Best practices for cementation

How to simplify cementation procedures for success.

By Laura Dorr

very clinical situation in the dental practice forces practitioners to make choices and decisions that will ultimately govern the end success of the procedure. It comes as no surprise that cementation is no different.

And there are many decisions to make when it comes to cements: Do you choose a light-cure or dual-cure cement? Self-etch or total-etch? Which brand will provide the highest bond strength and easiest cleanup? How long should you really be curing?

Each of these decisions can affect the outcome of your indirect restoration, so it's important to choose wisely each step of the way. Understanding how your cements work, their proper indications and best practices before you start a procedure can go a long way to minimizing the stress of the decision-making process and let you focus on what really matters: Creating a beautiful, longlasting restoration.

Cement properties

Long gone are the days where zinc phosphate was the only cement option available. Now, the market is flooded

with cements boasting various levels of insolubility, bond strength and retention. With so many properties to consider, cement selection has become one of the biggest challenges for many dentists.

"There are so many options today," says Robert Lowe, DDS, a general dentist in Charlotte, NC who has been practicing for 38 years. "The biggest mistake dentists make is they think all cements are equal. Don't pick a cement just because it's the cheapest or you buy all from one company. Most dentists want what's the quickest or easiest, but it's not always that easy to decide.

"Selection is very confusing for many dentists," agrees Susan McMahon, DMD, a cosmetic dentist in private practice in Pittsburgh. "I say, the simpler the better. If we can only have two or three cements in our practices, then the selection process would be much easier. Consider one for veneers, one for all other ceramics and one for implants."

So, what are the most important factors to consider with a cement? A lack of post-op sensitivity, predictable and consistent results, radiopacity, good bond strength and easy handling are all top considerations.



"I look for something that's flowable, radiopaque and has high compressive strength," says Johan Figueira, DDS, a comprehensive dentist practicing in Mexico. "And of course, it must be easy to use!"

In addition to strength and flowability, Dr. Lowe looks for several other characteristics.

"I'd say the top three properties to consider are calcium release, low film thickness and insolubility," Dr. Lowe says. "When it comes to film thickness, you don't want to create a thicker interspace than 30 to 50 microns. In most cements, film thickness is under 20 and certainly closer to 10 microns. So, this is an important property."

"The top concerns I have are no post-op sensitivity, predictable and consistent results and, importantly, beneficial calcium release," says Wynn Okuda, DMD, who is the president of the Pan Pacific Dental Academy and a private practitioner in Honolulu, HI."

Along with Dr Lowe, Dr. McMahon and Wynn Okuda, DMD, also cite calcium release as an important aspect to consider.

"The top concerns I have are no post-op sensitivity, predictable and consistent results and, importantly, beneficial calcium release," says Dr. Okuda, who is the president of the Pan Pacific Dental Academy and a private practitioner in Honolulu, HI.

"An ideal cement would release beneficial ions, and also have good bond strength to all substrates and materials," Dr. McMahon agrees. "For this reason, I like TheraCem."

"There aren't many materials that check all top three properties right now," Dr. Lowe says. "But BISCO's TheraCem does. It's a self-etching resin cement that has calcium-releasing properties and a pH that's basic."

Clinical indications

When just considering preferred cement properties, clinicians may find that many cements tick all the boxes. But not all materials are appropriate for every scenario. While doctors may favor certain cements, Dr. Okuda and Dr. Lowe believe that cement selection heavily depends on each individual case's clinical indications.

"I have a total-etch cement, I have self-etching cements and I have conventional cement, Dr. Lowe says. "So, what I use depends upon the clinical situation."

These clinical variables include the location and depth of a restoration, chemical compatibility with other materials, as well as curing processes.

Restoration location

One of the most important considerations in any clinical situation is the positioning of the restoration. For situations where color stability is a concern, such as anterior porcelain-bonded restorations, veneers or porcelain jacket crowns, clinicians should look for a material with good color stability, so the luting resin can't be seen through the veneer. Light-cured resin cements, such as Choice 2 from BISCO, that have a variety of colors, can be altered to allow clinicians control of the overall esthetics.

For thin anterior veneers, viscosity becomes another important consideration. Pick a luting resin that's too runny, you may get voids or bubbles inside the veneer, or leave open margins. Choose one that is too thick and the veneer may crack if too much pressure is placed upon it.

However, a less viscous luting resin is ideal for posterior bonded restorations such as e.Max or porcelain onlays/ inlays, Dr. Okuda says. And while esthetics aren't as critical in posterior restorations as anterior ones, a cement that offers a variety of color shades is preferable so that the shade can be adjusted to better blend with the tooth color.

Margin location

Margin depth can also affect cement choice. If the margin is above the gum, it's in an entirely different environment than a margin that is at gum level or below the gum. These different locations can affect bond strength, as well as



the patient's ability to keep the margins free of plaque or debris that could potentially damage the restoration or tooth.

When margins are under the gum, hydrophilic cements are what Dr. Lowe reaches for. Because they are more watertolerant, moisture won't affect the properties. In contrast, hydrophobic resin cements require expert isolation or the bond can fail due to moisture exposure.

"Margin placement is one of the biggest factors I consider with cement selection," Dr. Lowe says. "For margins that are under the gum, I chose a calcium aluminate. Water affects resins, so people that are just cementing everything with the latest and greatest resin not knowing where the margins are located, are going to run into problems."

That's not to say you should never use a resin cement on a sub-gingival margin, he clarifies. When a situation requires higher bond strengths, a resin cement may be the answer even though it's not the ideal material for the environment, because its bond strength is greater than that of calcium aluminate or conventional cement, particularly when used with total-etch.

"If you are dealing with short clinical crowns, using a totaletch technique can increase long-term success with these cases," Dr. Okuda agrees. "Personally, I've found that Duo-Link Universal and All-Bond Universal from BISCO are a great combination and can increase long-term success with these cases."

Dr. Okuda also prefers this combination because of the chemical compatibilities between the cement and dental adhesive, so the cement and adhesive work cohesively and little post-op sensitivity is experienced.

"Resin luting cements need to chemically pair with a dental adhesive to attain strong bonding for long-term success," Dr. Okuda explains. "It's another reason that I like Duo-Link Universal for posterior cases, because it has All-Bond Universal to pair with. For anterior bonded restorations, I combine Choice 2 with All-Bond Universal. Using sibling materials is always good because the chemistry of these materials was professionally engineered to work best with each other."

Light cure vs. dual cure

Location also plays a part in selecting cements when it comes to curing. Curing is a critical step, as weak or deficient curing can increase the frequency of sensitivity issues. When done correctly, light-cure, dual-cure and selfcure cements can all be effective—though their efficacy varies depending on the location and type of restoration.

For example, a dual-cure cement provides a stronger cure in deeper recessed areas of tooth preparation, or in thick





restorations such as zirconia or metallic porcelain-fusedto-metal. For this type of restoration, Dr. Okuda turns to TheraCem, because its ideal for crowns that don't have much light penetration but need maximum strength.

However, light curing allows more time for cleanup, which is an important consideration, particularly in multipleunit cases. This makes it an attractive option for thin restorations where it can be ensured that the light will penetrate effectively.

"During a multiple-unit case, I prefer light cure because it gives me more time to clean up," Dr. Lowe says. "The thing about dual cure is that there's no guarantee that the self-cure component will be as effective; they don't all self-cure at the same rate. However, dual cure will help give an added way to ensure the cement fully cures when you need deeper cures like through thicker crowns and things like that where light can't penetrate."

Steps for success

Once a cement has been selected, the hard work of cementation can begin. But it's important to plan ahead to ensure that the whole team understands the process and is working collaboratively. Taking a few extra steps can streamline the process and reduce the risk of errors.

"When cementing multiple units, a grid should be drawn on the benchtop by tooth number and then by stage of preparation (cleaned, then primer or silane if you're using that)," Dr. McMahon says. "That way the assistant and the doctor always know what stage each restoration is in; there's no confusion or mix-up with tooth numbers."

Dr. Figueira agrees that organization is key, and that establishing a set protocol can assist in making the process efficient, predictable and repeatable.

"You have to have a protocol and print it somewhere for your team," he says. "Even my front desk knows the protocols for cementation."

After the groundwork has been laid for the process, the work of cementation can begin.

Preparation

While some dentists may rely heavily on the cement to get the job done, it's not a solo act. The most important thing about cementation for any dental restoration is the preparation.

"Cements are not a catch-all for poor preparation and retention," Dr. Lowe says. "The preparation has to be retentive. It has to be as ideal as possible and the more you depend solely upon the cement to retain the restoration, the greater the potential for problems. So regardless of the type of cement the first thing always is to look at the preparation and make sure that it's properly retentive."

It may seem obvious, but checking that the restorations fit well and have tight and closed margins is an important step in cementing restorations. Many doctors think that their margins are closed when they're really not. A clinically acceptable margin on a crown is 30 to 50 microns, but bacteria are only one micron in diameter, Dr. Lowe says. This makes it critical for the luting cement to effectively fill the space between the crown and the tooth, to prevent bacterial contamination. However, tissue impingement on the margins can make it difficult to ensure clean margins.

"Often there can be tissue impingement on the margins of the prep and sometimes they release exudate or blood. Assuring the margins are clean and ready to accept the cement is critical," Dr. McMahon says. "I like to use my Gemini Laser to run around the margins with a light trough prior to cementation for a completely clean field."

And it's little things like this and other simple pre-seating steps that can make a big difference. "It's really all in the details," Dr. Okuda says. "Prior to seating a porcelain veneer or bonded e.Max restoration be sure to prepare the restoration properly. For a veneer and e.Max, make sure the intaglio surface is etched by the lab. Then place a silane coupling agent (such as BISCO's Bis-Silane) to increase bond strength to the restoration.

"For zirconia, be sure to place Z-Prime Plus from BISCO on the intaglio surface," he continues. "This will reduce contamination on the zirconia surface and increase the





CASE STUDIES

CASE STUDY #1 – Lithium Disilicate Veneers

Final smile



1. Pre-operative smile



4. Temporaries are mocked up



2. Preparations



5. Lithium disilicate veneers fabricated



3. Shade selection



6. Porcelain etchant used on restorations, then silane



7. Packing cord is applied under the gingiva for isolation



10. Veneer filled with eCEMENT



8. Enamel etch with phosphoric acid



11. Restorations seated



9. All-Bond Universal applied to tooth, air thinned and light cured



12. Excess cement is removed and then restorations are light-cured



bonding of the zirconia crown to the tooth. You must have a routine for seating that addresses all issues to have optimal outcome."

Planning ahead and being prepared are critical aspects of achieving that outcome. To address potential issues with cementation, Dr. Okuda recommends pumice cleaning the preparation. His next step prior to seating the crown is to cleanse all the prepped teeth with Cavity Cleanser (a chlorhexidine gluconate solution from BISCO). He also recommends desensitizing preps with MicroPrime G from ZEST Dental prior to placing adhesive on the tooth, which can help remove post-op sensitivity.

Before you begin to cement, you should also try on each restoration individually to check the marginal integrity, and then try in the restorations collectively to evaluate the proximal fit, Dr. Lowe says. "The clinical tip I always give is that I rarely cement more than two restorations at a time because I've got two hands."

These steps are critical to combat the micromovement that occurs after the crowns are placed, but prior to cementation. Dr. Lowe gives the example of cementing four crowns in a row: in the process of cementing two of the crowns, the other contacts can shift or become too tight and require adjustment. Instead, clinicians should try everything individually to evaluate the margins and then

"I think isolation is a critical thing, and it all depends on the margins," Robert Lowe, DDS says. "Margin placement is a critical factor in choosing the cement because if the margin of the crown is under the gum, there's no way to keep it dry, which makes it impractical to use hydrophobic cements." collectively—but hold off on cementation until after so that there is the opportunity to make microadjustments if the contacts are too tight once the crowns are cemented.

Isolation

Moisture is the downfall of many bonding procedures, so isolation is a key step. When a cement fails, it's likely that isolation issues came into play. Ensuring the field stays dry and clean and preventing contaminants from entering the working area can increase the efficacy and success of cements.

"Contamination is a big problem," Dr. Okuda says. "If you get saliva and blood on your tooth when seating a restoration, it's pretty much guaranteed that you will not have long-term success with this cementation. It's best to avoid this because if a cement fails, chances are you may have to redo the procedure. Having to redo crown and veneers will cost you more money than just doing it the right way the first time."

Dr. McMahon agrees that isolation cannot be taken lightly. "Once the selection of the cement has been made, then it's all about consistently isolating and cleaning before cementation," Dr. McMahon says. "After try-in, the restoration should be cleaned and the prep should be cleaned and kept isolated. Products like Isolite and DryShield work well for this."

Luckily, there are tools like rubber dams such as Optra-Gate from Ivoclar Vivadent and of course, Isolite from Zyris and DryShield[®] to help simplify isolation. Each clinical isolation situation is unique though and, just like with cements, each case may call for a different approach. These approaches can be greatly affected by margin location. If the margin is above the gum, it's much easier to achieve good isolation—while it's almost impossible to keep gingival crevicular fluid and saliva away from a margin that's below the gum line. In some cases, this may mean switching to a cement that is more moisture tolerant.

"I think isolation is a critical thing, and it all depends on the margins," Dr. Lowe says. "Margin placement is a critical factor in choosing the cement because if the margin of the crown is under the gum, there's no way to keep it dry, which makes it impractical to use hydrophobic cements."

Timing

For many things in life, timing is everything. Cementation is no different, particularly when it comes to the cleanup of excess cement. Clean up too early and you might displace the restoration. Wait too long, and you'll have to pull out the bur or drill to chip it off (which could lead to increased post-op sensitivity). "I think a big mistake that clinicians make is they try to clean up too fast before they allow the chemistry to actually work," Dr. Lowe says. "With resin self-etching cements, you don't want to disturb the restoration for at least 90 seconds to allow the self-etching properties of the cement to actually work on the dentin. So, if while cleaning you move the crown around before it works, you take the chance of lowering the bond strengths of the product immediately."

That doesn't mean you can't start cleaning up, Dr. Lowe says. You just have to take extra care to ensure the



CASE STUDIES CASE STUDY #2 – Zirconia Crowns

1. Zirconia crown fabricated.



2. Sandblasting



5. Crown is cemented onto screw



8. Implant abutment is sandblasted



3. Application of primer

6. Adjustments



9. Primer applied to abutment



4. Duo-Link Universal is placed inside the restoration



7. Polishing



10. Crown is screwed onto abutment, primer applied



restoration is held in place, or that it is stabilized by the dental assistants to prevent movement. The timing can sometimes be a difficult call to make. This goes back to following the directions for a specific product, and knowing the window of time you have to clean up. If you aren't prepared, Dr. Lowe says, you may not end up with the time you expected between the gel set and the final set—and if things set too quickly when you're placing multiple crowns, you'll run into problems.

"Of course, cleaning before the gel set is the easiest, because if you wait to clean until after the final set, then sometimes you need a drill to clean it up," Dr. Lowe says. "So, there's a clinical judgment there, and timing is critical."

It's also important to take into account your overall procedure time, which can be affected by how many restorations you are trying to finish.

"If you're seating multiple porcelain veneers at one time, you need a material that has a lot of working time," Dr. Okuda says. "You don't want the luting cement to cure too quickly."

Avoiding user error

While it's easy to blame the materials when restorations fail, in the end, the most common mistakes stem not from the cement or adhesives, but from user error. This makes technique and execution paramount. But often, the mistake occurs when dentists skip what should be the very first step: Reading the directions for a cement.

"I think one of the biggest culprits in cement failure is probably that dentists don't read directions," Dr. Lowe says. "There are so many different cements and they all behave slightly differently. It's important to follow the instructions and work within the confines of that particular product."

Not reading the instructions can not only lead to user error, but also to the misuse of cement in situations for which it is not indicated.

"One of the biggest mistakes is using the wrong cement for a specific clinical procedure," Dr. Okuda says. "Sometimes dentists want to buy the least number of materials so they'll use one cement for all situations. This clearly doesn't work. They need to invest in the proper materials to get long-term success."

Even if the correct cement is used (and the directions are followed exactly), technique can pose a challenge. And the more steps in the procedure, the greater the opportunity for error.

"There's always a degree of uncertainty as far as technique is concerned," Dr. Lowe says. "There's technique sensitivity, and the more things you involve the trickier things become. For example, if you're using etch-andrinse, how long are you etching? Are you etching too long or not etching long enough?

"Any time you're dealing with so many steps and different things to use, there's always a potential for mistakes when going through cementation," he continues. "And then add to that if someone is cementing four crowns at once or eight crowns at once. The complexity of the operation magnifies significantly."

Striving for successful cementation

In the end, complications can arise that are outside of the doctor's control. Patients may not practice good homecare, which will have a negative effect on the longevity of the restoration and the cement seal. They may not return for their follow-up appointments, eliminating the opportunity for the doctor to check for occlusion issues. And sometimes, even if you do everything right, the cement might fail.

But although there is always a risk that these scenarios may occur, through deliberate cement selection, proper utilization, exact technique and successful execution, clinicians can ensure they get the best results possible.

