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SIMPLIFIED SINGLE CROWN PROVISIONAL RESTORATIONS

Howard E. Strassler, D.M.D., F.A.D.M., F.A.G.D.
Professor and Director of Operative Dentistry
Department of Endodontics, Prosthodontics and Operative Dentistry
University of Maryland Dental School

with J. Richard Bradbury, D.D.S., Associate Professor
Department of Endodontics, Prosthodontics, and Operative Dentistry
University of Maryland Dental School

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COURSE OBJECTIVES

Upon completion of this course, the participant will be able to:

- List the functions of provisional restorations in xed prosthodontics.
- List materials that can be used for single crown provisional restorations in xed prosthdodontics.
- Describe the indications for the use of pre-formed single crown provisional restorations.
- Describe the technique for fabrication of a single crown provisional using a pre-formed composite resin crown form.

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WHY TAKE THIS COURSE?

PATIENT CARE—Offer your patients the most in-demand treatment methods while enhancing your practice's profitability.

CONVENIENCE—Review the latest information on single crown provisionals and related materials in a concise and consolidated format.

CE CREDITS—Successful completion of this course earns you 2 Continuing Dental Education Units.

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Temporary or provisional single crown restorations shield the underlying tooth preparation and pulp while the de nitive restoration is being fabricated by the laboratory. is pulpal protection promotes pulpal healing after the trauma of tooth preparation. Also, a well-adapted and contoured provisional crown assures the return to health of any soft tissues traumatized during the crown preparation and impression-making process by allowing the patient to maintain their oral hygiene adjacent to the temporary crown with brushing and ossing.

TABLE 1:
Partial listing of resin based provisional materials

NAME	MANUFACTURER
ACRYLIC RESIN	
Alike	GC America
Jet Tooth Shade	Lang Dental
Snap	Parkell
Unifast LC	GC America
BIS-ACRYL COMPOSITE	
Gorgeous Temp	Den-Mat
LuxaTemp	Zenith Dental
LuxaTemp Fluorescence	Zenith Dental
LuxaTemp Solar Plus	Zenith Dental
Protemp 3 Garant	3M-ESPE
Integrity	Dentsply Caulk
Fill-In	Kerr Dental
Temphase	Kerr Dental
Access Crown	Centrix Dental
Smart Temp	Parkell
Cool Temp Natural	Coltene-Whaledent
TempSpan	Pentron Clinical
Systemp C&B	Ivoclar

From a clinician's standpoint, temporary crowns provide critical information by helping the clinician decide if there is adequate occlusal clearance and reduction of the tooth preparation for the nal restoration. In the case of anterior esthetic restorations, the provisional crowns can provide the clinician with guidance as an esthetic trial to the color, contours, length, widths, and shapes of the teeth before fabrication of the nal porcelain-metal or all-porcelain restoration. If more than one tooth is being restored, provisional crowns provide important diagnostic information that help determine the desired occlusal relationships and, in cases where the crowns are being used to alter the occlusal vertical dimension, these provisional restorations are a guide to the desired occlusal position.

Other important purposes for the provisional restoration include the maintenance of the tooth preparation position both occlusally and proximally.[1-4] e provisional restoration should be adjusted to duplicate the desired nal occlusion and must have proximal contact with adjacent teeth to avoid tooth movement and shifting that can have a negative impact on the placement of the nal restoration. If the tooth or teeth that have been prepared shift after the impression is made, the restoration returned by the laboratory will very likely need more proximal contact and occlusal adjustment before cementation. In some cases, the movement of the tooth preparation can change the path of insertion for the nal crown or xed partial dentures and may not allow complete seating of the restoration during try-in. For a multiple unit, xed partial denture with a metal framework, that restoration may need to be sectioned for soldering and if the xed partial denture is all-ceramic, it may require a new impression and re-fabrication of the restoration.

Any changes in tooth position can lead to an increase in chair time required during the try-in and cementation appointment. In extreme cases when teeth have moved due to loss or fracture of the provisional restoration, the practitioner might have to fabricate acrylic resin copings and make a pick-up impression so that the laboratory has the new tooth preparation positions when prefabricating the nal restoration. In some cases due to tooth movement, the tooth preparation might need to be orthodontically repositioned or the teeth re-prepared. is leads to a signi cant increase in chair time and may lead to patient dissatisfaction due to the additional procedures and o ce visits. For the tooth that has shifted only a minor amount, the consequences may only be an increase in chair time during the cementation appointment.

As a clinician, the fabrication of temporary res-

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torations for a single crown requires pro ciency with a variety of materials and techniques that can be used to make well-adapted and functional provisionals. ere are many options to choose from for temporizing a single crown including: prefabricated polycarbonate crowns, composite resin crowns, stainless steel crowns, aluminum shell crowns, clear plastic colloid crown formers, acrylic resin for custom provisionals, bis-acryl automix composite resin materials and composite resin for custom fabrication.(2-4)

In many cases of single tooth preparation, the tooth being prepared is fractured, misaligned, or poorly contoured. In other cases, the patient presents for an emergency appointment with a tooth in need of a full-coverage restoration. ere is no time to fabricate a custom crown shell and making a template of the existing tooth is out of the question due to its poor condition. In these circumstances, the best choice is a prefabricated provisional crown form. For single tooth crown preparations, the practitioner can use prefabricated polycarbonate crown shells that require relining with an acrylic resin for anterior teeth and premolars. A preformed metal crown fabricated from stainless steel or aluminum can be used in some cases. In this instance, to make the provisional restoration well adapted to the tooth preparation margins, a dental resin would be placed to reline the prefabricated provisional.

Recently, a novel prefabricated crown form made of light-cured composite resin was introduced. Protemp Crown (3M ESPE) o ers the bene ts of any prefabricated crown form for ease of use, combined with the esthetics and excellent mechanical properties of fracture and wear resistance.

Another choice for the single crown is the use of a template that can be lled with a provisional resin to fabricate the temporary crown. Dental resins for temporary crown fabrication include acrylic resin or Bis-acryl composite resin materials. Table 1 contains a partial listing of provisional resin materials.

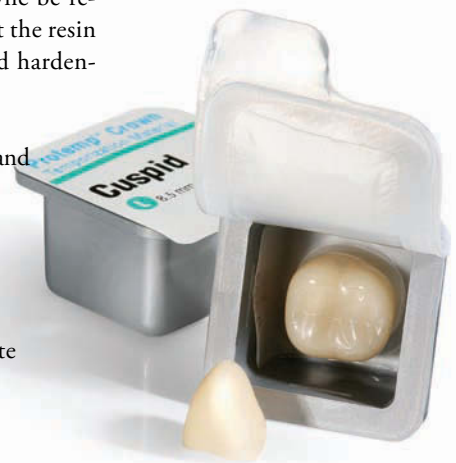
Typically when fabricating a temporary restoration with a dental resin, you must make one of two things: (a) a custom shell that will be relined with acrylic resin at the time of tooth preparation to mimic the nal contours and anatomy or (b) a carrier, or template, for the provisional restorative material that is fabricated prior to the tooth preparation appointment. e dental literature describes the use of warmed wax, pre-made acrylic shells, vacuum formed polypropylene matrices, and vinyl polysiloxane impressions.(2-7)

Fig. 1 A Protemp Crown kit

In the past, the choice of tooth colored provisional resins was limited to acrylic resins. With traditional acrylic resins, the fabrication of the provisional restoration usually requires mixing a powder and liquid together to form a paste that is placed in either a pre-made shell, template or carrier that is placed over the tooth preparation. Timing and monomer/powder ratio is critical to determining the setting time. It is usually di cult to time the setting and working stages of the polymerizaton reaction of acrylics. An inconsistent monomer-powder mix leads to di culty in timing the removal of the template from the tooth. Leaving the template in place with the arylic resin can lead to pulpal irritation or gingival trauma due to the heat of the setting reaction. Also, if the acrylic resin sets too fast, the temporary can become locked onto the tooth preparation due to the high degree of shrinkage of the resin. Perfect timing for acrylic resin requires that when the acrylic resin reaches a rubbery consistency, the carrier and acrylic be removed from the tooth preparation so that the resin can achieve complete polymerization and hardening out of the mouth.

Although these materials are tooth colored and relatively inexpensive, they are di cult to manipulate and have poor physical properties.(8) Powder-liquid acrylic resins are typically polymethylmethacrylates (PMMA). ese materials are sloppy to use, shrink on polymerization, generate

Fig. 1 B Examples of Protemp Crown in light-safe packaging



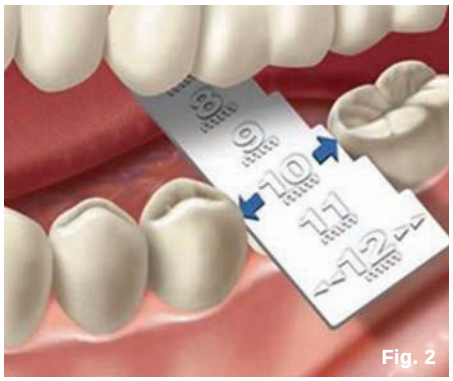


Fig. 2


Fig. 3

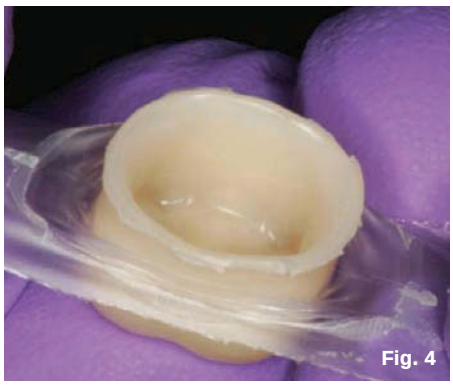


Fig. 4

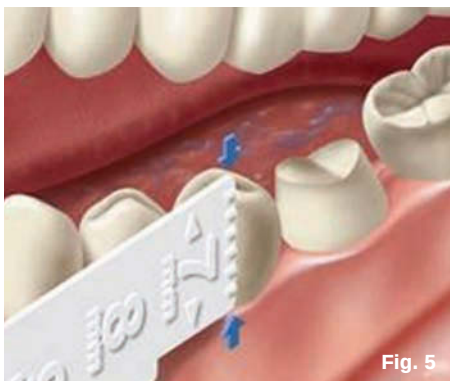


Fig. 5

Fig. 2 Protemp width measure gauge to determine mesial-distal width to select correct size of crown.

Fig. 3 Mandibular molar Protemp Crown selected.

Fig. 4 Removal of plastic covering from Protemp Crown.

Fig. 5 Measuring the occlusal gingival height of the crown to determine the trimming of the crown.

signi cant heat during polymerization and have an unpleasant odor while setting.[3, 8, 9] Also, these resins show signi - cant wear in occlusal function, are susceptible to breakage, have poor t and can discolor over time.[10, 11] When a bis-acryl composite resin provisional material was compared to PMMA, one study concluded that the bis-acryl composite resin was signi cantly superior to PMMA as a provisional restorative material.[11]

One concern with resin based restorative materials is environmental damage due to dietary solvents. Bis-acryl composites were more resistant to the problems of wear and color changes than other provisional materials.[12, 13] One method described in the literature for xed partial dentures that increases the exural strength and resistance to breakage of acrylic resins is the use of ber reinforcement embedded in the provisional material.[14, 15]

To overcome the de ciencies of acrylic resin, new custom temporary materials — bis-acryls with improved physical properties — have been introduced to simplify the fabrication of provisional restorations.[1, 5, 6, 8-10, 16] Bis-acryl composite resins are typically dispensed in a double-barrel tube con- guration where the catalyst and base pastes are mixed in automixing tips. Bis-acryl typically have signi cantly less shrinkage than acrylic resin due to the presence of radiopaque glass llers which improves the t of the provisional restoration to the tooth preparation.[8,11] ese glass llers also improve the wear characteristics of the material.

Bis-acryls have a paste-paste formulation which undergoes a three-stage polymerization reaction. e rst phase goes from a free- owing paste that adapts to the tooth preparation and then becomes elastic within 60-75 seconds. e second phase over the next four minutes is a cross-linking polymerization reaction allowing the polymer to reach a high compressive strength. e nal phase of polymerization allows the resin to reach its nal hardness within ve minutes after initial mixing so that the restoration can be adjusted and polished before cementation.

For single crowns, there has been an increasing trend toward the use of bis-acryl composite resin provisional materials due to their better physical properties and ease of use. With the introduction of Protemp Crown, a pre-formed crown made from composite resin takes advantage of the bene ts of bis-acryl composite resin provisional materials with the additional bene t of being in a preformed shell. It has been reported that provisional composites used for provisional restorations have advantages over other resin based provisional materials.[1, 5, 6, 8, 10-19]

Protemp Crown Temporization Material

Protemp Crown temporization material is a light-cured composite resin, preformed crown for single-unit temporization of mandibular premolars and molars, maxillary premolars and molars and canines (Fig. 1). It combines the advantages of composite-based temporization materials (t, wear resistance and esthetics) with the advantages of prefabricated crowns (t, ease of use, no need for additional matrix, and easy clean-up). It is a preformed, moldable composite-based crown that can o er custom t and adaptation in less than four minutes.

is novel temporization material is easily moldable. In its uncured condition, it handles like putty that can be easily molded and reshaped using your traditional composite instruments. Its moldable state o ers the ease of adaptation to the buccal, lingual and interproximal margins with the additional advantage of attaining proximal and occlusal contacts before light curing. e chemistry of this composite combines a light cured (on-demand setting) resin matrix lled with chemically interacting, aggregated organic llers.

Protemp Crown bis-GMA resin chemistry

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provides an improvement in physical properties.[19] Polymerization shrinkage is one of the most negative aspects of acrylic resins. Acrylic resins have almost a 5% shrinkage upon setting. is shrinkage leads to temporaries that don't t when tried back onto the tooth preparation. Protemp Crown's performance is similar to the polymerization shrinkage of a typical restorative composite, approximately 1.7% volumetric shrinkage. It has more than twice the compressive strength of a polymethylmethacrylate acrylic resin, almost 2.5 times greater diametral tensile strength and more than twice the exural strength. ese improved physical properties translate into a more durable single tooth provisional restoration. In function, the composite structure of Protemp Crown has been shown to be similar in wear resistance to typical restorative composites and more than twice the wear resistance of bis-acryl provisional composites. Protemp Crown also is radiopaque.

Technique with Protemp Crown

After the crown preparation, use the single-use crown size selection gauge to measure the mesial-distal width between the adjacent teeth (Fig. 2).

e Protemp Crown chart provides the width measurements for the preformed crowns that are available. For this case, the Protemp lower molar "S" crown was selected (Fig. 3). Each Protemp Crown has unit packaging in its own light-safe package. After the pre-formed crown was selected it was removed from the package and stored in a light-safe container for protection. After removal from the container, the plastic lm is removed from the crown form (Fig. 4). Using the same single-use gauge, determine the occlusal gingival height of the crown (Fig.5). Using a crown and collar scissors, trim the Protemp Crown to the height that has been determined following the gingival contours of the tooth (Fig. 6).

With the crown form cut to height and contour, it was tried on the moist tooth preparation. (During this time, turn the chairside operatory light to a lower setting or so that it is not in direct illumination of the tooth preparation to avoid the possibility of initial light curing of the Protemp Crown.) Because the width was pre-selected, the proximal contact should be correct. Use your gloved ngers to gently compress the crown on the buccal and lingual surfaces for initial adaptation of the crown form. Using a composite instrument, the crown was closely adapted to the buccal surface (Fig. 7). Using a plastic lling instrument and burnisher, push the composite resin crown form to have the mesial and distal marginal ridges the same height as the adjacent teeth. With the plastic lling instrument holding the buccal contour, the patient was instructed to bite down to establish the occlusion on the crown form. e buccal surface was then tack cured for 2-3 seconds with the patient biting down.

With the proximal contacts established, the buccal surface contoured and adapted and the occlusion established, the lingual surface was adapted. When adapting the lingual surface with the plastic lling instrument, use your gloved nger to stabilize the buccal surface to ensure the adaptation of the buccal surface. Once the lingual surface has been adapted with the plastic lling instrument, tack cure the lingual surface with your curing light for 2-3 seconds. With the buccal and lingual surfaces tack cured, the occlusal surface can be


Fig. 6


Fig. 7

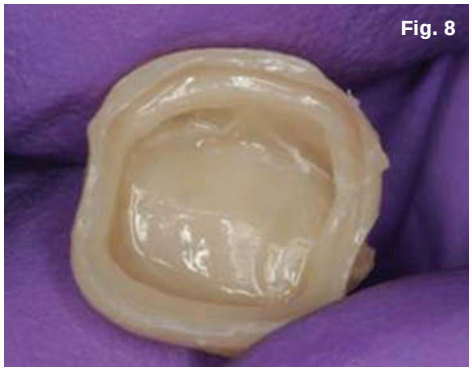
Fig. 8

Fig. 6 Following the gingival contours, use a crown and collar scissors to trim the height of the crown.

Fig. 7 Adapting the buccal margin of the crown.

Fig. 8 The crown after light curing; the margins are easily readable for trimming.

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Fig. 9


Fig. 10

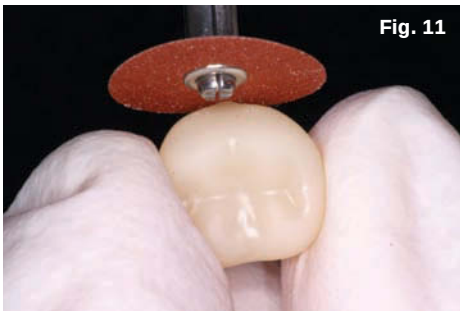
Fig. 11

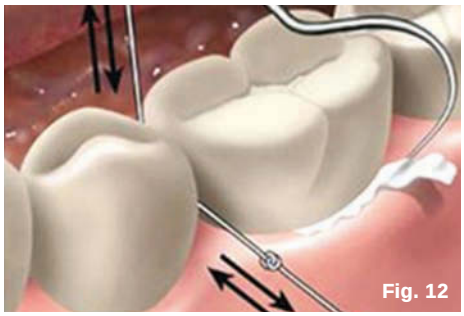
Fig. 12


Fig. 13A


Fig. 13B

Fig. 9 Trimming the gingival margins with an acrylic bur (SS White Burs). **Fig. 10** Fine trimming and refinement of the margins with a coarse XT Soflex disk. (3M-ESPE) **Fig. 11** Protemp Crown after polishing with Jazz composite polisher (SS White Burs). **Fig. 12** Schematic demonstrating temporary cement removal. Note the knot in the dental floss to pull out excess cement from the interproximal areas. **Fig. 13** Cemented Protemp crown provisional restoration demonstrating physiologic contours, esthetics, and function. Dentistry by Scott Arne, DDS **A** Buccal view **B** Occlusal view

cured for 2-3 seconds.

With the shape of the crown preliminarily hardened (tack cured), the crown form was removed and the crown was addition light cured on the buccal, lingual and occlusal surfaces for 40-60 seconds (dependent on the power density and type of the curing light used). Protemp Crown requires complete polymerization before any further adjustment. After complete polymerization, the margins of the crown form are easily visualized (Fig. 8).

e crown margins were trimmed with an acrylic bur (SS White) (Fig. 9) and a coarse XT disk (3M ESPE) on a pop-on mandrel (Fig. 10). e crown was tried in and the occlusion was adjusted. A nal polish of the Protemp crown was accomplished with a one-step diamond impregnated composite resin rubber abrasive (Jazz polisher, SS White) (Fig. 11).

e crown was cemented with a non-eugenol provisional cement (RelyX Temporary NE 3M ESPE). Sometimes, for teeth with large gingival embrasures, the cement is more di cult to remove from the embrasure spaces. For these cases, tying two to three knots into an end of dental oss will allow the larger knotted area to pull out the gross set cement. e set temporary cement was removed using an explorer and interproximally using a piece of dental oss that was knotted and pulled through the contact area (Fig. 12).

e completed ProTemp crown provides for positional stability of the tooth preparation, contour and gingival adaptation consistent with gingival health, esthetics, and wear resistance in function (Fig. 13).

Conclusion

is article described a technique for simpli ed, predictable, esthetic single crown provisional restorations with a novel, light cured composite resin preformed crown. Protemp Crown o ers an alternative to other esthetic provisional materials in an easy-to-use, preformed product with excellent mechanical properties.

Employing the techniques described, a clinician can reduce chair time by almost 30 minutes compared to when using a self-cure acrylic resin for temporary crowns and bridges. e techniques described will allow the clinician to fabricate high quality, well adapted provisional restorations that are wear resistant and more esthetic than conventional acrylic resins.

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1. According to this article, the fabrication of a well-made,fitting and adjusted provisional (temp) crown is important because:
a. the final restoration requires only minimal proximal contact and occlusal adjustment.
b. there is an increase in sensitivity but it will decrease over time.
c. clean-up of the final cement is more effective.
d. there is better numbing with local anesthetic.

2. An important function of a provisional restoration is to provide pulpal protection to the tooth that was prepared. This pulpal protection:
a. is dependent on the marginal seal of the restoration.
b. does not matter in the long run because most crowns need endodontic treatment.
c. promotes pulpal healing after the trauma of tooth preparation.
d. requires the use of a calcium hydroxide for temporary cementation.

3. TRUE or FALSE: During tooth crown preparation, the gingival tissues can sometimes be traumatized. In order to insure gingival tissue healing, the provisional restoration should always be fabricated to be short of the margins of the tooth preparation.
a. Both statements are true.
b. The first statement is true, the second statement is false
c. The first statement is false, the second statement is true.
d. Both statements are false.

4. Provisional restorations hold the position of prepared tooth occlusally and proximally. This means:
a. The provisional restoration margins retract the gingival tissues for easier impression making of the preparation margins.
b. The provisional restoration provides for maintenance of gingival tissues while cemented.
c. The provisional restoration allows space for temporary cement to seal the margins.
d. The provisional restoration stabilizes the tooth position so there is no movement after impression making, resulting in a more accurate fit and less adjustment of the final restoration.

5. Temporary crowns for anterior teeth can provide the practitioner with guidance for:
a. length of tooth (teeth).
b. width of tooth (teeth).
c. shape of tooth (teeth).
d. contours of tooth (teeth).
e. All the above.

6. TRUE or FALSE: Temporary crowns should never be used to alter the occlusal vertical dimension and evaluate occlusal change. Dental resins used for temporary crowns wear too quickly in function to be used to evaluate occlusal changes.
a. Both statements are true.
b. The first statement is true, the second statement is false.
c. The first statement is false, the second statement is true.
d. Both statements are false.

7. The reason why a provisional restoration should be adjusted to duplicate the desired final occlusion and proximal contact is because:
a. the patient will like the appearance of the provisional better and will have confidence in your abilities.
b. teeth can shift in position after preparation unless the provisional restoration provides for positional stability of the tooth.
c. it will help the patient not bite on their cheek while waiting for the final restoration.
d. None of these statements are true; the temporary is important only for pulpal protection.

8. If patients break their provisional restorations or they come off the tooth preparation, they should be instructed to:
a. not worry and wait until their next scheduled appointment.
b. cover the tooth with orthodontic wax until their next appointment to minimize sensitivity.
c. call the office as soon as possible to schedule an appointment to remake the provisional restoration.
d. take a pain medication if the tooth hurts and wait until their next scheduled appointment.

9. The choice of a prefabricated temporary crown will usually be made for a single tooth crown. The reason why a tooth will have a crown preparation and crown can be due to:
a. trauma and fracture of the tooth.
b. fracture of an existing restoration.
c. caries under an existing crown.
d. all the above can be reasons a tooth needs a crown preparation and crown.

10. Prefabricated temporary crowns are made from:
a. polycarbonate.
b. stainless steel.
c. aluminum.
d. composite resin.
e. All the above.

11. A provisional restoration made with acrylic resin can be fabricated by:
a. using a carrier (template) fabricated prior to the tooth preparation appointment.
b. pouring acrylic resin over the tooth preparation, allowing the patient to bite down and allowing it to completely harden in place. Trimming is done on the tooth.
c. using a custom shell that is relined on the tooth preparation at the time of tooth preparation.
d. Both a and b.
e. Both a and c.

12. The benefits of bis-acryl resins over acrylic resins as provisional restorations include:
a. less shrinkage than acrylic resin.
b. resistance to occlusal wear.
c. rapid setting.
d. All the above.

13. All the following have been described in the dental literature as a carrier (template) for provisional restorations EXCEPT one. The EXCEPTION is:
a. warmed wax.
b. Vacuum formed polyproplylene matrices.
c. cotton gauze wetted with glycerine.
d. vinyl polysiloxane impression material in a tray.

14. Acrylic resins may cause problems because they:
a. can cause pulpal irritation due to the heat of the exothermic reaction.
b. can cause gingival trauma due to the heat of the exothermic reaction.
c. are more difficult to mix with a consistent powder-liquid ratio that can lead to issues with timing to determine when to remove the temporary during fabrication.
d. all the above are issues with acrylic resins.

15. Bis-acryl can be reinforced when used for long span bridges by:
a. increasing the setting time.
b. adding fiber reinforcement to the restoration.
c. adding flowable composite resin to a channel prepared in the occlusal surface of the restoration.
d. increasing the setting time.

16. Protemp Crown is an innovative prefabricated, tooth colored crown. It is made from:
a. aluminum.
b. stainless steel.
c. composite resin.
d. acrylic resin.

17. According to laboratory testing, the composite resin used for Protemp Crowns has a volumetric polymerization shrinkage that is significantly less than acrylic resin. The polymerization shrinkage of the this composite is:
a. 1.7%.
b. 5.0%.
c. 12.4%.
d. 15.0%.

18. When compared to polymethyl methacrylate, the acrylic composite resin of Protemp Crown has:
a. the same compressive and tensile strength.
b. less compressive and tensile strength.
c. twice the compressive strength and two and half times greater tensile strength.
d. greater compressive strength but less tensile strength.

19. To select the size of Protemp Crown that will be used on a molar or premolar, one should:
a. use the provided single patient use disposable gauge to measure the mesial-distal dimensions between the adjacent teeth.
b. use the chart provided in the kit to determine the correct size of crown needed.
c. take them out of the box until you find the one that fits.
d. Both A and B.

20. TRUE or FALSE: After the Protemp Crown has been trimmed and placed on the tooth preparation, gently compress the crown on the buccal and lingual surfaces of the teeth using your gloved fingers for initial adaptation and take a composite instrument to adapt the crown on the buccal surface and push the crown composite to have the marginal ridges of the adjacent teeth at the same height. With the composite instrument holding the buccal contour, the patient should bite down on the Protemp Crown to establish occlusion before tack curing the crown on the buccal surface for 2-3 seconds with a curing light.
a. Both statements are true.
b. The first statement is true, the second statement is false.
c. The first statement is false, the second statement is true.
d. Both statements are false.

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SIMPLIFIED SINGLE CROWN PROVISIONAL RESTORATIONS

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