Establishing Clinical Guidelines to Ensure Optimized Pulp Therapy Outcomes: Utilization of Biologically Based Data

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"New opinions are always suspected, and usually opposed, without any other reason but because they are not already common." From An Essay concerning Human Understanding (John Locke 1690)

An often-asked question during our young years was, which came first, the chicken or the egg? For our profession, a similar academic question might be, which came first, direct or indirect pulp capping-save the pulp or save the tooth? Literature suggests that by removing severely decayed dentin our emerging dental profession of the 1700’s became more focused on treating mechanical carious pulp exposures than removal of soft cariously infected, affected dentin for so-called indirect capping, which came along later.

This article attempts to briefly review the historical and scientific timeline of pulp therapy, attempting to separate fiction from published science. Hopewell Smith (1898) was one of our first colleagues to report on the unique capacity of the dental pulp to heal and provide a “bacteriometric” seal (Ruby 1898). The FDA recently approved the “antibacterial cavity cleansing effect” for Clearfil Protect Bond, the world’s first product in this new class of adhesives. The ingredient that provides the antibacterial cavity cleansing effect is a new monomer called MDPB. This new functional monomer developed by Kuraray Medical, Inc. is included as part of the primer of Clearfil Protect Bond.

Why have an Antibacterial Cavity Cleansing Effect?
Self-etching systems combine dentin conditioning and bonding in two simple steps. In the first step, priming, the acidic component of the primer dissolves the smear layer and incorporates this dissolved layer into the mixture as it demineralizes the dentin. In today’s practice of very conservative tooth structure removal, it is possible and perhaps likely that a few bacteria remain in the infected dentin. Therefore, it seems advantageous to assure a complete antibacterial cavity cleansing effect prior to adhesive restoration of teeth, especially if that antibacterial cavity cleansing effect takes place in the...
oils of clove or cassia before closure. In 1874, Hirschfeld described her pulp therapy as using stamp paper moistened with carabolic, due to her understanding of employing a strong antiseptic to eliminate bacterial infection. Shortly afterwards, Hopewell Smith reported that an exposed aseptic pulp was capable of healing (1898). These data have been strongly revalidated by Massler (1967a, 1967b), Brännström et al. (1962, 1969, 1971, 1978) (Snuggs et al. 1993), and others referenced in this article.

EARLY ENDODONTIC TREATMENT

In 1824, Hudson was one of the first clinicians to describe, “stuffing the cavity of one tooth from the ends of its roots with gold” for which he received a ten-dollar fee. In the later decades, Johnstone (1884) recommended the use of iodoform cement containing carabolic, eugenol, and “indifferent porous powder saturated with formaldehyde vapour” to fill root canals. Gysi’s recommended his triopaste, which contained a 17% paraformaldehyde and arsenic as a devitalizing agent—today’s biological acceptance is quite different, as the American Association of Endodontists strongly recommend that permanent teeth NOT be treated with formalin containing agents (AAE 1989). In 1964, Rowe noted that since the early 1900’s, primary teeth had been routinely treated with formalin containing materials. However today, pediatric dental specialists have yet to find or accept an alternative non-toxic formalin-containing pulp therapy agent. It seems as though pediatric specialists have failed to demonstrate any difference in the biological pulp response between primary and permanent teeth. Opinions between specialties continue to differ, in spite of the biological data reporting the hazards of formalin containing agents.

HISTORICAL DENTAL RECORDS

The interested reader is encouraged to read the academic thesis of Rowe (1965a) for a historical review of materials used for pulp therapy. He developed a bridge between the recorded historical timeline by sorting out pulp therapy documentation into a scientific timeline. Somewhere, in antiquity, reside the actual records of direct pulp therapy, specifically, the technical procedures and materials to treat an exposed pulp. A report by Lufkin (1938) suggests that Philip Paff (1746) a dentist to King Frederick of Prussia first mentioned capping an exposed pulp before inserting a filling.

PRE-EXISTING CLINICAL DIAGNOSIS ARE NECESSARY

Jack (1900) suggested that early diagnostic criteria must be comprehensive and well defined before the clinicians started their intended treatment procedures. “Whether the cavity shall be filled temporarily or permanently depends upon the constitutional conditions and the state of the pulp at the time of treatment. The judicious operator should have made careful selection of the case to be treated and will decide from the clinical evidence whether the prognosis will be promising or not; clinicians with limited experience of immediate dressing are cautioned not to attempt a permanent restoration. Careful records should be methodically preserved, noting pre-existing conditions, and the controlling symptoms. Should subsequent irritation occur, a new diagnosis may be formed and a new course of treatment formed, and recorded in red ink. Fill the cervical portion of the cavity with gutta-percha, carrying it over the metal cap, then close the filling with zinc phosphate cement. In this way, with occasional renewal, the temporary work may be left for at least a year or more, with cases carried forward from ten to fifteen years. The restoration may be permanently closed after five years when no irritation had reappeared. In many instances, recovery was observed by secondary deposits of dental tissues, occluded with a bony tissue.”

The pulp biology histology from the late 1800’s up to today have identified this “bony tissue” as a dentin bridge. Again, you must consider that hard tissue formation (osteo-dentin a.k.a. dentin bridging) was observed against metal caps, non-calcium hydroxide agents! This published counsel from Jack over 100 years ago remains as a valuable clinical guideline today!

EARLY DENTAL LITERATURE: TO SAVE THE PULP OR THE TOOTH

When and from whom did the descriptive terminology “direct pulp cap” actually arise? It came from the clinical placement of small metal caps over an exposed pulp (Jack, 1900). Alternatives to metal caps were placement of an asbestos disk rendered antiseptic in various ways, or by placing paper disks coated on the pulp side with chloro-percha. Following accidental exposure, Jack recommended that pain control be treated by application of tincture of calendula, a rubber dam applied, hemorrhage controlled, and the exposure disinfected with a copper pledget saturated with hydro-naphthol, acetamin or formalin, remaining in place during preparation of the metal cap. Burchard (1900) suggested “an immediate dressing should be antiseptic, possess some anesthetic value, an incorporation of zinc oxide would provide a mild therapeutic action as an appropriate dressing.”

Jack indicated (1900) that metal caps were “best when made from platinum,” however tin was acceptable, their purpose was to provide thickness and concavity over the exposure, so as to protect the subjacent tissue from pressure from intruding into the exposed tissue. Clinical placement of a metal cap, should ensure that its round or oval borders pass beyond the pulp-exposure wall, and the plastic cement be allowed to flow over and around the margins of the metal cap and allowed to firmly set. Coverings were mixtures of carabolic acid, oil of cloves and zinc oxide or a mixture of oxysulfate or oxochloride of zinc, each mixed in a “plastic paste” and laid over the metal cap or exposure without producing pressure to the pulp. Burchard (1900) classified temporary stopping agents as adhesive or non-adhesive. Adhesives were composed of pink base-plate gutta-percha, Burgundy pitch, white wax, and calcium carbonate or zinc oxide, placed to temporarily fill the cavities for several days. The non-adhesive agent was mixed without Burgundy pitch. Jack (1900) indicated an important “principal of equal importance was to prevent compression of the pulp tissue from the capping material allowing its immediate contact with the pulp.” His reasoning was “if the least amount of space be permitted to exist between the capping agent and pulp, the space would fill with fluids, and pus and gases will form with consequent compression of the pulp.”

GERMICIDES, ANTISEPTICS, DISINFECTANTS & COAGULANTS TO TREAT THE EXPOSED DENTAL PULP

In 1900, the common clinical understanding was that cavity treatment involving an exposure was treated by the application of a therapeutic agent: as either a germicide, an antiseptic or disinfectant, each differing in degree, each having the power to destroy pathogens, as a coagulant (e.g. zinc chloride) or non-coagulant (e.g. NaOCl). Since the late 1950’s, NaOCl has resurfaced as the antiseptic of choice for disinfecting mechanical and carious pulp exposures.

In the late 1800’s, oxidizing agents such as Labarreque’s solution, a chlorinated soda, had fallen into general disuse along with hyposulfites. At that time electrolytic products of seawater called electrozene and meditrina (hypochlorites) were utilized for disinfection. During World War I, the successful use of NaOCl resurfaced as...
SUGGESTED CLINICAL PROTOCOL FOR SUCCESSFUL CAVITY AND PULP LAVAGE FOR DIRECT CAPPING OF AN EXPOSED PULP

1. Place a small drop of caries detector (e.g., Kuraray Caries Detector) onto the cavity as directed with an appropriate small sponge or cotton pellet, rinse thoroughly and remove excess fluid with high evacuation. DO NOT DRY. Remove the dark stained (red-purple) infected dentin. It is RECOMMENDED that you to use a large (#8 or #10) round bur at slow speed revolution. A too heavy and forceful hand instrumentation may often unroof the underlying dentin, leaving a large exposure, forcing carious debris into the subjacent pulp with damage. If a mechanical bur carious pulp exposure does occur, rinse with sterile water and gently remove the adjacent carious dentin with rotary instrumentation taking care to prevent pushing additional carious debris into the subjacent pulp tissue.

2. Flush the exposure site with sterile water and gently cover the exposure with a small cotton pellet only immediately saturated with a 5% solution of medical grade NaOCl for 20-30 seconds. Remove the pellet and gently flush the exposure site with sterile water. If hemorrhage persists, reapply a fresh cotton pellet dampened with 5% NaOCl and leave until hemorrhage is controlled and remove as described above. This is essential!

3. Place a small cotton pellet fresh dampened with a 2% to 5% NaOCl over the exposure and then place an acid etchant of your choice onto the dentin walls and floor AROUND THE NaOCL SATURATED COTTON PELLET, avoiding the exposed pulp. Acidic solutions will only cause new hemorrhage and biofilm contamination. Remove the pellet with high-speed evacuation and gently rinse with sterile water. Gently air disperse the cavity from approximately 10 cm. If you are using a two bottle system such as Kuraray’s Clearfil Protect Bond, gently apply onto the cavity dentin around the cotton pellet, as recommended to avoid pulp hemorrhage and lightly air disperse from 10 cm.

4. The choice of a direct capping agent remains the choice of the attending clinician. If you so choose to use a Ca(OH)2 agent, you must provide a “bacteriometric” seal to prevent long-term complications as discussed above.

5. If you so choose to use an adhesive system for direct capping, place the two-step self-etching bonding system onto the dentin, allowing it to gently flow over the exposure site taking care to avoid recurring hemorrhage. Light cure for 3-5 seconds so as to prevent pulp damage from an abrupt increased temperature rise from rapid polymerization. This will also prevent polymeric shrinkage from the pulp-dentin interface. Be aware that NO hemorrhage should occur around the dentin-pulp interface.

6. Place thin increments of an antimicrobial adhesive over the area and again use a short ramped light cure sequence. Complete the restoration to contour and finish to functional anatomy with your choice of instrumentations.

7. To enhance the “bacteriometric” nature of the final restoration, acid etch the enamel-restoration cavosurface interface with phosphoric acid, rinse gently, air dry and seal with the antimicrobial bonding resin, Clearfil Protect Bond, to seal any interfacial gap.
does an infected pulp die? The intention of the following is to provide you with proper biological and clinical data to answer these questions and to enhance your clinical treatments.

Histological data provides biological insight into several issues that deal with direct pulp capping with adhesive systems. Studies by Cox et al. (1982, 1986) demonstrated that exposed and inflamed pulps respond with a high capacity to heal and bridge. However long-term data (Cox et al. 1985) reported increased failure after two-to-three years direct pulp capping due to failure of the Dycal-Ca(OH)₂ base to provide a bacteriometic seal. This has been a reported clinical observation by Kidd (1976). A number of studies report that certain adhesive systems and their treatment systems are biologically compatible with the dental pulp with a high degree of dentin bridge formation when placed over an exposed pulp in the absence of any Ca(OH)₂ agent (Sudo et al. 1959, Katoh et al. 1978, Fusayama 1987, Hosoda et al. 1991, Hamriattaisi and Hosoda 1991, Onoe 1994, Ebihara and Katoh, 1996). These publications focus on specific points. Acids themselves do not kill pulp tissue when placed and rinsed within the normal few seconds of clinical placement. Histological data show healing and bridging follows in a timely manner. Hemorrhage control is most important before placing an adhesive system onto the dentin pulp interface. Equally important is the removal of any contaminating biofilm from blood and saliva components and bacterial organisms on the cavity walls as well as within the affected dentin. The interested reader is referred to recent publications (Cox et al. 1998, 2000, and Hafez et al. 2000, 2002), which have reviewed the issue of providing a properly cleansed cavity interface to receive an adhesive system. Histological data from these studies revalidate these data.

**KNOWING THE VARIABLES HELPS YOUR ODDS; IF YOU GAMBLE**

In order to develop an understanding of successful direct pulp capping it is imperative to consider the variables which lead to success or failure. These variables may allow us to understand and perhaps explain the discrepancies between several ISO usage studies. Kitasako et al. (1999a, 1999b) have suggested that if a tissue, or fluid exudate, protrudes onto the cavity floor and along the cavity wall before material placement, dentin hybridization will fail to occur, leading to microleakage and ultimately to a poor-to-nonde dentin bridge response. Stanley (1998) speculated that failure may occur from pulp tissue protruding into the cavity preparation, a sort of pulp polyp. It may be argued that failure to control the contaminating biofilm results in poor to incomplete hybridization, eventually permitting microleakage from loss of the “bacteriometic” seal. Do adhesives kill the pulp? A recent study by Cox et al. (2003) has reported in a six-month study, that restoring an exposed pulp with an antimicrobial adhesive and composite resin presented several constant reproducible results. Dentin bridge formation was present directly adjacent to the restorative interface with no pulp inflammation (Figs. 6, 7) at long-term usage periods. These data suggest that the new antimicrobial adhesive systems will provide a dynamic means to provide a long-term clinical “bacteriometic” seal along the entire restoration interface.

Studies (Sudo 1959, Hirota 1959, Otsuki 1988,Katoh et al. 1978, Akimoto et al. 1998, Cox et al. 1998, Hafez et al. 2000, 2002) have demonstrated that various concentrations of NaOCl provide both cavity disinfection and hemorrhage control when placed onto an exposed pulp. More specifically, they demonstrate that NaOCl provides for removal of the coagulum, clot, fibrin, damaged cells, the organic biofilm and it provides antisepsis of the cavity interface, and provides for clearance of most operative debris in the subjacent tissues described as “chipits” by Stanley (1989, 1998, 2002) who reported that the presence of dentin fragments are “definite stimulators of reparative dentin and can be an asset to encourage bridge formation in the right locations.” However, when carious-infected dentin chips (operative debris) are forced into the pulp, the clinician should expect poor healing to regional pulp abscesses leading to necrosis when the issue of disinfection or lavage is avoided.
Several important clinical conclusions may be drawn when based on these biological data. Various ISO usage studies on non-human primate pulps have demonstrated that use of 2% to 5% NaOCl, presents no in vivo toxicity to primary odontoblasts or to subjacent pulp cells or capillaries. In addition, there is no inhibition to pulp healing or to secondary odontoblastoid cell formation and eventual dentin bridge formation when capped with various adhesive systems. More importantly, there is a conspicuous absence of operative dentin debris (chips) at the exposure interface at all time periods. This debris has been shown to compromise the normal biological healing process (Figs. 8, 9). Perhaps a little known but histologically substantiated fact is the redeeming healing capacity of a dental pulp, which presents with an exposed carious lesion. It should be noted that Van Hassel (1971) described a localized pulp inflammatory response in terms of geographic “compartmentalization,” (Fig. 10) instead of an immediate massive pulp death via congestive strangulation.

REFERENCES
Kakahashi S, Stanley HS, Fitzgerald RJ (1965) The effects of surgical lavage and removal for sectioning. A new section through a non-inflamed monkey tooth (#1) following a large (3-mm wide) mechanical bur exposure and direct capping with a new anti-microbial adhesive and composite resin system after 97-days. The clear area on the right is the composite space following demineralization and composite removal for sectioning. A new pink-stained dentin bridge is present along the entire adhesive system interface. Areas of reparative dentin are seen above and below-merging with the dentin bridge. A hybridized dentin interface is seen along the cavity interface. New odontoblastoid cells are seen along the dentin bridge pulp interface with viable pulp tissue beneath No Ca(OH)2 agent was present. 40X magnification. Hematoxylin and eosin stain.

A 7µm section through a non-inflamed monkey tooth (#2) following a large (3-mm wide) mechanical bur exposure, lavaged with a 5% NaOCl, rinsed and direct capped with a new anti-microbial adhesive and composite resin system after 6-months. The clear area above is the composite space following demineralization and removal of the composite for sectioning. A new pink-stained dentin bridge is present along the entire adhesive system interface, which is continuous with the reparative dentin seen on the right. New secondary odontoblastoid cells are seen along the pulp interface of the dentin bridge with normal pulp tissue beneath. A hybridized dentin interface is seen along the entire adhesive interface above. No Ca(OH)2 agent was present. 120X magnification. Hematoxylin and eosin stain.

A 7µm section through a non-inflamed monkey tooth (#4) following an occlusal cavity preparation and a large (6-mm wide) mechanical bur exposure and direct capped with a commercial Ca(OH)2 base material (Lifemix), restored to the cavosurface margin with an amalgam alloy for 192-days. No NaOCl was used for surgical lavage. The clear area on the right is the amalgam-space following demineralization and its removal for sectioning. A new green-stained dentin bridge is present along the Ca(OH)2 interface. The dentin bridge is composed of operative debris with beginning fibrosis of the coronal tissue following its disintegration. 25X magnification. Masson trichrome stain.

A section through a non-inflamed human tooth (#6) that had received a class-V cavity preparation and then restored with an acid zinc phosphate cement to the cavosurface margin 21-days. The cavity space is seen in the extreme upper-right. A rather long and thick deposition of reparative dentin is seen, which blends with the dentin bridge composed mainly of operative debris. In addition to the many operative debris chips, small tunnel defects are visible within the substance of the bridge complex. 50X magnification. Masson trichrome stain.
Third party payers contractually reimburse only for completed procedures. They do not reimburse for individual subcomponents or techniques required to complete the procedure. With all bonded restorations, the bonding is nothing more than the technique used to complete the procedure. As such, the technique sensitive procedures are simply coded as the completed procedure.

I do not recommend separate fees for bonded and non-bonded restorations. When taking into consideration your usual fee for the completed procedure, examine the number of bonded and non-bonded restorations that you routinely perform. Your single fee should equally address both restorative techniques. The additional cost of the bonding agent is reflected in your total fee charged for the restoration.

According to the American Dental Associations Current Dental Terminology:

“Local anesthesia is considered to be part of restorative procedures. A one-surface posterior restoration is one in which the restoration involves only one of the five surface classifications (mesial, distal, occlusal, lingual, or facial, including buccal.”

AMALGAM RESTORATIONS (INCLUDING POLISHING)

“Tooth preparation, all adhesives (including amalgam bonding agents), liners and bases are included as part of the restoration. If pins are used, they should be reported separately (see D2951).”

RESIN-BASED COMPOSITE RESTORATIONS - DIRECT

“Resin-based composite refers to a broad category of materials including but not limited to composites. May include bonded composite, light-cured composite, etc. Tooth preparation, acid etching, adhesives (including resin bonding agents), liners and bases and curing are included as part of the restoration. Glass ionomers, when used as restorations, should be reported with these codes. If pins are used, they should be reported separately (see D2951).”

Under most dental reimbursement contracts, a sedative filling that is placed to mediate the pulp is usually a benefit as long as no other treatment is rendered to the same tooth on the same date of treatment. Sedative fillings are interim treatments and are not intended to be payable together with a completed restoration. If a sedative filling is reported in conjunction with a permanent restoration performed on the same date of service, it is most often classified as a component of the permanent restoration. The additional cost is neither reimbursable by the benefit plan nor payable by the patient.

According to the American Dental Associations Current Dental Terminology:

D2940 sedative filling

“Temporary restoration intended to relieve pain. Not to be used as a base or liner under a restoration.

Pulp cap procedures are frequently and easily confused with sedative fillings. According to current terminology and reimbursement criteria, sedative fillings (D2940) are an integral part of direct pulp caps (D3110), indirect pulp caps (D3120) and even therapeutic pulpotomy (D3220) procedures. Where the sedative filling is identified as a completed interim restoration, pulp caps are to be identified separately from the completed restoration. Sedative fillings are not to be identified separately when the completed procedure is either a direct or indirect pulp cap.

According to the American Dental Associations Current Dental Terminology:

D3110 pulp cap - direct (excluding final restoration)

“Procedure in which the exposed pulp is covered with a dressing or cement that protects the pulp and promotes healing and repair.

D3120 pulp cap - indirect (excluding final restoration)

“Procedure in which the nearly exposed pulp is covered with a protective dressing to protect the pulp from additional injury and to promote healing and repair via formation of secondary dentin.

It is most inappropriate to deceptively seek additional reimbursement from either the patient or their individual benefit plan by separately identifying adhesive techniques.

Atlanta Dental Consultants / Limoli and Associates is your source for insurance reimbursement information. From the Coding and Claim Submission Manual to the bimonthly newsletter, Dental Insurance Today, textbooks, fee reviews, consultations and seminars, they guide your practice through the ever-changing world of reimbursement systems. For additional information, contact them at 404-252-7808 or visit them at www.limoli.com
After placing many posterior direct composite restorations, Class I and II, some of my patients still experience a mild postoperative sensitivity. The use of self-etching bonding products seems to be more accepted today as compared to a year ago and I am evaluating which product to begin using. However, in those cases where the postoperative sensitivity remains, should I replace the restoration and use a self-etching product or should I wait to see if the subsides?

As noted by Dr. Christensen in the February 2004 issue of Dental Economics, page 112, "Post-operative sensitivity can be caused by numerous factors. Among them are: Occlusion too high on the restoration, tooth preparation very close to the pulp, previously present pulp degeneration, trauma caused by the tooth preparation, partially polymerized resin, improper priming of the dentin surface on the internal of the tooth preparation, a new or old crack in the tooth, or several other reasons."

Dr. Christensen also states on the same page that "You are well-advised to change to self-etching primer. Dr. Christensen also notes in this article that, "I have set a time limit of six weeks to wait before removing a restoration or beginning endodontic therapy, or both." Usually, when a restoration is removed and treated temporarily with a sedative-type filling, such as zinc-oxide/eugenol based material, the symptoms subside and the tooth can be restored then using a self-etching bonding product.

Should I use a dual cure adhesive with my dual-cure core buildup material?

According to Dr. Michael Miller in the "REALITY's answers" section of Dental Economics, January/February 2004 issue, page 30, “For the most part, our (REALITY) results found dual-cure materials do not require—nor is its performance enhanced by using—dual-cure adhesives. As long as the core is no thicker than 5 mm, cure the adhesive prior to placing core material. After you light-activate the core material, a light-cure adhesive should work just fine. This is a significant finding, since it allows us to simplify the placement of cores.”

Kuraray’s Photo Core core-buildup product has regularly received the coveted REALITY 5-Star award, including again in 2003. Photo Core used with Clearfil SE Bond provide a core buildup solution that is very easy, fast and economically practical—they are perfect partners. If you would like to experience why Photo Core consistently receives such a high rating, return the attached reply card and we will gladly send you a sample to use.

The Fluoride Release Function and How It Works

The bonding agent of Protect Bond contains a proprietary “micro capsule” to maintain the physical property after fluoride release. This technology enables the fluoride ions to be released through the “micro capsule” as it reacts with water.

Since the capsule remains inside the bond material intact, voids do not exist and act as weak points in the adhesive bond layer. The chart below compares the affect of fluoride release on the physical properties of a few products and clearly shows that there is very little affect on the physical properties of Protect Bond, while the other products show a definite decrease in physical properties over time as fluoride is released.

Adding the antibacterial cavity cleansing effect and fluoride release have no adverse effect on the physical properties, including bond strength. The bond strength of Protect Bond is excellent, in fact it is almost equal to that of SE Bond. Both SE Bond and Protect Bond have the same adhesive monomer, MDP, and the general composition is practically the same. Thus, results of tensile bond strength tests show that Protect Bond has a much better bond strength compared to total etch products, 2 step self-etch or 1 step self-etch adhesives products.

In addition to having similar physical properties to Clearfil SE Bond, the basic application procedure and indications for use of Protect Bond are the same. Therefore, primer conditioning, priming, and antibacterial cavity cleansing are completed in just 20 seconds with Protect Bond. Then the Protect Bond bonding agent is applied and MDPB is light-cured safely within the bonding agent. As with SE Bond, Protect Bond is a two-step self-etching primer with a simple procedure, very low technique sensitivity, and very high bond strength. Now, however, the new adhesive system provides more than just adhesion between the tooth structure and the restorative material. Protect Bond, the epoch-making product, provides antibacterial cavity cleansing and fluoride release for your confidence and your patient’s comfort.
FEATURES & BENEFITS

- Antibacterial Cavity Cleansing Effect
- Low Post Operative Sensitivity
- Fast and Simple to Use
- High Bond Strength
- Fluoride Releasing Properties

THE TRUELY UNIVERSAL COMPOSITE

CLEARFIL AP-X RESTORATIVE SYSTEM
CLEARFIL AP-X PLT

Ten years of clinical experience and scientific research guarantee Clearfil AP-X offers superior aesthetic appearance and exceptional physical properties. And...the ideal direct restorative material to use with SE Bond, especially for posterior restorations. It’s available in syringe or plt delivery systems. Enjoy the ease of use and the benefits of low wear and high fracture resistance, excellent polishability, low polymerization shrinkage, visible radiopacity, easy handing, ideal direct posterior restorative material, and very economical per application.