Successful Cementation With Composite Resin

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Educational objectives

Upon completion of this course, participants should be able to achieve the following:

• Determine the proper cement for a given application
• Learn to establish a clean field for cementing
• Learn to prepare the castings and the dentin substrate for cementing
• Learn to make the setting characteristics of cements work in the clinician’s favor
• Understand the relationships between primers and cements
• Understand the how and why of preparing the casting for cementing

Abstract

Indirect dental procedures culminate with the cementation process. Whether the restoration is metal, porcelain-fused-to-metal, or completely metal-free, a clean casting coupled with a clean field is absolutely necessary to assure long-term success and reliability. In this article, the author discusses the cementation procedure and how to create optimal conditions for excellent results using a composite resin-luting agent.
Background

Zinc phosphate cements have a long history in dentistry, showing excellent long-term survival rates when used with cast metal restorations. These cements are easy to handle, possess good compressive strength, and are low in cost. Unfortunately, they also display the lowest tensile strength, high solubility, brittleness and no adhesive properties. Accordingly, failures of cast dentistry cemented with zinc phosphate cement can frequently be caused by:

- Excessive dislodging forces
- Compromised mechanical retention
- Limited inter-arch space for adequate preparation
- Occlusal contact in excursions

Another class of cements that has enjoyed widespread use in dentistry has been the polycarboxylates (Durelon, 3M ESPE), which do provide some chemical adhesion through the free carboxylic acid group, bonding with the calcium in the tooth structure. Polycarboxylates have a lower compressive strength than zinc phosphate (55-85 Mpa) but a higher tensile strength (8-12 Mpa). The relatively high solubility of the polycarboxylates is problematic; however, crowns will stay in place while the tooth can decay from underneath the casting. These cements are designed for single metal units only, the excess of which must be removed prior to its fully set stage.

Another cement type, glass ionomer cement, offers some adhesion to tooth surface and restoratives as well as releases fluoride. Unfortunately these cements leak to a greater extent than the others. After about eight years, bacteria have been shown to migrate into the pulp through the dentin tubules. Recently, these cements have been modified with resin in an effort to reduce the microleakage and take advantage of resin's other capabilities.

The resin-luting agents have been shown to provide better retention and a better marginal seal than other cements. An advantage of the composite resin-luting agents that contain special adhesive monomers such as MDP (10 methacryloyloxydecylidihydrate phosphate) is that they will bond chemically not only to tooth structure, but also to metal oxides as well as porcelain. These cements show a substantial increase in retention of cast dentistry when compared to zinc phosphate, glass ionomer or conventional resin cements.

Clinical Technique

Sealing the Preparations

Recent research has shown that once the preparations are completed, a process called “Immediate Dentin Sealing” (IDS) will improve bond strength of indirect restorations and will protect the cut dentin from bacterial leakage during the provisional phase of the treatment. IDS is performed immediately following the preparation, prior to impression making or fabrication of provisional restorations, using Clearfil Protect Bond (Kuraray America), an antibacterial self-etching adhesive system. Protect Bond contains the adhesive monomer, MDP, which creates the hybrid layer without opening the dentin tubules by removing the smear layer and increasing dentin permeability. Once the preps are complete, the author recommends and uses the following IDS procedure:

1. Clean and scrub prep with cotton pellet and water, dry
2. Apply Clearfil Protect Bond Primer, wait 20 seconds, dry (Fig. 1)
3. Apply Clearfil Protect Bond “Bond” lightly air, light cure (Fig. 2)
4. Apply clear glycerin gel as an air-block agent and light cure again
5. Scrub preps with ethanol to remove oxygen inhibited layer remaining (Fig. 3)
6. Rinse and dry (Fig. 4)
7. Lubricate preps with Isolit (Degussa AG, Hanau) to avoid inadvertent bonding of acrylic before making provisionals
IDS requires the use of a bonded cement, therefore its use with cements that rely on the mechanical retention of the preparation such as zinc phosphate is contraindicated.

**Provisionals**

While the overall success of the restoration will be dependent on all of the elements leading up to the cementation visit, any discussion of the clinical technique needed for the permanent cement also should include comments on how the provisional crowns are cemented.

Once the provisional castings are completed and checked for fit, contour, occlusion and polish, they need to be cemented with a material that will not only retain them securely, but will allow their easy removal without fracturing the substrate. Further, the cements cannot contain any oils, such as eugenol, that would interfere with the set of the final cement. Accordingly, the author uses Durelon, a polycarboxylate cement, for the temporary cementation of the provisionals.

The author advises coating the outer surfaces of the provisionals with Masque (Harry J. Bosworth Co.), a silicone-based lubricant. This step, accomplished with a clean small brush makes cleanup very easy. The Durelon cement is mixed on a pad, a thin layer is loaded into the internal aspect of the provisional castings with a brush, then they are seated into place with firm pressure. A chairside timer is set for three minutes, after which time the excess cement attains a partial set (chewing gum consistency) and is easily cleaned up with curettes and floss. Then, the provisionals are polished with smooth pumice, oral hygiene reviewed, and the patient dismissed.

Close follow-up will enable the patient to maintain his or her gingival tissues very effectively, so in cases where hygiene is inconsistent, the patient should return to the office one week prior to case insertion for a scaling and polishing of the teeth to be restored, followed by oral hygiene review. This follow-up procedure is an effective way to keep the tissues healthy with minimal inflammation, so when the patient returns for the insertion visit, the case can be cemented without getting the field contaminated by blood or sulcular fluids.

**Final Case**

When the patient returns for the insert appointment, anesthesia is administered, if needed. The Durelon cement typically remains on the tooth, a distinct advantage in control of sensitivity (Fig. 5). An ultrasonic scaler is used to remove temporary cement, and a loose slurry of coarse pumice is used at low speeds to clean the residue from the substrate (Fig. 6).

At this point, it is imperative that the tissues do not bleed since a bloody field will contaminate the substrate, interfere with the cement bond, and very likely cause some discoloration in the final case. Accordingly, the best hemostatic control takes place prior to the insert appointment by optimizing tissue health with well-fitting provisionals and outstanding home care. Some hemostatic agents, especially those containing ferric salts, will interfere with the set of resin luting agents. If the tissues bleed, the injection of 2% lidocaine with 1:50,000 epinephrine directly into the affected papillae may constrict the capillaries enough to control the bleeding until the case can be bonded in place.

Additional hemostasis can be obtained by placing a #7 Sil-Trax retraction cord (Pascal Company, Inc.) soaked in Hemodent solution (Premier Products Company) into the sulci and rinsed after three seconds. Physical compression of the tissue with a gauze pad also is helpful.

If small capillaries have a slight “ooze” then ED Primer applied with a micro brush will control bleeding with an agent that will improve the final outcome rather than hinder it. This dental product will not interfere with the chemical bonding of a resin...
cemented casting to the dentin. ED primer is part of the Panavia kit and is described in more detail further in this article.

Once the try-in of the case has been completed satisfactorily, the castings need to be cleaned and decontaminated. The author accomplishes this by scrubbing with soap and water, then soaking the castings in a 42.5% hydrochloric acid. This acid bath is created using a 1:1 dilution of the concentrated solution that is available from chemical supply houses. The castings are rinsed, and then dried.

There are many resin cements from which the clinician can consider. In my opinion, Panavia F 2.0 (Kuraray America) is the most appropriate cement for this technique. Some clinicians may choose other products but I cannot guarantee identical results. Panavia is a resin adhesive cement that contains MDP, a self-etching primer that utilizes the smear layer as a legitimate bonding substrate, and creates a strong bond with metal oxides as well as with traditional and zirconium ceramics. In addition to the strong chemical bonds, this cement has a fluoride-releasing system as well as excellent wear resistance, low solubility, and high compressive, flexural and tensile strength. Finally, its ease of use and long successful record of more than 20 years offer a solid basis for its use.

The author recognizes other classes of cements, such as resin modified glass ionomers that are used for final cementation of cast dentistry. The preparation of the field that was previously described also is useful for this class of materials as well as many other types of cements used for this purpose.

The dentin substrate is first treated with ED Primer, a self-etching primer provided with the Panavia F 2.0 kit that creates the hybrid zone and accelerates the set of cement without removing the smear layer and thereby eliminating post-operative sensitivity. After being allowed to remain on the tooth for 20 seconds, the tooth is dried thoroughly. At this point, this resin cement can then be routinely used for all types of cast dentistry. ED Primer contains the adhesive monomer MDP as well as polymerization accelerators that cause the cement to set within one minute even if photo-activation is not possible. Further, the ED Primer will dissolve microscopic amounts of the Durelon cement that might remain on the tooth surface.

There are differences in the pre-treatment that is applied to the particular casting prior to loading the case with cement. For example, when the case contains a high-noble or noble-metal substructure, the internal surface of the casting is treated with "Alloy Primer" that will improve the bond to the metal and will co-polymerize with the MDP in the cement. For porcelain and cured composite castings, a preliminary treatment is required as follows:

1. Apply K-Etchant gel (Kuraray America) to internal surface of casting.
2. Rinse after 10 seconds and dry.
3. Activate the silane coupling agent by adding one drop of Clearfil Porcelain Bond Activator (Kuraray America) to one drop of the primer from Clearfil SE Bond (Kuraray America). Paint the mixture to the internal surface and dry (Fig. 7).

Individual castings are best handled by attaching them to a wax stick (Delar Wax) in a method described by Strupp. Now, a thin layer of MAque is applied on the external casting surfaces with a Microbrush (Microbrush International), under magnification, to within 0.5 mm of the margin (Fig. 8). The operator must take great care not to contaminate the internal aspect of the casting with the MAque since it will ruin the intended bond to the substrate. Similar to the cementation of the metal case, the cement forms a chemical bond between the activated porcelain surface and ED Primer-treated substrate.

The preparations after having been cleaned and then treated with ED Primer are ready for cementation. The cement is mixed on a pad for 20 seconds by the clock, and a thin layer applied to the internal aspects of the castings with a small brush. The castings are seated onto the preps one by one (Fig. 9), their fit verified with an explorer, continued on page 48
and a “wave cure” done for five to six seconds on the buccal and lingual surfaces with the curing light. This “wave cure” begins the setting process rapidly which prevents water absorption, plus it makes the initial cleanup easier to do by freeing up the interproximal contacts prior to the final set. At this point the case is left undisturbed for one minute to allow the cement inside the casting to set after coming in contact with the substrate that was previously treated with ED Primer. For this reason, it is important not to try and fill the cavity prep with freshly mixed cement prior to seating the casting! The ED Primer will cause the cement to set right away, and the casting will not seat all the way down. With the excess cement now partially set, it is easy to remove large chunks of it with a Bard Parker #12B blade, scalers, curettes and floss (Fig. 10). At this point, Oxyguard II (which is part of the Panavia kit) is syringed onto the seated castings and the case left undisturbed for three minutes by the clock, which is sufficient time for the cement to set.

The cleanup of excess cement is greatly facilitated by the earlier application of the Masque to the external casting surface. The use of this separating medium avoids the destructive use of rotary cutting instruments such as diamonds to remove set cement that will not come loose by other means. Once the excess is removed, a thorough scaling, polishing with rubber points and pumice, followed by flossing and rinsing will remove unseen cement and will create a smooth, maintainable surface for effective home plaque removal (Fig. 11).

A follow-up appointment in two weeks will enable the clinician to perform a final inspection of the field, making certain that no spicules of cement remain, and that the patient is performing satisfactory oral hygiene. At this appointment, oral hygiene is reviewed briefly, as well as a review of which kinds of foods and drinks to avoid. At this appointment, after full-arch impressions, soft trays are made of bleaching material and are fashioned for use with home fluoride gel (Prevident, Colgate). The patient is then re-scheduled for a three-month recall visit.

Conclusion

Complete control of the operative field will result in highly predictable results when cementing indirect dental restorations. The technique described above is useful when using any type of cement; however, the use of a composite resin adhesive such as Panavia F 2.0 offers multiple advantages. These specific benefits include the self-etching treatment of dentin, excellent durability, a fluoride releasing system and long-term consistent results.

Bibliography


** after simulated aging through cyclic loading (1.2 million) and dye penetration tests to determine microleakage, LSU School of Dentistry, current study.
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1. Which is not true?
   A) The catalyst in Panavia F® causes the monomer in ED Primer® to set.
   B) Dentin surface with the dry ED Primer causes Panavia F to set fully within one minute once the casting is seated.
   C) ED Primer can dissolve microscopic amounts of residual poly-carboxylate cement.
   D) An effective way to insert inlays following application of ED Primer is to load the cavity prep with Panavia F and then seat the casting.

2. Which cement must not be allowed to set completely prior to the removal of any excess?
   A) Durelon® cement.
   B) Zinc oxide eugenol cement.
   C) Calcium hydroxide cement.
   D) Zinc phosphate cement.

3. Since ED Primer is a self etching material...
   A) It functions exactly like 32% phosphoric acid in that it completely removes the entire smear layer.
   B) The timing of its application on cut dentin is critical for a successful result.
   C) Postoperative sensitivity can be expected to occur in about 30% of the cases.
   D) It creates a hybrid zone by keeping the smear layer intact thereby eliminating postoperative sensitivity.

4. Micro leakage occurs to the greatest extent in
   A) Resin cements.
   B) Zinc phosphate cements.
   C) Polycarboxylate cements.
   D) Glass ionomer cements.

5. Which is not true:
   A) Immediate dentin sealing with Clearfil Protect Bond is a good choice for full castings to be cemented with zinc phosphate cement.
   B) Both ED Primer and Oxyguard® will accelerate the set of Panavia F.
   C) Panavia F does not require photoinitiation with the curing light in order to set fully.
   D) Temporary cements containing eugenol should never be used for teeth that will be restored with a resin cement.

6. The best way to manage gingival tissue prior to cementation is:
   A) Use Viscostat® solution on bleeding tissues to achieve hemostasis.
   B) Achieve optimal tissue health with well fitting provisional.
   C) Apply Hemodent® to tissues for one minute, then rinse.
   D) Utilize retraction cord soaked in Hemodent, left in place for one minute.

7. Clearfil Protect Bond® does not...
   A) Disinfect the dentin surface.
   B) Contain MDP®, the adhesive primer found in ED Primer and Panavia F.
   C) Open the dentinal tubules by removing the smear layer.
   D) Release fluoride into the dentin.

8. An advantage to “wave curing” Panavia F is
   A) Beginning the setting process rapidly.
   B) Creating a partially set cement mix that is easier to handle at clean up.
   C) The ability to prevent the cement from bonding contacts together.
   D) All of the above.

9. The cement with the lowest tensile strength is:
   A) Polycarboxylate cement.
   B) Resin cement.
   C) Glass ionomer cement.
   D) Zinc phosphate cement.

10. The dental product used for hemostasis that will not interfere with the chemical bonding of a resin cemented casting to the dentin is:
    A) Viscostat.
    B) Hemodent.
    C) ED Primer.
    D) Superoxol bleach.

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