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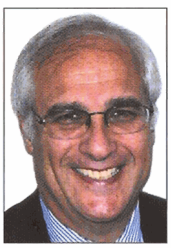
NEW TECHNIQUE

MonoCem® Adhesive Cementation



Howard S. Glazer, DDS

Over time, cements have traditionally relied on chemical-mechanical retention by design to adhere to the prepared tooth structure. Whether you were cementing a crown, bridge, inlay, or onlay, the design of the prepared tooth was the most influential factor in the retention of the restoration. Long axial walls and tapers were essential for creating precise mechanical fit. The cement merely filled in the "gaps" between prepared tooth structure and the restoration. A true chemical or adhesive bond was not predictable. Lack of success was increased even more when maintaining a dry field was somewhat of a challenge.

During the last several years, we have seen the development of cements that not only relate and hold 2 materials together as 1, but moreover, have now adhered to tooth structure to form a contiguous unit or "monobloc." This time, these newer cements in the "gap" bond the restoration and the prepared tooth structure. Certainly, it is important that cementation should be possible in a wet or moist field. However, in today's highly aesthetic marketplace, this quality alone may not be sufficient. An adhesive cement today must not only be biocompatible but must also be able to match closely the color of the restorative material and restoration.

No single cement is ideal in all situations. Often, the material and procedure define the choice of cement best suited for the situation at hand. Certain criteria are essential in selecting a cement. These include–but are not limited to–strength, reliability, predictability, setting time, and overall aesthetics. Add to this the ability to mix homogeneously, maintain a low film thickness, and clean up easily, and you have the essentials of "perfect" cement. Most recently, the ability of a cement to adhere to the prepared tooth has been a big advantage, and adhesive cements are most popular with practitioners.

The ability to bond to tooth structure is important. We know that resin cements will bond to enamel and dentin as well as create micromechanical attachments to restorative materials including ceramics. This is in sharp contrast to older cements like zinc phosphate, or even the later polycarboxylate cements that offered no adhesion to either tooth structure or restorative metals or ceramics. However, until now, the widespread use of resin cements has been unavoidably hampered by the number of steps and the chairside challenges of a complicated, multifaceted cementation protocol.

Ideally, cements should simply adhere to all restorative surfaces such as enamel, dentin, metal, porcelain, and even the latest material growing in popularity, zirconia. There should be a simplified

mixing procedure with a minimal number of applications, minimal steps such as wetting and/or drying, and be dual-cured. On the whole, resin cements can generally be divided into 3 categories: self-cured, light-cured, and dual-cured.

Self-cured resin cements have been traditionally best used for metal inlays and onlays, endodontic posts, and ceramo-metal and all metal restorations. They begin to set (ie, polymerize) by chemical reaction once their separate components are physically mixed together.

Light-cured cements depend on the light beam reaching all of the adhesive cement to ensure the cement is fully polymerized. This type of cement is best suited for metal-free restorations such as ceramic veneers, periodontal splints, or even metal-free orthodontic brackets. If, however, the ceramic is too thick such that the photoinitiators are not fully reached by the curing source, then the cement will not properly set, and there will be a resultant failure in the bonded/cemented restoration.

Dual-cured cements are indicated for restorations that are metal-free, and where there are sufficient self-cure initiators, they can be used in metal and ceramo-metal restorations. With this cement, the light initiates the photocure at the visible margins whereby it completely cures the cement almost instantly, while the cement not effected by the light will simultaneously self-cure over a specific period of time.

Shofu has seemingly conquered the problems heretofore mentioned with the introduction of MonoCem Self Adhesive Resin Cement. This cement is available in an auto-mix syringe so that a uniform, perfect mix is ensured whenever the material is dispensed. Even better is the fact that this cement is designed to be suitable for use in a moist environment and can be used with all types of crowns, bridges, inlays, and onlays, whether they are metal, ceramic, composite, zirconia, or any combination thereof.

Too many cements that are dual-cured require many technique-sensitive steps that are time-consuming and prone to operator error. MonoCem is actually a 1-step cement. You simply inject it onto the inner surfaces of the restoration and place the restoration. Prior to cementation, the tooth is left moist and requires no etch or prime. Curing can be initiated with a light source, or the material can simply self-cure.

MonoCem will be fully cured once exposed to the photocuring light source, and the unexposed cement will continue to cure fully in 7 minutes. The excess cement is easily cleaned with a scaler or curette once set. This cement is fluoride-releasing, and there is no post-cementation sensitivity.

There are 2 shades available: translucent and bleach white. The bleach shade is unique and useful with all ceramic restorations in the anterior segments. Both shades offer a low film thickness; 11 µm for the translucent shade and only 12.5 µm for the bleach shade. This low film thickness (compared to 25 µm for zinc phosphate cement) allows for a proper and fully seated restoration.

In today's world, there are many cements with a wide variety of steps and clinical applications. It is incumbent upon the practitioner to select the cement that will not only be easy to use but will also perform well over the life of the restoration. MonoCem Self Adhesive Resin Cement has facilitated the mixing of the cement while further simplifying the cementation procedure. In the end, we have a cement that acts like a true monobloc that has incorporated tooth and restoration into a single, functional unit.

MonoCem requires only 3 simple steps:

1. Rinse the tooth and leave moist. (No etch or prime of the surface is required.)
2. Using the automix tip, syringe the cement directly into/onto the restoration(s) after bleeding the syringe a bit as with any auto-mix product.
3. Place the restoration(s) onto the prepared tooth or teeth.

For more information, contact:

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AGD Impact
The Newsmagazine for General Dentists
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Products Review

What's hot and what's getting hotter

By Howard S. Glazer, DDS, FAGD

Products Review evaluates the latest in dental materials, equipment, and technology. All reviews are the opinions of the author, a practicing general dentist, and are not shared or endorsed by AGD Impact *or the Academy of General Dentistry.*

Materials

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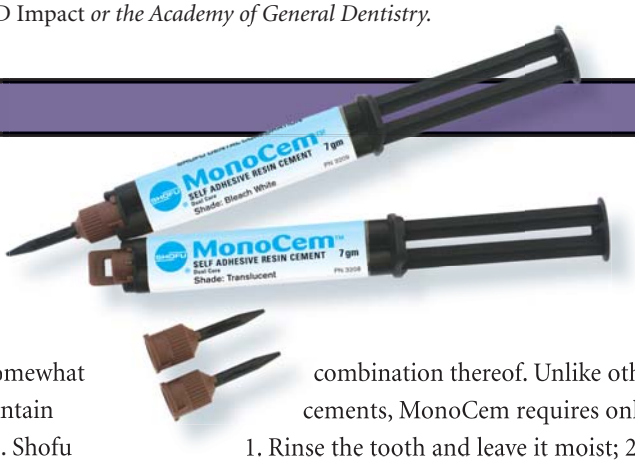

Cementation in a wet or moist field has always been somewhat of a challenge. Too often, it is nearly impossible to maintain the dry field requested by some cement manufacturers. Shofu Dental Corporation has seemingly conquered the problem with the introduction of MonoCem™ self adhesive resin cement. MonoCem is available in two shades: translucent and bleach white. Both shades come in a "no fuss-no muss" automix syringe that yields a perfect mix every time. This dual-cure cement is suitable for use in a moist environment and can be used with all types of crowns and/or inlay/onlays, be they metal (even Zirconia), ceramic, composite, or any combination thereof. Unlike other popular cements, MonoCem requires only three steps: 1. Rinse the tooth and leave it moist; 2. Syringe the cement into/onto the restoration (after bleeding the syringe a bit); and 3. Place the restoration onto the prepared tooth or teeth. The fluoride-releasing cement is easy to clean up once set. The films also are very thin. The translucent shade is 11µm, and the bleach shade, which is very useful with all ceramic restorations in the anterior segments, is 12.5µm. I have not experienced any problems with post-cementation sensitivity. The material cures fully in seven minutes.

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FIRST IMPRESSIONS

In First Impressions, Dr. George Freedman, DDS, gives readers a brief summary of products that have recently been introduced to dentistry, based on his clinical experience.

MonoCem
Shofu

Resin cements have many advantages: they bond to both tooth and crown surfaces, effectively eliminate marginal leakage, are strong (it is virtually impossible to remove a resin-cemented crown; it has to be cut off), and they are excellent under partially translucent aesthetic restorations. Resin cements also used to have their downsides: they required the tooth surfaces to be etched, primed, and bonded, often caused long-lasting post-cementation sensitivity, there were many steps in the mixing and the insertion of the cements (occasionally requiring trituration), and worst of all, they were technique-sensitive, requiring precise, time-limited, step-wise procedures at a clinical time when so many other things were happening. It can easily be said that the traditional resin cements were designed for a 6-handed operatory, not a 4-handed one. The introduction of Shofu's one-step MonoCem resin cement (with Embrace technology) literally revolutionizes the cementation process. MonoCem is self-adhesive to the tooth structure: no etching, no priming, no bonding, no drying, and no silane are required. MonoCem's designed to be applied to a moist tooth surface. Thus, vital dentin is not desiccated prior to cementation, and thus no post-cementation sensitivity occurs. MonoCem can be used for cementing PFM, gold, CEREC, reinforced ceramic crowns and bridges, inlays and onlays. MonoCem is available in 2 shades and has a low film thickness of 12 µm. MonoCem is injected directly from a dual-barreled syringe through an automixing tip for perfect self-cure chemistry every single time. Its photo-initiators allow for immediate marginal polymerization. Its tooth-integrating network eliminates microleakage and provides a virtually undetectable margin. MonoCem offers all-surface, all-restoration, one-step cementation for crowns and bridges—restorative dentistry has never been easier.✦

Shofu. For more information, call (800) 827-4638.

Dr. Freedman is past president of the American Academy of Cosmetic Dentistry and associate director of the Esthetic Dentistry Education Center at the State University of New York at Buffalo. He is also director of postgraduate programs in aesthetic dentistry at the Eastman Dental Center (Rochester) and university programs in Seoul, South Korea, and Schaan, Liechtenstein, and the chairman of the Clinical Innovations Conference (London). Dr. Freedman is the author or co-author of 9 textbooks, more than 200 dental articles, and numerous CDs, videos, and audiotapes, and is a team member of *REALITY*. He is a past director of CE programs in aesthetic dentistry at the Universities of California at San Francisco, Florida, UMKC, and Baylor College. A diplomate of the American Board of Aesthetic Dentistry, he lectures internationally on dental aesthetics, dental technology, and photography. Dr. Freedman maintains a private practice limited to aesthetic dentistry in Toronto, Ontario, and can be reached at (905) 513-9191.

TECHNICAL PROFILE

AN *INSIDE* LOOK FROM THE MANUFACTURER

Monocem: A Great Concept in Self-Etching Luting Agents

Regardless of their composition, indirect restorations historically have been cemented with zinc phosphate and polycarboxylate luting agents. The development of resin luting agents and glass ionomer cements, particularly in conjunction with the advent of hybridization concepts, has dramatically changed this type of approach. In contrast to traditional systems, it is now possible to not only bond to the surface of the tooth but also to the internal aspect of the restoration. Furthermore, the incorporation of these new concepts offers the promise of increased clinical longevity because of a decreased potential for microbial invasion and an increased resistance to secondary caries, as well as improved retention.

Figure 1 The MonoCem™ self-etching luting agent.

Properties of Monocem™ Self-Etching Resin Cement

- Easy, single-step automixing and application
- No surface preparation for tooth or restoration
- Bonds to all restorative materials
- Easy clean up
- High fluoride release
- Demand set
- No postoperative sensitivity
- Color-stable
- High retention strength
- Low film thickness (11 µm to 12 µm)
- Filler content 60%
- 100% polymerization
- Excellent physical and mechanical properties

While the enhanced clinical performance of the earlier resin cements was most welcome, the efforts necessary to use these novel materials were extensive, time consuming, and subject to error because of technique sensitivity. Specifically, both the preparation and the restoration had to be individually addressed. Some of the more traditional cementing techniques include acid-etching, rinsing, and drying of the prepared tooth, applying the dentin bonding agent, and then light-curing the restoration. Additionally, the internal aspects of the restoration require sandblasting and then surfacing with the appropriate sequencing of adhesive agent.

MonoCem™ (Shofu Dental Corporation, San Marcos, CA) was developed to simplify adhesive resin cementation and deliver the positive goals associated with excellent bonding without the numerous steps commonly necessary to do so. The simple procedure for luting and bonding the restoration are:

1. Rinse and leave the prepared tooth moist. The fabricated restoration itself should be left dry.
2. Inject the self-etching cement directly onto the internal surface of the restoration.
3. Insert the restoration onto the preparation; light-cure and/or self-cure.

In addition to the uniquely straightforward and simple directions for bonding the restoration, MonoCem is characterized by a number of excellent properties. It is a resin-based material with a filler content of 60%, providing it with excellent compressive (4,400 psi/310 MPa) and tensile strength. Despite the unusually high filler loading, the film thickness ranges between 11 µm to 12 µm, depending on the particular shade. The combination of the fine film thickness and dentin bonding ability results in the potential for generating margins which are virtually undetectable.

Other features of MonoCem are its ease of mixing, dispensing, and application. Consisting of a base and a catalyst, the material is packaged within a double-barreled syringe. Using minimal force, the material is ejected through an automixing tip. Because of the miniature size of the mixing device, the amount of material wasted in the mixing tip is less than 0.2 mL per mix. Because no special treatment of the restoration or the preparation is required, the luting agent can be injected directly onto the internal surface of the restoration or prosthesis that is being cemented. Because no dentin adhesives, etches, conditioners, or restoration surface treatments are required, the potential for a more predictable seating of the indirect restoration is likely. Finally, substantially reducing the number of steps that are typically required for cementation lowers the level of technique sensitivity and increases the potential for clinical success.

Another feature of this self-etching cement is its fluoride content and releasing ability. The fluoride ion release has been determined to be 7.9 ppm but is not associated with glass ionomer chemistry. Rather, the fluoride ion is actually part of the resin matrix, eliminating the potential for material degradation. Effective fluoride ion release plays a significant role in killing microbes responsible for cariogenesis long after the restoration has been inserted. Furthermore, the fluoride-containing resin matrix (using Embrace technology) undergoes total (100%) polymerization.

Eliminating the need for separately hybridizing the dentin surface to achieve high bond strengths also is an important feature. The incompatibility of dentin bonding agents and self-cure resins has been reported extensively in the literature but surprisingly has never prompted a clinical concern. Such incompatibility can cause interface failure and can obviously lead to nanoleakage, postoperative sensitivity, and debonding.

MonoCem is recommended for luting nearly all types of restorations; it is contraindicated for veneers. The recommended indications include precious and base-metal alloys, porcelain-fused-to-metal and metal-free crowns, bridges, inlays and onlays (both ceramic and laboratory-processed composite resins). Interestingly, this self-etching resin cement can be used with porcelain restorations without the need for silanation. It is also effective in bonding to both alumina- and zirconia-based ceramic systems. Furthermore, it successfully bonds chemically and mechanically to all types of core materials as well as to posts, including fiberglass and all types of alloys. Finally, the retention characteristics of this self-etching luting cement to most restorative systems are high.

Because the curing mechanism is based on chemical and light activation, there are many advantages. While the bulk of the cementing agent sets by chemical activation, the clinician can cure the margins in seconds. This means that cement exposed to moisture in the oral cavity can be cured on demand, preventing salivary contamination of the setting cement. Once the crown has been seated, exposing extruding cement to light activation for 2 to 3 seconds causes the material to attain a gel-like, nonsticky state. It is then possible to easily remove the extruded material with a scaler or explorer. The common problem of removing hardened cement well beyond the margins and interproximally is thus made considerably easier.

Figure 2 Finalized full-crown preparations on teeth Nos. 8 and 9.

Figure 3 Injection of luting agent into one of the ceramic crowns.

Figure 4 Seating and cementation of the full-crown ceramic restorations.

The development of MonoCem self-adhesive resin cement is a major advancement in resin-based luting agents. This recent addition to the clinician's armamentarium has extended the indications for resin cements and also dramatically simplified the process of cementation. Based on its properties and applications, it is probable that clinical longevity of all indirect restorations used in conjunction with this highly advanced material can be extended appreciably when indirect restorations are used in conjunction with this material.

PACKAGING

MonoCem Self-Etching Resin Cement is available in a number of formats. There are 2 shades: translucent and bleach. The kit also contains automixing tips and effective finishing points. In addition to 7-gram syringes, Shofu plans to introduce 3.5-gram syringes in the near future.

This article was written by Karl F. Leinfelder, DDS, MS.

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Adhesive Cementation: One Step and Predictable

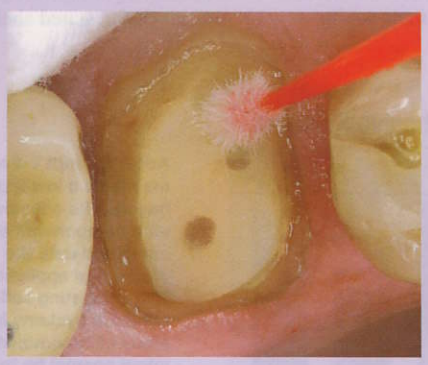
George Freedman DDS, FAACD, FADFE

Over the past century, dentists have used a variety of cements for indirect procedures. A cement is defined as an agent that relates two or more materials such that they stay together in a specific relationship, incorporated as if they were a single entity. Dental cements are used to attach dental restorations onto or into the teeth; some have been in use for many decades, while others have just recently been introduced.

The earliest luting cements relied on mechanical properties (long axial walls, tapered preparation, and precise fit) for retention. These conventional cements did little more than fill the space between the restoration and the tooth. The newer, adhesive cements, however, are designed to bond to both the restoration and the tooth, stabilizing the entire system. Adhesive cements bond to all the restorative components as they fill the gap between the restoration and the tooth, creating a MONOBLOC. In addition, adhesive cements are required to be functional, color-matched, and bio-compatible.

The type of procedure and the materials used determine the choice of cement; no single cement is ideally suitable for all purposes. Clinical selection criteria include strength, reliability, predictability, aesthetics, and most importantly, ease-of-use. Since resin cements bond to both enamel and dentin, and can develop micromechanical attachments to restorative materials, they have rapidly increased in popularity. After all, zinc phosphate and polycarboxylate cements have no adhesion or attachment whatsoever to enamel, dentin, metal, or ceramic.

Unfortunately, a great deal of confusion has developed in the indications and utilization modalities of resin cements. Although their adhesive properties are far superior to those of the earlier luting cements (zinc phosphate, polycarboxylate), dentists have hesitated to incorporate these materials due to their complex protocol, and the clinical



FIGURES 1 & 2—Prior to the 1-step resin cementation: remove the provisional crown, clean all provisional cement from the preparation (under magnification), and try-in the crown. Check for fit, margins, contacts, occlusion, shade, etc. Isolate (1) and moisten (2) prepared tooth.

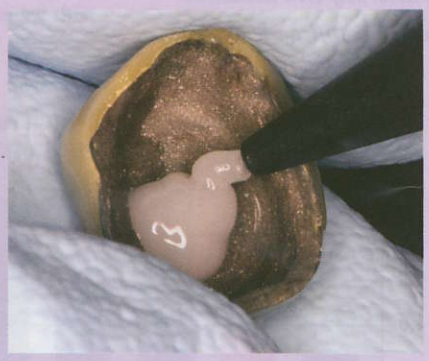


FIGURE 3—Step 1: Inject auto-mixed Shofu MonoCem dual-cure resin cement into the crown and seat on prepared tooth.

challenges associated with the many procedural steps required for applying them chairside.

The properties of an ideal cement include:

- Simple and effective adhesion to all dental and restorative surfaces (enamel, dentin, metal and porcelain).
- Little or no technique sensitivity (eliminating chairside mixing, multiple step applications, drying/wetting requirements, and a long self-cure setting time).
- Cementation must be easily performed by the dentist and the assistant together, or the dentist alone.

CURING MODES

Light-cure cements are indicated for thin, metal-free restorations (porcelain veneers, metal-free orthodontic retainers, and periodontal splints). In order to assure complete polymerization, the curing light must reach every part of the adhesive. Overly thick luting resin or ceramic can hamper deep photo-initiator activation, preventing complete polymerization, and leading to restorative failure.

Dual-cure resin cements are indicated for metal-free inlays, onlays, crowns, and bridges (and metal and ceramo-metal restorations where adequate self-cure initiators are present). The curing light beam polymerizes the visible resin cement directly, while light-inaccessible areas are cured by secondary chemical initiation. Once the dual-cure resin has been photo-initiated, phosphenes will continue the polymerization reaction in the remaining non-illuminated cement to completion.

Self-cure resin cements are indicated for metal inlays, onlays, metal and ceramo-metal crowns and bridges, and endodontic posts. These cements are not light-reactive, polymerizing to completion by chemical reaction after the separate components are physically mixed together.

RESIN CEMENT PARAMETERS

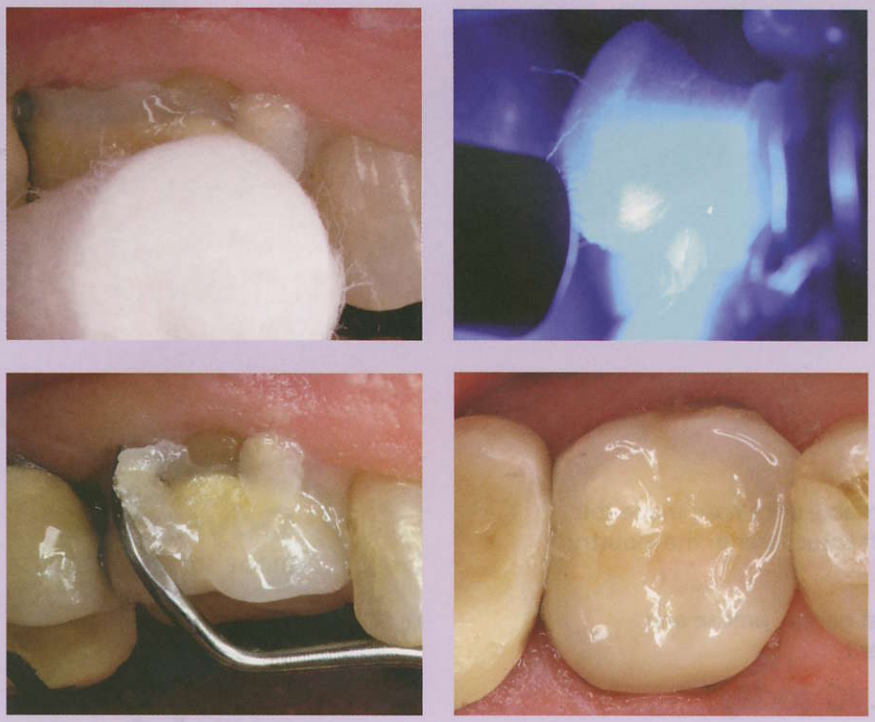
The **consistency** of cements ranges from very viscous to very runny. The clinical choice is a matter of personal preference. Viscous cements may require ultrasonic vibration during the seating of the restoration. Runny cements may not fill the tooth-restoration interface effectively.

The **film thickness** measures the minimum thickness that a cement must have under loading and functional pressures while maintaining its optimal properties. Most current resin cements have film thicknesses from 10-30µ. This resin film thickness fits well into clinical reality; the typical tooth-restoration gap observed with a good technician is about 50µ (film thickness of zinc phosphate is 25µ).

Resin cements are available in a variety of shades and opacities. Often, **translucent resin cements** offer the best aesthetic results. There is often a color discrepancy between tooth and restoration at the marginal interface. A resin gradient or color transition, can blend the colors.

Extraoral working time is no longer an issue with automix cements. Most four-handed practices utilizing automix cartridges prefer as short an extraoral working time as possible (a longer working time is appropriate for large cases or the solo dentist).

The **setting time** measures the polymerization phase of the cement after seating. This should always be as short as possible. Since the fluid pressure of the setting cement tends to extrude the restoration away from the preparation into high occlusion, con-



FIGURES 4-7—Maintain occlusal pressure (4) during light-curing of margins (5) and setting (approximately 5 minutes). Remove excess resin cement (6), and polish margins of the cemented crown (7).

Table 1

	Monocem (Shofu)	Embrace WetBond Universal Cement (Pulpdent)	Panavia F2.0 (Kuraray)	RelyX Unicem (3M ESPE)
Tooth preparation	1 rinse tooth and leave moist	1 rinse tooth and leave moist surface	1 rinse and damp dry 2 mix primer and apply to tooth 3 wait 30 seconds 4 gently air dry	1 rinse tooth and damp dry
Crown preparation	2 automix cement directly into coping	2 automix cement directly into coping	5 apply the metal primer 6 place base and catalyst onto mixing pad 7 mix cement 8 load cement into coping	2 activate capsule 3 load capsule into triturator 4 mix cement 5 place capsule into dispenser 6 load cement into coping
Crown seating	3 place crown onto preparation	3 place crown onto preparation	9 place crown onto preparation	7 place crown onto preparation

stant and continuous occlusal pressure is needed until polymerization is complete.

At the **rock-hard set time**, the cement is sufficiently hard that a sharp explorer cannot penetrate. At this stage, the exposed marginal cement can be routinely polished.

The **radiopacity** of the cement allows the dentist to distinguish between cement lines and recurring decay on radiographs during recall examinations.

The **post-cementation expansion** of resin cements will not affect metal or ceramo-metal crowns and bridges. An expansion that is too great or too rapid can be problematic for all-ceramic restorations, however. It is generally accepted that cements with less than 4% linear expansion are not likely to cause restorative failures (CRA Newsletter, Oct 2004).

The **ease-of-use** of a resin cement is often overlooked. The crucial questions include:

- How many steps are needed to prepare the tooth for cementation?
- How many steps are required to condition the internal surface of the crown?
- How many steps are required to prepare the cement components?

CEMENTATION TECHNIQUE

There are several steps that are common to all cementation procedures, and as such need not be considered in a comparison (removing the provisional crown and cement, pumicing the tooth, microabrading the internal surface of the crown, etc.).

Also common are the post-seating procedures for each of the cementation techniques: the margins are partially light-cured to initiate polymerization, and the excess cement removed. The margins are then fully light-cured, and polished once the cement is set.

Cementation is a well-documented protocol. Tooth surface preparation often involves several steps: etch, wash, condition, bond, and wait. Crown preparation includes internal surface activation, adhesion, and loading of the resin. Cement preparation can require material dispensing, measurement, and pad mixing. Add to these the absolute necessity for keeping the prepared tooth free of salivary (and other) contamination, and it is easy to see that traditional resin cementation can require six or eight hands for efficiency. Since most dentists practice in a 4-handed environment, this protocol is not realistic.

Dental practice is stressful at the best of times. There is no need to complicate it further, with techniques sensitive or clinically difficult procedures. The easier and faster a procedure is, the more readily it is adapted into the daily clinical routine.

Technique efficiency is also important consideration. Chairside time is the only commodity that a dentist has to offer, and given the operating overhead of a practice, it is expensive, costing at least $5-10 per minute. Thus, a more efficient cementation procedure is more valuable to the practitioner (assuming, of course, that all other clinical parameters remain the same). Another consideration is that each additional step (particularly in long, involved, multiphase procedures) brings with it an additional risk of clinical error or technique sensitivity; the more

the steps, the greater the risk.

Significant advances in the resin cementation techniques listed below include the elimination of all tooth preparation steps (etching and priming and bonding) for Monocem, Embrace and RelyX Unicem. Both Monocem and Embrace are simply automixed with a dual-barrel syringe through a mixing tip, and dispensed directly into the crown. RelyX Unicem capsule activation requires a triturator with appropriate settings for intensity and timing. Panavia F2.0 is manually pad-mixed and then spatulated into the crown. Monocem and Embrace are loaded directly into the crown, while RelyX Unicem requires a dedicated dispenser.

For all of these resin cements, the setting of the cement and the subsequent marginal curing and clean up are similarly straightforward.

The clinical steps required for PFM cementation with four popular cements: MonoCem, Embrace, Panavia F2.0, and RelyX Unicem are adapted from the CRA Newsletter, August 2004, are shown in Table 1.

Today's resin cements offer a variety of clinical options. They are predictable and easy to use clinically. Resin cements adhere to dentin and enamel and bond to metals and ceramics. These materials are so effectively related that they function together as a monobloc, much like the original healthy tooth.

Material technology advances have eliminated the need to etch or prime the tooth surface, or to manually mix cements. Dispensing has been simplified, eliminating technique sensitivity. With the simplification of cementation protocol, clinical confusion has been replaced by user-friendliness and predictability. **OH**

Dr. Freedman is past president of the American Academy of Cosmetic Dentistry and a founder of the Canadian Academy for Esthetic Dentistry. He is the Chairman of the Clinical Innovations Conference (London, United Kingdom) as well as the Dental Innovations Forum (Singapore). Dr. Freedman maintains a private practice limited to esthetic dentistry in Toronto, Canada, and can be reached at epdot@rogers.com.

Oral Health welcomes this original article.

Special thanks to Len Lim, RDT of Progenic Dental Lab for the excellent laboratory work.

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