

PROVISIONAL RESTORATIONS IN PROSTHODONTIC REHABILITATIONS - CONCEPTS, MATERIALS AND TECHNIQUES

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Abstract :

Provisional restorations in fixed prosthodontic rehabilitation are important treatment procedures, particularly if the restorations are expected to function for extended periods of time or when additional therapy is required before completion of the rehabilitation. These materials should not only satisfy the mechanical requirements such as strength and resistance to wear but also meet the biologic and esthetic demands. The prognosis of a fixed restoration greatly depends on this interim restoration.

This article describes the various materials used for these provisionals and also the techniques used to fabricate them along with their advantages and disadvantages.

Keywords: Provisional restorations, polymethyl methacrylate, acrylic resins

Introduction :

Fixed prosthodontic treatment, whether involving complete or partial coverage, natural tooth or dental implant abutments, commonly relies on indirect fabrication of a definitive prosthesis in the dental laboratory. Fabrication of this definitive prosthesis, on an average takes about 7-10 days during which the prepared tooth need to be protected from the oral environment and also its relationship with the adjacent and opposing tooth need to be maintained. Thus, in order to protect these prepared abutment teeth, provisional restorations are fabricated and the process is called as Temporization¹. The terms *provisional*, *interim*, or *transitional* have also been routinely used interchangeably in the literature.

The importance of a provisional crown to treatment outcomes is well established. The term "provisional" denotes "serving for the time being", as a necessary step in providing for the final arrangement². The prognosis of a fixed prosthodontic restoration depends on the quality of this provisional restoration. Fabrication of these provisional crowns uses variety of materials and techniques.

This article makes an attempt to put forth the various materials used and fabrication techniques for these

provisional restorative materials.

Requirements and concepts of provisional crowns:

The requirements can be biological, mechanical and esthetic requirements. The provisional crown protects the pulp from thermal and chemical insults after crown preparation and enamel removal³. It serves to maintain gingival health and contour while providing for an esthetic and/or functional interim restoration⁴. Provisional crown should also be easy to clean and not impinge on the tissues. Most importantly maintains interocclusal and intra-arch tooth relationships^{5,6,7}. Finally they should exhibit a good shade match and have a highly polished surface so that they are esthetically pleasing to the patient. All these factors are extremely important to the success or failure of treatment outcomes.

Besides the immediate protective, functional, and stabilizing value, interim restorations are useful for diagnostic purposes where the functional, occlusal and esthetic parameters are developed to identify an optimum treatment outcome before the completion of definitive procedures⁸.

Provisional restoration promotes numerous adjunct benefits to definitive prosthodontic treatment, thus the

materials and techniques used in the fabrication must reflect the various treatment demands and requirements.

Materials used in the fabrication of provisional crowns:

Materials used to fabricate provisional restorations can be classified as acrylics or resin composites. Several types of acrylic resin materials are available for interim restorative treatment like polymethyl methacrylate resins, polyethyl methacrylate resins or combinations of unfilled methacrylate resins⁹. Subcategories are based on method of polymerization like chemically activated, light activated or dual activated. Provisional crowns can be either pre-fabricated or custom made.

Acrylics:

These materials have been used to fabricate provisional restorations since the 1930s and usually available as powder and liquid. They are the most commonly used materials today for both single-unit and multiple-unit restorations. In general, their popularity is due to their low cost, acceptable esthetics, and versatility. They produce acceptable short-term provisionals but tend to discolour over time. Other disadvantages include an objectionable odour, significant shrinkage and heat generation during setting. The three types of acrylics are polymethyl methacrylates, poly-R' methacrylates and epimines.

Polymethyl methacrylates are commercially available as Jet (Lang), Alike (GC America), Temporary Bridge Resin (Dentsply/Caulk), Neopar (SDS/Kerr), and Duralay (Reliance). Advantages of this material include low cost, good wear resistance, good esthetics, high polishability, good colour stability whereas it also has certain drawbacks like significant amount of heat given off by exothermic reaction, high degree of shrinkage (about 8%) objectionable odour, short working time, hard to repair and radiolucent.

Plant et al. found that the intra-pulpal temperature rise associated with the polymerization of methyl methacrylate materials could be up to five times that associated with the normal consumption of thermally hot liquid¹⁰. Poly-R' Methacrylates (R' = ethyl, vinyl, isobutyl) are commercially

available as

Snap (a polyethyl methacrylate from Parkell), Splintline (a polyethyl methacrylate from Lang), Trim II (a polyvinyl methacrylate from Bosworth), Provisional C&B Resin (a polyvinyl methacrylate from Cadco), and Temp Plus (a polyisobutyl methacrylate from Ellman). Despite various advantages like low cost, less heat given off during reaction, less shrinkage than polymethyl methacrylates and extended working time, Poly-R' Methacrylates have certain disadvantages which include less esthetic than other currently marketed materials, eugenol deteriorates the resin, poor wear resistance, poor colour stability, objectionable odour, hard to repair and radiolucent.

Epimines were the first two-paste acrylics, commercially introduced in 1968 as Scutan (ESPE). Although Scutan had relatively low shrinkage, heat production and lowest pulpal irritability, it was weak and could not be altered or repaired.

Composites:

Composite provisional materials encompass a fairly variable category by virtue of the fact that they are chemically comprised of a combination of 2 or more types of materials. Most of these materials use bis-acryl resin, a hydrophobic material that is similar to bis-GMA. Composites are available as auto-polymerized, dual-polymerized and visible light polymerized. Bis-acryl provisional materials are resin composites and represent an improvement over the acrylics because they shrink less, give off less heat during setting, excellent esthetics, minimal odor and can be polished at chair-side. These products are provided in cartridges for use in an automix dispenser gun.

Commercially available bis-acryl auto polymerized composite include Bis jet, Integrity Luxatemp, Prottemp II, Prottemp Garant, Prottemp IV, Provitec, Smar Temp, Temphase, Turbotemp and Ultra Trim. Commercially available Bis-acryl composite (Dual-polymerized) are Iso temp, Luxatemp solar, Luxa-flow and Provipont DC. Urethane dimethacrylate composite, Visible light-polymerized is available as Triad.

Bis-acryl materials are compatible with other composite materials, but alterations for repairs and addition are difficult¹¹. Koumjian and Nimmo¹¹ showed an 85% decrease in transverse strength after repair of a bis-acryl material. They suggested that it might be more advantageous to make a new provisional restoration than repair this material. Young et al¹² compared bis-acryl and polymethyl methacrylate materials in terms of occlusion, contour, marginal fidelity, and finish. For both anterior and posterior teeth, they found the bis-acryl materials significantly superior to PMMA in all categories and amongst the various materials, studies have concluded that Protemp IV is most colour stable and with superior mechanical properties.

Preformed Crowns :

Preformed provisional crowns or matrices usually consist of tooth-shaped shells of plastic, cellulose acetate or metal. They are commercially available in various tooth sizes and are usually selected for a particular tooth anatomy. Nonetheless, available sizes and contours are finite which makes the selection process important for clinical success.

They are commonly relined with acrylic resin to provide a more custom fit before cementation, but the plastic and metal crown shells can also be cemented directly onto prepared teeth. Compared with custom fabricated restorations, this treatment can result in improper fit, contour, or occlusal contact for a provisional restoration¹³. Polycarbonate resin is commonly used for preformed crowns. These crowns combine microglass fibers with a polycarbonate plastic material. These serve as matrix material around a prepared tooth that is relined with acrylic resin to customize the fit¹⁵.

Polycarbonate resin is the commonly used for preformed crowns. These crowns combine microglass fibres with a polycarbonate plastic material¹³. This material possesses high impact strength, abrasion resistance, hardness, and a good bond with methyl-methacrylate resin¹⁵. Metal provisional materials are generally esthetically limited to posterior restorations. Aluminium shells provide quick tooth adaptation due to the softness and ductility of the

material, but this same positive quality can also promote rapid wear that results in perforation¹³.

Techniques of fabrication :

Many procedures involving a wide variety of materials are available to make satisfactory interim restorations. As new materials are introduced, associated techniques are reported, and thus, there is even more variety. What all the procedures have in common is the preparation of a mould cavity into which a plastic material is packed. Provisional restorations can be directly fabricated on the prepared teeth with the use of a matrix or indirectly by making an impression of the prepared teeth. A combination indirect-direct technique can also be followed which has evolved as a sequential application of these that involves fabrication of a preformed shell that is relined intra-orally.

1. Indirect Provisional Fixed Partial Denture :

On the diagnostic cast, place a selected acrylic tooth on the area of the missing tooth, adjust the occlusion and seal it with the carding wax.



Following this, a silicone putty index is made involving at least one tooth on either side of the abutment teeth.



Prepare the patient's teeth to receive the planned prosthesis.



Make a sectional impression of the prepared teeth and the adjacent structures and pour a check cast.



Lubricate the check cast with a petroleum jelly or any suitable separating media, mix the provisional restorative material, and place it in the tissue surface of the index and seat it on the check cast.



Try in the preformed restoration for its fit on the cast and then intra-orally.



Reline the temporary restoration to perfect the internal fit if necessary.



Finish, polish, and then cement the restoration.

This technique has various advantages over the direct technique as it eliminates contact of free monomer with

the prepared teeth or gingiva which might cause tissue damage and an allergic reaction or sensitization. The technique also avoids subjecting prepared tooth to the heat evolved from the polymerizing resin^{16, 17}. Principle disadvantage of this technique involves increased chair side time.

2. Indirect-direct provisional crown technique:

Pour an accurate pre-treatment diagnostic cast from an impression of the unprepared teeth. For FPDs, wax a pontic into the edentulous area of the study cast.



Make an impression using a high-viscosity elastomeric impression material. The silicone putty index is made involving at least on tooth each beyond the abutment teeth.



Remove the acrylic tooth and prepare the abutments on mounted diagnostic casts



Lubricate the prepared diagnostic cast with a petroleum jelly or any suitable separating media, mix the provisional restorative material, and place it in the tissue surface of the index and reseat it on the prepared diagnostic casts



After the acrylic resin has polymerized, finish the restoration



Prepare the patient's teeth. Try in the preformed restoration. Reline the temporary restoration to perfect the internal fit if required. Finish, polish and cement the restoration¹⁸.

With the indirect-direct technique, chair time can be reduced, since the provisional shell is fabricated before the patient's appointment. In addition, a smaller amount of acrylic resin will polymerize in contact with the prepared abutment that is during reline, resulting in decreased heat generation, chemical exposure, allergic reactions and polymerization shrinkage compared to the direct technique¹⁶. The disadvantage might be the potential need of a laboratory phase before tooth preparation and the adjustments needed to seat the shell completely on the prepared tooth.

3. Direct Provisional Fixed Partial Denture:

The direct technique of fabrication is not routinely

advocated due to potential tissue trauma and poorer marginal fit of the restoration.

4. Other technique

A provisional removable partial denture which is often used to replace anterior teeth prior to fixed prosthodontic treatment is used as an aid in making a provisional fixed restoration.

In any of these techniques, instead of building up the entire tooth with autopolymerising resin, the acrylic tooth can be trimmed in the form of a labial veneer and the rest of the tooth built up with autopolymerising resin. This tooth that has been trimmed in the shape of a veneer can be either used directly in the patient's mouth and rest of the tooth built up or can be used indirectly on a cast¹⁸.

5. Provisional restoration for post and core restorations:

- If custom made post and core is planned, the post and core portion can be instantly built and temporary crown be fabricated on it.
- If cast post is to be placed in the final restoration, the following measures may be taken.
 - i. A ball pin may be placed into the post space and an alginate over impression is made that would pick up the ball pin and then the restoration fabricated on the cast.
 - ii. Instead of placing the ball pin directly into the post space, it may be placed into the impression and the restoration fabricated.
 - iii. In an alternative technique, a ball pin may be placed into the post space and the restoration fabricated intra-orally using acrylic resin block technique. A tooth trimmed in the form of a labial veneer can be used in such cases¹⁸.

Discussion :

Various materials are available for the fabrication of provisional restoration but till date none have proven to be the most accurate and stable. Every material had its own merits and demerits that could be attributable to numerous factors. Any interim restoration should fulfil the biologic, mechanical and esthetic requirements.

Provisional restorations must not only provide an initial shade match, but also maintain the esthetic appearance over a period of time. Alterations in color of these restorations compromise the acceptability.

Color stability gains importance, particularly when the restorations involve esthetic zones and must be worn for extended periods of time. Discoloration of provisional materials may lead to patient dissatisfaction and even additional expense for replacement. This is particularly problematic when provisional restorations are subjected to colorants during lengthy treatments. Hence colour stability, along with mechanical properties is an important criterion in the selection of a provisional restorative material.

Koumjian et al.¹⁹ stated that methyl methacrylate resin was less colour stable than bis-acryl composite (Protemp II) in an in vivo study whereas study by Gupta et al²⁰ showed Revotek LC as the most colour stable material. Staining of these provisional were attributed to adsorption or absorption of colorants by resins. Factors like surface roughness, wear resistance and polishability also influenced the colour stability of these materials.

Various methods of fabrication are also described but none can be considered as a universally accepted standard technique. Indirect technique is generally preferred over the direct techniques as it overcomes the potential hazards caused to the tooth during fabrication by the direct

technique but routinely, situation dictates the material and the technique of fabrication.

Provisionalisation should also be considered during other treatment modalities like various stages of implant supported prosthesis which include provisionalisation prior to implant loading (removable and tooth supported), provisionalisation at first/second stage surgery (implant retained – at first stage surgery - single tooth, implant retained- partially edentulous and dentulous), tooth retained – at or before first stage surgery, implant retained- at second stage surgery, transitional implant provisional restoration, cement or screw retained provisional prosthesis.

Provisional restorations also play a significant role in the sequelae of maxillofacial rehabilitation by using interim obturators or feeding plates and interim dentures and also during transformation of an immediate denture to conventional denture prosthesis.

Conclusion :

One of the most important aspects of dental profession is to provide a predictable outcome to any oral rehabilitation, and the use of the provisional restoration is a critical phase in the treatment. Clinical techniques and indications are reasonably well characterized, but future research activities will need to focus on technological advancements to provide improved materials that demonstrate improved biocompatibility, physical properties, ease of use and esthetically pleasing appearance to the patients.

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