

## Direct Technique for the Fabrication of Acrylic Provisional Restorations

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### Abstract

Provisional restorations are fabricated to protect the prepared tooth structure during the period between tooth preparation and insertion of the definitive restoration. These restorations are also referred to in the literature as interim, temporary, or provisional restorations (protheses). Such restorations should be uncomplicated and inexpensive to fabricate in a short period of time. Several laboratory and clinical techniques for the fabrication of provisional restorations have been described in the literature, such as the indirect technique, direct technique, and indirect-direct techniques for both single and multiple unit restorations. This article describes a step by step clinical technique for the fabrication of a direct provisional restoration to satisfy the issues of esthetics, patient comfort, speech and function, maintenance of periodontal health, and maxillomandibular relationships while wearing the restoration.

**Keywords:** Provisional restoration, provisional prosthesis, acrylic provisional restoration, temporary restoration, interim restoration

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## Introduction

Provisional restorations are fabricated to protect the prepared tooth structure during the period between tooth preparation and the final restoration. This prosthesis is also referred to in the literature as an “interim, temporary, provisional prosthesis, or restoration”<sup>1</sup> (Table 1). Such restorations should be uncomplicated and inexpensive to fabricate in a short period of time. Several laboratory and clinical techniques for the fabrication of provisional restorations have been described in the literature, such as the indirect technique<sup>2</sup>, direct technique<sup>3</sup>, and indirect-direct techniques<sup>4</sup> for both single and multiple unit restorations.<sup>5-9</sup> After the provisional restoration has been properly trimmed and adjusted<sup>7,8,10</sup>, it is cemented with different luting agents such as resin based, zinc oxide eugenol, or non-eugenol cements.<sup>11</sup>

**Table 1. Glossary of terms.**

Provisional restoration = Interim prosthesis
Final restoration = Definitive restoration
Luting agents = Cement
Study casts = Diagnostic casts

Provisional restorations should protect the teeth (dentin and pulpal tissues) against invasive microorganisms, saliva, and food, which may penetrate the dentinal tubules as well as prevent thermal conduction for comfort.<sup>12-15</sup> Proper marginal adaptation will also protect the finish line of the tooth preparation.<sup>16-17</sup> Adequate maxillary and mandibular occlusal relationships as well as interproximal contacts will prevent the drifting and extrusion of teeth that can affect the fit of the final restoration. Maintaining these relationships between the teeth promote gingival health by preventing food impaction into the soft tissues.<sup>18,19</sup> Proper contouring of provisional restorations can assist in the maintenance of periodontal health by allowing access to the soft tissues during patients' oral hygiene procedures.<sup>20</sup>

To identify an optimum treatment outcome before the completion of a definitive restoration, diagnostic changes in tooth morphology and occlusal contours that were established during a diagnostic wax up can be evaluated for function, phonetics, and esthetics. Provisional restorations can also be used for extended treatment intervals

by providing long-term tooth protection and stabilization during adjunctive periodontal and endodontic treatment procedures.<sup>21,22</sup>

While there is no ideal provisional material suitable for all clinical conditions, there are several materials that can be used successfully as long as they satisfy mechanical, esthetic, and biological factors which are interrelated.<sup>23</sup>

## Mechanical Factors

Mechanically the provisional restorations, during function, must resist functional loads that occur during chewing as well as resist removal forces without fracturing.<sup>24</sup> To reduce the risk of fracture, the inter abutment connector size must be increased for strength, thus, limiting esthetic and biologic requirements. The inter abutment alignment, dimensional stability, and marginal integrity can be achieved by reinforcing the provisional restoration with a wire of fibers.<sup>25-27</sup> The strength is determined by the material's resistance to crack propagation.<sup>28</sup>

## Esthetic Factors

The appearance of an anterior provisional restoration usually has higher esthetic demands than those for the posterior region.<sup>29</sup> For esthetic clinical purposes, an initial accurate color shade match should remain color stable over the course of provisionalization.<sup>30,31</sup> Color changes are influenced by surface quality and porosity in conjunction with the oral hygiene habits of the patient.<sup>32</sup>

## Biological Factors

Biologically provisional materials should be non-irritating, non-toxic, and non-allergenic.<sup>33</sup> Proper contours and adequate marginal adaptation should maintain the periodontal health. If gingival inflammation is present, recession can occur at the free gingival margin<sup>34,35</sup> (Figure 1).

The fabrication of provisional restorations requires an array of clinical activities, material selection, and techniques to fabricate acceptable interim restorations. Ideally, they should be similar to definitive restorations by providing pleasing esthetics to enhance the self-image of the patient and help guarantee cosmetic acceptability of the definitive restoration for the patient and the dentist. The provisional

restoration must also provide adequate support and protection for the prepared tooth (teeth) while maintaining periodontal health.<sup>36</sup> It should maintain or restore function for two weeks to six months.

### Fabrication of Direct Acrylic Provisional Restorations

For the successful fabrication of provisional restorations, the following clinical and laboratory steps are required:

1. Fabrication of articulated diagnostic casts
2. Diagnostic wax-up on the study casts
3. Duplication of the diagnostic wax-up
4. Fabrication of a Vacuform (0.200 inch acetate splint material) matrix

A summary of the armamentarium used in the fabrication of provisional restorations is shown in Table 2.

#### Laboratory Phase

##### **Step 1: Fabrication of Diagnostic Casts**

Accurate impressions of both dental arches are required. Flaws in the casts can lead to an inaccurate occlusal relationship. Irreversible hydrocolloid impressions are sufficiently accurate and offer adequate surface detail for diagnostic casts (Figure 2).

The diagnostic study casts are used to evaluate the individual arches, overall occlusion, contours, and tooth positions of teeth to be restored of single and multiple units. It is recommended the casts be mounted with the aid of an inter-occlusal record either on a non-adjustable or semi-adjustable articulator.

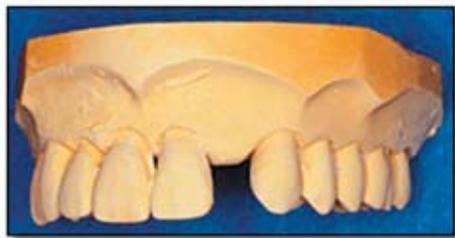
##### **Step 2: Diagnostic Wax-up on Study Casts**

Mounted casts are used for the diagnostic wax-up and will offer the following essential information:

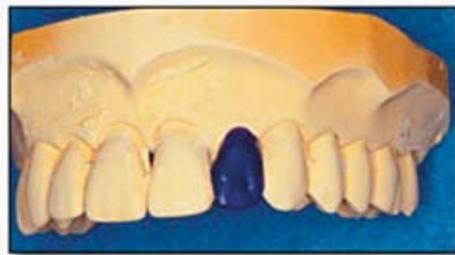
- Evaluation of the occlusion
- Orientation of the plane occlusion
- Amount of inter arch space
- Tooth inclination
- Arch form
- Size and shape of the existing dentition
- Approximate idea of tooth structure removal needed for the restoration
- \* Guide for occlusal adjustment (if necessary)



**Figure 1.** The design of a provisional restoration must allow for proper embrasure space, marginal extension, contact areas, and buccal and lingual contours. Inadequate marginal extension and contour results in tissue irritation as shown here.



**Figure 2.** A diagnostic study case.



**Figure 3.** Missing teeth are waxed to ideal contours on the diagnostic cast.



**Figure 4.** Adjacent teeth to be restored can be waxed to ideal contours on the diagnostic cast.

Table 2. Armamentarium and materials recommended for fabrication of temporary restorations.

General Items
<ul style="list-style-type: none"> <li>• Fine lead mechanical pencils 0.5 m 2B</li> <li>• Disposable "Benda Brush" – fine point</li> <li>• Autopolymerizing acrylic resin - shades #62, 65, 67, and 81</li> <li>• Dropper</li> <li>• Two dappen dishes or disposable cups</li> <li>• Cement mixing spatula</li> <li>• Cellulose acetate sheets</li> <li>• Straight slow speed handpiece</li> <li>• Scalpel blade #15</li> <li>• Scissors, C&amp;B (curved)</li> <li>• Silicone putty impression material</li> </ul>
Clinic and Laboratory Carbide and Diamond Rotary Instruments
<ul style="list-style-type: none"> <li>• Tapered round end (Brasseler #251EF.060)</li> <li>• Long, narrow, tapered, round end Brasseler #911HF-220 or 919-200)</li> <li>• Round bur, carbide #8 (Brasseler H71E.104.023)</li> <li>• Diamond disk (Brasseler #919HF-220 or #919-200)</li> </ul>
Acrylic Polishers (Wheels and Points)
<ul style="list-style-type: none"> <li>• DCH8DM wheel*</li> <li>• DCH8D wheel*</li> <li>• DCH2DM point*</li> <li>• DCH2D point*</li> <li>• BRO 1 0669-11*</li> <li>• BRO 2*</li> <li>• BRO 3*</li> <li>• Mandrel*</li> <li>• Chamois Buff 5/8" wheel*</li> <li>• Bristle brushes 5/8" wheel*</li> <li>• Acrylic polishing compound*</li> </ul>
*Brasseler

Using the diagnostic wax-up technique, the casts can be altered to create the proper shape and contours of the planned restoration. It is also used for the fabrication of temporary restorations and as a diagnostic guide to be used for the design of the final restoration (Figures 3 and 4).

**Step 3: Duplication of the Diagnostic Wax-up**

Either soft or hard putty consistency polyvinyl silicone impression material or addition silicone putty is mixed in equal amounts according to the manufacturer's instructions. It is prudent to avoid latex gloves as some brands can contaminate the impression material and inhibit its set. The mixed material can be used with or without an impression tray to make an impression of the diagnostic wax-up and adjacent teeth. The cast can be placed in warm water to accelerate the set of the silicone. The putty matrix is removed from the cast and is ready to be poured in fast or regular setting dental stone. After the stone has set, it can be removed from the impression matrix and trimmed with the model trimmer (Figures 5 and 6).

**Step 4: Fabrication of the Vacuform Matrix**

To facilitate the removal of the matrix material, block-out compound can be placed on the undercut areas of the cast. The cast is then placed on a vacuum forming machine (Figure 7) (UltraVac-Vacuformer, Ultradent, South Jordan, UT, USA).

A .020 inch acetate material sheet (Tray Material, Ultradent, South Jordan, UT, USA) is heated, and when ready, it is vacuum adapted onto the cast (Figure 8).

After the acetate sheet has cooled, it is trimmed with a scalpel blade along the block out compound.

To facilitate the cutting of the matrix material, plumber's caulking can be placed prior to the fabrication of the vacuformed matrix as shown in Figures 9 and 10.

Slowly pry off the vacuform matrix material from the cast and with curved scissors and trim the matrix approximately 2-3 mm on the buccal and lingual surfaces below the gingival margin for the tooth (teeth) to be provisionalized. It is suggested to include at least one to two teeth on either side



**Figure 5.** Silicone impression material used without a tray to make an impression of the diagnostic wax-up.



**Figure 6.** Maxillary duplicated stone cast made from the poured up silicone impression.



**Figure 7.** A vacuum forming machine.



**Figure 8.** The resulting acetate matrix adapted to the cast.



**Figure 9.** Plumber's caulking can be placed around the area to be cut out prior to vacuum forming the acetate material.



**Figure 10.** The scalpel blade is used to cut out the matrix along the plumber's caulking.



**Figure 11.** The custom acetate matrix extending 2-3 mm onto the gingival and over adjacent teeth to serve as stops.



**Figure 12.** Lingual view of the custom matrix.

of the prepared teeth as part of the matrix to act as stops during its use. The matrix should have precise interproximal detail, anatomic definition, and accurate occlusal morphology (Figures 11 and 12).

### Clinical Phase

#### **Step 1: Matrix Try-in**

Before the teeth are prepared, the vacuum formed matrix is placed in the mouth to verify the fit. The matrix can also be used as a "preparation guide" by placing it over the prepared teeth to verify if a sufficient amount of tooth structure has been removed to accommodate the provisional and, ultimately, the definitive restoration (Figure 13).

#### **Step 2: Matrix Preparation**

To avoid voids during the fabrication of the provisional restoration, vent holes can be pierced through the matrix with an explorer on the occlusal or incisal surface so during the fabrication of the restoration trapped air can escape (Figure 14).

The application of a thin coat of Vaseline® or glycerin to the prepared teeth and surrounding tissues is recommended to facilitate the removal of the cured acrylic resin.



**Figure 13.** Mock try-in of a custom matrix on a dentof orm with prepared teeth to demonstrate the fit and clearance between the matrix and the preparations.

### **Step 3: Resin Preparation**

The proper shade of autopolymerizing acrylic resin is selected for the provisional restoration. A combination of shades can be used such as a light shade for the incisal and a darker shade for the body of the tooth or teeth in the restoration.

The monomer and polymer are mixed according to the manufacturer's instructions in a dappen dish until a string-like consistency is reached (Figure 15).

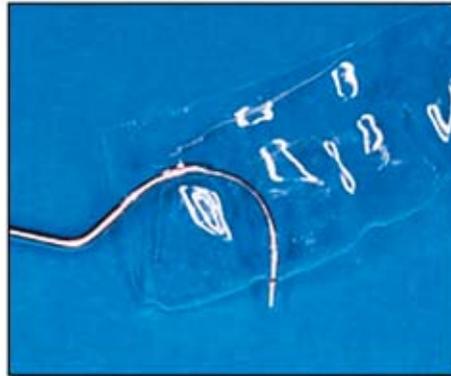
The acrylic mix is placed in the matrix at the location of the teeth to be included in the provisional restoration up to the gingival level (Figure 16a and 16b).

### **Step 4: Insertion in the Mouth**

Place the acrylic filled matrix over the prepared teeth and, using finger pressure only on the matrix covering the adjacent non-prepared teeth, verify that it is completely seated (Figure 17a and 17b).

Allow the acrylic resin to polymerize for approximately 11/2 minutes. As the acrylic sets, the matrix along with the acrylic resin should be resealed several times to prevent the acrylic from locking onto the prepared teeth during the final set. This should be repeated several times until the acrylic is completely hardened to offset shrinkage of the acrylic during polymerization. Irrigation with water is suggested during the polymerization to cool the acrylic as heat is generated by the exothermic reaction of the polymerization process.

After the acrylic resin has hardened, the matrix is removed from the prepared teeth and the acrylic provisional restoration is evaluated for any



**Figure 14.** Placement of vent holes with an explorer.



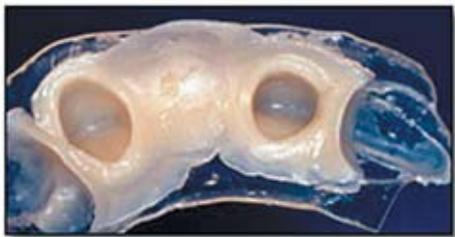
**Figure 15.** The string-like consistency of a properly mixed autopolymerizing acrylic resin.



**Figure 16.** Two shades of acrylic resin positioned in the acetate matrix to the level of the gingival margins. **A.** Labial view. **B.** Cervical view.



**Figure 17.** **A.** An incompletely seated matrix. **B.** Completely seated matrix. (Arrows indicate areas to place finger pressure to seat the matrix.)



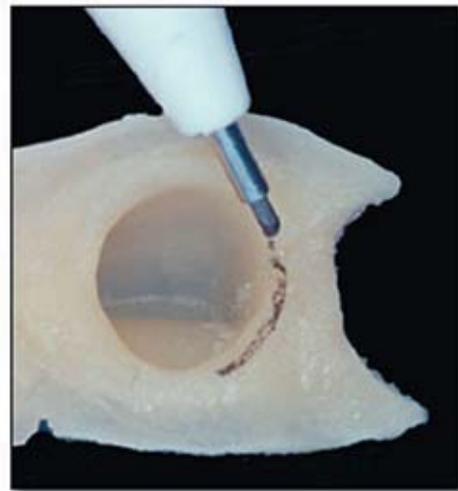
**Figure 18.** The rough acrylic restoration located in the matrix with good marginal definition.

deficiencies. The margin area should have good definition and proper extension to cover the entire cervical aspect of the preparation (Figure 18).

The acetate matrix is then separated from the hardened acrylic resin. Using a fine lead mechanical pencil, identify and outline the external margin finish line and the proximal contact areas of the provisional restoration (Figure 19a and 19b).

### Trimming and Contouring the Restoration

Go to the on-line article to view a short video of the following procedure.



**Figure 19.** **A.** Marking the interproximal contact area of the untrimmed provisional restoration. **B.** Marking the cervical margins.

### Types and Uses of Acrylic Burs

Different acrylic diameter cutting burs are used to remove the excess acrylic resin to establish ideal contours of the provisional restoration. A large, tapered, round-ended acrylic bur (Brasseler #251EF.060, Brasseler, Savannah, GA, USA) is used to remove the bulk and excess acrylic close to the margins (Figure 20).

A medium, tapered, round end acrylic bur (Brasseler #79EF.040, Brasseler, Savannah GA, USA) is used to remove the remaining excess acrylic closer to the margins (Figures 21a and 21b).

It should be noted accurate trimming of the margins can be simplified by holding the bur



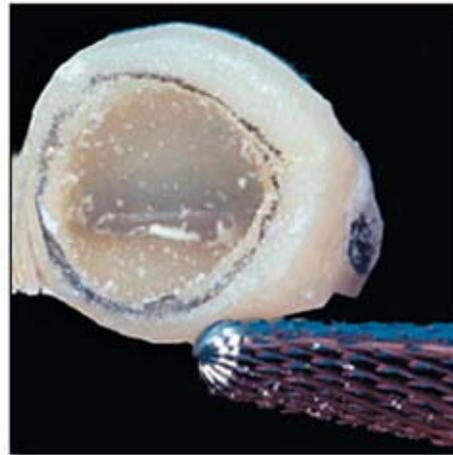
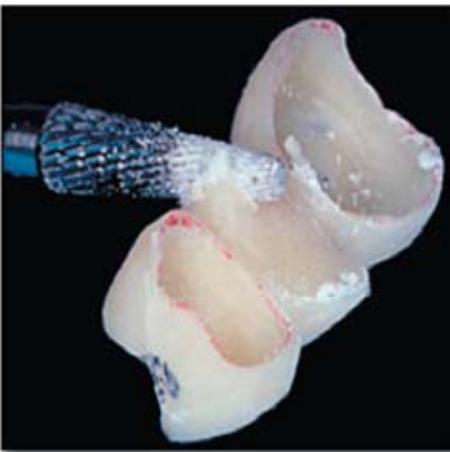
**Figure 20.** Large, tapered, round-ended acrylic bur is used to remove the bulk and excess acrylic close to the margins.

parallel to the desired final contour. A very thin extension remaining beyond the marked margin is an indication the contour is accurate at the cavosurface margin area. Any remaining excess can be easily removed from the margins using the fingers or a #15 scalpel blade (Figure 22).

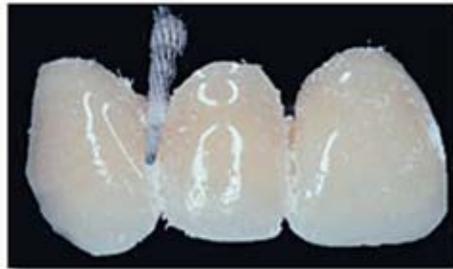
A long, narrow, tapered, round end bur (Brasseler #257EF.023, Brasseler, Savannah, GA, USA) is useful for trimming multiple unit provisional restorations to open interproximal embrasures and to contour the gingival portion of the pontic (Figure 23a and 23b).



**Figure 21. A.** The medium, tapered, round end acrylic bur is used to remove the remaining excess acrylic closer to the margins. **B.** This bur is also used to pre-contour the provisional restoration.



**Figure 22.** Contouring the margins.



**Figure 23.** Embrasure formation with a long narrow tapered acrylic bur. **A.** Labial view. **B.** Lingual view.

A diamond disc (Brasseler #919HF-220 or 919-200, Brasseler, Savannah, GA, USA) can be used to refine the interproximal and embrasure contours (Figure 24a and 24b).

A round carbide bur #8 (Brasseler #H71E.104.023, Brasseler, Savannah, GA, USA) can be used to make perforations to create vents on the occlusal or lingual surface before relining, to make occlusal adjustments, and to relieve the internal surface of the provisional restoration, if necessary, to facilitate proper seating.

### Margin Correction

It may be necessary to fill in voids or marginal discrepancies that occur as a result of shrinkage during polymerization of the acrylic resin. The provisional restoration is seated on the prepared teeth to evaluate the overall marginal integrity. If corrections are required, the restoration is removed and modified using the following technique.

#### Step 1: Margin Trimming

Using a medium tapered round bur (Brasseler #79E.040, Brasseler, Savannah, GA, USA) 1-11/2 mm of acrylic resin is removed from the external surface of the margin area. This will allow space to add acrylic to the restoration while minimizing the possibility of marginal shrinkage (Figure 25a and 25b).

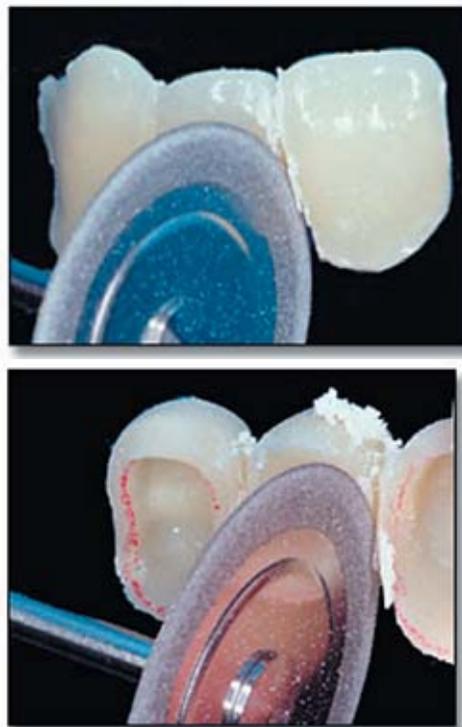
#### Step 2: Wetting of the Provisional

The modified provisional restoration is placed on the prepared tooth and some acrylic monomer is painted around the margin area to be repaired using a small paint brush (Bendabrush, Centrix, Shelton, CT, USA) (Figure 26).

#### Step 3: Addition of Acrylic Resin to the Margin

The brush tip is then wetted with monomer again and used to pick up a small bead of acrylic powder. If smaller amounts are required, some bristles can be cut from the brush tip (Figure 27).

A bead of acrylic is placed on the marginal area, where needed. Additional amounts are added as required. Some monomer is then lightly painted onto the setting acrylic to prevent excessive porosity at the repaired areas (Figure 28a and 28b).



**Figure 24.** Refining the embrasures with a diamond disc. **A.** Labial view. **B.** Inferior view.



**Figure 25.** Removal of external acrylic along the cervical margin of the provisional restoration. **A.** Anterior provisional crown. **B.** Posterior provisional crown.



**Figure 26.** A small amount of monomer is painted on the provisional restoration using a trimmed disposable paintbrush.



**Figure 27.** Brush tip size controls the size of the bead of acrylic to be applied.

After the acrylic resin has completely set, the marginal integrity is assessed and, if necessary, more acrylic resin is added until the repair is complete. The provisional restoration is removed, and after marginal areas have been verified, they are marked with a fine lead pencil. Excess acrylic resin is then trimmed away as needed and replaced on the prepared tooth to confirm the marginal adaptation. This process is repeated as necessary to achieve marginal seal (Figure 29).

### Occlusal Adjustment

With the provisional restoration seated in the mouth, the occlusal contacts in centric and lateral movements are verified and marked using articulating paper. The restoration is removed and excessive occlusal contacts are relieved with a #8 round bur (Brasseler, Savannah, GA, USA). This is repeated as necessary until proper occlusal contacts are achieved. The occlusal anatomy is reshaped and refined with the round bur or the medium tapered bur (Brasseler #H71E.104.023, Brasseler, Savannah, GA, USA).



**Figure 28. A.** A small bead of acrylic added to the defective area. **B.** A small amount of monomer is painted on the setting acrylic to prevent porosity in the area of repair.



**Figure 29.** The marginal integrity is assessed for marginal imperfections.

If the temporary fits too tightly on the prepared teeth, the internal surface is relieved with a round #8 bur. After adjustments are made, the provisional restoration is placed on the prepared teeth to verify its overall fit.



**Figure 30.** Shaping and finishing instruments.

### Final Finishing

The provisional restoration should have a polished surface to help prevent staining of the restoration as well as plaque accumulation that can irritate the gingival tissues and compromise periodontal health.

### Instrumentation

The following selection of Brasseler (Brasseler, Savannah, GA, USA) polishing wheels can be used for the finishing procedure (Figure 30):

- Brasseler Wheel DCH8DM
- Brasseler Wheel DCH8D
- Brasseler Point DCH2DM
- Brasseler Point DCH2D
- Brasseler BRO1 Wheel
- Brasseler BRO2 Wheel
- Brasseler BRO3 Wheel
- Brasseler 0669-11 Point

### Polishing Technique

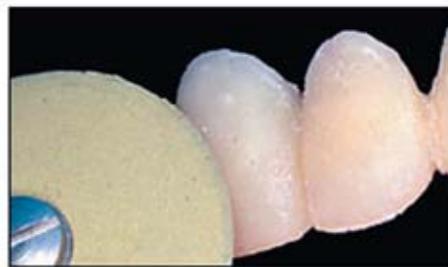
To finish the provisional restoration, it is washed with soap and water and dried with the air syringe. Medium grit polishing wheels and points are used to smooth all surfaces, embrasures, and gingival areas of any pontic area included in the restoration (Figure 31a, 31b, and 31c). Care must be taken to not polish away the gingival margins or desirable contours of the restoration.

A wet rag wheel on a laboratory lathe is used to polish all external surfaces of the temporary using a slurry of pumice, while taking care not to damage the margins and contours of the restoration.

The restoration is washed and dried. A small chamois wheel and acrylic polishing compound (Opal, Universal Polishing Paste, Ivoclar, Amherst, NY, USA) is used to obtain a high polish on the restoration. Care must be taken to avoid frictional heat damage to the acrylic while polishing (Figure 32, 33).



**Figure 31. A.** Smoothing the embrasures with a medium grit disk.



**Figure 31. B.** Smoothing the labial and lingual aspects of the restoration with a medium grit rubber wheel.



**Figure 31. C.** Smoothing the occlusal surfaces with a medium grit point.



**Figure 32.** Final polishing with a chamois wheel and acrylic polishing compound.

### Cementation of Provisional Restorations

Provisional restorations are usually cemented in place with a temporary cement or luting agent, to facilitate easy removal when the definitive restoration is ready to replace it. The primary function of the temporary cement is to secure the temporary and provide a seal to prevent marginal leakage and pulp irritation. Several luting agents, such as resin based and zinc oxide-eugenol or non-eugenol, have been recommended for the cementation of provisional restorations.

### Technique

The provisional restoration is washed with soap and water and completely dried with compressed air. The external surfaces of the restoration are lubricated with Vaseline®. Care must be taken not to allow any lubricant to touch the internal surfaces of the restoration.

The prepared teeth are isolated with cotton rolls and wiped dry with a cotton pellet to avoid desiccation. The prepared teeth are wiped with a cotton pellet saturated with 2% chlorhexidine gluconate to decontaminate the tooth surface and then dried again.

Using a cement spatula, the luting cement is mixed according to the manufacturer's instructions. A small brush is used to place a thin layer of cement inside the occlusal surface and along the internal surface of the margins of the provisional restoration. The restoration is then placed on the prepared tooth or teeth, seated completely, and allowed to set.

An explorer can be used to remove all hardened excess cement from around the margins and in the sulcus. Dental floss is used to remove cement from the interproximal areas. It is important to inspect for any cement remnants that may irritate the gingival tissue. Verify the occlusal contacts and adjust, if necessary.

### Home Care Instructions

Instructions regarding brushing, flossing, and the use of other hygiene aids should be reinforced so gingival health can be maintained while the definitive restoration is being fabricated. Functional activity on temporary restorations should be limited to chewing non-sticky foods.



Figure 33. Completed provisional restoration.

### Removal of Provisional Restorations

The primary goal when removing provisional restorations is to avoid damage to the prepared teeth and surrounding tissues. Secondly, it is desirable to preserve the provisional restoration in the event it has to be used again while changes are made in the definitive restoration.

Several methods can be used to safely remove a provision restoration. The choice is dependent on the retentive quality of the restoration and the preference of the clinician. The choice of techniques include removal with:

- A Cleoid- discoid instrument to engage a margin to lift it off the prepared tooth or teeth.
- A chisel and mallet to tap off the restoration.
- A pair of temporary-removal tweezers to grasp the restoration and lift it off the prepared tooth or teeth.
- A crown and bridge removal instrument or "tapping mallet" to engage the restoration and tap it off the prepared tooth or teeth when a weight is slid along the shaft of the instrument.

Local anesthesia is recommended if the tooth is vital.

### Summary

A provisional restoration must provide function, comfort, and esthetic replacement for the prepared tooth structures. Laboratory and clinical procedures for the fabrication of the direct technique were described in this article. It provided a concise step-by-step procedure for the fabrication of predictable, well fitting, functional, and esthetic provisional restorations.

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