

Restorative Dentistry Techniques

Natural vital pulp simulation in ceramic restorations using the Captek™ process from Precious Chemicals USA, Inc.

Captek™ fabrication technology employs capillary action to produce precise-fitting castings for virtually all crown and bridge applications. Captek™ precious-metal composite alloy can be used to form two moldable layers of wax that are impregnated with metal particles.

The process results in 22-karat gold copings and frameworks that are said to provide exceptional accuracy, esthetics, and strength. A Captek™ coping is formed in two layers: The first is a gold/platinum/palladium alloy; after firing, it forms a microscopic, three dimensional network of capillaries. When processed, the gold-alloy second layer is drawn into the first layer through capillary attraction, forming a warm, yellow-gold alloy that is 80% gold and 9% platinum group metals. The resulting composite metal alloy permits the casting to be thinned down to exceptionally fine margins.

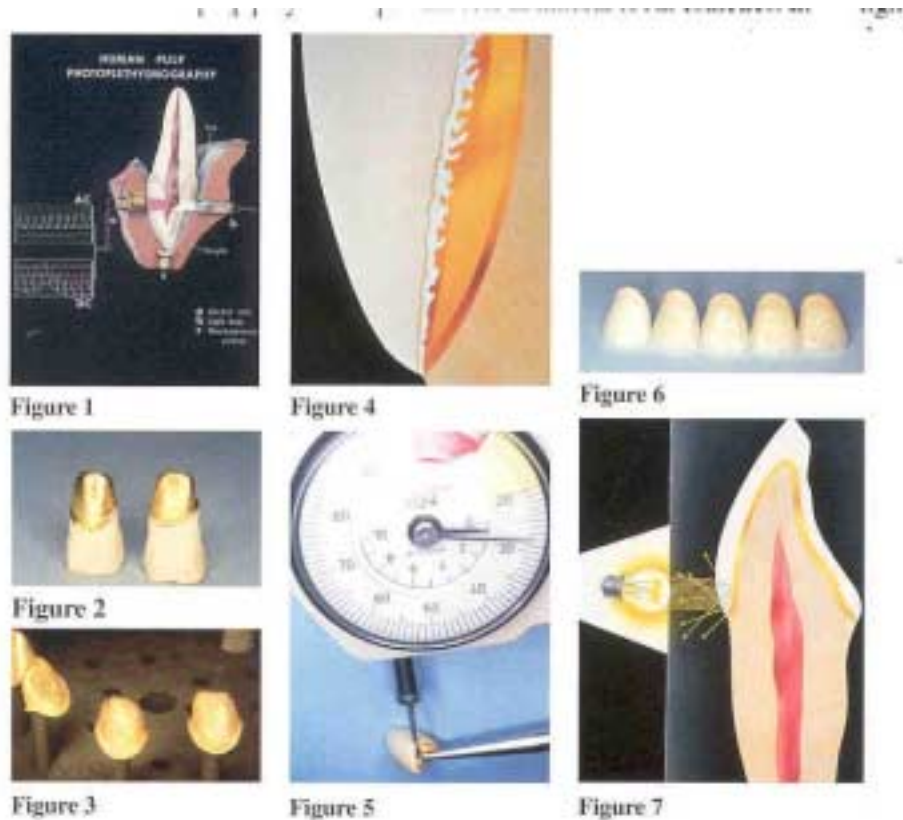
According to Itzhak Shoher, DMD, MSc, research manager of the Captek™ Division of Precious Chemicals USA, Inc., the intensive red color of vital dental pulp plays an important role in natural tooth esthetics. In young, more transparent teeth with large pulp chambers, the red color component is prominent, as it is in the teeth of lighter shades and in those that have undergone whitening or bleaching procedures. He emphasizes that when striving to achieve natural esthetics in dental restorations, it is extremely important to reproduce the optical effect prisms and dentinal tubules.

Dr. Shoher states, "In recent years, attempts have been made to improve esthetics through the use of white-color composite posts and cores for the support of all-ceramic restorations. These [can] result in dead-looking teeth, as the space of red vital pulps of natural teeth is [substituted] with white material." In addition, he comments, "A flat and shiny gold layer sometimes fired over dark cast metals or over the first opaque layer [fails to] produce the desired light-scattering effect seen in natural teeth. Attempts to [simulate the optical effect of] vital pulp [through use of] pink internal or external porcelain staining [often] result in unpleasing esthetics."

In Dr. Shoher's research on blood circulation changes in the human pulp,¹ the tooth was illuminated and the scattered red light from the pulp was recorded.

Figure 1 shows the apparatus used to measure red light transmitted and scattered off the pulp through the dentin and enamel. Small scattered red-light changes were recorded in the pulp during every systole and diastole. More intensive changes occurred when the tooth was cooled or heated.

1. A ceramo-metal interface was fabricated using Captek™ precious-metal composite alloy. The interface was developed to reproduce the optical effect of the vital pulp and the surrounding hard structures in ceramic restorations. Figure 2 shows the Captek™ copings as fired.
2. A 25-to-35-micron-thick layer of Capbond™ ceramo-metal bonder is applied and fired over the oxide-free gold-color surface of the Captek™ copings. The combined color represents 97% gold and 3% silver, which is reported to produce a favorable color background for porcelain. (The researcher found that pure gold color was too yellow for the lighter shades.)



3. The Capbond™ ceramo-metal bonder forms a structure of fine, goldish filaments. Thin opaque is painted on and infiltrates the Capbond™ sponge to form a mixed layer approximately 35 to 50 microns thick. The gold-porcelain mixed layer produces the desired scattered light-effect. *Note:* Thicker opaque layers reduce this optical effect and should be avoided. A thin layer of dentin and enamel over the Captek™ opaque interface is said to be all that is required to achieve a natural tooth appearance.

Figure 3 shows the Captek™ copings after firing Capbond™ bonder. The Capbond™ gold-filament network will be infiltrated with opaque porcelain to produce light scattering at the ceramo-metal interface.

4. A Captek™ porcelain restoration measuring 0.3 to 0.5 mm thick at the margin and 0.8 to 1.0 mm at the buccal of the anteriors is said to be sufficient to produce undetectable restorations, even in highly demanding cases.

Figure 4 provides a schematic cross section through the Captek™ ceramic crown at the margin. *Note:* the Captek™ metal is thinned to 50 microns; the Capbond™ ceramo-metal bonder with opaque porcelain measures 50 microns; the dentin porcelain measures 200 microns. According to the researcher, a limited total thickness of 0.3mm yields adequate esthetic results at the margin; it is recommended to prepare the teeth at the margin to accommodate restorations measuring 0.5 mm or thicker.

Figure 5 presents a Captek™ ceramic crown measuring 0.3 mm thick at the margin.

5. Limiting the thickness of the restoration facilitates matching the optical appearance of light shades of adjacent natural teeth as well as bleached teeth and those restored with laminate veneers. Figure 6 shows Captek™ ceramic crowns in shades A1-A4. The crowns measure 0.4 mm thick at the margins and 0.9 mm at the buccal.

Figure 7 demonstrates the light-scattering effect at the Captek™-porcelain interface. The color and light dispersion reportedly simulate vital pulp, surrounding tubular dentin, and enamel prisms.

More information on Captek™ technology can be obtained by calling 800-921-2227, or by writing to Precious Chemicals USA, Inc., 2957 S.R. 434, Suite 100, Longwood, FL 32779.

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