A Formula for Success

# Espertise™

## Scientific Facts

86th General Session & Exhibition
of the IADR

32nd Annual Meeting of the CADR
Toronto, ON, Canada

July 2–July 5, 2008

3M ESPE

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# Welcome

It is our great pleasure to welcome you to the 86th General Session & Exhibition of the IADR. We, the 3M oral care family, cordially invite you to visit the 3M ESPE Hospitality Center to meet representatives from 3M ESPE, 3M Unitek, OMNI Preventive Care, and Brontes Technologies Inc.

Our goal is to provide you with knowledge you can use and information you can trust. Therefore, we will be offering you a selection of 3M™ ESPE™ Espertise™ Scientific and Technical Resources. In addition to the latest 3M™ ESPE™ Espertise™ Scientific Facts Booklet, (featuring abstracts from this IADR as well as the last AADR meeting on April 2–5, 2008 in Dallas), you will also find CD collections, brochures and website registration information.

Throughout this brochure, we have reproduced a selection of scientific abstracts as originally submitted by their respective authors. Based on the data in these abstracts, we have added graphics and "Aim of the Study" as well as "Results of the Study" summaries. At the end of each chapter, you will find references to additional abstracts. Topic areas (of the more than 150 publications mentioned) include:

## Cement and Provisional Products

Introduced five years ago, 3M™ ESPE™ RelyX™ Unicem was the first self-adhesive universal resin cement in the market. The information presented includes *in vivo* data, clinical evaluations and results of prospective clinical trials. In these studies, it was learned that performance of these products is comparable to more complicated multi-step composite luting materials.

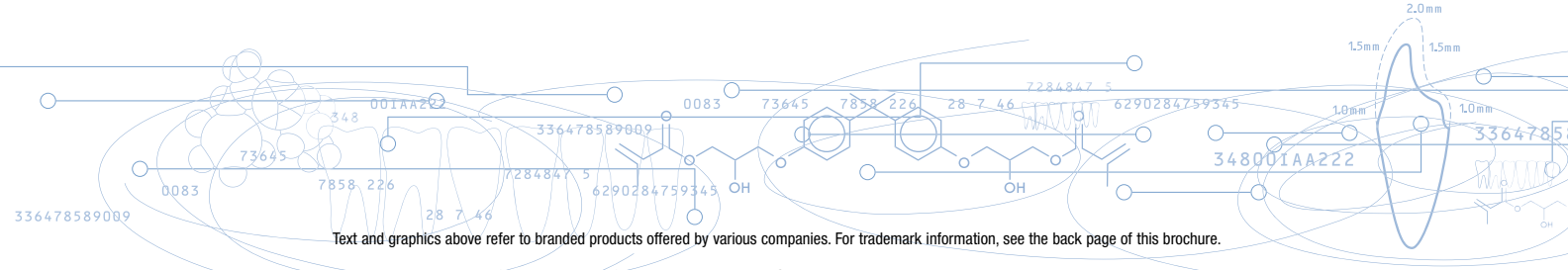
Also highlighted is the performance of temporization materials—specifically, the 3M™ ESPE™ Protemp™ Crown, the world's first single-unit, self-supporting, malleable, light-curable composite crown. In addition, you will see first insights on an experimental bis-acrylic temporization crown and bridge material. The new composite shows higher mechanical properties, especially on fracture resistance, resulting in longer *in vivo* survival rates. Its smoother surface allows use with no polish—enabling a faster and more comfortable procedure.

## Impression Products

A series of investigations—including a clinical study—feature the new 3M™ ESPE™ Pentamix™ 3 Device for faster and easier mixing of impression materials. The dispensing rate for the Pentamix™ 3 device is faster than other devices on the market while the physical properties of the impression material are not adversely affected. An *in vivo* study comparing a fast-setting polyether impression material—3M™ ESPE™ Impregum™ Penta™ Soft—showed significantly higher precision than Aquasil™ Ultra from Dentsply. The vinyl polysiloxane impression material, Imprint™ 3 from 3M ESPE, was clinically used by inexperienced dental students. It also showed clinically better first impressions compared to Aquasil Ultra. First *in vitro* data of an experimental polyether tray material delivered from a hand dispenser showed high-tear energy and superior flow behavior in comparison to market-leading products.

## Lab and Digital Products

CAD/CAM technology has made it possible to prepare restorations out of high strength ceramics like alumina and zirconia. Previously, ceramic restorations in the posterior region were limited to single units. Now, with the introduction of zirconia as a dental material, clinicians are able to place all ceramic



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restorations in a broad range of anterior and posterior indications. While several companies are offering dental zirconia materials, which are chemically quite similar, they are not necessarily the same. Big differences in performance and aesthetics result for a variety of reasons—such as raw material quality, blank processing and presintering, gluing and milling, as well as shading and final sintering processes. In this issue of Espertise scientific facts, you will find *in vitro* as well as *in vivo* data demonstrating the excellent characteristics of 3M™ ESPE™ Lava™ Crowns and Bridges. Longevity, marginal fit and translucency data are highlighted.

## Direct Restorative Products

From the moment 3M introduced composites in 1964, they have been continuously enhancing their mechanical properties, abrasion resistance, color and bond strength. All composites are subject to shrinkage, and therefore achieving permanent marginal integrity is always a challenge. After ten years of intensive research and development, 3M™ ESPE™ Filtek™ Silorane was introduced as a completely new type of composite—with breakthrough minimal polymerization shrinkage and stress. Data shown features the long-term oral stability of the composite, including the performance of its dedicative adhesive system. 3M™ ESPE™ Filtek™ Supreme Universal Restorative, which offers the unique combination of strength and aesthetics (achieved through 3M ESPE patented nanotechnology), continues its excellent clinical performance. A five-year study shows enamel-like vertical wear in posterior restorations. Furthermore, the 3M ESPE glass ionomer materials, Ketac™ Nano and Vitrebond,™ are represented in studies exploring long-term fluoride release, fluoride recharge, demineralization inhibition and anti-cariogenic potential. A distance-dependent depth of cure study introduces a prototype LED curing light. While previous studies showed a pronounced decrease in the curing performance with many common lights, the new Elipar™ S 10 shows highest curing performance at a clinically relevant distance of 7 mm.

## Preventive Products

3M ESPE OMNI Preventive Care provides patients with solutions to address early indicators of oral disease. The latest development to protect demineralization and release fluoride for a potential anti-cariogenic effect is the glass ionomer coating material Vanish™ XT Extended Contact Varnish. You will find Vanish study results in the last chapter of this booklet.

Our goal remains to keep bringing faster, easier and better solutions to our oral care customers and their patients worldwide. At this point, we want to thank and congratulate the many renowned universities and scientific institutions for their excellent work which is contained in the abstracts herein.

Sincerely,

Dr. Bettina Richter
Global Scientific Marketing Manager
St. Paul, MN and Seefeld, Germany
June 2008



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0215
AADR 2008

# Impregum™ *Soft* Polyether Tray Material

## Comparison Study Between Two Different Mixing Ratios of Polyethers

K. AURBACH, R. PERRY, and G. KUGEL, Tufts University, Boston, MA, USA

**Objectives:** To compare the properties of a hand-held (ExpIg/Garant) 2:1 ratio experimental polyether material versus the automix (Impregum Penta Quick-Soft) 5:1 ratio material.

**Methods:** The properties of two fast-setting 3M ESPE polyether impression materials were tested. Test groups: Group 1—Experimental (ExpIG/Garant); Group 2—Impregum Penta Quick-Soft (IPSQ). The following nine experiments were conducted on each group according to the norms of the International Organization for Standardization (ISO):

1. Consistency (CO)
2. Detail reproduction (DR)
3. Linear dimensional change (LC)
4. Compatibility with gypsum (CG)
5. Recovery from deformation (RD)
6. Strain in compression (SC)
   **(Tests measured according to ISO4823:2000)**
7. Shore hardness after 24 hours according to DIN53505
8. Tensile strength (TS)
9. Elongation at break (EL) according to DIN53504.

**Results**: Data were analyzed by 2-sample t-test. Mean values (standard deviation) are shown in the table below.

Both materials passed their respective testing requirements for DR and CG methods.

| | CO (mm) | LC (%) | RD (%) | SC (%) | SHORE A 24 h | TS (MPa) | EL (%) |
|---|---|---|---|---|---|---|---|
| **n** | 5 | 6 | 5 | 5 | 6 | Penta=9 Garant=8 | Penta=9 Garant=8 |
| **IPSQ (Penta)** | 36.2 (0.9) | -0.36 (0.046) | 98.35 (0.094) | 2.71 (0.101) | 55.50 (1.049) | 2.01 (0.149) | 299.3 (35.66) |
| **ExpIG (Garant)** | 35.1 (0.82) | -0.30 (0.066) | 98.49 (0.108) | 2.73 (0.076) | 58.83 (1.169)* | 2.16 (0.99)* | 281.8 (23.71) |
| **P value** | 0.08 | 0.09 | 0.06 | 0.78 | <0.001 | 0.03 | 0.25 |

* Statistically different ($p<0.05$)

**Conclusions:** The Experimental Group 1 (2:1 dispenser material) showed no statistical differences from Group 2 (Penta 5:1) material with two exceptions: Group 1 showed improved TS and higher levels of Shore hardness. Partially sponsored by 3M ESPE.

**Aim of the study:** To compare a new experimental Impregum tray impression material delivered from a hand dispenser versus the commercial automix (Impregum Penta Quick-Soft) 5:1 ratio material.

**Results of the study:** The new experimental Impregum tray impression material delivered from a hand dispenser had higher Tensile Strength and Shore hardness A than the commercial automix (Impregum Penta Quick-Soft) 5:1 ratio material.



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# Impregum™ *Soft* Polyether Tray Material

1106
AADR 2008

## Mechanical Properties of Monophase Impression Materials

R.A. YAPP, Dental Consultants Inc, Ann Arbor, MI, USA, and J.M. POWERS, Dental Consultants, Inc, Ann Arbor, MI, USA

**Objective:** The purpose was to compare mechanical properties of the monophase consistency of several addition silicone (AS), polyether (PE) and hybrid (H) elastomeric impression materials.

**Methods:** Pants tear energy (Webber RL, Ryge G: J Biomed Mater Res 1968; 2:281–296), strain in compression (ISO 4823) and elastic recovery (ISO 4823) were determined. Split pant tear specimens were 0.85 mm in thickness. All specimens were prepared in aluminum molds pre-heated to 37˚C and cured until the end of the specified setting time in a water bath at 37˚C. Specimens were tested (Instron 5866) at 5 minutes after the start of mixing. Data were analyzed by one-way ANOVA and Fisher's PLSD test at the 0.05 level of significance.

**Results:** Means of tear energy (J/m²), strain in compression (%), and elastic recovery (%) with standard deviations in parentheses (n=8) are listed. There were no statistical differences among the materials with the same superscripted letters (p=0.05).

| Material | Tear Energy, J/m² | Strain in Compression, % | Elastic Recovery, % |
|---|---|---|---|
| **AS–Aquasil Ultra Monophase fast set** | 1,380(70) | 3.78(0.26) | 99.37(0.12) |
| **PE–Impregum Soft** | 1,000(50) | 2.70(0.19)[b] | 98.29(0.06)[e] |
| **PE–Impregum Penta Soft Quick Step** | 910(80) | 2.80(0.15)[bc] | 98.35(0.10)[e] |
| **PE–P2 Polyether Magnum 360 Monophase** | 720(30)[a] | 4.19(0.14)[d] | 98.73(0.10) |
| **AS–Exafast NDS Monophase** | 700(120)[a] | 2.91(0.09)[c] | 99.6 (0.01)[g] |
| **AS–Affinis Monobody** | 700(70)[a] | 3.43(0.05) | 99.55(0.05)[f] |
| **AS–Flexitime Magnum 360 Mono Phase** | 660(50)[a] | 2.46(0.03) | 99.58(0.02)[fg] |
| **H–Senn Monophase Type** | 440(45) | 4.20(0.12)[d] | 99.13(0.09) |
| **Fisher's PLSD Interval (p=0.05)** | 70 | 0.19 | 0.10 |

**Conclusions:** An addition silicone and two polyether impression materials had significantly better tear energy than the other products tested. Elastic recovery was high for all materials with highest values for addition silicones. Supported in part by 3M ESPE.

**Aim of the study:** To compare mechanical properties of the type 2 consistency of several addition silicones, a new Impregum polyether tray material delivered from the hand dispenser and a commercial automix (5:1) Impregum polyether as well as hybrid elastomeric impression materials.

**Results of the study:** A new polyether tray material delivered from the hand dispenser and Impregum Penta Soft Quick Step had higher values in tear energy than the other six materials tested with the exception of Aquasil Ultra.



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3191
IADR 2008

# Impregum™ *Soft* Polyether Tray Material

## Flow of Impression Materials During Working Time

J.L. DURACK[1], C. HUDSON[1], B. KUPPERMANN[2], and T. KLETTKE[2], [1]3M ESPE, London, Canada, [2]3M ESPE, Seefeld, Germany

**Objectives:** Clinical success of precision impression materials is strongly dependent on the flow of the unset impression material. Flow is an especially important property when syringing in moist areas, like the gingival sulcus, and is needed for a detailed impression.

**Methods:** Gun-delivered tray materials were investigated: experimental Impregum Tray Material regular-set (IPr, 3M ESPE, #B304552, #C304560), experimental Impregum Tray Material fast-set (IPf, 3M ESPE, #B304551, #C304560), Honigum Mono (Ho, DMG, #589776), Flexitime Monophase (Flx, Heraeus-Kulzer, #285195), Aquasil Ultra Monophase (AqU, Dentsply, #070815), Affinis Monobody (Aff, Coltene, #0138005).

Measurements were done according to a published method (#3083 and #3048 IADR 2005) 25 seconds after start of mix and at the end of working time as recommended by the impression material manufacturer.

**Results:** Mean values and standard deviations are given (n=5). Results were analyzed by one-way-ANOVA and Tukey-test ($p<0.05$).

| Impression Material | Height shark fin [mm] (SD) | |
|---|---|---|
| | 25 sec | End working time |
| IPr | 16.5(0.5) | 10.9(0.5) |
| IPf | 17.5(0.5) | 13.7(0.3) |
| Ho | 2.8(0.3)* | 0.8(0.3)* |
| Flx | 2.2(0.3)* | 1.1(0.2)* |
| AqU | 10.5(0.5) | 2.2(0.3) |
| Aff | 3.8(0.3) | 1.1(0.2)* |

* Means are not significantly different.

**Conclusions:** IPr and IPf showed the best results in flow after 25 seconds and were also superior at the end of working time. Based on these measurements, IPr and IPf would be expected to show a high degree of clinical reliability.

**Aim of the study:** To compare the flow of a new Impregum polyether tray material delivered from the hand dispenser and a commercial automixable Impregum with commercial VPS impression materials.

**Results of the study:** Impregum impression materials exhibited higher flow than the VPS tested.



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# Impregum™ *Soft* Polyether Tray Material

3194
IADR 2008

## Insertion Force of Tray Impression Materials

T. KLETTKE[1], R. HAMPE[1], and J.T. MADDEN[2], [1]3M ESPE, Seefeld, Germany, [2]3M ESPE, St. Paul, MN, USA

**Objective:** The purpose of this study was to compare the insertion force of an experimental polyether tray material and six commercially available VPS tray materials. All materials were dispensed using the hand-held dispenser made by Mixpac Systems, AG.

**Methods**: Seven regular set impression materials were investigated: Impregum Soft Tray Material (IP, LOT B304552, C304560), 3M ESPE, Aquasil Ultra Monophase (AqUM, LOT 010815), Aquasil Ultra Heavy (AqUHB, LOT 070822), both Dentsply, Affinis MonoBody (AffM, LOT 0138005), Affinis Heavy Body (AffHB, LOT 0132677), both Coltene, Examix NDS Monophase (ExM, LOT 0708281), Examix NDS Heavy Body (ExHB, LOT 0705111), both GC. The test was performed (in accordance to CED/NOF/IADR 2004 #140) using a universal testing machine (Z010, Zwick). Equal quantities of each material were placed between specially formed stamps which were moved together under a controlled velocity of 500 mm/min until reaching a defined gap of 2 mm. The force during the movement was recorded (n=5). One-way ANOVA and a Tukey test for pair wise comparisons was used for analysis ($p<0.05$).

| Impression Material* | Insertion force [N] (SD) |
|---|---|
| IP[a] | 1,104.40(41.22) |
| AqUM[a] | 1,084.45(37.01) |
| AqUHB[a] | 1,126.34(16.97) |
| AffM[b,c] | 1,523.99(135.09) |
| AffHB[b] | 1,679.19(149.79) |
| ExM[a,d] | 1,244.64(43.77) |
| ExHB[c,d] | 1,355.26(59.72) |

* Materials identified with same letters (a,b,c,d) are not significantly different.

**Results:** The measured force values were between 1084 N (AqUM) and 1679 N (AffHB).

**Conclusions:** There are differences in the insertion forces among the materials tested. Within the limitations of this study, the new polyether IP demonstrated an insertion force comparable to commercially available VPS tray materials. The data supports the suitability of IP for the monophase and one-step tray/wash techniques.

**Aim of the study:** The purpose of this study was to compare the insertion force of an experimental polyether, Impregum Soft Tray Material, and six commercially available VPS tray materials that are delivered from a hand dispenser.

**Results of the study:** Extrusion forces vary from 1084.45 N (Aquasil Ultra Heavy Body) to 1355.26 N (Examix NDS Heavy Body). The new Impregum Soft Tray Material showed 1104.40 N which indicates its clinical suitability for the monophase and one-step tray/wash techniques.



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0016
CED/IADR 2007

# Impregum™ Penta *Soft* Quick Step Polyether

## Precision of Fast-Set Impressions–Randomized Controlled Clinical Trial

H. RUDOLPH[1], S. QUAAS[1], M. KOCH[2], J. PREIßLER[2], R. KOCH[2], and R.G. LUTHARDT[1], [1]Medizinische Fakultät der Universität Ulm, Germany, [2]Technische Universität Dresden, Medizinische Fakultät Carl-Gustav-Carus, Germany

**Objectives:** When fast-set impression materials are used for a one-stage impression technique, the clinical relevance of an exact timing for mixing, applying and syringing both material components is gaining importance. Aim of this clinical trial (RCT) was to determine the influence of a non-optimal timing on the precision of fast-set impressions. Primary objective was the precision of the three-dimensional (3D) tooth surface reproduction as well as the reproduction of the subgingival tooth surface.

**Methods:** Ninety-six probands were included and three one-stage impressions each were taken with either a polyether (PE: Impregum Penta H/L DuoSoft Quick, 3M ESPE, Germany) or an addition-curing silicone (AS: Aquasil Ultra LV, Dentsply DeTrey, Germany). The impression taken with optimal timing was chosen as reference. The two additional impressions were taken with two out of eight different non-optimal timings. The order in which the three impressions were taken as well as the material and the non-optimal timing were assigned to each proband according to a randomization list. Standardized-made master-casts were digitized and the data resulting from the non-optimal timed impressions was compared to the reference in order to access the 3D precision as well as the subgingival reproduction. Statistical analysis was performed using multivariate models.

**Results:** Mean values for tooth 46 ranged from +/- 12 microns for PE to +19 and -14 microns for AS. Significantly higher mean values (62 to -40 microns) were found for AS in contrast to PE (21 to -26 microns) in the area of the distal neighboring tooth. The reproduction of the subgingival tooth area did not show any significant differences.

**Conclusion:** The machine-mixed polyether material showed a significantly higher precision in the distal lower jaw, where the influence of saliva, swallowing and deformation due to impression removal is increasing.

The dental company 3M ESPE AG in Seefeld, Germany, supported this study.

**Aim of the study:** To investigate the precision of Impregum Penta H/L DuoSoft Quick versus Aquasil Ultra LV fast set in a randomised controlled clinical trial.

**Results of the study:** Under clinical conditions I of Impregum Penta H/L DuoSoft Quick has higher precision than Aquasil Ultra LV fast set.



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# Imprint™ 3 VPS Impression Material 0218

AADR 2008

## Contact Angle Measurement of Addition Type Polyvinyl Siloxane Impression Materials

R. CHAVALI, University of Alabama, Birmingham, USA, and J. BURGESS, University of Alabama at Birmingham, USA

**Objectives:** To measure and compare the hydrophilicity of five commercially available polyvinyl siloxane impression materials (PVS) by measuring the contact angle made by water on the set surface of the impression material.

**Methods:** Five type 3 (according to ISO4823:2000) PVS impression materials were used for the present study: Standout, Examix, Aquasil Ultra, Genie, and Imprint 3. Specimens were prepared by dispensing the impression materials into a square shaped brass mold (38 mm × 32 mm × 2 mm) setting on a glass slab with a plastic film separator. Another plastic film was quickly placed on top of the mold and pressed to create a flat surface by covering the plastic film (Hostaphan RN 75, thickness 0.075 mm) with a glass slab, expressing excess material and allowing the impression material to polymerize for 15 min. Excess material was removed and the specimens were placed for contact angle measurement (Drop Shaped Analyses System, DSA 100 Kruss, Hamburg, Germany). A drop of distilled water measuring 5 µl was dispensed onto the set impression material and contact angles were measured at 2 sec and 10 sec using a video camera. ANOVA and Tukey tests were used to determine intergroup differences ($p<.05$).

**Results:**

| Contact angle at | Imprint 3 | Standout | Examix | Aquasil | Genie |
|---|---|---|---|---|---|
| 2 sec[°] | 16.4(±4.8)[a] | 40.4(±7.1)[b] | 36.7(±3.2)[b] | 93.5(±2.9)[c] | 108.7(±1.1)[d] |
| 10 sec[°] | 6.0(±0.6)[a] | 17.9(±2.3)[b] | 29.1(±3. 7)[c] | 52.5 (±1.3)[d] | 80.9(±2.2)[e] |

Means with the same superscripted letters are not different statistically.

**Conclusions:** Different PVS materials exhibited different contact angles. The lowest contact angle which indicates highest hydrophilicity. Therefore pouring a cast in a hydrophilic impression material should produce fewer voids.

**Aim of the study:** To measure and compare the hydrophilicity of five commercially available polyvinyl siloxane impression materials.

**Results of the study:** Imprint 3 showed the highest hydrophilicity.

Results found in abstracts for Imprint™ 3 VPS Impression Material also apply to products registered under the following name(s): Express™ 2 VPS Impression Material and Express™ XT VPS Impression Material.



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# 1104 Imprint™ 3 VPS Impression Material

AADR 2008

## Tear Strength of Low-Viscosity Vinyl Polysiloxane Elastomeric Impression Materials

A.A. BOGHOSIAN, and E. LAUTENSCHLAGER, Northwestern University, Chicago, IL, USA

Marginal tearing of an elastomer reduces the accuracy of the impression.

**Objectives:** The purpose of this study was to determine the tear strength of various low-viscosity, fast-set vinyl polysiloxane elastomers.

**Methods:** Ten materials were tested: Aquasil Ultra XLV(Caulk), Imprint 3 Quick Step Light Body (3M ESPE), Splash Light Body Half Time and Precision Lite Viscosity (Discus), Genie Light Body Rapid Set (Sultan), Affinis Light Body Fast (Coltene/Whaledent), Stand Out Wash Fast Set and Take 1 Wash (Kerr), Exafast NDS Injection and Senn Light Body Rapid Set (GC). Five axial notch specimens, measuring 4" × 0.75" × 0.0090," were made in a proprietary stainless steel injection mold. The mold was filled with impression material, sealed, and immediately placed in a water bath at 35˚C. At the manufacturer's recommended mouth removal time, the mold was retrieved from the water bath. The specimens were gripped over the first inch from either end leaving 2 inches of gage length and continuously loaded on an Instron testing machine at a crosshead speed of 10 inch/minute until failure occurred. The data was statistically analyzed using ANOVA and post-hoc testing of means by the Scheffe test ($p \leq 0.01$). Letters (a–c) denote statistically significant differences between the groups.

**Results:**

| Impression Material | Tear Strength (Psi) |
|---|---|
| Aquasil Ultra XLV | 653.90+16.28[a] |
| Imprint 3 Quick Step Light Body | 637.28+17.09[a] |
| Splash Lite Body Half Time | 431.87+27.24[b] |
| Genie Light Body Rapid Set | 407.64+21.93[b] |
| Affinis Light Body Fast | 401.93+39.56[b] |
| Precision Lite Viscosity | 391.50+29.00[b] |
| Stand Out Wash Fast Set | 366.29+47.28[b] |
| Take 1 Wash Fast | 356.86+41.36[b] |
| Exafast NDS Injection | 264.14+12.57[c] |
| Senn Light Body Rapid Set | 239.00+18.79[c] |

**Conclusions:** Resistance to marginal tearing may be affected due to significant differences in the tear strength of low-viscosity vinyl polysiloxane impression materials. This research was supported in part by 3M ESPE.

Results found in abstracts for Imprint™ 3 VPS Impression Material also apply to products registered under the following name(s): Express™ 2 VPS Impression Material and Express™ XT VPS Impression Material.

**Aim of the study:** To measure tensile strength of commercially available VPS impression materials.

**Results of the study:** Imprint 3 and Aquasil Ultra showed the highest tensile strengths.



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# Imprint™ 3 VPS Impression Material 3172

IADR 2008

## Clinical Comparison of Two Impression Materials—Effectiveness for Inexperienced Operators

M.Z. ANABTAWI, J. O'NEAL, L. MITCHELL, and J.O. BURGESS, University of Alabama at Birmingham, USA

**Objectives:** This prospective randomized clinical trial compared a new polyvinyl siloxane (PVS) impression material (Imprint 3 Light Body, 3M ESPE, St. Paul, MN) to another commercially available PVS impression material (Aquasil Ultra LV, LD Caulk, Milford, DE) by evaluating the ability of inexperienced clinicians (pre-doctoral dental students) to obtain accurate final impressions for indirect fixed full-coverage restorations.

**Materials and methods:** One hundred and ten patients were enrolled in the study after receiving informed consent at the University of Alabama in Birmingham/School of Dentistry. Those meeting the inclusion criteria were randomly assigned to one of two treatment groups, Group A or Group B. Calibrated examiners evaluated the first impression of prepared posterior teeth at a magnification of 10X for acceptability (no voids or bubbles) according to the data collection sheet. Criteria evaluated and recorded were: position of tooth, type of preparation, preparation finish line (Class I–V), and gingival bleeding score. For subjects assigned to Group A, impressions were made with a PVS Imprint 3 while those in group B received Aquasil Ultra LV impression material. All impressions were made using a heavy tray material and a light body syringe material. For this interim report, 110 of a planned 300 impressions are completed.

**Results:** Fifty-four Imprint 3 vs. 56 Aquasil Ultra data collection sheets were recorded and analyzed using the Chi-Square test. Imprint 3 produced clinically better first impressions compared to Aquasil Ultra LV (p=0.043). Thirty unacceptable impressions were made; 10 were Imprint 3 Light Body and 20 were Aquasil Ultra LV.

**Conclusion:** Further analysis will be completed at the end of the study, and final conclusions will be drawn accordingly. However, with the current data we can say that the Imprint 3 produced more clinically acceptable impressions with inexperienced operators.

**Aim of the study:** To compare the new Imprint 3 Light Body versus Aquasil Ultra LV in a prospective randomized clinical trial.

**Results of the study:** Imprint 3 produced more clinically acceptable impressions with inexperienced operators than Aquasil Ultra.

Results found in abstracts for Imprint™ 3 VPS Impression Material also apply to products registered under the following name(s): Express™ 2 VPS Impression Material and Express™ XT VPS Impression Material.



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# 3195 Imprint™ 3 VPS Impression Material

IADR 2008

## Tensile Properties of Impression Materials

R. YAPP[1], H. HOFFMAN[2], J.M. POWERS[3], and J. PROSE[3], [1]Dental Consultants Inc, Ann Arbor, MI, USA, [2]3M ESPE, Seefeld, Germany, [3]Dental Consultants, Inc, Ann Arbor, MI, USA

**Objectives:** The study determined tensile toughness, tensile strength, percent elongation and elastic memory of six addition silicone impression materials [Imprint 3 Ultra-Regular Body (I3URB), Imprint 3 Regular Body (I3RB), Examix NDS Regular Type (ENDS), Aquasil Ultra LV (AULV), Genie Light Body (GL), Standout Fast Set Wash (SOFW)].

**Methods:** Flat dumbbell specimens (2.0 and 0.5 mm thick) were set in water (35˚C) for the recommended intraoral setting time and were tested in tension on an Instron at a crosshead speed of 200 mm/min. Elastic memory (deformation at 2 hours) was measured using gage bumps spaced 25 mm apart with traveling microscope (15X) at initial elongations (50, 100, 150%). Means and standard deviations were analyzed by ANOVA and Fisher's PLSD test ($p<0.05$).

**Results:** Values of properties at 2.0 mm are listed.

| Product | Toughness, N mm/mm³ | Tensile Strength, MPa | Percent Elongation | Elastic Memory 50% Elong. | Elastic Memory 100% Elong. | Elastic Memory 150% Elong. |
|---|---|---|---|---|---|---|
| **I3URB** | 5.7(0.5)* | 4.63(0.17)[a] | 263(11)[b] | -0.05 | -0.05 | 0.02 |
| **I3RB** | 5.2(0.4)[a] | 4.54(0.19)[a] | 252(7)[b] | -0.12 | 0.02 | 0.03 |
| **ENDS** | 4.9(0.9)[a] | 2.81(0.18) | 326(30)[a] | 0.14 | 0.31 | 0.56 |
| **AULV** | 4.4(0.4)[b] | 4.94(0.17) | 185(10) | -0.01 | 1.18 | 2.09 |
| **GL** | 4.6(0.8)[b] | 3.10(0.20) | 255(28)[b] | -0.18 | 0.01 | 0.37 |
| **SOFW** | 3.4(0.5) | 1.97(0.13) | 326(30)[a] | 0.19 | 0.67 | 1.20 |

*Means with standard deviations in parentheses. For each property, means with the same superscripted letters are not different statistically ($p=0.05$).

**Conclusions:** I3URB and I3RB had highest toughness. AULV, I3URB and I3RB had highest tensile strength. ENDS and SOFW had highest percent elongation. Toughness, tensile strength and percent elongation of 2 mm thick specimens were up to 20% higher than 0.5 mm specimens. All materials exhibited acceptable elastic memory; however, I3URB, I3RB, ENDS, and GL were significantly less deformed. Supported in part by 3M ESPE.

**Aim of the study:** To compare five commercial VPS impression materials regarding their toughness, tensile strength and elastic recovery at different elongations.

**Results of the study:** Highest elastic recovery was obtained for Imprint 3 Ultra-Regular Body and Imprint 3 Regular Body. Imprint 3 Ultra-Regular Body, Imprint 3 Regular Body and Aquasil Ultra had highest tensile strengths. Imprint 3 Ultra-Regular Body and Imprint 3 Regular Body showed highest toughness.

Results found in abstracts for Imprint™ 3 VPS Impression Material also apply to products registered under the following name(s): Express™ 2 VPS Impression Material and Express™ XT VPS Impression Material.



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# Polyether Retarder

0122

CED/IADR 2007

## Prolongation of Working Time with Polyether Retarder

T. KLETTKE, and R. HAMPE, 3M ESPE, Seefeld, Germany

**Objective:** To evaluate the effect of 3M ESPE Polyether Retarder on the working time of 3M ESPE Polyether impression materials as a function of the ratio retarder: impression material.

**Methods**: Polyether Retarder #258171, #217930 was mixed together with the investigated impression materials Impregum F, IF #B164283 #C252940, and Impregum Penta Soft, IPS #B224566 #C225369, using a spatula and a mixing block. The change in flowability of the mixture was used as an indicator. It was measured at room temperature using the 2 mm slit shark fin device having a weight of 148g±3g (#3292 IADR 1997): A reference without retarder was measured at 45 sec after start of mix according to ISO 4823:2000. Further measurements were conducted in 15 sec steps until the height of the shark fin dropped below 90% of the reference. This point was defined as the end of working time. Each measurement was repeated twice.

**Results:** For comparison of the automix-material IPS and the handmix-material IF a General Linear Model was used ($p \leq 0.5$).

Ratio retarder: impression material and corresponding working time obtained from shark fin height.

| Ratio Retarder : Impression Material [%] | Working Time IF [min] | Working Time IPS [min] |
|---|---|---|
| 0 | 1:45 | 1:30 |
| 25 | 1:45 | 1:45 |
| 50 | 2:00 | 2:00 |
| 100 | 2:30 | 2:15 |
| 150 | 2:45 | 2:30 |

The retardation of IPS was statistically equal to IF.

The working time of the tested 3M ESPE Polyethers was extended when 3M ESPE Polyether Retarder was added. The extension is controllable by the retarder dosage.

**Conclusions:** The working time of 3M ESPE Polyethers can be prolonged using 3M ESPE Polyether Retarder. Longer working times may be a clinical advantage especially for cases involving multiple preparations or with time-consuming impression techniques such as functional impressions.

**Aim of the study:** To evaluate the effect of 3M ESPE Polyether Retarder on the working time of 3M ESPE Polyether impression materials.

**Results of the study:** The working time of the tested 3M ESPE Polyethers was extended when 3M ESPE Polyether Retarder was added. The extension is controllable by the retarder dosage.



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# 1117 Polyether Retarder

AADR 2008

## Effect of Polyether Retarder on the Flowability of Impregum Soft

N. AIMJIRAKUL, Srinakharinwirot University, Bangkok, Thailand

**Objectives:** To determine the effect of different lengths of Polyether retarder on the flowability of Polyether impression material.

**Material and methods:** Medium-bodied consistency Impregum™ Soft (3M ESPE, Germany) was investigated with and without retarder. The length of the strands of the retarder varied from 0, 0.5, 1.0, 1.5 and 2 times the lengths of the strands of the catalyst/base paste. All tests are carried out at 30 sec intervals until manufacturer's recommended working time after end of mixing (30 sec, 60 sec, 90 sec, and 120 sec) at room temperature (32±2˚C). One hundred impressions are made (n=5) on shark fin model. Fin heights were analysed by One-Way ANOVA. Where significant differences in the groups were found, a comparison of individual means was performed by Tukey HSD post-hoc tests.

**Results:** One-Way ANOVA revealed significant differences among the lengths of the retarder ($P<0.01$). There is no significant difference between the longer length of retarder (1.5 and 2 times groups) at the short working time (30 sec). At the 60 sec working time, there is no significant difference between 0.5 and 1.0 times groups. The longest length of retarder showed significantly greatest fin height at the 90 sec working time ($P<0.01$).

**Conclusion:** The longer the retarder the longer the working time. Therefore, Polyether retarder can improve the flowability of Impregum Soft. In clinical application, it is suggested that Polyether retarder can be used for lengthening the working time and achieving better flow characteristics of Polyether.

**Aim of the study:** To determine the effect of different lengths of Polyether retarder on the flowability of Polyether impression material.

**Results of the study:** Polyether Retarder prolongs the working time and enhances the flowability of 3M ESPE Polyether impression materials.



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# Surface Roughness Measurements of Different Impression Materials Scanned by Profilometry

J.M. RODRIGUEZ, King's College London Dental Institute, United Kingdom, R. CURTIS, King's College London, United Kingdom, and D. BARTLETT, GKT Dental Institute, London, England, UK

**Objective:** To analyse roughness values of impression materials when scanned with a non-contacting laser profilometer (NCLP) (Taicaan™).

**Methods:** Nine impression materials were mixed according to the manufacturers instructions and expressed against a glass slab to record the surface characteristics. An area of 6 × 40 mm was scanned of each impression material and from these Ra, Rq and Rt roughness values were obtained from 20 randomly selected transverse profiles using surface metrology software (Boddies™). The surface of a glass slab was scanned over 10 randomly selected areas of 6 × 40 mm with a contacting profilometer (Renishaw™) and the same roughness parameters measured. Differences in the roughness values obtained from the impression materials were compared to that of the gold standard glass slab.

**Results:** In total, 15 areas were scanned from eight addition polyvinylsiloxane (PVS) and one polyether impression materials. The roughness values of the glass slab were Ra=0.567 µm (SD=0.133), Rq=0.739 µm (SD=0.163) and Rt=3.593 µm (SD=0.796). The roughness values for the impression materials varied between Ra=0.825 µm and 3.193 µm, Rq=1.041 µm and 4.207 µm and Rt=5.575 µm and 24.722 µm. Putty and light body impressions showed statistically significant higher roughness values ($p<0.05$) than heavy and medium body materials. The colour of the impression materials influenced roughness values: darker colours showed higher roughness values ($p<0.05$). Roughness values varied with different mixing techniques Pentamix™<gun/cartridge<hand mixed materials ($p<0.05$).

**Conclusions:** All impression materials showed higher roughness values compared to the glass slab.
This study was supported by the Guy's and St. Thomas' Charity Grant No G050202.

**Aim of the study:** To compare surface roughness of impression materials mixed with Pentamix 2 versus mixing with hand dispenser and hand mixing.

**Results of the study:** Compared to cartridge and hand mixed materials, the smoothest surface was obtained when using the Pentamix Mixing Unit.



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# 1016 Pentamix™ 3 Mixing Unit

AADR 2008

## Mix Quality and Dispensing Rate for Two Automatic Mixing Units

J. GRAMANN[1], T. KLETTKE[2], and S. STARR[1], [1]3M ESPE AG, Seefeld, Germany, [2]3M ESPE, Seefeld, Germany

**Objectives:** Dental professionals expect an automatic mixing unit to quickly deliver an impression material to either a tray or an intraoral syringe. Speed is important as impression materials have a finite working time. The counterbalance to speed is the homogeneity of the mix of the base and catalyst paste. A homogenous mix is critical in ensuring consistent, high quality impressions. The objective of this study is to compare the mixing quality of Pentamix™ 2 to that of the new Pentamix™ 3 which offers a dispensing rate two times faster than that of its predecessor and mixes either VPS or polyether impression materials.

**Methods:** Five samples of polyether impression material (3M ESPE, Impregum™ Penta™ Medium Body) were mixed with Pentamix™ 2 (3M ESPE; P2) and with the Pentamix™ 3 (3M ESPE; P3). After the material had polymerized, the distribution of the two different colored paste components (catalyst and base) was measured with a spectrometer (Ocean Optics, S2000) and a lens system enabling a spacial resolution of 0.1 mm. The samples were moved in the focus of the lens on a zigzag course in an area of $2 \times 8$ mm by two linear axis. During this movement, the a-value of the Lab color system was recorded by a data logger (113 values in ~6.5 minutes per run, per sample). The standard deviation of the a-value of each sample was used as the measurement of mix quality.

**Results:** The mean and standard deviations (in brackets) for color values by device was: P2: 0.24 (0.060), P3: 0.24 (0.042). Two Sample t-test and CI showed that the standard deviation of the color values of the samples mixed with P3 do not differ from the ones mixed with P2 (P-value 0.963).

**Conclusion:** P3 enables a dispensing rate two times faster than that of P2 with the same high quality material mix.

**Aim of the study:** To compare extrusion speed and mixing quality of Pentamix 3 versus Pentamix 2.

**Results of the study:** Pentamix 3 displayed a dispensing rate two times faster than Pentamix 2 with the same high mixing quality.



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# Extrusion Speed and Performance of Automated Mixing Units

T. KLETTKE, 3M ESPE, Seefeld, Germany, and J. GRAMANN, 3M ESPE AG, Seefeld, Germany

**Objectives:** Dental professionals expect an automatic mixing unit to quickly deliver an impression material to either a tray or an intraoral syringe. Speed is important as impression materials have a finite amount of working time. The objective of this study is to compare the extrusion speed and the drive performance of common automated mixing units to determine if there is speed loss when dispensing high viscosity impression materials.

**Methods:** Five samples of a type 2 (3M ESPE; Impregum Penta Soft Quick; M1) and a type 0 impression material (3M ESPE; Express 2 Penta Putty; M2) were mixed with Pentamix 3 (3M ESPE; P3), Pentamix 2 (3M ESPE; P2), Plug & Press Dispenser (Kettenbach; PP), Dynamix (Heraeus Kulzer; DM) and with MixStar (DMG; MS) for exactly 30 sec. After the materials had polymerized the weight of the samples was measured using a scale. The obtained values were used to calculate the average extrusion speed in ml/min.

**Results:** The mean of extruded impression material in ml/min and standard deviations (in brackets) for M1 and M2 by device was: P3: 156.15 (3.97) and 153.58 (0.49); P2: 83.18 (2.02) and 76.05 (1.07); PP: 102.48 (2.66) and 80.00 (3.44); DM: 74.93 (2.86) and 71.15 (0.84); MS: 46.85 (0.81) and not applicable. ANOVA ($p<0.05$) showed significant differences of extrusion speed for the following units (value in brackets): P2 (8.57); PP (21.94); DM (5.04); MS (not applicable).

**Conclusion:** Compared to the other automated mixing devices tested, P3 showed the highest extrusion speed and no significant difference when dispensing a type 0 and type 2 impression material. MS was not able to extrude a type 0 impression material. The time it takes to dispense a material depends on the type of the automated mixing device and may vary with the viscosity of the impression material.

**Aim of the study:** To compare the extrusion speed and the drive performance of common automated mixing units to determine if there is speed loss when dispensing high viscosity impression materials.

**Results of the study:** Compared to the other automated mixing devices tested, only the Pentamix 3 showed the highest extrusion speed and no significant difference when dispensing a type 0 and type 2 impression material.



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# 3207 Pentamix™ 3 Mixing Unit

IADR 2008

## Assessing Tray Filling with Various Mixing Techniques and Impression Materials

S. DOGAN, A.J. RAIGRODSKI, and L. MANCL, University of Washington, Seattle, USA

**Objectives:** Preferences of twenty dentists, assistants, and first-year dental students between electronic and hand mixing for different impression materials were compared.

**Methods:** The mixing and tray filling of Imprint™ 3 Penta™ Heavy Body (IHB) and Impregum™ Penta™ Soft (IPS) were compared using two electronic mixing machines: Pentamix™ 3 (3M ESPE) and Mixstar™-eMotion (Zenith/DMG). Imprint™ 3 Penta™ Putty (IPP) was mixed with Pentamix™ 3 and compared to hand-mixed putty Express™ (PP). IPS was mixed with Pentamix™ 3 and compared to hand-mixed Impregum™ F (IF). Participants rated their level of satisfaction for control of loading, ease of mixing, quality of mixing, level of cleanliness, duration of tray filling and overall rating. Paired t-test, one-way ANOVA test, Tukey's method, and Holm's method were used for statistical analysis.

**Results:** One-way ANOVA showed no significant difference between group comparisons regarding the preference of different electronic mixing machines for their overall ratings (P=1.0) mixing IHB and IPS. However, mixing HB and IPS with Pentamix™ 3 was significantly faster in the dentist and dental assistant groups (P<0.001) compared to Mixstar™-eMotion. Post-hoc pairwise comparison showed that dentists and assistants both had significantly shorter (P<0.001) mixing duration than students for IHB mixing with both electronic mixing machines. Although, the quality of mixing with Pentamix™ 3 was rated significantly higher (P<0.004) than that of Mixstar™-eMotion in the dental assistants group, it was not significantly different for both dentists and dental students. Assistants preferred electronic mixing of IPP with Pentamix™ 3 over the hand mixed PP significantly (P<0.001). Electronic mixing of IPS with Pentamix™ 3 was preferred over the hand mixed IF in all groups (P<0.001).

**Conclusions:** Electronic mixing offers better ease of mixing, control of loading, quality of mixing, and level of cleanliness. Overall, dentists, dental assistants, and dental students preferred electronic mixing over hand mixing.

**Aim of the study:** To measure preferences of dentists, assistants and first-year dental students between electronic and hand mixing. Also, two electronic mixing devices were compared regarding their extrusion speed.

**Results of the study:** Electronic mixing was preferred for all groups. It offers better ease of mixing, control of tray loading, quality of mixing and level of cleanliness.

Mixing with Pentamix™ 3 was significantly faster in the dentist and dental assistant groups compared to Mixstar™-eMotion.



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# Pentamix™ 2 Mixing Unit Versus Pentamix™ 3 Mixing Unit

3206
IADR 2008

## Pentamix 2 Versus Pentamix 3 Mixing Device: A Comparison

J. STELZIG[1], M. BALKENHOL[1], C. ERBE[2], and B. WÖSTMANN[1], [1]Justus-Liebig University, Giessen, Germany, [2]Johannes-Gutenberg University, Mainz, Germany

The Pentamix 1 and 2 (PII) devices have proven their suitability over the past years for mixing impression materials. Currently, the manufacturer has presented an improved version (Pentamix III–PIII) that automatically adjusts the mixing parameters to the material used.

**Objectives:** It was the aim of this study to compare the new PIII device with its predecessor PII regarding various material properties.

**Methods:** Three impression materials (Express 2 Penta Putty–E2PP, Express 2 Penta H–E2PH, Impregum Penta Soft–IPS) were used in combination with both devices. The delivery speed in ml/s (n=10), working time (n=5 target parameter: storage modulus and phase angle, using a RS600 rheometer) and the increase in temperature of the material during the mixing process (n=10) were determined for each of the materials. In addition, the Shore-A hardness was measured 10 min, 1 hr and 24 hr after mixing using a Shore-A gauge (n=3). For statistical analysis parametric and non-parametric tests were used (p=0.05).

**Results:** Delivery speeds ranged from 1.2 ml/s (E2PP) to 1.4 ml/s (E2PH, IPS) for the PII and from 2.4 ml/s (E2PP, IPS) to 2.5 ml/s (E2PH) for the PIII. Shore-A hardness of the materials did not differ significantly in between both devices (p>0.05). The working time was slightly increased using the PIII device. The temperature during mixing of E2PP was higher in the PII than in the PIII device, whereas for IPS it was vice versa.

**Conclusions:** Within the limits of this study it can be concluded that the PIII device delivers a considerably higher amount of material per time. At the same time it does not affect the Shore-A hardness and features slightly longer working times for E2PH and E2PP. The working time of IPS, however, was not affected.

**Aim of the study:** To compare delivery speed of Pentamix 2 versus Pentamix 3 using a type 0 and type 1 VPS impression material as well as an Impregum type 2 impression material. As clinically relevant parameters, Shore-A hardness and working time were assessed.

**Results of the study:** Delivery speed for Pentamix 3 was significantly higher for all impression materials. Shore-A hardness of the materials did not differ significantly between devices. The working time of the VPS impression materials was slightly increased using the Pentamix 3 device whereas it was not affected for Impregum.



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# 0371 Protemp™ 4/Protemp™ Plus

AADR 2008

## Selected Mechanical Properties of Temporary Crown and Bridge

V. BABCIC, R. PERRY, and G. KUGEL, Tufts University, Boston, MA, USA

**Objective:** This study examined an experimental provisional material and compares selected mechanical properties of this material with five other conventionally used provisional materials.

**Methods:** Six groups (N=6) were selected to undergo a three-point flexural test comparable to ISO4049 to determine flexural strength, fracture work and deflection using a Zwick materials testing machine. Compressive strength was measured according to standard DIN53454. Impact strength was measured according to Charpy (ISO 179-1). The materials used were Voco Structur-Premium (SP), 3M ESPE Experimental Protemp (ExpP), Zhermack Acrytemp (AT), Kaniedenta Kanitemp-Royal (KT), Dentsply Integrity-Fluorescence (INT) and DMG Luxatemp-Fluorescence (LT).

**Results:** Data was analyzed using a one way ANOVA with a Fisher test and a confidence interval of 95%. Summary of results and mean values including standard deviations (in brackets) were calculated.

| Mechanical Property | Summary of Results |
|---|---|
| Flexural strength (Mpa) | ExpP significantly better than AT, INT, KT, LT |
| Deflection (mm) | ExpP significantly better than AT, INT, KT, LT, SP |
| Fracture work (KJ/m²) | ExpP significantly better than AT, INT, KT, LT, SP |
| Impact strength (KJ/m²) | ExpP significantly better than AT, INT, KT, LT, SP |
| Compressive strength (Mpa) | ExpP significantly better than AT, INT, KT, LT, SP |

| Material | Flexural strength [Mpa] | Deflection [mm] | Fracture work [KJ/m²] | Impact strength [KJ/m²] | Compressive strength [Mpa] |
|---|---|---|---|---|---|
| **SP** | 113.0[4.4] | 1.04[0.06] | 8.64[0.94] | 8.5[1.2] | 340.8[17.0] |
| **ExpP** | 91.4[3.4] | 1.43[0.12] | 10.74[1.58] | 15.7[4.5] | 395.6[29.0] |
| **AT** | 70.0[6.0] | 1.25[0.10] | 6.77[1.03] | 7.0[1.6] | 257.5[20.2] |
| **KT** | 72.5[4.2] | 1.18[0.06] | 6.54[0.62] | 7.6[1.4] | 250.1[17.7] |
| **INT** | 72.5[3.6] | 0.97[0.10] | 5.13[0.83] | 8.8[2.6] | 283.0[19.2] |
| **LT** | 74.4[3.6] | 1.06[0.10] | 5.94[1.04] | 7.3[1.3] | 281.5[9.6] |

**Conclusion:** According to the results of this study, the ExpP material shows significantly better values for deflection, fracture work, compressive strength and impact strength when compared to each of the other materials. Partially sponsored by 3M ESPE.

**Aim of the study:** To compare in vitro mechanical properties of new Protemp 4/Protemp Plus temporary crown & bridge material to established temporary crown & bridge materials.

**Results of the study:** Protemp 4/Protemp Plus shows significantly better mechanical properties.



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# Atomic Force Microscopy (AFM) of Temporary Crown and Bridge Materials

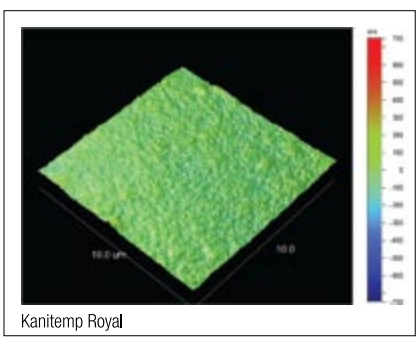
L. BERGMEIER[1], S. HADER[1], U. HOHEISEL[1], and V. JONES[2], [1]3M ESPE AG, Seefeld, Germany, [2]3M, St. Paul, MN, USA

**Objectives:** To compare surface topography of four cured, unpolished temporary crown and bridge materials using AFM imaging.

**Methods:** Tapping mode AFM scans of fully cured, unpolished material samples were performed. (Digital Instruments Dimension 50,000 SPM) using Olympus OTESP single crystal silicon levers with a force constant of ~40N/M as a probe. Setpoint: 75% of original free space amplitude (2.0V). Image scan size: 10 × 10 µm. Vertical scale: +/-750 nm. Roughness values were measured using Veeco Vision software (version 3.5)

**Results:** Average Roughness (Ra in nm) was: New Protemp: 22,96; Luxatemp Fluorescence: 237.9; Structur Premium: 131.8 ; Kanitemp Royal: 154.93. RMS Roughness values (Rq in nm) were as follows: New Protemp: 29.9; Luxatemp Fluorescence: 301.8; Structur Premium: 165.5; Kanitemp Royal: 208.5. Average maximum height values were (Rz in µm) New Protemp: 0.26; Luxatemp Fluorescence: 1.77; Structur Premium: 1.2; Kanitemp Royal: 2.03.

**Conclusions:** Unpolished new Protemp is significantly smoother than the other materials tested, making an extra polishing step unnecessary.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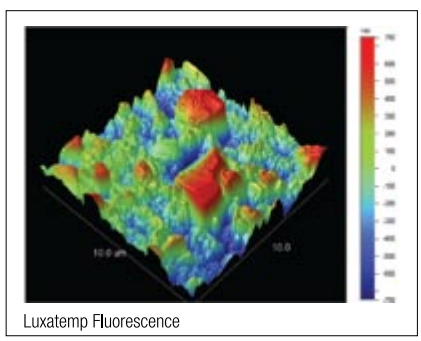
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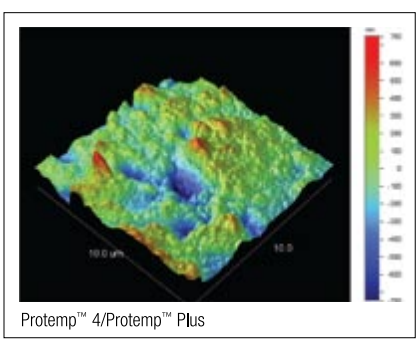
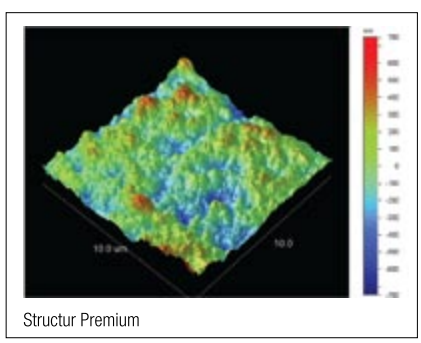

Protemp™ 4/Protemp™ Plus


Structur Premium

**Aim of the study:** To compare surface properties of Protemp Plus/Protemp 4 temporary crown and bridge material to three other leading crown and bridge materials via AFM scan.

**Results of the study:** Protemp Plus/Protemp 4 has significantly smoother surface properties even without polishing.



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2348
IADR 2008

# Protemp™ Crown Temporization Material

## Temporary Crown Clinical Performance in a Practice-Based Research Network (PROH)

T.J. HILTON[1], J.L. FERRACANE[1], C. BARNES[1], and R.C. RANDALL[2], [1]Oregon Health & Science University, Portland, USA, [2]3M ESPE Dental Products, Saint Paul, MN, USA

**Objectives:** The purpose of this study was to evaluate the performance of a new temporary crown (Protemp/3M ESPE), in 101 crown prepared teeth in the permanent dentition of adult patients.

**Methods:** Ten members of the PROH practice-based research network each placed 10 Protemp temporary crowns while fabricating crowns on 101 permanent posterior teeth using standardized preparation/luting criteria. Baseline (tooth preparation appointment) and recall (permanent crown cementation appointment 2–4 weeks later) assessments were completed for each temporary crown using modified Ryge criteria. Additionally, practitioners rated wear, bruxism, temperature and biting sensitivity (VAS). Changes from baseline to the recall appointment were analysed using McNemar's test for binary outcomes and the paired t-test for quantitative outcomes. Associations between measures were assessed using logistic regression and generalized estimating equations. A 0.05 level of statistical significance was used for all analyses.

**Results:** The overall retention rate of the temporary crowns was 87%, and the overall fracture rate was 11%. Patients identified as bruxers exhibited significantly greater wear than non-bruxers. There were significant changes between baseline and recall measures in temperature and biting sensitivity (VAS) and gingival index, but the changes into a better level were statistically balanced by changes to a worse level. There were no significant differences in occurrence of baseline/recall temperature sensitivity or biting sensitivity, nor was there a significant change in anatomic form from baseline to recall. Practitioners noted that a few temporary crowns demonstrated a marked color change.

**Conclusion:** In general, Protemp crowns performed satisfactorily as an interim restoration. Supported by 3M ESPE.

**Aim of the study:** Determine clinical performance of Protemp Crown, a new performed temporary composite restoration for single units.

**Results of the study:** Satisfactory overall clinical performance at recall 2–4 weeks after replacement with a retention rate of 87% and fracture rate of 11%.



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# Protemp™ Crown Temporization Material

0350
CED 2007

## Wear of Provisional Crown and Fixed Partial Denture Materials

C.J. KLEVERLAAN, A. WERNER, A.J. DE GEE, and A.J. FEILZER, ACTA, Universiteit van Amsterdam and Vrije Universiteit, Netherlands

**Objectives:** The aim of this study was to determine the three-body wear of five resin-based provisional materials: Protemp™ Crown (3M ESPE), Luxatemp (DMG), Integrity (De Trey Dentsply), Structure Premium (VOCO), and Trim II (Bosworth).

**Methods:** Structur Premium, Integrity and Luxatemp were mixed by their automix systems and allowed to self-cure at room temperature. Trim II, a powder-liquid C&B material, was mixed in the ratio P/L=13/7 by volume, and after the rubbery state allowed to cure at RT in a pressure pan (at 2 Bar) for 5 minutes. Protemp Crown was treated by special instructions from the manufacturer. Wear experiments were performed in the ACTA wear machine at various time periods after the start of curing.

**Results:** The table shows the consecutive wear in µm/200,000 cycles at five time moments. Statistically significant differences (two-way ANOVA) were found for the materials ($P<0.001$) and the different time periods ($P<0.001$). Comparing the mean wear within day one resulted in the following ranking: Protemp™ Crown<Integrity=Structure Premium<Luxatemp<Trim II. A decrease of the mean wear was observed for most materials during the first week.

**Conclusion:** The mean wear of Protemp™ Crown was significantly lower at all time periods than the other investigated provisional materials. The observed mean wear of Protemp™ Crown is in the order of permanent composite restorative materials, such as Tetric Ceram with a mean wear of 76(2) µm at day one.

Wear in µm/200,000 cycles determined in the ACTA wear machine at 15 N antagonist load.

| Age | Protemp Crown | Luxatemp | Integrity | Structure Premium | Trim II |
|---|---|---|---|---|---|
| **1 day** | 84(7) | 135(3) | 129(7) | 128(5) | 237(6) |
| **4 days** | 76(3) | 116(2) | 112(5) | 105(2) | 232(5) |
| **1 week** | 68(3) | 113(2) | 110(3) | 92(1) | 204(13) |
| **4 weeks** | 67(5) | 111(6) | 111(6) | 90(4) | 198(6) |
| **8 weeks** | 6(3) | 108(6) | 103(4) | 97(4) | 158(10) |

Materials were supplied by 3M ESPE AG Seefeld, Germany.

**Aim of the study:** Assess in vitro three-body wear for Protemp Crown, a new performed single unit composite restoration, in comparison to four other temporary crown and bridge materials.

**Results of the study:** Protemp Crown showed the significantly lowest wear rates compared to the other crown and bridge materials tested. Values were similar to composite materials used for permanent restorations.



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1567
IADR 2008

# Protemp™ Crown Temporization Material

## Clinical Study on Marginal Fidelity of Temporary Crown Systems

J.A. SORENSEN, R. TROTMAN and P.N. SORENSEN, Pacific Dental Institute, Portland, OR, USA

**Objectives:** A new temporary crown system made of a preformed self-supporting malleable composite (Protemp Crown™ 3M ESPE [PTC]) facilitates rapid fabrication of temporary crowns. This study compared the clinical marginal fit of PTC to molded temporary crowns made with autopolymerized BisAcryl (Luxatemp,™ Zenith, DMG [LUX]).

**Material and Methods:** Patients having posterior crowns made were randomly assigned to a temporary crown group: PTC. The appropriate size tooth form was selected, unwrapped, trimmed with scissors, pressed over the tooth preparation, and molded to margins with fingers and instruments while patient was biting. It was initially light-cured (LC), gently teased off of tooth and LC for 20 sec. LUX Material was placed in a vinyl polysiloxane (VPS) mold with an automixing gun, seated on tooth and allowed to polymerize. The mold was removed and crown retrieved. Crowns were trimmed with temporary polishing system (Brasseler USA) and cemented with either Systemp Link (Ivoclar Vivadent) or Dycal (Caulk Dentsply). At crown delivery appointment a small impression was made of temporary crown with low and high viscosity VPS. Epoxy resin (Buehler) was poured in impressions. Epoxy crown replicas were sectioned faciolingually into halves for premolars yielding four measurements and thirds for molars yielding eight measurements. Crowns evaluated: 13-LUX, 17-PTC. Measurement of marginal discrepancies was according to methodology described by Sorensen (J Prosthet Dent 1990;64:18). Vertical discrepancy=marginal gap size; horizontal discrepancy: +=overcontoured, -=undercontoured.

**Results:** Mean(sd) Marginal Discrepancy [µm]: Vertical: PTC=665(363), LUX=819(513), Horizontal: PTC=+352(434), LUX=+193(691). ANOVA, Tukey's test showed significant difference between PTC and LUX for vertical and horizontal discrepancies at $p<0.05$.

**Conclusions:** Significant differences existed for mean vertical and horizontal marginal discrepancies between temporary crown systems. Both systems had marginal overcontouring.

**Aim of the study:** Clinical assessment of marginal fit of Protemp Crown, a new preformed composite crown vs. Luxatemp, an established autopolymerizing bisacryl applied in to the matrix.

**Results of the study**: Protemp Crown showed a significantly reduced marginal gap. Both crown types were overcontoured.



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# Protemp™ Crown Temporization Material

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IADR 2008

## A Comparative Study Between Two Preformed Provisional Crown Fabrication Techniques

V. TSAKALELLI, N. CHAIMATTAYOMPOL, E. ANTONELLOU, and D. PARK, Tufts University School of Dental Medicine, Boston, MA, USA

Recently, there is a newly introduced preformed single provisional restoration ProTemp Crown (3M ESPE) proposed as an innovative, revolutionary breakthrough temporization material and technique. There is no original research of the comparison between ProTemp crowns to polycarbonated temporary crowns (3M ESPE).

**Objectives:** This current in vitro study was conducted to compare the amount of time spent to fabricate the different restorations and evaluate the quality of marginal integrity, interproximal and occlusal contacts of ProTemp and polycarbonated temporary crowns.

**Methods:** Tooth #4 secured in Columbia typodont was prepared in mannequin with chamfer finish line. Forty (N=40) single provisional crowns were fabricated on the prepared abutment tooth using two different techniques, Group 1—prefabricated polycarbonated crowns and Group 2—preformed ProTemp crowns, (20/Gp).

The amount of time spent for fabrication (including relining, when necessary) was recorded. Two calibrated and trained prosthodontists evaluated the marginal integrity and the interproximal contacts based on the Modified United States Public Health (USPHS) criteria. Occlusion was also evaluated. The amount of time spent to fabricate provisional crowns of both groups was recorded and statistically analyzed (ANOVA, $p<0.05$) and the rating of marginal integrity, interproximal contact and occlusion were recorded and statistically analyzed (Mann-Whitney U test, $p<0.01$).

**Results:** The results revealed that the amount of time spent to fabricate provisional crowns is statistically significant different between Group 1 and Group 2. The mean time to fabricate a provisional crown in Group 2 is less than in Group 1. Mann-Whitney U test was used to analyze marginal integrity, interproximal contact and occlusion. There were no statistically significant differences between the two techniques.

**Conclusion:** The use of ProTemp crown significantly reduced the time spent to fabricate a provisional crown. ProTemp technique was equivalent to polycarbonated provisional crown technique.

**Aim of the study:** To compare time needed for placement and clinical outcome of new Protemp Crown (preformed composite) and established Polycarbonate crowns.

**Results of the study:** While the placement procedure was significantly faster with Protemp Crown, the clinical outcome for marginal integrity, interproximal contact and occlusion was comparable for both products.



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# 2852 RelyX™ Fiber Post

IADR 2008

## Influence of Surface Treatment on Bonding Effectiveness of Different Fiber-Posts

F. ZICARI[1], B. VAN MEERBEEK[1], R. SCOTTI[2], and I. NAERT[1], [1]Catholic University of Leuven, Belgium, [2]University of Bologna, Italy

**Objectives:** To evaluate the effect of post pre-treatment on the bond strength of three adhesive cements to three post systems.

**Methods:** Three kinds of glass-fiber reinforced posts with a different matrix, namely epoxy resin (RelyX Posts, 3M ESPE), methacrylate resin, (GC-posts, GC) and composite resin (FRC Plus, Ivoclar-Vivadent), and three types of resin cements, namely Bis-GMA-based (Variolink II, Ivoclar-Vivadent), 10-MDP-based (Clearfil Esthetic Cement, Kuraray) and self-adhesive (RelyX Unicem, 3M ESPE), were used. Posts were not treated (control), treated with silane, or treated with Cojet/silane. Overall, 27 groups of eight specimens each were tested. Posts were inserted up to 9 mm depth into composite blocks (Paradigm, 3M ESPE). After one week storage at 37˚C, three sections (coronal, middle, apical) of 2 mm thickness were subjected to a push-out test using a universal loading device (5848-MicroTester, Instron, USA).

**Results:** Regarding the kind of post, the significantly highest push-out bond strength was observed for RelyX Posts and GC-Posts ($p<0.01$). Regarding the post pre-treatment, the Cojet/silane treatment significantly improved the bond strength ($p<0.01$) for FRC Plus and GC-Posts. Regarding the cement, RelyX Unicem scored higher ($p<0.01$).

| **Mean push-out bond strength (SD)** | | | |
|---|---|---|---|
| **Post** | | **Cement** | |
| | RelyX Unicem | Clearfil Esthetic Cement | Variolink II |
| **RelyX Post** | | | |
| Untreated | 12.40(2.67)$^{abcd}$ | 8.42(2.02)$^{ghilm}$ | 9.87(2.59)$^{defgh}$ |
| Silane | 10.36(3.53)$^{cdefg}$ | 8.41(2.53)$^{ghilm}$ | 9.16(3.52)$^{fghil}$ |
| Cojet/Silane | 14.49(3.39)$^{a}$ | 9.30(3.86)$^{fghil}$ | 8.80(2.50)$^{fghilm}$ |
| **FRC Plus** | | | |
| Untreated | 11.11(1.99)$^{bcdef}$ | 7.30(2.89)$^{hilmn}$ | 5.39(1.64)$^{n}$ |
| Silane | 10.93(3.44)$^{bcdefg}$ | 7.46(2.79)$^{hilmn}$ | 5.39(2.20)$^{n}$ |
| Cojet/Silane | 12.05(2.54)$^{abcde}$ | 9.72(3.52)$^{efghi}$ | 7.21(3.44)$^{ilmn}$ |
| **GC-Post** | | | |
| Untreated | 8.93(1.77)$^{fghilm}$ | 6.4(1.97)$^{lmn}$ | 6.34(1.73)$^{mn}$ |
| Silane | 11.15(2.23)$^{bcdef}$ | 6.97(3.04)$^{lmn}$ | 9.20(3.20)$^{fghil}$ |
| Cojet/Silane | 14.42(2.59)$^{a}$ | 13.23(2.30)$^{ab}$ | 12.86(3.25)$^{abc}$ |
| ANOVA: different superscript letters indicate significant difference ($p<0.05$) | | | |

The push-out bond strength was also found to be significantly different for the coronal, middle and apical sections ($p>0.01$).

**Conclusion:** Overall, the epoxy resin posts presented the best results. Silanization was not effective in enhancing the bond strength of any post system. Coating with silicated-alumina particles appeared to improve the bond strength to composite and methacrylate posts.

**Aim of the study:** In vitro evaluation of bond strength of three different posts and cements with regard to influence of post pre-treatment.

**Results of the study:** Silanization did not significantly enhance bond strength for any post-cement combination. Cojet/Silane treatment significantly improved bond strength for FRC- and GC-Posts with Variolink II and Clearfil Esthetic, but not for RelyX Unicem which had the highest bonding values to all untreated posts.



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# RelyX™ Fiber Post & RelyX™ Unicem Self-Adhesive Universal Resin Cement

1063
AADR 2008

## Sealing Ability of Three Fiber Post Systems

J. PERDIGAO[1], V. SANTOS[2], G. GOMES[3], and A.L. SILVA[2], [1]University of Minnesota, Minneapolis, USA, [2]University of Lisbon, Portugal, [3]Instituto Superior Ciencias Saude Egas Moniz, Caparica, Portugal

**Objectives:** To study the sealing ability of three fiber post systems using ammoniacal silver nitrate.

**Methods:** Thirty-six single-rooted teeth were endodontically treated and randomly assigned to two new fiber post systems and a control group: EV—everStick-POST + ParaCem Universal DC resin cement; RX—RelyX Fiber Post + RelyX Unicem resin cement; PP—ParaPost Fiber Lux + ParaCem Universal DC resin cement (control group). The roots were isolated with nail polish except for a 1.0 mm rim around the post, and immersed in 50 wt % ammoniacal silver nitrate for 24 hr followed by 8 hr in photo-developing solution. The roots were sectioned in 1 mm-thick disks and processed for backscatterered FESEM. For each tooth, the depth of silver infiltration was divided in ranks from zero to eight. Additionally, leakage was measured for each disk as the percentage of silver penetration around the adhesive interface. Data were analyzed with Kruskal-Wallis non-parametric test ($P<0.05$).

**Results:** No leakage occurred at the post-cement interface. For depth of silver penetration, RX resulted in the lowest degree of nanoleakage, but not statistically different from that of EV ($P<0.148$). RX resulted in lower degree of leakage than PP at $P<0.023$. EV resulted is statistically similar depth of penetration than PP at $P=0.492$. The mean percentage of silver infiltration at the dentin-resin cement interface was statistically similar for all groups ($P>0.05$). However, EV resulted in the greater number of disks with nanoleakage (23 out of 96), followed by PP (21 out of 96) and RX (14 out of 96).

**Conclusion:** The use of the new IPN technology in EV did not improve the root wall sealing ability compared with the control group. RX, which uses a new simplified self-adhesive protocol, resulted in a tighter seal to root dentin than the control.

**Aim of the study:** To compare three fiber post systems and the corresponding adhesive luting system regarding sealing ability.

**Results of the study:** RelyX Unicem in combination with RelyX Fiber Post showed the highest seal while having the simplest cementation protocol.

Results found in abstracts for RelyX™ Unicem Self-Adhesive Universal Resin Cement also apply to products registered under the following name(s): RelyX™ U100 Self-Adhesive Universal Resin Cement.



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0359
AADR 2008

# RelyX™ Unicem Self-Adhesive Universal Resin Cement

## Shear Bond Strength of Self-Adhesive Cements

T. GHUMAN, R.S. ZADEH, D. CAKIR, J. BURGESS, L.C. RAMP, and P. BECK, University of Alabama at Birmingham, USA

Self-adhesive cements are becoming popular due to the reduced number of steps required for cementation. New self-adhesive cements continue to develop and improve but further testing is required.

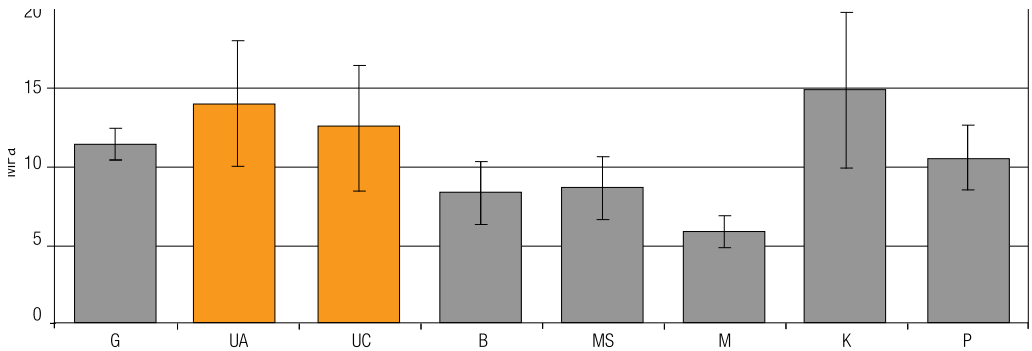
**Objective:** To measure shear bond strength to zirconia disks of seven commercially available and a new adhesive cement.

**Methods:** The surface of 80 Cercon discs (d=10 mm, thickness=4 mm) was wet ground with 320-grit SiC abrasive paper (Wehmer 108, IL, USA) for 1 min, followed by air-abrasion with 25 mm AL203 (Kavo American Corp., IL, USA). They were randomly assigned to eight groups, 10 each. Light-cured composite rods (MZ100/A2, 3M ESPE, MN, USA), ( d~2.35 mm) were prepared and were abraded with 25 mm AL203 for 2 sec, followed by applying adhesive bonding agent (Clearfil SE, Kuraray USA, Inc., NY, USA) and light curing for 20 sec. Rods were cemented to Zirconia using self-adhesive cements (G-Cem/GC [G], RelyX Unicem Aplicap/3M ESPE [UA], RelyX Unicem Clicker/3M ESPE [UC], BisCem/BISCO [B], Multilink Sprint/Ivoclar-Vivadent [MS], MaxCem/Kerr [M], Experimental Cement/Kuraray [K], Panavia F2.0/Kuraray [P]) following manufacturer's instruction with constant weight of 400 g and cured for 20 sec (Coltolux Coltene/Whaledent, OH, USA, 750 Mw/cm$^2$). Samples were incubated at 37˚C for 24 hr, thermocycled between 6 and 600˚C with a 15 sec dwell time for 1,000 cycles and debonded using a universal testing machine (Instron 5565, MA, USA) with crosshead speed of 1 mm/min. The results were analyzed with ANOVA followed by Tukey/Kramer (p=0.05). Samples were evaluated by SEM (ISI, SX-30, MA, USA).

**Results:** Mean±SD in MPa.

| G | UA | UC | B | MS | M | K | P |
|---|---|---|---|---|---|---|---|
| 11.4±1 | 14±4 | 12.4±4 | 8.3±2 | 8.6±2 | 5.8±1 | 14.8±5 | 10.5±2 |

Tukey/Kramer post-hoc test showed no significant difference (p>0.05) between experimental cement (K) and G-Cem, Panavia F 2.0, Unicem cements.




**Conclusion:** Self-adhesive cements continue to develop but further improvement should be continued. This study was supported in part by Kuraray.

**Aim of the study:** The authors compared several self-adhesive resin cements, one hybrid self-adhesive and one resin cement regarding shear bond strength to sandblasted zirconia.

**Results of the study:** RelyX Unicem Aplicap and Clicker performed better than BisCem, MaxCem and Multilink Sprint and showed comparable bond strength as, e.g., the multi-step resin cement Panavia F2.0.

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# RelyX™ Unicem Self-Adhesive Universal Resin Cement

0659
AADR 2008

## Evaluation of Zirconia-Based Bridges in UK General Practice; Two-Year Results

R.J. CRISP, University of Birmingham UK, Cheshire, United Kingdom, and F.J.T. BURKE, University of Birmingham, England, UK

**Objectives:** The clinical evaluation of the performance of Lava* zirconium oxide all-ceramic bridges using LavaCeram* veneering porcelain and cemented with the self-adhesive resin cement RelyX Unicem* (*3M ESPE, Seefeld, Germany) placed in four UK general dental practices (sites at Alness, Buxton, Coleraine & Liverpool) over a five-year period.

**Methods:** Tooth preparation, bridge construction (at one central laboratory) and cementation were carried out to manufacturer's instructions. Using modified Ryge criteria, the operator completed baseline assessments of marginal fit, colour match and gingival health. Annual reviews, by a calibrated examiner and the operator, also looked at secondary caries status, surface quality and post-operative sensitivity.

**Results:** To date 42 bridges have been placed, and 22 bridges (mean age 24.1 months) in 19 patients (13 Female and 6 Male) have been reviewed at two years (39 bridges, of mean age 12.3 months, reviewed at one-year). No failures, secondary caries or staining were observed. A second veneering porcelain chip was detected (one reported at one-year), otherwise surface quality was optimal. No pain or sensitivity was reported. 95% of bridges were optimal for marginal adaptation & no change in colour match from baseline was detected. The gingival health was as tabulated.

| 1=healthy gingivae<br>2=mild inflammation<br>3=moderate inflammation<br>4=severe inflammation | Baseline | One year | Two year |
|---|---|---|---|
| **Facial** | 85% 1, 15% 2 | 95% 1, 5% 2 | 95% 1, 5% 3 |
| **Mesial** | 82% 1, 18% 2 | 100% 1 | 100% 1 |
| **Distal** | 85% 1, 15% 2 | 95% 1, 5% 2 | 95% 1, 5% 2 |

This study was supported by 3M ESPE AG, Seefeld, Germany.

**Conclusion:** After two years of clinical service the all-ceramic zirconia-based bridges were continuing to give good clinical service and monitoring will continue to determine performance over the five-year period.

**Aim of the study:** Lava zirconia bridges cemented with the self-adhesive resin cement RelyX Unicem were observed over 2 years of clinical service. Secondary caries, marginal adaptation, post-operative sensitivity and staining were evaluated.

**Results of the study:** After 2 years of clinical service RelyX Unicem showed very good clinical performance. Ninety-five percent of the bridge restorations showed perfect margins. No failures, sensitivities, secondary caries nor staining were reported.

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2301
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# RelyX™ Unicem Self-Adhesive Universal Resin Cement

## In Vitro Retentive Strength of Self-Adhering Cements to Zirconium-Oxide Crowns

C.P. ERNST, A. SCHATTENBERG, C. BLUM, E. STENDER, and B. WILLERSHAUSEN, Johannes Gutenberg University, Mainz, Germany

**Objectives:** The retentive strength of a resin cement in combination with a new, but conventional type adhesive (XP Bond-SCA-Calibra/DENTSPLY), five self adhering cements (RelyX Unicem Aplicap, RelyX Unicem Clicker/3M ESPE, Maxcem/sds Kerr, Multilink Sprint/Ivoclar [2X], exp. cement/ DENTSPLY), two glass ionomer-cements (Ketac Cem/3M ESPE, Meron/VOCO) and a resin-modified glass-ionomer cement (Meron Plus/VOCO) were examined for luting zircon-oxide ceramic crowns (LAVA, 3M ESPE) on extracted human teeth.

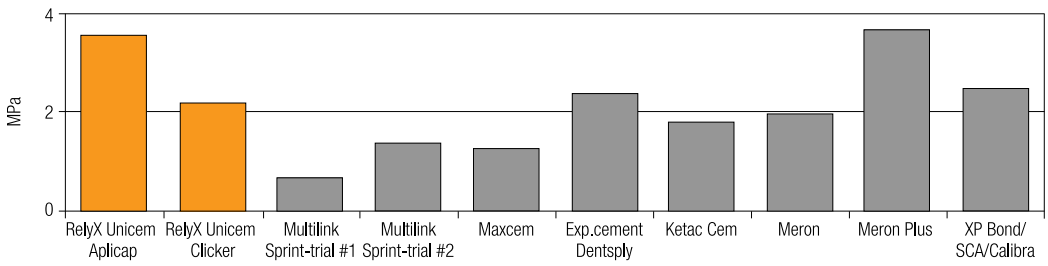
**Method:** One hundred extracted teeth (n=10) were prepared in a standardized manner (10,° hr=3 mm). The resin cements and the adhesive system were used according to manufacturers recommendations; in dual-curing systems, only the self-curing approach was conducted. The crown's inner surfaces were sandblasted (Rocatec Pre). After thermocycling (5,000X, 5–55°C), the cemented ceramic crowns (Rocatec-pretreatment at the outer surface; connected over a low shrinkage epoxy resin to macro-mechanical undercuts in a resin block, made out of Paladur denture base material) were removed along the path of insertion using a Zwick universal testing device. The retention surface was determined individually for each tooth (Dahl & Oilo, Dent Mater 2, 1986). Statistical analysis was made using the SPSS 11.0 program (Wilcoxon rank test, Bonferroni-adjustment).

**Results:** The retentive strength values [N/mm²] were (Min/Q1/Median/Q3/Max): RelyX Unicem Aplicap: 1.8/2.6/3.6/4.3/4.7 RelyX Unicem Clicker: 1.1/2.0/2.2/2.9/6.7; Multilink Sprint—trial #1: 0.5/0.6/0.7/1.2/2.3; Multilink Sprint—trial #2: 0.8/1.3/1.4/1.5/4.8; Maxcem: 0.6/0.9/1.3/1.6/2.3; Exp. cement DENTSPLY: 0.8/1.3/2.4/3.1/4.8; Ketac Cem: 0.2/1.0/1.8/2.2/3.0; Meron: 1.1/1.8/2.0/2.3/3.1; Meron Plus: 2.0/2.5/3.7/5.0/7.4; XP Bond/SCA/Calibra: 0.8/2.2/2.5/3.4/5.0. RelyX Unicem Aplicap and Meron Plus showed statistically significant higher median retentive strength than Multilink Sprint and Maxcem ($p<0.0005$)

**Conclusion:** Meron Plus and RelyX Unicem showed the highest median retentive strength values. The group of self adhering cements showed a wide variety in retentive strength.

This study was supported by Ivoclar Vivadent, 3M ESPE, VOCO, and DENTSPLY

Retentive Strength (median values)

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**Aim of the study:** The objective was to compare the bond strength of different cementation materials when luting full-ceramic (Lava Zirconia) crowns to human teeth after thermal stress.

**Results of the study:** In this clinical relevant test setup RelyX Unicem sef-adhesive resin cement showed better median bond strength than conventional resin, self-adhesive resin or glass ionomer cements.



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# RelyX™ Unicem Self-Adhesive Universal Resin Cement

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## Partial Ceramic Crowns Luted with RelyX Unicem: One-Year Results

F. SCHENKE, K.-A. HILLER, G. SCHMALZ, and M. FEDERLIN, University of Regensburg, Germany

**Objectives:** The aim of this prospective longitudinal split-mouth study was to compare the performance of partial ceramic crowns (PCC) inserted with RelyX Unicem either with (RXUSE) or without (RXU) selective enamel etching.

**Methods:** Forty-three patients received 86 restorations. In each patient, one PCC was placed with RXU and one PCC with RXUSE. The restorations were clinically rated using modified United States Public Health Service (USPHS) criteria at baseline (BL), 6 and 12 months after placement. Chisquare-tests were performed for statistical analysis.

**Results:** From the total of 43 patients, 34 patients (male 15, female 19) were available for the three recalls. Median patient age was 41 years (range 24–59). Median (25–75%) PBI was 6% (3–9%). RXU: 25 PCC were placed in molars, nine in premolars. RXUSE: 26 PCC were placed in molars, eight in premolars. One PCC (RXU) debonded after 11 months, one PCC (RXUSE) fractured after 12 months in situ. Both restorations were replaced. The evaluation using USPHS criteria revealed that marginal adaptation and marginal discoloration were significantly influenced by the observation periods:

| | | | Marginal Adaptation | | | | Marginal Discoloration | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Time | | Alfa | Bravo | Charlie | Delta | Alfa | Bravo1 | Bravo2 | Charlie |
| **RXU** | BL | n<br>% | 33<br>97.1 | 1<br>2.9 | 0<br>0 | 0<br>0 | 33<br>97.1 | 0<br>0 | 1<br>2.9 | 0<br>0 |
| **RXU** | 6 mo | n<br>% | 29<br>85.3 | 5<br>14.7 | 0<br>0 | 0<br>0 | 32<br>94.1 | 2<br>5.9 | 0<br>0 | 0<br>0 |
| **RXU** | 12 mo | n<br>% | 17<br>51.5 | 16<br>48.5 | 0<br>0 | 0<br>0 | 25<br>75.8 | 8<br>24.2 | 0<br>0 | 0<br>0 |
| **RXUSE** | BL | n<br>% | 34<br>100 | 0<br>0 | 0<br>0 | 0<br>0 | 33<br>97.1 | 0<br>0 | 1<br>2.9 | 0<br>0 |
| **RXUSE** | 6 mo | n<br>% | 26<br>76.5 | 8<br>23.5 | 0<br>0 | 0<br>0 | 29<br>85.3 | 5<br>14.7 | 0<br>0 | 0<br>0 |
| **RXUSE** | 12 mo | n<br>% | 18<br>52.9 | 16<br>47.1 | 0<br>0 | 0<br>0 | 25<br>73.5 | 7<br>20.6 | 2<br>5.9 | 0<br>0 |

No statistically significant differences between the different luting techniques were observed during the observation periods.

**Conclusion:** Within the limitations of the present study, adhesive luting with RelyX Unicem with or without selective enamel etching can be recommended.

**Aim of the study:** The authors compared the influence of selective enamel etching on the clinical performance of RelyX Unicem for cementation of partial ceramic crowns.

**Results of the study:** The split-mouth design revealed equal performance of RelyX Unicem independent of selective etching of enamel regarding marginal adaptation and discoloration. The authors can recommend both procedures for clinical use. 3M ESPE recommends simplicity: for the usual range of indications, no selective enamel etching is necessary and thus not recommended.

Results found in abstracts for RelyX™ Unicem Self-Adhesive Universal Resin Cement also apply to products registered under the following name(s): RelyX™ U100 Self-Adhesive Universal Resin Cement.



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0971
IADR 2008

# RelyX™ Unicem Self-Adhesive Resin Cement

## Nanoleakage of Luting Agents for Bonding Posts After Thermo-Mechanical Fatigue

K. BITTER[1], J. PERDIGAO[2], C. HARTWIG[1], S. PARIS[1], and A. KIELBASSA[1], [1]Charité—Universitätsmedizin Berlin, Germany, [2]University of Minnesota, Minneapolis, USA

**Objectives:** The aim was to investigate the depth and extension of nanoleakage of four different luting agents for bonding fiber posts after thermo-mechanical fatigue.

**Methods:** Twenty-four extracted human anterior teeth were endodontically treated, sectioned at the cemento-enamel junction and restored with fiber posts using four commercially available resin cements as well as four corresponding core build-up materials (n=6): Panavia F 2.0/Clearfil DC Core Automix (Kuraray), Variolink II/Multicore Flow (Ivoclar Vivadent), RelyX Unicem/Filtek Z250 (3M ESPE), and Multilink Sprint/Multicore Flow (Ivoclar Vivadent). The specimens received all-ceramic crowns and were subjected to thermo-mechanical fatigue (1.2 million cycles). After cutting off the crowns, the roots were isolated with nail polish except for a 1 mm-wide rim around the root canal, immersed into 50 wt % ammoniacal silver nitrate solution for 24 hr and exposed to a photo-developing solution for 8 hr. The specimens were sectioned perpendicular to the long axis of the tooth into four slices (thickness=0.8 mm), fixed, dehydrated and processed for FESEM. Leakage was measured using Backscattered FESEM and EDS.

**Results:** The depth of nanoleakage was significantly affected by the resin cement ($p<0.015$; Kruskall-Wallis). Multilink Sprint demonstrated significantly deeper penetration of silver particles compared to all other materials ($p<0.05$; Mann Whitney-U-Test). At a depth of 0.8 mm the material RelyX Unicem demonstrated only isolated silver particles whereas all other materials still showed distinctive leakage.

**Conclusion:** The four resin cements resulted in nanoleakage to a certain extent after thermo-mechanical fatigue and would not be able to hermetically seal the root canal if leakage occurred around the margins of the coronal restoration. Due to the different demonstrated sealing abilities of the resin cements it can be concluded that the choice of the luting agent is an important aspect regarding the long-term stability of the restoration.

**Aim of the study:** To investigate the sealing ability of two conventional and two self-adhesive resin cements when luting fiber post into the root canal. To simulate clinical conditions, teeth were endodontically treated and completely restored with core build-up and full ceramic crown and further subjected to extensive thermo-mechanical loading.

**Results of the study:** The self-adhesive resin cement RelyX Unicem performed statistically comparable to the multi-step resin cements Variolink II and Pananvia F2.0 including their bonding systems. Visible leakage (SEM) was least with RelyX Unicem.

Results found in abstracts for RelyX™ Unicem Self-Adhesive Universal Resin Cement also apply to products registered under the following name(s): RelyX™ U100 Self-Adhesive Universal Resin Cement.



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# RelyX™ U100 Self-Adhesive Resin Cement

0446
IADR 2008

## Bond-Strength and Morphological Interface Between Dentine and Auto-Adhesive Cements

M.F. DE GOES[1], R. VAZ[2], A. ANTUNES[1], and M.A.C. SINHORETI[1], [1]Piracicaba Dental School—UNICAMP, Piracicaba—SP, Brazil, [2]Dental School—UFMG, Belo Horizonte—MG, Brazil

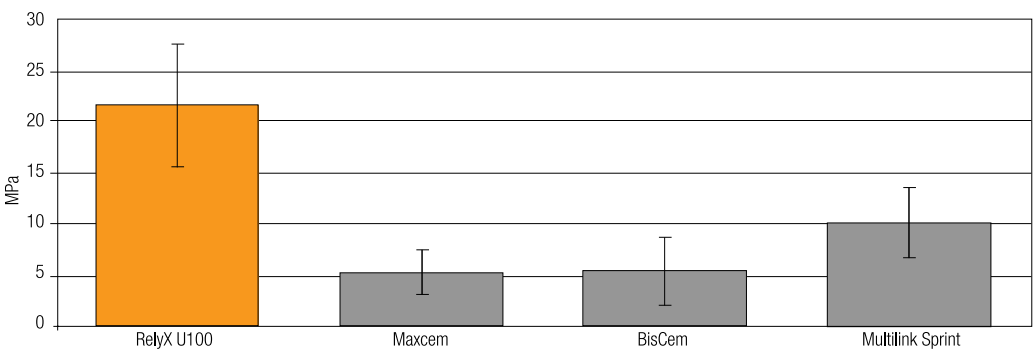
**Objectives:** Evaluate bond strength and the morphological interface between auto-adhesive luting cements, human dentin and indirect resin composite.

**Methods:** The oclusal enamel of 16 human molars was removed using a low-speed saw. The medium dentin exposed was ground with SiC (600 grit). Indirect composite resin discs (Sinfony, 3M ESPE) were confectioned and were sandblasted with 50 µm aluminum oxide particles, and bonded to dentin surfaces, according to manufacturers instructions with the following auto-adhesive luting cements: Rely X U100 (3M ESPE), Maxcem (Kerr), BisCem (Bisco) and MultilinK Splint (Ivoclar/Vivadent) After 24-hour water storage (37˚C), each tooth was sectioned in X and Y directions to obtain twenty 0.8±0.1 mm two cross-sectional area sticks. Specimens were tested in tension with an Instron at cross-speed of 0.5 mm/min. Statistical analysis included ANOVA and Tukey test. The surfaces of eight dentine discs (1.5 mm thick) were treated with each of the auto-adhesive cements and bonded to form disc-pairs for SEM analysis.

**Results:** (Mean MPa±S.D.) RelyX U100: 21.5±5.95; Maxcem: 5.3±2.11; BisCem: 5.4±3.25 and Multilink Splint: 10.1±3.39. U100 resulted in statistically higher bond strength values than all other cements (p=0.00001). Fracture pattern analysis in SEM revealed predominance of cohesive cement fractures for U100 and adhesive for Maxcem, BisCem and Multilink Splint cements. RelyX U100 showed continuous interaction with underlying dentin as resin tags infiltrated into the dentinal tubules. No hybrid layer formation was observed. Other cements revealed discontinued regions at the dentin-cement interfaces.

**Conclusions:** The U100 cement presented morphological dentin interaction and higher bond strength than all other cements.

Bond Strength




Supported by CNPq PQ 310845/06-8.

**Aim of the study:** Several recent self-adhesive resin cements were evaluated regarding their bond strength to human dentin and the morphology of their interface to dentin.

**Results of the study:** RelyX U100 self-adhesive resin cement showed at least twice the bond strength to human dentin than the other materials investigated and was the only cement that displayed continuous and close (resin tags in dentinal tubuli) interaction to the dentin.

Results found in abstracts for RelyX™ U100 Self-Adhesive Resin Cement also apply to products registered under the following name(s): RelyX™ Unicem Self-Adhesive Universal Resin Cement.



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# 0659 Lava™ Crowns and Bridges

AADR 2008

## Evaluation of Zirconia-Based Bridges in UK General Practice; Two-Year Results

R.J. CRISP, University of Birmingham UK, Cheshire, United Kingdom, and F.J.T. BURKE, University of Birmingham, England, UK

**Objectives:** The clinical evaluation of the performance of Lava* zirconium oxide all-ceramic bridges using LavaCeram* veneering porcelain and cemented with the self-adhesive resin cement RelyX Unicem* (*3M ESPE, Seefeld, Germany) placed in four UK general dental practices (sites at Alness, Buxton, Coleraine & Liverpool) over a five-year period.

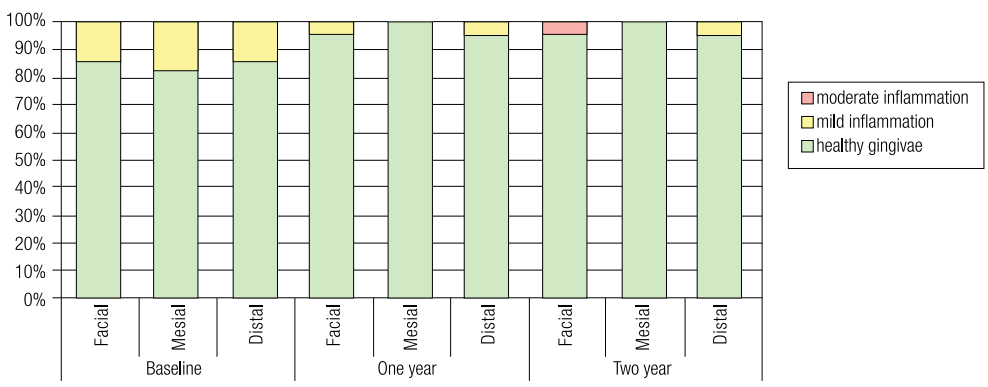
**Methods:** Tooth preparation, bridge construction (at one central laboratory) and cementation were carried out to manufacturer's instructions. Using modified Ryge criteria, the operator completed baseline assessments of marginal fit, colour match and gingival health. Annual reviews, by a calibrated examiner and the operator, also looked at secondary caries status, surface quality and post-operative sensitivity.

**Results:** To date 42 bridges have been placed, and 22 bridges (mean age 24.1 months) in 19 patients (13 Female and six Male) have been reviewed at two years (39 bridges, of mean age 12.3 months, reviewed at one year). No failures, secondary caries or staining were observed. A second veneering porcelain chip was detected (one reported at one year), otherwise surface quality was optimal. No pain or sensitivity was reported. 95% of bridges were optimal for marginal adaptation and no change in colour match from baseline was detected. The gingival health was as tabulated.

| 1=healthy gingivae<br>2=mild inflammation<br>3=moderate inflammation<br>4=severe inflammation | Baseline | One year | Two year |
|---|---|---|---|
| **Facial** | 85% 1, 15% 2 | 95% 1, 5% 2 | 95% 1, 5% 3 |
| **Mesial** | 82% 1, 18% 2 | 100% 1 | 100% 1 |
| **Distal** | 85% 1, 15% 2 | 95% 1, 5% 2 | 95% 1, 5% 2 |

**Conclusion:** After two years of clinical service the all-ceramic zirconia-based bridges were continuing to give good clinical service and monitoring will continue to determine performance over the five-year period. This study was supported by 3M ESPE AG, Seefeld, Germany.

Gingival health of Lava bridges veneered with Lava Ceram




**Aim of the study:** The aim of the study was to investigate the clinical performance of Lava™ bridges veneered with Lava™ Ceram.

**Results of the study:** Lava bridges performed well without any failures, secondary caries or staining. The gingival health was slightly improving from baseline and stayed quite stable over the two-year observation time.



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# Lava™ Crowns and Bridges & Paradigm™ C

3154
IADR 2008

## Translucency Comparison of CAD/CAM Materials

R. ALKHUNAIZI, R. POBER, and R. GIORDANO, Boston University, MA, USA

**Objective:** To compare the translucency of eight core and five full-contour CAD/CAM materials using reflectance contrast ratio as a method of measurement.

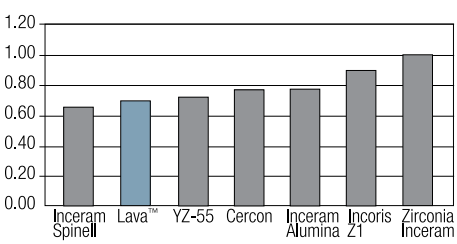
**Methods:** Seven core materials were tested: a. Lava (3M/ESPE); b. Incoris ZI (Sirona); c. YZ-55 (Vita); d. Cercon (Dentsply); e. Inceram Spinell (Vita); f. Inceram Alumina (Vita); g. Inceram Zirconia (Vita). Five full-contour materials were tested: a. Paradigm C (3M/ESPE); b. Vitamark II (Vita); b. E.max CAD (Ivoclar); c,d. Empress CAD HT and Empress CAD LT (Ivoclar). Reflectance measurements of core and full-contour materials were determined on disc specimens 1.5 and 0.5 mm thick, respectively. By sectioning the blocks of relevant materials, specimens were produced. Lava, Incoris ZI,YZ-55 and Cercon specimens were sintered, Inceram specimens were glass infused and e.max CAD specimens were fired for crystallization according to manufacturer instructions. All specimens were tested in a spectrophotometer (i5,X-Rite, GretagMacbeth) across the visible spectrum (400–700 nm) with CIE standard illuminant D65. Contrast ratios (CR) were calculated from the luminous reflectance of the specimens on a black surface (Yb) to the reflectance on a white surface (Yw), (CR=Yb/Yw). One way analysis of variance (ANOVA), two sample t-tests and a Satterthwaite-Welch t-test were used.

**Results:** Mean contrast ratios are shown below:

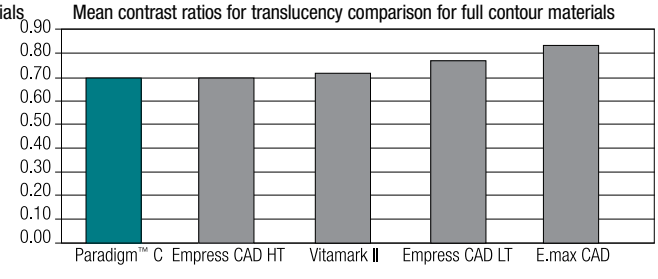
| **Core Materials** | **Lava** | **Incoris ZI** | **YZ-55** | **Cercon** | **Inceram Spinell** | **Inceram Alumina** | **Inceram Zirconia** |
|---|---|---|---|---|---|---|---|
| **Contrast Ratio** | 0.69 (0.024) | 0.9 (0.006) | 0.71 (0.01) | 0.77 (0.017) | 0.65 (0.07) | 0.77 (0.02) | 0.99 (0.16) |
| **Full-contour materials** | **Paradigm C** | **Vitamark II** | **E.max CAD** | **Empress CAD HT** | **Empress CAD LT** | | |
| **Contrast Ratio** | 0.69 (0.009) | 0.71 (0.02) | 0.83 (0.007) | 0.69 (0.01) | 0.76 (0.014) | | |

**Conclusion:** ANOVA test revealed differences between both groups of materials. At α=0.05 ANOVA and t-tests indicate the following ranking of materials according to contrast ratio (from most translucent to most opaque). Core materials: Inceram Spinell> Lava, YZ-55>Cercon, Inceram Alumina>Incoris ZI>Inceram Zirconia. Full-contour materials: Paradigm C, Vitamark II, Empress CAD HT>Empress CAD LT>E.max CAD.

Mean contrast ratios for translucency comparison for core materials




Mean contrast ratios for translucency comparison for full contour materials




**Aim of the study:** This study evaluated the translucency of eight core and five full-contour CAD/CAM materials.

**Results of the study:** Both 3M ESPE products (Lava™ and Paradigm™ C) were ranked high for translucency in comparison to other core and full-contour materials.



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# 0173 Paradigm™ MZ100

CED 2007

## Fracture Resistance of Minimally Prepared Resin-Bonded CEREC Inlays

E. TSITROU[1], M. HELVATJOGLU-ANTONIADES[2], S.E. NORTHEAST[1], K. PAHINIS[1], and R. VAN NOORT[1], [1]University of Sheffield, United Kingdom, [2]Aristotle University of Thessaloniki, Greece

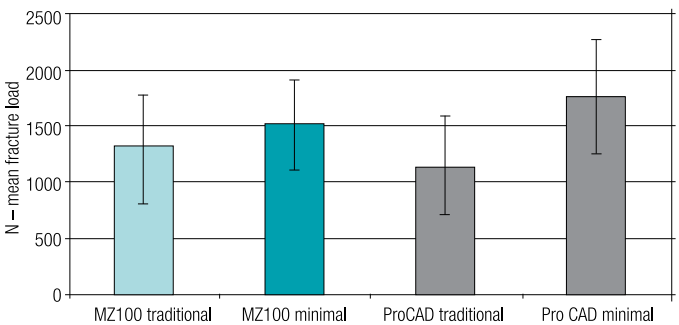
**Objectives:** This study compared the structural integrity and fracture mode of teeth restored with traditionally and minimally prepared resin-bonded CAD/CAM inlays fabricated from the same material.

**Methods:** Forty intact maxillary premolar teeth were used and divided in four groups. Two groups were prepared according to a traditional inlay preparation design and two groups were prepared according to a minimal preparation design. Two restorative systems were tested; a composite system comprised of Paradigm MZ100 (3M/ESPE) blocks and RelyX Unicem (3M/ESPE) resin cement and a ceramic system comprised of ProCAD blocks (Ivoclar-Vivadent) and Variolink II (Ivoclar-Vivadent) resin cement. Inlays were cemented according to manufacturers' instructions. Each specimen was loaded axially to their occlusal surface at a cross head speed of 0.5 mm/min in a universal testing machine until fracture. Load data was analyzed using ANOVA comparing inlays of the same restorative material. The mode of fracture of the inlays was also recorded and analysed using a non-parametric test (Kruskal-Wallis).

**Results:** For the composite system, the mean fracture load and SD was 1322 N (±445) for the traditional inlays and 1511 N (±395) for the minimal inlays, while for the ceramic system was 1135N (±450) for the traditional inlays and 1761 N (±494) for the minimal inlays. Statistical analysis of the results showed that there was no statistically significant difference between the two designs for the composite system, while for the ceramic system the minimally prepared teeth showed higher mean fracture strength. Non-parametric analysis (Kruskal-Wallis) of the mode of fracture showed that there was no statistically significant difference between traditionally and minimally prepared inlays for both systems ($p>0.05$).

**Conclusions:** Within the limitations of this experimental study, only the ceramic inlays when prepared with a minimally preparation design demonstrated higher fracture strength as compared to the traditionally prepared teeth.

Fracture resistance of inlays




**Aim of the study:** The intention of the study was to find out whether there is a difference in fracture strength of composite or ceramic inlays either prepared traditionally or minimally.

**Results of the study:** The fracture strength of Paradigm™ MZ100 is not statistically significantly different when applying two different preparation methods, delivering mean fracture strength of 1322N (±445) for traditional and 1511N (±395) for minimal inlays.



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# Microtensile Bond Strength of CAD/CAM Blocks Using Self-Adhesive Resin Cement

W. EL-BADRAWY[1], G. NATHAN[1], L. KOSOVSKI[1], H. OMAR[2], and R.C. ROPERTO[3], [1]University of Toronto, Canada, [2]University of Toronto, Toronto, ON, Canada, [3]University of Manitoba, Winnipeg, Canada

**Objective:** To determine microtensile bond strength of ceramic and composite CAD/CAM blocks bonded to dentin and to composite material using self-adhesive and conventional resin cements.

**Methods:** Occlusal surfaces of extracted sound human molars were sectioned horizontally below the DEJ to produce dentin sections 3 mm thick. Composite discs 3 mm thick were made from MZ100 composite (3M ESPE) using a special mold. Three types of Vita CEREC Blocks: Mark-II (Group I), Trilux (Group II) and Esthetic-line (Group III) (Vita Zanfabrik) and composite block (Paradigm MZ100, 3M ESPE) (Group IV) were sectioned into slices 3 mm thick. Ceramic sections were surface-treated using a porcelain treatment kit. Each group was subdivided into two subgroups: one was cemented to dentin and the other to composite using two resin cements, conventional cement (Calibra/ Prime & Bond-NT, Dentsply) as control; and self-adhesive cement (RelyX Unicem, 3M ESPE). Bonded specimens were stored in water for 24 h at 37˚C then sectioned to obtain rods 1 × 1 × 6 mm using slow-speed diamond saw. The rods were then tested in microtensile testing machine (Bisco). Means and SDs were calculated and data statistically-analyzed using ANOVA and Tukey's post-hoc tests.

**Results:** Microtensile bond strengths to dentin with Calibra in MPa were: Group I: 20.4(2.3), Group II: 17.6(2.6), Group III: 19.9(2.9), Group IV: 24.5(2.5). With RelyX Unicem values were: Group I: 10.1.4(2.5), Group II: 13.2(4), Group III: 15.8(3.1), Group IV: 33.3(2). For both cements Paradigm MZ100 blocks had significantly higher bond strengths to dentin compared with three ceramic blocks ($p<.05$). Microtensile bond strengths to composite with Calibra in MPa were: Group I: 31.1(4.8), Group II: 29.5(5.8), Group III: 27.5(6), Group IV: 24.2(7). For RelyX Unicem values were: Group I: 37.2(6.1), Group II: 29.7(3.2), Group III: 31(3.8), Group IV: 23.4(3.6). All groups showed higher bond strength to composite material with the two cements except for Paradigm MZ100.

| MPa | Mark II | Trilux | Esthetic-line | Paradigm MZ100 |
|---|---|---|---|---|
| **Calibra** | 20.4(2.3) | 17.6(2.6) | 19.2(2.9) | 24.5(2.4) |
| **RelyX Unicem** | 10.1(2.5) | 13.2(4) | 15.8(3.1) | 33.2(2) |

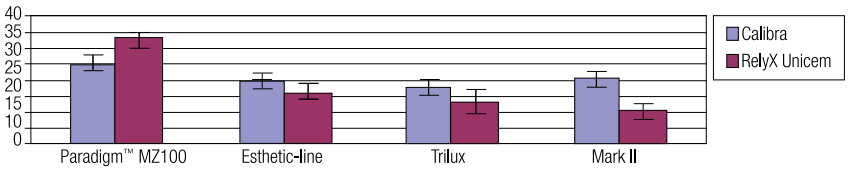
Microtensile bond strength to dentine

| MPa | Mark II | Trilux | Esthetic-line | Paradigm MZ100 |
|---|---|---|---|---|
| **Calibra** | 31.1(4.8) | 29.5(5.8) | 27.5(6) | 24.2(7) |
| **RelyX Unicem** | 37.2(6.1) | 29.7(3.2) | 31(3.8) | 23.4(3.6) |

Microtensile bond strength to composite

**Conclusions:** A composite CAD/CAM block (Paradigm MZ100) had higher microtensile bond strength to dentin compared to three ceramic CAD/CAM blocks. Acknowledgements: 3M ESPE and Dentsply.

Microtensile bond strength to dentin




**Aim of the study:** The aim of the study was to evaluate the microtensile bond strength of ceramic and composite blocks bonded to dentin or composite.

**Results of the study:** Paradigm MZ100 showed higher microtensile bond strength to dentin compared to three ceramic CAD/CAM blocks.



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# 0199 Paradigm™ MZ100

IADR 2008

## Stability, Adaptation and Wear of Composite and Stainless Steel Crowns

R. LANG, M. ROSENTRITT, and G. HANDEL, University of Regensburg, Germany

**Objectives:** In-vitro study to compare fracture resistance (FR) and marginal adaptation (MA) of experimental preformed composite crowns (EXP), MZ100 and stainless steel (SS) crowns.

**Methods:** Single molar crowns were fabricated with EXP, MZ100 and SS (all 3M ESPE, USA). The roots of human molars were fixed with a 1 mm polyether layer to imitate the periodontium. Each test group (eight crowns) was prepared as listed below. All crowns were thermocycled and mechanically loaded (TMCL: 12000 × 5˚C/55˚C, 2.4 × 106 × 50N, 1.66 Hz) with human antagonists, then axially loaded to failure (Zwick 1446; v=1 mm/min). Failure detection was set to 10% of Fmax. Occlusal wear was measured in comparison to the unworn surface by a 3D scanning device (Willytec,G). MA (% perfect margin) was determined in a scanning electron microscope (Phillips Quanta FEG 400, NL) via replica-technique before and after TCML. Statistical analysis was performed with the Mann-Whitney-U-test (P=0.05).

| Crown: | 1 MZ100 | 2 EXP | 3 EXP | 4 EXP | 5 EXP | 6 SS |
|---|---|---|---|---|---|---|
| **Prep-Situation** | one cusp missing | one cusp missing | one cusp missing | one cusp missing | two cusps missing | one cusp missing |
| **Core-buildup** | MZ100 & Single Bond | none | none | MZ100 & Single Bond | none | MZ100 & Single Bond |
| **Margin liner** | none | Filtek Flow | none | Filtek Flow | none | none |
| **Cement** | RXU100 | RXU100 | RXU100 | RXU100 | RXU100 | Ketac Cem Easymix |
| **FR (N) Median (Q1/Q3)** | 3199 (3002/3740) | 2090 (1798/2601) | 2621 (2427/2882) | 3068 (2434/3480) | 2444 (1828/2963) | 1500 (1014/1540) |
| **MA before TCML [%] Median (Q1/Q3)** | 89 (85/100) | 100 (91/100) | 98 (90/100) | 84 (79/95) | 100 (96/100) | 0 (0/0) |
| **MA after TCML [%] Median (Q1/Q3)** | 88 (60/94) | 84 (74/96) | 96 (81/100) | 75 (58/90) | 75 (45/93) | 0 (0/0) |

**Results:** MZ100 showed highest FR, followed by EXP and SS crowns. EXP and MZ100 showed best MA, SS crowns displayed no acceptable marginal adaptation. The crown surfaces showed comparable wear rates for MZ100, EXP and SS crowns.

**Conclusion:** These results indicate that MZ100 and EXP crowns may be fit for clinical application in permanent restorations (five years+). Clinical research is needed to confirm.



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# Evaluation of Varied Repair Methods Applied to CAD/CAM Blocks

K.R. COULTER, J.E. SCOTT, and T. BONSTEIN, University of Manitoba, Winnipeg, Canada

**Objectives:** The study aim was to determine the best repair method for three types of CAD/CAM blocks.

**Materials and Methods:** Three types of CAD/CAM materials, two ceramic (Vitablocs Esthetic Line, Vident and ProCAD, Ivoclar Vivadent) and one composite (Paradigm MZ100, 3M ESPE), were sectioned into 48 specimens ($5 \times 2 \times 3$ mm), then embedded and randomly divided into 12 groups (n=12). Specimen surfaces were either roughened by a fine diamond bur (Brasseler, USA) or air abraded by 30 mm aluminum oxide particles (CoJet System, 3M ESPE). Clearfil Repair (Kuraray America) was applied and polymerized according to manufacturers' instructions. A cylindrical mould ($2.3798 \times 4$ mm) was used to fabricate composite cylinders from either flowable (Esthet X Flow, Dentsply) or hybrid (Filtek Z250, 3M ESPE) composite resin. Specimens were stored in water at 37˚C for 24 hours and sheared using the Ultradent method with Zwick Z010 Compression Tester set to move at 1 mm/minute. Data were analyzed using ANOVA single factor (a=0.05). Scanning Electron Microscope (SEM) was used to assess the modes of fracture.

**Results:** ProCAD and Paradigm blocks yielded statistically significant higher shear bond strengths as compared to Vitablocs ($p<0.05$). There was no statistically significant difference between bond strengths for bur and CoJet abrasion ($p>0.05$) or between hybrid and flowable resins ($p>0.05$). Failed specimens showed mostly cohesive fractures within the blocks.

**Conclusions:** Within the study's limitation, the significant difference found in the reparability of CAD/CAM blocks may be attributed to block composition; however, all block/surface preparation/resin combinations yielded clinically acceptable shear bond strengths when bonded by Clearfil Repair. Both fine diamond bur abrasion and CoJet abrasion may be used to roughen CAD/CAM restorations after which either flowable or conventional hybrid composite resins can be bonded to repair the material.



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# 0557 Paradigm™ C

CED 2007

## Two-Body Wear Investigations of Dental Ceramics with ABREX

J. GEIS-GERSTORFER and C. SCHILLE, University of Tübingen, Germany

**Objectives:** Enamel wear by ceramics may adversely affect maintenance of the vertical dimension of occlusion and can increase the potential for thermal sensitivity. The aim of this study is to determine the in vitro two-body contact wear of different machinable ceramics compared with human enamel.

**Materials and Methods:** The ceramic materials Paradigm C (3M ESPE), Mark II (Firma Vita), Vitadur Alpha (Firma Vita), ProCAD (Firma Ivoclar) and as a reference human enamel were investigated. After embedding the samples in epoxy the surfaces were wet polished with SiC up to FEPA P4000. The wear was studied using a pin-on-disk apparatus ABREX against 6 mm steatite balls as antagonists (45°, 5 N load, 5,000 cycles). Oral moist conditions were simulated using mod. Fusayama saliva. The amount of wear was determined topographically with the use of a 3D profilometer (Concept 3D, Mahr, Germany) by measuring the height loss of the antagonist, and the depth of wear track of the restorative materials. Mean values and 95% CI significance level were calculated from at least five measurements of each material.

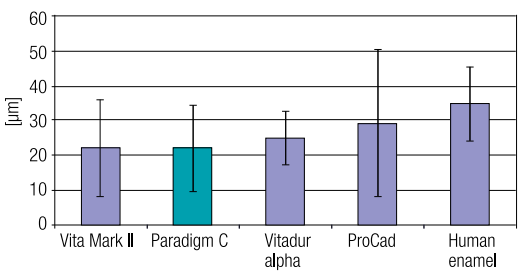
**Results:** Mean values (±S.D.) are given in the table:

| Material | Depth of wear [µm] | Height loss of antagonist [µm] |
|---|---|---|
| **Paradigm C** | 22.1 ± 13.8 | 150 ± 27 |
| **Vita Mark II** | 21.9 ± 12.5 | 150 ± 47 |
| **ProCad** | 29.2 ± 21.1 | 160 ± 27 |
| **Vitadur alpha** | 25.0 ± 7.6 | 200 ± 28 |
| **Human enamel** | 34.6 ± 10.6 | 110 ± 74 |

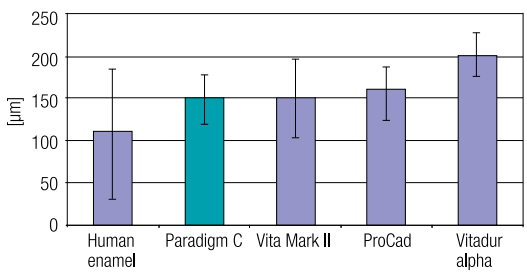
**Conclusion:** Depth of wear and height loss of the antagonists (steatite balls) showed similar results with the machinable ceramics. It was concluded that the machinable ceramics were significantly less abrasive and more resistant to wear than human enamel. However, an adverse effect was found at the antagonist situation.

Supported by 3M ESPE.

Depth of wear




Height of loss of antagonist




**Aim of the study:** With this study, the two-body contact wear of Paradigm C and other machinable ceramics were evaluated and compared to human enamel.

**Results of the study:** Depth of wear and height loss of the antagonists (steatite balls) showed similar results with the machinable ceramics. It was concluded that the machinable ceramics were significantly less abrasive and more resistant to wear than human enamel.



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# Optical Properties of Veneer Materials

F.S. HOSSAIN, J.M. POWERS, and R. PARAVINA, University of Texas Dental Branch at Houston, USA

**Objective:** To evaluate translucency parameter (TP), Yellowness Index (YI, ASTM E313-73), Whiteness Index (WI, CIE Ganz 82), and Tappi Brightness (TB, T525–1986) of veneer materials.

**Materials and Method:** Specimen preparation and positioning: Specimens (15 × 12 mm, 0.7 mm thick, n=5 per shade) were made. Shades A1, A2 and A3 of materials for veneers—3M Paradigm (3M ESPE) and Vita Mark II (Vita Zahnfabrik) were used. TP was recorded three times for each specimen using a spectrophotometer using both the white and black background. Means and standard deviations were determined. The data was evaluated by analysis of variance. Fisher's PLSD interval for comparison of means was calculated at the 0.05 level of significance.

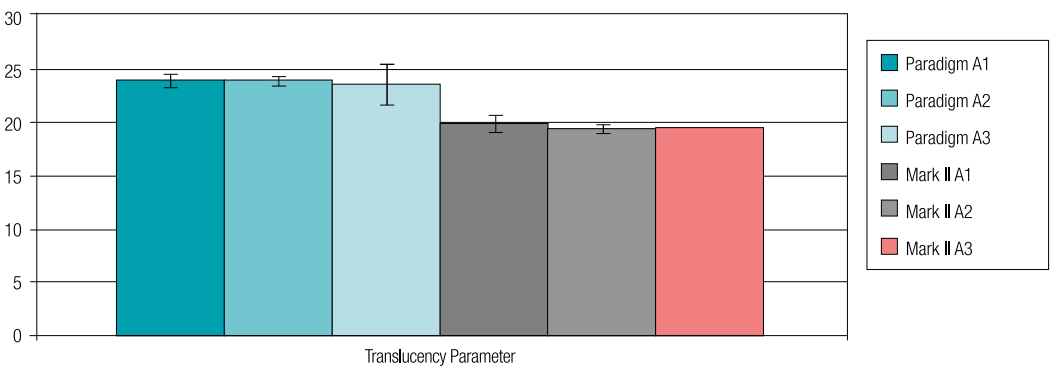
**Results:**

| Material | Shade | TP | YI | WI | TB |
|---|---|---|---|---|---|
| **Paradigm** | A1 | 23.7(0.6)[a] | 15.7(0.2) | 23.4(0.4) | 46.1(0.5) |
| | A2 | 23.7(0.4)[a] | 22.8(0.1) | 2.6(0.8) | 42.2(0.6) |
| | A3 | 23.4(1.9)[a] | 24.8(0.4) | -4.4(3.6) | 40.3(2.4)[c] |
| **Mark II** | A1 | 19.7(0.8)[b] | 14.7(0.2) | 26.2(0.8) | 46.6(1.0)[d] |
| | A2 | 19.2(0.4)[b] | 20.3(0.4) | 13.4(2.3) | 45.5(1.0)[d] |
| | A3 | 19.3(1.0)[b] | 27.8(0.6) | -8.2(2.7) | 40.8(1.0)[c] |

Means (s.d.) of translucency parameter (TP). Yellowness Index (YI, ASTM E313-73), Whiteness Index (WI, CIE Ganz 82), and Tappi Brightness (TB, T525–1986).
Fisher's PLSD critical differences are 0.8 for TP, 0.3 for YI, 2.0 for WI, and 1.1 for TB. $p<0.0001$.

**Conclusion:** Within the limitations of this study, Paradigm exhibited higher translucency than Mark II ($p<0.0001$).

Optical properties of veneer materials




**Aim of the study:** The purpose of this study was to compare the optical properties like translucency parameter, yellowness index, whiteness index and tappi brightness of different shades of veneering materials (Paradigm C; Vita Mark II).

**Results of the study:** In this study, Paradigm C exhibited higher translucency than Vita Mark II.



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Disinfection Effect on Tear Strength of Hydrophilic PVS Impression Materials
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A. SHAH, J.O. BURGESS, M.S. LITAKER, P.R. BECK, and D. CAKIR, UAB School of Dentistry, Birmingham, AL, USA

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M. SAHABI[1], M. DAVOUDIAN[1], and M. EJLALI[2], [1]Shahid Beheshti University of Medical Sciences, Tehran, Iran, [2]Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran

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E.W. ESTAFANOUS, The University of Iowa College of Dentistry, Iowa City, USA, C. PALENIK, Indiana University School of Dentistry, Indianapolis, USA, and J.A. PLATT, Indiana University, Indianapolis, USA

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Compatibility of $H_2O_2$-Based Surface Disinfectant with Elastomeric Impression Materials
R. PUTTAIAH[1], J. SMITH[1], S.-M. LIN[1], and V.J. SETIEN[2], [1]Baylor College of Dentistry TAMUS HSC, Dallas, TX, USA, [2]Baylor College of Dentistry, Dallas, TX, USA

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Compatibility of $H_2O_2$ High-Level Disinfectant on Elastomeric Impression Materials
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Dimensional Stability of Model Produced by Modified Putty-Wash Polyvinyl-Siloxane Impression
N. CHAIMATTAYOMPOL, and D. PARK, Tufts University School of Dental Medicine, Boston, MA, USA

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A. MAURER, S. HADER, R. GUGGENBERGER, J. FETZ, and J. ZECH, 3M ESPE AG, Seefeld, Germany

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I.C. CORREA, Universidade Federal do Rio de Janeiro, Brazil, M.J.D.S. ALENCAR, Universidade Federal do Rio de Janiero, Rio de Janeiro, Brazil, and A.C.V. GOMES FILHO, Vigodent S/A Ind. Com, Rio de Janeiro, RJ, Brazil

0013
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Mechanical Modeling and Laboratory Testing of Anatomically Correct All-Ceramic Crowns
P.G. COELHO, N.R.F.A. SILVA, M. CABRERA, E.A. BONFANTE, E.D. REKOW, and V.P. THOMPSON, New York University, USA

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B. TASKONAK[1], G.A. BORGES[2], J.J. MECHOLSKY[3], and K.J. ANUSAVICE[3], [1]Indiana University School of Dentistry, Indianapolis, USA, [2]Universidade de Uberaba, Brazil, [3]University of Florida, Gainesville, USA

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J.W. KIM, J.-H. KIM, V.P. THOMPSON, D.E. REKOW, and Y. ZHANG, New York University, USA

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F.D. JARAD, and A. MILOSEVIC, University of Liverpool, United Kingdom

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D. EVLI, N. OZDEN, and E. CELIK, Ankara Universitesi, Turkey

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G. HERTLEIN, M. KRAEMER, and T. MEURER, 3M ESPE AG, Seefeld, Germany

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O. MOLDOVAN[1], N. CORCODEL[2], R.G. LUTHARDT[1], AND H. RUDOLPH[1], [1]Medizinische Fakultät der Universität Ulm, Germany, [2]University of Heidelberg, Germany

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D. CHARLTON[1], H.W. ROBERTS[2], and A. TIBA[1], [1]Naval Institute for Dental and Biomedical Research, Great Lakes, IL, USA, [2]USAF Dental Evaluation and Consultation Service, Great Lakes, IL, USA

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S. CULVER, D. CAKIR, J. BURGESS, and L. RAMP, University of Alabama at Birmingham, USA

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### Fracture Resistance of Temporary Crown and Bridge Materials after Chewing—Simulation
S. HADER, U. HOHEISEL, and R. HECHT, 3M ESPE AG, Seefeld, Germany

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G.M. GOMES[1], J.C. GOMES[1], O.M. GOMES[1], G.C. MARTINS[2], and A.L. CALIXTO[1], [1]Ponta Grossa State University, Ponta Grossa, Parana, Brazil, [2]Ponta Grossa State University, Brazil

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M.A. BOTTINO[1], L.W. ZARDIN[2], M. AMARAL[2], P. BALDISSARA[3], L.F. VALANDRO[2], G. GALHANO[1], and M.A. DE VILLA[2], [1]São Paulo State University (UNESP), São José dos Campos, Brazil, [2]Federal University of Santa Maria, Brazil, [3]University of Bologna, Italy

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### Color Stability of Three Resin Cements After Accelerated Aging
B.J. LAU[1], C. ALVAREZ-GAYOSSO[1], M.A. ALVAREZ[2], and P.A. FERNANDEZ[1], [1]Universidad Nacional Autonoma de Mexico, Mexico City, Mexico, [2]Facultad de Odontologia Mexico, Mexico 22 DF, Mexico

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### Shear Bond Strength of Resin Cements to E.max Pressed Ceramic
F. GEORGE, M.E. RAZZOOG, M. SIERRAALTA, and B. ABBO, University of Michigan, Ann Arbor, USA

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### Time-Dependent Polymerization of Dual-Cured Luting Agent Beneath Ceramic
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### Mechanical Properties of Three Resin Cements After Accelerated Aging
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### Effects of Saliva Contamination on Bond Strength of Luting Cements
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### Clinical Evaluation of Indirect, Posterior, Inlay-Retained Fiber-Reinforced-Composite Restorations: 4.5-Year Follow-Up
O. KUMBULOGLU[1], M. ÖZCAN[2], and A. USER[1], [1]Ege Universitesi, Izmir, Turkey, [2]University Medical Center Groningen, Netherlands

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### Performance of Luting-Agents on Bond Strength on Coronal and Root-Dentin
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L.F. VALANDRO[1], M. AMARAL[1], M.F. SANTINI[1], V.F. WANDSCHER[1], R. AMARAL[2], and M.A. BOTTINO[2], [1]Federal University of Santa Maria, Brazil, [2]São Paulo State University (UNESP), São José dos Campos, Brazil

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### Effect of Ceramic Surface Treatment on Bonding to Inceram Alumina
L.M. MIRAGAYA[1], F.E. VASCONCELLOS[1], R. POBER[2], R. GIORDANO[2], and C.E. SABROSA[1], [1]Universidade do estado do Rio de Janeiro, Brazil, [2]Boston University, MA, USA

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### Long-Term Bonding to Modified Zirconia Surface
J.-H. PHARK[1], S. DUARTE[1], M.B. BLATZ[2], and A. SADAN[1], [1]Case Western Reserve University, Cleveland, OH, USA, [2]University of Pennsylvania, Philadelphia, USA

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### Effect of Alloy and Surface Treatment on Adhesive Cement Strength
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X. QIAN, H. BUI, and D. TOBIA, Kerr Corporation, Orange, CA, USA

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### Bond Strength of Two Glass-Fibre Post Systems in Root Canals
F.S.L. WONG[1], M. PIRVANI[2], and S. PARKER[2], [1]Barts and The London School of Medicine and Dentistry, United Kingdom, [2]Bart's and The London School of Medicine and Dentistry

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G.R. BASSO, A. DELLA-BONA, D.L. GOBBI, and D. CECCHETTI, University of Passo Fundo, Brazil

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A. SADR, Y. SHIMADA, and J. TAGAMI, Tokyo Medical and Dental University, Japan

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A.M. BINMAHFOOZ, and D. NATHANSON, Boston University, MA, USA

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I. RADOVIC[1], C. MAZZITELLI[2], N. CHIEFFI[2], and M. FERRARI[2], [1]University of Belgrade, University of Siena, Serbia and Montenegro, [2]University of Siena, Italy

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Bonded and Self-Adhesive Cements' Bond Strengths Between Zirconia-Crowns and Dentin
R. PERRY[1], J. CAREY[2], C. DEFURIA[2], J. ORFANIDIS[1], and P. STARK[2], [1]Tufts University School of Dental Medicine, Boston, MA, USA, [2]Tufts University, Boston, MA, USA

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Shear Bond Strength of Self-Adhesive Resin Cements to Dentin
A. KIREMITCI, Hacettepe University, School of Dentistry, Ankara, Turkey, and P. ALTINCI, Private Practice, Ankara, Turkey

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Comparison Load-Fatigue Performance of Self-Adhesive Resin Cements Bonded To Dentin
Y. CHAIYABUTR, and J.C. KOIS, Kois Center Research, Seattle, WA, USA

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L.F. PEGORARO, University Of São Paulo, Bauru, Brazil, A.P.R.V. PEDREIRA, University of São Paulo, Bauru, Brazil, T.A. PEGORARO, University of São Paulo, Bauru School of Dentistry, Brazil, M.F. DE GOES, Dental School of Piracicaba—UNICAMP, Brazil, and R.M. CARVALHO, Bisco, Inc, Schaumburg, IL, USA

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R. RUSH, J. WHITING, H. STRASSLER, and L.G. SENSI, University of Maryland Dental School, Baltimore, USA

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Effect of Cementation Technique on Pushout Strength of Fiber Posts
C. POLO, J. BROOME, J. BURGESS, and L.C. RAMP, UAB School of Dentistry, Birmingham, AL, USA

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Effects of Polymerization-Mode on the Push-Out Retention of Self-Adhesive Resin-Cements
A.H. CURY[1], T.A. PEGORARO[2], J.C. PEREIRA[1], B. SUH[3], and R.M. CARVALHO[3], [1]University of São Paulo, Bauru School of Dentistry, Brazil, [2]University of São Paulo, Bauru School of Dentistry, Brazil, [3]Bisco, Inc, Schaumburg, IL, USA

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Enhanced Silane-Aided Bonding to Silica-Coated Zirconia with Novel Silanes
J.P. MATINLINNA[1], L.V.J. LASSILA[2], P.K. VALLITTU[2], and S. KARLSSON[1], [1]Nordic Institute of Dental Materials (NIOM), Haslum, Norway, [2]University of Turku, Finland

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Fiber Post Bonding Effectiveness to Root Canal and Composite Core
A. RATHKE, D. HAJ-OMER, and B. HALLER, University of Ulm, Germany

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H.-S. YANG[1], M.-S. VANG[1], M.H. KIM[2], H.S. HAN[2], and J.M. YOO[2], [1]School of Dentistry, Chonnam National University, Gwangju, South Korea, [2]Dental Science Research Institute and BK2[1], Gwangju, South Korea

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Performance of Luting Agents on Bond Strength on Coronal and Root Dentin
B.D.C.F. BARRETO, C.G. CASTRO, R.E. CAMPOS, and C.J. SOARES, Universidade Federal de Uberlândia, Brazil

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P. MAKISHI[1], Y. SHIMADA[1], A. SADR[1], S. WEI[1], S. ICHINOSE[2], and J. TAGAMI[3], [1]Tokyo Medical and Dental University, Japan, [2]Instrumental Analysis Research Center, Tokyo Medical & Dental University, Japan, [3]Tokyo Medical and Dental University & COE Program, FRMDRTB at TMDU, Japan

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Leakage of Different Luting Cements for Quartz-Fiber Post Cementation
W. DASCH, M. EL-ARYAN, M.J. ROGGENDORF, J. EBERT, A. PETSCHELT, and R. FRANKENBERGER, University of Erlangen-Nuremberg, Germany

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Polymerization and Cementation Methods of Two Self-Adhesive Luting Cements
A. KROKIDIS[1], E. CAVAZZANA[1], A. SPERANZA[1], G. MERLATI[2], E. TOSCO[3], and A. CERUTTI[1], [1]University of Brescia, Italy, [2]Universita degli Studi di Pavia, Italy, [3]University of Ancona, Italy

2313 IADR 2008
Bond Strength of Self-Adhesive Luting Cements to Zirconia After Thermocycling
M. IRIE[1], M. OKA[1], Y. MARUO[1], G. NISHIGAWA[1], S. MINAGI[1], K. SUZUKI[1], and D.C. WATTS[2], [1]Okayama University, Japan, [2]University of Manchester, United Kingdom

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K. OHKUMA, Nippon Dental Univ., School of Life Dent. at Niigata, Japan, R. YAPP, Dental Consultants Inc, Ann Arbor, MI, USA, and J.M. POWERS, Dental Consultants, Inc, Ann Arbor, MI, USA

0383 IADR 2008
Push-Out Strength of Resin Cements to Radicular Dentin
M. COUTINHO[1], A.A. LEME[2], A. INSAURRALDE[1], P.M.C. SCAFFA[3], and R.T. LIMA[4], [1]Faculdade de Odontologia da Universidade Federal de Mato Grosso do Sul, Campo Grande, Brazil, [2]Universidade Federal Mato Grosso Do Sul, Campo Grande, Brazil, [3]Faculdade de Odontologia de Bauru—USP, Brazil, [4]University of Minnesota, Minneapolis, USA

0234 IADR 2008
Microtensile Bond Strength of CAD/CAM Blocks Using Self-Adhesive Resin Cement
W. EL-BADRAWY[1], G. NATHAN[1], L. KOSOVSKI[1], H. OMAR[2], and R.C. ROPERTO[3], [1]University of Toronto, Canada, [2]University of Toronto, Toronto, On, Canada, [3]University of Manitoba, Winnipeg, Canada

0330 IADR 2008
Microtensile Bond Strength of Glass-Fiber Posts with Self-Adhesive Resin Cements
S. ZAITTER[1], M. D. SOUSA-NETO[1], Y. T. SILVA-SOUSA[1], R.C. ROPERTO[1], and O. EL-MOWAFY[2], [1]University of Ribeirao Preto—Unaerp, Ribeirão Preto, Brazil, [2]University of Toronto, Canada

2309 IADR 2008
Effect of Ceramic Surface Treatment on Bonding to Inceram Alumina
L.M. MIRAGAYA[1], F.E. VASCONCELLOS[1], R. POBER[2], R. GIORDANO[2], and C.E. SABROSA[1], [1]Universidade do estado do Rio de Janeiro, Brazil, [2]Boston University, MA, USA

2346 IADR 2008
Self-Adhesive Composite Versus Zinc-Oxide-Phosphate Luting Cements: A Prospective Clinical Trial
J. WIMMER, M. BEHR, M. ROSENTRITT, C. KOLBECK, and G. HANDEL, University of Regensburg, Germany

0839 AADR 2008
Bond Strengths of Four Self-Adhesive Resin Cements to Zirconia Ceramic
K. YOSHIDA[1], K. KAMADA[2], and M. ATSUTA[2], [1]Nagasaki University Hospital of Medicine and Dentistry, Japan, [2]Nagasaki University, Graduate School of Biomedical Sciences, Japan

0841 AADR 2008
Long-Term Bonding to Modified Zirconia Surface
J.-H. PHARK[1], S. DUARTE[1], M.B. BLATZ[2], and A. SADAN[1], [1]Case Western Reserve University, Cleveland, OH, USA, [2]University of Pennsylvania, Philadelphia, USA

0663 AADR 2008
Microhardness of Dual-Cured Resin Cements Through Ceramic
M.T. BARBOSA, G.C. LOPES, G.M. ARCARI, and S. MONTEIRO JR, Universidade Federal de Santa Catarina, Florianópolis, Brazil

0842 AADR 2008
Retention of Zirconia Crowns Bonded with Five Adhesive Cements
D. CAKIR[1], T.E. PRENTICE[1], A. MILLER[2], J. BURGESS[1], and L.C. RAMP[1], [1]University of Alabama at Birmingham, USA, [2]Dentsply International, York, PA, USA

0837 AADR 2008
Dentin Bond Strength of Self-Adhesive Luting Materials
W.T. NAUGHTON, and M.A. LATTA, Creighton University, Omaha, NE, USA

0424 CED 2007
Benefits of a Two-Step Cementation Procedure for Prefabricated Fiber Posts
L.A. JONGSMA, P.B. BOLHUIS, P. PALLAV, C.J. KLEVERLAAN, and A.J. FEILZER, ACTA, Universiteit van Amsterdam and Vrije Universiteit, Netherlands

0182 CED 2007
Bonding Potential of Pre-Heated Self-Etch and Self-Adhesive Resin Cements
A. CANTORO[1], C. GORACCI[2], F. PAPACCHINI[1], C. MAZZITELLI[1], G.M. FADDA[1], and M. FERRARI[1], 1University of Siena, Italy, [2]University of Siena, Livorno, Italy

0013 CED 2007
IPS-Empress Inlays Luted with a Self-Adhesive Resin-Cement After Two Years
M. TASCHNER[1], R. FRANKENBERGER[1], A. PETSCHELT[1], and N. KRÄMER[2], [1]University of Erlangen, Germany, [2]University of Dresden, Germany

0185 CED 2007
Polymerization Shrinkage of Resin Cements
T. SPINELL[1], A. SCHEDLE[1], and D.C. WATTS[2], [1]Bernhard Gottlieb University Clinic of Dentistry, Vienna, Austria, [2]University of Manchester, United Kingdom

0221 CED 2007
Push-Out Bond Strength and Sealing Effectiveness of Fiber-Post Bonding
F. ZICARI[1], B. VAN MEERBEEK[1], E. DEBELS[1], J. DE MUNCK[1], R. SCOTTI[2], and I. NAERT[1], [1]Leuven BIOMAT Research Cluster, Catholic University of Leuven, Belgium, [2]University of Bologna, Italy

0186 CED 2007
Self-Adhesive Post Cementation: A Comparison Between Two Different Luting Cements
N. BARABANTI, A. KROKIDIS, P.A. ACQUAVIVA, E. CAVAZZANA, A. SPERANZA, and A. CERUTTI, University of Brescia, Italy

# Indirect Restorative References (continued)


0138
CED 2007
Zirconia Bonding Through Silicatization and Silanization
T.T. HEIKKINEN[1], L.V. LASSILA[1], J.P. MATINLINNA[2], and P.K. VALLITTU[1], [1]University of Turku, Finland, [2]Nordic Institute of Dental Materials (NIOM), Haslum, Norway

0467
CED 2007
Simulated Pulpal Pressure Influences Self-Adhesive Cements Bonding to Dentin
C. MAZZITELLI[1], F. MONTICELLI[2], R. OSORIO[2], A. CASUCCI[1], A. BORRACCHINI[1], M. TOLEDANO[2], and M. FERRARI[1], [1]University of Siena, Italy, [2]University of Granada, Spain

0376
AADR/Dallas 2008
Wear of the Enamel Antagonist and Five Restorative Materials
S. CULVER, D. CAKIR, J. BURGESS, and L. RAMP, University of Alabama at Birmingham, USAn

# Adper™ Adhesives

0354

AADR 2008

## Shear Bond Strength of Three Adhesives to Enamel and Dentin

P. JAMPANI, D. CAKIR, J. BURGESS, and L. RAMP, University of Alabama at Birmingham, USA

Bonding agents have evolved from total etch to two-bottle and finally one-bottle self etching systems. These newly developed systems may not bond as well to enamel or dentin as total-etch materials.

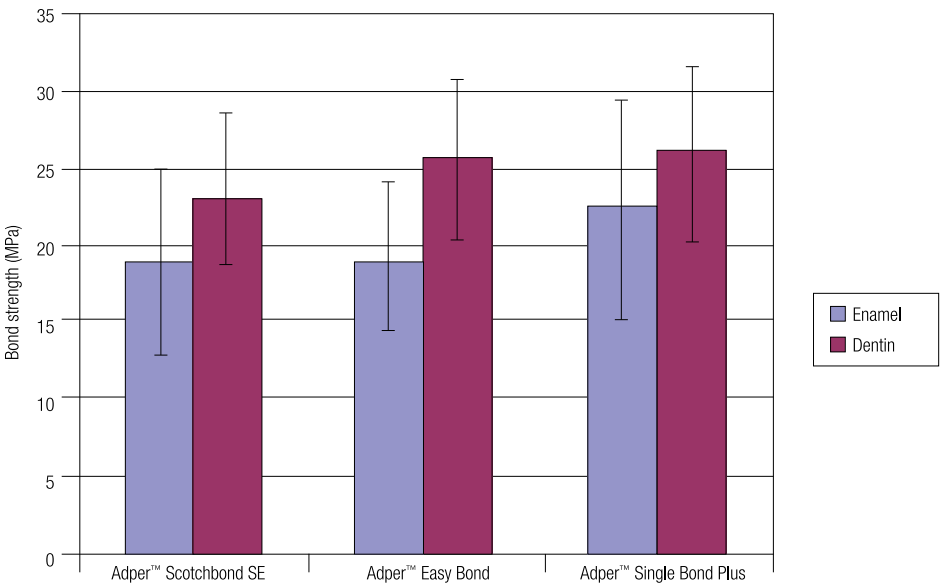
**Objectives:** To measure and compare the shear bond strength of three adhesives to enamel and dentin.

**Methods:** Sixty extracted, intact human molars were divided into two groups and wet ground with a series of abrasives ending with 600 grit to obtain flat enamel (E) and dentin (D) surfaces. The materials used were Adper Scotchbond SE (3M ESPE) a two-component self-etching adhesive, Adper Easy Bond (3M ESPE) a single-component self-etching adhesive and Adper Single Bond Plus (3M ESPE) a total-etch one-bottle adhesive. The adhesives were applied to the bonding area according to manufacturer's instructions. A plastic tube (diameter~1.5 mm) filled with composite-resin (MZ100) was placed over the adhesive and cured for 40 seconds with a curing light (Fusion, output>800 Mw/cm$^2$). Samples (n=10) were stored in water for 24 hours at 37˚C in an incubator before testing. Specimens were placed in a special fixture mounted on a Universal testing machine (INSTRON, model number 5565) and loaded to failure at a crosshead speed of 1 mm/min. The failure load was converted to bond strength by dividing by the bonding area. The data were analyzed with two-factor ANOVA (p=0.05).

**Results:** (n=10) (Mean±SD).

| | Adper Scotchbond SE | Adper Easy Bond | Single Bond Plus |
|---|---|---|---|
| **E** | 18.9±6 | 19.2±5 | 22.6±7 |
| **D** | 23±5 | 25.7±5 | 26.1±6 |

**Conclusions:** No significant difference was shown between the substrate or the bonding agent (p>0.05). Early in vitro results show that the self-etching adhesives show promise as effective bonding agents.




Results found in abstracts for Adper™ Scotchbond™ SE Self-Etch Adhesive also apply to products registered under the following name(s): Adper™ SE Plus Self-Etch Adhesive.

Results found in abstracts for Adper™ Easy Bond Self-Etch Adhesive also apply to products registered under the following name(s): Adper™ Easy One Self-Etch Adhesive.

Results found in abstracts for Adper™ Single Bond Plus Adhesive also apply to products registered under the following name(s): Adper™ Single Bond 1 XT Adhesive and Adper™ Single Bond 2 Adhesive.



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# Eighteen-Month Storage Adhesion Study of Adper™ Scotchbond™ SE Self-Etch Adhesive

B.A. SHUKLA, V.A. RUSSELL, R.R. WERTISH, and S.M. AASEN, 3M ESPE Dental Products, Saint Paul, MN, USA

**Objectives:** This study investigated the effects of long-term storage on the shear bond strengths (SBS) of a new two-bottle self-etch adhesive Adper™ Scotchbond™ SE (SBSE, 3M ESPE) versus a fifth-generation total-etch adhesive, Adper™ Single Bond Plus (SB+, 3M ESPE) on two substrates: bovine cut enamel (E) and superficial dentin (D).

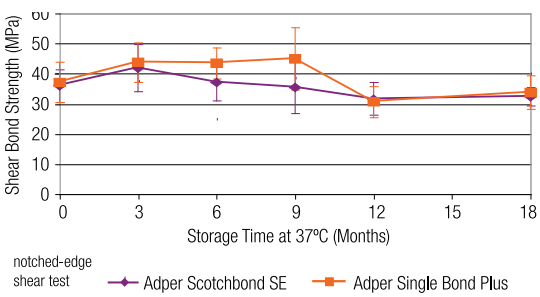
**Methods:** A notched-edge shear method was used to measure the SBS to bovine E and D (composite: Filtek™ Z250 A2, 3M ESPE). Bonded specimens were stored in water at 37˚C and tested after storage intervals of 24 hr (baseline data, "t=0") and 3, 6, 9, 12 and 18 months.

**Results:** Mean (std dev) SBS in MPa and p-values (two-sample t-tests, $p<0.05$) are listed in the table.

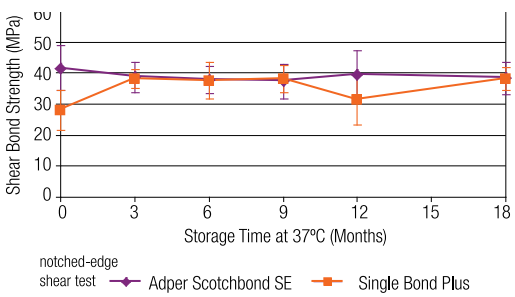
| Storage Time (mo) | SBSE, E | SB+, E | SBSE, D | SB+, D |
|---|---|---|---|---|
| **0** | 41.6 (7.3) n=8 | 28.0 (6.2) n=7 | 36.0 (5.5) n=7 | 37.3 (6.7) n=7 |
| **3** | 38.6 (4.8) n=8 | 38.1 (2.9) n=8 | 42.1 (7.8) n=8 | 43.9 (6.5) n=7 |
| **6** | 37.8 (4.2) n=8 | 37.5 (5.8) n=8 | 37.3 (6.2) n=7 | 43.6 (5.3) n=8 |
| **9** | 37.3 (5.6) n=8 | 38.1 (4.4) n=7 | 35.6 (8.7) n=7 | 45.0 (10.4) n=7 |
| **12** | 39.5 (7.8) n=8 | 31.4 (8.0) n=8 | 31.8 (5.4) n=8 | 30.8 (5.2) n=6 |
| **18** | 38.4 (5.2) n=8 | 38.2 (3.6) n=8 | 32.6 (3.1) n=8 | 33.9 (5.7) n=8 |
| **p-value, t=0 vs. 18 mo** | 0.330 | 0.002 | 0.149 | 0.308 |

**Conclusions:** There were no statistical differences ($p>0.05$) in SBS for SBSE after bonded samples were aged for 3, 6, 9, 12 or 18 months for a given substrate (E or D), compared to baseline data. SBSE was statistically equivalent ($p>0.05$) to the control SB+ at each of the aging time points for a given substrate (E or D). The p-values for SBSE vs. SB+ at 18 months were 0.927 and 0.568 for E and D, respectively.

Long-Term Bond Storage Study: Bovine Dentin




Long-Term Bond Storage Study: Bovine Cut Enamel




Results found in abstracts for Adper™ Scotchbond™ SE Self-Etch Adhesive also apply to products registered under the following name(s): Adper™ SE Plus Self-Etch Adhesive.

Results found in abstracts for Adper™ Single Bond Plus Adhesive also apply to products registed under the following name(s): Adper™ Single Bond 1 XT Adhesive and Adper™ Single Bond 2 Adhesive.



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# Saliva Effect on Bond Strength for a New Self-Etch Adhesive

V.A. RUSSELL, T.D. DUNBAR, B.A. SHUKLA, and S.M. AASEN, 3M ESPE Dental Products, St. Paul, MN, USA

**Objectives:** This study investigated the effects of various human saliva contamination and decontamination protocols on the shear bond strengths (SBS) of a new two-bottle self-etch adhesive Adper™ Scotchbond™ SE (SBSE, 3M ESPE) on bovine cut enamel (E) and superficial dentin (D).

**Methods:** A notched-edge shear method (Ultradent) was used to measure the SBS (composite: Filtek™ Z250 A2, 3M ESPE) with n=10. Bonded specimens were tested after 24 hr storage in water at 37˚C. Various application protocols were used (see table), with the following abbreviations:

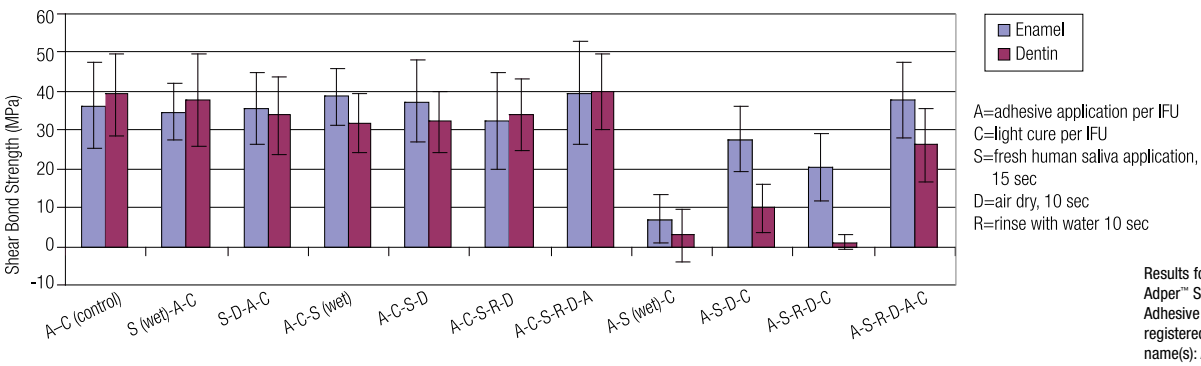
A=adhesive application per IFU
C=light cure per IFU
S=fresh human saliva application, 15 sec
D=air dry, 10 sec
R=rinse with water, 10 sec

**Results:** Mean (std dev) SBS in MPa and p-values (two-sample t-tests, $p<0.05$) are listed in the table.

| Application Protocol | SBSE, E | SBSE, D |
|---|---|---|
| **A-C [control]** | 36.3 (11.2) | 39.2 (10.5) |
| **S(wet)-A-C** | 34.7 (7.4) p=0.713 | 37.7 (12.1) p=0.758 |
| **S-D-A-C** | 35.6 (9.0) p=0.871 | 33.7 (9.9) p=0.245 |
| **A-C-S(wet)** | 38.7 (7.3) p=0.584 | 31.9 (7.7) p=0.096 |
| **A-C-S-D** | 37.4 (10.5) p=0.828 | 32.1 (8.0) p=0.105 |
| **A-C-S-R-D** | 32.4 (12.4) p=0.470 | 34.2 (9.2) p=0.271 |
| **A-C-S-R-D-A** | 39.6 (13.5) p=0.558 | 40.1 (9.7) p=0.847 |
| **A-S(wet)-C** | 7.0 (6.4) p=0.000 | 2.9 (6.7) p=0.000 |
| **A-S-D-C** | 27.6 (8.5) p=0.067 | 9.9 (6.1) p=0.000 |
| **A-S-R-D-C** | 20.4 (8.6) p=0.002 | 1.0 (2.0) p=0.000 |
| **A-S-R-D-A-C** | 37.8 (9.8) p=0.750 | 26.1 (9.5) p=0.009 |

**Conclusion:** SBSE maintained high SBS (32 to 40 MPa) statistically equivalent to the controls when saliva contamination occurred prior to applying adhesive or on the cured adhesive film. Saliva applied to uncured adhesive resulted in statistically lower SBS than the controls, with a more pronounced effect on dentin. However, if the saliva was rinsed off and the adhesive was reapplied, the SBS was increased to >20 MPa and was statistically equivalent to the control on Enamel.

Shear Bond Strength vs. Contamination Protocol




A=adhesive application per IFU
C=light cure per IFU
S=fresh human saliva application, 15 sec
D=air dry, 10 sec
R=rinse with water 10 sec

Results found in abstracts for Adper™ Scotchbond™ SE Self-Etch Adhesive also apply to products registered under the following name(s): Adper™ SE Plus Self-Etch Adhesive.



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0248

IADR 2008

# Filtek™ Silorane Low Shrink Posterior Restorative System

## The Comprehensive Stability of Silorane-Matrix Composites

D.C. WATTS, and H.Y. MARGHALANI, University of Manchester, United Kingdom

**Objectives:** The aim was to compare several measures of material stability of a silorane-matrix composite with representative dimethacrylate-matrix composites. These included setting shrinkage and stress, viscoelastic creep/recovery and stability in solvents.

**Methods:** Filtek Silorane-matrix composite (3M ESPE) was investigated along with representative high-performance dimethacrylate composites which may be comparable as regards (i) filler volume-fraction and/or (ii) filler size-distribution. Materials were thoroughly light-cured by established protocols. Shrinkage was measured by the bonded-disk method and shrinkage-stress by the Bioman method, both at 23˚C. Four groups of cylindrical specimens (4 × 6 mm) were prepared in molds, by complete light irradiation, and then conditioned in 3 solvents: methyl ethyl ketone (MEK), ethanol, and water for 1 month at 37˚C. The creep-strain under 35 MPa compressive stress in 37˚C water was recorded continuously for 2 hr and then the unloaded recovery-strain for 2 hr. The data were statistically analysed by ANOVA, Bonferroni's test and by linear regression.

**Results:** A plot of maximum stress (MPa) versus maximum strain (%) for shrinkage showed a highly-significant ($p<0.01$) differentiation of Silorane from dimethacrylate-matrix materials; <1% strain and <2MPa stress. Maximum viscoelastic creep was <1% for Silorane with high recovery, and for all 3 solvents studied. With dimethacrylates, max-creep strongly correlated with solubility-parameter of conditioning solvents: MEK>ethanol>water, up to 4% strain. Similar trends were found for permanent-set.

**Conclusion:** A Silorane-matrix composite exhibited high dimensional and host-stress stability during and following photopolymerisation. This benefit was also found in viscoelastic-strain stability in compression after extended exposure to conditioning solvents of increasing power. This solvent-stability may be attributable to the highly-reactive silorane cationic setting chemistry and the resulting hydrophobic silorane network structure.

Results found in abstracts for Filtek™ Silorane Low Shrink Posterior Restorative System also apply to Filtek™ P90 Low Shrink Posterior Restorative and Filtek™ LS Low Shrink Posterior Restorative System.

**Aim of the study:** The study compared material stability of a silorane-matrix composite with representative dimethacrylate-matrix composites.

**Results of the study:** Filtek Silorane exhibited high dimensional and stess-stability and a high stability when exposed to solvents. The latter may be attributed to the hydrophobic silorane network structure



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# Clinical and In-Vitro Evaluation of Posterior Composites Wear: Five-year RCT

S. PALANIAPPAN, B. VAN MEERBEEK, M. PEUMANS, and P. LAMBRECHTS, Catholic University of Leuven, Belgium

**Objectives:** To determine at five-year follow-up of a randomized clinical trial (RCT), the clinical performance, bio-tribo-corrosive wear behaviour and worn-surface topography of nano-composite Filtek Supreme (3M ESPE) and monomodal compact filled composite resin MZ100 (3M ESPE) restorations.

**Methods:** Eighteen Filtek Supreme and 18 MZ100 restorations were placed in upper/lower molars and bonded with Single bond Adhesive (3M ESPE). Restorations were evaluated at baseline, and at 6, 12, 24, 36, 48, 60, months of clinical service according to USPHS-criteria. At recalls, gypsum-replicas were used for 3D Pro-laser scanning (Willytec-Munich) to quantify wear by measuring vertical, volumetric loss of enamel and composites and araldite-epoxy-resin-replicas for scanning-electron-microscopy (SEM) analysis (Philips-XL20) of worn surface.

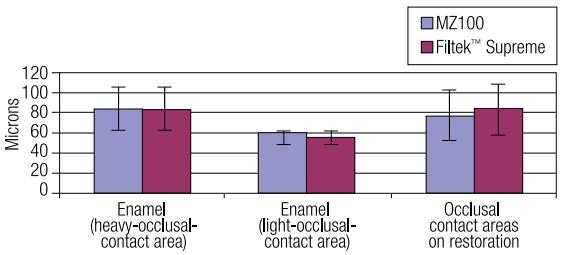
**Results:** The recall rate at five-year follow-up was 100% and major failure requiring restoration replacement was not observed. While the polishability of Filtek Supreme restorations was significantly better than MZ100 ($p<0.05$), both types of restorations showed significantly decreased ($p<0.05$) alpha scores for colour match (Filtek Supreme-10%, MZ100-12%) and marginal degradation (Filtek-Supreme-4%, MZ100-5%) at five-years. No significant differences were observed for other criteria. Wear data presented enamel-like vertical loss but volume loss of both restoration types was significantly higher ($p<0.05$) than that of enamel, due to the greater composite surface area versus enamel surface area. Furthermore, volume loss of MZ100 was significantly higher ($p<0.05$) than that of Filtek Supreme restorations. This is related to differences in friction properties. SEM explained relative differences in vertical and volume loss behaviour.

Mean and standard-deviation of wear of composites versus enamel

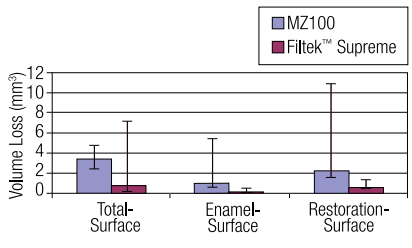
| Parameters | MZ100 | Filtek Supreme |
|---|---|---|
| **Volume Loss ($mm^3$)** | | |
| Total Surface Volume Loss | -3.5±1.2 | -1.0±6.0 |
| Enamel Surface Volume Loss | -1.2±4.1 | -0.4±0.2 |
| Restoration Surface Volume Loss | -2.3±8.3 | -1.0±0.4 |
| **Vertical Loss (µm)** | | |
| Enamel (Heavy Occlusal Contact Area) | -84±21 | -84±21 |
| Enamel (Light Occlusal Contact Area) | -55±7 | -55±7 |
| Occlusal Contact Areas on Restoration | -77±25 | -83±26 |
| Marginal Degradation (Range) | -60 to -560 | -60 to -590 |

**Conclusion:** The monomodal-compact-filled MZ100 and the nanofilled Filtek Supreme posterior composites used in this study showed very acceptable clinical performance and presented qualitative and quantitative differences in wear behaviour versus human enamel after five-years of clinical service.

Vertical Loss




Volume Loss




Results found in abstracts for Filtek Supreme Plus Universal Restorative also apply to products registered under the following name(s): Filtek™ Z350 Universal Restorative and Filtek™ Supreme XT Universal Restorative.



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0243
IADR 2008

# Ketac™ Nano Light-Curing Glass Ionomer Restorative

## Fluoride Release of Nano-Ionomer and Compomer Materials with Adhesive Coatings

S. MITRA, A. FALSAFI, J. OXMAN, and T. TON, 3M ESPE Dental Products, Saint Paul, MN, USA

**Objective:** To compare the long-term fluoride release of a nanofilled resin-modified glass ionomer restorative material versus a compomer with or without their recommended primer or adhesive.

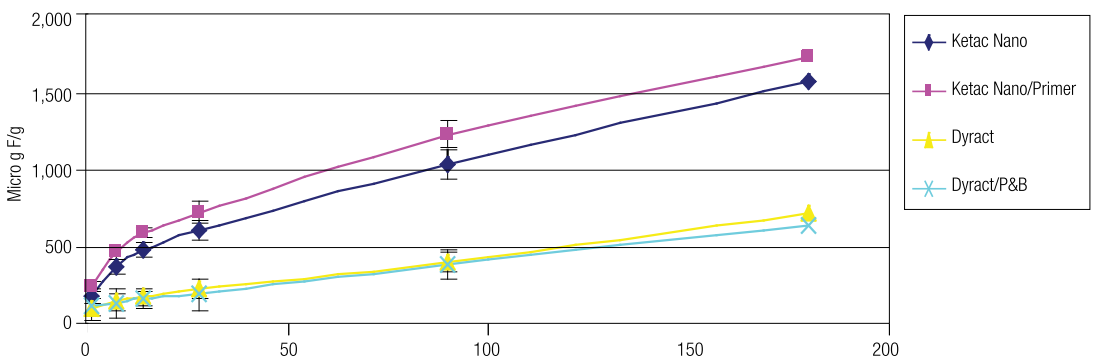
**Methods:** Restorative materials included: Ketac™ Nano nano-ionomer without (KN, 3M ESPE) or with Ketac Nano Primer (KNP) and Dyract™ Extra Compomer without (DY, Dentsply) or with Prime and Bond NT Adhesive (DYA). Cured discs (20 × 1 mm) of the materials were prepared in triplicate. One set of each cured material was further coated on both sides with the recommended adhesive treatment, and light cured per manufacturer's directions. Fluoride release of each sample set (37°C deionized water) was measured periodically between 1 to 180 days using fluoride selective electrode and TISAB buffer solution.

**Results:** The mean values for cumulative fluoride release, including the standard deviations, are summarized in the following table:

| Cumulative Fluoride Release After Days (micro g F/g sample) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Material** | **Chemistry** | **1** | **7** | **14** | **28** | **90** | **180** |
| **KN** | **RMGI** | 173 ± 43 | 361 ± 47 | 480 ± 47 | 602 ± 48 | 1,031 ± 68 | 1,572 ± 91 |
| **KNP** | **RMGI** | 238 ± 31 | 454 ± 34 | 584 ± 34 | 722 ± 35 | 1,228 ± 73 | 1,733 ± 85 |
| **DY** | **Compomer** | 103 ± 47 | 136 ± 48 | 169 ± 49 | 218 ± 50 | 400 ± 64 | 710 ± 67 |
| **DYA** | **Compomer** | 107 ± 96 | 131 ± 97 | 152 ± 97 | 185 ± 53 | 382 ± 100 | 629 ± 100 |

**Conclusion:** ANOVA analysis was performed at $p<0.05$ per Tukey's pairwise comparison test. The fluoride release rates of Ketac Nano with (KNP) and without (KN) primer were statistically comparable, and released significantly higher fluoride than either Dyract (DY) or Dyract coated with adhesive (DYA). DY and DYA were statistically equivalent. All of the materials exhibited sustained fluoride release over 6 months.

Cumulative Fluoride Release




Results found in abstracts for Ketac™ Nano Light-Curing Glass Ionomer Restorative also apply to products registered under the following name(s) Ketac™ N100 Light Curing Nano-Ionomer Restorative.



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# Ketac™ Nano Light-Curing Glass Ionomer Restorative

0244
IADR 2008

## A Novel Nano-Ionomeric Restorative with Improved Polish and Wear-Resistance

A. FALSAFI, V.J. MADSEN, S.B. MITRA, J.D. OXMAN, and T.T. TON, 3M ESPE Dental Products, Saint Paul, MN, USA

**Objective:** The goal of this study was to compare the polish and wear properties of Ketac Nano, a nano-ionomeric glass ionomer, with several commercial resin-modified glass ionomeric (RMGI) and hybrid composite restorative products. The restoratives evaluated included three commercial RMGI materials: Fuji II LC (FIILC, GC), Fuji Filling LC (FFLC, GC), Ketac Nano (KN, 3M ESPE), and a hybrid composite Tetric Evo Ceram (TEC, Ivoclar Vivadent). FIILC is a powder/liquid-based system while FPP and KN are paste/paste.

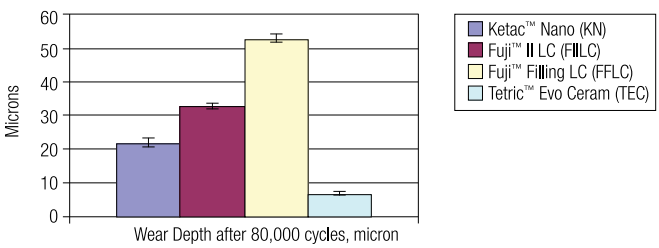
**Method:** All materials were mixed and light-cured per manufacturers' recommendation. Samples were polished per a clinically relevant procedure using commercial finishing/polishing systems. The gloss of multiple samples was measured immediately after polishing using a gloss meter at 60 degrees. Three-body wear depth was measured after 80,000 cycles according to ACTA Protocol. Multiple specimens of each material per test protocol were prepared and immersed in 37˚C deionized water for 24 hr before testing.

**Results:** Atomic Force Microscopy (AFM) pictures of polished samples will be presented. The mean values including their standard deviations in the parentheses are summarized in the following table:

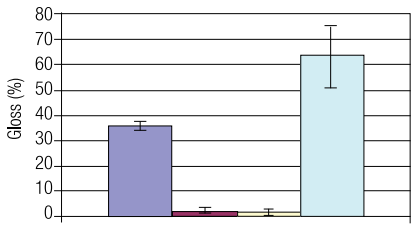
| Restorative | Chemistry | Format | Wear Depth after 80,000 cycles, micron | Initial Polish Number |
|---|---|---|---|---|
| Ketac Nano (KN) | RMGI | Paste/Paste, hand-mixed | 21.8(1.3) | 36.5(1.3) |
| Fuji II LC (FIILC) | RMGI | Powder/Liquid capsule and hand-mixed | 32.6(0.8) | 3.4(0.6) |
| Fuji Filling LC (FFLC) | RMGI | Paste/Paste, hand-mixed | 52.7(1.2) | 2.4(0.4) |
| Tetric Evo Ceram (TEC) | Hybrid Composite | One part Paste | 6.8(0.4) | 64.2(11) |

**Conclusions:** ANOVA with Tukey's comparison was performed at $p<0.05$. Ketac Nano paste/paste nano-ionomeric restorative (KN) showed significantly higher gloss compared to other RMGIs, closer to that of a hybrid composite. Ketac Nano paste/paste nano-ionomer (KN) had significantly lower wear rate compared to other RMGIs.

Wear Depth After 80,000 Cycles




Gloss After Polish




Results found in abstracts for Ketac™ Nano Light-Curing Glass Ionomer Restorative also apply to products registered under the following name(s): Ketac™ N100 Light Curing Nano-Ionomer Restorative.



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0844

AADR 2008

# Ketac™ Nano Light-Curing Glass Ionomer Restorative

## Fluoride Recharge of a Nano-Ionomer Restorative Material

T. TON, J. THALACKER, A. FALSAFI, J. OXMAN, S. MITRA, and H.T. BUI, 3M ESPE Dental Products, Saint Paul, MN, USA

**Objective:** To compare the in-vitro recharge capability of a novel resin-modified glass ionomer (RMGI) restorative material versus other conventional glass ionomers (GI).

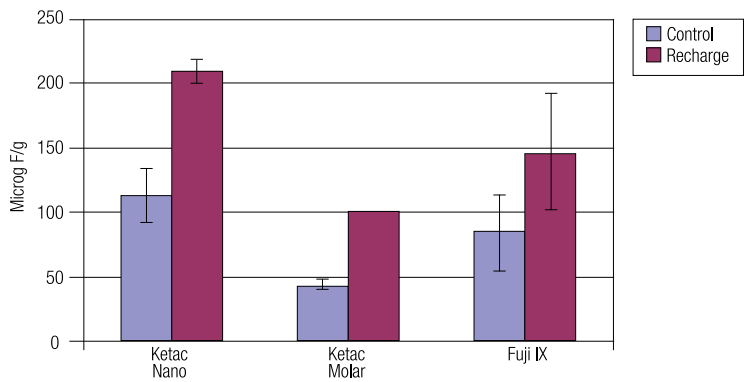
**Methods:** Materials used were Ketac™ Nano nano-ionomer (KN, 3M ESPE), Ketac™ Molar (KM, 3M ESPE), and Fuji IX (F IX, GC). Two sets of three cured discs (20 × 1 mm) of each product were prepared and stored in 37˚C deionized water. Fluoride release was measured after 1, 7, 14, 28, 90 days using fluoride selective electrode and TISAB buffer solution. At day 90, the second set of specimen were recharged by applying Oral-B Neutra-Foam, sodium fluoride foaming solution, for 1 minute and subsequently rinsed with deionized water for 1 minute and stored in 37˚C deionized water. Fluoride release from recharged and control discs was measured after 1, 2, 3, 4, 7 days per above procedure.

**Results:** The mean values including their standard deviations are summarized in the following table:

| Material | Chemistry | 7 Day Cumulative F Release after 3 months (control), micro g F/g sample | 7 Day Cumulative F Release after recharge at 3 months, micro g F/g sample |
|---|---|---|---|
| **KN** | **RMGI** | 112 ± 21 | 210 ± 8 |
| **KM** | **GI** | 42 ± 3 | 100 ± 9 |
| **F IX** | **GI** | 85 ± 27 | 147 ± 45 |

**Conclusion:** ANOVA analysis was performed at $p<0.05$ per Tukey's pairwise comparison test. KN nano-ionomer, an RMGI, demonstrated significantly greater F-release after short exposure to external F source. This behavior is similar to that previously reported for GI materials.

Fluoride Recharge

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# Ketac™ Nano Light-Curing Glass Ionomer Restorative & Vitremer™ Core Buildup Restorative

0987
AADR 2008

## Fluoride Release of a New Nano-Ionomer Restorative Material

H.T. BUI, A. FALSAFI, S. MITRA, J. OXMAN, and T. TON, 3M ESPE Dental Products, Saint Paul, MN, USA

**Objective:** To compare the long-term fluoride release of a novel resin-modified glass ionomer (RMGI) restorative material versus other RMGI and conventional glass-ionomers (GI).

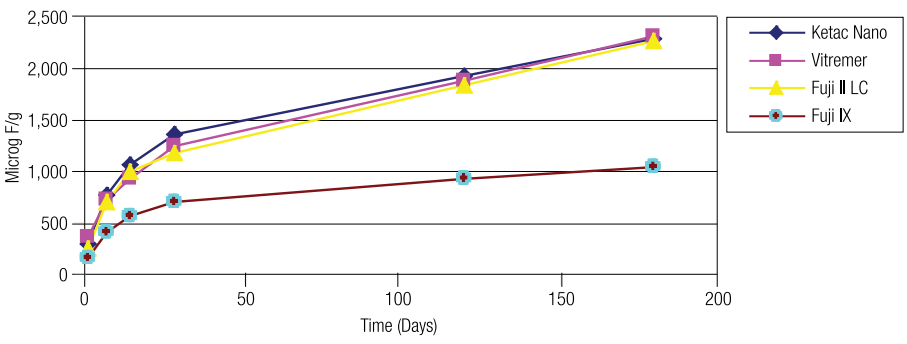
**Methods:** Materials used were Ketac™ Nano nano-ionomer (KN, 3M ESPE), Vitremer™ (VM, 3M ESPE), Fuji IX (F IX, GC) and Fuji II LC (F II LC, GC). Fluoride release from three cured discs (20 × 1 mm) of each product in 37˚C deionized water was measured after 1, 7, 14, 28, 120, 180 days using fluoride selective electrode and TISAB buffer solution.

**Results:** The mean values for cumulative fluoride release, including the standard deviations, are summarized in the following table:

| | | Cumulative Fluoride Release After Following Days (micro g F/g sample) | | | | | |
|---|---|---|---|---|---|---|---|
| **Material** | **Chemistry** | **1** | **7** | **14** | **28** | **120** | **180** |
| **KN** | **RMGI** | 292 ± 28 | 781 ± 59 | 1,071 ± 63 | 1,358 ± 65 | 1,933 ± 105 | 2,285 ± 106 |
| **VM** | **RMGI** | 365 ± 26 | 734 ± 84 | 940 ± 85 | 1,249 ± 87 | 1,876 ± 88 | 2,309 ± 89 |
| **F II LC** | **RMGI** | 254 ± 5 | 701± 30 | 991 ± 32 | 1,183 ± 34 | 1,846 ± 41 | 2,266 ± 55 |
| **F IX** | **GI** | 160 ± 30 | 399 ± 50 | 557 ± 51 | 698 ± 53 | 937 ± 55 | 1,053 ± 58 |

**Conclusion:** ANOVA analysis was performed at $p<0.05$ per Tukey's pairwise comparison test. While the six-month cumulative fluoride release of KN nano-ionomer, VM and F II LC, all resin modified glass-ionomers were statistically comparable, they significantly released greater fluoride than F IX, a conventional glass-ionomer. All conventional and resin modified glass-ionomer restorative materials exhibited sustained fluoride release over 6 months.

Fluoride Release

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# 1775 Ketac™ Molar

IADR 2008

## Clinical Evaluation of Multiple-Surface ART Restorations: Six-Year Follow-Up

M.F.L. NAVARRO[1], T.C. FAGUNDES[1], C.A.R. CARVALHO[1], T.J.E. BARATA[2], D.F.G. CEFALY[1], and J.R.P. LAURIS[1], [1]Bauru School of Dentistry, University of São Paulo, Brazil, [2]University of North of Paraná, Brazil

**Objective:** To evaluate the performance of multiple-surface restorations made with two different glass ionomer cements (GICs) using the Atraumatic Restorative Treatment (ART) in permanent teeth.

**Methods:** A total of 60 restorations, 36 Class I involving two or more tooth surfaces, and 24 Class II were placed in schoolchildren (9–16 years of age) by two dentists using standard ART procedures. The restorations were randomly divided into two groups in a parallel-group study design. Thirty cavities were filled with high strength GIC (Ketac Molar-3M ESPE, code K), and the other 30 cavities with resin-modified GIC (Fuji VIII-GC Corp., code F). Two calibrated independent examiners carried out the evaluation according to ART criteria. The inter examiner kappa was 0.92. A difference was considered statistically significant if $p<0.05$.

**Results**: In the 6-year follow-up, 22 patients (47.8%) and 43 restorations (71.7%) were evaluated. The success rates of the restorations were 43.5% and 60.0% for K and F, respectively. Failures registered were: 9 restorations replaced by other restorations (6K, 3F), 7 restorations with marginal defect >0.5 mm (repair is needed; 4K, 3F), 3 restorations partly or completely missing (2K, 1F), 1 restoration with wear >0.5 mm (repair is needed; 1F), and 1 tooth missing due to secondary caries (1K). There was no statistically significant difference between GICs, cavity types or operators. There was a statistically significant difference between baseline and 6-year results for both groups ($p=0.001$ and $p=0.013$, for Ketac Molar and Fuji VIII, respectively). Although the real reasons for replacement of restorations were unknown, secondary caries was observed in only one ART restoration.

**Conclusions:** Both GICs performed similarly and ART approach provided approximately 50% of survival rate for multiple-surface restorations over a 6-year period. This study was supported by CNPq — grant 485476/2007-0.

**Aim of the study:** This study evaluated the performance of multiple surface restorations made with Ketac Molar and Fuji VIII using Atraumatic Restorative Treatment.

**Results of the study:** Ketac Molar and Fuji VIII performed similarly with a survival rate of approximately 50% for multi-surface restorations over a six-year period.



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# Isolation Method and the Survival of Proximal ART Restorations

A.M. KEMOLI, Nairobi University, Kenya, and W.E.V. AMERONGEN, ACTA—Vrije Universiteit, Amsterdam, Netherlands

**Objective:** To determine the influence of rubber dam and cotton roll isolation methods on the survival rates of proximal ART restorations placed in deciduous molars by experienced/inexperienced operators/assistants, using three brands of glass ionomer cements.

**Methods:** Using only hand instruments, 804 restorations (fillings and sealants) were made in 6 to 8 year-olds by experienced/inexperienced operators randomly paired with experienced/inexperienced assistants. Fuji IX, Ketac Molar Easymix and Ketac Molar Aplicap glass ionomer cements were randomly used to restore the cavities under randomly selected cotton roll or rubber dam isolation methods. The restorations were evaluated by independent examiners soon after placement at 7, 30, 150 and 365 days.

**Results:** After one year, the cumulative survival rates for sealants and fillings were 29.6% and 44.8% respectively. There were no statistical differences in the cumulative survival of sealants and fillings in relationship to the isolation method used (Chi-square, $p<0.05$). But, Kaplan-Meier survival test indicated slightly more fillings survived with rubber dam than with cotton roll isolation methods up to one year. The method of isolation and the survival rates of the restorations were not significantly affected by the experiences of the operator or the material used. However, experienced assistants were associated with higher statistical survival rates of the restorations irrespective of the isolation method used.

**Conclusion:** There were no significant statistical differences with the survival of the proximal restorations made using the two methods of isolation in relationship to the material and the experience of the operator. Experienced assistants had significant statistical influence on the survival of the restorations compared to inexperienced assistants, irrespective of the experience of the operator and the isolation method applied.

**Aim of the study:** This study evaluated the influence of rubber dam and cotton roll isolation methods on the survival rates of ART restorations placed in deciduous molars by experienced/inexperienced operators/assistants using Ketac Molar Aplicap, Ketac Molar Easy Mix and Fuji IX glass ionomer cements.

**Results of the study:** No statistical differences in survival of the restorations were seen depending on the isolation method, the restorative material used or the experience of the operator. Experienced assistants had a significant statistical influence on the survivals of the restorations.



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0364
AADR 2008

# Vitrebond™ Plus Light Cure Ionomer Liner/Base

## Demineralization Inhibition of Glass Ionomer Base In Class V Preparations

A. COOMES, and K. DONLY, University of Texas–San Antonio/Health Science Ctr, USA

**Objectives:** Extracted human teeth were restored in three ways to determine best possible placement of a glass ionomer cement base, Vitrebond Plus, in a Class V preparation to inhibit the formation of secondary caries.

**Methods:** Thirty extracted teeth were collected, placed in three groups of ten and Class V preparations were placed on the facial surface of each tooth. Preparations were standardized with the following dimensions: pulpal extension of 1.5 mm, mesiodistal width of 8 mm and occlusogingival dimension of 6 mm. Group I contained preparations with glass ionomer placed on the pulpal floor. Group II contained preparations with glass ionomer covering all exposed dentin. Group III was the control group with Single Bond adhesive placed over all prepared dentin. All three groups were then restored with a non-fluoride releasing resin composite, according to manufacturer's instructions and an acid protective varnish applied to the teeth excluding a window with the experimental restoration. Teeth were thermo-cycled then placed in a demineralization solution after which teeth were sectioned and viewed with a polarized light microscope. The gingival dentin cavosurface margin demineralization was measured with an imaging software program.

**Results:** The mean areas ($\mu m^2$) of the artificial lesions (±S.D.) in the dentin 100 µm from the gingival cavosurface margins were: Group I: 53.3±10.8; Group II: 64.9±13.8; Group III: 85.4±19.2. ANOVA indicated significant variation among the groups ($p<0.001$). A Dunn's multiple comparison test indicated both Group I and Group II to have significantly less demineralization than the control (Group III), however, there was no significant difference between Groups I and II ($p<0.05$).

**Conclusions:** The data from this study indicates there is significantly less dentin demineralization next to the gingival dentin cavosurface margin if a resin-modified glass ionomer cement base has been placed prior to a resin-based composite restoration.



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# Vitrebond™ Plus Light Cure Glass Ionomer Liner/Base

0952
IADR 2008

## Chemical Interaction of RMGI with Hydroxyapatite via ESCA and FTIR

C. HUDSON[1], C.-Y. LEE[2], S.B. MITRA[2], S.J. PACHUTA[2], G.A. KORBA[2], H.T. BUI[3], and R.P. RUSIN[3], [1]3M ESPE, London, Canada, [2]3M, St. Paul, MN, USA, [3]3M ESPE Dental Products, Saint Paul, MN, USA

**Objectives:** Characterize the chemical interaction of a resin-modified glass ionomer, 3M™ ESPE™ Vitrebond™ Plus Liner/Base (VBP), to hydroxyapatite.

**Methods:** The liquid component of VBP was applied to a hydroxyapatite disk for 1 hr; sonicated in ultrapure (18 milliohm) water 3 min to remove excess; dried under nitrogen. XPS spectra were collected on the disk before and after treatment, and on VBP-liquid; elemental concentrations were calculated, and analyzed via one-way ANOVA and Tukey's t-test ($p<0.05$). A Ca-VBP-polymer salt was synthesized and measured for comparison. FTIR spectra were collected for VBP-liquid, hydroxyapatite powder, and a liquid-hydroxyapatite mixture; also, for mixed VBP liner, periodically during 24 hr after light-curing.

**Results:** Concentrations via XPS are shown below, atomic % (SD). Superscript letters in each column denote groups that are not statistically different.

| | n | Ca | P | N | C |
|---|---|---|---|---|---|
| **HAP pellet** | **4** | 18.3(0.2)[a] | 15.0(0.6)[a] | – | 22.8(1.1)[c] |
| **VBP liquid** | **3** | – | – | 2.4(0.2)[a] | 73.3(0.1)[a] |
| **VBP-treated HAP pellet** | **4** | 9.1(4.2)[b] | 7.9(3.2)[b] | 0.9(0.7)[b] | 47.4(11.3)[b] |
| **Ca-VBP salt** | **3** | 1.3(0.5)[c] | – | 1.3(0.3)[a, b] | 74.9(0.9)[a] |

The elevated carbon and nitrogen on treated HAP indicate that the methacrylate-modified polyalkenoic acid in the VBP-liquid adhered to the HAP; the apparent reduction in calcium and phosphorous is attributed to signal attenuation by adherent polyacid. In the XPS spectra the O-C=O (289eV) peak of the liquid broadened and shifted slightly for the treated hydroxyapatite, indicative of a chemical bond. FTIR spectra of the liquid/hydroxyapatite mixture compared to the VBP-liquid or hydroxyapatite alone show a decrease in the COOH peak (1,713 cm-1) and increase in carboxylate absorption peaks at 1,563 cm-1 and 1,411 cm-1 due to the formation of calcium carboxylate. FTIR spectra of setting reaction of VBP liner reveals progress of the acid-base GI reaction by the appearance of the carboxylate peak at ~1,720 cm-1 together with concomitant decrease of the carboxylic acid peak at ~1,570 cm-1.

**Conclusions:** ESCA and FTIR evidence show that the methacrylate-modified polyalkenoic acid component in Vitrebond Plus chemically bonds to hydroxyapatite; and, that VBP exibits the carboxylate crosslinking reaction of a true glass ionomer.



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0490
IADR 2008

# Vitrebond™ Light Cure Glass Ionomer Liner/Base

## Evaluation of the Anti-cariogenic Potential of an Experimental GIC

G.C. PADOVANI, B.C.I. RIBEIRO, M.J. BERTOLINI, M.A. ZAGHETE, A.C. PIZZOLITTO, and M.S.M. CANDIDO,
São Paulo State University–UNESP, Araraquara, Brazil

**Objective:** The aim of this work was to evaluate the in vitro fluoride release, uptake ability, and the inhibitory activity dealing with the glass ionomer cements (GIC): Vitrebond (3M ESPE), Ionomaster F (WILCOS), and also an experimental GIC.

**Methods:** The fluoride release of ten specimens were fabricated according to the instructions of the manufacturer for each of the five experimental groups, GI (Vitrebond), GII (Ionomaster), GIII (Powder Experimental + Liquid Vitrebond), GIV (Powder Experimental + Liquid Ionomaster), GV (Powder Experimental + Liquid Experimental). All of the specimens were subjected to a pH cycling model during 15 days. Afterwards, all the specimens were subjected to the application of acidulated phosphate fluoride (APF, 1.23% at pH 3.6-3.9) for 4 minutes. Thereafter the specimens were washed and subjected to the same pH cycling for an additional 15 days. The solution fluoride concentration was determined during a period of 30 days. For the microbiological test, the five experimental groups were evaluated on S. mutans, L. acidophilus, and A.viscosus using the agar diffusion testing. The inocula were obtained by seeding the bacterial strains into BHI medium and then were incubated at 37˚C for 24 hours. A 0.2% chlrorexidine digluconate solution (GVI) was used as the control. The experimental method was repeated in 10 Petri dishes, incubated at 37˚C, for 24, 48, and 72 hours. The inhibition zones around the wells were subsequently measured.

**Results:** There was statistically significant difference among materials.

**Conclusions:** This study revealed a higher fluoride release for Ionomaster F, followed by the Vitrebond, along with similar features for the three groups using the experimental cement; all the experimental groups presented a rise in fluoride release upon uptake, despite the different release features. The antibacterial activity for two CIVMRs was highly significant. Vitrebond presented the best antibacterial activity on A. Viscosus and L. Acidofilus.



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# Vitrebond™ Light Cure Glass Ionomer Liner/Base

0491
IADR 2008

## Thermal Protective Effects of an RMGIC Liner During Irradiation

C.A. FELIX, and R.B. PRICE, Dalhousie University, Halifax, Canada

**Objectives:** High-power curing lights are being marketed to the dental profession as faster-curing, time-saving and ultimately money-saving improvements. However, these higher-power lights may cause an unacceptable increase in temperature during curing. This study investigated the thermal protective effects of a resin-modified glass ionomer cement liner when irradiated by currently available high-power curing lights.

**Methods:** A 4 mm deep Class I preparation was prepared in an extracted human maxillary molar. Two thermocouples were threaded through the palatal root, one positioned in the center of the chamber and the other in the pulp horn. One mm diameter tubing was placed over the mesial and distal roots and water flow was set at 0.025 ml/min at a temperature of 37˚C. Several curing lights were tested including varieties of PAC, QTH, and LED lights. Heat transfer was measured when the preparation was empty (simulating bonding agent cure), and while curing a 1 mm increment of either a flowable composite or an RMGIC (Vitrebond) liner.

**Results:** Significant thermal changes were observed in the pulp horn only. In the empty preparation, only the PAC light was able to significantly increase pulpal temperature above 5.5˚C (Zach & Cohen, 1965). With 1 mm of flowable composite, all three varieties of lights were able to significantly increase pulpal temperature beyond 5.5˚C. None of the curing lights tested showed a significant increase in temperature while curing the RMGIC liner. Significance is defined as $p<0.01$.

**Conclusions:** High-power curing lights have the potential to cause irreversible temperature damage to the pulp during polymerization. The pulp horn experiences a greater temperature increase than does the mid-chamber. An RMGIC liner helps prevent significant heat transfer to the pulp as it does not require a cured bonding agent prior to placement. Funding for this project was provided by Dalhousie University.



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# 0684 Vitrebond™ & Vitrebond™ Plus Light Cure Glass Ionomer Liner/Base

IADR 2008

## Microleakage in Class V Restorations In Vitro

Q.N.T. BUI, R. PERRY, and G. KUGEL, Tufts University, Boston, MA, USA

**Objective:** In-vitro study assessed the marginal microleakage on Class V cavities.

**Methods:** Sixty molars divided into four groups (N=15). Preparations on the buccal/lingual surface with a dimension of 4 mm (occlusogingival), 3 mm (mesiodistal) and 1.5 mm (depth). The occlusal/gingival margins were 2 mm above/below the cemento-enamel junction.

Group 1: Resin-modified glass ionomer primer (Vitrebond™–3M ESPE), acid etch (Adper Single Bond Plus–3M ESPE)

Group 2: Acid etch, flowable Tetric Flow (Ivolar Vivadent),

Group 3: Resin-modified glass ionomer primer (Vitrebond Plus), acid etch

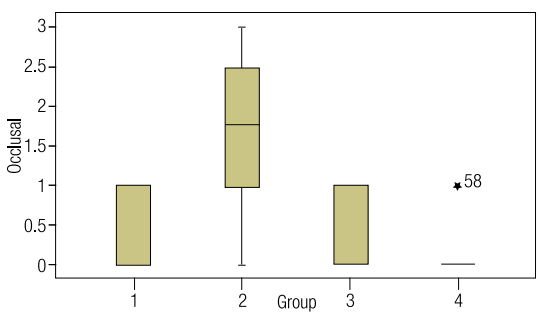
Group 4: Acid etching, no liner

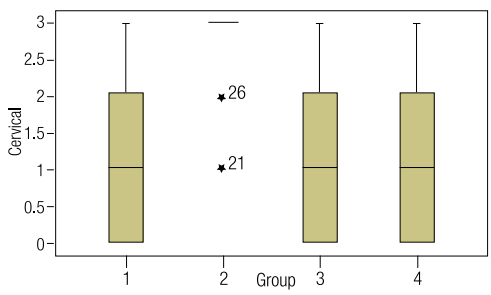
Groups were restored with Z 250 (3M ESPE) composite and finished with Softflex XT (3M ESPE). Specimens were thermocycled 1,000 cycles between 5–55˚C (30 sec dwell time). They were stored in basic fuchsine 0.5% at 37˚C for 24 hrs, sectioned along a bucco-lingual plane through the middle. Scores were accessed: 0—no penetration, 1—penetration short of the dentinoenamel junction, 2—penetration short of the axial wall, 3—penetration to and along the axial wall.

**Results**: Kruskal-Wallis revealed statistical difference for all groups, cervical (p=0.000) and occlusal (p=0.000) interfaces. The cervical interfaces Mann-Whitney U displayed significant differences between Groups 4 and 2 (p=0.00). No significant difference among Groups 1, 3 and 4 (p=0.775, p=0.838, p=0.925). The occlusal interfaces, significant differences among Groups 4 and 2 (p<0.000). No significant differences among the Groups 1, 3 and 4 (p=0.061, p=0.217).

A comparison at cervical and occlusal in each group, ANOVA tests, revealed significant differences among all groups (p<0.0001).

**Conclusions:** At the cervical interfaces, a flowable prior to composite restoration significantly increases microleakage. At the occlusal interfaces the use of resin-modified glass ionomer primer or no liner can help to reduce microleakage. Microleakage at the cervical is greater than at the occlusal interfaces.



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# Vitrebond™ & Vitrebond™ Plus Light Cure Glass Ionomer Liner/Base

1066
IADR 2008

## Long-Term Compressive and Diametral Tensile Strength of RMGI Liner Materials

H.T. BUI[1], S. MITRA[1], J.C. ROLF[1], E.A. CRAWFORD[2], K.M. CUMMINGS[1], R. RANDALL[1], and R. RUSIN[1], [1]3M ESPE Dental Products, Saint Paul, MN, USA, [2]3M ESPE Dental Products, St. Paul, MN, USA

**Objectives:** Evaluate the long-term compressive strength (CS) and diametral tensile strength (DTS) of a new resin-modified glass ionomer liner. The liners tested were 3M™ ESPE™ Vitrebond™ Plus Liner/Base (VBP) and 3M™ ESPE™ Vitrebond™ Liner/Base (VB). VBP is a new resin-modified glass ionomer material in a paste/paste delivery, which exhibits the aluminum-carboxylate crosslinking reaction and fluoride release of a true glass ionomer.

**Methods:** Samples were cured in 4 mm diameter glass tubes with the paste held under axial compression, then cut to 8 mm for compressive strength (CS) and 2 mm for diametral tensile strength (DTS). Storage times in deionized water at 37˚C were 1 day, 1 mo, and 3 mo (n=5 for each group). Samples were tested on an Instron machine at a crosshead speed of 0.5 mm/min. The data were analyzed via one-way ANOVA and compared with Tukey's t-test ($p<0.05$).

**Results:** CS and DTS in MPa are shown below.

| Liner | Time | CS, MPa(stdev) | DTS, MPa(stdev) |
|---|---|---|---|
| **VBP** | 1 day | 124.8(4.7) | 25.1(1.8) |
| **VBP** | 1 mo | 147.3(12.7) | 29.6(2.4) |
| **VBP** | 3 mo | 149.8(7.6) | 29.5(1.2) |
| **VB** | 1 day | 85.9(18.5) | 19.2(2.0) |
| **VB** | 1 mo | 100.6(11.8) | 19.8(2.8) |
| **VB** | 3 mo | 98.0(13.3) | 22.2(1.4) |

**Conclusions:** The 1 day, 1 mo, and 3 mo CS were statistically equivalent within each material group; the 1 day, 1 mo, and 3 mo DTS were statistically equivalent within each material group. CS and DTS of VBP were statistically higher than VB 1 day, 1 mo, and 3 mo. Both VB and VBP maintain their physical properties over the times tested.



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IADR 2008

# Vitrebond™ & Vitrebond™ Plus Light Cure Glass Ionomer Liner/Base

## Effect of an RMGI Liner on Polymerization Shrinkage of Composites

S. MITRA, J.C. ROLF, H.T. BUI, K.M. CUMMINGS, R. RANDALL, and R. RUSIN, 3M ESPE Dental Products, Saint Paul, MN, USA

**Objective:** Evaluate the effect of a new resin-modified glass ionomer liner (3M™ ESPE™ Vitrebond™ Plus Liner, VBP) on the polymerization shrinkage stress of composites with a range of shrinkage (3M™ ESPE™ Supreme,™ SUP; Ivoclar™ Tetric™ EvoCeram, EVO; Dentsply™ EsthetX,™ EX), compared with three RMGI liners (3M™ ESPE™ Vitrebond™ Liner, VB; GC™ Fuji™ Paste Pak Liner, FPP; GC™ Fuji™ Lining LC, FLC) and two flowable composites (Kerr™ Revolution,™ REV; 3M™ ESPE™ Supreme™ Flow, SPF).

**Methods:** The deflecting disc method [Watts & Cash. Dent Mater 1991;7:281] was used to measure volumetric polymerization shrinkage of a 2 mm thickness of composite alone, and of 2 mm thickness of composite combined with 0.5 mm thickness of each test material; n=5 per group. Percent reduction in shrinkage for composite combined with each liner was calculated. Data were analyzed via one-way ANOVA and Tukey's t-test ($p<0.05$).

**Results:** Table shows mean volumetric % shrinkage(stdev), and % reduction in shrinkage over composite alone. These results can be closely correlated to flexural modulus data (Rusin et al., 2007).

| Liner | % Shrinkage, SUP + liner | % reduction over SUP alone | % Shrinkage, EVO + liner | % reduction over EVO alone | % Shrinkage, EX + liner | % reduction over EX alone |
|---|---|---|---|---|---|---|
| **VBP** | 1.48(0.20) | 52.7% | 1.47(0.07) | 35.4% | 1.84(0.11) | 38.7% |
| **VB** | 1.11(0.20) | 64.6% | 1.21(0.15) | 46.6% | 1.49(0.22) | 50.2% |
| **FPP** | 2.14(0.13) | 31.4% | 1.91(0.17) | 15.9% | 2.47(0.46) | 17.5% |
| **FLC** | 2.03(0.21) | 34.9% | 1.75(0.19) | 23.0% | 2.20(0.15) | 26.5% |
| **REV** | 2.25(0.09) | 27.9% | 1.90(0.10) | 16.3% | 2.81(0.11) | 6.3% |
| **SPF** | 2.56(0.05) | 18.2% | 1.99(0.06) | 12.5% | 2.82(0.11) | 6.1% |
| **Composite alone** | 3.13(0.10) | – | 2.27(0.12) | – | 3.00(0.18) | – |

**Conclusions:** Use of RMGI liners VBP, VB, FPP and FLC resulted in a statistically significant reduction in the volumetric shrinkage of composites, with VBP and VB having the greatest effect. Shrinkage reduction was greater for VBP and VB than for FPP and flowables REV and SPF when used with SUP, EVO, and EX.



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# Direct Restorative References


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Gloss and Roughness Produced by Polishing Kits on Composite Resins
R. ZADEH, D. CAKIR, L.C. RAMP, and J.O. BURGESS, University of Alabama at Birmingham, USA

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Effect of Light-Unit And Aging Process on Bonding of Composite-Restorations
C.B. SANTOS-DAROZ[1], F. VOLTARELLI[2], A.N. CAVALCANTI[3], M. ALVES[4], A. PERIS[5], and G. MARCHI[2], [1]State University of Campinas - Piracicaba Dental School, Piracicaba - SP, Brazil, [2]Piracicaba Dental School, Brazil, [3]Piracicaba School of Dentistry, Piracicaba, SP, Brazil, [4]São Paulo State University, Piracicaba, Brazil, [5]Amazonas State University, Manaus, Brazil

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Bonding to Old and Young Dentin – An SEM Observation
G.C. LOPES, L.C.C. VIEIRA, and E. ARAÚJO, Universidade Federal de Santa Catarina, Florianopolis SC, Brazil

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Trans-Enamel Polymerization: Effect on Composite Hardness
G. GOMES, Instituto Superior Ciencias Saude Egas Moniz, Caparica, Portugal, and J. PERDIGAO, University of Minnesota, Minneapolis, USA

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Bioactive Glasses in Dentin that Reduce Leakage Maintain Bond Strength
D. ZEIGER[1], S.J. MARSHALL[1], L.G. WATANABE[2], K. SAEKI[3], A. TOMSIA[4], E. SAIZ[4], and G.W. MARSHALL[1], [1]University of California, San Francisco, USA, [2]University of California - San Francisco, USA, [3]University of California San Francisco, USA, [4]Lawrence Berkeley National Laboratory, CA, USA

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In-Vitro Microtensile Bond Strength of Four Self-Etch Adhesives
J. PURK[1], V. DUSEVICH[1], A. GLAROS[2], and J.D. EICK[1], [1]University of Missouri Kansas City, USA, [2]Kansas City University of Medicine and Biosciences, MO, USA

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S.H. MIRMOHAMMADI[1], C.J. KLEVERLAAN[2], and A.J. FEILZER[2], [1]ACTA and Isfahan University of Medical Sciences, Amsterdam, Netherlands, [2]ACTA, Universiteit van Amsterdam en Vrije Universiteit, Netherlands

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Enamel Sealing Ability of Self-Etch Adhesive
J. PERDIGAO[1], P. MONTEIRO[2], and G. GOMES[2], [1]University of Minnesota, Minneapolis, USA, [2]Instituto Superior Ciencias Saude Egas Moniz, Caparica, Portugal

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Physical Properties of Hybrid Composite Resins Containing Prepolymerized-Filler Particles
J.T. BLACKHAM, and K. VANDEWALLE, USAF, San Antonio, TX, USA

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A.M. ANDRADE[1], S.K. MOURA[2], A. MUENCH[1], A. REIS[3], A.D. LOGUERCIO[4], A.C. LASCALA[1], A.P. MANSO[1], and R.H.M. GRANDE[1], [1]University of São Paulo, São Paulo, Brazil, [2]University Camilo Castelo Branco, São Paulo, Brazil, [3]University of Oeste de Santa Catarina, Joaçaba–SC, Brazil, [4]Universidade Estadual de Ponta Grossa, Ponta Grossa - PR, Brazil

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Influence of Finishing Time on Marginal Sealing of Direct Restorations
J.C. RAMIREZ BARRANTES, L.N. BARATIERI, G. CARPENA LOPES, and E. MEDEIROS DE ARAÚJO JUNIOR, Federal University of Santa Catarina, Florianopolis, Brazil

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R. RAJANNA, A. OBEIDI, P.-R. LIU, M. MCCRACKEN, L. RAMP, P. BECK, R. MARSHALL, and J. BURGESS, University of Alabama at Birmingham, School of Dentistry, USA

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Effect of Four Medium Used in In-Vitro Composite Wear Testing
N.C. LAWSON[1], C. MICHELSON[2], D. CAKIR[1], and J. BURGESS[1], [1]University of Alabama at Birmingham, USA, [2]University of Michigan, Ann Arbor, USA

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Accelerated Aging Effects on Color, Translucency and Gloss of Composites
R.D. PARAVINA, L. ROEDER, F.S. HOSSAIN, and J.M. POWERS, University of Texas Dental Branch at Houston, USA

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Wear and Polymerization Shrinkage of Highly Filled and Flowable Composite Materials
C. MICHELSON[1], D. CAKIR[2], and J. BURGESS[2], [1]University of Michigan, Ann Arbor, USA, [2]University of Alabama at Birmingham, USA

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Characterization of a New Dimer Acid Based Resin Nano-Hybrid Composite
C. BRACHO-TROCONIS[1], S. RUDOLPH[2], J. BOULDEN[1], N. WONG[1], and T. GLOYD[2], [1]Septodont, Confi-Dental Division, Louisville, CO, USA, [2]Confi-Dental Products Co, Louisville, CO, USA

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Microtensile Bond Strength of Bonding Agents after High-Heat Storage
N.Z. BABA, M.C. LEHNHOF, F.A. BERRY, and H. LU, Loma Linda University, CA, USA

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Two-Year Clinical Evaluation of Self-Etch Adhesives in Posterior Restorations
C. ANAUATE-NETTO[1], J. PERDIGAO[2], M. DUTRA-CORREA[3], N. CASTILHOS[4], A.R. CARMO[1], H.R. LEWGOY[1], R. AMORE[1], and H.J. CORDEIRO[1], [1]Universidade Bandeirante de São Paulo, Brazil, [2]University of Minnesota, Minneapolis, USA, [3]UNESP and São Carlos Physics Institute, São José dos Campos, Brazil, [4]Universidade de Mogi Das Cruzes, Mogi das Cruzes, Brazil

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Dental Materials Biocompatibility Measured using Heat-Shock Protein Expression
F. GARCIA-GODOY, and P.E. MURRAY, Nova Southeastern University, Fort Lauderdale, FL, USA

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H.W. ROBERTS, USAF Dental Evaluation and Consultation Service, Great Lakes, IL, USA, D.W. BERZINS, Marquette University, Milwaukee, WI, USA, and D. CHARLTON, US Navy Institute for Dental and Biomedical Research, Gurnee, IL, USA

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Adhesive Bond Strength Under Pulpal Pressure at the Gingival Wall
J. PURK, R. SPENCER, J. ATWOOD, and D. KRUSE, University of Missouri Kansas City, USA

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M. HARTUNG, K. SCHEPKE, and O. KAPPLER, 3M ESPE AG, Seefeld, Germany

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Curing Efficiency and Temperature Increasement Produced by Photo-Activation Devices
E.D.P. GODOY, S.K. PEREIRA, and B.M. CARVALHO, Universidade Estadual De Ponta Grossa, Brazil

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F.A. DAYOUB, and T.F. NAHLAWI, Faculty of Dental Medicine, Damascus University, Damascus, Syria

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N. HOFMANN, University of Wuerzburg, Germany, and S. GRÜNHAGEN, Private practice, Würzburg, Germany

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A. SCHATTENBERG, I. BUSEMANN, B. WILLERSHAUSEN, and C.-P. ERNST, Johannes Gutenberg University, Mainz, Germany

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C.O. NAVARRA[1], M. CADENARO[1], F. ANTONIOLLI[1], S. ARMSTRONG[2], J. JESSOP[2], R. DI LENARDA[1], and L. BRESCHI[1], [1]University of Trieste, Italy, [2]University of Iowa, Iowa City, USA

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Bonding Silorane to Dentine
P.D. BRANDT[1], F.A. DE WET[1], and I. DU PREEZ[2], [1]University of Pretoria, School of Dentistry, South Africa, [2]University of Limpopo, Medunsa Campus, Pretoria, South Africa

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Dentin Shear Bond Strengths of Self-Etch Adhesives
Y. GUVEN, E.B. TUNA, and O. AKTOREN, Istanbul University, Faculty of Dentistry, Turkey

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S. DUARTE, Jr.[1], J.-H. PHARK[1], F. VARJAO[1], M.B. BLATZ[2], and A. SADAN[1], [1]Case Western Reserve University, Cleveland, OH, USA, [2]University of Pennsylvania, Philadelphia, USA

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Connective Forces Between Layers of Filtek™ Silorane versus Methacrylate Composites
K. DEDE, A. SYREK, O. KAPPLER, R. GUGGENBERGER, W. WEINMANN, and C. THALACKER, 3M ESPE AG, Seefeld, Germany

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Dentin/Pulp Biocompatibility of an Adhesive System for Silorane Restorative
Y. LI[1], S. LEE[1], W. ZHANG[1], S. ZUNT[2], M. ROHRER[3], and J. KIM[1], [1]Loma Linda University, CA, USA, [2]Indiana University School of Dentistry, Indianapolis, USA, [3]University of Minnesota, Minneapolis, USA

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O. KAPPLER, C. THALACKER, A. SYREK, and W. WEINMANN, 3M ESPE AG, Seefeld, Germany

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One-Year Bond Strength Evolution of the Silorane Restorative System
A. SYREK, O. KAPPLER, R. GUGGENBERGER, W. WEINMANN, K. DEDE, H. LOLL, and C. THALACKER, 3M ESPE AG, Seefeld, Germany

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R. GUGGENBERGER, W. WEINMANN, A. SYREK, O. KAPPLER, and C. THALACKER, 3M ESPE AG, Seefeld, Germany

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In-Vitro Microtensile Bond Strength of Four Self-Etch Adhesives
J. PURK[1], V. DUSEVICH[1], A. GLAROS[2], and J.D. EICK[1], [1]University of Missouri Kansas City, USA, [2]Kansas City University of Medicine and Biosciences, MO, USA

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R. BUERGERS, S. HAHNEL, M. ROSENTRITT, and G. HANDEL, Regensburg University Medical Center, Germany

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J. ELLAKURIA, M. COLLADO, J. ARRONDO, I. SOLER, I. SANCHEZ, M. LARTITEGUI, and P. CEARRA, Basque Country University, Leioa, Spain

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Ionic Exchange from Glass-Ionomer with Ultrasonic Excitation for Tunnel Restoration
C. HENGTRAKOOL, W. CHANASONGKRAM, and U. KEDJARUNE, Prince of Songkla University, Hatyai, Songkla, Thailand

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Glass-Ionomer Restoratives—What Test Provides the Best Performance Indicator?
Z. ALI, and G.J.P. FLEMING, Dublin Dental School & Hospital, Ireland

# Vanish™ XT Extended Contact Varnish

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AADR 2008

## Demineralization Protection of a New Protective Coating

R.P. RUSIN[1], A.M. PFARRER[2], M.D. ERICSON[3], J. LLOYD[3], K.M. CUMMINGS[1], and D. TANTBIROJN[3], [1]3M ESPE Dental Products, Saint Paul, MN, USA, [2]OMNI Preventive Care, A 3M ESPE Company, West Palm Beach, FL, USA, [3]University of Minnesota, Minneapolis, USA

**Objectives:** Evaluate the ability to protect underlying and adjacent enamel from in vitro demineralization of a new protective coating, EXM-713, a resin-modified glass ionomer, compared to Ultradent™ Ultraseal XT™ Plus™ Sealant (US), Pulpdent™ Embrace™ Wetbond™ Sealant (EW), 3M™ ESPE™ Vitrebond™ Plus Light Cure Liner/Base (VBP), and GC™ Fuji™ Triage™ Glass Ionomer Sealant (FT).

**Methods:** Polished bovine enamel specimens (n=10) having areas with acid-resistant nail varnish coating, test coating, and uncoated were soaked in 0.1 M lactic acid gel for 20 days at 37˚C as a simulated anti-cariogenic challenge. Mineral loss (DZ) was determined by cross-sectional microhardness of the enamel under the varnish, under the test coating, and the adjacent uncoated enamel at 0.5 mm and 2 mm from the coating. Data were analyzed via one-way ANOVA and compared with Tukey's t-test ($p<0.05$).

**Results:** Mean(SD) mineral loss (DZ, vol %-micron) are shown. Means with same letter designations within a row are not statistically significantly different.

| Area | US | EW | VBP | EXM-713 | FT |
|---|---|---|---|---|---|
| **Under nail varnish** | 2.7(14.1)[a] | -9.1(12.6)[a] | -0.5(13.7)[a] | -7.8(8.1)[a] | 14.7(43.7)[a] |
| **Under coating** | -9.6(19.4)[a] | -5.9(28.1)[a] | 1.8(17.0)[a] | -7.3(5.2)[a] | 78.9(183.8)[a] |
| **Uncoated area, 0.5 mm** | 3,648(461)[a] | 1,998(835)[b] | 425(442)[c] | 240(243)[c] | 111.6(158.9)[c] |
| **Uncoated area, 2 mm** | 3,013(704)[a] | 2,134(632)[b] | 658(523)[c] | 408(576)[c] | 421.6(377.3)[c] |

**Conclusions:** All coating materials provided physical barrier protection against the acid challenge. In addition to protecting the underlying enamel against demineralization, each coating is expected to provide clinically meaningful protection against demineralization and tooth decay, when applied according to manufacturer's instructions. EXM-713, VBP, and FT exhibited statistically significant greater protection against the acid challenge of adjacent enamel, both at 0.5 mm and 2 mm from the coating, than EW or US.

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0845
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# Vanish™ XT Extended Contact Varnish

## Fluoride release from a New Protective Coating

J. FITCH, K.M. CUMMINGS, and R.P. RUSIN, 3M ESPE Dental Products, Saint Paul, MN, USA

**Objectives:** Compare the fluoride release of an experimental coating material to a similar RMGI material and to two sealants. EXP is a resin-modified glass ionomer coating material in a paste/paste delivery, based on the chemistry of 3M™ ESPE™ Vitrebond™ Plus Liner/Base (VBP). The sealants were GC Fuji™ Triage (FT) and Pulpdent™ Embrace™ Wetbond™ (EW).

**Methods:** Disk-shaped, 1 mm thick by 20 mm diameter samples were cured by exposing them to illumination from a dental curing light for 120 seconds on each side of the disk. Each was immersed separately in 25 ml of deionized water in a specimen vial, and stored in a 37˚C oven. At each measurement interval, the specimen vial was removed from the oven, the leachate solution removed and reserved, and replaced with 25 ml of fresh deionized water. Fluoride concentration was measured with a fluoride ion-specific electrode, after addition of TISAB II buffer. Data were analyzed via one-way ANOVA and compared with Tukey's t-test ($p<0.05$).

**Results:** Cumulative fluoride release (stdev) in µg F/cm$^2$ is shown below.

| Material | 1 day | 7 days | 2 wk | 4 wk |
|---|---|---|---|---|
| **EXP** | 58.1(3.6)$^a$ | 134.4(7.7)$^c$ | 184.8(10.2)$^e$ | 244.4(12.4)$^g$ |
| **FT** | 45.7(11.9)$^a$ | 74.2(19.4)$^d$ | 89.6(22.5)$^f$ | 106.4(26.6)$^h$ |
| **VBP** | 57.5(6.4)$^a$ | 130.4(14.8)$^c$ | 177.5(19.7)$^e$ | 234.6(24.2)$^g$ |
| **EW** | 38.9(0.6)$^b$ | 75.3(1.5)$^d$ | 87.9(3.0)$^f$ | 100.2(4.0)$^h$ |

Groups identified by the same superscript letter are not significantly different ($p>0.05$).

EXP was equivalent to VBP at all times; EXP and VBP were higher than FT and EW at 7 days, 2 wk, and 4 wk. FT is equivalent to EW at all times. At 1 day, EXP and VBP were higher than EW and equivalent to FT.

**Conclusions**: EXP displays sustained fluoride release, comparable to other glass ionomers.



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# Vanish™ XT Extended Contact Varnish

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## Strength of a New Protective Coating

K.M. CUMMINGS and R.P. RUSIN, 3M ESPE Dental Products, Saint Paul, MN, USA

**Objective:** Compare the compressive strength (CS) and diametral tensile strength (DTS) of different glass ionomer materials used to seal dentin. The materials used were one experimental material (EXP), and commercial materials: 3M™ ESPE™ Vitrebond™ Plus Liner/Base (VBP), and GC Fuji™ Triage (FT). EXP is a resin-modified glass ionomer coating material in a paste/paste delivery.

**Methods:** Samples were cured in 4 mm diameter glass tubes with the paste held under axial compression, then cut to 8 mm (CS) and 2 mm (DTS) in length. Specimens were conditioned in deionized water at 37˚C for 24 hours prior to testing on an Instron machine. Data were analyzed via one-way ANOVA and compared with Tukey's t-test ($p<0.05$).

**Results:** CS and DTS in MPa are shown below.

| | CS(stdev) | DTS(stdev) |
|---|---|---|
| **EXP** | 119.6(8.4) | 26.8(3.1) |
| **FT** | 108.3(46.6) | 15.8(2.3) |
| **VBP** | 106.1(8.5) | 21.5(3.2) |

**Conclusions:** CS was not statistically different for all materials; DTS was not statistically different for all materials. EXP has physical properties suitable for providing a coating to seal dentin.



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# Vanish™ XT Extended Contact Varnish

## Dentin Permeability of a New Protective Coating on Smear-Layer Dentin

R.P. RUSIN[1], K. AGEE[2], M. SUCHKO[2], K.M. CUMMINGS[1], A.M. PFARRER[3], and D.H. PASHLEY[2], [1]3M ESPE Dental Products, Saint Paul, MN, USA, [2]Medical College of Georgia, Augusta, USA, [3]OMNI Preventive Care, A 3M ESPE Company, West Palm Beach, FL, USA

**Objectives:** Compare the convective fluid movements across dentin covered with a smear layer after placement of an experimental coating material, EXM-713, versus an RMGI liner and a nanofilled adhesive control. EXM-713 is a resin-modified glass ionomer coating material.

**Methods:** Crown segments cut from extracted unerupted third molars were cemented onto plexiglass slabs penetrated by a stainless steel tube allowing filling of the pulp chamber with water under 140 cm $H_2O$ pressure. These were attached to a device that measured fluid movement through the dentin. The dentin surface was etched with 37% phosphoric acid for 15 sec to permit measurement of the maximum permeability; three strokes on 320 grit paper yielded a controlled smear layer, which was coated with either 3M™ ESPE™ Vitrebond™ Plus Liner/Base (VBP) or EXM-713. Permeability was measured on the etched, smeared, and coated dentin for each sample. A control group, 3M™ ESPE™ Adper™ Single Bond Plus Adhesive (SBP) applied to etched dentin, was also measured. Cross-sectional SEM was done on EXM-713 and VPB. Data were analyzed via one-way ANOVA and Tukey's t-test ($p<0.05$).

**Results:** Permeability, in microliter/min at 140 cm $H_2O$ (stdev), is shown below. Groups with the same superscript letter are not significantly different ($p>0.05$).

| Material | n | Etched | Smear | Coated | % Reduction |
|---|---|---|---|---|---|
| **EXM-713** | **6** | 14.6(13.1)[a] | 3.7(2.4)[b] | 0.25(0.32)[c] | 96.5(6.0)% |
| **VBP** | **6** | 10.7(7.4)[a] | 3.2(1.9)[b] | 0.17(0.25)[c] | 98.9(1.1)% |
| **SBP** | **10** | 13.8(5.6)[a] | n/a | 0.9(1.3)[c] | 93.3(8.0)% |

**Conclusions:** EXM-713 and VBP are effective at sealing smear-layer-covered dentin and reducing fluid flow through it; both are not statistically different from SBP in their ability to reduce fluid flow. SEM of EXM-713 and VPB showed resin infiltration of the smear layer, resin tags on the etched dentin, and a resin-rich layer at the interface.



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# Vanish™ XT Extended Contact Varnish

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AADR 2008

## Dentin Permeability of a New Protective Coating Material

R.P. RUSIN[1], K. AGEE[2], M. SUCHKO[2], K.M. CUMMINGS[1], and D.H. PASHLEY[2], [1]3M ESPE Dental Products, Saint Paul, MN, USA, [2]Medical College of Georgia, Augusta, USA

**Objectives:** Compare the convective fluid movements across dentin after placement of an experimental coating material, versus a nanofilled adhesive and an RMGI liner.

**Methods:** Crown segments were cut from extracted unerupted third molars, and cemented onto a plexiglass slab fitted with a stainless steel tube allowing filling of the pulp chamber with water under 140 cm $H_2O$ of pressure. This was attached to a device that measured fluid movement through the dentin. The dentin surface was etched with 37% phosphoric acid for 15 sec, presenting a model for the exposed tubules typical of root sensitivity. The dentin was coated with either 3M™ ESPE™ Adper™ Single Bond Plus Adhesive (SBP), 3M™ ESPE™ Vitrebond™ Plus Liner/Base (VBP), or EXM-713 experimental coating material. EXM-713 is a resin-modified glass ionomer coating material in a paste/paste delivery. Permeability was measured on the etched and the coated dentin for each sample. Data were analyzed via one-way ANOVA and compared with Tukey's t-test ($p<0.05$).

**Results:** The permeability in microliter/min at 140 cm $H_2O$ is shown below.

| Material | n | Etched | Coated | % Reduction |
|---|---|---|---|---|
| **SBP** | **11** | 13.8(5.6)[a] | 0.9(1.3)[b] | 93.3(8.0)[c] |
| **EXM-713** | **12** | 10.5(6.1)[a] | 1.5(2.4)[b] | 87.7(18.6)[c] |
| **VBP** | **11** | 12.1(6.1)[a] | 1.3(1.4)[b] | 87.9(13.9)[c] |

Groups identified by the same superscript letter are not significantly different ($p>0.05$).

In all groups the permeability of the coated surface was much lower than the etched surface. Etched permeability was equivalent for all groups; coated permeability was equivalent for all groups; percent reduction in permeability was equivalent for all groups.

**Conclusions:** SBP, EXM-713, and VBP are effective at sealing open dentin and reducing fluid flow through dentin. EXM-713 was equivalent to SBP and VBP in its ability to reduce fluid flow.



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# Vanish™ XT Extended Contact Varnish

## Fluoride Recharge of a New Protective Coating

J.A. FITCH[1], J.E. SWANSON[1], K.M. CUMMINGS[1], A.M. PFARRER[2], and R.P. RUSIN[1], [1]3M ESPE Dental Products, Saint Paul, MN, USA, [2]OMNI Preventive Care, A 3M ESPE Company, West Palm Beach, FL, USA

**Objectives:** Compare the fluoride recharge of an experimental coating material, EXM-713, to another RMGI material, 3M™ ESPE™ Vitrebond Plus Liner/Base. EXM-713 is a resin-modified glass ionomer coating material.

**Methods:** Cured 20 × 1 mm disks were stored separately in deionized water at 37˚C. Fluoride release was measured after 0.5, 1, 2, 4, 8, 24, 48, and 72 hr using fluoride selective electrode and TISAB II. Dentifrice treatments were applied at 72, 95, and 119 hr; fluoride data were collected at 1, 2, 3, 5, 24 hr after each treatment; treatment comprised soaking disk 2 min in slurry of 3M™ ESPE™ ControlRx™ 5000 ppm Fluoride Prescription Dentifrice with deionized water (water: dentifrice=3:1). Data after treatment were compared to immediately before treatment via one-way paired t-test ($p<0.05$).

**Results:** Cumulative fluoride release rate, microgram F/cm$_2$/hr (n=5). Within each recharge period and material, groups with superscript* are pre-recharge, H are higher than pre-recharge, E are equivalent to pre-recharge ($p>0.05$).

| | time, hr | 72* | 73.0 | 74 | 75 | 77 | 94.8* | 95.6 | 96.1 | 97.1 | 99.5 | 119* | 119.8 | 120.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXM-713 | Avg | 0.68* | 2.36H | 1.02H | 0.85H | 0.78H | 0.62* | 3.03H | 1.08H | 0.77H | 0.73H | 0.57* | 2.51H | 1.13H |
| | StDev | 0.03 | 0.89 | 0.24 | 0.11 | 0.05 | 0.04 | 0.95 | 0.15 | 0.06 | 0.08 | 0.02 | 0.96 | 0.34 |
| VBP | Avg | 0.53* | 1.00H | 0.75H | 0.58H | 0.56E | 0.54* | 1.42H | 0.62E | 0.6H | 0.54E | 0.44* | 1.3H | 0.75H |
| | StDev | 0.03 | 0.18 | 0.18 | 0.04 | 0.08 | 0.03 | 0.04 | 0.09 | 0.04 | 0.02 | 0.05 | 0.25 | 0.11 |

| | time, hr | 121.3 | 123.3 | 143.3 |
|---|---|---|---|---|
| EXM-713 | Avg | 0.78H | 0.64H | 0.53E |
| | StDev | 0.12 | 0.04 | 0.01 |
| VBP | Avg | 0.58H | 0.51E | 0.44E |
| | StDev | 0.05 | 0.03 | 0.01 |

**Conclusions:** The fluoride release rate of both EXM-713 and VBP is higher after dentifrice treatment versus before, lasting up to 5 hr for EXM-713, 3 hr for VBP. The recharge levels at 95 hr and 119 hr were not statistically different, but statistically higher than at 72 hr, showing that the effect is repeatable. EXM-713 and VBP can repeatably recharge and re-release fluoride from application of a prescription-strength dentifrice.



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# Vanish™ 5% NaF White Varnish

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## Coating Thickness Influences Fluoride Release from White Fluoride Varnish

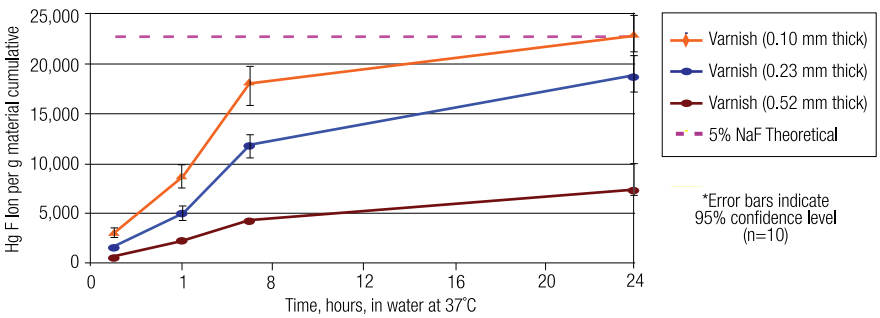
P.-J. FLANIGAN, M. ENSLIN, and P.M. SEILER, 3M Company, St.Paul, MN, USA

**Objective:** Determine whether the coating thickness of OMNI's Vanish® Varnish 5% Sodium Fluoride White Varnish (Vanish) influences the amount of fluoride released in water over 24 hours.

**Method:** Thin (0.10 mm), medium (0.23 mm), and thick (0.52 mm) coatings of Vanish were coated onto resin-coated glass slides (n=10) in an area of 25 mm by 32 mm. Each sample was immediately weighed and placed in 25 ml DI water at 37˚C. After 1 hour, the water was collected and replaced with fresh DI water. A 10 ml aliquot of collected water was diluted 1:1 with TISAB II prior to fluoride analysis. Buffered samples were evaluated using a calibrated fluoride ion selective electrode. This procedure was repeated at 4, 7, and 24 hours. Fluoride concentrations observed were converted to micrograms of fluoride and normalized to micrograms of fluoride released vs. the coating weight for each slide. Cumulative mean micrograms of fluoride released per gram of Vanish applied at each time point were analyzed using two-way ANOVA at each collection time. (t-test, $p<0.05$).

**Results:** The cumulative fluoride released per gram of sample in water at 37˚C over time is shown below. Thin coatings of Vanish released a greater percentage of total fluoride than thicker coatings. The thinnest coating (0.10 mm) slowly releases 100% of the total theoretical fluoride amount within 24 hours.

Vanish Fluoride Ion Release*




**Conclusion:** Thinner coatings of Vanish release more fluoride per unit mass than thick coatings. This suggests that only a thin coating is necessary to maximize the fluoride bioavailability and simultaneously minimize the amount of fluoride placed in the oral cavity.



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# ControlRx™ 1.1% Sodium Fluoride Dentifrice

## Enamel Remineralization and Fluoride Uptake From 5000 ppm Fluoride Pastes

R.L. KARLINSEY[1], A.C. MACKEY[1], G.K. STOOKEY[1], and A.M. PFARRER[2], [1]Indiana Nanotech, Indianapolis, USA, [2]OMNI Preventive Care, A 3M ESPE Company, West Palm Beach, FL, USA

Prescription-based fluoride formulations are recommended for those patients most at-risk for caries formation and progression. The efficacy of these 5000 ppm fluoride formulations, however, can vary depending on the formulation, and this in turn may impart significant differences in product performance.

**Objective:** The purpose of this research was to determine the ability of 5000 ppm fluoride (NaF) pastes in remineralizing weakened enamel emulating early caries formation.

**Methods:** Three millimeter diameter bovine enamel specimens were prepared in the usual manner and initially softened in a carbopol-lactic acid solution [White, DJ: Caries Res 21 1987 228–42] for a period of 36 hrs (37˚C). Following initial softening, specimens (N=10) were stratified (mean VHN=35) into the following groups: (a) distilled (DI) water (negative control), (b) Prevident, (c) ControlRx, or (d) Modified ControlRx (containing calcium) and cycled (10 days) in a lesion reversal model consisting of four 2-minute treatments (diluted 1:3 with DI water) and one 4-hour acid challenge (carbopol-lactic acid, pH=5.0) per day. Between these events, specimens were immersed in artificial saliva [ten Cate, et al.: Caries Res 22 1988 20-6]. After 10 days of cycling, surface microhardness and enamel fluoride uptake were evaluated.

**Results:** Mean surface microhardness recoveries (±SEM) were (a)-6.54±1.38, (b)6.54±1.96, (c)93.08±6.05, and (d)136.70±9.03 with a<b <c<d (ANOVA, pairwise multiple t-tests, p>0.05). Fluoride uptake measurements (±SEM) were (a) 245.8±11.6, (b) 2510.9±181.4, (c) 6858.4±444.6, and (d) 8634.2±311.7 with a<b<c<d (ANOVA, pairwise multiple t-tests, p>0.05).

**Conclusions:** The model was sensitive to fluoride's rehardening benefits as demonstrated by statistical differences between the DI water and both ControlRx and Prevident. Remineralization and fluoride uptake from the Prevident formulation was found to be statistically inferior to both ControlRx and Modified ControlRx. The Modified ControlRx paste exhibited greater rehardening than the unmodified ControlRx.



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# Preventive Products References


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Surface Rehardening of Softened Enamel by Fluoride Varnishes
R.L. KARLINSEY[1], K.E. FREDERICK[1], A.C. MACKEY[1], G.K. STOOKEY[1], and A.M. PFARRER[2], [1]Indiana Nanotech, Indianapolis, USA, [2]OMNI Preventive Care, A 3M ESPE Company, West Palm Beach, FL, USA

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Fluoride Bioavailability in Close Proximity to Professional Fluoride Applications
A.M. PFARRER, OMNI Preventive Care, A 3M ESPE Company, West Palm Beach, FL, USA, G.D. WOOD, Dental Products Testing, Indianapolis, IN, USA, and B.R. SCHEMEHORN, Dental Products Testing, Indianapolis, IL, USA

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Fluoride Uptake from Professional Fluoride Applications Applied Directly onto Lesions
B.R. SCHEMEHORN[1], G.D. WOOD[1], and A.M. PFARRER[2], [1]Dental Products Testing, Indianapolis, IN, USA, [2]OMNI Preventive Care, A 3M ESPE Company, West Palm Beach, FL, USA

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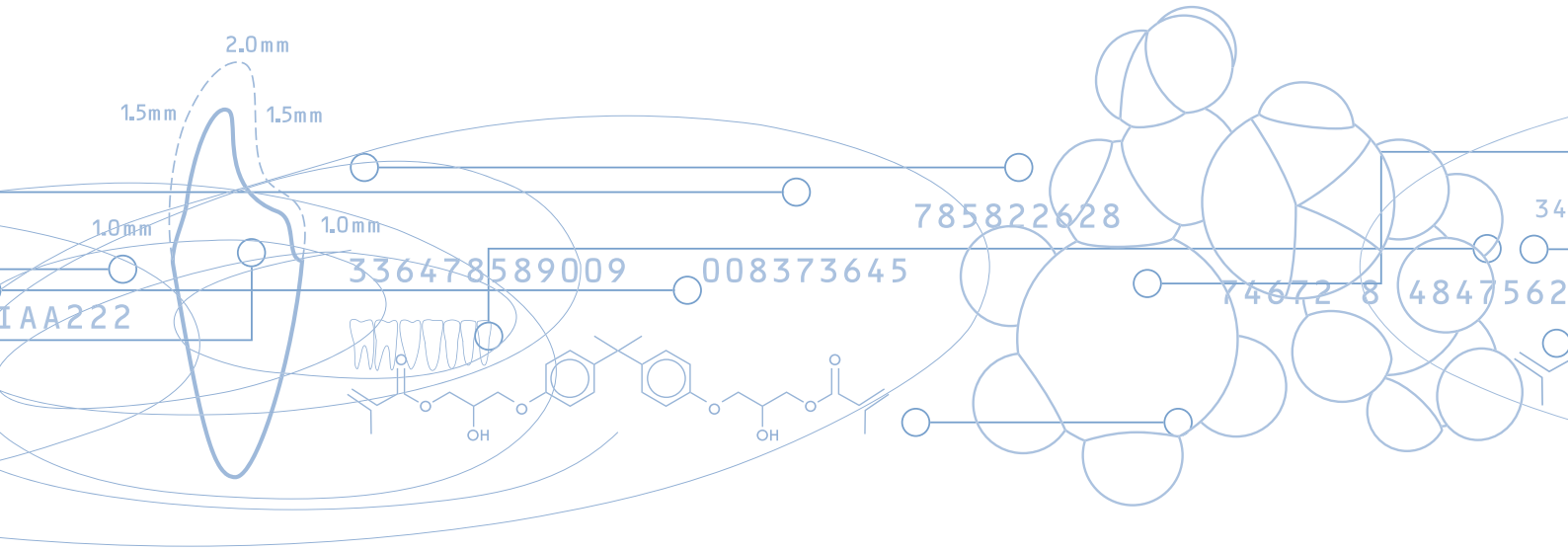
Based on the data contained in the abstracts, 3M ESPE has provided graphics, “Aim of the Study” and “Results of the Study” to visualize and summarize the results.




**3M ESPE Technical Hotline: 1-800-634-2249**
**3M ESPE Web site: www.3MESPE.com**

3M ESPE

**Dental Products**
3M Center
Building 275-2SE-03
St. Paul, MN 55144-1000
USA

**3M Canada**
Post Office Box 5757
London, Ontario N6A 4T1
Canada
1 888 363-3685

**3M ESPE AG**
ESPE Platz
D-82229 Seefeld
Germany