per day for 3 weeks using either 10% or 16% carbamide peroxide gel in custom-fitted trays. Shades were taken at baseline and at 1, 6, 12, and 24 months after bleaching. The shades were evaluated both with a digital spectrophotometer (Vita Easyshade) and with 2 calibrated examiners using a value-oriented Vita Classical shade guide.

**Results:** Of the original 92 patients, 81 were available for the 2-year recall. Using the Vita shade guide, the improvement in color was 5 to 6 tabs at the 1-month post-treatment recall; this stayed about the same throughout the study and was similar in both groups. With the spectrophotometer, lightness of the teeth in both groups significantly improved at the 1-month recall (delta-\(L^*\) = 4 in both groups) and changed very little over the 2-year period. yellowness (delta-\(b^*\)) also improved significantly, but had some relapse between 1 month and 2 years. A similar effect was observed for redness (delta-\(a^*\)). The overall color change (delta-\(E\)) at 2 years was >4 in both groups, meaning that the bleaching effect was still perceptible.

**Conclusions:** Two years after bleaching, teeth remained significantly lighter than they were before treatment, although some relapse of the yellow and red colors were observed.

**Reviewer's Comments:** Numerous clinical trials of bleaching have been reported, so does this one offer anything new? The answer is probably yes. First of all, it is one of the few that reported results at a fairly long time after bleaching, and it involved a large number of patients. It showed that the concentration of the bleaching gel had no effect on long-term results. A 16% concentration of carbamide peroxide might achieve results faster than a 10% concentration, but does not provide a better result over time. Also, patients generally want to know how long the bleaching effect will last. According to the results of this study, "at least 2 years" would be a good answer in most cases. (Reviewer-Edward J. Swift, Jr, DMD, MS).
The additive, polyethyleneimine, does not weaken the composite.

**Background:** *Streptococci mutans* adhesion and colonization on restorative materials leads to secondary caries. Unfortunately, composite restorations tend to accumulate more plaque than other restorative materials. Plaque-forming bacteria and ingested liquids contribute to degradation of the composite restoration. It is possible that nonpolymerized monomers accelerate cariogenic bacterial growth. This in turn increases surface roughness leading to more plaque accumulation. Incorporation of small amounts of quaternary ammonium polyethyleneimine (PEI) provides a strong antibacterial effect without compromising physical properties of the composite.

**Objective:** To investigate whether PEI nanoparticles have an antibacterial effect lasting ≥6 months and whether these particles prevent the increasing surface roughness caused by *S. mutans* biofilm.

**Methods:** Samples included 1% by weight of PEI nanoparticles added to Filtek Flow (3M ESPE) composite. The material was pressed into smooth disks and cured. The surfaces were examined for chemical composition as well as contact angle to assure PEI-containing samples were identical to regular Filtek Flow samples. Samples were subjected to direct contact with *S. mutans* for 6 months. Bacterial growth was estimated. At the end of the test period, disks were washed 3 times, sonically cleaned for 15 minutes, and dried to assure all biofilm was removed. Each disk was scanned with a Dimension 3100 Scanning Probe Microscope.

**Results:** Analysis demonstrated antibacterial effect in samples containing PEI nanoparticles. Samples without PEI showed no antibacterial effect. After 1 month of bacterial challenge, samples without PEI showed increased roughness, while samples with PEI demonstrated no increase in roughness. This antibacterial effect did not diminish over the 6 months of the study. This could be important in preventing recurrent caries at restoration margins. The PEI apparently damages bacteria cellular walls.

**Conclusions:** Incorporation of hydrophobic, nonleaching, quaternized polyethyleneimine nanoparticles in composite resins is a means of preventing bacterial infection. PEI nanoparticles modified the surface of composite resin to provide an antibacterial effect and to prevent changes in surface roughness caused by the bacteria. This may increase service life of composite restorations.

**Reviewer’s Comments:** While more research is needed to verify these results, this appears to offer a possible solution to prevent a problem with composite restorations. If the polyethyleneimine can be added to the composite at low cost without affecting its physical properties long-term or posing a threat to the patient, it should be done. Additional research, including in vivo research, is needed. (Reviewer-Thomas G. Berry, DDS, MA).

Keywords: Composite Resins, Surface Roughness, Biofilm, Nanoparticles, Polyethyleneimine

Print Tag: Refer to original journal article
Does Type of Curing Light Affect Dentin Bond Strength?

Degree of Conversion of Etch-and-Rinse and Self-Etch Adhesives Light-Cured Using QTH or LED.

Faria-e-Silva AL, Lima AF, et al:


Polymerization of 2 self-etch materials tested in this study was significantly less when activated with light-emitting diode light-curing units.

Objective: To evaluate the effect of 3 light-emitting diode (LED) units and 1 quartz-tungsten-halogen (QTH) light-curing unit on the degree of conversion (DC) of 4 commercial adhesive systems.

Methods: 4 adhesive systems were evaluated in this study: Scotchbond Multi-Purpose (SBMP), Single Bond 2, Clearfil SE Bond, and Clearfil S3 Bond. Only the adhesives (not the primers) of SBMP and SE Bond were tested. The DC of each adhesive was measured using Fourier Transform mid-infrared spectroscopy, which is a standard method for this purpose. A constant volume of each material was tested, with light-activation by one QTH device (Optilux 501) and 3 LED devices (the Radii Cal, FreeLight 2, and Bluephase). The irradiance and spectral distribution of each device were measured using a power meter and spectrometer, respectively.

Results: The intensity of the QTH device was 760 mW/cm². Intensities of the 3 LED devices ranged from 600 to 1100 mW/cm². The QTH light had the broadest spectral distribution. The DC of SBMP was just under 60%, regardless of the curing light used. The DC of Single Bond was approximately 80% and, like SBMP, was affected little by the curing light. In contrast, the DC of Clearfil SE Bond was 74% with the QTH and declined by approximately 10% with each of the LEDs. An even greater effect was observed for Clearfil S3 Bond, which had a 77% degree of conversion with the QTH but only 43% to 45% with the LED devices.

Conclusions: Polymerization of the 2 self-etch materials tested was significantly less when activated with LED light-curing units.

Reviewer’s Comments: LED curing units, unless they are equipped with different chips emitting different wavelengths, have a much narrower emission spectra than QTH units. This is not a problem with most contemporary restorative materials, with some possible exceptions such as bleach-shade composites. However, the results of this study are somewhat troubling. Clearly, more research on the subject is needed. Adhesives are likely to perform best when thoroughly cured, and this study indicates that this might not always be the case. It should be noted that the various adhesives and curing units were all used under the same conditions (ie, the same exposure time [20 seconds]), and that the LED units tested are not the newest ones available. (Reviewer-Eduard J. Swift, Jr, DMD, MS).

Keywords: Curing Lights, Dentin Bond Strengths

Print Tag: Refer to original journal article
Direct Composites Are Good Option for Reshaping Teeth


Wolff D, Kraus T, et al:

J Dent 2010; 38 (December): 1001-1009

Direct composite buildups are an esthetic, functional, and noninvasive option for recontouring teeth and closing diastemas.

Objective: To describe the survival and different failure types of >300 composite restorations placed to close diastemas.

Design/Participants: This was a retrospective clinical study involving 101 patients with a total of 327 direct composite buildups that had been placed by restorative dentistry specialists at a single facility in Germany during a 6-year period.

Methods: All of these restorations had been placed using rubber dam, a putty matrix technique, a 3-step etch-and-rinse adhesive system, and incremental layering of composite. Several brands of composite were used. The restorations were evaluated using a clinical exam, standardized photos, and U.S. Public Health Service rating criteria. When a restoration was lost, it was considered a failure. When a restoration had a problem such as marginal discoloration, small fracture, etc, the problem was addressed, and the restoration was classified as a "survival with repair." If the restoration was present, intact, and had no defects, it was classified as a "survival." The primary outcome measure of the study was the survival time of the composite restorations, the analysis of which was performed using the Kaplan-Meier statistical method.

Results: At a mean recall time of 27.8 months, 284 of the 327 restorations were present without evident defects. Only one restoration had been lost. Of the 42 restorations with defects, most were minor fractures of the composite material. The statistical analysis calculated an estimated 5-year survival rate of 79.2%. More than 90% of the graded restorations were categorized as clinically excellent or clinically good.

Conclusions: Direct composite buildups are an esthetic, functional, and noninvasive option for recontouring teeth and closing diastemas with clinically promising survival rates.

Reviewer’s Comments: I don’t believe there is any earthshaking new information in this study; rather, it verifies what we already know – that anterior teeth can be reshaped and diastemas can be closed with direct composite buildups. The authors point out that composite buildups are less durable than porcelain veneers, but they are more conservative. The study demonstrated the importance of operator effects on restoration longevity. For example, the clinician who placed more restorations than anyone else (n=92) had a failure rate of 17%. The clinician who placed the second highest number of restorations (n=52) had a failure rate of only 2%. (Reviewer-Edward J. Swift, Jr, DMD, MS).

Keywords: Composites, Clinical Trial

Print Tag: Refer to original journal article
According to this study, implant torque wrenches were found inaccurate 62.5% of the time at the 32 Ncm setting.

**Objective:** To measure the accuracy of manual torque wrenches used in dental offices.

**Methods:** The researchers selected 16 private dental offices in Brazil, where manual torque devices were routinely used. A healing abutment was attached to a digital torque meter to test the wrenches at their 20 and 32 Ncm settings. Five repetitions of each torque measurement setting were made, and the means were calculated. The torque wrenches were <2 years old and had not been calibrated since they were purchased. The wrenches and the number tested included Nobel Biocare (6), Conexão (6), Biomet 3i (3), and Straumann (1). The accuracy of the torque wrenches was defined as ± 10% of the target value.

**Results:** 62.5% of the wrenches were considered accurate for the 20 Ncm setting (mean measurement range, 16.4 to 25.9 Ncm). Of the wrenches, 37.5% were considered accurate for the 32 Ncm setting (mean measurement range, 20.9 to 43.2 Ncm); 75% of the inaccurate wrenches measured lower than the target setting, and 25% measured higher than the target.

**Reviewer's Comments:** This simple but useful study increases our awareness of another important factor in our implant restorations. Attaining the appropriate preload tightening of an implant screw is important to prevent future loosening. Screw loosening would be the more likely complication based on this study's findings, and excessive screw torque would be a less likely complication. Like all mechanical devices, torque wrenches age with use, corrode due to infection control processing, and malfunction from buildup of debris in the operating mechanisms. Replacing torque wrenches with some regularity is less costly than dealing with the complications of loose screws. In addition, manufacturers should take note of these findings since none of the wrenches were >2 years old and should provide evidence on appropriate replacement intervals. (Reviewer-Charles B. Hermesch, DMD).

**Keywords:** Implant, Torque, Abutment

**Print Tag:** Refer to original journal article
What to Expect From ART Restorations and Sealants


de Amorim RG, Leal SC, Frencken JE:

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Atraumatic restorative treatment may be successfully used for single-surface restorations and sealants.

Objective: To update the data on the longevity of atraumatic restorative treatment (ART) sealants and restorations. The survival of such restorations in primary and permanent teeth and the therapeutic effect in regard to caries prevention on permanent teeth were also evaluated.

Methods: The available literature on ART published in English, Portuguese, and Spanish was searched using PubMed, Medline, LILACS, and BBO databases. Exclusion criteria were as follows: survival results <1 year; incorrect statistical analysis; ART performed by undergraduate students; ART restoration or sealant placed with a low- or medium-viscosity glass ionomer cement (GIC) or other material; and/or the use of a rotary instrument. Publications were also excluded because of lack of clarification (by the authors of the published literature) when requested.

Results: 29 publications were included in this meta-analysis. Mean annual failure rates for high-viscosity GIC ART were: 3.5% and 19% for single- and multiple-surface restorations in primary teeth, respectively (over a 2-year period); 5% and 4% for single-surface restorations in permanent teeth over 3 and 5 years, respectively; 14% for multiple-surface restorations in permanent teeth over the first year; and 9.3% for completely lost sealants in permanent teeth over the first 3 years. The mean annual caries rate in pits and fissures sealed with the press-finger technique was 1% over 3 years.

Conclusions: A high survival rate was found for single-surface ART restorations using high-viscosity GIC in primary and permanent teeth over 2 and 5 years, respectively. A low short-term survival was noted for multiple-surface ART restorations using the same type of material over 2 years (although the small number of studies limits the conclusions). High survival and prevention of dentin lesions was found for the same type of material over 3 years. The ART approach is an effective alternative treatment for managing dental caries.

Reviewer’s Comments: The literature search did not use the same keywords for different languages. Also, all publications in Portuguese and Spanish did not meet the inclusion criteria. Such publications were supposed to be the differential between this and another meta-analysis published on the same topic 5 years ago. Interestingly, 29 publications were selected but these involved 27 studies. Thus, publications of the same project with results at different times were included. The quality of the studies is also questionable, as none of the studies provided information on all the quality assessment criteria used. Lastly, only a small number of long-term studies were included. These factors should be taken into consideration when interpreting the results. (Reviewer-Ricardo Walter, DDS, MS).

Keywords: Atraumatic Restorative Treatment, Glass Ionomer, Survival, Restorations, Sealants

Print Tag: Refer to original journal article
The use of a conditioner is critical for effective bonding of resin-modified glass ionomer restorative material to prepared dentin.

**Objective:** To improve understanding of how a resin-modified glass ionomer (RMGI) bonds to dentin prepared in various ways.

**Methods:** 32 mid-coronal dentin surfaces were obtained by removing the occlusal third of extracted third molar crowns using a water-cooled diamond saw. Mid-coronal surfaces of an additional 16 teeth were obtained by fracture using a hammer and scalpel blade. For the first 32 specimens, the dentin was further treated by grinding with a medium-grit diamond rotary instrument or irradiation with a short-pulse Er:YAG laser. The surface of half of the specimens in each preparation group was conditioned with 20% polyacrylic acid. An RMGI restorative material, Fuji II LC, was applied to the dentin in increments to form a 5 to 6 mm build-up. The bonded specimens were sectioned and trimmed to form small hourglass-shaped specimens for microtensile bond strength testing (MTBS). MTBS values were obtained using a universal testing device. Additional specimens were made to evaluate the surface topography of the various preparation techniques (using scanning electron microscopy [SEM]) and to evaluate the bonded interfaces (using transmission electron microscopy [TEM]).

**Results:** Without the conditioner, mean MTBS values were 30.7 MPa for fractured dentin, 17.9 MPa for diamond-prepared dentin, and 5.1 MPa for laser-irradiated dentin. With the conditioner, the respective values were 30.2, 31.4, and 5.1 MPa. SEM showed an irregular smear layer-covered surface. The fractured dentin had no smear layer and had open dentin tubules. Laser irradiation produced a very irregular surface without a smear layer. TEM showed the presence of a hybrid layer when the conditioner was used.

**Conclusions:** The use of a conditioner is critical for effective bonding of RMGI to prepared dentin.

**Reviewer's Comments:** RMGIs are far from the most popular tooth-colored materials in use today. However, they form very stable bonds to tooth structure, bonds that are both chemical and physical. These results suggest that the conditioner supplied with the material should be used to optimize adhesion to dentin that has been prepared. In contrast, when dentin has not been prepared, the conditioner is not necessary – for example, when placing the material on a fracture site as a temporary measure. (Reviewer-Erward J. Swift, Jr, DMD, MS).

**Keywords:** Glass Ionomer, Adhesion

**Print Tag:** Refer to original journal article
Placement of protective coating adhesive may improve fracture toughness of restorative material over time.

**Background:** Fracture toughness (FT) of restorative materials refers to their resistance to crack propagation. Materials with lower FT are more likely to fracture. Bulk and marginal fracture, major causes for restoration replacement, are related to low FT.

**Objective:** To use a 4-point bend test method to compare FT of several materials, to assess the effect of 8-week storage in distilled water, and to determine the effect of resin surface coating on FT of glass ionomer (GI) cements.

**Methods:** 6 materials were used to make 168 standardized bar-shaped specimens. Surfaces were flattened and smoothed. Materials used were Dyract (polyacid-modified composite), Freedom (polyacid-modified composite), Quix Fil (composite), Fuji VII (self-cure glass-ionomer cement), Fuji IX (self-cure GI), and Fuji II LC (resin-modified GI). Fuji II LC and Fuji IX were tested both with and without applying G-Coat Plus (nanofilled self-adhesive protective coating). Specimens were divided into 3 groups and stored in distilled water for 48 hours, 4 weeks, or 8 weeks. Specimens were then subjected to a 4-point bend test until fracture, and the FT was calculated.

**Results:** Quix Fil demonstrated the highest FT, and Fuji VII had the lowest FT. Storage in distilled water decreased FT from 48 hours to 4 weeks for Fuji II LC, coated Fuji II LC, Fuji VII, and Fuji IX. No significant differences were noted for coated Fuji IX and for Freedom from 48 hours to 4 and 8 weeks. Quix Fil also showed a decrease in toughness over the time when stored in distilled water. Dyract showed no decrease in FT after 4 weeks of water storage, but there was a significant decrease by 8 weeks. FT after 2-day distilled water immersion was more than twice as great for resin-modified GI than for conventional GI. The use of coated resin-modified GIs may provide additional fracture resistance. A decrease in FT after water storage may result from water sorption by the composite.

**Conclusions:** Surface coating of conventional GI cements using G-Coat Plus did not increase FT. However, coating was effective for Fuji II LC. The self-adhesive coating bonds to the GI to provide a lamination effect. Coating increases FT and allows maturation of GI reaction with delayed water exposure, yielding a stronger material.

**Reviewer's Comments:** FT of GI materials has never been considered one of their advantages. If more research bears out using this coating adhesive over Fuji II LC and if other light-cured resin-modified GI materials increase their FT, it is worth incorporating in the placement of GI restorations. This article was published in June 2010, but given that few articles have been published since then on this topic, this article remains very timely. (Reviewer-Thomas G. Berry, DDS, MA).

Keywords: Aging Effects, Glass Ionomer, Resin-Modified Glass-Ionomer Restorations

Print Tag: Refer to original journal article
The deleterious effects of sodium hypochlorite on dentin bonding seem to be reversible with other chemicals.

**Background:** Irrigation solutions used in endodontics are designed to aid in the disinfection of root canals. However, some solutions decrease the bond strength of resin-based materials and can potentially compromise treatment outcome. Solutions to restore the bond strength of such materials to dentin are available.

**Objective:** To evaluate the effects of various combinations of irrigation solutions on the bond strength of Epiphany self-etch sealer (Epiphany SE), which is a dual-cured composite resin and part of the Resilon/Epiphany obturation system (SybronEndo).

**Methods:** Extracted teeth had their coronal surfaces reduced to flat dentin. These were allocated into 5 groups to be treated with: (1) 10 mL of deionized water for 10 minutes (control); (2) 10 mL of 5% sodium hypochlorite (NaOCl) for 10 minutes; (3) 10 mL of 5% NaOCl for 10 minutes followed by 10 mL of 10% sodium ascorbate (Na-Ascr) for 10 minutes; (4) 10 mL of 5% NaOCl for 10 minutes followed by 5 mL of 2% chlorhexidine (CHX) for 5 minutes; or (5) 10 mL of 5% NaOCl for 10 minutes followed by 10 mL of Na-Ascr for 10 minutes and 5 mL of 2% CHX for 5 minutes. After conditioning and drying of the dentin surface (dentin was left moist), build-ups of Epiphany SE were placed and light-cured for 40 seconds. Samples were stored in 100% humidity at 37°C for 7 days and then tested in shear.

**Results:** The NaOCl group did not differ from the negative control group (distilled water). Groups that use Na-Ascr had the highest bond strength values with no difference between them. The group treated with NaOCl followed by CHX presented intermediate results.

**Conclusions:** Sodium ascorbate may be the best available option to reverse the detrimental effects of NaOCl on dentin. That also seems to be able to prevent the reaction between CHX and NaOCl.

**Reviewer’s Comments:** Several good points were discussed by the authors. (1) The bonding procedure in this study was performed on moist dentin, which could have affected the results. Another study with an earlier version of Epiphany, which was performed on air-dried dentin, failed to show any negative effect of sodium hypochlorite on bonding. (2) Sodium ascorbate is a reducing agent that results in slightly increased roughness surface and greater exposure of collagen fibrils. One limitation of this chemical is that it has a short shelf life and needs to be freshly manipulated for use. (3) Studies have shown the formation of a precipitate when NaOCl is put in contact with CHX; that has been shown to be toxic and carcinogenic. Sodium ascorbate seems to eliminate the formation of such precipitate. (4) The shear bond strength values in this study are fairly low, and the differences among treatments are of questionable clinical relevance. The use of a positive control would have been helpful for interpreting the results. (Reviewer-Ricardo Walter, DDS, MS).

**Keywords:** Epiphany SE, Irrigants, Shear Bond Strength, Sodium Ascorbate
Follow-up on traumatized teeth is essential for optimal outcome.

**Objective:** To review trends in managing dentoalveolar traumatic injuries (DTI) to primary and young permanent teeth.

**Methods:** The authors used PubMed to search the English literature (1990 to 2009) and included 116 references. **Crown Fractures:** Uncomplicated crown fractures should be restored immediately to prevent drifting or supereruption. Complicated crown fractures involving the pulp in primary teeth usually require extraction. Complicated crown fractures in young permanent teeth require maintaining pulp vitality whenever possible. Direct pulp capping with mineral trioxide aggregate (MTA) is a good alternative to calcium hydroxide because it seals well and sets in a moist environment. **Root Fractures:** Vertical root fractures require extraction, whereas horizontally fractured teeth may be treated by surgical uncovering and orthodontic extrusion. Surgical submergence of the fractured vital root may be performed to preserve alveolar bone for a future implant. A pulpally vital permanent tooth with a root fracture can be repositioned and splinted for 4 weeks to allow hard tissue repair of the fracture. A nonvital permanent tooth with a root fracture is endodontically treated down to the fracture line with intracanal calcium hydroxide to stimulate apexification. **Subluxation:** Subluxation of primary teeth generally requires no treatment. Subluxated permanent teeth should be taken out of occlusion and splinted for no more than 2 weeks. **Extrusive Luxation:** In primary teeth, extrusive luxation can be repositioned and splinted for 1 to 2 weeks. Permanent teeth should be repositioned and splinted for up to 3 weeks. Endodontic treatment may be required (placement of calcium hydroxide in the canal for 2 weeks and then gutta percha obturation). **Intrusive Luxation:** Intrusive luxation of primary teeth requires extraction if displacement has occurred into the developing successor or it may allow for passive re-eruption if the successor is not involved. Intrusive luxation in permanent teeth calls for passive re-eruption in teeth with incomplete root formation or active repositioning of teeth with mature roots. Endodontic treatment should begin within 3 weeks of the trauma and calcium hydroxide placed in the canal. **Extrusive Luxation:** In permanent teeth, this requires passive repositioning or active repositioning with splinting for 1 to 2 weeks. Permanent teeth are repositioned and splinted for up to 3 to 4 weeks. **Avulsion:** Primary teeth should not be replanted. Permanent teeth with a closed apex should be replanted quickly (<60 minutes) and splinted for up to 2 weeks. Begin endodontic treatment 10 to 14 days after replantation. Permanent teeth with an open apex should be replanted within 1 hour and followed for potential revascularization of the pulp. Revascularization can occur in teeth with an open apex, short-rooted tooth with pulp necrosis. Replantation of the open apex tooth beyond 60 minutes should be endodontically treated.

**Reviewer's Comments:** All of the DTI management plans require careful and consistent follow-up to achieve optimal results. All stabilization should be done with flexible splinting. (Reviewer-Charles B. Hermesch, DMD).

**Keywords:** Dental Trauma, Injury, Crown-Root Fracture, Luxation, Avulsion, Replantation

Print Tag: Refer to original journal article
Previous Estimates of Connector Size for Zirconia FPDs Likely Understated


Occlusal stresses are concentrated at the connector, so these dimensions should be maximized for better predictability.

**Background:** Zirconia-based dental restorations make up a significant percentage of esthetic restorations and are increasingly being suggested for use in fixed partial dentures (FPDs). The primary mode of failure is through fracture of veneering porcelain and fracture of the prosthesis at the connector. Along with the mechanical properties of the zirconia itself, the geometry and dimension of the prosthesis may have a significant effect on clinical fracture. Previous studies have estimated that the behavior of FPDs is relative to a cylindrical beam rather than the more complex shape of a dental prosthesis. The connector shape relative to retainers and pontics in a prosthesis results in a stress concentration that is much greater than in a simple beam. For this reason, it is likely that the minimum connector diameter suggested by previous studies is lower than necessary for predictable success under occlusal load.

**Objective:** To estimate the maximum stress concentration associated with the connector geometry in a 4-tooth FPD with the goal of providing estimates of the connector size required to achieve 20 years of function with a failure probability of 5%.

**Methods:** The authors describe the connector geometry of a 4-tooth posterior FPD with 2 pontics. Rather than assuming a simple beam, they describe a smaller connector dimension, the radius of curvature of the connector, both at the intersection with the retainer as well as at the intersection of the pontics. This model was then combined with known cyclic stress figures and average mastication frequency figures to estimate a minimum diameter for connectors for an estimated 20-year prosthesis lifespan.

**Results:** Previous recommendations underestimated the connector diameter. Using this model, along with previously published occlusal load data, the authors estimate minimum connector diameters of 5 mm to 6 mm.

**Conclusions:** Due to stress concentrations that occur as the framework narrows at the connector, previous studies proposing appropriate connector diameters have underestimated the connector size necessary for long-term clinical success.

**Reviewer’s Comments:** This is a very technical and theoretical study attempting to predict clinical longevity of a ceramic prosthesis. It is, however, an evolutionary step in zirconia FPD framework design. It is also a mathematical model, not a clinical trial. This illustrates the difficulty the dentist faces in making the decision, along with the patient, to use a prosthesis made with relatively new technology. These findings suggest that previous estimates of connector size are understated. Clearly, the best evidence is the clinical trial, but these have obvious temporal limitations. This is particularly true with new innovations that change faster than the data from clinical trials can be gathered. Until clinical trials provide solid evidence, we are faced with more risk; therefore, informed consent is critical. (Reviewer-Daniel E. Wilson, DDS).

Keywords: Zirconia Fixed Partial Denture, Longevity, Occlusal Load

Print Tag: Refer to original journal article
Zirconia restorations may be an alternative for patients with metal allergy.

**Objective:** A case report on the use of zirconia restorations in metal allergy patients.

**Participants/Methods:** This study reported on 14 patients (8 female and 6 male; age range, 20 to 66 years) who developed intraoral signs and symptoms of an allergic reaction after receiving 25 base metal alloy bridges and 5 crowns made from Remanium CS and Wiron 88 and 99. These patients developed one or more signs (gingivitis, stomatitis, swelling, erythema, blisters, papules, or ulcerative lesions) and symptoms (slight irritation in the neighborhood of the prostheses) within 4 to 22 weeks of prostheses placement and were referred for dermatologic evaluation. The most common intraoral reactions were gingivitis and stomatitis, and the most common extraoral reaction was perioral dermatitis. The dermatologist performed skin patch testing on the upper back with the standard test substances (Chemotechnique Diagnostics) authorized by the International Contact Dermatitis Research Group. Skin patch testing was also administered using 28 dental screening substances. None of the patients had existing amalgam or composite resin restorations. Skin patch testing found that the most frequent allergy-positive responses were to nickel sulfate (all 14 patients), copper sulfate (all 14 patients), palladium chloride (10 patients), cobalt chloride (8 patients), gold sodium thiosulfate (7 patients), methyl methacrylate (4 patients). After patch testing, the existing base metal crowns and bridges were removed and replaced with zirconia-based cores and feldspathic veneering porcelain. The patients were followed up every 2 months for 3 years to check for allergic signs and symptoms.

**Results:** No allergic signs and symptoms were found intraorally or extraorally during follow-up.

**Conclusions:** “Zirconia fixed partial dentures (FPDs) may be an alternative to porcelain-fused-to-metal FPDs in patients with metal allergies.”

**Reviewer's Comments:** Case reports such as in this study have the lowest level of scientific evidence, and the findings should be interpreted cautiously. This case report does not answer some important questions. (1) Did the patients have prior exposure to nickel from orthodontic hardware, prosthetic appliances, or jewelry? (2) Why were base metals originally used in these patients? (3) Was metal exposed to the oral mucosa or did porcelain cover the underlying metal? Considering the number of patients today with allergy to nickel-containing jewelry, dentists probably under-recognize the dental signs and symptoms of metal allergy. Obviously, using base metals in patients with confirmed metal allergy is contraindicated. Any all-ceramic restoration would presumably be nonallergenic in a metal-allergic patient. The use of zirconia-cored restorations in these 14 patients was shown to be a suitable alternative. (Reviewer-Charles B. Hermesch, DMD).

Keywords: Metal Allergy, Zirconia Crowns

Print Tag: Refer to original journal article
The enamel wear potential of composites should be taken into consideration when designing a posterior indirect restoration.

**Background:** Indirect composite restorations have been advocated because of their low abrasiveness of opposing natural dentition. However, some reports have shown that modern composites can be detrimental to the opposing teeth.

**Objective:** This study used novel methodologies to test the enamel wear caused by composite resins and the composite resin wear resistance. The surface morphology of the composite resins also was observed.

**Design/Methods:** 5 indirect composite resins were used in this in vitro study: Estenia, BelleGlass, Artglass, Solidex, and Infis. Flat enamel surfaces were obtained by grinding the buccal surface of human teeth. Specimens were cut from the flat enamel surface after polishing. Composite resin specimens were prepared and mounted along with the enamel specimens in the rotating sliding wear test device. A second experiment was performed because of a limitation of the first experiment (ie, unable to evaluate cases in which the composite resin wore more than the enamel. The surfaces of the composite resins after polishing with alumina paste and removal of the resin matrix (and consequent exposure of filler particles) were evaluated using scanning probe microscopy.

**Results:** Estenia, Belle Glass, and Artglass wore enamel and presented a greater resistance to wear than enamel. No enamel wear was noted with Solidex and Infis. Solidex presented wear resistance identical to enamel, whereas Infis wore more than enamel.

**Conclusions:** Significant wear of enamel is induced by indirect composite resins with large (protruding) filler particles.

**Reviewer's Comments:** The hardness of materials has been linked to their wear behavior on opposing (tooth) structures. Even though increased composite hardness resulted in increased enamel wear in the present study, all composites used had lower hardness than enamel. This study directly correlates particle size of indirect composite resins and enamel wear. The materials with the largest exposed particles after the buff-polishing experiment resulted in more enamel wear. The results of this in vitro study correlate to findings from published clinical studies. (Reviewer-Ricardo Walter, DDS, MS).

**Keywords:** Enamel Wear, Posterior Composite Resin, Scanning Probe Microscope

**Print Tag:** Refer to original journal article