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Review Article

Provisional Restoration in Prosthodontics: A Review

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***ABSTRACT*:**
Provisional restorations are an essential phase in the treatment procedure for fixed provisional restoration. Provisional restorations are designed in order to protect oral structures and promote function and esthetics for a limited period of time, after which they are to be replaced by a definite prosthesis. Provisional restorations are important during the rehabilitation process, knowledge of the mechanical properties of the available materials allows us to predict their clinical performance. 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 present review article describes the different materials used for these provisional restorations and also the techniques used to fabricate them along with their advantages and disadvantages.
Key words: Restoration, Rehabilitation, Prosthesis.

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INTRODUCTION:

Provisional or interim restorations are commonly used in dentistry during the time between tooth preparation and placement of the definitive restoration.[1] The provisional restorations have become a valuable tool for esthetic and functional diagnosis in dentistry. Dentists can gain their patients' confidence by handling this intermediate stage of treatment successfully, achieving the necessary predictability for a successful final restoration.[2] According to Shillingburg, the restorations should:

1. Proper pulp protection
2. To prevent supraeruption or tipping of the teeth
3. Serve proper occlusal function for the patient
4. Can be easily maintainable in a hygienic condition
5. The material should withstand occlusal forces and should be retentive
6. Be aesthetically pleasing and can be polished so as to prevent plaque accumulation
7. Margins should not intrude the gingival tissues and induce gingival pathosis.[3]

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 1 fabricated and the process is called as Temporization.[4]

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 removal .[5] It serves to maintain gingival health and contour while providing for an esthetic and/or functional interim restoration.[6] Provisional crown should also be easy to clean and not impinge on the tissues. Most importantly maintains interocclusal and intra-arch tooth relationships.[7-9] 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 procedures.[10]

Materials

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 resins.[11]

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.

The advantages are due to their low cost, acceptable esthetics, and versatility. The disadvantage include 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, 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 liquid.[12]

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, dualpolymerized 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-acrly auto polymerized composite include Bis jet, Integrity Luxatemp, Protemp II, Protemp Garant, Protemp 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 lightpolymerized is available as Triad Bis-acryl materials are compatible with other composite materials, but alterations for repairs and addition are difficult.[13] Koumjian and Nimmo 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.[13]

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 restoration.[14,15] Polycarbonate resin is commonly used for preformed crowns. These crowns combine micro-glass fibers with a polycarbonate plastic material. These serve as matrix material around a prepared tooth that is relined with acrylic resin to customize the fit.[16] Polycarbonate resin is the commonly used for preformed crowns. These crowns combine microglass fibres with a polycarbonate plastic material.[14] This material possesses high impact strength, abrasion resistance, hardness, and a good bond with methyl-methacrylate resin.[16] 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 perforation .[14]

Techniques of fabrication

1. Indirect Provisional Fixed Partial Denture

The technique involves fabrication of the interim restoration outside the mouth. Fabrication of provisional restorations using the indirect technique eliminates the problems associated with the direct technique and also has the advantage that it can be partially delegated to auxiliary personnel.[17] Fisher et al. describes the use of an indirect technique for provisional fabrication that uses a fast-setting plaster. The technique has several advantages over the direct procedures. There is no contact of free monomer with the prepared teeth or gingival which might cause tissue damage and an allergic reaction or sensitization. The technique avoids subjecting prepared tooth to the heat evolved from the polymerizing resin. Indirect technique produces restoration with a superior marginal fit and as an auxiliary is involved in fabricating the restoration in the lab, it frees the patient and dentist for considerable amount of time.[18,19] Principal disadvantage of the technique includes increased chair side time and increased number of intermediate steps. It is a tedious task to perform if there is inadequacy of assistants or the laboratory facilities. In addition, the technique involves use and possible damage of diagnostic casts.[20]

Procedure:

1. On the diagnostic cast, place a selected acrylic tooth on the area of the missing tooth, and seal it with the carding wax.
2. Following this, a silicone putty index is made involving at least one tooth each beyond the abutment teeth.
3. Prepare the patient's teeth in the usual manner.
4. Make a sectional impression of the prepared teeth and the adjacent structures and pour a check cast.
5. 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.
6. Try in the preformed restoration for its fit on the cast and intraorally.
7. Reline the temporary restoration to perfect the internal fit.
8. Finish, polish, and cement the restoration

Indirect-Direct Provisional Fixed Partial Denture

The technique produces a custom made preformed external surface form of the restoration but the internal tissue surface form if formed by the underprepared diagnostic casts. This indirect-direct procedure has several advantages. With the combination indirect-direct technique, chair time can be reduced, since the provisional shell is fabricated before the patient's appointment. Enhanced control over restoration contours minimizes the time required for chair side adjustments. In addition, a smaller amount of acrylic resin will polymerize in contact with the prepared abutment, resulting in decreased heat generation, chemical exposure, and polymerization shrinkage compared to the direct technique.[19] Another advantage is that contact between resin monomer and soft tissues is reduced and less chances of allergic reactions. The disadvantage of this procedure is the potential need of a laboratory phase before tooth preparation and the adjustments that are frequently needed to seat the shell completely on the prepared tooth.

Procedure:

1. Pour an accurate pretreatment diagnostic cast from an impression of the unprepared teeth. For FPDs, wax a pontic into the edentulous area of the study cast, and modify with wax to obtain ideal contours, contacts, and occlusion.
2. Lightly lubricate the modified diagnostic cast, and make an impression using a high-viscosity elastomeric impression material. To provide an adequate bulk of material at the margins of the provisional, trim the sharp edge on the elastomeric over impression that represents the gingival crevice with a round bur to allow for extra bulk of resin material in this area. The silicone putty index is made involving at least on tooth each beyond the abutment teeth.
3. Remove the acrylic tooth and prepare the abutments on mounted diagnostic casts.
4. 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.
5. After the acrylic resin has polymerized, finish the restoration. The provisional restoration should be paper thin and correctly contoured, and it should precisely follow the gingival margins on the cast.
6. Prepare the patient's teeth in the usual manner (to the gingival margins).
7. Try in the preformed restoration. (If the amount of tooth reduction is adequate, the provisional restoration will show optimal marginal fit with no need for adjustment.)
8. Reline the temporary restoration to perfect the internal fit.
9. Finish, polish, and cement the restoration.[17,21]

3. Direct Provisional Fixed Partial Denture

In the direct technique, patient's prepared teeth and the gingival tissues directly provide the tissue surface form eliminating all the intermediate laboratory procedures. This is convenient when assistant training and the office laboratory facilities are inadequate for efficiently producing an indirect restoration. However the direct technique has significant disadvantages like potential tissue trauma from the polymerizing resin and inherently poorer marginal fit. Therefore, the routine use of directly formed interim restoration is not recommended when indirect techniques are feasible.

Procedure:

1. Before the tooth preparation, place an acrylic tooth in place of the missing tooth and make an alginate impression or a putty index.
2. Prepare the patient's teeth in the usual manner.
3. Lubricate the prepared teeth and the adjacent gingival margins with petroleum jelly, and reseat the index or the alginate impression with provisional restorative material in the dough stage on the tissue surface of the impression.
4. Remove and reseat the restoration until it sets.
5. Finish, polish, and cement the restoration.
4. Alternative Techniques for Direct Technique

1. Acrylic Resin Block Technique for Direct Provisional Restoration

A useful, though seldom employed, method for making provisional restorations is the acrylic resin block technique. It provides a means of fabricating the interim restoration without the use of diagnostic casts and laboratory processing costs. The technique requires knowledge of dental anatomy and the patience and artistic traits inherent in dentists.

Procedure:

i. Tooth Preparation is carried out in a usual manner.

ii. Autopolymerizing acrylic resin of the suitable shade is mixed and allowed to set to a doughy consistency (the sheen of surface-free monomer has completely disappeared). After the abutments and surrounding gingiva have been lightly lubricated with petrolatum, the acrylic resin record is placed over the prepared abutments, and the patient is guided to closure in the centric occlusion position.

iii. The acrylic resin record is removed and replaced a few times during the curing process to minimize the effect of the exothermic heat on the abutments. After polymerization, the occlusal surface of the resin record is analyzed for anatomic design and may be marked with pencil as to cusp location and buccolingual width to facilitate carving the crown forms.

iv. Carbide burs and diamond stones are used to roughly develop contour and form of the provisional restoration.

v. Since no impression matrix is used to carry the acrylic resin mix over the prepared teeth, the initial splint must be relined to assure adequate marginal adaptation and integrity. The inside of the crowns is relieved with a round carbide bur to provide space for the relining acrylic resin. The inner surfaces are moistened with monomer and filled with a fresh mix of acrylic resin. The splint is then replaced over the prepared abutments while the acrylic resin cures. The patient is again guided to closure in the centric occlusion position.

vi. The provisional restoration is carved to correct occlusal anatomy, crown contour, and embrasure form with burs, stones, and discs. This must be done with sufficient care and attention to detail so that it approximates the environment to be established by the final restoration. The provisional splint must be smooth and highly polished.

vii. The completed provisional restoration is now ready for placement with temporary cement. Zinc oxide and eugenol cements should be avoided, as they tend to soften the acrylic resin on contact and may weaken the restoration.[22]

2. Before starting to make a crown preparation, an irreversible hydrocolloid impression is made and immediately poured while waiting for the anesthetic to take effect. Following this an acrylic teeth is placed in the missing tooth region on the diagnostic cast and a shell matrix is custom made from mouthguard material. Lubricate the prepared tooth and adjacent teeth. Add just enough tooth-colored acrylic resin to fill only the prepared tooth space in the shell matrix and place the matrix over the teeth in the patient's mouth, pressing down on the adjacent teeth. Wait for the material to set, finish, polish, and cement the restoration.

Alternatively, the restoration can be fabricated in a similar fashion outside the patient's mouth on the master cast after tooth preparation using the custom made shell matrix making it an indirect procedure.[23]

3. After contours of badly broken-down teeth are restored with wax, a preliminary alginate impression with a stock dentulous tray is made of the area to be prepared. Preferably, a complete-arch impression is obtained. The borders and septa are trimmed away from the set impression to facilitate reseating in the mouth. If a posterior fixed partial denture is to be made, a strip of irreversible hydrocolloid is removed from the edentulous ridge area to form a pontic in the completed temporary restoration. If an anterior fixed partial denture is to be made, then a denture tooth (or teeth) may be fixed in place with a small piece of soft rope wax prior to fabrication of the impression.

In an another technique, instead of replacing the missing tooth in temporary restoration in posterior quadrants, alginate impression can be scored in the form of a bar running across the edentulous region connecting the abutment teeth, thus producing a final restoration with crowns on the abutment teeth connected by a bar maintaining the integrity of the restoration. Instead of scoring a bar, a reverse pontic can also be scored in the alginate impression.

4. In this technique, after removing the impression tray from the mouth, one should shorten the proximal projections of the impression material, and trim away the excess impression material palatally/lingually and buccally/facially to ensure complete reseating of the tray intraorally. Then, in this preoperative impression, grooves has to be created starting 1 mm buccally and lingually to the margin of the prepared tooth and continue towards the buccal and lingual flange areas to provide a pathway for the excess interim restorative material to escape.[24]
5. In another 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.

An irreversible hydrocolloid impression of the anterior segment of the provisional removable partial denture is made. Cold-cure acrylic resin of an appropriate shade is poured into the impression or placed into it with the powder-liquid method. The cured resin is removed from the impression as a block section of the anterior teeth and stored in water until needed. When the provisional fixed splint is being made, this block section of pontics is directly attached to the provisional crowns made for the abutment teeth. The block section of pontics may also be helpful if the provisional removable restoration is lost. The abutment teeth can then be prepared, individual provisional abutment crowns made, and the pontic section added. Alternatively, the unprepared abutment teeth can be acid etched and the block section of acrylic pontics directly attached to them with composite resin.
Alternatively, in an indirect way, an impression can be made with the existing removable partial denture in place, and this impression may be used to make the temporary restoration by placing it on the master cast that would be made after the tooth preparation.

6. In any of these techniques, instead of building up the entire tooth with autopolymerizing resin, the acrylic tooth can be trimmed in the form of a labial veneer and the rest of the tooth built up with autopolymerizing 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 cast.
7. Using the existing prosthesis as a provisional restoration: when a cemented fixed prosthesis is to be removed for the reason of remaking it, damage to the prosthesis is of little concern. The important principle in such a case is to remove the prosthesis with minimum risk to the natural abutment teeth. It is possible to remove a cemented fixed prosthesis with little or no risk of damage to the abutment teeth by sectioning the prosthesis and expanding the retainer. Once removed, the prosthesis can be rebuilt to be used as a provisional or temporary prosthesis. The advantages of using the existing prosthesis are that the long-span fixed partial denture is stronger with metal reinforcement; the prosthesis incurs less occlusal wear with a metal or porcelain restoration versus an acrylic restoration; less time is required for fabricating a temporary restoration.[25]

Alternatively, an impression of the existing fixed partial denture may be made before attempting its removal, and this impression may be used to make the temporary restoration by placing it on the master cast that would be made after the tooth preparation.

8. In cases the patient presents with tooth preparation already being done and without a temporary, the following measures may be undertaken.
    a. To build up the prepared tooth with the carding wax and place an acrylic tooth in the area of missing tooth and take an impression and use it to fabricate the temporary restoration.
    b. To make the impression of the prepared tooth as it is and then score the impression in the form of reverse pontic and also in the area of the prepared tooth in an attempt to duplicate the unprepared tooth.
    c. To use acrylic resin block technique forming direct provisional restoration.
9. Provisional restoration for post and core restorations:
    i. If custom made post and core is to be used, the post and core portion can be instantly built and temporary crown be fabricated on it.
    ii. If cast post is to be placed in the final restoration, the following measures may be taken.
        a. A ball pin may be placed into the post space and an alginate over impression made that would pick up the ball pin and then the restoration fabricated on the cast.
        b. Instead of placing the ball pin directly into the post space, it may be placed into the impression and the restoration fabricated.
        c. In an alternative technique, a ball pin may be placed into the post space and the restoration fabricated intraorally using acrylic resin block technique. A tooth trimmed in the form of a labial veneer can also be used to serve the purpose.

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. Making adequate provisional restorations requires significant time and effort. Provisional restorations should be delegated to qualified dental assistants to reduce the overhead cost of producing crowns and fixed prostheses. The 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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