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REVIEW

Marginal integrity of provisional resin restoration materials: A review of the literature

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Abstract Marginal adaptation of provisional restorations is a critical property of these treatments. It is a function of the chemical composition, setting method, and aging procedures. Interim materials include polymethyl methacrylate (PMMA), polyvinyl ethyl methacrylate (PVEMA), Bis-phenol A glycidyl methacrylate (Bis-GMA) composites, and urethane dimethacrylate (UDMA) composites. This review summarizes and compares their marginal fit in the light of the potential disrupting factors and the underlying mechanisms. All these materials fail in moderate- or long-term durations under oral stresses and water sorption, and should be rapidly replaced by permanent restorations before damaging teeth and adjacent tissues.

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1. Introduction

Provisional fixed partial dentures are a critical part of fixed prosthesis treatments.[1–8] Due to unforeseen events such as laboratory delay, patient unavailability, and necessary gingival or temporomandibular joint treatments, interim restorations must keep requirements for providing patients' health during extended treatment periods.[1–3,5,9,10] An optimum interim fixed restoration must protect the underlying preparation, pulp, and gingiva, and should ensure the return to health of any traumatized soft tissues while the definitive restoration is being fabricated by the laboratory.[1–5,9,11] It must satisfy interrelated biologic, mechanical, and aesthetic factors,[4,6,8,12] including resistance to fracture, marginal fit, color stability, wear resistance, tissue compatibility, ease of manipulation, and cost.[6,8,10] This essay summarizes the commonly used materials and the effects of aging procedures.

2. Provisional materials

Custom-fabricated materials are used for fabrication of provisional fixed prostheses utilizing direct clinical, indirect laboratory or indirect/direct techniques.[13,14] These materials are categorized according to various criteria. The most general method is the chemical composition of the material, which divided these materials into methacrylates or composites.[13,15,16] The most common methods in the material science literature are categorization by polymerization method and chemical composition.[13,15–17] The four groups included in the chemical resin composition categories are poly(methyl methacrylate), poly(R′methacrylate), microfilled composite, and light-cured resin.[13,18,19]

2.1. The conventional material: polymethyl methacrylate (PMMA)

The most common interim restorations are made of polymeric resins which consist of acrylic and composite resins.[4] Polymethyl methacrylate (PMMA) was first invented in 1877. It was then used in the production of transparent materials named Plexiglass.[13,20] The first use of polymethyl methacrylate (PMMA) in dentistry was for the fabrication of complete denture bases introduced in 1937.[13,21] Its qualities of biocompatibility, reliability, relative ease of manipulation, and low toxicity were soon incorporated by many medical specialties.[21] The use of PMMA in fixed prosthodontics appeared shortly after, initially for permanent restorations.[13,22,23] Self-curable PMMA appeared about a decade later with the clinical implication for interim fixed prostheses.[13,24] Since their introduction, PMMAs quickly became the most frequently used interim fixed prostheses material.[13,25,26] Traditionally thermoplastic acrylic resins such as PMMA were used as materials of choice for temporary restorations. These are currently the most common materials for preparation of provisional restorations.[18,25–28] Some examples for PMMA include Caulk temporary bridge resin (Dentsply, York, PA, USA), TCB (Bioweld Altripone, Manila, Philippines), Vita VM CC (Vident, Brea, CA, USA), and Jet (Lang Dental, Wheeling, IL, USA).[13]

2.2. Novel materials

New generations of interim materials are gaining acceptance due to their easier handling, more predictable results and better mechanical properties.[4,29] New interim materials include polyethyl-methacrylate resin (PEMA), polyvinyl-ethyl methacrylate resin (PVEMA), epimines, Bis-acrylic resin composites and urethane dimethacrylate resin compositetes.[13,30]

2.3. Poly(R′methacrylate)

This is a family of polymers with the formula of poly(R′methacrylate), in which R′ represents an alkyl group larger than methyl (e.g., ethyl or isobutyl).[13] The most common available products in this group include polyethyl methacrylate (PEMA), polyvinyl ethyl methacrylate (PVEMA), and polybutyl methacrylate (PBMA). The materials in this group have similar clinical behavior.[13] Examples for PVEMA include Snap (Parkell, Edgewood, NY, USA), Trim, and Trim II (Harry Bosworth, Skokie, IL, USA). Examples for PBMA and PEMA are Temp Plus (Ellman Int, Hicksville, NY, USA) and Splintline (Lang Dental), respectively.[13]

2.4. Microfilled composite

Bis-phenol A glycidyl methacrylate (Bis-GMA) is a difunctional monomer of high molecular weight. The polymer form combined with inert filler particles was the first resin composite used in dentistry.[13] Further development of the Bis-GMA structure and filler content led to the development of other molecules such as: ethoxylated Bis-GMA, triethyleneglycol dimethacrylate (TEGDMA) and urethane methacrylates (UDMA).[13,23] The improved material then found its way to other fields, and Bis-acryl resins have become popular for fabrication of interim fixed prostheses. Examples of these materials are Luxatemp (Zenith-DMG, Englewood, NJ, USA), Protemp 3 Garant (3M ESPE, USA) and Provipont (Ivoclar/Vivadent, Liechtenstein).[13]