

Simplifying the Cementation of Porcelain Onlays



By Jose-Luis Ruiz, DDS, FAGD

The use of full porcelain restorations is increasing, offering the advantages of excellent aesthetics, less tooth reduction than porcelain-fused-to-metal (PFM) crowns, and kindness to the gingival tissues. One reason these types of restorations are not more popular, though, is their technique sensitivity. As reported in the text, *Esthetic Dentistry, A Clinical Approach to Techniques and Materials* (Dale and Aschheim; Mosby), resin cementation of these restorations can require up to 22 steps, any of which can lead to failure if performed incorrectly.

Mainly because of this complicated and technique sensitive cementation, many dentists turn to PFM crowns as the primary indirect aesthetic restorative option. PFM crowns require more aggressive preparation and difficult tissue management, including aggressive cord packing; they are less aesthetically pleasing; and they sometimes require gingival removal. However, their cementation is easy and predictable. Simplification of the cementation of full porcelain restorations would be a huge step forward in aesthetic dentistry.

Utilizing a new technique as described in this article has made the cementation of porcelain onlays a more routine and enjoyable procedure.

With society demanding a more attractive smile,¹ and an increased life expectancy demanding more conservative dentistry, patients are continually refusing the "ideal" gold onlay even after being presented with its many advantages.² For a patient who places an emphasis on aesthetics, the treatment of choice for a small cavity is a composite filling. However, when the same patient presents with a larger cavity, large composites may be a less attractive choice. Likewise, when the patient refuses a gold onlay because of its unattractive appearance, the most commonly used restoration is a PFM crown.

A more ideal option, however, would be a porcelain onlay,³ as it conserves existing dentition, is gentle to the gingival tissue, and is more aesthetically pleasing. It is this author's opinion that more dentists are not utilizing

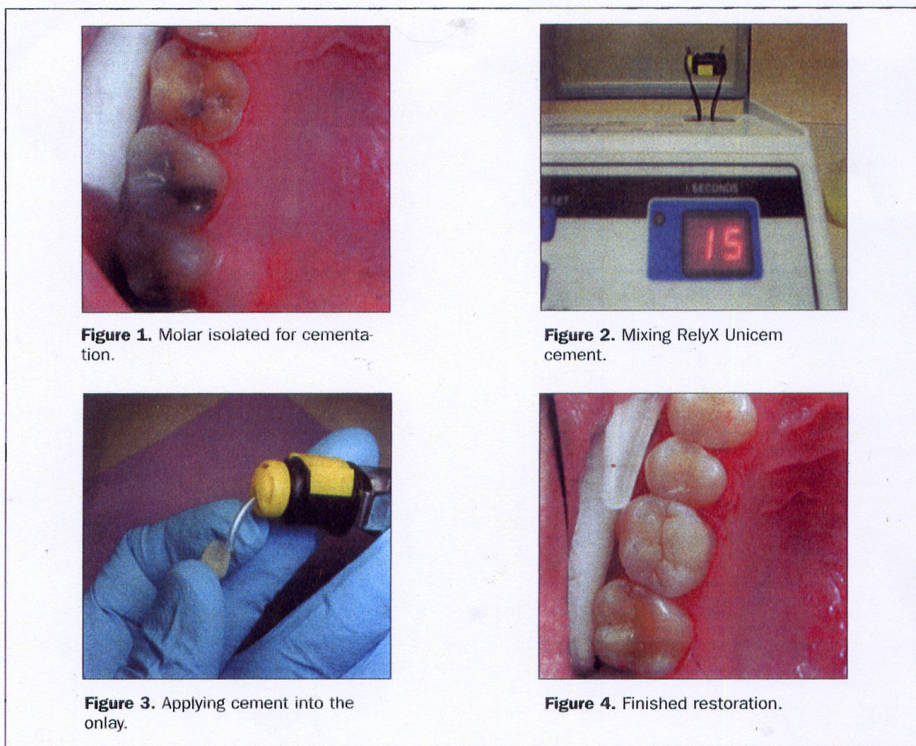


Figure 1. Molar isolated for cementation.

Figure 2. Mixing RelyX Unicem cement.

Figure 3. Applying cement into the onlay.

Figure 4. Finished restoration.

porcelain onlays or all-porcelain restorations because they need to be bonded and cemented utilizing resin cement,⁴ which is a more technique sensitive procedure.

The preparation and impression technique for porcelain onlays is much simpler than that for a PFM. Because all preparation is supragingival, no cord or tissue management is needed, and less tooth reduction is required. Eliminating the need for tissue management, accordingly, makes it easier to take an impression. Until recently, the only difficult part of the treatment was the cementation.

CONVENTIONAL TECHNIQUE FOR CEMENTING PORCELAIN ONLAYS

Conventional onlay cementation utilizing a total-etch bonding system is very technique sensitive.⁵ The many complicated steps required create the possibility for error and failure, including postoperative sensitivity or onlay fracture because of cementation error. Conventional onlay cementation requires

more than 13 separate steps (Table 1). The time spent following these steps can be without a doubt the most stressful few minutes of the dentist's day, since any mistake can lead to failure.

NEW TECHNIQUE FOR CEMENTING PORCELAIN ONLAYS

This article presents a case report using a technique for cementing porcelain onlays that requires less than half the steps and half the time of conventional techniques. The cement used in this technique is RelyX Unicem Self-Adhesive Universal Resin Cement (3M ESPE). The restoration should be porcelain etched and silanated.⁶ However, because the cementation can be accomplished so quickly, isolation is much easier and there is no need to use desensitizer, as the material is a self-etch/self-bond system, and sensitivity is almost nonexistent. The cement is then mixed and the restoration

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inserted in the mouth. Note that care should be placed in properly curing the cement,⁷ although the material is dual-cure. After cleaning

residual cement, the dentist then can finish as usual. Table 2 depicts this new technique.

CASE REPORT

The following case report

demonstrates how utilizing this new cementation technique for porcelain onlays requires significantly less steps than a conventional technique. This ultimately saves the dentist time while

offering the patient aesthetically pleasing results and reducing the risk of discomfort.

A 41-year-old male presented with a large 20-year-old amalgam filling that was

broken and leaking, with extensive cuspal fracture. As the patient insisted that no visible metal be utilized, treatment options were limited, as damage to the tooth was too extensive for a conventional composite filling. Accordingly, the only remaining option was a PFM or more conservative nonmetal onlay. After being presented with both options, the patient chose an onlay.

The initial preparation visit is, as mentioned, considerably simplified and shortened because tooth preparation is less complicated, no tissue management is needed, and impression taking is easier because margins are supragingival.

TECHNIQUE

Step 1. Pretreatment of the restoration was accomplished according to the manufacturer's recommendation. In this case, the porcelain onlay was silane treated after try-in and clean-up.

Step 2. After removal of the temporary restoration, the tooth was thoroughly cleaned utilizing a pumice and water slurry.

Step 3. The tooth was isolated. Note: Because cementation will be accomplished very rapidly, simple cotton roll isolation usually is sufficient (Figure 1).

Step 4. RelyX Unicem Self-Adhesive Universal Resin Cement was activated by inserting the Aplicap (3M ESPE) capsule into the Activator. The handle was pressed down completely and held for 2 to 4 seconds. The activated capsule was inserted into the mixing device and mixed for 15 seconds at high speed (Figure 2).

Step 5. Cement was applied to the restoration and tooth, ensuring margins were wet with cement (Figure 3). The restoration was inserted using gentle pressure.

Step 6. The composite was polymerized utilizing a curing light for 3 seconds on the buccal and lingual surfaces.

Step 7. Excess cement was removed, and the interproximal areas were carefully flossed.

Step 8. After the cement was thoroughly cleaned, a full cure cycle was performed (or, allow the material to self-cure for 5 minutes from start

Citanest® Plain Dental (prilocaine HCl Injection, USP) 4% Injection

Citanest® Forte Dental (prilocaine and epinephrine Injection, USP) 4% Injection with epinephrine 1:200,000

For Local Anesthesia in Dentistry

Brief Summary of Prescribing Information

INDICATIONS AND USAGE

4% Citanest Plain Dental (prilocaine HCl) and 4% Citanest Forte Dental Injections are indicated for the production of local anesthesia in dentistry by nerve block or infiltration techniques. Only accepted procedures for these techniques as described in standard textbooks are recommended.

CONTRAINDICATIONS

Prilocaine is contraindicated in patients with a known history of hypersensitivity to local anesthetics of the amide type and in those rare patients with congenital or idiopathic methemoglobinemia.

WARNINGS

DENTAL PRACTITIONERS WHO EMPLOY LOCAL ANESTHETIC AGENTS SHOULD BE WELL VERSED IN DIAGNOSIS AND MANAGEMENT OF EMERGENCIES THAT MAY ARISE FROM THEIR USE. RESUSCITATIVE EQUIPMENT, OXYGEN AND OTHER RESUSCITATIVE DRUGS SHOULD BE AVAILABLE FOR IMMEDIATE USE.

To minimize the likelihood of intravascular injection, aspiration should be performed before the local anesthetic solution is injected. If blood is aspirated, the needle must be repositioned until no return of blood can be elicited by aspiration. Note, however, that the absence of blood in the syringe does not assure that intravascular injection will be avoided.

Citanest Dental with epinephrine injections contain sodium metabisulfite, a sulfite that may cause allergic-type reactions including anaphylactic symptoms and life-threatening or less severe asthmatic episodes in certain susceptible people. The overall prevalence of sulfite sensitivity in the general population is unknown and probably low. Sulfite sensitivity is seen more frequently in asthmatic than in nonasthmatic people.

Methemoglobinemia: Prilocaine has been associated with the development of methemoglobinemia. Very young patients, patients with congenital or idiopathic methemoglobinemia, or patients with glucose 6-phosphate deficiencies are more susceptible to methemoglobinemia.

Patients taking drugs associated with uric acid induced methemoglobinemia such as sulfonamides, acetaminophen, acetaminol, aniline dyes, benzocaine, chlorzoxazone, dapsone, naphthalene, nitrites, nitrofurantoin, nitroglycerin, nitroprusside, pamaquine, para-aminosalicylic acid, phenacetin, phenobarbital, phenytoin, primaquine, and quinine are also at greater risk for developing methemoglobinemia.

PRECAUTIONS

General: The safety and effectiveness of prilocaine depend on proper dosage, correct technique, adequate precautions, and readiness for emergencies. Standard textbooks should be consulted for specific techniques and precautions for various regional anesthetic procedures. Resuscitative equipment, oxygen, and other resuscitative drugs should be available for immediate use. (See WARNINGS and ADVERSE REACTIONS.) The lowest dosage that results in effective anesthesia should be used to avoid high plasma levels and serious adverse effects. Repeated doses of prilocaine may cause significant increases in blood levels with each repeated dose because of slow accumulation of the drug or its metabolites. Tolerance to elevated blood levels varies with the status of the patient. Dehydrated, elderly patients, acutely ill patients, and children should be given reduced doses commensurate with their age and physical status. Prilocaine should also be used with caution in patients with severe shock or heart block.

Local anesthetic injections containing a vasoconstrictor should be used cautiously in areas of the body supplied by end arteries or having otherwise compromised blood supply. Patients with peripheral vascular disease and those with hypertensive vascular disease may exhibit exaggerated vasoconstrictor response. Ischemic injury or necrosis may result. Preparations containing a vasoconstrictor should be used with caution in patients during or following the administration of potent general anesthetic agents, since cardiac arrhythmias may occur under such conditions.

Cardiovascular and respiratory (adequacy of ventilation) vital signs and the patient's state of consciousness should be monitored after each local anesthetic injection. Restlessness, anxiety, lightheadedness, blurred vision, tremors, depression or drowsiness should alert the practitioner to the possibility of central nervous system toxicity. Signs and symptoms of depressed cardiovascular function may commonly result from a vasovagal reaction, particularly if the patient is in an upright position. (See ADVERSE REACTIONS, Cardiovascular System.)

Since amide-type local anesthetics are metabolized by the liver, prilocaine should be used with caution in patients with hepatic disease.

Patients with severe hepatic disease, because of their inability to metabolize local anesthetics normally, are at greater risk of developing toxic plasma concentrations. Prilocaine should also be used with caution in patients with impaired cardiovascular function since they may be less able to compensate for functional changes associated with the prolongation of A-V conduction produced by these drugs.

Many drugs used during the conduct of anesthesia are considered potential triggering agents for familial malignant hyperthermia. Since it is not known whether amide-type local anesthetics may trigger this reaction and since the need for supplemental general anesthesia cannot be predicted in advance, it is suggested that a standard protocol for the management of malignant hyperthermia should be available. Early unexplained signs of tachycardia, tachypnea, labile blood pressure and metabolic acidosis may precede temperature elevation. Successful outcome is dependent on early diagnosis, prompt discontinuance of the suspect triggering agent(s) and institution of treatment, including oxygen therapy, indicated supportive measures and dantrolene (consult dantrolene sodium intravenous package insert before using).

Prilocaine should be used with caution in persons with known drug sensitivities. Patients allergic to para-aminobenzoic acid derivatives (procaine, tetracaine, benzocaine, etc.) have not shown cross sensitivity to prilocaine.

Use in the Head and Neck Area: Small doses of local anesthetics injected into the head and neck area, including retrobulbar, dental and stellate ganglion blocks, may produce adverse reactions similar to systemic toxicity seen with unintentional intravascular injections of larger doses. Confusion, convulsions, respiratory depression and/or respiratory arrest, and cardiovascular stimulation or depression have occurred. These reactions may be due to intra-arterial injection of the local anesthetic with retrograde flow to the cerebral circulation. Patients receiving these blocks should have their circulation and respiration monitored and be constantly observed. Resuscitative equipment and personnel for treating adverse reactions should be immediately available. Dosage recommendations should not be exceeded. (See DOSAGE AND ADMINISTRATION.)

Information for Patients: The patient should be informed of the possibility of temporary loss of sensation and muscle function following infiltration or nerve block injections.

The patient should be advised to exert caution to avoid inadvertent trauma to the lips, tongue, cheek mucosae or soft palate when these structures are anesthetized. The ingestion of food should therefore be postponed until normal function returns.

The patient should be advised to consult the dentist if anesthesia persists, or if a rash develops.

Clinically Significant Drug Interactions: The administration of local anesthetic injections containing epinephrine or norepinephrine to patients receiving monoamine oxidase inhibitors, tricyclic antidepressants or phenothiazines may produce severe, prolonged hypotension or hypertension. Concurrent use of these agents should generally be avoided. In patients when concurrent therapy is necessary, careful patient monitoring is essential.

Concurrent administration of vasopressor drugs and ergot-type oxytocic drugs may cause severe, persistent hypertension or cerebrovascular accidents.

Prilocaine may contribute to the formation of methemoglobinemia in patients treated with other drugs known to cause this condition (see methemoglobinemia subsection of WARNINGS).

Drug/Laboratory Test Interactions: The intramuscular injection of prilocaine may result in an increase in creatine phosphokinase levels. Thus, the use of this enzyme determination, without isoenzyme separation, as a diagnostic test for the presence of acute myocardial infarction may be compromised by the intramuscular injection of prilocaine.

Carcinogenesis, Mutagenesis, Impairment of Fertility: Studies of prilocaine in animals to evaluate the carcinogenic and mutagenic

potential or the effect on fertility have not been conducted.

Chronic oral toxicity studies of ortho-toluidine, a metabolite of prilocaine, in mice (150-800 mg/kg) and rats (150-800 mg/kg) have shown that ortho-toluidine is a carcinogen in both species. The lowest dose corresponds to approximately 50 times the maximum amount of ortho-toluidine to which a 50 kg subject would be expected to be exposed following a single injection (8 mg/kg) of prilocaine.

Ortho-toluidine (0.5 µg/mL) showed positive results in *Escherichia coli* DNA repair and phase-induction assays. Urine concentrates from rats treated with ortho-toluidine (300 mg/kg, orally) were mutagenic for *Salmonella typhimurium* with metabolic activation. Several other tests, including reverse mutations in five different *Salmonella typhimurium* strains with or without metabolic activation and single strand breaks in DNA of V79 Chinese hamster cells, were negative.

Use in Pregnancy: Teratogenic Effects—Pregnancy Category B. Reproduction studies have been performed in rats at doses up to 30 times the human dose and revealed no evidence of impaired fertility or harm to the fetus due to prilocaine. There are, however, no adequate and well-controlled studies in pregnant women. Animal reproduction studies are not always predictive of human response. General consideration should be given to this fact before administering prilocaine to women of childbearing potential, especially during early pregnancy when maximum organogenesis takes place.

Nursing Mothers: It is not known whether this drug is excreted in human milk. Because many drugs are excreted in human milk, caution should be exercised when prilocaine is administered to a nursing woman.

Pediatric Use: Dosages in children should be reduced, commensurate with age, body weight, and physical condition. (See DOSAGE AND ADMINISTRATION.)

ADVERSE REACTIONS

Swelling and persistent paresthesia of the lips and oral tissues may occur. Persistent paresthesia lasting weeks to months, and in rare instances paresthesia lasting greater than one year have been reported.

Adverse experiences following the administration of prilocaine are similar in nature to those observed with other amide local anesthetic agents. These adverse experiences are, in general, dose-related and may result from high plasma levels caused by excessive dosage, rapid absorption or unintentional intravascular injection, or may result from a hypersensitivity, idiosyncrasy or diminished tolerance on the part of the patient. Serious adverse experiences are generally systemic in nature. The following types are those most commonly reported.

Central Nervous System: CNS manifestations are excitatory and/or depressant and may be characterized by lightheadedness, nervousness, apprehension, euphoria, confusion, dizziness, drowsiness, tinnitus, blurred or double vision, vomiting, sensations of heat, cold or numbness, twitching, tremors, convulsions, unconsciousness, respiratory depression, and arrest. The excitatory manifestations may be very brief or may not occur at all, in which case the first manifestation of toxicity may be drowsiness merging into unconsciousness and respiratory arrest.

Drowsiness following the administration of prilocaine is usually an early sign of a high blood level of the drug and may occur as a consequence of rapid absorption.

Cardiovascular System: Cardiovascular manifestations are usually depressant and are characterized by bradycardia, hypotension, and cardiovascular collapse, which may lead to cardiac arrest.

Signs and symptoms of depressed cardiovascular function may commonly result from a vasovagal reaction, particularly if the patient is in an upright position. Less commonly, they may result from a direct effect of the drug. Failure to recognize the premonitory signs such as sweating, a feeling of faintness, changes in pulse or sensorium may result in progressive cerebral hypoxia and seizure or serious cardiovascular catastrophe. Management consists of placing the patient in the recumbent position and ventilation with oxygen. Supportive treatment of circulatory depression may require the administration of intravenous fluids, and, when appropriate, a vasopressor (eg, epinephrine) as directed by the clinical situation.

Allergic: Allergic reactions are characterized by cutaneous lesions, urticaria, edema or anaphylactoid reactions. Allergic reactions as a result of sensitivity to prilocaine are extremely rare and, if they occur, should be managed by conventional means. The detection of sensitivity by skin testing is of doubtful value.

Neurologic: The incidences of adverse reactions (eg, persistent neurologic deficit) associated with the use of local anesthetics may be related to the technique employed, the total dose of local anesthetic administered, the particular drug used, the route of administration, and the physical condition of the patient.

DOSAGE AND ADMINISTRATION

The dosage of Citanest Plain Dental Injection and Citanest Forte Dental Injection varies and depends on the physical status of the patient, the area of the oral cavity to be anesthetized, the vascularity of the oral tissues, and the technique of anesthesia. The least volume of injection that results in effective local anesthesia should be administered. For specific techniques and procedures of local anesthesia in the oral cavity, refer to standard textbooks.

Inferior Alveolar Block: There are no practical clinical differences between Citanest Dental with and without epinephrine when used for inferior alveolar blocks.

Maxillary Infiltration: Citanest Plain Dental is recommended for use in maxillary infiltration anesthesia for procedures in which the painful aspects can be completed within 15 minutes after the injection. Citanest Plain Dental is therefore especially suited to short procedures in the maxillary anterior teeth. For long procedures, or those involving maxillary posterior teeth where soft tissue numbness is not troublesome to the patient, Citanest Forte Dental is recommended.

For most routine procedures, initial dosages of 1 to 2 mL of Citanest Plain Dental Injection or Citanest Forte Dental Injection will usually provide adequate infiltration or major nerve block anesthesia.

The maximum recommended dose that should ever be administered within a two hour period in normal healthy adults should be calculated based upon the patient's weight as follows:

Weight	Maximum recommended dose
<150 lbs (<70 kg)	4 mg/lb (8 mg/kg)
≥150 lbs (≥70 kg)	600 mg (15 mL) or 8 cartridges

In children under 10 years of age it is rarely necessary to administer more than one-half cartridge (40 mg) of Citanest Plain Dental Injection or Citanest Forte Dental Injection per procedure to achieve local anesthesia for a procedure involving a single tooth. In maxillary infiltration, this amount will often suffice to the treatment of two or even three teeth. In the mandibular block, however, satisfactory anesthesia achieved with this amount of drug will allow treatment of the teeth in an entire quadrant.

ASPIRATION PRIOR TO INJECTION IS RECOMMENDED, since it reduces the possibility of intra-vascular injection, thereby keeping the incidence of side effects and anesthetic failure to a minimum.

NOTE: Parenteral drug products should be inspected visually for particulate matter and discoloration prior to administration whenever the solution and container permit. Solutions that are discolored and/or contain particulate matter should not be used.

Any unused portion of a cartridge of Citanest Plain Dental or Citanest Forte Dental Injection should be discarded.

Maximum Recommended Dosages: In patients weighing <150 lbs (70 kg), no more than 4 mg/lb (8 mg/kg) should be administered. In patients weighing ≥150 lbs, no more than 600 mg (8 cartridges) of prilocaine HCl should be administered as a single injection.

Children: It is difficult to recommend a maximum dose of any drug for children since this varies as a function of age and weight. For children of less than ten years who have a normal lean body mass and normal body development, the maximum dose may be determined by the application of one of the standard pediatric drug formulas (eg, Clark's rule). For example, in a child of five years weighing 50 lbs, the dose of prilocaine hydrochloride should not exceed 150-200 mg (6.6-8.8 mg/kg or 3-4 mg/lb of body weight) when calculated according to Clark's rule.

For more detailed information, consult your DENTSPLY Pharmaceutical representative and read the full Prescribing Information.

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PHARMACEUTICAL

Table 1. With Conventional Cementation Technique Utilizing Any Total-Etch Bonding System, Strict Isolation Is Essential and Must Be Maintained for Several Minutes.

Tooth Preparation:

- (1) Isolate
- (2) Etch (30 seconds)
- (3) Rinse (10 seconds)
- (4) Apply Desensitizer (60 seconds)
- (5) Apply Primer (20 seconds)
- (6) Apply Bond
- (7) Mix and Apply Cement
- (8) Seat Restoration
- (9) Light Cure
- (10) Clean and Finish

Onlay Preparation:

- (1) Porcelain Etch
- (2) Apply Silane
- (3) Apply Primer

Table 2. Reduced Number of Steps With New Cementation Technique.

Tooth Preparation:

- (1) Isolate
- (2) Mix and Apply Cement
- (3) Seat Restoration
- (4) Cure
- (5) Clean and Finish

Onlay Preparation:

- (1) Porcelain Etch
- (2) Silane

of mix). Note: At this time, the margins were finished with the appropriate finishing burs, strips, and polishing system.

Figure 4 depicts the completed restoration.

CONCLUSION

Utilizing a new technique as described in this article has made the cementation of porcelain onlays a more routine and enjoyable procedure. Whereas bonded restorations require strict isolation throughout the procedure, and the conventional cementation appointment has been viewed with apprehension, cementation is now completed more quickly, and isolation rarely is a problem. Since implementing this procedure, dozens of restorations have been placed with complete success by the author. Further, at 1-week follow-up appointments, pa-

tients report very little post-operative sensitivity. Long-term success, as in other pro-

cedures, will be determined only after a few years of function in the mouth.♦

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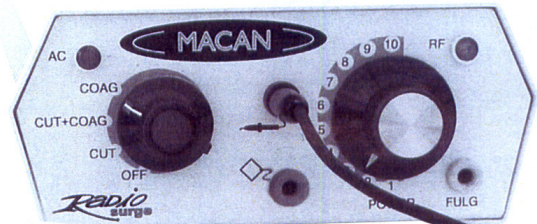
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