Class II Solution™

Study and case compilation

THE DENTAL
SOLUTIONS
COMPANY™

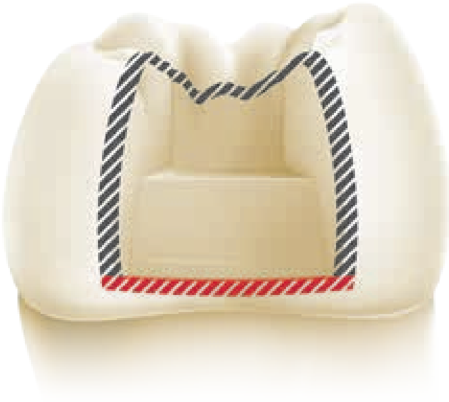
Dentsply
Sirona

Class II Solution™

45%
of direct restorations are Class II procedures.[1]

Challenges of a Class II filling

- Creation of a strong contact
- Avoidance of post-operative sensitivity
- Reliable adhesive bond
- Secure marginal adaptation
- Ideal light curing
- Efficient esthetics and polish
- Recurrent caries



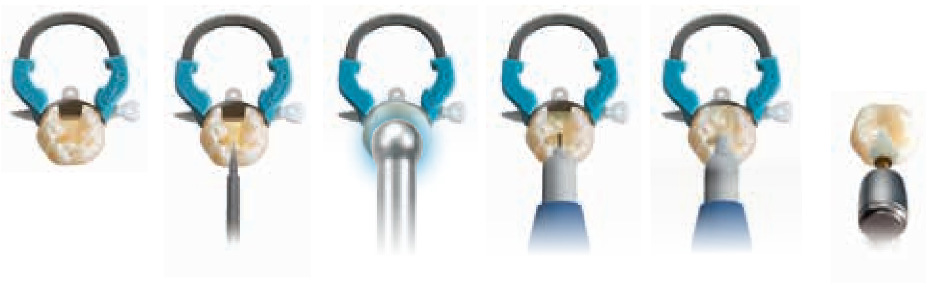
Recurrent caries is the main reason for composite fillings to fail. The floor of the proximal box is the most vulnerable interface, therefore ensuring success at this interface is critical to restoration success.

That's why Dentsply Sirona developed the Class II Solution™. It is a proven approach to achieving a reliable outcome, addressing key challenges with innovative product solutions at each step of the procedure.

With a solution for each step of the procedure, the Class II Solution™ provides you with tools to achieve procedure success and patient satisfaction.

[1] American Dental Association Procedure Recap Report (2006).

Content



Class II Clinical Case

Dr. Andre Reis
Sao Paulo, Brazil

Disto-occlusal Composite Resin Restoration

A 38 year old male patient presented a failed Class II DO composite restoration on a lower molar. After radiographic and clinical examination, the patient was anesthetized, and the old failed restoration, as well as the caries lesion, was removed. The Class II DO cavity restoration was performed using an optimized approach.

Before – fractured composite

After

Conclusion

This case study shows a typical situation where most dentists face three common issues: postoperative sensitivity, composite adaptation and contact point creation. In order to reduce the chance of postoperative sensitivity, the selective etching approach was used with a universal adhesive.

For perfect composite adaptation, the low polymerization stress, self-leveling, bulk-fill composite SDR®[1] was used. In addition, for perfect proximal contour and optimal creation of a tight contact point, the sectional matrix system Palodent® V3 was used.

Last, in order to create a nice occlusal anatomy and obtain a perfect shade match, a modern universal composite was applied.

The combination of all these dental materials from Dentsply Sirona allows easier, faster and predictable placement of Class II restorations.

Video

1 SDR® technology is included in several products such as SDR®, SureFil SDR® flow, SureFil SDR® flow+ and also the new SDR® flow+. It is self-levelling for excellent cavity adaptation, it enables dentists to bulk-fill up to 4 mm and exhibits extremely low polymerization stress.

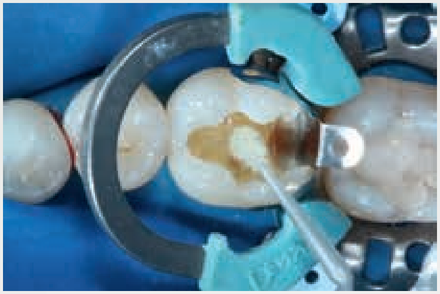
1. The old composite restoration and caries were removed. Note that the distobuccal cusp was also compromised.

2. The Palodent® V3 sectional matrix system was placed using the Universal Ni-Ti ring and the 6.5 mm matrix to prevent gaps in gingival-axial corner.

3. The hollow underside of the wedge allows placement of a second wedge from the opposite side for a tight gingival margin.

4. Enamel margins were selectively etched with phosphoric acid.

5. Note the chalky white appearance after rinsing off the phosphoric acid and air-drying.



6. Prime&Bond elect® was applied in the selective etching mode.

7. In one single increment of up to 4 mm, SDR®[1] was inserted to replace the dentin structure. Light activation was performed for 20 sec with SmartLite® Focus®.

8. Afterwards, TPH Spectra® (shade A1), was used for the occlusal surface. First, a composite increment was inserted for reconstruction of distal proximal ridge.

9. Appearance after placement of the composite. Note the characterization stains.

Palodent® V3
Sectional Matrix System

Prof. Dr. A. Lussi
Bern, Switzerland

Adjacent teeth damaged by dental bur

Objective
Cutting and finishing approximal preparations with conventional instrumentation and methods may produce iatrogenic damage in adjacent tooth surfaces which subsequently requires restoration. The objective of this investigation was to determine the occurrence of iatrogenic damage and whether, under everyday working conditions in dental practice, such damage could be reduced significantly by using an alternative method and instrumentation designed especially for the purpose.

Method
Dental practitioners were asked to take impressions of teeth scheduled for Class II amalgam restorations. One group (control) prepared the teeth with conventional rotary instrumentation (n = 71), while the test group used a new method and instrumentation (n = 63). These comprised a set of files, a right-angle handpiece with reduced stroke, 36 fixed (rotation-locked) positions for the files and a cylindrical bur with a recessed front-end cutting surface. Damage to the adjacent teeth was assessed under a stereomicroscope.

Results
Using conventional methods, all adjacent tooth surfaces showed damage, often exposing deep layers of dental tissues. There was a clinical and statistically significant reduction of incidence and severity of iatrogenic preparation trauma in the test group.

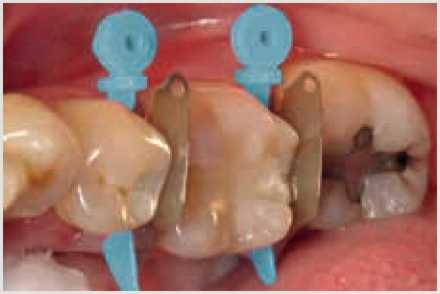
Conclusion
It appears that conventional approximal box preparation results in significant damage to adjacent tooth surfaces. With the system tested, damage to adjacent tooth surfaces during preparation of proximal boxes can be significantly reduced. This should have an impact on the subsequent rate of restoration for the adjacent surfaces.

Source: Iatrogenic damage to adjacent teeth during classical approximal box preparation (Lussi A, Gygax M, J Dent 1998; 26: 435-441).

[1] Palodent® Plus was re-branded to Palodent® V3 in 2015.

Palodent® V3 WedgeGuard – Clinical Examples

Prof. Dr. A. Lussi


Insert Palodent® V3[1] WedgeGuard before starting preparation

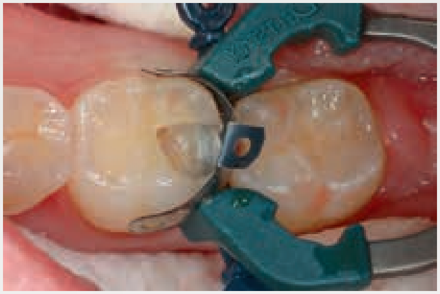

WedgeGuard protects adjacent tooth during preparation


Remove plate from WedgeGuard, wedge remains

Dr. N. Conte


Initial Case. Proximal caries on the distal area of the first lower molar.


Insertion of the Palodent® V3 WedgeGuard before tooth preparation.


Cavity preparation and the Palodent® V3 system in place.


Palodent® V3 WedgeGuard showing damage caused to the WedgeGuard (and not the adjacent tooth) after tooth preparation.

Predictable tight contacts with Palodent® V3

Dr. W. Dias

1. Matrix band is burnished with the round – ball end of the pin twizzer.

2. Matrix band is in place, providing a good seal at the margins. NiTi ring creates the necessary separation. All is ready for the restoration.

3. Final restoration with a very natural contact point.

Versatile Clinical Uses

Cusp missing. Ring still holds firmly. Provided by Dr. Dao.

MOD. Rings position allows full visibility in the cavity. Provided by Dr. Kurtzmann.

Stacked wedges in periodontal case. Provided by Dr. Hugenberg.

Back to back restoration. Provided by Dr. Dias.

Interactive rings and wedges. Provided by Dr. De La Peña.

Perfect marginal adaptation and proximal seal. Provided by Dr. Ayad Mouayad Al-Obaidi.

Prime&Bond active™
Universal Adhesive

Bond strength to dentin under variable moisture conditions

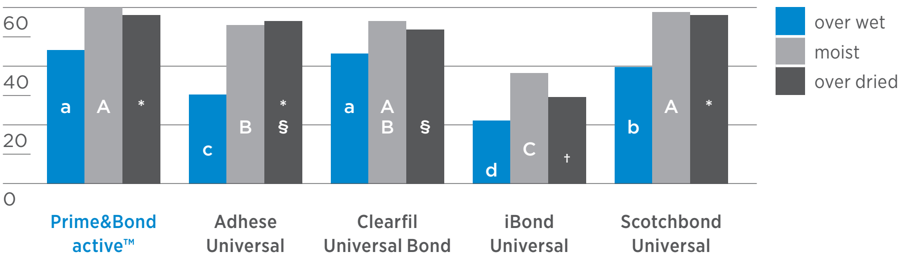
Prof. M. A. Latta
Omaha, USA

Objectives
Aim of the study was to compare the shear bond strength of various adhesives to differently moist dentin.

Method
Extracted human molars were mesiodistally cut in half, mounted and wet ground (4000 grit) to a flat dentin surface to standardize the smear layer. Dentin surfaces were conditioned according to the etch&rinse technique and divided into 15 groups of 15 specimens each. Dentin bonding was tested either under ideal conditions (i.e. moist dentin) or challenged by different degrees of moisture. Over dried dentin was achieved by thorough air drying for 10 s. Over wet dentin was simulated by application of 2.5 µL distilled water onto a 4 mm round area. After application and light-curing of the adhesives according to the direction for use, brass moulds were used to bond composite cylinders to the treated dentin. The composite was condensed and light-cured, followed by storing the specimens in water for 24 h at 37 °C. Shear bond strength was determined using a test machine at a crosshead speed of 1 mm/min. Statistical analysis was carried out at $p < 0.05$.

Results
There were significant differences among the adhesives. Under ideal moist conditions, Prime&Bond active™ was statistically equal in mean bond strength to Clearfil Universal and Scotchbond Universal. However, under suboptimal conditions, Clearfil Universal had significantly lower bond strengths on over dried dentin, while Scotchbond Universal was significantly more sensitive to over wet dentin.

Mean bond strength of adhesives in etch&rinse mode on differently moist dentin



Bars with different letters or symbols are statistically significantly diffferent.

Source: Shear bond strength to differently moist dentin, M. Latta, Omaha, USA, 2016.

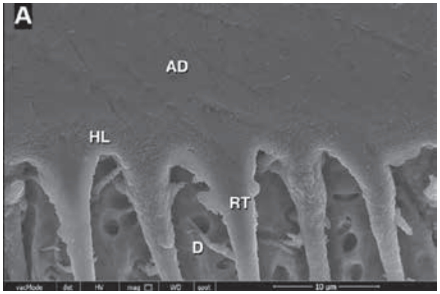
Dr. Andre Reis
Sao Paulo, Brazil

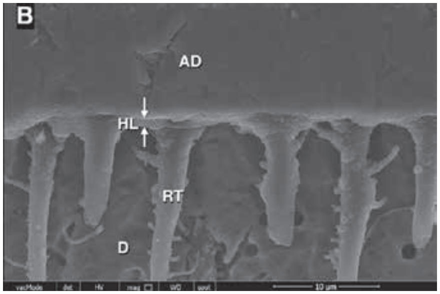
Hybrid layer on moist and over dried dentin

Objective
Incomplete infiltration and sealing of dentin is one of the critical conditions leading to post-operative sensitivity and poor bonding. In order to visualize the capability to properly wet and infiltrate dentin surfaces field emission scanning electron microscopy (FE-SEM) was applied to investigate the resin-dentin interface.

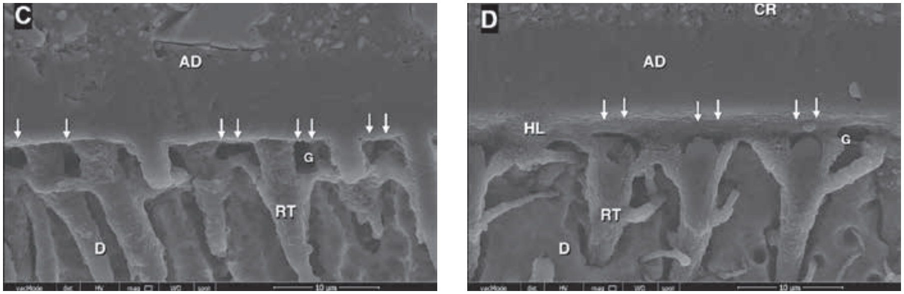
Method
The exposed dentin surface of 24 extracted human molars were ground (600 grit) flat in order to standardize the smear layer and divided into eight groups. Dentin was conditioned according to the etch&rinse technique, and dentin bonding was tested either under ideal moist conditions or after air drying for 10 s to simulate over dried dentin. After application of four different universal adhesives, the bonded surfaces were covered with a thin layer of SDR® composite. Adhesive and composite were light-cured separately. After 24 h of water storage, each specimen was cut into two resin-dentin slabs. For the FE-SEM analysis, the slabs were embedded in epoxy resin and deproteinized in sodium hypochlorite. Next, they were dehydrated in ascending concentrations of ethanol and sputter coated. Representative images of resin-dentin interfaces produced by the adhesives on moist and over dried dentin were recorded.

Representative FE-SEM images of resin-dentin interfaces produced by four adhesives applied on etch-and-rinse mode to over dried dentin. While Prime&Bond active™ produced a well-formed hybrid layer (A), the hybrid layer of Adhese Universal was considerably thinner (B). Arrows point defects and gaps within the resin-dentin interface produced by Futurabond U (C) and Scotchbond Universal (D). AD = adhesive layer, CR = composite resin, D = dentin, G = gap, HL = hybrid layer, RT = resin tag.





Source: Hybrid layer on moist and over dried dentin, Dr. A. Reis, Guarulhos University, Sao Paulo, Brazil, 2016.



Results

For moist dentin, a well- formed hybrid layer was observed for all universal adhesives tested. However, when the adhesives were applied to over dried dentin, remarkable differences were observed in comparison to interfaces produced on moist dentin. Defects, gaps and reduced hybrid layer thickness were observed when Adhese Universal, Futurabond U, and Scotchbond Universal were applied to over dried dentin.

Conclusion

The findings from the micro-morphological investigation of Prime&Bond active™ support the robust bond strength when dentin was over dried. Prime &Bond active™ does not seem to be sensitive to the degree of moisture, and presented well-formed hybrid layers when applied to either moist or over-dried dentin.

Dr. Andre Reis
Sao Paulo, Brazil

Film thickness

Objective

Light-curing the adhesive may interfere with the fit of indirect restorations. A thicker adhesive can tend to pool. On a radiograph, that pooling can be also mistaken for a void or secondary caries. Therefore, investigations on the film thickness were conducted.

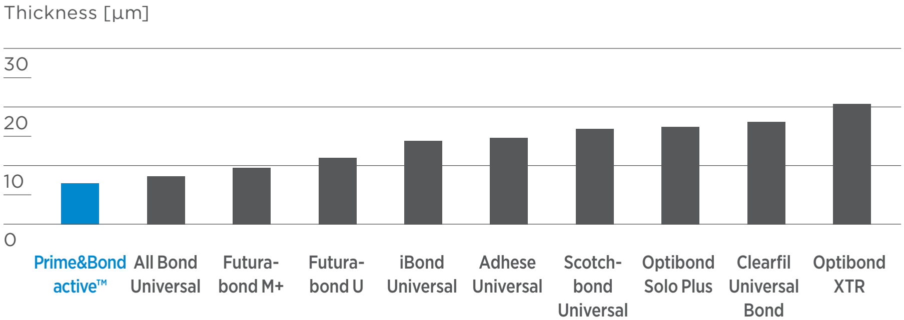
Method

The exposed dentin surface of 36 extracted human molars were ground (600 grit) flat in order to standardize the smear layer. After application of the adhesives according to the DFU, the bonded surfaces were covered with a thin layer of SDR® composite. Adhesive and composite were light-cured separately. Except for the etch&rinse adhesive Optibond Solo Plus, the adhesives were applied in the self-etch mode. After 24 h of water storage, the specimens were cut into resin-dentin slabs and embedded in epoxy resin. Next, they were dehydrated in ascending concentrations of ethanol and sputter coated. The film thickness of the adhesive layers was measured by means of FE-SEM, while the hybrid layer was not included in the measurements. For each adhesive, five images with three measurements on each image were evaluated using an image analysis software. Results were analyzed by parametric tests at $p < 0.05$.

Results

Prime&Bond active™ provides a lower film thickness than a number of other adhesives enabling separate light-curing of the adhesive layer without possible misfits of the seated restoration.

Mean values of film thickness for the tested adhesives



Source: Film thickness FE-SEM evaluation of resin-dentin interfaces produced by universal and etch-and-rinse adhesive systems, Dr. A. Reis, Guarulhos University, Sao Paulo, Brazil, 2016.

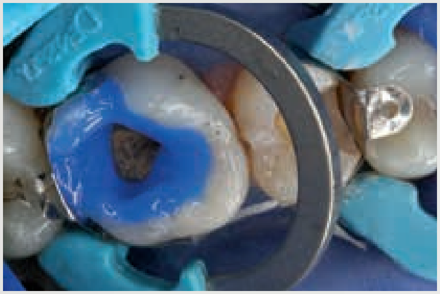
Prime&Bond active™ – Clinical and SEM examples

Dr. W. Dias

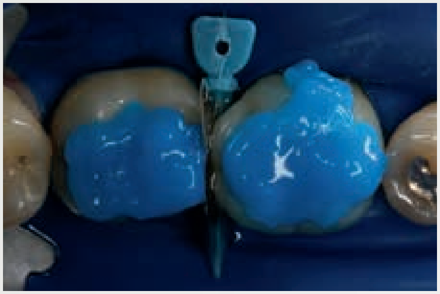
Application of Prime&Bond active™.

Uniform layer and low film thickness, no impact on final esthetics.

Prime&Bond active™ – Etching modes



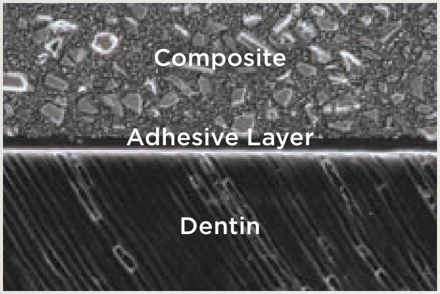
Selective etch technique.
Provided by Dr. Ostermeier.



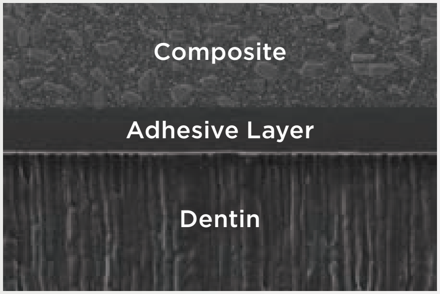
Total etch technique.
Provided by Dr. Dias.

Adhesive applied in self-etch mode.
Provided by Dr. Dias and Dr. Ruiz.

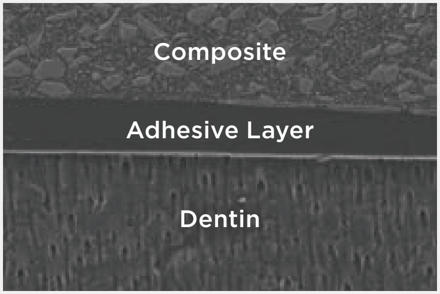
Low film thickness



Prime&Bond active™



Scotchbond™ Universal



Clearfil™ Universal

Source: “Film Thickness FE-SEM evaluation,” Andre F. Reis, DDS, MS, PhD.

SDR® flow+
Bulk Fill Flowable

5 year recall report

Prof. J. van Dijken
Umeå, Sweden

Posterior bulk-filled resin composite restorations: A 5-year randomized controlled clinical study

Objective
To evaluate in a randomized controlled study the 5-year clinical durability of a flowable resin composite bulk-fill technique in Class I and Class II restorations.

Method
In total, 86 patients with one or two pair similar Class I or II cavities received 200 composite restorations by two dentists. The SDR®[1] cavity of each pair was filled in bulks of 4 mm up to 2 mm short of the occlusal surface and covered with the hybrid composite Ceram·X® mono+. The other cavity was conventionally filled with Ceram·X® mono+ in 2 mm layers. The majority of the cavities were deep and had extended size. In all cavities, Xeno® V+ was applied as the adhesive. All restorations were in occlusion. The restorations were evaluated at baseline and then annually during 5 years.

Results
No post-operative sensitivity was reported. At 5 years, 183 restorations, 68 Class I and 115 Class II, restorations were evaluated. Ten restorations failed, 4 SDR® flow+ and 6 conventionally layered restorations, all of which were Class II. The main reason of failure was tooth fracture and secondary caries resulting in annual failure rates of 1.1% for SDR®[1] and 1.3% for conventionally layered restorations. No significant differences were observed between bulk-filled and conventionally layered composite restorations for the evaluated criteria at the recall ($p = 0.12$).

Conclusion
The stress decreasing flowable bulk-fill resin composite technique showed good durability during the 5 year follow-up.

Source: van Dijken JWV, Pallesen U. 2016: Posterior bulk-filled resin composite restorations: A 5-year randomized controlled clinical study; J Dent 2016 Aug; 51:29-35.

[1] SDR® technology is included in several products such as SDR®, SureFil SDR® flow, SureFil SDR® flow+ and also the new SDR® flow+. It is self-levelling for excellent cavity adaptation, it enables dentists to bulk-fill up to 4 mm and exhibits extremely low polymerization stress.

Acceptable ratings at the 5-year recall

Criteria	SDR®[1] bulk-fill procedure (n = 92)	Conventional layering procedure (n = 91)
Anatomical form	96.7%	94.5%
Marginal discoloration	100%	100%
Marginal adaptation	96.7%	95.6%
Color match	100%	98.8%
Surface roughness	100%	100%
Secondary caries	97.8%	97.8%

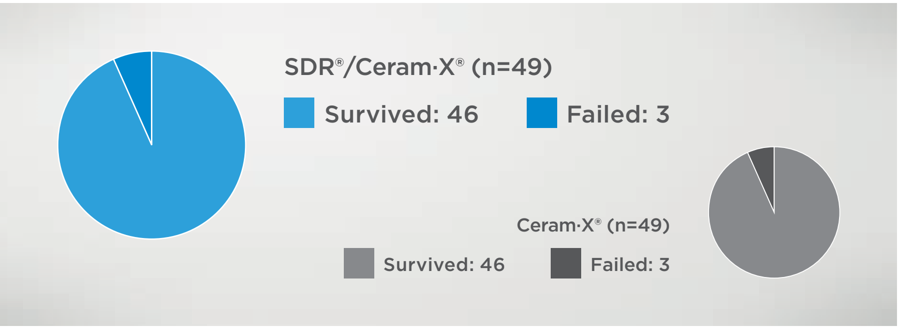
6 year recall report

In another study, a total of 98 Class I and Class II restorations were evaluated at recall. 49 restorations using SDR® and Ceram·X® in the bulk fill technique were intraindividually compared to the number using just Ceram·X® composite in the layering technique as described above.

- Clinically safe
- Highly acceptable clinical durability
- Clinical performance and failure rate was equivalent to conventional layering (3 restorations each)

The AFR (annual failure rate) observed belong to the lowest ones reported in Class II clinical follow ups with equal clinical design without patient selection.[1]

Prof. J. van Dijken
Umeå, Sweden



Source: van Dijken JWV, Pallesen U, 2017: Bulk-filled posterior resin restorations based on stress-decreasing resin technology: a randomized, controlled 6-year evaluation.; Eur J Oral Sci. 2017 Aug;125(4):303-309.

[1] Prof. J. van Dijken

Technical performance of SDR® bulk-fill technology: Low shrinkage stress

Prof. Dr. N. Ilie
Munich, Germany

Shrinkage stress of resin composites

Objective
Monomer development for a reduced shrinkage of composite materials still challenges the modern research. The purpose of this study was to analyze the shrinkage behavior of an innovative composite material for dental restorations based on a resin system that is claimed to control polymerization kinetics having incorporated a photoactive group within the resin.

Method
Shrinkage stress development within the first 300 s after photoinitiation was evaluated (n = 10). SDR®[1] was measured in comparison to regular methacrylate-based micro- (Esthet·X® Flow) and nano-hybrid flowable RBCs (Filtek Supreme Plus Flow). Additionally, the high viscosity counterparts of the two regular flowable methacryate-based composites (Esthet·X® HD and Filtek Supreme Plus) as well as a low shrinkage silorane-based micro-hybrid composite (Filtek Silorane) were considered. The curing time was 20 s (LED unit Freelight2, 3M-Espe, 1226 mW/cm²).

Results
SDR®[1] achieved the significantly lowest contraction stress (1.1 ± .01 MPa) followed by the silorane-based composite (3.6 ± .03 MPa), whereas the highest stress values were induced in the regular methacrylate-based flowable composites Esthet·X® Flow (5.3 ± .3 MPa) and Filtek Supreme Flow (6.5 ± .3 MPa). SDR®[1] achieved also the lowest shrinkage rate (maximum at 0.1 MPa/s). For all analysed materials, no significant difference in the micro-mechanical properties between top and bottom were found when measured on 2 mm thick increments 24 h after polymerization. The categories of flowable materials performed in the measured micro-mechanical properties significantly inferior when compared to the hybrid-composites, showing lower Vickers hardness (HV) and modulus of elasticity (E) and predominantly higher creep and plastic deformation. Within the flowable RBCs, SDR®[1] achieved the lowest Vickers hardness, the highest modulus of elasticity, the highest creep and showed the significantly lowest elastic deformation.

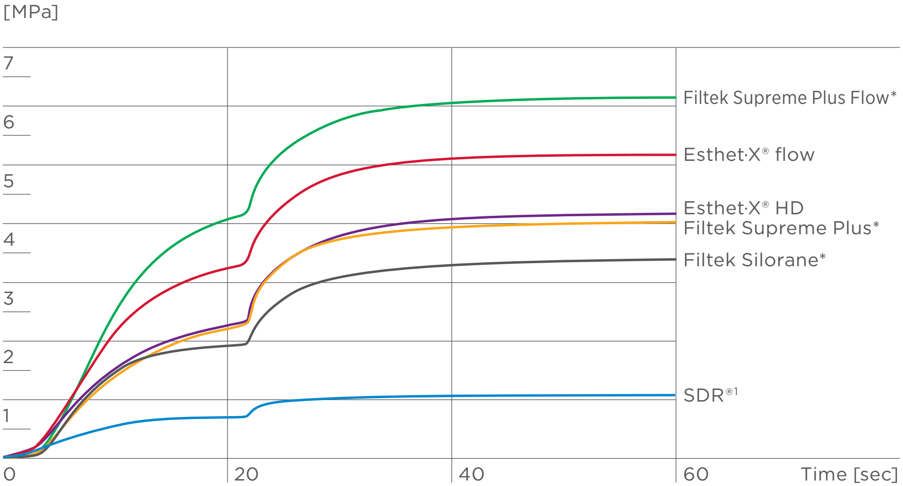
[1] SDR® technology is included in several products such as SDR®, SureFil SDR® flow, SureFil SDR® flow+ and also the new SDR® flow+. It is self-levelling for excellent cavity adaptation, it enables dentists to bulk-fill up to 4 mm and exhibits extremely low polymerization stress.

Conclusion

SDR®1 revealed the lowest shrinkage stress and shrinkage-rate values in comparison to regular methacrylate composites but intermediate micro-mechanical properties. Being at the same time more rigid (higher modulus of elasticity) and more plastic (low We/Wtot and high creep values) as the regular flowable materials, its effect on interfacial stress build-up cannot be easily predicted.

Shrinkage stress

Comparison of the shrinkage stress development (averaged curves, n = 10) as a function of time, for SDR®1 with controlled polymerization, the silorane-based microhybrid composite and four regular methacrylate-based composites.



Source: Investigations on a methacrylate-based flowable composite-based on the SDR® technology (Ilie N, Hickel R, Dental Materials 27 (2011), 348-355)

* Not registered trademarks of Dentsply Sirona, Inc.

Self-leveling of SDR® flow+

Dr. A. Reis

A universal adhesive system was applied in the selective etching mode.

After solvent evaporation, light curing was performed with SmartLite® Focus® curing light for 10 sec.

In one single increment of up to 4 mm, SDR® flow+ was inserted to replace dentin structure. Light-activation was performed for 20 sec with SmartLite® Focus®.

Bulk Fill Application & self-leveling

Dr. A. Reis and Dr. W. Dias

Application of SDR® flow+ on pulpal floor, after adhesive application.

SDR® flow+ can be applied up to 4 mm layers at the time.

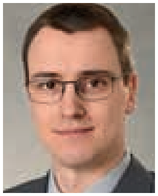
After the application of SDR® flow+, leave at least two millimeters of space for the capping composite material.

Walter Dias
Konstanz, Germany

ceram.x®
Universal Nano-Ceramic Restorative

Flexural strength

Prof. Dr. Ing. U. Lohbauer
Erlangen, Germany



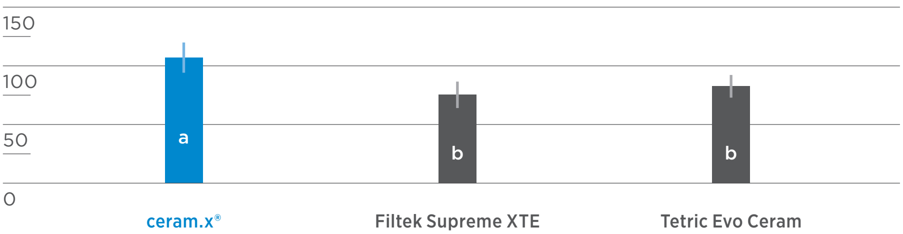
Dr. R. Belli
Erlangen, Germany

Objectives
The objective of this study was to investigate different composites regarding their flexural strength.

Method
Fifteen specimens (2 x 2 x 25 mm) were made following ISO 4049 and stored in distilled water at 37 °C for 14 days. Flexural strength was tested with a crosshead speed of 1 mm/min in a four-point bending test with 10 and 20 mm distance between the upper and lower support, respectively. Four-point bending allows challenging a larger portion of the bending beam compared to three-point bending described in the ISO 4049. Therefore, the resulting values are typically lower.

Results
High flexural strength is considered by international standards to be an important mechanical property for posterior restorations bearing occlusal stress.
Mean flexural strength of ceram.x® universal composite surpasses 100 MPa – the threshold for indirect restorations according to ISO 4049 – even under four-point bending.

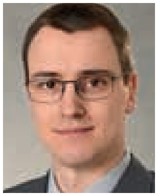
4-point bending test
Mean flexural strength [MPa]



Bars with different letters are statistically significantly different.

Source: Measurement of fracture toughness and fatigue resistance of 4 restorative materials, U. Lohbauer, R. Belli, 2015, University of Erlangen. In vitro study, report # 14.1524, 2015.

Prof. Dr. Ing. U. Lohbauer
Erlangen, Germany



Dr. R. Belli
Erlangen, Germany

Fracture toughness

Objective

Fracture toughness describes the resistance to catastrophic failure of an existing crack in a material. This study aims at evaluating the fracture toughness of three different composites.

Method

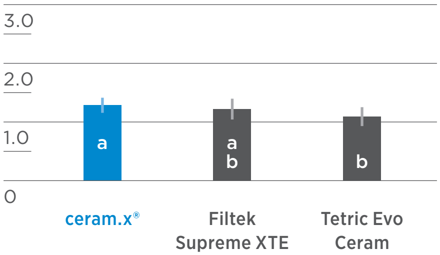
Fifteen specimens of three different composites were prepared in a mold with an integrated V-shaped notch and stored dry at 37 °C for 14 days. The notch was further sharpened using razor blades in a custome made device to control load and depth of sharpening. Specimens were loaded at a crosshead speed of 10 mm/min in a three-point bending test. The crack length was measured under light microscope.

Results

High fracture toughness is needed to resist propagation of cracks in the material and improves longevity of a restoration. ceram.x® universal composite shows a good fracture toughness comparable to other control materials.

Fracture toughness

Mean fracture toughness [MPa $m^{0.5}$]



Bars with different letters are statistically significantly different.

Source: Measurement of fracture toughness and fatigue resistance of 4 restorative materials: U. Lohbauer, R. Belli, 2015, University of Erlangen. In vitro study, report #14.1524, 2015.

Wear

Prof. M. A. Latta
Omaha, USA

Objective

Wear in the oral cavity is a multifactorial process. Besides abrasion during grinding movements different wear patterns are generated during forceful occlusal contacts. Furthermore, localized wear in the occlusal contact area (OCA) might be different from generalized wear induced by chewing the food bolus without direct contact to the antagonist. Therefore, we used the so called "Leinfelder Wear Machine" to test both situations – localized and generalized wear.

Method

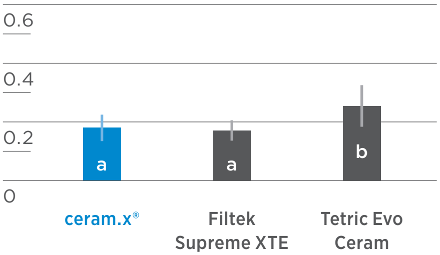
Two protocols were applied to test generalized and localized wear, respectively. Both protocols include loading the specimens for 400,000 cycles at 1 Hz with 80 N with a stylus that additionally rotates for 30°. To mimic the food bolus a slurry of about 44 micron acrylic glass beads surrounded the specimens in both protocols. To stimulate generalized wear, the stylus was pressed through the slurry onto the specimen without touching it. To simulate localized wear, a steel bearing was mounted to their stylus so that it contacted the specimens.

Results

Low loss of material is beneficial in occusal areas under chewing forces for a stable occlusion. ceram.x® universal composite showed very good resistance to generalized wear. Under the harsh conditions of localized wear ceram.x® universal composite showed very high resistance to loss of height resulting in a low depth of the wear facet.

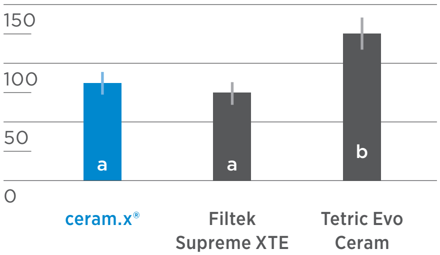
Volume loss under generalized wear

Mean volume loss [mm³]



Maximum depth of wear facet under localized wear

Mean maximum depth [µm]



Bars with different letters are statistically significantly different.

Source: A Laboratory evaluation of localized wear and generalized wear of dental restorative materials, Mark A. latta, Creighton university. 2015 Report #14.1523, 2015.

ceram.x® – Clinical challenge with advanced layering

Dr. Ayad Al-Obaidi

Initial case showing defective and leaking old amalgam restorations.

Rubber dam isolation, caries removal, tooth preparation and finishing of the margins with fine-grit diamond burs in slow speed.

Excellent proximal adaptation and contact area of Palodent® V3 matrix. Intimate contact and contour on the vestibular and palatal embrasure areas.

Modeling step by step. After SDR® flow+ application and proximal ridge build-up, ceram.x® universal composite is carefully placed using the oblique incremental technique.

Modeling step by step. Placement and modeling of the second increment (A2) on the mesial-vestibular cusp. This increment is cured for 20 seconds before the next step.

Modeling step by step. ceram.x® universal composite is carefully placed on the distal-vestibular cusp using the oblique incremental technique. 20 second cure.

Final basic anatomy and contour. Well defined pits and fissures as well as cusp ridges help prevent excessive occlusal adjustment. 20 second cure.

Advanced modeling for the enhancement natural anatomy and contour of the cusp morphology using ceram.x® universal composite BW (Bleach White).

Two-week recall. Final restoration and excellent gloss retention with ceram.x® universal composite A2 and BW giving the tooth back its lost anatomy and natural esthetic appearance.

Excellence in class II with SDR® flow+ and ceram.x®

Initial case showing defective and fractured old amalgam restoration.

Rubber dam isolation, caries removal, tooth preparation and finishing of the margins with fine-grit diamond burs in slow speed.

Excellent proximal adaptation and contact area of Palodent® V3 matrix. Intimate contact and contour on the vestibular and palatal embrasure areas.

Magnified view of the excellent proximal adaptation and contact area of Palodent® V3 matrix. The proximal contour may be enhanced with Teflon tape for additional compression effect.

In one single increment of up to 4 mm, SDR® was inserted to replace the dentin structure. Light activation was performed for 20 sec with SmartLite® Focus®.

Appearance after composite placement. Note the deep pits and fissures obtained and the robust proximal contact, with nearly no vestibular and palatal excess.

Occlusal view. Appearance after composite placement. Note the natural contour and engaging appearance obtained with Palodent® V3 and ceram.x® universal composite A2 and BW.

3-month recall. Occlusal-palatal view depicting excellent gloss retention. Note the characterization and natural appearance obtained with ceram.x® universal composite A2 and BW.

Dr. Ayad Al-Obaidi
Baghdad, Iraq

SmartLite® Focus®
Pen-Style LED Curing Light

Mr. C. Felix
Bluelight Analytics™,
Canada

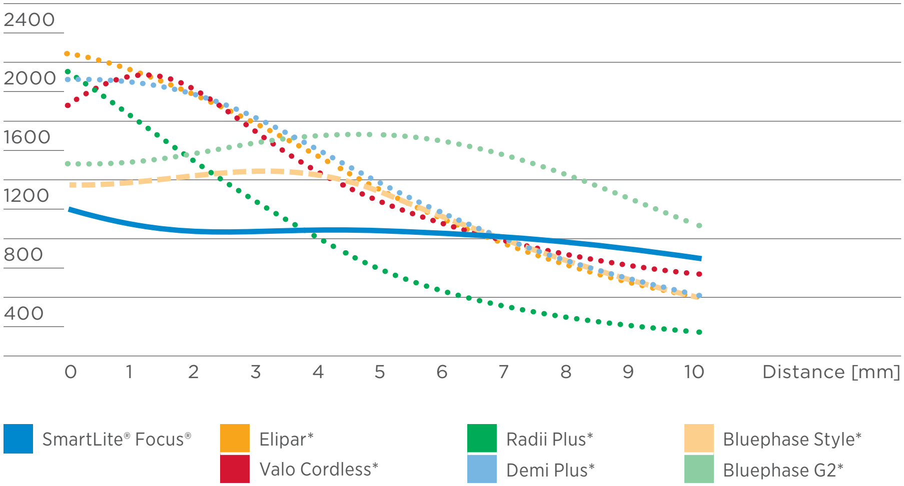
Irradiance over distance and curing efficiency

Typically, irradiance of curing lights is measured while the device is held as close to the photometer sensor as possible – “near-to-tip” irradiance. Due to different designs of the components influencing the overall optic performance (LED dome, reflector, lens, light guide), devices show completely different pattern when irradiance is measured over distance.

SmartLite® Focus® was optimized to allow a lower “near-to-tip” irradiance (measured at 0 mm distance) but to maintain high irradiance over distance – which is opposite to the behavior of a number of competitive lights. This is quite important to note as it stands in contrast to the current approach promoting curing devices via the “near-to-tip” irradiance.

Irradiance over distance[1]

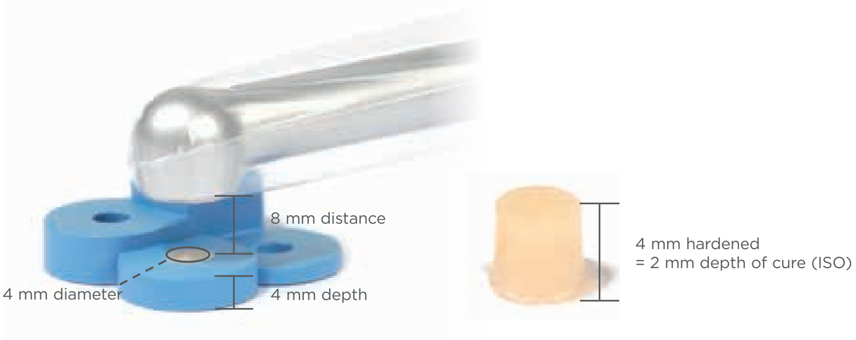
Irradiance [mW/cm²]

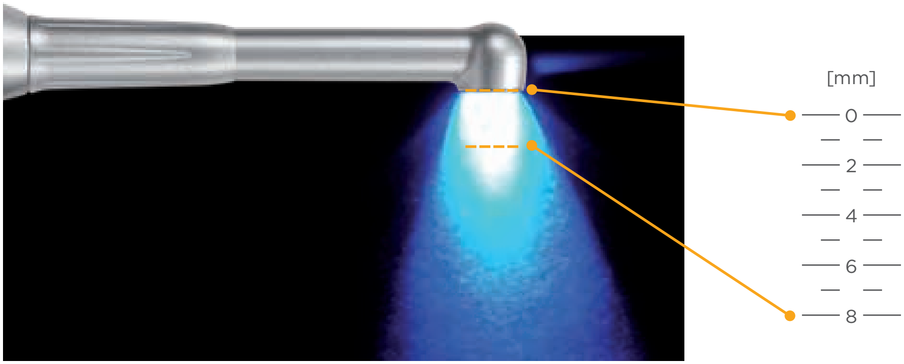


[1] Source: Report by Bluelight Anlaytics™ Inc., 2012.
[2] Source: Data on file.
* Not registered trademarks of Dentsply Sirona, Inc.

Measurements using SmartLite® Focus® at a distance of 8 mm confirmed a given exposure time/depth of cure combination as determined with the tip in direct contact to the specimen (according to ISO 4049). Thus, SmartLite® Focus® is more robust regarding vertical distance to the cavity.

Depth of cure at 8 mm distance[2]





Light beam remains focused even at a distance.

Mr. C. Felix
Bluelight Analytics™,
Canada

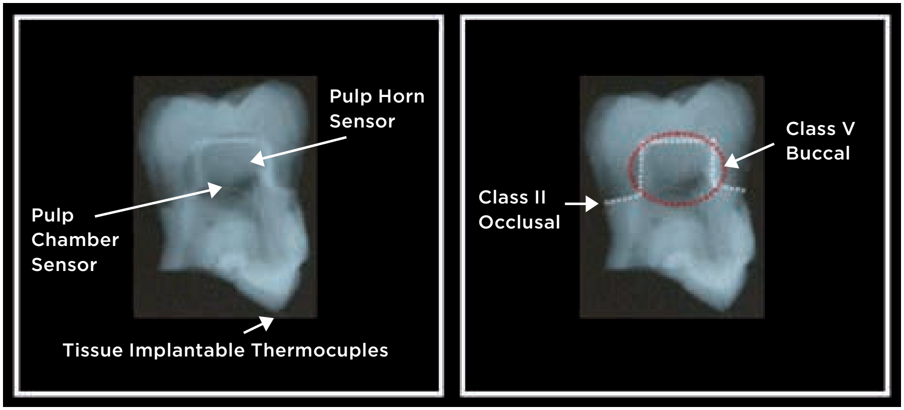
Pulp chamber temperature increase

As described in literature, temperature increase of 5.5 °C may induce permanent damage to pulp cells (Zach et. Al., 1965)[2]. Temperature increase was measured in two different constellations (class II and V) with two differently positioned sensors (pulp horn and pulp chamber). Radiographs illustrating the position and distance to the light tip are shown in Figure 1.

Temperature increase after 20 seconds light exposure at pulp horn sensor in class V is shown in Figure 2. The critical value of 5.5 °C temperature increase was reached by most of the tested curing lights. Therefore, caution should be taken especially when curing the adhesive layer in class V or deep class I and II cavities when using high power curing lights.

In this regard it is important to note that the typically given "near-to-tip" irradiance is not absolutely evenly distributed over the entire curing surface but represents the average value. At high resolution, irradiance as high as almost 6000 mW/cm² could be measured as shown in Figure 3.

Fig. 1: Placement of sensors and distance to surface[1]



Distance to tip [mm]	Pulp Horn	Pulp Chamber
Occlusal Class II	4	5
Buccal Class V	2	5

[1] Source: Report by Bluelight Analytics™ Inc, 2012.
[2] Source: Pulp response to externally applied heat (Zach L, Cohen G. Oral Surg Oral Med Oral Pathol. 1965 Apr;19:515-30).
* Not registered trademarks of Dentsply Sirona, Inc.

Fig. 2: Temperature increase in Class V[1]

[°C]

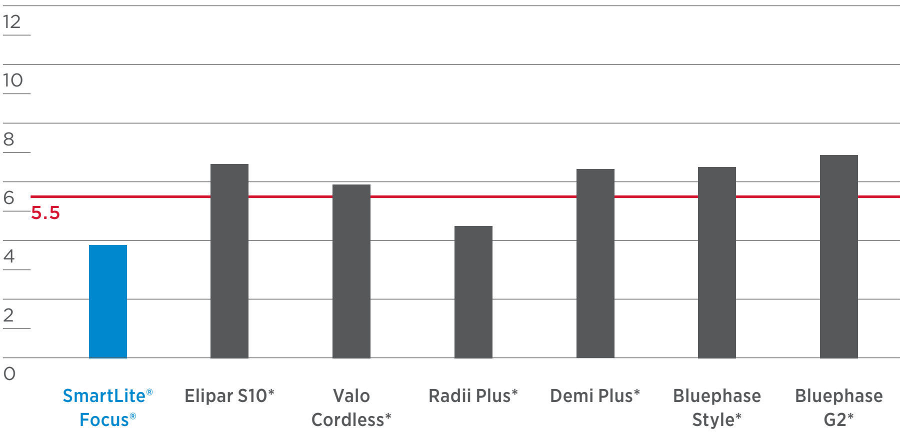
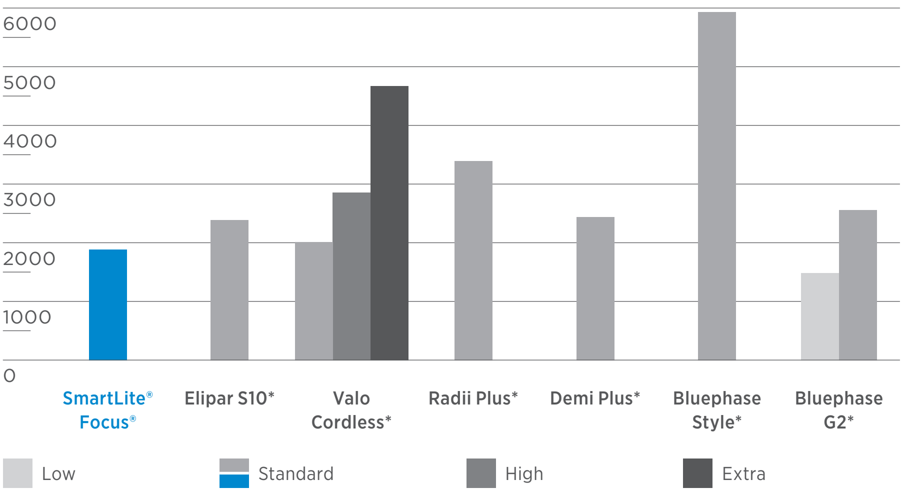


Fig 3: Maximum irradiance at 0 mm distance at high resolution[1]

[mW/cm²]



[1] Source: Report by Bluelight Analytics™ Inc, 2012.

[2] Source: Pulp response to externally applied heat (Zach L, Cohen G. Oral Surg Oral Med Oral Pathol. 1965 Apr;19:515-30).

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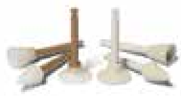
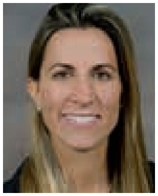
Enhance® Finishing System

Enhance® PoGo® Polishing System





Prof. J. Da Costa
Portland, OR

Finishing and Polishing - System Comparison

Objective

Determine the time (amount of finishing/polishing-F/P) necessary to create the maximum gloss possible in a system approach – ceram.x® universal composite/Enhance® F/P system and Filtek Supreme XTE with Sof-Lex discs.

Method

Rectangular-shaped composite specimens (n = 5; W = 5.0 mm, L = 12 mm, 2.5 mm thick) were made and abraded by one or two passes on #600 silicon carbide paper to produce a standard surface. Within 10 minutes of the lightcuring cycle, the specimens were finished and polished by one experienced clinician (JD). Gloss was measured in intervals of 20 seconds until there was no real improvement in gloss.

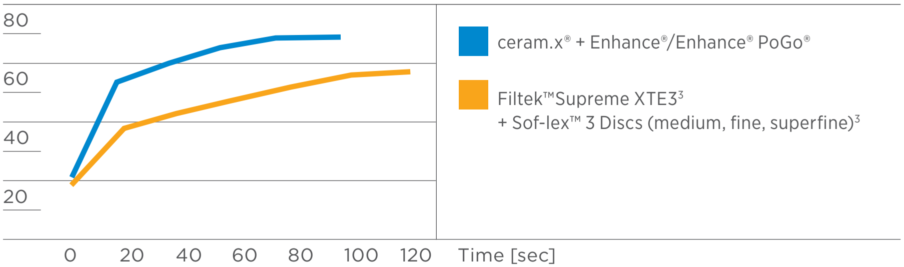
Results

Using Enhance for finishing and Enhance® PoGo® for polishing ceram.x® universal resulted in higher gloss in a shorter time compared to using Sof-Lex medium to superfine discs on Filtek Supreme XTE. One step of polishing ceram.x® universal composite with Enhance® PoGo® resulted in gloss above the 40 GU (Gloss Unit) level whereas two steps with Sof-Lex fine and superfine discs on Filtek Supreme XTE were needed to reach this level, reportedly being considered as clinical acceptable gloss.[1]

After achieving a natural looking finish with Enhance®, create a high-end luster with the Enhance® PoGo® diamond polishing system.

Maximum gloss per system[2]

[Gloss Unit]



Source:
Evaluation of time to achieve high and maximum gloss and gloss retention for various dental composite/polishing system combinations. DA Costa J, Ferracane JL. In vitro study, report #14.1543, 2016.

[1] ADA professional product review (2010). Polishing systems. 5(1) 2-16.
[2] Da Costa J, Ferracane JL (OHSU, Portland, OR)
[3] Not a registered trademark of Dentsply Sirona, Inc.

Finishing and polishing with Enhance® and Enhance® PoGo®

Dr. A. Ferrando


Initial case.


After restoration placement, contouring and finishing is done using Enhance® mini cups.


After restoration placement, contouring and finishing is done using Enhance® mini points.


Final result.


Enhance® mini

Dr. W. Dias


Class II DO restoration with ceram.x® universal composite after finishing with Enhance®.


Enhance® PoGo®


Class II DO restoration with ceram.x® universal, final result after polishing with Enhance® PoGo®.

Marginal elevation with ceram.x® and SDR® flow+

Dr. W. Dias and Dr. E. Taviloglu

In cases where the gingival floor of the proximal box is subgingival, a marginal elevation procedure may be accomplished with SDR® flow+. After marginal elevation, rubber dam is applied and a class II restoration is placed with a class II solution technique.

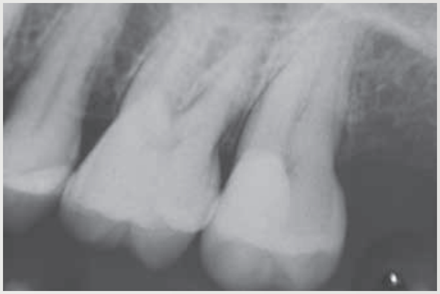
Initial case.

Under partial isolation, insertion of proximal matrix, adhesive application in self-etching mode, SDR® flow+ application. For extreme sub-gingival cases, the AutoMatrix® system can be used.

Final results after light-curing and removal of the Palodent® V3 sectional matrix.

Rubber dam isolation.

Final results after the class II solution application.



Radiographic control, notice excellent marginal adaptation, seamless transition from SDR® flow+ to ceram.x® universal composite and lack of air-bubble entrapment.

Engin Taviloglu
Istanbul, Turkey

The Class II Solution™

Dr. W. Dias and Dr. A. Ferrando

Before

After

Alvaro Ferrando
Murcia, Spain

Class II MO restoration on first upper molar with ceram.x® universal composite. Provided by Dr. A. Al-Obaidi.

For more information visit www.dentsplysirona.com.

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