



Your practice is *our* inspiration.™

Guide to Cementation

Clinical Guide





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sē'měn-tā'shən

The act or process of attaching by means of cement

Marika Nemeth

In dentistry we have been using different forms of cements for as long as there have been restorations needing to be fixed permanently to tooth structure. Over the past decades there has been a huge barrage of cementation products available to dentists. Also specializing for use in different fields of dentistry; restorative, orthodontic, endodontic, surgery, implant, etc. Thus making the task of choosing which type of cement to use, how to use it, AND for which indication very confusing. In recent years there has been an influx of prosthetic restorative materials to choose from. Choices ranging from traditional PFM, All Ceramic, Zirconia, Indirect Composite resin and CAD-CAM milled products have become the standard options.

Today's dental practice can vary from a single operator working from one chair in Nanaimo to a multi-associate group practice in Zürich. All have the expectation of receiving the highest quality in products to give to their patients. With so many different types of procedures and clinical decisions to be made, clearly one type of cement and/or luting product cannot satisfy all situations. Therefore it is imperative that dentists have many types of cements available in their practice.

We at Kerr hope you will enjoy reading our guide. We strive to deliver to you the highest quality in all our products that you use everyday.

Your practice is *our* inspiration!



Cementation in Dentistry

Inspired by...

“Ideally, dental cements should adhere to tooth structure as well as restorative materials. They should exhibit the following characteristics:

- resist functional forces
- be insoluble in oral fluids
- be effective while maintaining a low film thickness
- be compatible with pulp tissue
- exhibit anticariogenic properties
- be easy to manipulate and clean up

To date no one cement has achieved all of these properties together, but the current offering of resin cements demonstrate high strength, relatively low solubility, self or dual cure functions; reduced or eliminated post-op sensitivity, and relative ease of handling. Kerr dental cements have been a part of my daily practice for over 25 years”

Dr. Isaac Novak



STEP	PRODUCT	KERR PRODUCTS	
Impression for study models	Impression Material	Take 1 Alginate Alginot FS	 Take 1 Alginate  Alginot FS
Pour up of models	Stones and Plasters	Snow White Plaster type 2 Orthodontic Model Mix Stone Hydrocal Denture Model Stone	
Impression for Temporization	Impression Material	Alginot FS Take1 Alginate	 Alginot FS  Take 1 Alginate

STEP

PRODUCT

KERR PRODUCTS

Tooth Preparation

Burs

Beavers Carbide Jet Burs

BlueWhite Diamond Burs



Beavers Carbide Jet Bur



BlueWhite Diamond Bur

Final Impression

Impression Material

Take 1 Advanced



Options: Delivery, viscosity and set time

	LB* Wash Flowable, highly flexible and hydrophilic	RB* Wash Highly thixotropic with incredible tear strength	Med/Mono* The perfect balance between flow and body	HB* Tray Outstanding dimensional stability and elasticity	Putty Ultra-high viscosity for extra mechanical compression
Unidose® Kerr's unique Unidose delivery offers dual benefits: targeted syringe delivery and the elimination of cross-contamination concerns	Super Fast Fast Set Regular Set	Super Fast Fast Set Regular Set			
Cartridge Convenient 50 ml cartridges make mixing & application of Take 1 Advanced precise and easy	Super Fast Fast Set Regular Set	Super Fast Fast Set Regular Set	Super Fast Fast Set Regular Set	Super Fast Fast Set Regular Set	
Volume For busy offices, Take 1 Advanced Volume delivery speeds up impression taking, reduces hand fatigue and lowers cost per use				Fast Set Regular Set	Regular Set
Hand Mix For instances when a higher viscosity tray material is desired and other mixing methods are unavailable					Regular Set

*LB = Light Body, RB = Regular Body, Med/Mon = Medium/Monophase, HB = Heavy Body

STEP	PRODUCT	KERR PRODUCTS	
Check Clearance	Clearance Measurement	Flex Tab	
Bite Registration	Impression Material	Take 1 Advanced Bite Registration	
Temporary Crown & Bridge fabrication	Temporization Material	FILL-IN Temphase	
Temporary Crown & Bridge cementation	Temporary Cements	TempBond	

Temporary
Cement removal

Rotary
Instruments

OptiClean



Veneers Step:
Isolate Preps

Plastic
Interproximal
Strips

Hawe Striproll

Hawe Transparent Strips



Permanent
Cementation of
Crown & Bridge

Permanent
Cements

Maxcem Elite

NX3



Finishing
& Polishing

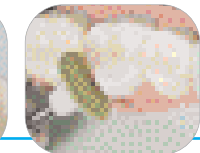
Interproximal
Finishing Strips

OptiStrip



Polishers

Identoflex Porcelain / Ceramic Polishers
Identoflex Diamond Ceramic Polishers



Mechanical & Physical Properties...



...what are they and why are they so important in cementation?

“all mechanical properties are measures of the resistance of a material to a deformation/fracture under an applied force”

A dental prosthesis is designed with multiple functions in mind. It is a man made object that is replacing natural teeth lost for any number of reasons. It needs to be esthetically pleasing for the patient, provide protection of underlying teeth, fit into the existing dynamics of the mouth and occlusion, AND be strong enough to last years, resisting the forces of mastication. Given the fact that in normal biting and chewing the average biting force is 170 pounds, it's a small miracle that from a dentist's impression, a dental technician is able to fabricate a piece of functional art so precise!

Mechanical Properties

Compressive Strength

The maximum stress a material can withstand when subjected to compression.

* A high compressive strength means the cement can better resist the compressive stress or chewing force.

Tensile Strength

The maximum stress a material can withstand when subjected to tension.

* A high tensile strength means the cement can better resist the tensile stress (e.g. experienced when you chew sticky food).

Bond Strength

Force, normalized with bonding area, required to separate two materials bonded together with an adhesive.

* A high bond strength will result in a long and lasting restoration.

Shear Bond Strength

Shear force, normalized with bonding area, required to separate two materials bonded together with an adhesive

* A high shear bond strength will result in a long and lasting restoration.

Elastic Modulus

A measure of rigidity of the material.

* Its importance is unknown for a cement. Basically you do not want a cement that is too soft as it will not adequately support the restoration under stress.

Flexural Strength

The maximum stress a material can withstand when subjected to bending.

* A high flexural strength means the cement can better resist the bending stress when the tooth is flexed.

Physical Properties

Film Thickness

The thickness of a cement under certain pressure.

* If the film thickness is too large, it will interfere with the seating of the restoration.

Solubility

The amount of material soluble in water after the cured cement is soaked in water for 7 days.

* If the solubility is too high, it will weaken the cured cement and cause marginal ditching.

Setting Time

Setting time is the time (from the start of mixing) when the mixed material is fully hardened.

* Once the cement is set, the cement will be strong enough to withstand the forces of finishing/polishing.

pH

is a measure of the acidity or basicity of a solution/material.

* If the pH of the cured material is too low (or acidity too high), the bond may not be durable as the cement may undergo degradation.

Radiopacity

Measures the capacity of a material to absorb x-ray.

* A high radiopacity for a cement will allow it to show when examined with x-ray so that it will not be mistaken as gap or void.

Eugene Qian, Ph. D.

Principle Scientist, Dental Materials Center, Kerr Corporation

Temporary Cementation

Inspired by...

TempBond has been a staple in my practice since the start of my dental career. It is easy to use, has sufficient strength over a relatively short period of time to withstand mastication and keep temporary crowns and bridges in place while the eugenol base soothes pulpal tissue. For patients allergic to eugenol the TempBond NE version is equally effective. If a concern arises because a restoration's bonding ability may be affected by eugenol, the TempBond Clear is a great choice. With availability in automix syringe delivery, the convenience of this product takes a seat, second to none.

Dr. Isaac Novak



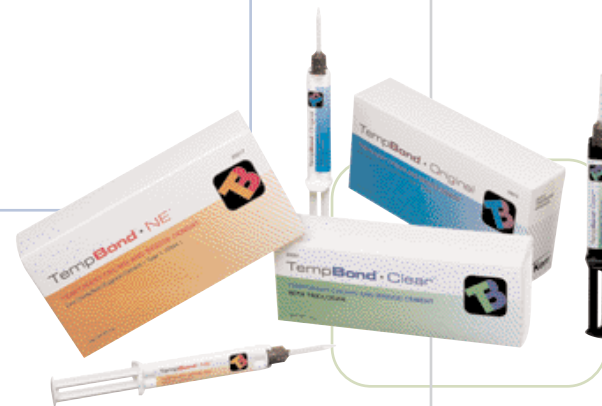
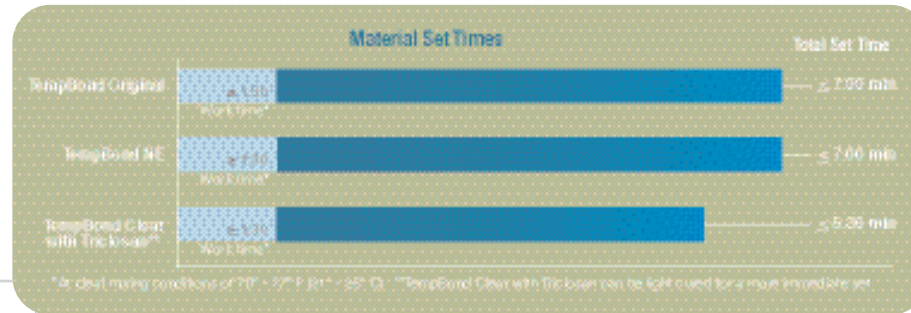
TempBond™

Temporary Cement

TempBond™ temporary cement for trial restorations or temporary crowns and bridges withstands mastication, seals the restoration and prevents seepage, yet is easy to remove. Non-eugenol TempBond NE™ will not inhibit the polymerization of permanent resin cements and acrylic temporaries. And resin-based TempBond Clear™ with Triclosan is the most translucent provisional cement in the market for superior esthetics.

Features

- **Delivery choices.** Unidose®, tubes and new automix syringe offer flexibility in delivery options.
- **Flows and mixes easily.** Delivers optimal consistency for solid, complete seating of restorations.
- **High bond strength.** Heightens patient confidence. Prevents leakage and sensitivity to cold and heat.
- **Easy to remove.** Enhances patient comfort. Minimizes potential for damage to the prep or temporary.



Case courtesy of Dr. Tony Soileau

Research

TempBond was developed in 1961 based on zinc oxide-eugenol chemistry, a classic setting reaction with over 100 years of clinical history. Then in 1989, Kerr introduced TempBond NE with eugenol-free zinc oxide, substituting carboxylic acids in place of eugenol. And TempBond Clear with Triclosan incorporates a unique redox initiator system and low refractive index fillers for excellent color stability and high translucency.

Clinically proven performance you trust

Permanent Cementation

Inspired by...

Zirconium-based porcelain crowns represent an alternative restorative material that enhances the dentist's and technician's ability to provide durable, aesthetic and functional restorations in the anterior or posterior region of the mouth especially when metal-free restorations are a primary desire of the patient. I recently used Maxcem Elite to cement Lava® crowns for a patient. Excess cement was easily removed from the margins and accomplished within a short amount of time before final curing with the DEMI curing light for 10 seconds. No finishing of the cement was necessary along the margins.

Dr. Ara Nazarian



Maxcem Elite™ in Clinical Cases

Zirconia Crowns, Teeth 17-27

Patient case pictures courtesy of Dr. Ara Nazarian



Patient's original smile



Patient's original restorations with fracture lines and failing margins



Patient's teeth prepped with Expasyl for gingival retraction before taking impressions



Cementing Lava® crown using Maxcem Elite



Final zirconia restorations seated using Maxcem Elite



Patient pleased with final results of her smile

All trademarks are property of their respective owners.

Maxcem Elite Review

Now is a great time to practice aesthetic and cosmetic restorative dentistry. Today, unlike ever before, clinicians and technicians have a variety of indirect restorative materials from which to choose in order to quickly, easily and predictably restore a patient's smile.

Traditionally, porcelain-fused-to-metal restorations have been placed when strength and durability in the posterior region were required, and/or in the anterior region when complete isolation from moisture could not be achieved, thereby eliminating all-ceramic restorative possibilities. Esthetically, all-ceramic restorations have been this author's ideal choice for aesthetics, but problems of sensitivity have developed because of errors that can occur during the multiple steps required for bonding, especially when placing several units of restorations at one seating.

Single component; Self-etch resin cement system

Dr. Ara Nazarian

Fortunately, Maxcem™ Elite by Kerr is a single component; self etch resin cement system that eliminates multiple steps when bonding indirect restorations. Clinicians have everything they need for etching, priming and bonding in one syringe. Maxcem™ Elite bonds tenaciously to all dental substrates while maintaining excellent mechanical and esthetic properties. The cement is conveniently dispensed directly into the restoration or cavity preparation using a dual auto mix syringe. Optional curved tips are also available for inlay/onlays and post placement applications. No more 90-second wait before tack curing, no hand mixing and no refrigeration required. Using the amine free chemistry similar to its cousin NX3, Maxcem™ Elite has superior color stability enabling its use under esthetic restorations anywhere in the mouth. So whether you decide to use this cement for zirconia, all ceramic, indirect composite, or even porcelain to metal restorations, the process is as easy as 123!

According to the manufacturer, some features and benefits include the following:

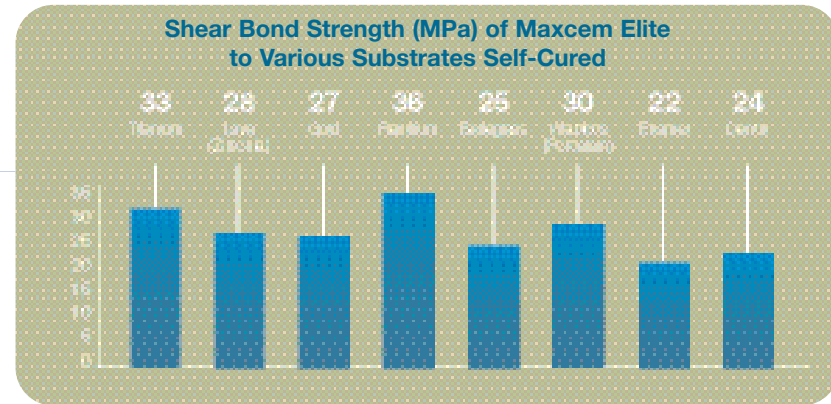
Features

- High bond strength and compatibility to common dental substrates
- Ability to tack-cure immediately
- Ease of use
- Applicable for common indirect restorations
- Patented Redox System

Benefits

- High bond strength without adhesive needed
- Saves time at patient chair side
- No need to refrigerate
- Easy clean-up
- No hand mixing required
- Anterior, posterior / ceramics, PFMs and CAD/CAM materials
- Color stability, esthetic, works with all substrates from opaque to translucent

Depending on the substrates, bond strengths have been recorded between 22-36 MPa. When combined with OptiBond® All-In-One, Kerr's research team found dentin and enamel bond strength of Maxcem™ Elite to be 35MPa and 30MPa, respectively. When combined with OptiBond Solo™ Plus, Kerr's research team found dentin and enamel bond strength of Maxcem™ Elite to be 35MPa and 33MPa, respectively. The following chart illustrates these different levels.



24-hour testing. Internal data. Available upon request.

As dentists, we are always looking for something that is quick and simple to use yet very effective. Maxcem™ Elite is indeed an enhanced and better version of the traditional Maxcem™ cement; one of the first to introduce the self etch resin cements to the dental profession. Now with increased bond strengths and the ability to spot tack, Maxcem™ Elite will prove to be a new enhanced leader in the field.



Maxcem Elite™

Maxcem Elite self-etch, self-adhesive resin cement for indirect restorations

Maxcem Elite™ is Kerr's newest innovation in the self-adhesive cement space. The market, while continuing to embrace the technology of this relatively new category, still harbors concerns about the bonding capabilities of cements that bypass the bonding step. Maxcem Elite is formulated to ease this concern by taking the science behind self-adhesive cements and evolving the chemistry to ultimately provide bond strengths and superb esthetics that surpass competitive claims.



Superior Bond Strengths and Compatibility To All Common Dental Substrates

Maxcem Elite is indicated for cementation of anterior or posterior composites, ceramics, PFMs and metal restorations, CAD/CAM materials, zirconia-based restorations, posts, and cementing crowns to implants. Maxcem Elite's enhanced bond strengths are achieved as follows:

- Optimized amount of GPDM and other adhesive monomers to improve wettability.
- Modified resin matrix system to reduce surface tension to etch more effectively, hence eliminating the 90-second wait of previous generation of Maxcem, in addition to enhancing shelf life so no refrigeration is needed.
- Re-designed filler system to promote a more intimate contact with tooth.

Maxcem was the first in the self-adhesive cement category to offer what is truly the easiest to use and fastest procedure on the market with the dual-syringe delivery system. Maxcem Elite continues this legacy with automix tips that now come with optional curved tips – intraoral tips for inlays/onlays, and root-canal tips for post cementation – to dispense cement in those hard-to-reach places in the mouth. No hand mixing, and no separate activation, mixing or dispensing device required.

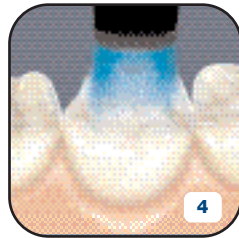
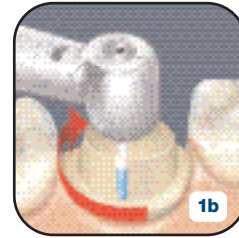
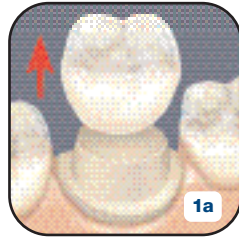
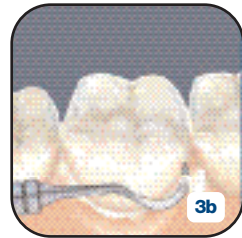
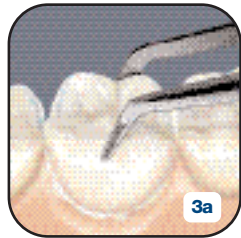
Maxcem was famous for its cleanup. Now, Maxcem Elite's cleanup is just as fast as excess cement is easily removed after reaching a gel state. Maxcem Elite comes with a technique guide that summarizes the full instructions for use, making the cementation process an easy and user-friendly experience.

The Proprietary Redox Advantage

Most self-cure or dual-cure resin cements use a benzoyl peroxide (BPO) and tertiary amine pair to initiate polymerization and curing, resulting in discoloration over time due to oxidation of amine. Now with an amine-free redox initiator system and optimized resin matrix, Maxcem Elite, together with NX3, Kerr's traditional resin cement, are the first truly color-stable resin cements in the market. Maxcem Elite's color stability and high translucency enable esthetic integrity and allow for cementation of both anterior and posterior restorations, making it a universal cement that helps simplify and minimize the office inventory.

**Taking simplicity
to the next level**

Maxcem Elite™ Application Guide



1) Preparation

- Remove provisional restoration.
- Remove temporary cement and debris using OptiClean or your instrument of choice. Rinse and lightly air dry.
- Try in restoration to ensure proper fit.
- Rinse thoroughly and lightly air dry. Do not desiccate.
- Pre-treat final restoration according to manufacturer's directions.

2) Dispensing

- Select desired shade of Maxcem Elite.
- Remove cap and bleed cartridge once before initial use.
- Place appropriate mixer on dual syringe cartridge. Mixer with wide opening is only for use with curved tips.

- Dispense cement directly into restoration or tooth preparation using intra-oral tip. For posts, dispense cement directly onto Peerless Post or your post of choice, or dispense directly into canal using root-canal tip.

3) Placement

- Seat restoration onto preparation. Hold in place with light pressure.
- Allow cement to flow from all margins.
- Remove excess cement. Excess can be removed in gel state (gel state is achieved in 2-3 minutes). Immediate tack-curing to hasten gel state is optional.

4) Final cure

- Light cure all surfaces including margins using Demi curing light for 10 seconds. See footnote for recommended curing times for other curing light models.*
- For non-translucent restorations, allow cement to self-cure for 4-5 minutes.

5) Finish and polish

- Polish margins with Gloss Plus discs, cups or points. Use HiLusterPlus polishers for a final high luster shine.
- Check occlusion.

* **Caution:** Uncured methacrylate resin may cause contact dermatitis and damage the pulp. Avoid contact with skin, eyes and soft tissue. Wash thoroughly with water after contact.

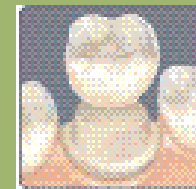
Caution: Kerr Gel Etchant contains Phosphoric Acid. Avoid contact with skin, eyes, and soft tissue. In case of contact with skin or eyes, flush immediately with water. Get medical attention for eyes. Do not take internally.

* **Recommended Cure Times:** Demi and L.E.Demetron II: 10 seconds L.E.Demetron I and Optilux™ 501: 20 seconds For all other lights, see manufacturer's recommendation. Maxcem Elite is indicated for final cementation

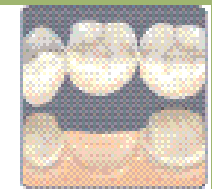
Indication

Maxcem Elite is indicated for final cementation of:

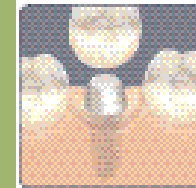
- All-ceramic (including zirconia or alumina strengthened, and Cerec) and composite crowns, bridges, inlays and onlays
- Metal and porcelain fused to metal crowns, bridges, inlays and onlays
- Prefabricated metal or fiberglass posts



Crowns



Bridges



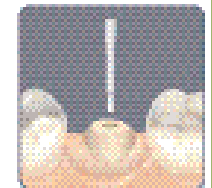
Implants



Inlays



Onlays



Posts

Maxcem Elite™ in Clinical Cases

Premise Indirect Composite Inlay, Tooth 16

Case courtesy of Dr. Stephen Poss



1) Shade selection for optimal esthetics



2) Original amalgam restoration



3) Restoration margins should not coincide with static occlusal contacts



4) Final impression
(Take 1 Advanced impression material)



5) Create temporary with light cure temporary filling material and cement into place (Fill-In Temporary material & TempBond Clear used)



6) Inlay on model



7) Isolation of prepped tooth with rubber dam



7) Clean restoration. Etch inlay with phosphoric acid if ceramic. If restoration is a lab resin, blast internal surface with Aluminum Oxide



9) Coat internal aspect of the ceramic with silane (Kerr Silane Primer)



10) Place thin coat of Maxcem Elite on the inlay covering all aspects of the internal surfaces



11) Seat the restoration



12) Carefully floss and light cure the restoration for 2 seconds to obtain cement gel state



13) Remove access and floss again



14) Check occlusion. Clean excess and if necessary adjust restoration with a fluted carbide bur



15) Finish/polish restoration with cups and brushes (Occlubrush used)



16) Final restoration

Clinician Review

The necessity of finding alternatives to amalgam and the growing demand of patients for highly aesthetic restorations have brought an increase in popularity of resin composite materials for dental restorations. These materials have proven effective in terms of aesthetic results and biomechanical properties. Polymerization shrinkage¹ is the main drawback of resin composites and it directly depends on filler content. In large cavities, especially when the cervical margins are located in dentine, the polymerization of large amounts of filling material may cause a higher shrinkage stress, resulting in marginal gaps and defects², which open the way to bacterial micro-infiltration, secondary caries, pulp irritation, post operative sensitivity and marginal discoloration³.

A promising method for reducing the problem of polymerization shrinkage is the use of a thin increment of resin luting material in conjunction with indirect restorations, such as veneers, inlays, onlays, overlays⁴. This thin layer of material will be the only part of the restoration subjected to polymerization shrinkage.

Adhesive Cementation

Prof. Francesco Mangani

Today, adhesive cementation represents a predictable technique, which can be used with both indirect resin composite and all-ceramic restorations plus endodontic posts. This procedure is essential to guarantee a favorable long-term prognosis. However, it is discussed here in terms of selection of the most suitable materials and techniques. The criteria which must be taken into account in inlay cementation can be divided in:

- **Mechanical:** to achieve a micro-mechanical and chemical bonding
- **Structural:** to increase the strength of the restoration
- **Biological:** to produce a tight marginal seal between the tooth and the restoration.
- **Aesthetic:** to achieve a perfect colour match between the tooth and the restoration.

The cementation of an indirect restoration can be carried out with light-curing, self-curing or dual-curing⁵ materials.

Light-curing luting cements are generally available as a single paste contained in an opaque, light-proof syringe. They can be easily handled, allow for a better control of the setting times and ensure high quality margins, thanks to their high filler content. However, light-activated curing is a drawback in deep cavities, as the UV light may fail to activate benzoyl peroxide, leaving part of the luting cement with a low degree of conversion. This will influence its mechanical properties. Another disadvantage of these materials is their high polymerization shrinkage.

Among the advantages of self-curing or dual-curing luting cements is their optimal monomer conversion, even at low radiant energy intensity; their disadvantage is their extreme flowability. Moreover, the need to mix two components (i.e., powder – liquid or paste – paste) is responsible for porosity or void formation and air bubble inclusion, which may compromise the bond between the filling material and the tooth substrate.

Self-curing luting cements allow for a lower control on curing time, but ensure a lower shrinkage stress, which is partially improved by viscous flow.

Light-curing and self-curing luting cements can set even in those areas which cannot be reached by UV light. However, in this case, the working time starts when the two components are mixed together.

The physical and mechanical properties of composite materials are closely related to the degree of monomer conversion into polymer^{6,7,8}. In light-activated systems, the degree of conversion decreases as the distance between the curing light and the filling material increases, since the radiant energy is reduced when passing through the restoration^{9,10}. This result, supported by the studies on the degree of conversion of light-curing flowable resin composites used in the cementation of increasingly

thicker inlays, has clearly shown the inadequacy of this class of material, as they fail to achieve proper curing when used to cement a restoration with a 3mm thickness or higher¹¹. The only indication is veneer cementation, as their lower thickness permits the radiant energy to reach the composite material and start the curing process. It has been shown that light-curing composite pre-heating increases the degree of monomer conversion, which improves the properties of the luting material, resulting in better homogeneity and handling of the material¹²⁻¹⁹.

In vitro investigations have shown that the degree of conversion of a light-curing micro-hybrid composite, pre-heated in an oven at 54°C and used in increasingly thicker restorations (2, 3, and 4 mm thickness) is similar to that of dual-curing materials under the same radiant energy, regardless of the light source (LED or halogen)²⁰. Therefore, this method is particularly interesting, as it combines the benefits of light-activated materials with a high degree of monomer conversion. Moreover, this technique is used in the cementation of anterior and posterior restorations.

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NX3™ Review and Clinical Case

Acceptable clinical performance of dental cements requires an adequate resistance to dissolution in the oral environment, a strong bond through mechanical interlocking and adhesion, high strength under tension, good manipulation properties, such as acceptable working and setting times, and a biologic acceptability for the substrate.

Resin-based cements are generally used for aesthetic restorations (ceramic or resin based) and have become popular because they have addressed the disadvantages of solubility and lack of adhesion noted in previous materials. Restorative dentistry is constantly undergoing change, driven in part by new clinical applications of existing dental materials and the introduction of new materials. Kerr has recently introduced NX3, a new third generation dual-cure resin cement, with the following features:

Clinical cementation procedures for predictable aesthetic results: tips & tricks

Dr. Montri Chantaramungkorn

- Proprietary amine-free initiator system and optimized resin matrix.
- Simplified delivery: a dual-cure auto-mix syringe eliminates hand mixing.
- Light-cure applications: a cement for veneers and indications requiring unlimited work time.
- Bonds to all substrates: excellent adhesion to dentin, enamel, CAD/CAM blocks, ceramic, porcelain, resin and metal.
- Self-etch or total-etch: bonding protocol compatibility. No dual-cure activator required.
- Superior color stability: long-term esthetics for both dual-cure and light-cure cements.
- Optimal handling: easy clean-up in gel state. The following article discusses aesthetic adhesive procedure techniques for the new NX3 in luting leucite reinforced glass ceramic restorations with predictable aesthetic results.

An aesthetic resin cementation appointment may be divided into six steps:

Step 1_ Try-in and shade control of the laboratory-made restoration

Step 2_ Adhesive treatment of the inner surface

Step 3_ Adhesive treatment of the tooth surface

Step 4_ Adhesive luting

Step 5_ Control and adjustment of the occlusion

Step 6_ Finishing and polishing

Case presentation:

A 27-year-old male patient was presented with unsightly black gingival shine through resulting from dull PFM crowns in both maxillary central incisors (Figs. 1, 2). After treatment, the newly replaced leucite reinforced glass ceramic restorations (Empress Esthetic) (Fig. 3) cemented with NX3, are harmoniously integrated with the adjacent teeth and the gingival architecture (Figs. 4, 5).



Step 1: Try-in and shade control of the laboratory-made restoration

Marginal adaptation and proximal contact of the laboratory-made restoration were first checked on the die-cast model. The better the fit, the easier excess luting resin cement can be removed, as there is less danger of tearing the luting composite out of the luting space during excess removal (Fig. 6). The



try-in gels matched both dual- and lightcure cements, a huge advantage when it comes to aesthetic restorations. The intro kit contains three colors – yellow, clear and white – however, other shades are also available. In my practice, clear, white and opaque-white are used the most.



Clear try-in was used while closely matching the work piece to the adjacent tooth (Fig. 7).

The fit and shade control was verified by using the try-in gel. This step is quite helpful in determining the final shade aspect of the restoration, luted with the concurrent shade of resin luting. In this case, clear shade try-in paste was used (Fig. 8).

Only minimal adjustments of the workpiece are possible at this moment, otherwise the restoration will have to be sent back to the laboratory for correction and the luting session will have to be postponed.



Step 2: Adhesive treatment of the inner surface

After the try-in gel was thoroughly washed off and gently dried with oil-free compressed air, the inner side of the silica-based ceramic was conditioned with 5 percent hydrofluoric acid for 60 seconds. This helps to promote optimal morphological change of the surface for the penetration of the silane primer (Fig. 9). For this type of ceramic, silane acts principally as promoter of wettability on the roughened surface and for the successive application of the luting agent (Fig. 10).

The shiny aspect of the inner surface was visible after drying off the silane primer with hot air for two minutes (Fig. 11). After the surface adhesive treatment and before insertion, the restoration had to be protected from light (Fig. 12).



Step 3: Adhesive treatment of the tooth surface

OptiClean was used for the complete removal of temporary cement and debris. It removes all traces of temporary cement and delivers a perfectly clean cementation surface of the entire tooth preparation. Used on a slow speed handpiece, OptiClean is a singleuse instrument with a 1.6 mm diameter tip for excellent interproximal access (Fig. 13). After the total removal of the temporary cement, the operating field and tooth preparation surface was properly prepared with the application of plumber tape to the adjacent teeth. The gingival was retracted with a #00 Ultrapak® retraction cord (Fig. 14).



According to the manufacturer, NX3 is compatible with self-etch (OptiBond All-In-One) and total-etch adhesives (OptiBond Solo Plus, OptiBond FL) and obtains high bond strength whether the cement is lightcured or dual-cured. In this case I chose a total-etch adhesive (OptiBond FL). A total etch of the enamel dentin and resin surface of the composite core was done for 15 seconds with Kerr gel etchant 37.5% phosphoric acid. Afterwards, copious amounts of water were used for rinsing until the etchant was completely removed (Fig. 15). After rinse off and gentle air drying the

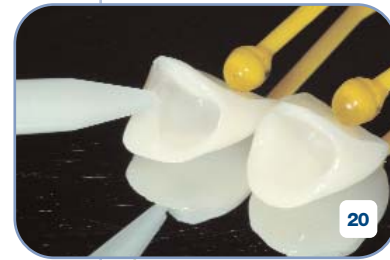
etched surface was bonded to a proper moist condition. OptiBond FL Prime was applied on the conditioned surface in a light scrubbing motion for 15 seconds. Another drying session of five seconds got rid of the volatile solvent. At this point the dentin/enamel surface should have a slightly shiny appearance (Figs. 16–19). Light curing is not advisable! The surface was then ready for one adhesive luting of the restoration with NX3 cement dual cure.



Step 4: Adhesive luting

NX3 dual-cure resin cement was then easily dispensed on the previously prepared inner surface of the restorations (Fig. 20). The placement of the restorations onto the adhesively prepared tooth surface was done manually by gently pressing at the incisal edge (Figs. 21, 22). This was done immediately after the cement was dispensed.

Excess cement in the gel state was easily removed with a sharp interproximal carver (Fig. 23). Direct focus of the operative light on the restoration during placement should be avoided. At this point, more pressure was exert to ensure that the restoration was fully seated and that the thickness of the cement was as thin as possible.



After all the excess cement and the retraction cords had been removed,



all surfaces were light cured for 20 seconds each, using a Hi-power LED curing device (Figs. 24–27). Even though dual-cure resin cement was used, light curing helped to ensure better polymerization and better bonding to the tooth surface. When using dual-cure cements, clinicians should delay the light-curing procedure to the maximum time clinically possible. That way a maximum degree of conversion of the resin cement may be achieved after light activation, reducing the risk of excessive water uptake.

Step 5: Control and adjustment of the occlusion

The adjustment of the occlusion was safely executed after the restorations were adhesively luted to the teeth. This can be done by checking for a hi-spot in centric and protrusive movement of the jaw. A hi-spot can be corrected with a fine diamond in a hi-speed handpiece (Figs.28–30).

Step 6: Finishing and polishing

The ceramic surface that was adjusted by grinding was then polished back to high-gloss finish with OptraFine (Ivoclar Vivadent) a new, high-performance diamond polishing system for ceramic materials, which affords a unique combination of highly efficient application and perfect polishing results.

Interproximal ceramic margins under the gum line were finished and polished to a smooth transition with Epitex Strips (GC). These strips are ultra-thin because abrasive particles are not bonded to the strip with adhesive. This also allows easier access in tight contact points and helps minimize gingival damage.



Conclusion

The ideal luting agent should guarantee:

- a durable bond between the involved structures and provide a good marginal adaptation *as well as additional attributes like*
- optimal biomechanical properties,
- low solubility in the oral cavity,
- radiopacity,
- increased working and setting time for easy manipulation,
- adequate viscosity for complete seating, and
- optimal esthetic properties.

Currently, no commercially available luting cement is ideal for all situations. NX3 was created to meet those aforementioned requirements. Clinicians could work universally with this product in cementing aesthetic crowns, veneers, inlays, onlays, CAD/CAM restorations with efficient and more predictable esthetic results.

The literature list is available from the publisher
This article was originally published in
Cosmetic Dentistry Vol. 2, Issue 1/2008

NX3™

Permanent cement

NX3 Nexus® Third Generation is an esthetic permanent cement that represents a breakthrough in resin cement technology. Employing a proprietary redox initiator system and a well-balanced resin matrix, NX3 retains all the desirable attributes a resin cement has to offer – color stability, high bond strengths, good mechanical properties, low water solubility and good translucency. Universally indicated for all indirect applications including veneers, NX3 dual-cure and light-cure cements deliver unmatched esthetics, excellent handling properties, enhanced adhesion to all substrates and great versatility. NX3 has excellent adhesion to CAD/CAM blocks in addition to dentin, enamel, ceramic, porcelain, resin and metal.

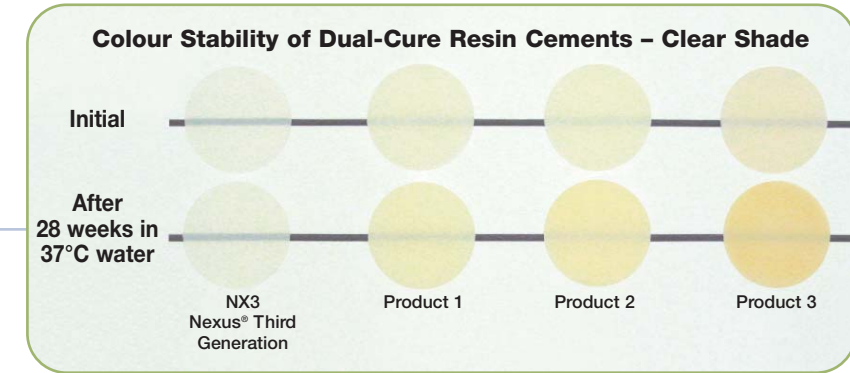
Unparalleled Colour Stability

CAD/CAM restorations such as Vitablocs™, ProCAD® and Zirconia are more opaque than traditional porcelain restorations.

Therefore, using just a light-cure cement is a concern due to inadequate light penetration. But with NX3, for the first time, you not only get the reliable curing of a dual-cure resin cement but more importantly – you get unmatched color stability due to Kerr's proprietary redox initiator system.

Breakthrough technology is the reason behind the outstanding performance of NX3. Most resin cements on the market today use a benzoyl peroxide (BPO) and tertiary amine pair as their redox initiator system to initiate polymerization and curing – a system inherent with problems as it compromises the esthetics of ceramic restorations. The unique redox initiator system in NX3 eliminates these problems.

Initiator systems using BPO/amine have two significant color-stability flaws. First, the catalyst paste on its own will progressively discolor (yellowish tint) upon storage on the shelf. Second, the self-cured or dual-cured cement will progressively discolor over time, compromising long-term esthetics. The proprietary redox initiator system present in NX3 offers significant advantages over BPO/amine initiator systems, eliminating the undesirable discoloration for a more esthetic restoration.



Internal data. Available upon request.

Features

- **Optimal handling.** Easy cleanup in gel state.
- **Simplified delivery.** Dual-cure automix syringe eliminates hand mixing.
- **Light-cure applications.** Cement for veneers and indications requiring unlimited work time.
- **Self-etch or total-etch.** Bonding protocol compatibility. No dual-cure activator required.
- **Superior color stability.** BPO and Amine-free initiator system offers long-term esthetics.

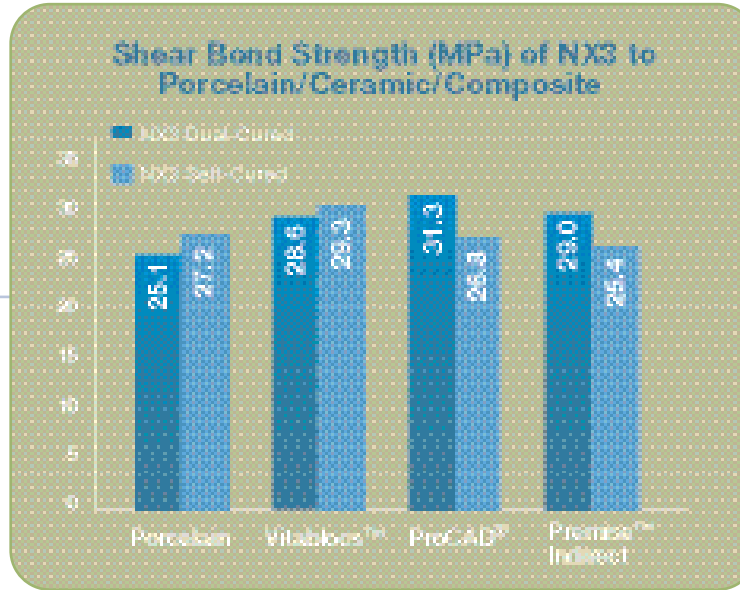
All trademarks are property of their respective owners.

NX3
NEXUS® THIRD GENERATION

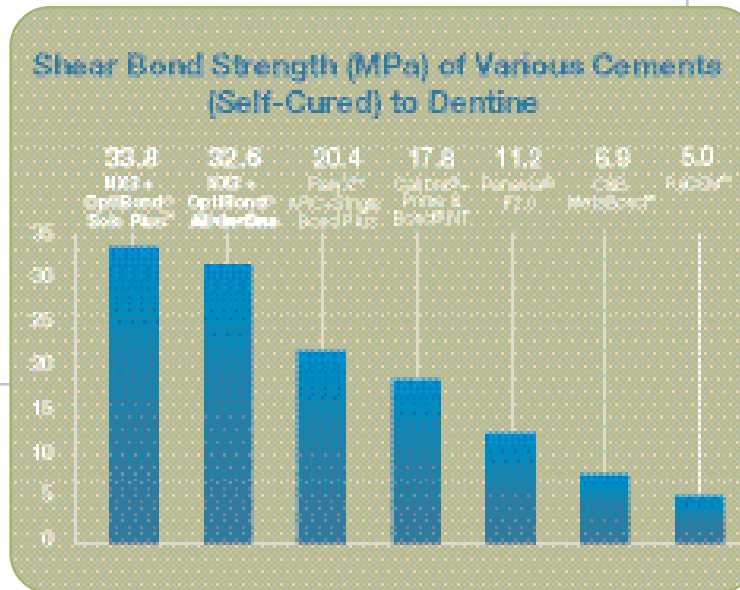
Bonding to Composite and Ceramic Substrates

NX3, which requires an adhesive, achieves excellent bond strengths and is universally indicated for all indirect applications – all ceramic-based restorations, including CAD/CAM blocks, zirconia/alumina-strengthened ceramics, and Premise Indirect – whether NX3 is light-cured or self-cured.

Through the powerful combination of a novel acid-resistant redox initiator system and a unique, well-balanced resin matrix, NX3 eliminates the incompatibility issue that has plagued most resin cements. The end result is a cement compatible with the newer generation acidic adhesive systems, making it well suited for cementing all restorative materials – even metal-based restorations where there is limited or no light accessibility.



Internal data. Available upon request. All trademarks are property of their respective owners.



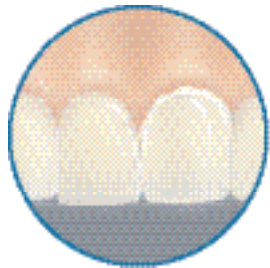
24-hour internal testing. Data available upon request. All trademarks are property of their respective owners.



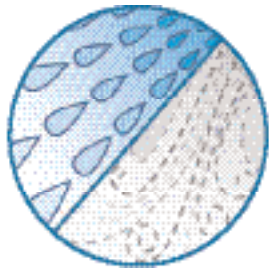
Your practice is *our* inspiration.™



NX3™ Application Guide VENEERS



1. Apply try-in gel to veneer and seat. Check color and fit. Remove veneer.



2. Thoroughly wash out try-in gel. Air dry. Shield silane primer from ambient light and apply.



3. Select bonding system and apply to prep.

One set of NX3 try-in gels matches both dual-cure and light-cure cements.

For veneer indications – Use NX3 dual-cure when cementing 1–2 units.

Use NX3 light-cure when cementing multiple units that need longer work time.

RECOMMENDED CURE TIMES

- *Demi 5 seconds
- *L.E.Demetron II 5 seconds
- *L.E.Demetron I 10 seconds
- *Optilux™ 501 10 seconds
- **Demi 10 seconds
- **L.E.Demetron II 10 seconds
- **L.E.Demetron I 20 seconds
- **Optilux 501 20 seconds

For all other lights, follow manufacturer's recommendation.



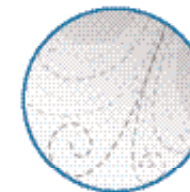
SELF-ETCH
OptiBond® All•In•One



A. Dip brush. Apply OptiBond® All•In•One with scrubbing motion for 20 seconds.



B. Repeat.



C. Gently air dry first. Then use medium force for at least 5 seconds.



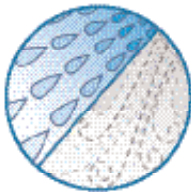
D. Light cure for 10 seconds.



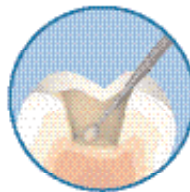
OptiBond® SoloPlus™



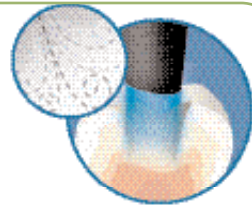
A. Etch enamel and dentin for 15 seconds.



B. Rinse and air dry.



C. Apply OptiBond® Solo Plus™ for 15 seconds.



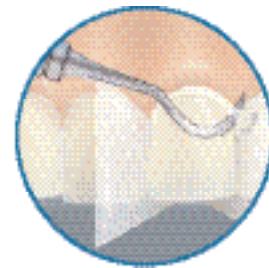
D. Air dry for 3 seconds.

E. Light cure for 10 seconds.*

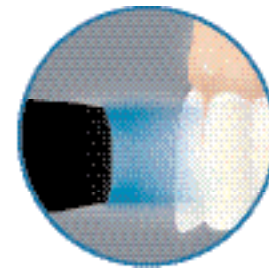
Proceed to next step below.



4. Dispense NX3 cement (light-cure or dual-cure) directly into veneer.



5. Seat veneer. Spot cure for several seconds. Remove mylar strip. Clean excess cement from margins.

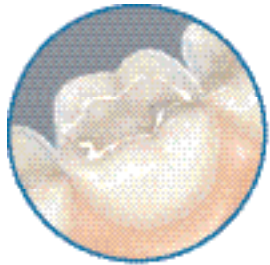


6. Light cure all surfaces for 20 seconds each.**

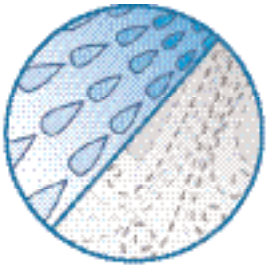


7. Finish and polish.

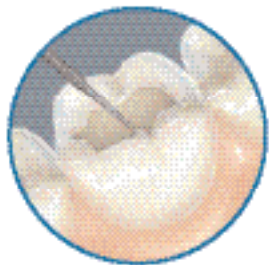
NX3™ Application Guide INLAY/ONLAY



1. Apply try-in gel to veneer and seat. Check color and fit. Remove veneer.



2. Thoroughly wash out try-in gel. Air dry. Shield silane primer from ambient light and apply.



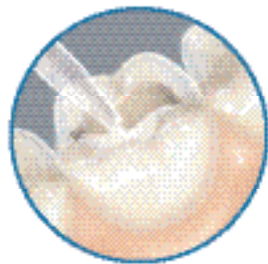
3. Select bonding system and apply to prep.

NX3 dual-cure cement exhibits unparalleled color stability with its patented amine-free initiator system.

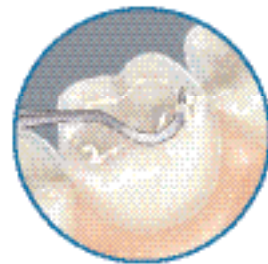
RECOMMENDED CURE TIMES

*Demi	5 seconds
*L.E. Demetron II	5 seconds
*L.E. Demetron I	10 seconds
*Optilux™ 501	10 seconds
**Demi	10 seconds
**L.E. Demetron II	10 seconds
**L.E. Demetron I	20 seconds
**Optilux 501	20 seconds

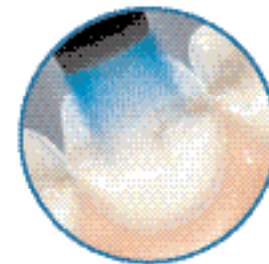
For all other lights, follow manufacturer's recommendation.



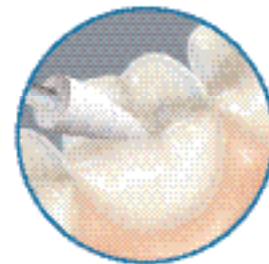
4. Dispense NX3 cement (light-cure or dual-cure) onto restoration or prep.



5. Seat restoration onto prep, allowing cement to flow from all sides. Tack cure (1-2 seconds) to facilitate cleanup. Remove excess cement.



6. Light cure all surfaces for 20 seconds each.**



7. Finish and polish.



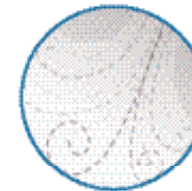
SELF-ETCH OptiBond® All•In•One



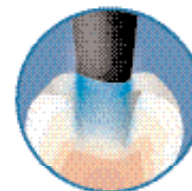
A. Dip brush. Apply OptiBond® All•In•One with scrubbing motion for 20 seconds.



B. Repeat.



C. Gently air dry first. Then use medium force for at least 5 seconds.



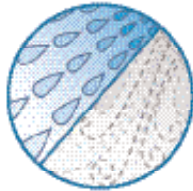
D. Light cure for 10 seconds.



OptiBond® SoloPlus™



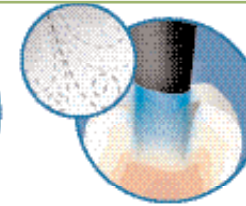
A. Etch enamel and dentin for 15 seconds.



B. Rinse and air dry.



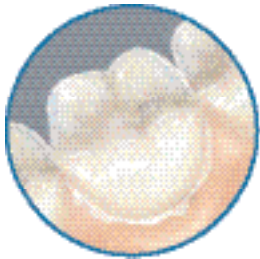
C. Apply OptiBond® Solo Plus™ for 15 seconds.



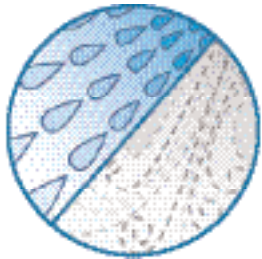
D. Air dry for 3 seconds.
E. Light cure for 10 seconds.*

Proceed to next step below.

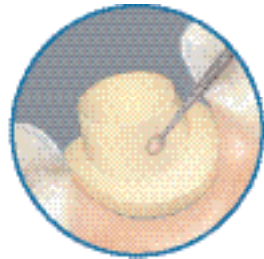
NX3™ Application Guide CERAMIC CROWNS



1. Apply try-in gel to veneer and seat. Check color and fit. Remove veneer.



2. Thoroughly wash out try-in gel. Air dry. Shield silane primer from ambient light and apply.



3. Select bonding system and apply to prep.



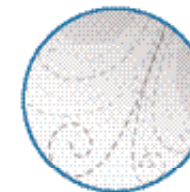
SELF-ETCH
OptiBond® All•In•One



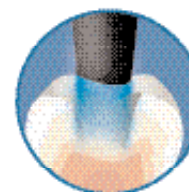
A. Dip brush. Apply OptiBond® All•In•One with scrubbing motion for 20 seconds.



B. Repeat.



C. Gently air dry first. Then use medium force for at least 5 seconds.



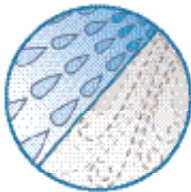
D. Light cure for 10 seconds.



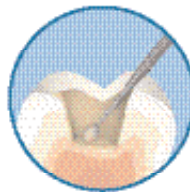
OptiBond® SoloPlus™



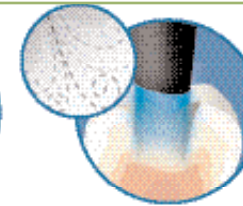
A. Etch enamel and dentin for 15 seconds.



B. Rinse and air dry.



C. Apply OptiBond® Solo Plus™ for 15 seconds.

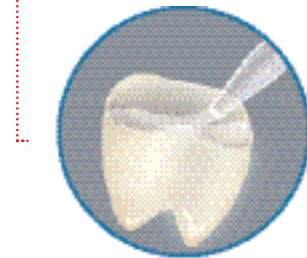


D. Air dry for 3 seconds.

E. Light cure for 10 seconds.*

Proceed to next step below.

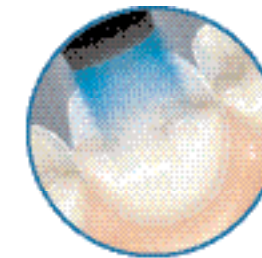
NX3's optimal handling allows easy cleanup in gel state.



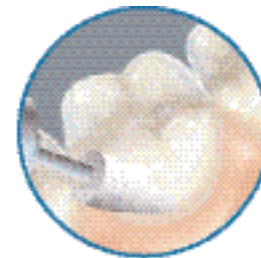
4. Dispense NX3 dual-cure cement onto restoration or prep.



5. Seat restoration onto prep, allowing cement to flow from all sides. Remove excess cement.



6. Light cure all surfaces for 20 seconds each.**



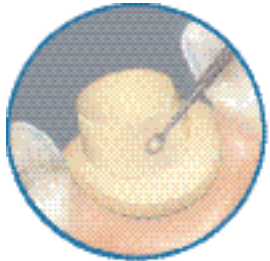
7. Finish and polish.

RECOMMENDED CURE TIMES

- *Demi 5 seconds
- *L.E. Demetron II 5 seconds
- *L.E. Demetron I 10 seconds
- *Optilux™ 501 10 seconds
- **Demi 10 seconds
- **L.E. Demetron II 10 seconds
- **L.E. Demetron I 20 seconds
- **Optilux 501 20 seconds

For all other lights, follow manufacturer's recommendation.

NX3™ Application Guide METAL-BASED C&B



1. Select bonding system and apply to prep.

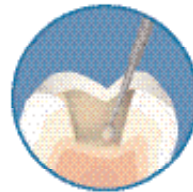
NX3 simplifies your procedure not necessary to use a primer/adhesive on the metal surface.



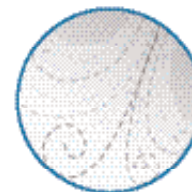
SELF-ETCH OptiBond® All•In•One



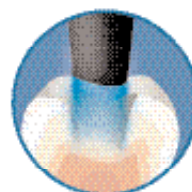
A. Dip brush. Apply OptiBond® All•In•One with scrubbing motion for 20 seconds.



B. Repeat.



C. Gently air dry first. Then use medium force for at least 5 seconds.



D. Light cure for 10 seconds.

Proceed to next step above.



2. Dispense NX3 dual-cure cement onto restoration or prep.



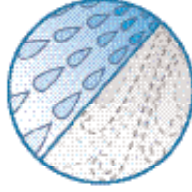
3. Seat restoration onto prep, allowing cement to flow from all sides. Remove excess cement.



OptiBond® SoloPlus™



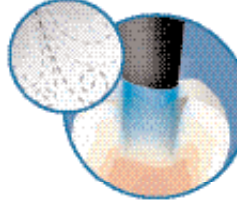
A. Etch enamel and dentin for 15 seconds.



B. Rinse and air dry.

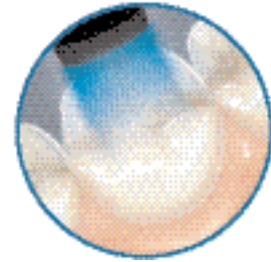


C. Apply OptiBond® Solo Plus™ for 15 seconds.



D. Air dry for 3 seconds.

E. Light cure for 10 seconds.*



4. Light cure all surfaces for 20 seconds each.**



5. Finish and polish.

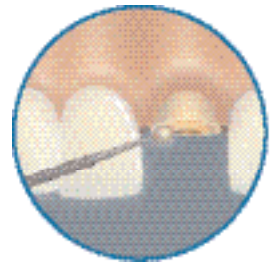
NX3™ Application Guide POSTS AND CORE

NX3 can be used as a core build-up material. Its excellent dark-cure compatibility with acidic adhesives enables bulk filling ability.

RECOMMENDED CURE TIMES

*Demi	5 seconds
*L.E. Demetron II	5 seconds
*L.E. Demetron I	10 seconds
*Optilux™ 501	10 seconds
**Demi	10 seconds
**L.E. Demetron II	10 seconds
**L.E. Demetron I	20 seconds
**Optilux 501	20 seconds

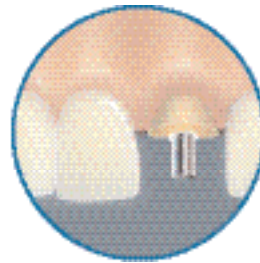
For all other lights, follow manufacturer's recommendation.



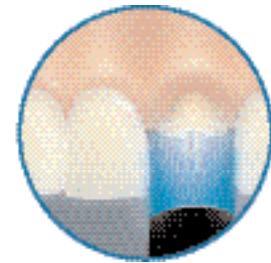
1. Prepare post space. Size and fit post. Apply adhesive onto post, air thin, do not light cure.



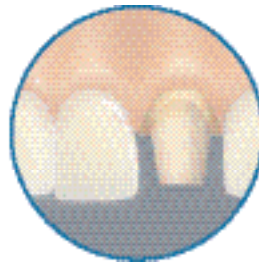
2. Apply NX3 dual-cure cement onto post or into post prep.



3. Seat post, and vibrate post to avoid trapped air. Maintain pressure until post is stable.



4. Remove excess cement and light cure all surfaces for 20 seconds each.**



5. Proceed with core build-up.



NX3™ in Clinical Cases
Replacement of Maryland Bridge,
with a zirconia bridge, teeth 13-11.
Porcelain Veneers, teeth 21-23
Case courtesy of Dr. Ara Nazarian



1) Preoperative view of smile



2) Preoperative retracted view



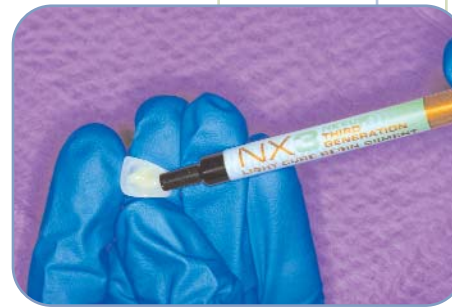
3) Preoperative palatal view



4) Preparation



5) Restoration



6) Loading of veneers with NX3



7) Postoperative palatal view



8) Postoperative retracted view

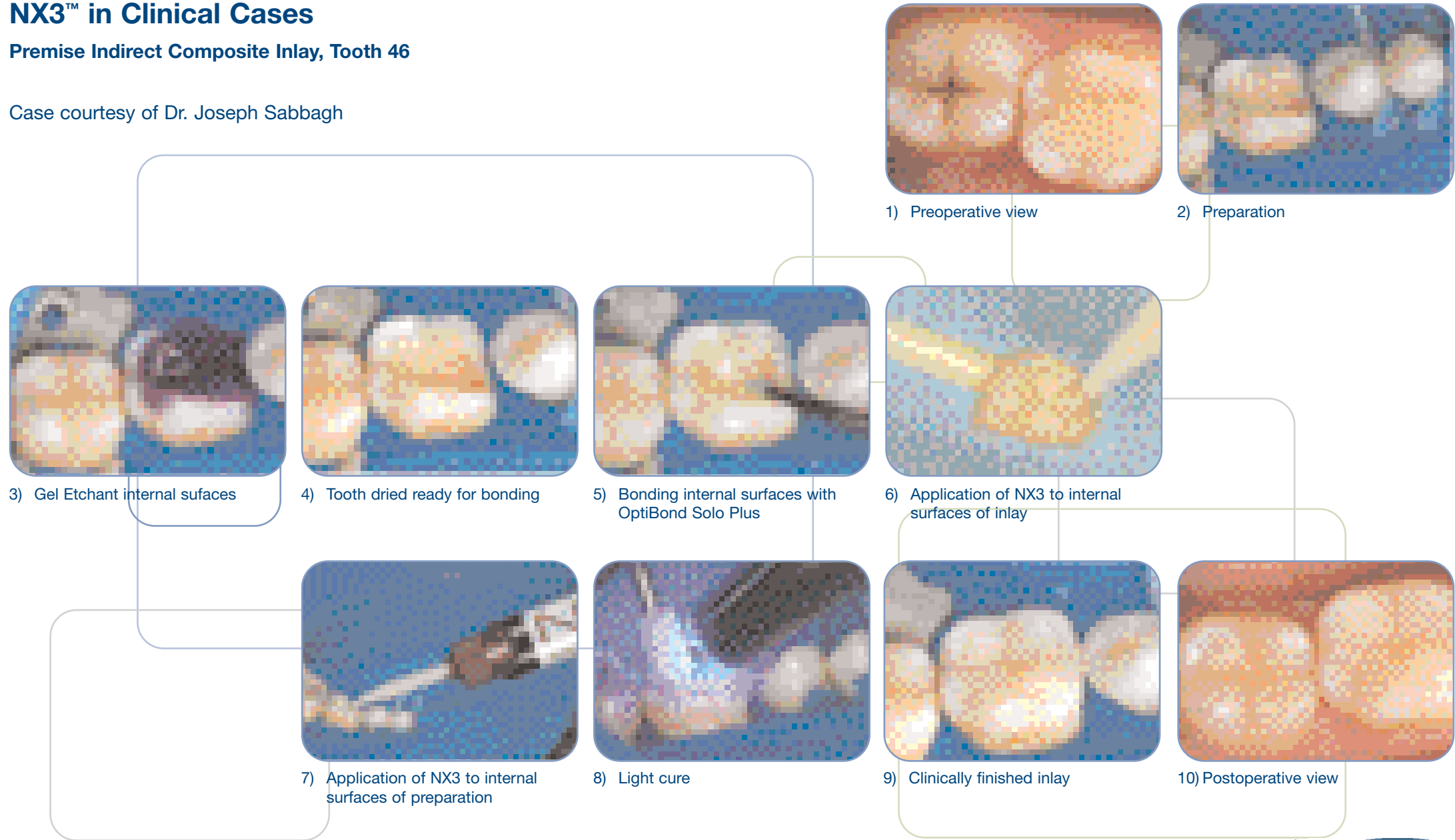


9) Postoperative view of smile

NX3™ in Clinical Cases

Premise Indirect Composite Inlay, Tooth 46

Case courtesy of Dr. Joseph Sabbagh





PRODUCT	MaxCem Elite™	NX3™
ADHESION	22-36 MPa	25-35 MPa
PROTOCOL	Self Etch <i>no etch needed</i> Self Adhesive <i>no bonding agent needed</i>	OptiBond All•In•One <i>no etch needed</i> OptiBond Solo Plus <i>etch needed</i>
POLYMERIZATION METHOD	Self Cure/ Light cure	Self Cure/ Light cure
CROWNS BRIDGES INLAYS ONLAYS	Metal / Ceramic Metal	✓
	Zirconium / AluminumOxide	✓
	All Ceramic	✓
	Indirect Composite Resin	✓
SPECIAL INDICATIONS	Veneers	•
	Adhesive Bridges	•
	Maryland Bridges	•
	Posts	✓

✓ Recommended • Not recommended

NX3... to be used when...

Clinician prefers more traditional procedure of etch & bond and/or preference for veneer luting systems specifically for esthetics

Clinician prefers automix tips; insuring even mix of base and catalyst, facilitates cement placement in prosthesis, on tooth structure, in root canal for posts

Existing preps are minimally retentive, requiring maximum bond strength

Veneer cases when time, placement and light cure are critical. Dentist has time for a longer cementation procedure

Polymerization method can be chemical self cure and/ or light cure

Suggested bonding agents OptiBond Solo Plus or OptiBond All in One



Maxcem Elite... to be used when...

Clinician prefers fast, easy, one step procedure. No etching or bonding procedure is desired

Clinician prefers automix tips; insuring even mix of base and catalyst, facilitates cement placement in prosthesis, on tooth structure, in root canal for posts

Existing preps have adequate to maximum retention

The seating of prosthesis will be straightforward

Polymerization method can be chemical self cure
Chemical self cure will begin after mixing



**Dr. Montri Chantaramungkorn, DDS**

Is a successful full-time private practitioner specializing in Comprehensive Restorative and Cosmetic Dentistry in Chiangmai, Thailand. He has been teaching Esthetic Dentistry at Chiangmai University since 1985 and was the Chairman of Department of Restorative Dentistry at Chiangmai University from 1993 to 2002. He is also a Diplomate of the Thai Board of Operative Dentistry and enjoys giving lectures on current materials and techniques on newly developed material in Restorative Dentistry.

**Prof. Francesco Mangani, MD, DDS**

Prof. Mangani is a graduate of Medicine and General Surgery and he received his Post Graduate Certificate in Odontostomatology. He is Associate Professor at the Faculty of Medicine and Surgery and Chair of Restorative Dentistry at School of Dentistry Tor Vergata University Rome. He is also Chair of Dental Aesthetics, School of Dental Hygienist, Tor Vergata University Rome and Head of the Aggregate Functional Area of Restorative Aesthetic Dentistry, Tor Vergata University Clinical Hospital Rome.

He is an active member of Italian Academy of Conservative Dentistry, Italian Academy of Aesthetic Dentistry, Italian Society of Endodontics, Italian Society of Conservative Dentistry. He has authored over 180 scientific publications and more than 50 abstracts from research sessions concerning conservative dentistry and endodontics.

He has also authored 5 books of Restorative Dentistry.

**Dr. Ara Nazarian**

Ara Nazarian, DDS is a graduate of the University of Detroit-Mercy School of Dentistry. Upon graduation, he completed an AEGD residency in San Diego, California with the United States Navy. Currently, he maintains a private practice in Troy, Michigan with an emphasis in comprehensive and restorative care. In 2002, he received the Excellence in Dentistry Award and Scholarship. His articles have been published in various professional dental journals including: Contemporary Esthetics, Dental Equipment and Materials, Dental Products Report, Dentistry Today and Dentaltown Magazine.

Dr. Nazarian also serves as a clinical consultant for the Dental Advisor, testing new products on the market. He is a member of the Academy of General Dentistry and the American Academy of Cosmetic Dentistry and is a Fellow with the International Congress of Oral Implantologists.

**Marika Nemeth**

Product Manager Prosthetics
KerrHawe Europe
marika.nemeth@kerrhawe.com

Marika received her Certified Dental Assistant Diploma from George Brown College in Toronto Canada in 1984 & 2003 from University of British Columbia in Orthodontics.

Marika has had a long career in clinical dentistry. She now works as product manager for Europe managing products in the cements and impression material lines.

**Dr. Isaac Novak, Bsc, DDS**

Is a 1974 graduate of Western Ontario University in London Ontario. For the majority of his 36 years in practice he has had a special interest in aesthetic full mouth reconstruction. Dr. Novak enjoys a rewarding career as the senior practitioner in his family practice in Mississauga, Ontario, Canada. He is an active consultant for several dental manufacturers, has authored articles, and continues to lecture on aesthetic rehabilitation, as well as new product development. He is a member of American Academy of Cosmetic Dentistry, Ontario Dental Association, Halton Peel Dental Association and serves as dental advisor to Alternative Dental Laboratories. In his free time Dr. Novak enjoys skiing, hockey, golf, and photography.

**Dr. Stephen Poss**

Dr. Stephen Poss is a graduate of the University of Tennessee and maintains an aesthetic based practice in Brentwood, Tennessee. Dr. Poss has directed numerous live patient continuums at various teaching institutes emphasizing anterior and posterior aesthetic dentistry since 1995. Dr. Poss is presently the Clinical Director at The Center for Exceptional Practices in Cleveland, Ohio. He is also on the editorial team of Reality publishing.

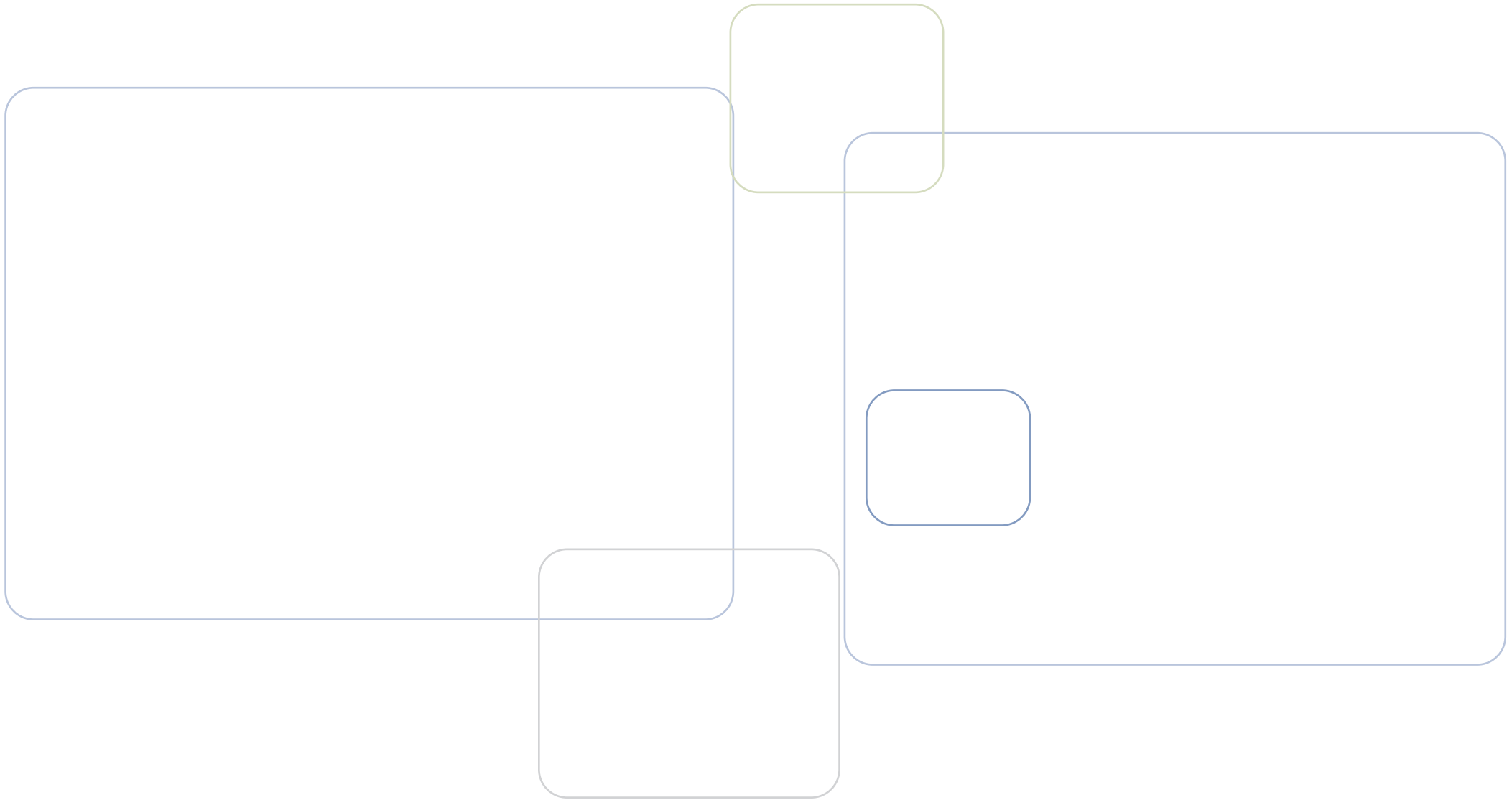
Dr. Poss lectures internationally on esthetic dentistry and TMD. He is an active consultant to several dental manufacturers in the area of new product development and refinement. He has had numerous articles published in the leading dental journals. He maintains a cosmetic-oriented restorative practice in Brentwood, Tennessee.

**Dr. Joseph Sabbagh**

Dr. Joseph Sabbagh graduated from the Saint-Joseph University (Beirut) in 1996 and in 2000 he obtained a Master in Operative Dentistry (Restorative Dentistry and Endodontics) from the Catholic University of Louvain (Belgium). He also obtained two certificates of Advanced Studies in Biomaterials and Operative Dentistry from the University of Paris-VII (France) in 1997 and 1998.

In 2004, he obtained his PhD in Biomaterials from the Catholic University of Louvain. He has published many papers in the dental literature and has lectured locally and internationally. He is fellow of the International College of Dentists, a member of the Lebanese Dental Association and member of the Academy of Operative Dentistry.

- Assistant Professor in the department of Conservative and Aesthetic Dentistry in the Lebanese University, Lebanon.
- Senior Lecturer in Operative and Cosmetic Dentistry in the "Dental College" (a Lebanese private college for dental continuing education) Beirut, Lebanon.
- Fellow researcher in the Catholic University of Louvain (Cribio division), Belgium.
- Private practices in Beirut and Brussels specialized in Cosmetic Dentistry and Endodontics.



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