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Compilation of Scientific Abstracts

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COMPILATION **OF SCIENTIFIC ABSTRACTS**

MARCH 2013

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COMPANY PROFILE

More than 85 years of Kuraray

Kuraray Co. Ltd., established in 1926 in Kurashiki, Japan, was originally involved in the industrial production of fibers out of viscose. Today, thanks to Kuraray's technological strength and comprehensive experience, the company successfully covers the sectors polymer chemistry, chemical synthesis, and chemical engineering developing and producing a broad range of high-quality and innovative products.

In 1973, Kuraray entered the business field of dental materials with the objective to respond to requirements of dental practice precisely and carefully – with products which convince users by their reliability and high quality.

Inventor of the bonding system

In 1978, Kuraray introduced the first bonding system to the market: CLEARFIL™ BOND SYSTEM-F, the start of the age of adhesive dentistry. At the same time, the company developed the total-etch technique for enamel and dentin.

Today, Kuraray continues to steadily produce innovative quality products which meet the requirements of a profession that also develops constantly. Its products that make history – such as PANAVIA™ F2.0, CLEARFIL™ SE PROTECT, CLEARFIL™ SE BOND and CLEARFIL™ AP-X – are proof of Kuraray's capability to develop solutions for practice from the results of their pioneering research.

Entering the era of synergy

Kuraray Noritake Dental Inc. was born on 1 April 2012 from Kuraray medical Inc. and Noritake Dental Supply Co., Limited.

Kuraray Noritake Dental Inc. will promote the development of materials that possess new functions by integrating technologies from the area of organic dental materials (including bonding agents, resin cements and composites) and the area of inorganic dental materials (including ceramics for crowns and plaster). The future of dentistry looks bright for materials born our of the integration of our technologies.

The real test starts with the usage of our products

We are delighted to present with this compilation of abstracts the most recent and informative scientific information on our clinically tested and evaluated products.

Dedicated to develop and produce high quality products, the external verification of the products' quality is vital for us. Hence, Kuraray expresses its gratitude to the universities for including Kuraray's products in their research.

Please feel invited to contact us in case of questions –
We are happy to provide even more information.

ADHESIVES

CLEARFIL™ SE BOND
CLEARFIL™ SE PROTECT
CLEARFIL™ S^3 BOND PLUS
CLEARFIL™ LINER BOND 2V

CLEARFIL™ SE BOND

3136 Restorative system and thermal cycling influencing dentin margin gap-OCT evaluated

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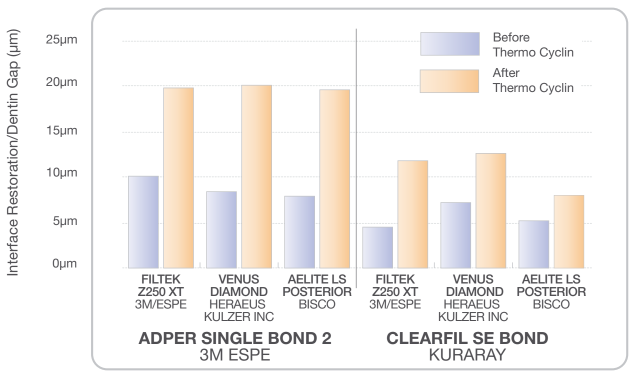
Objective: To evaluate the dentin marginal integrity (dentin gap presence) of class V restorations made with different restorative systems: Composites: Filtek™ Z250 XT® - 3M/ESPE (Z250); Venus Diamond® – Heraeus Kulzer Inc (VD) and Aelite™ LS Posterior® - Bisco (AP); Adhesive Systems: Adper™ Single Bond 2® (SB2) and Clearfil SE Bond®– Kuraray Inc (CSE) by Optical Coherence Tomography (OCT), submitted to thermo cycling.

Method: 30 class V cavities were accomplished on freshly extracted sound third molars. Class V cavities were distributed into 6 groups according to adhesive systems and composites (n=5): G1 – Z250 + SB2; G2 – VD + SB2; G3 – AP + SB2; G4 – Z250 + CSE; G5 – VD + CSE; G6 – AP + CSE. Specimens were analyzed by OCT before and after thermal challenge (1000 cycles: 5°C and 55°C, with a dwell time of 30s in each bath). The interface restoration/dentin gap (µm) was evaluated from one OCT shot from each group using Image J. Data were submitted to two-way ANOVA and Tukey post-hoc test ($p<0.05$).

Result: Thermal challenge provided a significant increase on gap formation for all groups (before/after: G1 - 10.1 ± 1.2/19.8 ± 3.7; G2 - 8.4 ± 2.4/20.1 ± 6.9; G3 - 7.9 ± 3.0/19.6 ± 4.8; G4 – 4.5 ± 2.0/11.8 ± 5.6; G5- 7.2 ± 5.7/12.6 ± 6.6; G6 - 5.2 ± 2.2/8.0 ± 1.6 – $p<0.05$). Before and after thermo cycling, SB showed higher gap values than CSE ($p<0.05$), except for G5 that before thermo cycling presented similar gap values than SB groups, but it was not different from CSE values ($p>0.05$).

Dentin Marginal Integrity (Dentin Gap Presence)



Conclusion:

The adhesive system Clearfil SE Bond showed lower dentin gap values than Adper Single Bond2, when analyzed the marginal integrity, regardless thermo cycling. Thermo cycling provided an increase on gap margin for all restorative systems.

CLEARFIL™ SE BOND

553 Shear Bond-Strength of Modern Self-etched adhesive to Total-etched Enamel

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Objective: One of the major concerns with composite restorations is their ability to achieve effective initial bonding (Dent Mater 2006; 22: 875-883). The purpose of this study was to evaluate etching versusnon-etching enamel on the shear bond-strength (SBS) of composite restorations (Clearfil AP-X, Kuraray Noritake), pretreated with seven self-etched adhesives (SEA): (Scotchbond Universal, 3M ESPE (SU); OptiBond XTR, Kerr (OX); All-Bond Universal, Bisco (AU); G-aenialBond, GC (GA); BeautiBond Multi, Shofu (BB); EE Bond, Tokuyama (EB); Clearfil SE Bond, Kuraray Noritake (SB).

Method: The surface of polished enamel (# 1,000) was pretreated by etching (Scotchbond Universal Etchant, 3M ESPE, 15 sec.) and washing (10 sec.) (TE), or not etched (SE). Prepared enamel surfaces were pretreated as described above. A Teflon mold with a cylindrical hole (diameter, 3.6 mm; height, 2 mm) was clamped onto the enamel surfaces and was filled with Clearfil AP-X. SBS were measured immediately after light-activation (IM) or after one-day storage in water (37 oC) (1-D). Statistical analyses were performed by t-Test (TE vs. SE, $p<0.05$, S: Significantly different).

Result:

Summary: (SBS, Mean (S.D.), MPa, Number of tooth fractures, n=10)

IM

	SU	OX	AU	GA	BB	EB	SB
TE:	32.5(6.0, 4)	31.0(5.0, 3)	25.2(5.4, 3)	25.2(4.5, 0)	30.9(6.4, 2)	33.0(4.9, 4)	35.2(4.9, 5)
	S	S	S	S	S	S	S
SE:	16.5(3.5, 0)	16.3(2.8, 0)	10.6(3.6, 0)	19.9(4.8, 0)	20.4(4.4, 0)	17.9(2.0, 0)	23.2(5.1, 0)

1-D

TE:	35.7(3.1, 5)	36.0(4.2, 6)	34.0(3.1, 6)	33.1(3.5, 6)	34.1(4.2, 6)	36.4(3.6, 7)	38.9(3.7, 9)
	S	S	S	S	S	S	S
SE:	21.6(6.1, 1)	30.8(6.3, 3)	18.5(5.5, 1)	23.8(5.5, 0)	25.9(2.9, 0)	22.3(5.0, 0)	31.5(5.7, 4)

Conclusion:

SBSs of all SEAs to enamel pretreated by TE were significantly greater than SE groups. However many enamel surfaces retreated by TE were easily fractured.

CLEARFIL™ SE BOND

547 Bond Strength To Enamel Using New Universal Adhesive Bonding Agents

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New universal adhesive bonding agents have been recently marketed for use as a self-etch adhesive or as an etch-and-rinse adhesive depending on the dental substrate and clinician's preference.

Objectives: The purpose of this study was to evaluate the shear bond strength of composite to enamel using two new universal bonding agents compared to a self-etch bonding agent when applied in self-etch and etch-and-rinse modes.

Methods: Sixty enamel sections were obtained from human third molars and mounted in PVC pipe. A small area of the enamel was flattened using a diamond wheel and 600-grit silicon-carbide paper. The sixty enamel specimens were randomly divided into three groups of twenty and assigned to two universal adhesive bonding agents, All-Bond Universal (Bisco) and Scotchbond Universal (3M/ESPE), and one self-etch adhesive, Clearfil SE (Kuraray). Each group had ten specimens bonded in a self-etch mode and ten specimens bonded in an etch-and-rinse mode with a separate 37% phosphoric acid etch. Each specimen had its assigned adhesive applied per manufacturers' directions, then placed in an Ultradent Jig. Composite (Filtek Z250, 3M/ESPE) was inserted into the mold in 2-mm increments to a height of 3-4 mm and cured for 20 seconds per increment. All specimens were stored for 24 hours in 370C distilled water and tested in shear in a universal testing machine (Instron). A mean shear bond strength value (MPa) and standard deviation was determined per group (see table). Data was analyzed with 2-way ANOVA/Tukey's (alpha=0.05).

Results: The 2-way ANOVA found a significant difference between groups based on bonding agent ($p<0.001$) and surface treatment ($p=0.007$) with no significant interaction ($p=0.375$).

Bonding Agent	**Shear Bond Strength** (St Dev) **MPa**		**2-way ANOVA**
	Self-Etch	Etch-and-Rinse	
All-Bond Universal	11.2 (1.6)	17.0 (3.3)	B
Scotchbond Universal	14.0 (2.6)	18.4 (7.7)	B
Clearfil SE Bond	19.7 (5.8)	24.4 (6.9)	A

Conclusions:

Etching enamel significantly increased the shear bond strength of composite to enamel. Clearfil SE had significantly greater bond strength to enamel than Scotchbond Universal and All-Bond Universal, which were not significantly different from each other.

CLEARFIL™ SE BOND, CLEARFIL™ SE Protect

557 Bond durability of four contemporary self-etching systems

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Objective: To evaluate the bonding performance of four commercial available self-etching systems stored in water for 24 hours and 24 months.

Method: Four self-etching adhesives were employed in this study: Easy Bond (EB,3M ESPE, USA), G-Bond plus (GBp, GC Corporation, Japan), SE Bond (SE, Kuraray Medical INC. Japan) and Protect Bond (PB, Kuraray Medical INC. Japan). 16 human third molars without caries were separated into 4 groups with 4 teeth in each adhesive system. After bonding followed by the manufacture's instruction, the teeth were build-up with resin composite (Clearfil AP-X) and being stored in 37 °C distilled water for 24 hours. The bonded specimens sectioned into 1.0 mm^2 sticks and storage into 37 °C distilled water again for 24 hours, and 24 months. Micro-tensile bond strength (μTBS) test was performed, after different water-storage duration at a crosshead speed of 1 mm/min. The obtained data were expressed as MPa and statistically analyzed by Games-Howell test and Tukey test ($p<0.05$).

Result: Regarding all-in-one adhesives, EB and GBp indicated significant decrease after 24 months water storage in comparison with 24 hours. On the other hand, two 2-step self-etching systems expressed no statistically decrease in μTBS after 24 months water-storage comparing with that of 24 hours.

Conclusion:

Water storage could affect bonding performance of all-in-one system significantly, on both of HEMA-contained and HEMA-free all-in-one system. 2-step self-etching systems might have consistent bonding performance comparing with that of all-in-one systems.

CLEARFIL™ SE Protect

614 Antibacterial Activity of Dental Adhesive System: An invitro study

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The development of caries is dependent on the interaction of four primary factors: tooth surface, diet, time, and the presence of oral bacteria. Bacteria are the main cause of secondary caries, which develop as a result of failures in resin composite restorations.

Objective: The purpose of this study was to investigate the efficacy of antimicrobial dental bonding agent, Clearfil™ SE Protect on planktonic and biofilm oral bacteria.

Methods: Clearfil™ SE Protect bond (SEP) which contains MDPB, an antimicrobial agent and SE bond (SE) dental adhesive agents were purchased from Kuraray Inc. ATCC strains of Streptococcus mutans 31377, S. gordonii 10558, Enterococcus faecalis 11700, and Actinomyces viscosus 19246 were cultured for 24 hours and also 7 day old mixed biofilm of these bacteria were prepared in a 48-well culture dish. A stock 1% solution of SEP and SE primer was prepared in PBS. Minimal bactericidal concentration was determined by adding 0.1 ml of diluted SEP or SE to bacteria ($1x10^5$). Biofilm bacteria ($2x10^6$ cells) were incubated with conditioned media (CM) from UV-cured and un-cured discs of SEP and SE (5-120 minutes) and bacterial viability was tested by MTT assay.

Results: Clearfil SEP displayed bactericidal properties at highest dilutions (1/4096) while Clearfil SE showed very little. More than 80% of the bacteria were killed in 60 minutes compared to less than 30% with SE. Biofilm-grown bacteria also found to be susceptible to SEP-CM. Only 780 viable bacteria were detected after treatment with CM prepared from SEP discs, compared to $8.22x10^5$ viable bacteria with SE-CM.

Conclusion:

Clearfil™SEP composite with MDPB proved to be highly antimicrobial against planktonic and biofilm oral bacteria and may aid in prevention of secondary caries.

CLEARFIL™ S³ BOND PLUS

1913 Degree conversion of dental adhesives polymerized with different curing units

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Objective: Despite recent findings indicate prolonged light exposure are needed to properly polymerize simplified dental adhesives, manufacturers recommend short curing times. The aim of this study was to measure the degree of conversion (DC) of three one-step adhesives polymerized with a halogen or a LED curing unit for a short time. The tested hypothesis was that a short curing time is adequate to polymerize the adhesives and that the type of curing unit does not affect the DC.

Method: Three adhesives were selected: Adper Scotchbond Universal (3M ESPE); G-Bond (GC); S³ Bond Plus (Kuraray). Resins were photo-polymerized with a quartz-tungsten-halogen (Elipar 2500, 3M ESPE; output 500 mW/cm2) or LED (Bluephase, Ivoclar Vivadent-low power mode, output 1,000 mW/cm2) curing light for 10s. DC of adhesives was measured with a Fourier transform infrared spectrophotometer. Data were analyzed with a two-way ANOVA and Tukey's post-hoc test and t-test at a=0.05.

Result: DCs of the tested adhesives are shown in Table 1.

Table 1. DC%±SD of the tested adhesives.

Adhesive	Elipar 2500	Bluephase
Uno	29.6 ± 3.1^{abA}	20.2 ± 1.7^{aB}
G-Bond	23.1 ± 2.2^{aA}	19.6 ± 2.5^{aA}
S³ Bond Plus	35.8 ± 3.7^{bA}	34.4 ± 1.9^{bA}

Same superscript lower case letters indicate no statistical difference in columns and same superscript upper case letters indicate no statistical difference in rows ($p>0.05$).

S³ Bond Plus showed the highest DC values with both curing units ($p<0.05$); Adper Scotchbond Universal showed a reduced DC when polymerized with the LED light ($p<0.05$). Overall low DC values were obtained with both curing units.

Conclusion:

The tested hypothesis was rejected because the DC was affected by the curing light. The 10s-exposure produced low DC values with both curing units, thus longer curing times should be recommended to polymerize dental adhesives.

CLEARFIL™ LINER BOND 2V

3106 Ten-year clinical evaluation of cervical lesion restorations using self-etch adhesive

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Objective: To evaluate the clinical performance of acid-etching prior to the application of self-etch adhesive in non-carious cervical lesions (NCCLs) resin restorations.

Method: A split-mouth study design was developed after approval of Human Ethics Committee from the Institutions. Seventy restorations of Z-100 resin composite associated with Clearfil Liner Bond 2V adhesive were placed in 70 NNCLs of 30 adult subjects. The adhesive was applied according to two bonding strategies: with or without prior acid etching. Patients were recalled after 3½ and 10 years. Restorations were evaluated in accordance with USPHS modified criteria. The cumulative loss rate was calculated according to ADA guidelines formula.

Result: After 3½ years, 57 restorations were evaluated in 24 patients. For acid-etched group the cumulative loss rate was 1.78% (1 restoration) while the non-etched group did not show any restoration loss. At the 10-year recall, 50 restorations were evaluated in 22 patients. The cumulative loss rates were 3.92% (2 restorations) and 7.84 % (4 restorations), respectively, for non-etched and etched groups No postoperative symptoms were reported after 3½ years while six teeth (3 for non-etched group and 3 for etched group) presented sensitivity at the 10-year follow-up.

Conclusion:

The acid-etching of NCCL prior to application of Clearfil Liner Bond 2V did not significantly improved the clinical performance of composite restorations after 10 years.

COMPOSITES

CLEARFIL™ MAJESTY ES-2
CLEARFIL™ MAJESTY ESTHETIC
CLEARFIL™ MAJESTY FLOW

CLEARFIL™ MAJESTY ES-2

403 New Composite Material with Value-Based Shade Matching Concept

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Objective: When restoring teeth with composite restorations it can be difficult to determine the appropriate shade match, as well as the composite shade combinations to achieve this shade. This study assessed the accuracy of a newly developed layered composite material that uses the VITA approved shade concept.

Materials and Methods: Tooth preparation was made in the body region of 15 VITA Classical shade tabs (3mm diameter and 5mm depth, except for shade D4). Each of the 60 tabs were filled with composite of 4 systems (Clearfil Majesty-Classical;CMC, Clearfil Majesty- Premium;CMP, Tetric Evoceram; TE, Filtek Supreme;FS) according to shade selection instructions of each system. The Clearfil Majesty-Premium shades are divided into 5 value groups (Value-1:B1,A1,B2, Value-1: D2,A2,C1, Value-3: C2,A3,D3, Value-4:B3,A3.5,B4, Value-5: C3,A4,C4), and 5 combinations of enamel and dentin shades cover 15 VITA Classical shades. The color of the composite restorations (middle area of 2 mm diameter) was measured by a dental spectrophotometer (Crystaleye), and the color difference dE with the corresponding shade guide tab was calculated. ANOVA and multiple-comparison test was performed.

Result: Color difference dE for each system was as follows: 0.9~5.2(CMC), 1.2~4.1(CMP), 0.5~7.7(TE), 0.6~4.6(FS), and average values were, 2.7+1.3, 2.7+0.9, 3.6+2.2, 2.9+1.2, respectively. Although CMP indicated the smallest dE, there was no significant difference observed among 4 systems.

Conclusion:

Restorations made with Clearfil Majesty-Premium, which has only 5 recommended shade combinations, had dE values smaller than or similar to the other tested systems. It could be said that Clearfil Majesty-Premium offers an efficient, user friendly approach for obtaining esthetic composite restorations.

CLEARFIL™ MAJESTY ES-2

402 Assessment of Color Blend-Effect of Composite Material

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Objective: Achieving a well color matched composite restoration is still a challenge in clinical dentistry. An often experienced phenomenon is the shade of a composite being different before placement compared to after placement. This study investigated this "color blending-effect" of dental composite by comparing the color of various composites before and after placement into dental shade guides.

Materials and Methods: Tooth preparation was made in the body region of 15 VITA Classical shade tabs (3mm diameter and 5mm depth, except for shade D4). Replicas of the prepared shade tabs were made with PVS impression material ("Rubber tab"). Each of the shade tabs and rubber tabs were filled with 4 composite systems (Clearfil Majesty-Classical;CMC, Clearfil Majesty- Premium;CMP, Tetric Evoceram;TE, Filtek Supreme;FS) according to shade selection instructions of each system. The composites were filled into rubber tabs were then removed from tabs after being cured; these were considered as "unfilled" composites. The color of composites, both filled and unfilled (middle area of 2 mm diameter), were measured by a dental spectrophotometer (Crystaleye), and color differences dE between unfilled and filling composites were assessed. ANOVA and multiple-comparison test were performed.

Result: Color difference dE between filled and unfilled for the 4 systems were as follows: 8.1 +2.6(CMC), 7.8+2.2(CMP), 5.9+1.3(TE), 8.2+1.9(FS), and dL* was 2.9+1.5(CMC), 3.6+1.5(CMP), 2.8+1.4(TE), 2.6+1.8 (FS), and db* was 7.3+2.5(CMC), 6.7+1.9(CMP), 4.8+0.7(TE), 7.4+1.5 (FS), respectively. FS had significantly smaller dE and db* color difference values, indicating less of a blend-effect compared to the other 3 systems.

Conclusion:
The major color shift of composites after being placed (i.e. unfilled to filled) was an increase of L* (1.1 times) and b* (1.6 times), and the blend-effect created a significantly detectable color change, which may support a better color matching on composite restoration.

CLEARFIL™ MAJESTY ESTHETIC

1679 Two-body Wear of Restorative Composite Materials

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Objectives: The aim of this in-vitro study was to investigate the two-body wear behaviour of different restorative composite materials as a function of magnitude of load and number of chewing cycles.

Methods: Specimens (n=8/material; d=8mm; thickness=2mm) of three composite materials (Clearfil Majesty, Kuraray, G; Gradia Direct Posterior, 3M Espe, G; Esthet X HD, Dentsply, USA) were fabricated (polymerization unit: Elipar S10, 3M Espe) and subjected to a pin-on-block wear simulation in a chewing simulator (f=1.6Hz; lateral movement: 1mm; mouth opening: 2mm; thermal cycling: 5/55°C, 2min/cycle), using steatite antagonists (d=3mm). Number of chewing cycles (40,000; 80,000; 120,000) and magnitude of load (50N; 100N; 150N) were varied. Wear depth and wear volume of the specimens were determined (Laserscan 3D, Willytec, G) and analysed statistically with one-way ANOVA and post-hoc Bonferroni test (α=0.05).

Results:

Material	Loading [N]	Chewing cycles (x1000)	Wear depth [µm] Mean±SD	Wear volume [10^8 µm^3] Mean±SD
Clearfil Majesty	50	40	91.5± 30.8	0.7±0.4
		80	115.3±29.2	1.3±0.4
		120	125.2±21.2	1.6±0.5
	100	120	148.5±40.6	2.1±0.4
	150	120	167.7±50.4	2.5±0.9
Gradia Direct Posterior	50	40	116.3±9.7	1.1±0.3
		80	153.1±14.8	2.1±0.3
		120	163.1±30.6	2.3±0.5
	100	120	243.4±64.1	4.0±2.0
	150	120	289.9±45.1	4.9±1.2
Esthet X HD	50	40	125.9±50.7	1.5±0.9
		80	128.0±40.3	2.1±1.1
		120	156.5±29.6	2.4±0.7
	100	120	201.2±23.4	3.4±1.1
	150	120	244.5±34.3	3.7±1.0

Significantly ($p<0.05$) higher wear depths and volumes compared to the initial results (50N/40,000 cycles) were observed if load was increased to 100 or 150N for 120,000 chewing cycles.

Conclusion:

The results of the wear tests revealed that wear depth and volume increased with magnitude of load and number of chewing cycles. Statistically significant differences were observed with simultaneous increasing of loading and number of cycles, however not for variations of chewing cycles at 50N. Wear of Clearfil Majesty was lower than for Esthet X HD and Gradia Direct Posterior.

CLEARFIL™ MAJESTY FLOW

(The brand name of Clearfil Majesty LV in the US Market is Clearfil Majesty Flow)

1112 Mechanical Strengths and Polymerization Shrinkage of Recent Flowable Resin Composites

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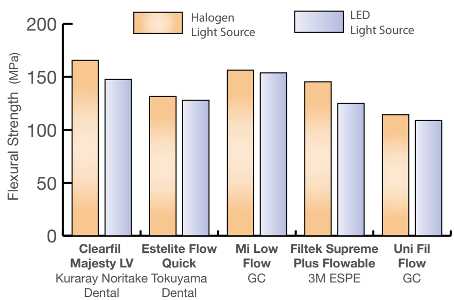
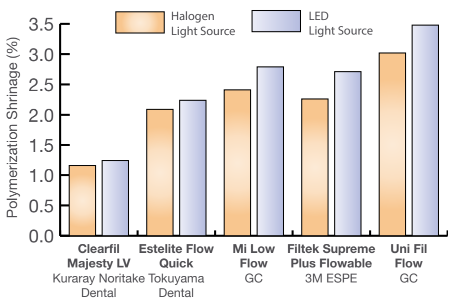
Objective: The purpose of this study was to examine the mechanical strengths and the polymerization shrinkage of recent flowable resin composites as compared with a previous flowable resin composite.

Method: Four recent flowable resin composite; Clearfil Majesty LV (CM, Kuraray Noritake Dental), Estelite Flow Quick (EF, Tokuyama Dental), Mi Low Flow (ML, GC) and Filtek Supreme Plus Flowable (SF, 3M ESPE), and one previous restorative; Uni Fil Flow (UF, GC) were used. Cylindrical specimens (ϕ4*8mm) for compressive strength test and beam specimens (2*2*25mm) for flexural strength test were prepared and cured with a halogen light source (HL, Optilux 501, Kerr) or a LED light source (LED, G-Light Prima, GC). All specimens were stored in a moisture box for 24 hrs at 37°C and then both mechanical strengths were measured (n=5). Each restorative was also filled into a translucent mold (ϕ4*8mm) and cured with HL or LED. Polymerization shrinkage was measured using a laser sensor for 180 sec (n=5). The data were analyzed using ANOVA and q-test.

Result: The mean values of compressive strengths with HL/LED were CM:327.4/283.5, EF:332.4/294.0, ML:279.2/250.7, SF:297.4/262.8 and UF:236.6/223.8 and the values of flexural strengths were CM:165.6/147.6, EF:131.5/128.0, ML:156.4/153.8, SF:145.3/125.0 and UF:114.19/108.91 in MPa. The mean values of polymerization shrinkage (%) with HL/LED were CM:1.16/1.24, EF:2.09/2.24, ML:2.41/2.79, SF:2.26/2.71 and UF:3.02/3.48. The mechanical strengths and the polymerization shrinkage were influenced by the differences in restoratives and light sources. The mechanical strengths of recent restoratives were significantly greater than that of UF, and the polymerization shrinkage of recent restoratives was statistically smaller than the value of UF. It seemed that those properties were due to the filler system and the reactivity of resin monomer.





Conclusion:

Mechanical strengths and polymerization shrinkage of recent flowable resin composites were improved sufficiently.

RESIN CEMENTS

PANAVIA™ SA CEMENT
PANAVIA™ F2.0
CLEARFIL™ ESTHETIC CEMENT EX

PANAVIA™ SA CEMENT, PANAVIA™ F2.0

2919 Short-term versus Long-term Shear Bond Strength of Different Luting Agents

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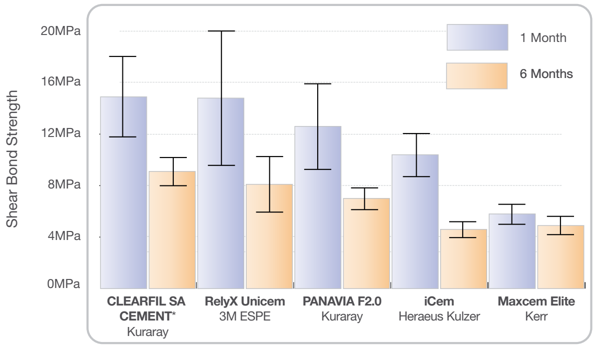
Objective: The aim of this study was to compare the short-term and long-term shear bond strength at the cement-restoration interface of different luting agents bonded to different restoration materials by using a newly developed testing procedure.

Method: Hollow cylinder-shaped specimens made from glass ceramic, Y-TZP zirconia and non-precious metal were used as restoration materials. A cylinder with smaller diameter was cemented into each specimen using one of the five luting agents according to the manufacturers´ instructions (Clearfil SA Cement **CSA** and Panavia F2.0 **PF**, Kuraray, Japan; Maxcem Elite **ME**, KerrHawe, Switzerland; iCem **iC**, Heraeus Kulzer, Germany; RelyX Unicem **RX**, 3M ESPE, Germany). The cemented specimens (n=10 for each restoration-cement-combination) were stored in distilled water (37°C) for 1 month (1M) and 6 months (6M) respectively. A universal testing machine (Z010, software: TestXpertII V3.0, Zwick/Roell, Germany) was used for testing and results were statistically analyzed (ANOVA, α=0.05, univariate, SPSS 20.0).

Result: Non-precious metal showed the significantly highest shear bond strength both after 1M (16,4 ± 6,0 MPa) and 6M (9,6 ± 4,5 MPa). Glass ceramic broke cohesively in all cases. CSA (1M: 14,9 ± 6,0 MPa / 6M: 9,1 ± 3,2 MPa), RX (1M: 14,8 ± 9,1 MPa/ 6M: 8,1 ± 5,4 MPa) and PF (1M: 12,6 ± 8,0 MPa/ 6M: 7,0 ± 2,8 MPa) showed higher values than iC (1M: 10,4 ± 4,5 MPa/ 6M: 4,6 ± 2,1 MPa) and ME (1M: 5,8 ± 2,6 MPa/ 6M: 4,9 ± 2,5 MPa). After 6M, the shear bond strength decreased significantly (except ME: no significant decrease) and the divergence in the measurement values decreased.



*Currently Known as **PANAVIA SA CEMENT**

Conclusion:

Short-term results for shear bond strength testing should be evaluated critically. The newly developed procedure for shear bond strength testing offers the major benefit of a real shear test largely without a component of tensile bond strength.

PANAVIA™ SA CEMENT, PANAVIA™ F2.0

2920 Long-term Tensile Bond Strength of Luting Agents at the Cement-Restoration-Interface

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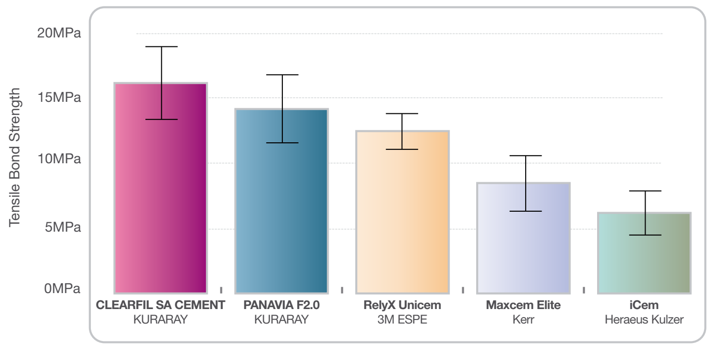
Objective: The aim of this study was to evaluate the tensile bond strength at the cement-restoration interface and analyze the fracture site after long-term storage of different luting agents bonded to restoration materials by using a newly developed testing procedure.

Method: As restoration materials, disc-shaped specimens made from glass ceramic, Y-TZP zirconia and non-precious metal were used. A cylinder with smaller diameter was cemented onto each specimen. The five luting agents (Clearfil SA Cement **CSA** and Panavia F2.0 **PF**, Kuraray, Japan; Maxcem Elite **ME**, KerrHawe, Switzerland; iCem **iC**, Heraeus Kulzer, Germany; RelyX Unicem **RX**, 3M ESPE, Germany) were used according to the manufacturers´ instructions. The cemented specimens (n=5 for each restoration-cement-combination) were stored for 6 months in distilled water (37°C). A universal testing machine (Z010, software: TestXpertII V3.0, Zwick/Roell, Germany) was used for testing and results were statistically analyzed (ANOVA, $\alpha=0.05$, univariate, SPSS 20.0).

Result: Debonding of samples during storage was noticed (ME/Y-TZP zirconia: 2/5, iC/Y-TZP zirconia: 2/5). In these cases, tensile bond strength was considered to be 0 MPa. Non-precious metal showed significantly higher values (14,8 ± 6,0 MPa) than Y-TZP zirconia (10,6 ± 8,1 MPa) and glass ceramic (9,1 ± 2,6 MPa). For CSA (16,2 ± 6,9 MPa), PF (14,2 ± 6,5 MPa) and RX (12,5 ± 3,9 MPa), tensile bond strength was significantly higher than for ME (8,5 ± 4,3 MPa) and iC (6,2 ± 4,6 MPa). Only in case of glass ceramic, the disc-shaped specimen itself broke in almost every case cohesively. Purely adhesive fractures could be detected for ME (2/15) and iC (6/15). In case of non-precious metal, purely cohesive failures within the cement could be detected (5/5) for ME, PF and SAC.



Conclusion:

The newly developed procedure offers the major benefit of a real tensile test largely without a component of shear bond strength.

PANAVIA™ F2.0

1068 Resin cements bonding to normal/caries-affected dentin with intrapulpal-pressure-simulation and/or thermocycling

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Objective: To evaluate the bond durability of different resin cements to normal (ND) and caries-affected dentin (CAD) under intrapulpal-pressure-simulation (IPPS) with/without thermocycling.

Method: Carious one-hundred-twenty molars were used. Occlusal enamel was cut and dentin substrates were differentiated using visual, tactile and dye permeability methods. Prepared crown segments were divided into three main groups (n=40) according to resin cements [resin cement with etch-and-rinse adhesive (Variolink II/Adper Scotch Bond MultiPurpose), resin cement with self-etch adhesive containing MDP (Panavia F2.0/ED primer II), or self-adhesive resin cement (RelyX Unicem)] used to bond fabricated resin composite blocks (Filtek Z250) that received mechanical and chemical surface treatments. Each main group was subdivided into two subgroups (n=20) according to whether IPPS was applied during bonding (P_1) or not (P_0). Each bonded crown segment was sectioned into sticks (1.0±0.01mm^2). Within each subgroup ND/CAD sticks were subdivided into two classes based on thermocycling (10,000cycles, 5°-55°C) was applied (T_1) or not (T_0). Sticks of each class (n=20) were then subjected to microtensile bond test. Data were statistically analyzed using three-way ANOVA with repeated measures and Bonferroni post-hoc test ($p<0.05$). Failure modes were determined using scanning electron microscope.

Results: Self-adhesive resin cement was the most sensitive resin cement to the tested conditions. It revealed similar bond to ND and CAD, however, the bond was significantly affected after P_1+T_1. There was significant difference between the bond values of Variolink II to ND and CAD with P_0 and T_1. Panavia F2.0 bonded equally to ND and CAD with all tested conditions. The most predominant modes of failure were adhesive and mixed ones.

Conclusion:

Self-adhesive resin cement bonding still cannot compete other resin cements. Etch-and-rinse resin cement is sensitive to dentin substrate and storage condition. Resin cement with Self-etch adhesive containing MDP is more reliable for maintaining bonding to ND/CAD even with the combination between IPPS and thermocycling.

CLEARFIL™ ESTHETIC CEMENT EX

2468 Shades of Resin Cements and Try-in Pastes on Ceramic Veneers

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Objectives: Color of cement layer may affect the esthetic result of definitive metal-free restorations. The purpose of this in vitro study was to evaluate the agreement between the color of resin cements and corresponding try-in pastes on ceramic veneers.

Methods: Ceramic disks (Vitablocs MarkII, A3 shade, thickness of 0.5 and 1.0 mm, VITA) were bonded to background material (Filtek Supreme Plus Restorative, A3 shade, thickness of 4.0mm, 3M ESPE) using two shades of two resin cement systems: Variolink II (VL, base/catalyst and try-in paste, shade: Yellow: Y and Brown: B, Ivoclar vivadent) and Clearfil Esthetic Cement (EC, paste and try-in paste, shade: Universal: U and Brown: B, Kuraray Noritake Dental). Color measurements were performed at placement of try-in pastes and resin cements with colorimeter (CR-400, Konica Minolta). Color difference (ΔE) was calculated and the data were statistically analyzed using Student's t-test (n=5).

Results: ΔE values for 0.5 mm thickness of ceramic veneers were VL-Y:1.12±0.53, VL-B:1.79±0.57, EC-U:0.99±0.32, EC-B:1.79±0.48, and for 1.0 mm thickness were VL-Y:1.18±0.32, VL-B:1.01±0.12, EC-U:1.62±0.79, EC-B:1.20±0.65. The 1.0 mm thickness group showed no significant difference in color change, however there was statistically significant in the 0.5mm thickness group ($p<0.05$). In spite of the presence of significant difference, the color change was considered to be within the clinically acceptable range ($\Delta E < 2.0$).

Conclusion:

Correspondence between the color of resin cements and try-in pastes is important factor to obtain good esthetic result clinically. Results of this in vitro study suggest that the color of resin cements and corresponding try-in pastes achieved high agreement.

CERAMICS

Noritake CZR

Noritake CZR

3054 Long-term Survival of Posterior Zirconia Crowns in Clinical Practice

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Objective: This retrospective survey study evaluated and compared the long-term clinical success of porcelain-fused-to-zirconia (PFZ) and conventional porcelain-fused-to-metal (PFM) crowns on posterior teeth in private practice.

Method: A total of 3355 premolar and molar crowns (2274 PFZ; 1081 PFM) fabricated by one dental laboratory (Cusp Dental Laboratory) were followed by the respective private practitioners (13 total; 6 General dentists and 7 Prosthodontists) using a print survey. In the PFZ group, one veneering porcelain (Noritake CZR, Kuraray Noritake Dental) was used in combination with three coping systems (Lava, 3M ESPE; Procera, Nobelbiocare; Katana, Kuraray Noritake Dental). The participating private practitioners were asked to indicate any post-cementation complications (i.e. crown/tooth failures, porcelain chipping, etc.), all of which were considered failures. Kaplan-Meier Survival Analysis was used for statistical analyses.

Result: Mean survival time was 7.4 years for both PFZ and PFM posterior crowns with a survival probability of 98.4% for PFZ and 99.3% for PFM crowns.

Conclusion:
Within the limitations of this restrospective survey, PFZ and PFM posterior crowns made in private practice and fabricated by one dental laboratory demonstrate very high survival times and survival probabilities with low complication rates.

KURARAY'S EXPERIMENTAL MATERIALS

New Desensitizer
Experimental Antibacterial Primer

New Desensitizer

3584 Dentinal Tubule Sealing Ability of hydroxyapatite forming desensitizer "CPD-100"

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Objectives: "CPD-100 (CPD)" is composed of tetracalcium phosphate (TTCP), dicalcium phosphate anhydrous (DCPA), inorganic basic accelerator, nanofiller and water was developed to form hydroxyapatite occluding dentinal tubules to treat dentinal hypersensitivity. The purpose of this study was to evaluate the durability of dentin tubule occlusion after treatment of CPD with a commercially available desensitizer in a simulated oral environment.

Methods: Bovine dentin disks (n=20, thickness:0.5 mm(±0.02 mm)) were treated with 3% EDTA for 30 seconds to expose dentinal tubules. CPD powder and liquid were mixed and applied for 30 seconds on 10 dentin disks with rubbing. The other disks were treated with Super Seal (SS, Phoenix Dental) according to the manufacture instructions. All samples were treated under pulpal pressure of 15 cm H_2O, and then half of the disks from each group were immersed in artificial saliva (AS) at 37°C for 3 days. The dentin permeability reduction (PR%) was evaluated by hydraulic conductance device and the morphology was observed by scanning electron microscopy (SEM).

Results: The PR% (n=5) data are shown in Table 1. The dentin PR% of CPD showed consistently high value throughout the experimental period. On the other hands the PR% of SS was significantly reduced 3 days after immersion in AS. SEM observation exhibited that the open dentin tubules were completely occluded immediately after application of CPD and SS, while no occlusion was found in SS after 3 days AS immersion.

Table 1. Permeability Reduction

	Permeability Reduction (%) (SD)	
	immediately after application	after 3 days AS immersion
CPD-100	78.1 (2.3)	72.8 (4.8)
Super Seal	80.7 (12.2)	-35.4 (10.8)

Conclusion:

"CPD-100" might exhibit reliable clinical performance superior to a commercially available desensitizer used in this study in terms of durability of dentin tubule occlusion by forming hydroxyapatite.

Experimental Antibacterial Primer

3563 Development of antibacterial resin-based root canal sealer containing MDPB

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Objectives: To develop a new resin-based root canal sealer with antibacterial effects, an experimental sealer, which consists of an experimental primer containing antimicrobial monomer 12-methacryloyloxydodecylpyridinium bromide (MDPB) and a Bis-GMA-based resin (SA cement, Kuraray Noritake Dental), was prepared. The purposes of this study were to investigate the antibacterial effects of the MDPB-containing primer using an infected root canal model, and assess the bonding and sealing abilities of the experimental sealer.

Methods: The root specimen sectioned from human extracted tooth and infected with Enterococcus faecalis SS497 was treated with the experimental primer containing 5% MDPB (EP), the control primer without MDPB (CP), or Epiphany primer (PENTRON, PP) and the viable bacterial number counted. The bonding ability of the experimental sealer was examined by interfacial morphological observation and measurement of microtensile bond strength to root canal dentin. Leakage tests using fluid filtration methods were performed and the results were compared with those of PP/Epiphany sealer.

Results: Significantly greater reduction in viable bacteria in the tooth model was obtained by EP than CP or PP (Fisher's PLSD test, $p < 0.05$). Application of EP after irrigation with 5% NaOCl resulted in 100% killing of infected bacteria in dentinal tubules. No gap formation between the experimental sealer and root canal dentin was observed. The experimental sealer demonstrated significantly greater bond strength (Student's t - test, $p < 0.05$) and smaller leakage after 1 and 4 weeks storage (Fisher's PLDS test, $p < 0.05$) compared with PP/Epiphany sealer.

Conclusion:

In addition to rapid killing effects against bacteria in dentinal tubules, the experimental sealer employing the MDPB-containing primer has high bonding and sealing abilities, which are expected to contribute to successful root canal treatment.

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