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Introduction

Temporary crown and bridge restorations are essential interim solutions that stabilize and protect tooth structure during the time span from final impression through the final laboratory-fabricated crown or bridge restoration. “Temporary” and “provisional” are terms that are synonymous in dentistry. The temporary restoration must protect the tooth structure from the rigors of the oral environment and demand high quality materials.

Crown and bridge restorations require several distinct treatment phases for completion. A temporary restoration is needed during the interim phase. Dental professionals must maintain function with a temporary restoration. In addition to stabilize and protect existing tooth structure, materials are expected to be tough (fracture resistant and flexible), retain a natural looking appearance and maintain space and longevity. The rapid evolution of esthetic restorative materials, such as composites and ceramics, has been accompanied by improvements of temporary materials. Currently, a large number of temporary materials are available for the effective restoration of prepared teeth.

Background

Temporary materials are classified in two distinct categories. They are prefabricated crowns and chemical-cured materials.

Prefabricated Crowns

Prefabricated Crowns are available in many forms for a variety of single-unit applications. Since 1975, 3M ESPE has been a market leader in prefabricated crowns. Their use has a broad application base from short-term to longer-term coverage. Prefabricated temporary crowns provide accurate anatomy and the ability to fit while conforming to the margin. The 3M ESPE Iso-Form™, Gold Anodized and Polycarbonate Crowns are easy to place and save time while maintaining tooth function.

Chemical-cured Materials

Powder/Liquid Acrylic

Powder/liquid acrylics have been used for temporary restorations since the late 1930's for both single and multiple-unit temporary restorations. Two types of acrylic materials are sold today.

The oldest group of polymer-based direct temporary materials are the acrylic MMA/PMMA resins. Polymethyl methacrylate microbead powder (PMMA) is mixed with a methyl methacrylate monomer (MMA) liquid (e.g. Jet™, Alike™). The high level of monomer release should not be underestimated, in particular when regarding the application to the freshly prepared tooth using the direct technique. The result is a highly exothermic setting reaction requiring the early removal of the temporary restoration from the preparation to prevent damage to the pulp. This could result in an unsatisfactory fit due to the subsequent polymerization shrinkage.

Materials made of monofunctional acrylate monomers (e.g. Snap™, Trim® II) with a higher molecular weight have been developed to eliminate some of the disadvantages of polymethyl methacrylate systems. These materials also involve a powder/liquid system which is mixed by hand. The materials consist of blends of polyethyl methacrylate powder and a
methacrylate resin (Ethyl, Isobutyl or Vinyl). This results in a lower setting temperature and, in comparison with PMMA materials, slightly enhanced mechanical strengths which are offset by poor esthetics and resistance to chewing forces. In addition, the restorations can be attacked by cements containing eugenol, a potential disadvantage.

**Composite-Based Resin**

There are a number of products used for temporary restorations that fall into the general category of composite-based resin systems. Composite-based temporization materials contain two main components, a resin and a filler system.

The resin system is the organic matrix in which other components are dispersed or dissolved. It consists of monomers and can be polymerized.

The filler system consists of discrete particles that are dispersed in the resin system. Size range of the fillers can vary from fine particles (0.5 to 3 µm) to microfine particles (0.04 to 0.2 µm), while shapes can be regular or irregular. Particles of different sizes and shapes are sometimes blended to obtain desired properties. Filler particles are usually surface treated. (See Figure 1 - not drawn to scale).

The most common, and successful class of material on the market is the group of Bis-acrylic composites (e.g. Protemp™ 3 Garant™, Luxatemp®, Integrity™, Structur® Premium). Comparable with composites used for direct restorations, these materials consist of an organic resin system and inorganic fillers. Monomers such as bisphenol-A-glycidyl methacrylate (bis-GMA), triethylene glycol dimethacrylate (TEGDMA) or similar monomer systems derived from Bowen resin are used as the organic resin system. The inorganic fillers account for approximately 40% by weight in the bis-acrylic paste formulations. The introduction of the bis-acrylic systems for temporary restorations provides a material with improved mechanical properties, a lower setting temperature and reduced polymerization shrinkage as well as good color stability and polishability. When the hand-mix versions (paste/paste) were supplemented by auto-mix cartridge systems in the early 90s, it also became possible to satisfy the demands for simple, clean and fast handling.

**Protemp™ 3 Garant™ Temporization Material**

In 2002, 3M ESPE introduced Protemp 3 Garant Temporization Material. Protemp 3 Garant is a strong temporary material with improved resistance to fracture and therefore very low fracture rate. 3M ESPE produced a material that offers superior mechanical properties, reduced polymerization heat, precise fit, and esthetic results. Protemp 3 Garant Temporization Material is one of the toughest composite-based temporary materials on the market today.
Protemp 3 Garant is ideally used for esthetic single and multi-unit restorations including anterior and posterior teeth, veneers, inlays and onlays, as well as crown linings.

**Protemp™ Crown Temporization Material**

**Product Description**

The most recent innovative product from 3M ESPE and the Protemp™ family of temporary products is 3M™ ESPE™ Protemp™ Crown Temporization Material for single-unit temporization. The Protemp Crown innovation combines the advantages of composite-based chemical-cured temporization (custom fit and esthetics) with the advantages of prefabricated crowns (fast, easy, no matrix and no mess). It is a preformed malleable composite-based crown that can deliver a custom fit for your patients in less than four minutes. This revolutionary new method for single unit temporization is simple to use while resulting in significant fabrication time saving, custom fit and tooth-colored esthetics.

**Indications**

Protemp Crown is used for single-unit esthetic temporary restorations in the following permanent dentition without the use of a matrix:

- Molar
- Bicuspid (premolar)
- Cuspid (canine)

**Features and Benefits**

In addition to the favorable characteristics that a composite-based temporization material such as Protemp 3 Garant Temporization Material provides, the innovative new Protemp Crown Temporization Material has some special features.

The most distinct feature is its unique handling property. In its uncured state Protemp Crown handles like wax (or clay) and can be modeled and reshaped easily using a composite instrument. In the wax stage, the crown can easily be adapted to the tooth preparation, margins, and proximal contacts. Additionally, the patient can gently bite down into the Protemp Crown in its uncured state to form the proper occlusal contacts.

This desired rheology is achieved by using a combination of a special crystalline resin system and highly interacting aggregated inorganic fillers. As a result the material is physically crosslinked and has a 3-dimensional, physically crosslinked structure. (See Figure 2 - not drawn to scale).

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*Figure 2. A schematic representation of physical crosslinking of 3M™ ESPE™ Protemp™ Crown Temporization Material*
After light-curing, a mechanically stable composite material is obtained that is wear resistant, radiopaque and polishable, due to the highly crosslinked resin and filler systems.

A special feature of Protemp Crown is the delivery method. Unlike all other composite temporary materials that are delivered in a paste/paste or powder/liquid form, Protemp Crown is delivered in the form of an anatomically shaped (preformed) crown. The wax-like malleability of the material in the uncured state makes it possible to use it successfully and quickly on most posterior and canine teeth with nine (9) sizes and shapes. (See Figure 3).

<table>
<thead>
<tr>
<th>Size Selection Chart</th>
<th>Approximate Range Mesial Distal Width</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BICUSPID (Premolar) Upper</strong></td>
<td></td>
</tr>
<tr>
<td>Bicuspid (Premolar) Upper S</td>
<td>6 - 7 mm</td>
</tr>
<tr>
<td>Bicuspid (Premolar) Upper L</td>
<td>7 - 8 mm</td>
</tr>
<tr>
<td><strong>MOLAR (1st &amp; 2nd) Upper</strong></td>
<td></td>
</tr>
<tr>
<td>Molar Upper S</td>
<td>9 - 10 mm</td>
</tr>
<tr>
<td>Molar Upper L</td>
<td>11 - 12 mm</td>
</tr>
<tr>
<td><strong>CUSPID (Canine) Universal</strong></td>
<td></td>
</tr>
<tr>
<td>Cuspid (Canine) Universal S</td>
<td>6 - 7 mm</td>
</tr>
<tr>
<td>Cuspid (Canine) Universal L</td>
<td>8 - 9 mm</td>
</tr>
<tr>
<td><strong>BICUSPID (Premolar) Lower</strong></td>
<td></td>
</tr>
<tr>
<td>Bicuspid (Premolar) Lower</td>
<td>6 - 9 mm</td>
</tr>
<tr>
<td><strong>MOLARS (1st &amp; 2nd) Lower</strong></td>
<td></td>
</tr>
<tr>
<td>Molar Lower S</td>
<td>9 - 10 mm</td>
</tr>
<tr>
<td>Molar Lower L</td>
<td>11 - 12 mm</td>
</tr>
</tbody>
</table>

Another feature of Protemp Crown is the light-activated curing that allows the dental professional to be in control of setting (cure-on-demand). After the customization and fitting steps, a high strength composite temporary crown can be quickly and conveniently obtained simply by light curing using a dental curing light.
Composition

The light-curable resin of Protemp Crown is composed of bis-GMA, and a second functionalized dimethacrylate resin. Silanated zirconia-silica and fumed silica fillers are used to impart physical strength, radiopacity, and wear resistance. The silanated inorganic filler loading is approximately 78% by weight; the average particle size of the filler is approximately 0.6 micrometers. Protemp Crown also contains pigments. The qualitative composition of Protemp Crown Temporization Material is listed in Table below. (See Table 1).

<table>
<thead>
<tr>
<th>Resin</th>
<th>Filler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimethacrylate polymer</td>
<td>Zirconia Silica</td>
</tr>
<tr>
<td>bisGMA</td>
<td>Fumed Silica</td>
</tr>
<tr>
<td></td>
<td>Silane</td>
</tr>
<tr>
<td></td>
<td>Pigments</td>
</tr>
</tbody>
</table>

Biocompatibility

Biocompatibility is an essential requirement for dental materials. Protemp Crown and its ingredients were assessed for product safety according to testing guidelines outlined by the FDA (General Program Memorandum G95) and ISO 10993-1: 2003(E) as well as ISO 7405:1997(E). A Diplomate of the American Board of Toxicology found Protemp Crown safe for its intended use.
Physical Properties

Protemp Crown is designed to deliver a strong, simple, and fast to customize, single unit temporary crown. This new product combines the advantages of Protemp 3 Garant Temporization Material, like the excellent clinical performance (strength and fracture resistance), custom fit and esthetics, while maintaining the advantages of a prefabricated crown (fast, easy and no matrix or impression). In this section Protemp Crown physical properties are reviewed. Physical property testing was conducted by 3M ESPE unless otherwise noted.

Compressive and Diametral Tensile Strength

Compressive and diametral tensile strength are two common measurements that characterize material strength.

Compressive strength measures the strength of a material when a force is applied. Rods are made of the crown material and simultaneous forces are applied to the opposite ends of the sample length. The sample failure is a result of shear and tensile forces.

The compressive strength value obtained for Protemp™ Crown Temporization Material is significantly similar to Protemp™ 3 Garant™, Integrity™ and Structur® Premium. However, compressive strength for Protemp Crown was significantly higher than Jet™ and Trim® II and Luxatemp®. A high compressive strength helps to withstand the forces from chewing. The compressive strength of the various materials are shown in Figure 4 below. (See Figure 4)

![Figure 4. Compressive Strength](attachment://image.png)
Diametral tensile strength is measured using a similar test method. Compressive forces are applied to the sides of the sample, not the ends, until fracture occurs.

The diametral tensile strength of Protemp™ Crown Temporization Material was significantly higher than Protemp™ 3 Garant™, Luxatemp®, Jet™, and Trim® II. The value for Protemp Crown was statistically similar to Integrity™ and Structur® Premium. The diametral tensile strength values are shown in Figure 5 below. (See Figure 5)

![Figure 5. Diametral Tensile Strength](image)

**Flexural Strength**

Flexural strength is a method of defining a material’s strength under bending forces and combines the forces found in compression and tension. This test is conducted by applying a load to a material specimen bar that is supported at each end. Flexural strength is the value obtained when the sample breaks.

A high flexural strength contributes to the durability of a temporary restoration. The flexural strength of Protemp™ Crown Temporization Material was statistically higher than the values of the other materials tested. (See Figure 6).

![Figure 6. Flexural Strength](image)
Wear Rate

The measurement of wear is critical as an indicator of longevity and space maintenance in temporary restorations. 3M ESPE uses the ACTA (Academic Centre for Dentistry Amsterdam) three-body wear machine and test method for wear rate measurements.

The wear rate is determined by a three-body wear test and compared to other temporization materials and 3M™ ESPE™ Filtek™ Z250 (a restorative material used as a control). In this test, Filtek Z250 Restorative and the temporization materials (1st body) are placed and cured onto a wheel (shaded slots in the diagram); the test wheel then contacts another wheel acting as an “antagonistic cusp” (2nd body). The two wheels counter-rotate against one another, dragging an abrasive slurry (3rd body) between them. Volume loss of the test materials is measured following a predefined cycle of wheel rotations.

The wear rate of Protemp™ Crown Temporization Material was significantly lower than Trim® II and Jet® and showed the least wear rate when compared to Protemp™ 3 Garant™, Luxatemp®, Integrity™ and Structur® Premium. Protemp Crown wear values were close to the control, Filtek™ Z250 Restorative. The wear rate values are shown in Figure 7 below. (See Figure 7)

![3-Body Wear Diagram](image)
Fracture Toughness

Delong R, MDRCBB: University of Minnesota, USA

Fracture toughness was determined by an in-vitro short rod fracture toughness test. Fracture toughness \( (K_{1c}) \) is related to the energy required to propagate a crack. In this test a chevron notch is cut into a cured cylinder and the parts on either side of the chevron are pulled apart.

The fracture toughness data shown below indicates that the short rod fracture toughness of Protemp Crown is higher than Luxatemp®, Jet™, and Trim® II, Structur® Premium and equivalent to Protemp™ 3 Garant™ Temporization Material, and two 3M ESPE restorative materials, Z100™ Restorative and Sinfony™ Indirect Lab Composite. (See Figure 8)

Radiopacity

The radiopacity of a temporary material is important for verification of fit and space maintenance of the temporary restoration.

The radiopacity of Protemp Crown was measured according to ISO 4049; the results are shown in the chart below (See Figure 9). Protemp Crown is radiopaque and has greater radiopacity than the other materials tested.
Polymerization Shrinkage

The measurement of shrinkage during polymerization is important for assessing a material's accuracy of fit. Materials with low polymerization shrinkage provide for good clinical fit of the temporary restoration. One standard method for measuring polymerization shrinkage is the method described by Watts and Cash (Meas. Sci. Tehcnol. 1991, 2: 788-794).

In this method, an uncured disc shaped specimen is sandwiched between a glass microscope slide cover and glass plate, then light cured through the lower rigid plate. The flexible microscope slide is deflected during the polymerization of the test specimen. The less the microscope slide bends, the lower the shrinkage. Deflection is measured and recorded as a function of time. Although this process actually measures linear shrinkage, volumetric shrinkage is closely approximated due to the fact that the dimensional changes are mostly limited to the thickness dimension. The lower the value, the less shrinkage.

As the chart below shows, the value of Protemp Crown shrinkage is lower than the other materials tested. (See Figure 10)

![Watts Shrinkage Chart]

Oxygen Inhibited layer

Protemp Crown offers a material chemistry that leads to a very thin oxygen inhibited layer. The very low oxygen inhibited layer of Protemp Crown offers minimal resin stickiness on the temporary crown surface that makes handling and shaping much easier. In addition, the low oxygen inhibition allows for simple and fast finishing and polishing. The oxygen inhibited layer of Protemp Crown is significantly less than traditional temporization products (See Figure 11).
Polymerization Temperature Rise

The ability to cure-on-demand is a feature of Protemp Crown that allows dental professionals flexibility during the procedure. In the application of Protemp Crown, the operator has complete control of the set by adapting the crown to the preparation and initiating a tack cure when it is advantageous to do so to hold the material in place. Protemp Crown is intra-orally tack cured using a dental curing light for 2-3 seconds on each of the buccal, lingual and occlusal surfaces. The intra-oral temperature is minimized as the temperature rise is due to the short tack curing rather than a longer time for the chemical reaction. The final light cure (60 seconds) is completed outside of the mouth.

Intra-oral heat during cure was simulated by measuring the effect of light cure on a cylindrical cell of material for 10 seconds. The temperature is measured until it peaks. The maximum temperature reached is divided by the weight of the sample.

Protemp Crown was statistically similar to Protemp™ 3 Garant™ and Structur® Premium, lower than Jet™ and Trim® II and slightly higher than Integrity™ and Luxatemp® (See Figure 12).
Material Durability in Mastication Simulator

Rosentruitt M, Lang R, University of Regensburg, Germany
IADR abstract NO.1561 2006

A widely used dynamic in-vitro method for measuring a material’s performance regarding wear, marginal fit, fracture strength and simulated chewing force is conducted using a mastication simulator. In this study, at the University of Regensburg, a mastication simulator is used to gain long-term experience through modes of temperature changes (thermocycling) and mechanical loading. The strength of a material and intra-oral influences (fluid, temperature and chewing forces) are simulated to replicate the oral environment. These results are the first indicator for a materials strength and performance over time before it is placed clinically.

In this study for each material combination, 8 identical single-unit temporary crowns were used, and cemented to human molar preparations. Crowns were subjected to thermocycling in water of 5° and 55° C and mechanical loading (50N/1.6Hz/480,000 cycles). A steel sphere was used as the antagonist. The conditions chosen simulated approximately 2 years in the mouth. In addition, overall wear was assessed through SEM examination.

As shown in Figure 13, one Protemp Crown fractured during the thermocycling and mechanical loading test with the remainder surviving. All of the Trim® II crowns failed, six by deformation and two by fracture; all of the Protemp™ 3 Garant™ crowns survived (See Figure 13).

In addition, overall wear was assessed through SEM. Upon examination, Protemp Crown showed a minimal amount of wear demonstrated in the SEM pictures below (figure 14 and 15).

This dynamic in-vitro testing completed in the mastication simulator indicates that Protemp Crown Temporization Material is suitable as a temporary restoration.
Global Application Test

In a global application test conducted by 3M ESPE, 105 dentist evaluators placed approximately 1558 temporary single-unit crowns using Protemp Crown Temporization Material from 3M ESPE. The dentist evaluators were selected to represent segments that preferentially use one of the following materials for their single-unit temporary restorations (Prefabricated Crown, Bis-Acrylic, Powder/Liquid). The evaluators completed a questionnaire to report their use and experiences with the Protemp Crown and effectiveness of the final restoration. Also, evaluators compared Protemp Crown to the technique they use most often for single unit temporary restorations.

Placements

Shown below is the total number of Protemp Crowns (temporary single-units) placed during the application test. Dentist evaluators used Protemp Crown for the temporary restoration in the following teeth; molars accounted for 53%, bicusps (premolar) 30% and cusps (canine) 17% of all placements. (See Figure 16).

![Crown Placements (n=1558)](image_url)
Ease of Use

The overall satisfaction with ease of use was reported for Protemp Crown and recorded by the dentist evaluators based on the product used most often for single unit temporization. The 64 US dentist evaluators rated the overall satisfaction and ease of use on a scale between Very Difficult (1) and Very Easy (5). As seen in Figure 17, evaluators from the various temporization user groups rated the overall satisfaction with ease of use for Protemp Crown high and therefore easy to use. (See Figure 17).

In addition, the evaluators were asked to rate the top 4 reasons why Protemp Crown was easier to use. Dentists responded 1) no impression or matrix needed, 2) no mess or clean-up (i.e.: hardware, mix tips), 3) easy to obtain occlusal fit, and 4) easy to obtain interproximal contacts.

Fast

The speed of placement was rated at least twice as fast by 60% of dentist evaluators when compared to the product used most often for single unit temporary restorations. (See Figure 18)
Permanent Crown Fit

The fit of the permanent crown is one indication of the effectiveness of a temporary material and its ability to maintain space and to protect the preparation. During the application test, dentists rated on a scale of Very Poor (1) to Excellent (5), the permanent crown fit after using Protemp Crown as the temporary restoration. The permanent crown fit following a Protemp Crown temporary was rated very good to excellent by the evaluators as shown in Figure 19. (See Figure 19).

![Permanent Crown Fit](image)

Esthetics

The esthetics of Protemp Crown was rated by the dentist evaluators on a scale of Very Poor (1) to Excellent (5). Below is the esthetic rating for Protemp Crown. Esthetics was rated good to excellent by 84% of the dentist evaluators. (See Figure 20)

![Esthetics](image)

The global application test described in the previous section indicates Protemp Crown Temporization Material from 3M ESPE has excellent clinical performance and proven acceptance when used for single-unit temporary applications in permanent dentition.

This innovative development allows Protemp Crown to be considered the next generation temporary single-unit crown material. The clinical aspects and material properties ensure that the daily application in the dental operatory is easy to use, fast, and provides for excellent strength and esthetics.
Instructions For Use*

Precautionary Information for Patients:
This product contains substances that may cause an allergic reaction by skin contact in certain individuals. Avoid use of this product in patients with known acrylate allergies. If allergic reaction occurs, seek medical attention as needed, remove the product if necessary and discontinue future use of the product.

Precautionary Information for Dental Personnel:
This product contains substances that may cause an allergic reaction by skin contact in certain individuals. To reduce the risk of allergic response, minimize exposure to these materials. In particular, avoid exposure to uncured product. If contact occurs directly with the skin, wash skin with soap and water. Use of protective gloves is recommended; however, acrylates may penetrate commonly used gloves. After product placement, remove and discard gloves, wash hands immediately with soap and water and then re-glove. If allergic reaction occurs, seek medical attention as needed.

Storage and Use
- Do not expose the crowns to elevated temperatures or intense light.
- Unopened kits can be refrigerated (4°C or 40°F). Allow product to come to room temperature for use.
- Do not store materials in proximity to eugenol containing products.
- The crowns are designed for use at room temperature of approximately 21-24°C or 70-77°F.
- Shelf life at room temperature is 24 months.
- See outer packaging for expiry date.
- Do not use product after the expiration date.

General Information
Protemp™ Crown Temporization Material manufactured by 3M ESPE, is designed for use as a short-term temporary restoration. It is a self-supporting, malleable, visible light activated composite crown that allows for a custom fit.

Indication
For temporary restoration of permanent teeth prepared for single unit crowns.
- Molar
- Bicuspids (Premolar)
- Cuspid (Canine)

Tooth Preparation
Prepare tooth using conventional techniques.

1) Size Selection
Determine proper size crown. After tooth is prepared, determine the proper Protemp Crown size.
- Measure the mesial-distal width of the prepared tooth using the 3M ESPE Crown Size Tool or a caliper. (Note: adequate tooth structure is necessary to retain crown)

3M ESPE Crown Size Tool. The Crown Size Tool contains graduated widths from 7-12 millimeters. Insert the tool until contact is made with the adjacent teeth and in line with contact points and resting on the occlusal surface of the crown preparation. Slide tool
between adjacent teeth (the tool will wedge). The wedging point, relative to the tool establishes the approximate mesial distal width of the Protemp Crown. The 3M ESPE Crown Size Tool is designed for single use.

Select crown.
• Select the Protemp Crown that coincides with the approximate mesial distal width range provided on the Size Selection Chart.
• Remove the Protemp Crown from the sealed crown case.
• Hold film between thumb and finger and carefully remove film from Protemp Crown.

  Note:
  - Measure carefully, once removed from sealed package, the crown cannot be placed back into the package for re-use at a later date.
  - Protemp Crowns are light sensitive and precaution should be taken to minimize ambient and operatory light exposure.

2) Protemp Crown Preparation
• Gently roll crown in gloved fingers to pre-warm and straighten axial walls.

  Note:
  - If the Protemp Crowns are stored in a cool environment, gently rolling the axial wall of the crown will make it more malleable and less prone to fracture during placement.
  - Gently rolling eliminates the flare at the margin and reduces the circumference of the crown at the margin.
    As the crown is placed onto the tooth preparation it will expand and hug the preparation.

Trim Protemp Crown.
• Determine the amount of excess to be removed from the Protemp Crown by measuring the approximate height of the adjacent teeth. This can be done by using the 3M ESPE Crown Size Tool, perio-probe, or by placing the Protemp Crown on the preparation.
• Follow the gingival contour when trimming excess material to establish proper crown length using a crown scissor.
• Be conservative in removing excess material.

3) Adaptation
Adapt Protemp Crown.
• Seat trimmed Protemp Crown to verify length.
• Adapt, shape and establish interproximal contacts and preparation margins for a snug fit onto the moist preparation.
• Have patient gently close to establish occlusion, open to adapt occlusal surface.

Adapt buccal margin.
• While patient is in occlusion adapt the facially accessible margin.

  Note:
  - After the crown is adapted to the prepared tooth a tack-cure is required to reduce the possibility of distortion upon removal. Do Not Over Tack Cure.

• Tack cure the buccal surface using a dental curing light for 2-3 seconds.

Adapt lingual margin.
• Have patient open, holding crown in place.
• Adapt lingual margin. While adapting the lingual margin apply finger pressure to the adapted buccal surface to prevent dislodging.
• Tack cure the lingual surface for 2-3 seconds.
• Tack cure the occlusal surface for 2-3 seconds.

   Note:
   - A dental curing light with a wavelength range 420-500 nm and a minimum light intensity of
     400 mW/cm₂ is recommended
   - Avoid looking directly at the light guide and do not stare at the light reflection from the
     crown surfaces while curing
   - The use of an eye shield or protective glasses that effectively block light below 500 nm
     wavelength is recommended

4) Final Light Cure
   • Carefully remove the Protemp Crown.
   • Light cure adapted Protemp Crown outside of the mouth for a total of 60 seconds.
   • Fully light cure by exposing all surfaces of the Protemp Crown to the light.

5) Finish and polish
   • Trial fit cured Protemp Crown and make necessary adjustments.
   • Check occlusion.
   • Use a standard method to finish and polish.
   • Finish using a fine carbide bur and/or Sof-Lex™ Finishing and Polishing Systems from
     3M ESPE.
   • Polish using a dry muslin rag wheel or polishing brush.

6) Temporary Cementation
   • Isolate the tooth.
   • Clean preparation.
   • Lightly air dry. DO NOT OVER DRY THE TOOTH

   Prepare temporary cement.
   • Prepare temporary cement following manufacturer instructions and apply cement to the
     internal surface of the Protemp Crown.
   • Care should be taken to prevent air entrapment during mixing and seating.

   Place crown.
   • Using gentle thumb pressure, slowly seat crown into place.
   • Have patient gently close into occlusion and allow excess cement to flow out.

   Remove excess cement.
   • Follow cement manufacturer's instructions for proper set time.
   • Carefully check the sulcus of the treated teeth and the surrounding areas: remove any
     cement residue that remains in the sulcus and along the Protemp Crown margin.
   • Clean the interproximal areas by drawing a piece of knotted floss back and forth under
     the contact points.

Custom Characterization and Repair

Use a flowable; for example a Filtek™ Supreme Plus Flowable, Protemp™ AddOn Material or
Sinfony™ Magic Stain from 3M ESPE for custom characterization. Make custom
characterization, correction or repair with no need for a bonding agent. If you intend to use
other products, refer to the pertinent manufacturer's instructions for use.
3M ESPE Filtek™ Flowable / Protemp™ AddOn / Sinfony™ Magic Stain to Protemp™ Crown Temperization Material

The composite materials can be applied to the final and clean surface of the Protemp Crown.

- Roughen the bonding surface of the Protemp Crown with a rotary instrument.
- Protemp Crown should be free from contamination – e.g. saliva or polishing dust. Use alcohol to clean surface.
- Thoroughly dry with a stream of air.
- Apply the composite materials in increments to the Protemp Crown.
- Follow recommended light cure times for composite materials.
- Finish and polish as recommended in the “Finish and Polish” instructions.

The finished crown should approximate, as nearly as possible, the original tooth in terms of space occupied in the arch, proper relationship with adjacent teeth and functional occlusion with the opposing dentition.

Warranty

3M ESPE warrants this product will be free from defects in material and manufacture. 3M ESPE MAKES NO OTHER WARRANTIES INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. User is responsible for determining the suitability of the product for user's application. If this product is defective within the warranty period, your exclusive remedy and 3M ESPE's sole obligation shall be repair or replacement of the 3M ESPE product.
**Technique Guides**

**Protemp™ Crown Temporization Material**

**Indication**
Short-Term Temporary Restoration

**Tooth Preparation**
Prepare tooth using conventional techniques.

- **Select Size and Prepare Protemp Crown**
- **Adaptation**
  - Buccal/Lingual/Occlusal
  - Tack 2 - 3 sec. each
- **Final Cure**
  - Remove from mouth
  - Final Cure 60 sec.
  - Check occlusion
- **Finish & Polish**
  - Cementation

**Size Selection**
- Determine the mesial-distal width and temporary crown height using the 3M ESPE Crown Size Tool.
- The 3M ESPE Crown Size Tool is designed for single use.
- On the occlusal surface, slide measuring tool between abutment teeth, the wedging point establishes the approximate mesial-distal width
- Use the Size Selection Chart on page 4 to select the appropriate size crown
- Measure carefully, Protemp Crown is light sensitive and once removed from the sealed crown case it **cannot** be used at a later date.

**Protemp Crown Preparation**
- Remove crown from sealed crown case (2a)
- Hold film between thumb and finger (2b)
- Carefully remove film from Protemp Crown
Protemp™ Crown
Temporization Material

- Measure the height of the adjacent teeth as a guide to the amount of excess to be trimmed off the Protemp Crown
- Follow the gingival contour when trimming excess material from Protemp Crown

Adaptation
- Place Protemp Crown onto the prepared tooth
- Adapt, shape and establish interproximal contacts for a snug fit onto the moist preparation
- Gently close to adapt buccal surface and establish occlusion
- Adapt buccal margin
- Adjust occlusion

- While patient is in occlusion check buccal margin
- Tack cure buccal surface 2-3 seconds

DO NOT OVER TACK CURE!
Protemp™ Crown
Temporaryization Material

- Open mouth for adaptation of lingual surface
- Apply finger pressure to buccal surface to prevent dislodging of temporary crown
- Adapt lingual margin

- Tack cure lingual surface 2-3 seconds
- Tack cure occlusal surface 2-3 seconds

Final Cure
- Gently remove Protemp Crown from the preparation
- Light cure outside of the mouth for 60 seconds (fully cure by exposing all surfaces to the light)
- Trial fit cured crown and adjust occlusion, trim margin and contour if necessary

Finish & Polish
- Finish using a fine carbide bur and/or 3M ESPE Sof-Lex™
- Polish Protemp Crown using a dry muslin rag wheel or polishing brush

Temporary Cementation
- Isolate the teeth
- Prepare temporary cement
- Apply cement to the internal surface of the Protemp Crown
Protemp™ Crown
Temporization Material

- Slowly seat the crown
- Gently close into occlusion

- Remove excess cement
- Floss interproximal areas
- Check Sulcus

Size Selection Chart

<table>
<thead>
<tr>
<th>Crown Name</th>
<th>Approximate Range Mesial Distal Width*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUSPID (Canine) Universal</td>
<td>6-7 mm</td>
</tr>
<tr>
<td>Cuspid (Canine) Universal S</td>
<td>6-7 mm</td>
</tr>
<tr>
<td>Cuspid (Canine) Universal L</td>
<td>8-9 mm</td>
</tr>
<tr>
<td>BICUSPID (Premolar) Upper</td>
<td>6-7 mm</td>
</tr>
<tr>
<td>Bicuspid (Premolar) Upper S</td>
<td>6-7 mm</td>
</tr>
<tr>
<td>Bicuspid (Premolar) Upper L</td>
<td>7-8 mm</td>
</tr>
<tr>
<td>MOLAR (1st &amp; 2nd) Upper</td>
<td>9-10 mm</td>
</tr>
<tr>
<td>Molar Upper S</td>
<td>9-10 mm</td>
</tr>
<tr>
<td>Molar Upper L</td>
<td>11-12 mm</td>
</tr>
<tr>
<td>MOLAR (1st &amp; 2nd) Lower</td>
<td>9-10 mm</td>
</tr>
<tr>
<td>Molar Lower S</td>
<td>9-10 mm</td>
</tr>
<tr>
<td>Molar Lower L</td>
<td>11-12 mm</td>
</tr>
<tr>
<td>BICUSPID (Premolar) Lower</td>
<td>6-9 mm</td>
</tr>
</tbody>
</table>

* The seating point relative to the measurement tool identifies the approximate mesial-distal width and size range for selecting a Protemp Crown.

Customer Care Center: 1-800-624-3249 • www.3MESPE.com
Please refer to instructions for more detailed information as well as precautionary and warranty information.
* Refer to the most current version of the Instructions For Use and Technique Card that is included with the product.
Tips for Success and Frequently Asked Questions

Q. What is Protemp™ Crown Temporization Material?
A. Protemp Crown is a preformed, light-cured, tooth colored, methacrylate-based composite crown designed for temporary restoration of posterior teeth prepared for full crowns. In the uncured stage, Protemp Crown's self-supporting, malleable consistency makes it easy and fast to place, trim, fit, and customize.

Q. What sizes and shapes of Protemp Crown will be available?
A. There are (9) Protemp Crown sizes: Molars, Bicusps (Premolar), Cuspids (Canine)
   - Upper Small Molar
   - Upper Large Molar
   - Lower Small Molar
   - Lower Large Molar
   - Upper Small Bicuspid (Premolar)
   - Upper Large Bicuspid (Premolar)
   - Lower Bicuspid (Premolar)
   - Universal Small Cuspid (Canine)
   - Universal Large Cuspid (Canine)

Q. Will Protemp Crowns be available for anterior dentition?
A. Protemp Crowns for anterior teeth would complement the product line and introduction into the market place will be considered at a later date. Use Protemp™ 3 Garant™ Temporization Material for your temporary anterior restorations, as well as bridges.

Q. Can Protemp Crowns be used in both right and left dentition?
A. Yes, the anatomy of Protemp Crown is symmetrical to allow for placement in either the right or left dentition. In addition, the crowns are malleable allowing for individual customizing and shaping. Subsequently, this reduces the number of crown shapes and sizes that need to be stocked in the dental office.

Q. What shade is Protemp Crown?
A. Protemp Crown is offered in one universal shade.

Q. What is the reason for the clear film on the crown?
A. The film protects the crown during the manufacturing process and should be removed prior to placement.

Sizing:

Q. What size Protemp Crown is recommended if the mesial-distal width measurement falls between sizes?
A. The dental professional will determine the appropriate crown size. If the mesial-distal measurement falls between sizes the following should be taken into consideration: mesial-distal width, amount of existing tooth structure, diameter of the preparation. Generally, it is acceptable to use a smaller size crown, because Protemp Crown is malleable, it will easily adapt to the space.
Q. Is the 3M ESPE Crown Size Tool sterilizable?
A. The Crown Size Tool is for single use and not sterilizable. After use, properly dispose of the used Crown Size Tool.

Q. Are additional 3M ESPE Crown Size Tools available?
A. Yes, additional Crown Size Tools are available by contacting 3M ESPE. Also, a caliper can be used to measure the mesial-distal width.

One of the features of Protemp Crown is the reduced number of sizes. After handling and placing a few crowns, dental professionals will become comfortable choosing the correct size.

Handling:
Q. What light output is needed to fully cure Protemp Crowns?
A. A dental curing light with a wavelength range 420-500 nm and a minimum light intensity of 400 mW/cm² is recommended.

When using a standard intensity curing light, e.g. halogen, tack cure 2-3 seconds per surface (buccal, lingual and occlusal) and final cure outside the mouth for 60 seconds. For high intensity curing lights follow the manufacturer recommendation for curing composites, e.g. Freelight 2, tack cure 1-2 seconds per surface (buccal, lingual and occlusal) and final cure outside the mouth for 30 seconds.

During final cure, care must be taken to rotate the Protemp Crown to ensure total cure on all surfaces. Over curing will not damage the Protemp Crown.

Q. What is the most effective way to trim a Protemp Crown?
A. Using crown and bridge scissors, trim the Protemp Crown excess by following the height of the gingival contour. Avoid trimming an equal length around the entire circumference of the crown.

Q. What dental instruments are needed when adapting a Protemp Crown to the preparation?
A. There are no special dental instruments needed. Many dentists found that their gloved fingers work best during initial Protemp Crown placement. A composite placement instrument works well for adapting the marginal, interproximal and occlusal surfaces.

Q. Should I wear special gloves while working with Protemp Crown?
A. No, Protemp Crown was tested and is compatible with several common brands of gloves. Gloves commonly used in dentistry do not offer protection from exposure to uncured methacrylate resins such as bis-GMA. After placement, adaptation and light curing the crown, it is recommended that gloves be removed, hands washed and re-glove as needed.

Q. Can Protemp Crowns be lined?
A. Yes, Protemp Crown can be lined using Protemp 3 Garant Temporization Material. However, evaluation results show that lining is not necessary. If lining is desired, the following steps are suggested:
   • Roughen the inner surface of the cured Protemp Crown with a rotary instrument.
   • Remove debris with alcohol and dry with a stream of air
   • Dispense 3M ESPE Protemp 3 Garant into the Protemp Crown.
   • Fill the crown approximately 1/2 full (do not over fill)
• Seat crown into place and gently guide patient into occlusion.
• Remove crown from prepared tooth at 1:35 min:sec after dispensing.
• Trim excess material at the margins and continue finishing and polishing.
• Reseat crown on the prepared tooth to verify proper fit.
• Cement crown with temporary cement. Refer to the cementation information.

See Instructions for Use for additional information regarding, Custom Characterization and Repair.

Q. How do I obtain a snug marginal fit?
A. Protemp Crown provides for a snug marginal fit. After buccal adaptation and tack cure, apply light finger pressure to the buccal margin, have patient gently open, continue to hold crown in place during lingual adaptation and tack cure. This will provide for a snug margin and prevent the crown from dislodging.

Q. Does Protemp Crown stretch if I need a little extra length?
A. Protemp Crown is malleable and can be slightly stretched, be careful to select the appropriate size crown and avoid the need to overstretch the material. Over stretching can reduce the strength of the Protemp Crown.

Q. How strong is Protemp Crown after tack cure and during removal?
A. When removing the tack cured Protemp Crown from the preparation remember that the crown is semi-cured and has potential for distortion. Care should be taken to protect the crown during removal. After crown removal, you may want to consider placing the crown back onto the preparation to check the fit once more. Then remove for final cure outside the mouth.

Q. Will Protemp Crown bond to a preparation that contains existing composite or core build-up?
A. Yes, Protemp Crown is a composite based material and may bond to composite or core build-up materials. Use petroleum jelly, mineral oil or water as a separating medium to prevent bonding to each other.

Q. What should I do to prevent a Protemp Crown from locking onto the preparation?
A. A Protemp Crown snugly fits the preparation, to prevent locking on avoid undercuts and block out where necessary; use petroleum jelly, mineral oil or water as a separating medium and/or limit tack curing to 2-3 seconds. Care should be taken to not over tack cure!

Q. What can I do to make the Protemp Crown more malleable?
A. Gently rolling the Protemp Crown between your fingers will soften the crown and make it more malleable and eliminates the flare at the margin. The crown will easily stretch as it is placed onto the tooth preparation.

Q. Do operatory lights affect the stability of Protemp Crown?
A. After removing Protemp Crown from the crown case it will remain stable under operatory light for several minutes. If the Protemp Crown case is opened and the crown is exposed to light for an extended period of time (i.e. 10 minutes or more), polymerization will begin and will affect handling properties.
Q. Can Protemp Crown be repaired or customized?
A. Protemp Crown can be easily customized and/or repaired. See Instructions for Use for detailed information, Sub-section: Custom Characterization and Repair.

Q. Does Protemp Crown require a specific temporary cement?
A. Non-eugenol based cements are preferred. Eugenol containing temporary cements may impair the setting or bonding surface of the permanent cement when seating the final restoration.

Q. How can I achieve a high polish?
A. After finishing, Protemp Crown should be free from contamination, use alcohol to clean and remove the slight oxygen inhibited layer. Thoroughly dry with a stream of air. A high polish can be achieved using a dry muslin rag wheel or polishing brush.
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