Vigorous agitation of one-step self-etch adhesives improves their bond strength to dentin.

**Objective:** To evaluate the resin-dentin bond strengths and microleakage of 3 one-step self-etch adhesives applied either passively or with agitation.

**Methods:** The adhesives used in this study were Adper Prompt L-Pop (AD), Clearfil S3 Bond (S3), and Xeno III (XE). Occlusal surfaces of 30 extracted third molars were ground to expose a flat dentin surface that was polished to 600-grit to create a standardized smear layer. The adhesives were applied either passively or with agitation. For passive application, the material was spread over the entire dentin surface for 3 to 5 seconds and then left undisturbed for 15 to 20 seconds. For agitation, the adhesive was applied and vigorously scrubbed with a microbrush for 15 to 20 seconds. For both methods, the adhesive was dried with compressed air and light-cured. Composite was applied and cured in increments. The bonded specimens were sectioned into small "sticks" for microtensile bond strength testing (µTBS), which was accomplished using a universal testing machine. Failure modes were evaluated at 400x magnification. Additional specimens were reserved for scanning electron microscopy (SEM). To evaluate leakage, sticks were immersed in silver nitrate solution for 24 hours. Resin-dentin interfaces were examined using SEM, and the amount of silver nitrate penetration was measured using image analysis software.

**Results:** Agitations significantly improved the mean µTBS of all 3 adhesives: from 17.2 to 29.9 MPa for AD; from 19.4 to 31.8 MPa for S3; and from 16.5 to 26.3 MPa for XE. AD had greater leakage than the other 2 adhesives, but the application method made no difference for any of them.

**Conclusions:** Vigorous agitation of one-step self-etch adhesives improves their bond strength to dentin. **Reviewer’s Comments:** This is certainly not the only study to evaluate application methods for self-etch adhesives. However, it is a good one with very obvious results. Although the authors did not measure the pH of the adhesives, the ones chosen seem to be very representative, including the most acidic (AD) and a mildly acidic one (S3). Interestingly, manufacturers of S3 and XE specifically recommend passive application, which, judging from the results of this study is an incorrect recommendation. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Self-Etch, Application Method, Microtensile Bond Strength

Print Tag: Refer to original journal article
The Effect of Nano-Structured Alumina Coating on Resin-Bond Strength to Zirconia Ceramics.

Jevnikar P, Krnel K, et al:

Dent Mater 2010; 26 (July): 688-696

A laboratory applied alumina coating may improve zirconia restoration cementation.

**Background:** The use of zirconia frameworks for crown and bridge applications has exploded in the past several years and is a part of most contemporary aesthetic dental practices. While this material has proven to possess some excellent mechanical properties, reliable bonding to the intaglio surface of these restorations has remained a challenge. Air abrasion to create a roughened surface and air abrasion followed by imbedding silica-treated alumina particles have been recommended, but both can result in surface damage with the potential of later crack propagation. The search continues for a reliable, noninvasive method to improve the bonding to zirconia.

**Design/Objective:** This in vitro study investigates a novel nano-structured alumina coating as it relates to improving the bond to zirconia.

**Materials/Methods:** 120 zirconia disc-shaped specimens were fabricated and randomly divided into 3 equal groups according to surface treatment. One group was subjected to airborne particle abrasion with aluminum oxide particles, another polished, and the third remained "as-sintered" to serve as a control. Half of each group was coated with a nano-structured alumina coating by immersion in the alumina suspension and subsequent thermal treatment. The morphology of the coating was analyzed using scanning electron microscopy and atomic force microscopy. Composite resin cylinders were fabricated from Filtec Z250 (3M ESPE) and bonded to the specimens with Rely X Unicem (3M ESPE). Each group was either stored in distilled, body temperature water or subjected to thermal cycling. All specimens were then subjected to shear-bond strength testing in a universal testing instrument.

**Results:** Microscopic examination of the surface characteristics of the alumina coating revealed a uniform, micro-retentive surface that was not influenced by the character of the underlying zirconia. The alumina coating was apparently firmly adhered to the zirconia and uniformly 240 nm in thickness. The coated specimens all demonstrated significantly higher bond strengths than the noncoated groups both before and after thermocycling. During thermocycling, the "as-sintered" and polished groups (without coating) debonded spontaneously. Among the coated groups, the underlying surface did not significantly influence the bond strengths.

**Conclusions:** The application of a nano-structured alumina coating to zirconia followed by thermal conditioning significantly improves the bond strength performance to resin cement independent of previous surface treatment of the zirconia.

**Reviewer's Comments:** This early study provides great promise for a surface treatment that may be conveniently applied at a dental laboratory and improve the cement retention to zirconia restorations. Since this does not involve mechanical manipulation of the zirconia surface such as air abrasion, the integrity of the zirconia is seemingly unaltered, which should provide more mechanical predictability. Likewise, the thickness of the coating proved to be 2 orders of magnitude less than typical restoration gaps and therefore should not influence restoration fit. We anxiously await further investigation. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Zirconia, Shear Bond Strength, Cementation, Alumina Coating

Print Tag: Refer to original journal article
Curing Times Can Depend on Type of Photoinitiator Present in Composite

Pulpal-Temperature Rise and Polymerization Efficiency of LED Curing Lights.

Leprince J, Devaux J, et al:

Oper Dent 2010; 35 (March): 220-230

Reduced curing times are possible with high-intensity LED curing units, but optimal curing times are longer than those recommended by manufacturers and can depend on the type of photoinitiator present in the composite.

Objective: To evaluate the polymerization efficiency of 4 light-emitting diode (LED) light-curing units (LCUs) and their thermal effects on the pulp chamber.

Methods: The LED curing devices used in this study included 2 single-peak devices (bluephase 16i and Freelight 2) and 2 multiple-peak devices (bluephaseG2 and G-Light). As a control, a conventional halogen unit (XL3000) was used. All lights were used to cure Tetric Evo Ceram composite shade A2 (with camphorquinone as the dominant photoinitiator) and Bleach XL (with TPO as the dominant photoinitiator). The composite was cured in 2-mm deep molds using the LED units at exposure times of 10, 20, and 40 seconds. The halogen light was used at 40 seconds. Vickers hardness of top and bottom surfaces was measured using a microhardness tester. To measure temperature changes within the pulp chamber under the various curing conditions, a thermocouple was placed inside the pulp chamber of an extracted molar. The remaining dentin thickness between composite cured on the tooth surface and the pulp was 2 mm. Temperature was recorded during irradiation and extended until ambient temperature had been regained.

Results: For the A2 shade composite, all of the LED irradiation conditions provided top surface hardness equal to or exceeding that of the halogen control. Much greater differences were observed at the bottom surface. For example, the mean Vickers Hardness Number for the Freelight 2 at 10 seconds was only about half that of the bluephase 16i at 40 seconds. For the bleach shade composite, top surface hardness produced by the 2 single-peak LED units was significantly less than produced by the control. Irradiation time had a significant effect on bottom surface hardness. The 3 most intense lights caused higher temperature changes when they were used for 40 seconds (5°C to 6°C when the pulp chamber was covered by 2 mm of A2 composite and 2 mm of dentin).

Conclusions: Reduced curing times are possible with high-intensity LED curing units, but optimal curing times are longer than those recommended by manufacturers and can depend on the type of photoinitiator present in the composite.

Reviewer's Comments: This is an interesting study that provides useful information on 2 current topics related to light-curing technology, the effects of alternative photoinitiators and temperature changes caused by high-intensity LED units. (Reviewer-Erward J. Swift, Jr, DMD, MS).

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Keywords: Light-Curing, Photoinitiators, Temperature

Print Tag: Refer to original journal article
Light-Curing Produces Better Polymerization

The Effect of Curing Mode on Extent of Polymerization and Microhardness of Dual-Cured, Self-Adhesive Resin Cements.

Cadenaro M, Navarra CO, et al:

Am J Dent 2010; 23 (February): 14-18

Dual-cure, self-adhesive resin cements demonstrate comparable values to conventional, dual-cured resin cement.

**Background:** Dual-cured cements undergo polymerization via light stimulation and by a self-curing reaction even in the absence of light. Dual-cured cements are now containing acidic monomers and priming agents. This combines etching, priming, bonding, and cementing into a one-step procedure. However, one-step self-etch systems exhibit a lower degree of conversion than multistep adhesives, which may make them more subject to degradation because more uncured monomer increases water sorption.

**Objective:** To compare the effect of utilizing either light- or self-curing modes of dual-cured adhesive cements versus conventional dual-cured cement (control) on the extent of polymerization and microhardness.

**Materials/Methods:** Maxcem (Kerr) and RelyX Unicem self-adhesive systems were compared to Panavia F2.0 conventional dual-cured resin cement. All specimens were subjected to a constant temperature (35°C) in a nitrogen atmosphere to avoid oxygen inhibition. Materials were handled/mixed according to the manufacturers’ directions. During photopolymerization, the halogen curing tip was positioned 5 mm from the specimen; output intensity was 600 mW/cm2. Polymerization was conducted under 2 conditions: Group 1 specimens were immediately irradiated 20 seconds, with the extent of polymerization constantly scanned via exothermic reaction over 2 hours; Group 2 specimens were not light-cured but exothermic heat from the self-curing reaction was scanned over 2 hours. After a 2-hour scanning period, specimens in both groups were then subjected to another 2 minutes of light exposure to determine if additional monomer reaction occurred. A third 2-minute irradiation was then conducted. Vickers microhardness measurements were also gathered.

**Results:** In all materials, light curing produced an initial high and narrow peak rapidly decreasing after the light exposure ended. Self-cured specimens demonstrated a lower and broader peak. Polymerization was greater for all specimens when both light-activated and self-activated modes were used. When the light-activated mode only was used, there was no difference among the 3 cements. With the self-cure mode only, RelyX Unicem and Panavia F2.0 achieved lower values than Maxcem. Microhardness values were higher when light-activation was used. Panavia had the lowest microhardness values in the light-activation mode and RelyX had the lowest in the self-cure mode. Self-cure polymerization results in lower conversion rates than does light-curing polymerization. Microhardness values were also lower in the self-cure mode.

**Conclusions:** Dual-cure, self-adhesive resin cements demonstrate comparable values to conventional, dual-cured resin cement. All cements tested demonstrated higher values when light-cured.

**Reviewer's Comments:** This study demonstrates that not all resin cements react the same. A specific cement may be better for one situation than for another (eg, situations in which no light exposure is possible so cement must rely on self-curing reaction only). It demonstrates that the 2 curing modes do not produce an equal degree of conversion. Exposing dual-cure resin cement to the curing light, if possible, promotes better polymerization. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: Polymerization, Curing Mode, Microhardness, Resin Cements

Print Tag: Refer to original journal article
Are All Curing Lights and Tips the Same?

Irradiance Uniformity and Distribution From Dental Light Curing Units.

Price RBT, Rueggeberg FA, et al:


Using different light guides on the same light-curing unit significantly affects its power output, irradiance values, and beam homogeneity.

**Objective:** To quantify and qualify the irradiance distributions from a variety of commercial light-curing units (LCUs).

**Methods:** The curing devices tested in this study (including type of light source and light guide) were: Sapphire (PAC; “reverse turbo,” 5.5 to 9 mm); Bluephase 16i (LED; 13 to 8 mm turbo), FLASHLite Magna (LED; no light guide), Optilux 501 (QTH; standard, 11 mm), Bluephase 16i (LED; standard, 11 mm), and SmartLite IQ (LED; 13 to 8.5 mm turbo). The power of each light was measured by multiple exposures on 2 different meters. Irradiance values were calculated by dividing mean power values by the light tip area. Irradiance across the tips was determined by using a special apparatus designed to accurately characterize light beams. Beam analyzer software color-coded irradiance in both 2 and 3 dimensions. Another software package was used to generate histograms of the irradiance levels at different locations of the beam. To determine the effect of light guide type on power output and irradiance distribution, the same curing device (Bluephase 16i) was tested using both standard and turbo light guides.

**Results:** The mean irradiance values for the tested lights at tip end (in mW/cm2) were 2208 for the PAC light, 1714 for the Bluephase 16i/turbo, 1120 for the FLASHLite, 786 for the halogen, 725 for the Bluephase/standard, and 570 for the IQ. "Top Hat Factors" (THPs) were also calculated for each light (perfect distribution of emitted light forms a cylinder with a flat top, ie, a top hat). The FLASHLite had the lowest THF at 0.32 and the IQ had the highest at 0.74 (higher is better, indicating a more uniform beam). For the LED device using standard and turbo light guides, the standard produced a higher THF than the turbo. All of the tested lights had varying irradiance levels at different locations across the beam. As one example, the Bluephase 16i with turbo tip produced a beam that was >2000 mW/cm2 in 34% of its area but was <500 mW/cm2 in approximately 4% of its area.

**Conclusions:** Using different light guides on the same light-curing unit significantly affected its power output, irradiance values, and beam homogeneity.

**Reviewer’s Comments:** This is an extremely well done study on light-curing. From a clinical standpoint, the most important finding was that turbo tips significantly reduce homogeneity of the light beam. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Curing Lights, Irradiance Uniformity, Distribution

Print Tag: Refer to original journal article
Different Finishing/Polishing, Different Result

Surface Texture and Roughness of Polished Nanofill and Nanohybrid Resin Composites.
Endo T, Finger WJ, et al:
Dent Mater J 2010; 29 (March): 213-223

Steps should not be skipped when finishing and polishing restorations.

**Background:** High-quality aesthetics and enhanced longevity of resin-based restorations is directly affected by finishing and polishing. For instance, poor finishing/polishing of such restorations is likely to result in higher plaque accumulation and extrinsic discoloration.

**Objective:** To study the effects of different polishing systems on the surface texture of different composite resins.

**Methods:** Rectangular specimens of a nanofilled composite resin, Filtek Supreme XT (3M ESPE), and 3 nanohybrid composite resins, Grandio (Voco), Tetric EvoCeram (Ivoclar Vivadent), and Venus Diamond (Heraeus Kulzer GmbH) were fabricated. Specimens were finished/polished with the following systems: (1) Venus Supra (Heraeus Kulzer GmbH); (2) Compo Master and DirectDia Paste (Shofu, Inc.); and (3) Sof-Lex Pop-On Discs (3M ESPE). While the latter was used dry, the other systems were applied with water spray. Surface roughness was measured at different steps during the finishing/polishing procedures. Specimens from each group were randomly selected for scanning electron microscopy examination.

**Results:** All composite resins, except for Grandio, showed decreased surface roughness when finer-grit instruments were used after initial finishing (first 1 or 2 step[s] in each system). The use of DirectDia Paste after Compo Master resulted in rougher surface on Grandio specimens. Overall, the lowest surface roughness was found with Filtek Supreme XT and the highest with Grandio. Venus Supra and Sof-Lex systems performed somewhat similarly.

**Conclusions:** Venus Supra and Sof-Lex systems resulted in very good finishing/polishing of all composite resins tested.

**Reviewer's Comments:** Venus Supra is a two-step system, Sof-Lex is composed of 4 urethane coated discs of different grits of aluminum oxide, and the Shofu system is a two-step system (Compo Master) that can be followed by a diamond paste (DirectDia Paste). Both Venus Supra and Compo Master have different shapes. In the present study, the coarsest disc of the Sof-Lex system was not used as well as one of the instruments (grits) of the Compo Master system. The diamond polishing paste DirectDia deteriorated the surface achieved with Compo Master especially for the Grandio composite resin. The reason for that is not clear. The inferior results achieved for the Shofu system may have been influenced by the steps neglected. Shofu recommends Compo Master Coarse (2 steps) to be used prior to Compo Master (2 steps). As for the Venus Supra system, that system does not require a polishing paste as the final step. (Reviewer-Ricardo Walter, DDS, MS).

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Keywords: Composite Resin, Finishing, Polishing, Surface Roughness

Print Tag: Refer to original journal article
Endodontic procedures should be followed by final restoration within 2 weeks.

**Background:** The endodontic access cavity of the tooth must be sealed to prevent recontamination prior to the final restoration placement. The provisional material that is used must withstand mechanical forces, thermal changes, be nontoxic, and not affect future bonding to the tooth. All materials currently used have some strengths, but they also present some weaknesses.

**Objective:** To investigate the sealing ability of Cavit, Ketac, DuoTemp, and a combination of Ketac glass-ionomer and Cavit. DuoTemp is a dual-cure zinc oxide/zinc sulfate-based material with natrium fluoride.

**Materials/Methods:** 100 extracted mandibular molars were prepared with standardized access openings. One control group had no access opening and the other control group had an access opening that was not restored. Provisional materials were mixed according to manufacturers’ directions and placed in a 4-mm thick layer. Samples were stored in a brain-heart infusion agar at 37°C in 100% humidity. *Streptococcus mutans* was applied twice daily to the agar culture. Bacterial leakage was determined by observation of turbidity at 7, 14, 21, and 28 days. All positive controls leaked at all observation periods.

**Results:** Leakage at 7 days, recorded from the greatest leakage to the least leakage, was: Ketac alone; Cavit; Ketac/Cavit mixture; and DuoTemp. The percentage of leakage at 14 days increased significantly with the rank order from greatest to least as fellows: Ketac alone; Ketac/Cavit combination; Cavit alone; and DuoTemp. No increase in percentage of leakage was noted between 14 and 28 days. All materials leaked, so placement of the final restoration within 60 days following completion of the endodontic therapy is critical to prevent contamination.

**Conclusions:** None of the tested materials provided a reliable seal after 14 days. Cavit and DuoTemp provided the best seal during the study. This study suggests the endodontically treated tooth should receive a final restoration or core buildup within 2 weeks to minimize coronal microleakage.

**Reviewer’s Comments:** This study emphasizes what endodontists have told us for some time. Endodontic therapy must be followed soon with the final restoration to make it ultimately successful. The patient who delays seeing the restorative dentist risks having to repeat the endodontic procedure. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: Endodontic Openings, Provisional Restorations, Bacterial Leakage

Print Tag: Refer to original journal article
How to Increase Flexural Strengths of Zirconia and Improve Resin Bonding

The Effect of Zirconia Surface Treatment on Flexural Strength and Shear Bond Strength to a Resin Cement.

Qeblawi DM, Muñoz CA, et al:

J Prosthet Dent 2010; 103 (April): 210-220

Mechanical modification of the surface increases the flexural strengths of zirconia, and resin bonding is improved by a combination of mechanical and chemical conditioning.

Objective: To evaluate the effect of airborne-particle abrasion (APA), silicoating, and hand grinding on the flexural strength of zirconia and the effects of these surface treatments on resin bond strengths to zirconia.

Methods: Zirconia bars were fabricated from IPS e.max ZirCAD blocks. As a control, one group of bars was not treated after sintering. Other groups were airborne-particle abraded (50-µm aluminum oxide), silicoated (using 3M ESPE’s Co-Jet system), or were ground with a fine-grit rotary diamond in a high-speed handpiece. Flexural strengths were determined following 24-hour water storage using a 3-point bend apparatus in an Instron universal testing machine. Zirconia rods were formed for bond strength testing. Following each of the surface treatments described above, specimens were further treated by hydrofluoric acid etching and silanation, silanation only, or zirconia primer (with some specimens undergoing no additional treatment as controls). The zirconia rods were bonded to buccal or lingual dentin of extracted human molars using the Multilink resin cement system, which includes a self-etch primer. Shear bond strengths were determined using the Instron universal testing machine. The groups that had the highest immediate bond strengths were duplicated and tested again after aging.

Results: Particle abrasion and hand grinding produced higher flexural strengths than silicoating or the control. There were many interactions between the various mechanical and chemical treatments, but silicoating (which embeds silica-modified aluminum oxide particles) plus silanation provided the highest mean shear bond strengths. Aging reduced resin adhesion in some, but not all, groups.

Conclusions: Mechanical modification of the surface increased the flexural strengths of zirconia, and resin bonding was improved by a combination of mechanical and chemical conditioning.

Reviewer’s Comments: I was surprised to see that mechanical roughening of the zirconia surface actually increased its flexural strength. This probably can be explained by the fact that zirconia undergoes a phase transformation that improves its strength in areas subjected to compressive forces. The findings with regard to resin bonding, on the other hand, were not a surprise. Previous studies have reported that silicoating is effective for bonding resin to zirconia. Also, special primers for zirconia are being introduced and appear to be effective. (Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: Zirconia, Flexural Strength, Resin Bonding

Print Tag: Refer to original journal article
Tribochemical silica coating seems to allow the best bonding to old composite resin restorations.

**Background:** The success of composite resin repairs greatly depends on the composite-composite bonding. Techniques such as the use of an intermediate bonding agent and air abrasion with silica-coated alumina particles followed by silanation have been suggested.

**Objective:** To compare the composite-composite bond strengths and composite surfaces of different composite resins subjected to different in vitro aging methods.

**Methods:** 1 microhybrid (Quadrant Anterior Shine [Cavex Holland BV]), 2 nanohybrids (Grandio [Voco] and Tetric EvoCeram [Ivoclar Vivadent]), and 1 nanofilled composite resin (Filtek Supreme Plus [3M ESPE]) were investigated. Specimens were fabricated and tested on 3 aging conditions: (1) thermocycling; (2) immersion in water for 6 months; and (3) immersion in citric acid. A non-aged group served as controls. After aging, composite resins were conditioned with 1 of 2 protocols: (1) application of an intermediate bonding agent layer or (2) tribochemical silica coating. In protocol 1, fresh composite resins were used with bonding agents from the same manufacturer: Quadrant Unibond for Quadrant Anterior Shine; Solobond Plus for Grandio; Multilink for Tetric EvoCeram; and Adper Single Bond Plus for Filtek Supreme Plus. No etchant was used. For the tribochemical silica coating procedure, composite resin surfaces were treated with an intraoral air abrasion device (30-µm alumina particles coated with silica). After that treatment, a silane coupling agent was applied, allowed to react, and an intermediate bonding agent applied (Visio™ Bond [3M ESPE]). The elemental composition of the composite resin surface was determined using x-ray photoelectron spectroscopy. Atomic force microscopy was used to evaluate surface roughness and field emission scanning electron microscopy was used to image the morphology of the composite resin surfaces.

**Results:** Composite resin type, surface conditioning, and aging methods had significant effects. Tribochemical silica coating showed higher bond strength values than the bonding agent alone, especially after water storage. All aging conditions roughened the surface.

**Conclusions:** The storage conditions tested negatively affect the surface of composite resins and the composite-composite bond strength. Failure mode analysis indicates that tribochemical silica coating should be favored over intermediate bonding agent alone for the repair of aged composite resins.

**Reviewer's Comments:** The results of this study are not surprising and confirmatory only. However, the clinical significance of the different results for the treatments provided is not known. Both surface treatments were provided without any further preparation of the aged composite resins, which is unlikely to happen in the daily practice. (Reviewer-Ricardo Walter, DDS, MS).

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Keywords: Composite, Repair, Bonding Agent, Silica Coating

Print Tag: Refer to original journal article
Multistep Adhesives Still Show Better Bonding

A Randomized Clinical Evaluation of a One- and Two-Step Self-Etch Adhesive Over 24 Months.

Loguercio AD, Mânica D, et al:

Oper Dent 2010; 35 (May): 265-272

One-step adhesives may not demonstrate the same bond durability as two-step adhesives.

**Background:** Adhesive systems can be classified by how they affect the smear layer. Etch-and-rinse systems remove it, while self-etch systems modify it. Self-etch systems combine an acidic primer and an adhesive resin to create a one-step procedure. Evaluation of the clinical effectiveness of a one-step self-etch adhesive has questioned whether these adhesives are as effective as other systems with ≥2 steps. This may be because there is a lack of a non-solvated resin layer, which makes the adhesive become a very permeable membrane. Placement of a hydrophobic resin coating improves the bond strength of these adhesives.

**Design/Objective:** To conduct a 24-month randomized prospective study to evaluate performance of All Bond Self-Etch used as a one- or as a two-step, self-etch adhesive in noncarious cervical lesions (NCCLs).

**Participants/Methods:** One restoration using a one-step adhesive and one using a two-step adhesive were placed in each of 33 patients. The NCCLs were prepared by cleaning them with pumice and water, rinsing and drying them, and then placing rubber dam isolation. Lesions were nonretentive and had no bevel. Adhesives were applied according to manufacturer's directions. Aelite (BISCO, Inc.) composite was applied in increments with each layer light-cured 30 seconds before finishing. One week after insertion, the restorations were polished with finishing discs. Restorations were evaluated at baseline and at 6, 12, and 24 months in the following categories: color match; anatomical form; marginal adaptation; marginal discoloration; postoperative sensitivity; and presence of recurrent caries. At both 6- and 12-month recalls, all restorations were rated as excellent for anatomic form, marginal adaptation, and postoperative sensitivity. Marginal discolorations were noted in 4 one-step adhesive restorations and in 1 two-step restoration. At 24 months, 6 one-step and 3 two-step restorations were rated Bravo for anatomical form and 6 one-step and 4 two-step restorations were rated Bravo for marginal discoloration. Restoration retention was slightly lower for one-step restorations after 24 months. One-step adhesives are more prone to water sorption, which can lead to early adhesive failure. Concentration of hydrophobic monomers in the two-step procedure for two-step adhesives achieves better long-term retention.

**Conclusions:** One-step All Bond SE exhibited good performance for the 24 months of this study, but two-step All Bond SE achieved higher performance. Application of an extra hydrophobic bond layer over the self-etch adhesive system improved the retention rate.

**Reviewer's Comments:** The one-step systems work, but the addition of the extra step produces better performance. There is the possibility that the time saved with one-step procedures may result in poorer performance of the restoration. Careful attention to placement of one-step adhesives is critical to maximize their performance. The concentration on time and effort saved by decreasing the number of steps required presents a potential downside. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: Self-Etch Adhesive, One-Step, Two-Step, Strength, Durability

Print Tag: Refer to original journal article
When Should Final Restorations in Aesthetic Zone Be Placed?

Contemporary Crown-Lengthening Therapy: A Review.

Hempton TJ, Dominici JT:

J Am Dent Assoc 2010; 141 (June): 647-655

Crown lengthening may help facilitate restorative procedures but may have aesthetic implications.

**Background:** Periodontal crown lengthening surgery is still commonly employed to expose healthy tooth structure in the case of fractured or diseased teeth, which may have significant aesthetic implications. In addition, this treatment modality may be used to recontour gingival tissues in an effort to create a more aesthetic result.

**Objective:** To study and summarize the literature regarding the rationale, methods, and recommendations regarding periodontal crown lengthening.

**Methods:** PubMed and Google Scholar searches using key words associated with crown lengthening and restorations with periodontal implications were accomplished.

**Results:** The indications for crown lengthening include "functional" reasons such as exposure of tooth structure gingival to caries, fracture, or to create healthy tooth structure apical to foundation restorations. Crown lengthening may be performed for aesthetic reasons in cases of delayed passive eruption or to improve symmetry. A potential sequela of crown lengthening in the anterior aesthetic zone is the exposure of the gingival embrasure revealing the “black triangle.” The authors discuss the biological width, the preponderance of literature agreeing that the minimum distance from the osseous crest to a restoration margin is 3 mm in order to avoid chronic inflammation. The review contains a discussion of ferrule dimension and states that the literature centers on 1.5 mm as the minimum ferrule or solid tooth structure apical to the foundation restoration. Crown lengthening is often performed to obtain this dimension and still respect the biologic width. The remainder of the article addresses the basic techniques used for gingivectomy procedures as well as the more common crown lengthening involving osseous recontouring. A discussion of bony resection to solve the problem followed by creation of positive architecture illustrates the bone's influence on gingival form and position. The contraindications and risks of this procedure, both in terms of reduced periodontal support and esthetic liabilities, are discussed. Finally, issues of wound healing and tissue level stability are reviewed.

**Conclusions:** The authors conclude that this procedure is still a viable procedure for facilitating restorative treatment as well as for aesthetic reasons. They suggest that in order to insure a stable result in the aesthetic zone, final restorations should be done no sooner than 6 months after the surgical procedure.

**Reviewer's Comments:** This study is flawed in that the literature search strategy is not detailed, and there was no mention of inclusion or exclusion criteria for articles. Therefore, the only criterion for article inclusion is the author's judgment. That being said, this article is a good basic review of the issues revolving around this procedure, particularly for the newer practitioner. Those dentists that practice this procedure regularly will likely be frustrated by the lack of subtlety, particularly involving the variation in periodontal dimensions and the implications for superior aesthetic outcomes. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Crown Lengthening, Biologic Width, Esthetic Recontouring, Ferrule

Print Tag: Refer to original journal article
**Any Advantage Lining Cavities With Flowable?**

Senawongse P, Pongprueksa P, Tagami J:  
Dent Mater J 2010; 29 (May): 324-329

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**Flowable composites may be used as liners to minimize the negative effects of polymerization shrinkage.**

**Background:** Cervical lesions have multifactorial etiology with occlusion playing a significant role. Occlusal forces may also be responsible for failure of Class V restorations. To protect the bond between tooth and restorative material, an elastic bonding area at the tooth-composite resin interface has been proposed. That would compensate for polymerization contraction and occlusal stresses and possibly extend the longevity of the restoration.  

**Objective:** To compare the elastic modulus and microleakage of different materials/placement techniques in Class V composite resin restorations with and without occlusal loading.  

**Design/Methods:** This in vitro study used extracted premolars. Preparations 2 mm (high) x 4 mm (wide) x 2 mm (deep) were created using diamonds at the CEJ on the facial surfaces. Occlusal margins were in enamel and gingival margins in cementum/dentin. The prepared teeth were divided into 3 groups and restored as follows: (1) One-Up Bond F Plus adhesive and Estelite Sigma in bulk increment; (2) One-Up Bond F Plus adhesive, Palfix Estelite LV Low Flow liner, Estelite Sigma; and (3) One-Up Bond F Plus adhesive, Palfix Estelite LV High Flow liner, Estelite Sigma. Elastic modulus was measured on dentin, hybrid layer, adhesive, and composite resins. Half of the remaining specimens underwent mechanical loading. Microleakage was evaluated on these specimens as well as on controls that were not mechanically loaded.  

**Results:** Significant differences in elastic modulus were present except when comparing hybrid layer and flowable composites. Overall, occlusal force loading and flowable composites were not significant when determining microleakage. However, occlusal loading did increase microleakage in the dentin group bulk filled with composite resin – no flowable.  

**Conclusions:** The elastic modulus of flowable composites may suffice to compensate for occlusal stresses. This was somewhat confirmed by the reduced microleakage at dentin margins when flowable composites were used.  

**Reviewer's Comments:** A limitation of this study may be the microleakage test applied. Slices of teeth were used to study microleakage, which may not have been representative of the groups. Nevertheless, specimens restored with flowable composite resins showed less microleakage than the bulk filled group and that is somewhat in agreement with the literature. Lastly, the preparations in this study are not necessarily consistent with noncarious cervical lesions, which have lower C-factor and usually very sclerotic dentin. (Reviewer-Ricardo Walter, DDS, MS).

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**Keywords:** Elastic Modulus, Microleakage, Flowable, Occlusal Loading

**Print Tag:** Refer to original journal article
CT Software Can Visualize Prosthetic Outcomes

CT Scanning in Implant Placement.
Kosinski T, Langberg M:

Inside Dent 2009; 10 (November/December): 50-54

Background: The use of CT scanning software enables the clinician to determine the ideal position before the actual surgery. Surgical placement of implants becomes less invasive and more predictable because implants are angled correctly.

Objective: To present a case report demonstrating the use of CT scanning in implant placement. Case Report: A 79-year-old man presented with an unsatisfactory maxillary denture opposing reconstructed mandibular teeth. Since the patient had a severe gag reflex, an implant-retained, palate-less denture was planned. Bone loss made design selection important. A Straumann Dental Implant System with an 8° Morse taper internal correction and a flared neck was chosen. The planning software was used to visualize the patient's entire oral anatomy and simulate implant placement. A surgical guide was created by the 3D images and was used to guide implant placement. Before the CT scan was done, a radiographic guide was fabricated to aid visualization of optimal prosthetic outcome. Teeth were positioned in wax, and a hard model was created to illustrate final results. The radiographic guide was placed intraorally during the CT scan to allow visualization of ideal teeth position on a 3D model. The 3D model was analyzed, and planning and placement simulation was completed on the computer. The newly created surgical guide directed implant placement into the ideal location—in this case, into the first molar and canine areas. The guide determined implant location, angulation, size, and depth. Because of the pre-placement visualization, no tissue flap was needed for implant placement. Implant shoulders were left slightly coronal to the crestal bone for easy access. Three months were allowed for good bone integration. Soft tissues appeared healthy, so an impression was made with a closed custom tray using an impression cap and positioning cylinders. The laboratory placed proper analogs in the impression to make a master model. Zest Locators were incorporated for retention of the palate-less denture. The Locater attachments were positioned extra-coronally to allow good tissue adaptation and easy maintenance with a toothbrush.

Results: Follow-up showed good abutment stability, no implant mobility, and no plaque accumulation. Implants were not probed to avoid damaging the peri-mucosal seal. Radiographs were scheduled at yearly recalls to determine bone position and contours. Because metal scalers and ultrasonic scalers can damage titanium abutment surfaces, plastic, gold, or graphite scalers are recommended.

Conclusions: The palate-less denture had good retention, and the patient's gagging problem was eliminated. CT scans and scanning software make surgical implant placement routine. Anatomical variations are determined prior to treating the patient.

Reviewer's Comments: Current sophistication of scanners makes implant planning and placement much more precise than 2 or 3 decades ago. Not only are placement problems decreased, but restorations are also much easier to perform because of the ideal location of implants. Improvements in technology are making implants routinely successful. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: CT Scan Software, Implant Placement

Print Tag: Refer to original journal article
Objective: To compare the marginal adaptation of Class II "open-sandwich" restorations using either a resin-modified glass ionomer (RMGI) or dual-cure composite as the dentin substitute.

Methods: Standard Class II (MO) preparations were made in extracted human third molars. The proximal boxes terminated just apical to the cementoenamel junction. The preparations were randomly assigned to 2 groups depending on the dentin substitute used—either the dual-cure composite Multicore Flow or the RMGI Fuji II LC. In the Multicore group, All Bond 2 was used as the adhesive. In the Fuji II LC group, a 10% polyacrylic acid conditioner was applied before the glass ionomer. All restorations were completed using Tetric Evo Ceram composite; in the RMGI group, All Bond 2 was used as the adhesive after placement of the RMGI. The RMGI had been allowed to chemically cure for 5 minutes and then was light activated for 40 seconds. Ten teeth were prepared and restored as controls, using Multicore and Tetric Evo Ceram without an adhesive. All of the restored specimens were subjected to thermal and mechanical load cycling using a fatigue cycling machine. They were immersed in silver nitrate to detect leakage at gingival margins of the Class II restorations. Leakage was scored on a 0- to 3-point scale.

Results: Leakage was significantly greater in the restorations with Multicore Flow than in those with Fuji II LC as the dentin replacement.

Conclusions: For open-sandwich posterior composite restorations, RMGI is a better choice than dual-cure composite for the dentin substitute.

Reviewer's Comments: The gingival margin is the location in Class II composite restorations where failure due to leakage or recurrent caries is most likely, particularly when enamel is absent. A variety of methods have been proposed to help seal that margin, including flowable composites, self-cure or dual-cure composites, or various types of glass ionomers. Numerous studies, including the present one, indicate that glass ionomers might be the best choice. Glass ionomers form a bond with tooth structure that is partially chemical in nature and tends to be very stable over time. Unfortunately, many or most glass ionomers can be difficult to manipulate in clinical situations. (Reviewer: Edward J. Swift, Jr, DMD, MS).
Laser energy can be used to disintegrate the bonding resin.

Objective: This case report discusses treatment of discoloration under a ceramic crown. Case Report: A pressed ceramic crown was cemented on a maxillary central incisor using a total etch-and-bond protocol with resin cement (Variolink Veneer). Four weeks after cementation, the patient presented with the gingival third distinctly darker. The differential diagnosis was staining resulting from infiltration of chromogenic bacteria. Bleeding and leakage of crevicular fluid occurred during cementation. Discoloration resulted from interaction of hydrogen sulfide produced by Actinomyces bacteria interacting with iron compounds in blood and gingival exudates. Examination, including a radiograph, indicated that the tooth was asymptomatic and vital. Crown removal was indicated. A Waterlase Yttrium-Scandium-Gallium Garnet (YSGG) laser was chosen to break the cement bond interface and allow a clean removal of the restoration without damage. Hydrokinetic energy from the Waterlase YSGG laser at a setting of 4.0W, 65% air, and 55% water was applied. The laser was applied in alternating horizontal and vertical patterns for 30 seconds on both facial and lingual surfaces. Next, the crown was carefully dislodged using a spoon excavator applied at the lingual margin. Magnification revealed no damage to the porcelain. No remaining cement was visible inside the crown or on the tooth. To ensure that the intaglio surface was receptive to rebonding, it was air abraded, etched 60 seconds with 9% hydrofluoric acid, rinsed, and dried. Two coats of silane were applied. Scotchbond Multipurpose bonding agent was applied and light cured. A retraction cord was placed to prevent crevicular fluid leakage. The tooth was cleaned with a slurry of chlorhexidine and fine pumice, followed by scrubbing with a sodium hypochlorite-soaked cotton pellet. The tooth was rinsed and then etched with 35% phosphoric acid followed by Excite bonding agent applied with rubbing for 15 seconds. The crown was luted with resin cement. Margins were coated with glycerin to prevent an oxygen-inhibited layer. Gingival retraction paste was placed to eliminate bleeding upon removal of the retraction cord. Excess cement was removed, and the patient was dismissed.

Conclusions: Hydrokinetic YSGG laser energy destroyed the cement bond between tooth and crown without damaging the porcelain. This allowed the crown to be rebonded after cleaning and allowed reconditioning of the tooth and crown. This technique appears to be successful only when laser light energy penetrates the restoration to the cement interface.

Reviewer's Comments: The author presents a unique way of solving an old problem—removal of a ceramic restoration without fracturing it during removal. This article also illustrates another problem. Leakage of fluids, especially blood, at the margins during bonding is a critical error. It is imperative that the bonding site be isolated to achieve the aesthetic results required. The laser technique is well worth trying if it is necessary to remove a ceramic restoration with the intention of rebonding it. (Reviewer-Thomas G. Berry, DDS, MA).

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Keywords: Occlusion, Laser, Bonded Ceramic Crown, Removal

Print Tag: Refer to original journal article
Better composite margins are produced by finishing diamonds than by carbide burs.

**Objective:** (1) To evaluate the effects of different finishing instruments on the resin-enamel marginal integrity of composite restoration, and (2) to determine whether orientation of the finishing procedure had any effect on marginal integrity.

**Methods:** 75 bovine incisor crowns were embedded in acrylic with the facial enamel protruding slightly above the acrylic surface. The enamel was ground flat and polished to 1200 grit. Standardized preparations were made in each tooth and were restored using the etch-and-rinse adhesive Single Bond and a single increment of Filtek Z-250 composite. The preparations were slightly overfilled to allow for finishing. The restored specimens were assigned to 5 treatment groups. As a positive control, some specimens were mechanically polished to 1200 grit. As a negative control, specimens were finished using 100-μm diamonds. One group was finished using 16-blade cross-cut burs. The others were finished using a series of 8-, 16-, and 30-fluted burs, either straight or spiral cut, or with a series of fine, extra-fine, and ultra-fine diamonds. All finishing was done using an electric handpiece with water coolant at 30,000 rpm. A standard pressure was applied and monitored with a load cell. Restoration margins were examined using an optical microscope at 300x magnification. The largest gaps were digitally photographed, and gap width measurements were made using image software.

**Results:** The smallest marginal gaps (mean, 0.73 μm) were observed in the 1200-grit control group; the worst marginal gaps (mean, 16.2 μm) were seen in the negative control, diamond-finished group. Of the other finishing systems used, the diamond series provided the best results. All of the carbide bur finishing systems had similar results that were not as good as the diamonds. The location of marginal gaps did not appear to be associated with the orientation of striations created by finishing.

**Conclusions:** Finishing diamonds produce better composite margins than those produced by carbide burs.

**Reviewer's Comments:** Out of habit, I use carbide burs far more than I use diamonds for finishing composite restorations. However, based on this study, I will reconsider diamonds. The 3-step diamond series was kinder to margins than the any of the carbide finishing burs, including a spiral-cut series that I use frequently. (Reviewer—Edward J. Swift, Jr, DMD, MS).

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Keywords: Resin-Based Composite Restorations, Finishing Instrumentation

Print Tag: Refer to original journal article
The most frequent complications of posterior zirconia core fixed partial dentures are chipping and decementation.

**Objective:** To determine the clinical performance over 4 years of zirconia-based posterior fixed partial dentures (FPDs) made with 2 types of veneering ceramics.

**Design:** Prospective clinical trial.

**Participants/Methods:** 75 patients with a mean age of 49 years (range, 26 to 76 years) were selected for replacement of 1 or 2 missing posterior teeth with a total of 99 FPDs. Patients were excluded if they had bruxism, severe periodontal disease, pulpitis, or horizontal abutment tooth mobility >1 mm. Experienced dentists prepared the abutment teeth to the Cercon manufacturer's clinical guidelines (1.5 mm occlusal reduction, heavy chamfer, and a minimum of 6 degrees of axial taper). All of the FPD frameworks were milled from Cercon zirconia blanks and then sintered to their final strength. The framework minimum thickness was 0.4 mm, and the connector cross-section minimum area was 9 mm². Two different types of veneering ceramic were baked onto the zirconia frameworks. The veneering ceramics differed in their coefficients of thermal expansion (CTE): 8.5 for the experimental ceramic versus 9.5 for the standard ceramic. The FPDs were conventionally cemented with zinc phosphate and evaluated every 6 months for various technical and biologic events. Eight of the original 75 patients were lost to follow-up over the 4-year evaluation period.

**Results/Conclusions:** The overall FPD survival rate was 93.7% for the experimental versus 95.2% for the standard group. Seven FPDs failed and had to be replaced for various reasons (1 for marginal chipping, 3 for loss of retention, 1 for a root fracture, 1 for a periodontal lesion, and 1 due to caries). Various interventions were required in 23% of the 99 FPDs to maintain their function (6 FPDs required recementation, 4 required excavation of caries at the margin and repair, and 13 had chipping of the veneer porcelain). No statistically significant differences were found between the 2 types of veneering ceramics in terms of the various criteria evaluated.

**Reviewer's Comments:** This study contains some good information on the various complications that can arise from FPDs with zirconia frameworks, specifically chipping of the veneering ceramic and loss of retention. The study represents one method that a major manufacturer made to reduce the porcelain chipping problem in restorations with zirconia cores. Successful porcelain-fused-to-metal (PFM) systems are known to be critically dependent on appropriate matching of the coefficients of thermal expansion between the metal framework and porcelain. In this study, the differing coefficients of thermal expansion of the 2 veneering ceramics did not make a detectable difference. This study has potential bias in that the 2 types of veneering porcelains were not randomly assigned to patients, the evaluators served as the operators, and there were no controls (to compare to other types of FPDs such as PFM). (Reviewer-Charles B. Hermesch, DMD).

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Keywords: Zirconia-Ceramic, Restorations

Print Tag: Refer to original journal article
Composites do not match Vita shade tabs well, even when a layering technique is used.

**Objective:** To compare the final shade of different enamel shades of composites over a white backing, a black backing, or a dentin shade composite with the corresponding Vita Classical Shade tabs.

**Methods:** Disk-shaped specimens of composite (1 mm thick for enamel shades, 1.5 mm for dentin shades) were made in Teflon molds. Three composites were used: Filtek Supreme Plus, Premise, and Estelite Sigma. (Note: different manufacturers use different terminology for their composites; eg, a body shade of Filtek Supreme is not the same as a body shade of Premise. For this study, the authors selected similar opacities of the materials regardless of specific manufacturer terminology.) Four enamel shades were evaluated: B1, B2, A1, and A2. Three dentin shades were used: A1, A2, and A3. The color of enamel composites was measured by a single operator using a Minolta CR-221 colorimeter, placing the composite specimen over a white or black backing, or with the dentin composite placed between the enamel composite and the backing. The colorimeter was also used to measure the color of the middle portion of B1, B2, A1, and A2 shade tabs. Delta-E values (representing overall color differences between composites and shade tabs) were calculated.

**Results:** Over the white and black backgrounds, the only enamel composite with a color difference of <3.3 (considered the threshold for visual detection) versus the shade tab was Premise B1 over black. Color differences ranged up to a delta-E value of 13.7. Shade matching was much better over the dentin composite, as several of the shades of the 3 composites had color differences of <3.3. Still, only a few of the layered composites matched the CIELAB color parameters of the shade tabs.

**Conclusions:** Composites do not match Vita shade tabs well, even when a layering technique is used.

**Reviewer's Comments:** Layering of composite restorations has become a popular way for improving aesthetic results. Many manufacturers now supply their composite materials in different opacity levels to provide better replication of the opacity and translucency levels of teeth. Most of these composites come in Vita shades; however, as the present study shows, they do not always match the Vita shade tabs well, even when a layering technique is used. (Reviewer—Edward J. Swift, Jr, DMD, MS).
Bonding agents with low pH are likely to be incompatible with some self- and dual-cured resin-based materials.

**Background:** Incompatibilities between some etch-and-rinse and self-etch adhesive systems with self- and dual-cured resin-based materials exist. These incompatibilities are believed to be due primarily to an adverse reaction between unpolymerized acidic resin monomers in the adhesive and the tertiary amine catalyst in the composite resin. The application of an adhesive resin layer (no primer) prior to the resin-based restorative or cement has been suggested to overcome the problem.

**Objective:** To evaluate the compatibility of different adhesives with different resin luting cements.

**Design:** This was an in vitro study that used extracted human third molars.

**Methods:** Teeth were randomly divided into groups according to combinations of resin luting cement and adhesive. Materials used were 2 "all-in-one" adhesive systems, One Up Bond F (Tokuyama) and Xeno III (Dentsply); 2 two-step self-etching primers, Clearfil SE Bond (Kuraray) and Unifil Bond (GC); and an experimental protocol, Xeno III and the bonding resin of Clearfil SE Bond. Variolink II (Ivoclar Vivadent) and Multilink (Ivoclar Vivadent) were the resin luting cements tested. Adhesives were applied to dentin, and titanium cylinders were cemented. Specimens were tested in shear bond strength after 10 days of storage at 37°C in 100% humidity.

**Results:** Unifil Bond had the highest mean shear bond strength to Variolink II. The other cements did not differ when used with Variolink II. Unifil Bond and the experimental group had the highest mean shear bond strength to Multilink. Clearfil SE Bond presented an intermediate value and One Up Bond F and Xeno III seem to be incompatible to that material. While the former presented a very low shear bond strength to Multilink, the latter did not bond at all.

**Conclusions:** This study confirms the incompatibility between certain simplified adhesives and self-cured resin-based materials. A hydrophobic bonding resin layer seems to prevent problems with incompatibility.

**Reviewer's Comments:** There is extensive literature on this topic. Incompatibilities between adhesives with low pH and self- and dual-cured resin-based materials are known for about a decade. Clinicians should be aware of these and use the appropriate adhesive with materials that are not light-cured. The results for Clearfil SE Bond are intriguing, however. A bonding layer of that material was used in the experimental group resulting in higher mean shear bond strength with Multilink. The reason for the poor performance of Clearfil SE Bond (solo) and Multilink is unclear at this point. (Reviewer-Ricardo Walter, DDS, MS).

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**Keywords:** Resin Cement, Self-Etching, Shear Bond Strength, Incompatibility

**Print Tag:** Refer to original journal article
Ceramic vs Composite Resin for Milled Crowns


Vanoorbeek S, Vandamme K, et al:

Int J Prosthodont 2010; 23 (May-June): 223-230

Milled all-ceramic crowns outperform milled composite resin crowns over 3 years.

Objective: To determine the clinical performance over 3 years of single crowns made with cores milled from either all ceramic blocks or composite resin blocks.

Design/Methods: In this prospective, partially randomized clinical trial, 200 crowns (59 composite resin and 141 all-ceramic crowns) were placed in 130 patients with stable occlusion. The patients ranged in age from 18 to 70 years, and the majority of the crowns (78%) were on maxillary anterior and posterior teeth. The GN-1 CAD/CAM system was used to mill both the all-ceramic and composite resin cores. The all-ceramic cores were milled from aluminum oxide pre-manufactured blanks and veneered with a feldspathic porcelain (GC Initial AL). The composite resin cores were milled from pre-manufactured blanks from the GC company and veneered with the corresponding GC Gradia composite resin. Appropriately trained prosthodontic graduate students prepared the teeth and cemented all the crowns with a dual-cured adhesive resin cement. The crowns were examined 3 times over a 3-year period by 2 independent evaluators for various biologic and technical factors. Wear was measured via laser scanning of casts. Success was defined as crowns having no significant discrepancies that required repair or remake.

Results: Approximate 75% of the crowns were available for the 3-year recall period. The cumulative survival at 3 years was 97% for the all-ceramic crowns and 88% for the all-composite resin crowns. The success rate was 81% for the all-ceramic crowns and 56% for the all-composite resin crowns. Patients rated their satisfaction with the crown aesthetics favorably in 97% of the all-ceramic crowns versus 65% for the all-composite resin crowns. The average vertical wear at the occlusal contact areas was 93 μm and 174 μm for the all-ceramic and all-composite resin crowns, respectively.

Reviewer's Comments: Although this study has some design problems, it does show convincingly that milled composite resin crowns had inferior clinical performance compared to all-ceramic crowns. In fact, the first 59 composite resin crowns had so many early complications that the researchers discontinued enrollment of patients in that leg of the study. At best, milled composite resin crowns might be used as provisional crowns but not as long-term restorations. The study findings suggest that the physical properties of composite resin (especially wear and strength) have still not been developed to the point that they can be expected to perform successfully over the long term in the restoration of cusps or large occlusal surfaces in posterior teeth.

(Reviewer-Charles B. Hermesch, DMD).

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Keywords: Milled All Ceramic, Milled Composite Resin Crowns

Print Tag: Refer to original journal article
A novel daytime bleaching system significantly lightens tooth color but is not as effective as the standard overnight custom tray system.

**Objective:** To compare the clinical efficacy and side effects of a new daytime at-home bleaching system using 28% carbamide peroxide versus overnight application of 10% carbamide peroxide.

**Participants/Methods:** 20 young adult patients participated in this randomized clinical trial. Initial $L^*$, $a^*$, and $b^*$ values of the upper left or right incisors and canines were made using a Vita-Easyshade dental spectrophotometer. The teeth were bleached using 1 of 2 systems. As a control, Opalescence 10% carbamide peroxide gel was applied in custom trays for 6 to 8 hours overnight for 10 days. The other system was the Meta Tray, which includes foam strips impregnated with 28% carbamide peroxide gel that is placed into a special stock tray that is inserted into the mouth. The gel is warmed with a light source through the tray for 20 minutes. The bleaching regimen was a single 20-minute daily application for 10 days. Tooth color was measured electronically, and photographs were made after bleaching and at 1 year after treatment. To evaluate tooth and gingival sensitivity, patients were asked to record any sensitivity and rate it on a 0- to 4-point scale.

**Results:** The overall color change achieved by overnight bleaching with Opalescence was 9.3 delta-E units, primarily due to changes in the $L^*$ (lightness) and $b^*$ (yellow) parameters. After 1 year, the color change was 8.3 units different from baseline. In contrast, the color change produced by the Meta Tray system was only 4.3 units immediately after treatment and 3.2 units at 1 year. More tooth sensitivity occurred in the Opalescence group, and more tissue irritation occurred in the Meta Tray group.

**Conclusions:** The novel daytime bleaching system significantly lightened tooth color, but was not as effective as the overnight custom tray system.

**Reviewer's Comments:** The Meta Tray system evaluated in this study is a European product, and I am not sure whether it is currently available in the United States. However, I did have a chance to use the product a couple of times 3 to 4 years ago. Whether this product is available or not, this is a worthwhile study because it confirms something we already know—bleaching is time and dose dependent. The daytime system contained 3 times more peroxide than the overnight system, but its total application time was approximately 95% less.

(Reviewer-Edward J. Swift, Jr, DMD, MS).

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Keywords: At-Home Bleaching

Print Tag: Refer to original journal article
Grinding, Clenching in Children Increase With Age

Awareness of Tooth Grinding and Clenching From Adolescence to Young Adulthood: A Nine-Year Follow-Up

Strausz T, Ahlberg J, et al:

J Oral Rehabil 2010; 37 (July): 497-500

Large fluctuations occur in self-reported grinding and clenching between ages 14 and 23 years.

**Objective:** To determine the occurrence of self-reported tooth grinding and clenching from adolescence to young adulthood.

**Methods/Participants:** The researchers interviewed the same cohort of 156 subjects 4 times over a 9-year period. Two standardized questions were asked when the subjects were aged 14, 15, 18, and 23 years: have you noticed or has anyone mentioned that you (1) grind your teeth during sleep and/or (2) clench your teeth while awake? The original cohort had an equal number of males and females. A complete data set covering each of the 4 assessments over the 9 years follow-up was available for 80% of the original cohort (60 males, 65 females).

**Results:** Overall, the percentage of self-reported grinding and clenching increased between ages 14 and 23 years. The self-reported grinding increased from 15% at baseline to 21.7% at 9 years for males and from 13.9% to 20% for females. The self-reported clenching increased from 3.3% at baseline to 13.3% at 9 years for males and from 10.1% to 16.9% for females. The only statistically significant gender difference was in clenching occurrence; females had higher rates than males. Within individual subjects, the self-reported grinding and clenching varied greatly. Approximately 22% of the subjects reported grinding and clenching at least once during the study. Only one subject self-reported grinding at each of the 4 interview times. None of the subjects self-reported clenching at each of the 4 interview times.

**Conclusions:** “Self-reported bruxism increases from adolescence to young adulthood.”

**Reviewer’s Comments:** It has been commonly thought that a high percentage of children grind and/or brux their teeth, judging on the extent of occlusal wear seen in the primary teeth. Most children were thought to outgrow their grinding and bruxing, and only a few continued this behavior into adulthood. This study's finding that grinding and clenching actually increased from adolescence to early adulthood is interesting and has implications for restoring teeth with resin or ceramic restorations. However, keep in mind that self-reported data have limitations. This study did not include objective intraoral and extraoral findings of grinding and clenching. The fluctuations within individuals point to the episodic nature of grinding and clenching. Perhaps it is best to take a “wait and see” approach to young patients who respond "yes" to our questions about grinding and clenching. A very conservative approach is indicated considering the current state of our knowledge about grinding and clenching. (Reviewer-Charles B. Hermesch, DMD).

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Keywords: Bruxism, Grinding, Adolescence

Print Tag: Refer to original journal article
When repairing resin-modified glass ionomer materials, repair with the same material is brand dependent. Composite resin may be a more predictable repair material.

**Background:** The positive attributes of glass ionomer materials are well known. One of the problems with glass ionomer products is solubility in an acid environment. This has been addressed with a class of materials called resin-modified glass ionomers (RMGI), which have been formulated into final restorative materials, liners, luting cements, and sealants. Like all restorative materials, they may fracture or wear, leading to a desire for repair. Many studies have addressed the repair of resin composite and amalgam, and both methods have proven to be clinically viable options. To date, there are few studies addressing the viability of RMGI repair.

**Design/Objective:** This in vitro study investigated the shear bond strength of 2 RMGI materials using either the same material or a resin composite as the repair material.

**Methods:** 150 epoxy specimens were created with standardized cavity preparations. Half were restored with Ketac N100 and the other half with Fuji II LC. The 75 specimens of each material were further divided into 5 groups of 15 each to be bonded to the respective RMGI or composite resin with pretreatment with the GI conditioner/primer (polyacrylic acid), phosphoric acid, or no pretreatment. After 24 hours of water storage, the specimens were subjected to shear bond strength testing in a universal testing machine. The fractured surfaces of each specimen were then examined microscopically to determine the mode of failure, whether adhesive, cohesive in "old" or "new" material, or mixed. Additional samples were fabricated to characterize the surface morphology of the RMGI materials after the surface pretreatment.

**Results:** The shear bond strength of the Ketac N100 to itself was unacceptably low, with a very high percentage of adhesive failure. The resin composite bonded to the Ketac material performed significantly better regardless of surface treatment, and the failures were cohesive in the "old" material. The "old" Fuji II LC bonded equally well to both the "new" RMGI and the resin composite with little effect from different preconditioning methods. Morphologic characterization of the surfaces demonstrated little effect from any of the acid preconditioning.

**Conclusions:** Repair of Ketac N100 is viable only with resin composite. Repair of Fuji II LC was reasonable with either material. Pretreatment with either polyacrylic or phosphoric acid did not have a significant influence with either material.

**Reviewer's Comments:** Recent literature and practice have lent credence to the repair of composite and amalgam restorations as a conservative treatment option. This study begins to answer some of the questions regarding similar repair of RMGI restorations. Composite resin repaired both materials similarly, and the preponderance of cohesive failure in the old material suggests chemical bonding. The difference in the repair success when the respective RMGI materials were used suggests that, until more data are available, repairing this class of material with composite resin is prudent. (Reviewer-Daniel E. Wilson, DDS).

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Keywords: Resin-Modified Glass Ionomer, Restoration Repair, Bond Strength

Print Tag: Refer to original journal article