

Polymethyl metha acrylate denture base: An overview



The denture base material has been the most significant material in prosthodontic research. The research has been done consistently for more than a century to find the ideal or superior denture base material. Many materials have been tried and tested. It started from the wood, ivory, bone, wax, vulcanite, ceramic, metal, and now to polymethyl metha acrylate (PMMA) and its advancements. PMMA has been time tested, the gold standard, and used in fabrication of various prosthesis for many decades. It has been a primary choice of denture base material and one of the most widely used dental material. On literature search, this can be the most tested dental material across the world in dentistry. The material in conventional form of heat cure-polymerized material PMMA to recent advance computer-aided design/computer-aided manufacturing acrylic block have been used with success in dentistry. A greater anticipation and more advanced research on this material can be anticipated in future.

The PMMA has been modified by reinforcements to improve the properties. The commonly used reinforcements can be categorized into metal reinforcements, fibers, fillers, and nanoparticles.^[1] The fibers used in various studies were mostly glass, aramide, nylon, polyethylene, polypropylene, and vegetable fibers. The fillers used were alumina, zirconia, silver, and titanium. The nanoparticles of the same metals, nonmetals, and minerals are used. Latest studies on nano-PMMA reinforcements have used hydroxyapatite, nanoclay, halloysite nanotubes, nanocarbons, and nanodiamonds.^[2] Hybrid reinforcements have been tried in few studies where they have combined the combinations of material reinforcements to evaluate the properties of the material. The properties of these modifications have been evaluated in many *in vitro* studies published across the literature and proved to be effective. An overview of analysis on the published literature on denture base material and their modifications provides data on the flexural strength and few mechanical, physical, or antimicrobial properties of altered denture base material. It is essential that detailed properties of the modified denture base materials are evaluated for effective translational research.

The literature has documented the versatility and clinical use of PMMA denture base material. It has also provided an option to look for better material. This being a gold standard or the minimal requirement of the denture base material, the modifications from the basic for superior properties were appreciated and accepted. Unfortunately, the studies on PMMA or on its modifications have not progressed beyond few mechanical properties.^[3,4] There are few advanced studies or clinical trials on PMMA available in literature compared to the basic studies. It is essential that extensive Level 1 studies have to be done on these materials to obtain the optimization, but it is preferable to design future studies on PMMA and its modifications with Level 2 and Level 3 studies. Although PMMA has been accepted as a material of clinical standard, it requires documentation. The documentation of this era is clinical trials and systematic reviews. The scoping evaluation on the clinical trials of PMMA denture base resin has less documentation to establish the scientific legitimacy of the materials.

In the present generation, nanofillers have been used extensively to modify denture base materials.^[5] The studies fail to provide information on synthesis, type, size, composition, and percentage of addition of these fillers to basic materials. The addition of one composition and percentage can improve the strength but its effects on other properties of materials have not been evaluated. SEM and microstructure valuations are required to observe the bonding of these materials to the base materials. In addition, it is essential that the concentration of material addition has to be obtained through optimization ratio of the material. These limitations are a big setback for research advancement in denture base material. This makes it mandatory that future denture base resin studies have to investigate beyond flexural strength and regular mechanical properties. Phase 2 and Phase 3 research studies should be encouraged to add significant data to the literature.

The flexural strength of PMMA is optimum to meet the intraoral functional situations. There can be situations of fracture and failure of PMMA. The studies have identified

the causes and found the remedies and management strategies for the same. Although research required finding alternative and better materials, testing standards and parameters of these materials have to improve. Majority of the studies lack standardization in testing protocol and subsequently to think beyond strength is essential. Numerous reinforcement materials have been tried and tested for flexural strength. These materials which have brought superior and inferior data have not been tested for other properties such as color, antimicrobial, creep, warpage, residual monomer, bonding, and repair of the material to meet the intraoral standards. It is essential that all properties are evaluated and more clinical data required to substantiate the superiority of the modified denture base materials.

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