Review Article

Provisionalization in Prosthodontics: A Literature Review

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ABSTRACT:

Provisionalization in prosthodontics is a crucial process in the restoration of missing teeth, where temporary prostheses are used to maintain esthetics, function, and gingival health before the final restoration is placed. The choice of materials and techniques for provisional restoration significantly influences clinical outcomes.

This review aims to provide a comprehensive analysis of the materials and techniques used in provisional restorations, with an emphasis on their functional and esthetic outcomes, as well as their impact on long-term treatment success.

A detailed literature review was conducted on studies published between 2010 and 2025, which discuss the different materials (e.g., acrylics, composite resins, and metals) and techniques (e.g., direct and indirect methods) used in provisionalization.

The review identifies that acrylic-based materials remain the most commonly used for provisional restorations due to their ease of manipulation and esthetic qualities. However, composite resins are gaining popularity for their superior mechanical properties and better fit. Additionally, the use of CAD/CAM technology for fabricating provisional restorations has been associated with improved precision and reduced chair-side time.

Provisionalization plays a significant role in the overall success of prosthodontic treatments. The choice of materials and techniques should be tailored to individual patient needs, considering factors like esthetics, functionality, and longevity. Further research is needed to evaluate the long-term effects of newer materials and digital technologies in provisional restoration fabrication.

KEY WORDS: Provisional restoration, PMMA, Bis-acryl composite, CAD/CAM, Direct technique

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INTRODUCTION:

Provisional or interim prosthesis or restoration is a fixed or removable dental or maxillofacial prosthesis designed to enhance esthetics, stabilization and/or function for a limited period of time, after which it is to be replaced by a definitive dental or maxillofacial prosthesis, according to the Glossary of Prosthodontic Term.[1]

In dentistry, temporary or interim restorations are frequently utilized during interim period between tooth preparation and definitive replacement.[2] This review collates and synthesizes existing evidence on provisionalization in prosthodontics, identifying benefits, limitations, and variations in materials and techniques. It clarifies the clinical and biological roles of provisional restorations in ensuring proper function,

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esthetics, and tissue protection before final prosthesis. Through systematic review of literature, it highlights gaps and inconsistencies, guiding future research and evidence-based clinical practice.[3]

CONCEPTS AND REQUIREMENTS FOR TEMPORARY CROWNS:-

These include Biomechanical, Biological and esthetic considerations.

1. BIOLOGICAL:-

- ***Pulpal protection***: Maintains pulp vitality by sealing exposed dentinal tubules and preventing microbial, thermal, and chemical insults. This is essential during endodontic therapy to prevent coronal leakage. [4]
- ***Periodontal health***: Healthy gingival tissues are maintained by smooth, plaque-resistant surfaces and proper emergence profiles. Overextended margins can cause gingival recession. [5]
- ***Tissue contour maintenance***: Proper pontic design and proximal contours preserve papillae and allow plaque control in edentulous areas.
- ***Biocompatibility***: Materials must be non-toxic and non-allergenic. Methacrylate monomers can cause allergic reactions in rare cases.[6]

2. BIOMECHANICAL:-

- ***Strength and durability***: Must withstand occlusal forces without fracture or deformation, especially in long-term cases. [7]
- ***Positional stability***: Maintains tooth position by ensuring proper proximal and occlusal contacts, preventing drifting or supraeruption.
- ***Interabutment relationship***: Preserves spatial relationship of abutments until the final prosthesis is placed.
- ***Ease of removal and recementation***: Should allow retrieval for tissue evaluation without damage or distortion.
- ***Ease of fabrication***: Should be economical, easy to manipulate, repair, and reline. Fast setting improves clinical efficiency. [8]

3. *Esthetic*:

- ***Colour and shade match***: Should harmonize with adjacent teeth for a natural appearance. [9]
- ***Surface finish***: Highly polished surfaces are necessary for esthetics and gingival health.
- ***Function and comfort***: Should restore phonetics and maintain occlusal and interproximal relationships.
- ***Diagnostic utility***: Provisionals serve as a mock-up to assess esthetics, function, and occlusion before definitive treatment. [10]

CLASSIFICATION OF PROVISIONAL RESTORATION:-

1. *ACCORDING TO THE METHOD OF FABRICATION*:

Preformed crowns:-

a) *Resin*: Cellulose acetate, polycarbonate, photopolymerized composite resin

b) *Metal*: Aluminum, tin–silver, nickel–chromium, and stainless steel.

Custom-made:-

a) *Direct technique:*

Base plate wax technique, shell-fabricated technique, and template-fabricated technique.

b) *Indirect technique:*

Template-fabricated provisional restoration, over impression-fabricated provisional crown, over impression-fabricated bis-acryl composite provisional, template-fabricated VLC provisional restoration, and shell-fabricated provisional restoration.

Direct and indirect combination techniques and digital techniques are the other two techniques.

2. ACCORDING TO THE PERIOD OF USE:

Long-term and short-term.

MATERIALS USED IN PROVISIONALIZATION:

Materials for provisional restorations are classified based on their chemical composition and polymerization method:

1. Chemically activated acrylic resins
2. Heat-activated acrylic resins
3. Light-activated acrylic resins
4. Dual-activated acrylic resins
5. Alloys

The most commonly used material is acrylic resin, with types including polymethyl methacrylate (PMMA), polyethyl methacrylate (PEMA), and polyvinylethyl methacrylate (PVEMA).[11,12]

POLY METHYL METHACRYLATE:

Autopolymerizing PMMA, introduced in 1940, remains widely used for provisional restorations.[13] It consists of a polymer powder (with dibutyl or diethyl phthalate) and a monomer liquid (methyl methacrylate). Available in multiple shades, PMMA offers the highest flexural strength among temporary materials.[14] However, its exothermic setting reaction can cause pulpal damage during direct fabrication, with temperatures reaching up to 82°C.

Therefore, PMMA is preferred for indirect techniques. It is more colour-stable than other methacrylates but has low abrasion resistance.[15,16,17]

***Strengthening of PMMA*:**

Crack propagation resistance is key to longevity, especially in long-span provisionals.[18] Reinforcements include fibers (glass, carbon, Kevlar) and metal structures like stainless steel meshes and wires.[18] Adequate bonding between resin and reinforcement is critical.

***Polyethyl Methacrylate (PEMA)*:**

PEMA was developed to address PMMA's drawbacks.[19] It produces less heat during setting, making it pulp-friendly for direct use. Though easy to handle and polish, it has lower strength and is less color stable, limiting its use in high-stress areas.[20,21] Splintline is a PEMA-based product.

***Polyvinylethyl Methacrylate (PVEMA)*:**

PVEMA behaves similarly to PEMA but has inferior strength and color stability compared to PMMA.[10] Its clinical use is limited. Examples include Snap, Trim, and Trim II.

***Bis-Acryl Composite Resins*:**

Bis-acryl resins offer low heat release, good marginal fit, and minimal shrinkage but are brittle and costly.[22] They are harder to repair and show reduced strength after modification.[23] Brands include Luxatemp and Protemp II.

***Bis-GMA Resins*:**

Bis-GMA materials combine the advantages of methacrylates and bis-acryls. They provide excellent marginal fit, polishability, and easier repair due to chemical compatibility with composites. [24] Tempspan and Protemp Crown are common examples.

***Visible Light-Cured (VLC) Urethane Dimethacrylate Resins*:**

Developed in the 1980s, VLC resins use light-activated polymerization with minimal monomer release, reducing toxicity.[25] They offer good strength and marginal adaptation but have poorer stain resistance and higher cost. Revotec LC is a commercially available VLC material.[26]

RECENT DEVELOPMENTS IN INTERIM FIXED RESTORATION:

Recent advancements have improved the mechanical and physical properties of temporary crown and bridge materials. Reinforcement techniques include the addition of fibers, metal oxide nanoparticles, and the adoption of CAD/CAM technology.[27]

***Fiber-Reinforced Temporary Restorations*:**

Fiber-reinforced prostheses consist of a composite substructure veneered with aesthetic materials, offering high mechanical strength and good appearance-suitable for long-term provisional restorations. Classification depends on fiber type, orientation (woven, braided, or unidirectional), and impregnation. Unidirectional glass fibers show superior flexural strength and handling properties.[28]

Common dental fibers include glass, carbon, and polyethylene. Polyethylene enhances PMMA and bis-acrylic materials with good ductility, biocompatibility, and aesthetics. Carbon fibers improve mechanical strength but are limited by poor aesthetics and possible toxicity. Fiber adhesion to resin is improved using saline coupling agents for methacrylates or bonding agents for bis-acryls. Though fiber reinforcement shows positive effects in long-span prostheses, some studies report tissue irritation and poor bonding.[29]

***Nanoparticle-Reinforced Interim Restorations*:**

Nanotechnology introduces materials like zirconium oxide, titanium oxide, and aluminum oxide to enhance temporary restorations.[30] Both surface-treated and untreated nanoparticles are used. While surface-modified nanofillers improve bonding through silane agents, they are costly. Studies also support the use of unmodified nanoparticles. [31]

Nano zirconia (ZrO_2), known for hardness and biocompatibility, improves the strength of resins with minimal aesthetic impact.[32] Combining nano-ZrO_2 with fibers further enhances flexural and impact strength. Coupling agents improve filler dispersion and adhesion to the matrix. [33]

According to Chowdhury et al. (2021), titanium and zirconium nanofillers increase PMMA's mechanical strength but may raise surface roughness, promoting microbial adhesion.

FUTURE TRENDS IN PROVISIONAL RESTORATION:-

***Digital provisional restoration*:** Digital technology has significantly advanced provisional restoration by increasing precision, efficiency, and reproducibility. A fully digital workflow involves intraoral scanning, CAD design, and CAM fabrication, minimizing manual intervention and errors.[34]

Workflow:

1. ***Intraoral scanning***: Captures accurate 3D impressions, enhancing patient comfort and reducing distortion.
2. ***CAD***: Allows detailed customization of anatomy, occlusion, and contours for improved function and esthetics.
3. ***CAM:*** Produces restorations using high-performance materials like pre-polymerized PMMA or resin composites, offering excellent marginal fit and strength.

Advantages:

- Enhanced precision and fit
- Reduced chairside time with systems like CEREC
- Better material strength and esthetics
- Reproducibility of designs for future use

CAD/CAM Interim Restorations:

CAD/CAM provisional restorations, made from low-porosity blocks/discs, offer reduced polymerization shrinkage and improved mechanical properties. These are beneficial in complex cases involving TMJ disorders, vertical dimension alterations, or implant healing. Patients can digitally preview comfort and esthetics before final restorations. [35, 36]

CAD/CAM uses digital data to mill external surface form (ESF) and tissue surface form (TSF) from dense resin discs. Composite resins and CAD/CAM PMMA are common materials. Their residual monomer content is low (around 1%), reducing allergic potential. These restorations provide high wear resistance, accuracy, and biocompatibility. Diagnostic wax-ups or scans guide design, and data can be reused for final restorations. Multi-unit prostheses can also be fabricated.

Drawbacks include the need for in-office milling units, digital impression systems, and some monochromatic blanks. Milling also requires efficient coolant systems to prevent polymer clogging.[37]

3D Printing in Provisional Restorations:

Three-dimensional (3D) printing, especially Digital Light Processing (DLP), allows rapid, cost-effective production of resin prostheses. DLP uses high-power LED sources to cure entire resin layers at once, creating precise restorations with hybrid UV-curable resins.

Studies by Revilla-León et al. (2020) showed that 3D-printed interim restorations had favorable mechanical and chemical properties. Molinero-Mourelle et al. (2020) found DLP-produced methacrylate resin restorations had marginal fits within clinically acceptable limits.[38]

TECHNIQUES IN PROVISIONAL RESTORATION:

In fixed prosthodontics, fabricating temporary restorations is a critical step. Temporary restorations must fulfil essential criteria: pulpal protection, positional stability, occlusal function, cleanliness, marginal accuracy, strength, durability, and aesthetics. Once assessed intraorally, they also act as a blueprint for the definitive prosthesis.[39]

Provisional restorations play a pivotal therapeutic role in fixed prosthodontic rehabilitation, especially when they are required for extended durations or when interim treatments are needed before final restoration. Since preparation and provisionalization often occur within the same appointment, the process must be efficient. A well-executed provisional not only conserves chairside time but also enhances periodontal health and the integrity of abutments, while offering a preview of the final outcome. The literature is abundant with techniques and variations for provisional restoration fabrication. [40]

Various procedures are available, utilizing a range of materials. Despite this variability, the fundamental principle remains the same: a mold cavity is created into which a plastic material is introduced. Using a matrix, provisionals can be fabricated directly on prepared teeth, indirectly through impressions, or by combining both methods via the indirect-direct technique, where a prefabricated shell is relined intraorally.

INDIRECT PROVISIONAL FIXED PARTIAL DENTURE:-

In this technique, the temporary restoration is fabricated extraorally. The indirect method, described by Fisher et al., utilizes quick-set plaster and offers distinct advantages over direct methods.[41]

***Advantages*:**[42]

- Eliminates contact between free monomer and prepared tooth or gingiva, reducing the risk of tissue injury, hypersensitivity, or allergic reactions.
- Prevents heat from polymerizing resin from reaching the tooth.
- Saves chairside time by delegating tasks to auxiliaries.
- Yields better marginal adaptation.

***Drawbacks*:**[43]

- Requires more time and intermediate steps.
- Needs adequate lab facilities and staff.

- Diagnostic casts may cause slight inaccuracies

Method: Place acrylic tooth on diagnostic cast edentulous site and seal with carding wax. Fabricate silicone putty index extending beyond adjacent teeth. Prepare teeth, take sectional impression, pour check cast. Load index with temporary material, seat on cast, check intraoral fit, reline if needed, then finish, polish, and cement.

INDIRECT-DIRECT PROVISIONAL FIXED PARTIAL DENTURE:

This method combines extraoral fabrication of the external contours with intraoral adaptation to prepared teeth.

Advantages:

- Reduces chairside time.
- Offers better control of contours.
- Limits heat and monomer exposure.
- Reduces risk of allergic reactions. [39]

Drawbacks:

- Requires a lab phase before tooth preparation.
- May involve adjustments for shell seating.

Method: Take impression of unprepared teeth; pour diagnostic cast. Wax pontic on cast for FPD, contouring for contacts and occlusion. Lubricate cast; make elastomeric index, trim gingival edge. Prepare mock abutments conservatively on cast. Load restorative material in index; reseat on cast, polymerize, trim, and shape shell. Prepare patient's teeth; try-in, reline intraorally if needed. Polish and cement.

DIRECT PROVISIONAL FIXED PARTIAL DENTURE:

Here, the restoration is fabricated intraorally on the prepared teeth and gingiva, eliminating lab phases.

Advantages:

- Ideal when lab access is limited.

Drawbacks:

- Poorer marginal fit.
- Risk of pulpal or soft tissue injury due to exothermic polymerization.

Method: Insert acrylic tooth pre-preparation; make putty index or alginate impression. Prepare teeth. Apply petroleum jelly on teeth and gingiva. Load impression with material; reseat intraorally, removing periodically until set. Finish, polish, and cement.

OTHER DIRECT TECHNIQUES:-

I. ***Acrylic resin block technique:*** A practical, artistic method requiring no diagnostic cast.

Method: Prepare teeth. Mix acrylic to doughy stage. Seat over lubricated abutments; guide into occlusion. Remove/reseat to control heat. Carve anatomy with burs/stones after setting. Hollow internal surface, reline with fresh resin, reseat. Finish and cement with non-eugenol cement.[40]

II. ***Shell matrix method:*** Take a pre-prep impression and fabricate a shell using mouth-guard material and an acrylic tooth. Seat filled shell matrix on patient's teeth. Allow to set, finish and cement.

III. ***Alginate modification:*** Take full-arch alginate impression after wax build-up. Modify edentulous area to form a pontic or bar. Use the impression to fabricate a restoration directly.

IV. ***Using a removable partial denture (RPD)*****:** Use an RPD to imprint pontics in alginate. Use cold-cure resin to form block pontics. Attach pontics to abutment crowns or directly bond with composite.

TEMPORIZATION BEFORE TOOTH PREPARATION:

A. ***Unprepared diagnostic cast*** **:**[44]

- No modification to cast.
- Impression taken, relined intra-orally, and finished.

B. ***Prepared mock on cast*** **:**[10]

- Cast is mock-prepared.
- Shell-type provisionals fabricated and relined intraorally.

C. ***Direct Intraoral Matrix with Reline*****:**

- Follows standard direct method.

D. ***Indirect matrix on cast*****:**

- Follows standard indirect method.

TEMPORIZATION AFTER TOOTH PREPARATION:

A. ***Direct Formation on Cast:***

- Temporary restoration created post-preparation.

Options:

- Heat-cured acrylic via lost-wax.
- Self-cure acrylic, possibly fiber-reinforced.
- Light or dual-cure composites.
- Cast metal provisionals.

B. ***Prefabricated crowns:***

- Metal, polycarbonate, or cellulose acetate crowns trimmed and relined.

C. ***If patient presents without temporary:***

1. Build-up with wax, place acrylic tooth, take

C. If patient presents without temporary:

impression.

2. Use reverse pontic in impression.
3. Use acrylic block technique.

TEMPORARY POST AND CORE RESTORATIONS:

Options:

- Direct method using a ball pin.
- Indirect over-impression with embedded pin.
- Acrylic block build-up over pin.

USING EXISTING PROSTHESIS AS TEMPORARY:

When removing a permanent prosthesis:

- Section prosthesis to preserve abutments.
- Reassemble and reuse as provisional.

Advantages:

- Saves time.
- Metal reinforcement provides strength.
- Less occlusal wear.

Alternatively, take an impression before removal and fabricate the provisional from it.

MANAGEMENT OF PROVISIONAL RESTORATIONS' DEFICIENCIES:

Provisional restorations serve as critical interim prostheses in restorative and prosthodontic treatment, safeguarding the prepared tooth, maintaining occlusal function, guiding tissue healing, and fulfilling esthetic demands until the final restoration is placed. However, temporary prostheses are susceptible to various deficiencies that can compromise their function, integrity, and patient comfort.

Common Deficiencies in Provisional Restorations:-

Several issues can arise during the fabrication or intraoral use of provisional restorations:

1. Marginal discrepancies, which may lead to microleakage, gingival inflammation, and bacterial infiltration.
2. Lack of adequate retention or stability, causing premature dislodgement.
3. Poor esthetic outcome, reducing patient satisfaction, especially in the anterior region.
4. Structural fractures, often due to the use of weak or brittle materials, or mechanical stresses.

Challenges in Provisional Restorations:-

1. ***Marginal inaccuracy:***

Precise marginal fit is critical to protect the pulp from bacterial, thermal, and chemical insult. Inaccuracies can result from polymerization shrinkage (up to 6% in PMMA, 1- 4% in composite), distortion during setting, and less accurate direct fabrication methods. Repeated removal, moisture exposure, occlusal forces, and cementation may further compromise marginal integrity. Techniques such as bench polymerization, staged setting, marginal trimming, and relining improve adaptation and retention.

2. ***Fractures:***

Mechanical failure is common, particularly in long-span bridges and thin cervical regions. Material properties like flexural strength and fracture resistance are crucial; PMMA and heat-polymerized resins perform better than bis-GMA or auto/light-cured resins. Fiber reinforcement (glass, carbon, polyethylene) and metal substructures enhance strength in extensive or long-term temporization, provided placement and impregnation are correct.

3. ***External contour nonintegrity:***

Proper external morphology ensures esthetic harmony, occlusal balance, and tissue support. Poor contour can cause loss of proximal contacts, tooth drifting, improper occlusion, gingival overgrowth or collapse, and esthetic compromise. Gradual modification of the contour or emergence profile can condition soft tissues and maintain ridge form, improving esthetic and functional outcomes.

Available Materials and Bonding Strengths for Repairs, Modifications, or Relining:

Repairing or modifying provisional restorations requires compatibility between the existing base material and the newly added one. Bond strength depends on:

- Chemical similarity, with higher strength achieved when base and repair resins share similar polymer backbones.
- Surface treatment, such as roughening, monomer conditioning, or air abrasion.

Self-cure PMMA resins are widely used for repair due to their ease of manipulation and compatibility. However, these materials exhibit:

- Strong exothermic reactions
- Shrinkage during polymerization
- Residual monomer release, which may be cytotoxic or allergenic

Bis-acryl resins are preferred for their controlled mixing (via cartridge systems), low shrinkage, and better marginal accuracy. Their repair using

methacrylate resins is discouraged due to poor chemical compatibility. Instead, light-cured flowable composites offer a better repair alternative. These materials:

- Are available in a range of viscosities and shades
- Provide strong bonds with bis-acryl when combined with a bonding agent
- Show minimal polymerization shrinkage and odor

However, long-term fracture resistance in composite-to-composite repair remains questionable due to reduced bond strength over time as polymer chains become less reactive.

Particular Clinical Practices:-

Relining: Relining involves adapting the internal surface of a provisional to better fit the prepared tooth. Materials like self-cured PMMA or light-cured flowable composites are typically used. To ensure proper seating and reduce hydrostatic pressure:

- Venting should be performed
- Internal relief of the restoration is recommended
- Surface cleaning and roughening of margins enhances bonding

Firm pressure or a seating guide helps ensure full seating. Light water misting during polymerization reduces thermal impact from the exothermic reaction.

Repairs:

Repair is often more practical and economical than refabrication, but the strength of the repair is typically inferior. Common techniques include:

- Surface beveling (at 45°)
- Mechanical roughening
- Air abrasion with aluminum oxide
- Removal of contamination and aged surface layers

Use of bonding agents after these steps facilitates both chemical adhesion and mechanical interlocking.

External Modifications:

Minor additions using brush-on acrylic wash or flowable composite resins can restore contours, proximal/occlusal contacts, or improve marginal seal. These adjustments are especially helpful in:

- Modifying emergence profiles
- Managing tissue contours post-extraction
- Correcting esthetic deficits

Surface treatment is essential when bonding to older restorations, as reduced monomer content and water sorption lower bonding potential. Flowable composites, combined with bonding agents, provide a practical solution for minor intra-oral adjustments in multi-unit temporaries.

CONCLUSION:

Provisional restorations are essential in prosthodontics, protecting prepared teeth while maintaining function, esthetics, phonetics, and patient comfort. Proper material choice and fabrication techniques ensure optimal marginal fit, strength, and contour. By addressing fractures, marginal inaccuracies, and contour deficiencies, provisional restorations facilitate soft tissue conditioning and guide the final restoration. Far from being mere temporary substitutes, they serve critical diagnostic, therapeutic, and biological roles, enhancing the predictability and success of definitive prostheses and overall patient satisfaction.

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Conflicts of Interest

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