



INNOVATION IN ARTIFICIAL DENTURE TOOTH MATERIAL- A REVIEW.

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ABSTRACT :

Because artificial teeth restore function, appearance, and phonetics, they are essential to the success of complete dentures. For artificial denture teeth, polymethyl methacrylate (PMMA) has long been the preferred material because of its low cost, simplicity of manufacturing, and aesthetically pleasing results. Nevertheless, new and improved acrylic-based materials with superior mechanical, biological, and physical properties have been made possible by advances in material science. In addition to digital materials created by CAD/CAM milling and 3D printing technology, contemporary prosthetic teeth are now made from nano-filled PMMA, Interpenetrating Polymer Networks (IPNs), Microfilled Reinforced Polyacrylics (MRP), and Sustained Life Materials (SLM). Through enhancements in wear resistance, color stability, fracture toughness, and adhesion to denture bases, these technologies seek to solve the drawbacks of traditional acrylics. High strength and long-term aesthetic performance are provided by IPN-based polymers, whereas SLM and MRP materials improve wear and fatigue resistance in high-stress areas. Hygiene and natural aesthetics have been further enhanced by the development of antibacterial acrylics and composite-enamel-layered constructions.

Key Words: Poly Methyle Metha Acrylate [PMMA]; Resin Material; Composite Material; Nano Material; CAD-CAM Milling Material.

Introduction:

The patient's occlusal load, opposing dentition, prosthetic longevity expectations, and aesthetic requirement should all be taken into consideration when choosing an artificial tooth material. For edentulous patients, ongoing advancements in denture tooth materials promise more realistic, long-lasting, and pleasant prosthetic options.

1. Polymethyl Methacrylate (PMMA) – Conventional Acrylic Resin

Properties: [1]

- Good esthetics (translucency mimics natural teeth)
- Moderate hardness and wear resistance
- Easily bondable to denture base
- Light weight
- Economical and easy to adjust or polish

Indications:

- Used widely in complete and partial dentures
- Preferred when esthetics are a priority
- Used in patients with mild parafunctional habits

Uses:

- Most commonly used material for artificial teeth in complete denture sets

Limitations:

- Poor abrasion resistance compared to composite teeth

- Tends to discolor and wear over time

2. High-Impact Acrylic Resin (Modified PMMA) [2]

Properties:

- Improved fracture toughness due to rubber-modified polymers
- Better impact resistance compared to conventional PMMA
- Slightly increased flexural strength

Indications:

- For patients with a history of denture breakage
- Used in complete dentures where additional toughness is desired

Uses:

- Artificial teeth in both complete and implant-supported overdentures

3. Cross-Linked Acrylic Resin [3]

Properties:

- Intermolecular cross-linking increases hardness and wear resistance
- Better color stability
- Reduced water sorption
- More resistant to crazing and staining

Indications:

- For patients with bruxism or heavy masticatory forces
- Ideal for long-term use in complete dentures

Uses:

- Posterior artificial teeth
- Complete denture teeth with high functional demands

4. Composite Resin Teeth [4]

Properties:

- Made from urethane dimethacrylate and inorganic fillers
- High wear resistance and surface hardness
- Better esthetic properties (can mimic translucent enamel)
- More brittle than PMMA

Indications:

- High esthetic requirement cases (e.g., anterior segment)
- Implant-supported complete dentures
- Where wear resistance is a concern

Uses:

- Premium-grade complete dentures
- Suitable for opposing natural dentition or ceramics

5. Nano-Hybrid Acrylics [5]

Properties:

- Acrylic resins reinforced with nano-sized fillers
- Improved mechanical and esthetic properties
- Enhanced polishability and stain resistance

Indications:

- Advanced complete dentures where aesthetics and strength are critical
- Patients with a history of frequent wear of teeth

Uses:

- Premium denture teeth in high-function and high-esthetic zones

6. Acrylic Teeth with Composite Layering (Dual Layered) [6]

Properties:

- Denture teeth with an acrylic core and a composite surface layer
- Combine the esthetics and polishability of composite with the resilience of PMMA
- Better color stability and longevity

Indications:

- For highly esthetic demands in complete dentures
- Patients needing both esthetics and mechanical performance

Uses:

- Aesthetic complete dentures
- Implant-supported prostheses

Material	Esthetics	Hardness	Wear Resistance	Indication Area
PMMA	Good	Moderate	Low	General complete denture use
High-Impact Acrylic	Good	Moderate	Moderate	Fracture-prone cases
Cross-Linked Acrylic	Good	High	Moderate-High	Bruxism, long-term prostheses
Composite Resin	Excellent	High	High	Esthetic/high-wear zone, anterior teeth
Nano-Hybrid Acrylic	Excellent	High	High	High-function, premium dentures
Acrylic-Composite Layered	Excellent	High	Very High	Aesthetic and functional prostheses

To accommodate diverse clinical situations, acrylic teeth for full dentures are made from a variety of materials. Newer materials including cross-linked, composite, and nano-hybrid acrylics provide substantial advantages in terms of durability, aesthetics, and patient satisfaction, but standard PMMA is still the most commonly used since it is inexpensive and simple to use. Patient needs, aesthetic requirements, functional stress, and financial factors must all be taken into account while making the choice.

RECENT ADVANCEMENTS IN MATERIALS FOR ARTIFICIAL ACRYLIC TEETH IN COMPLETE DENTURES

Advanced acrylic and hybrid material compositions made possible by modern material science improve the biocompatibility, lifespan, wear resistance, and aesthetics of prosthetic teeth. The objective is to overcome the drawbacks of traditional PMMA and more closely resemble natural teeth.

1. Nano-Filled Acrylic Resin [7]

Advancement:

adding nanoparticles to the PMMA matrix, such as titanium dioxide, zirconia, and silica.

Qualities:

- Increased resistance to abrasion and surface hardness

Better color stability, less plaque buildup, and greater flexural strength compared to traditional PMMA

Signs:

- High-function areas, such the back of the teeth; • Decorative areas because of improved polishability

Uses:

- Complete denture teeth for long-term use

2. 3D Printed Acrylic Teeth [8]

Advancement:

Customized artificial teeth are made using CAD/CAM and 3D printing (additive manufacturing) technology.

Features: • Exceptional fit and precision • Adaptable morphology and appearance

- Mechanical strength comparable to milled acrylics
- Layer-by-layer printing enables the duplication of distinct anatomy.

Signs:

- Complete dentures using digital designs; • Quick denture production (emergency prosthesis)

Uses:

- Teeth sets for full dentures fabricated via digital workflow

3. CAD/CAM Milled Pre-polymerized Acrylic Teeth [9]

Advancement:

using machined tooth blocks composed of highly cross-linked, pre-polymerized PMMA.

Features include: • Greater durability and accuracy; • Greater wear resistance and color stability; • Homogenous material with fewer flaws or porosities;

Signs:

Long-term dentures; complete dentures supported by implants; and cases of bruxism

Uses:

- Premium denture teeth in full-arch prostheses

4. Fiber-Reinforced Acrylic Composite Teeth [10]

Advancement:

Glass or polyethylene fibers are used to strengthen the teeth of acrylic resin. Better stress distribution under load; increased tensile and flexural strength; increased resistance to cracking and debonding; complete dentures in patients with high masticatory loads; and patients with prior denture tooth fractures are among the indications.

Uses:

- Posterior artificial teeth in complete or overdentures

5. Multilayer Acrylic-Composite Hybrid Teeth [11]

Advancement:

production of multi-layered denture teeth that combine a highly aesthetically pleasing composite enamel layer with a PMMA dentin core.

Qualities:

- Superior esthetic gradient from dentin to enamel; • High resistance to wear and staining; • Natural depth of color and translucency

Signs:

- Dentures for patients who are younger or more socially active; • Anterior teeth in highly aesthetic dentures

Uses:

- Premium anterior denture teeth

6. Antibacterial and Bioactive Acrylic Materials [12]

Progress: Creation of PMMA containing bioactive substances (such as quaternary ammonium compounds and silver nanoparticles).

Features include: • Prevents plaque and bacterial adhesion; • Preserves aesthetically pleasing appearance; • Offers antimicrobial protection for elderly or immunocompromised people.

Indications: • Immunocompromised and elderly patients • Individuals at risk for denture stomatitis

Applications: • Denture liners or teeth that are antimicrobial

Material Type	Key Advancement	Properties	Primary Indication
Nano-Filled PMMA	Nanoparticle reinforcement	Better strength & wear resistance	Posterior teeth, esthetic cases
3D Printed Teeth	Additive digital fabrication	High precision, customizable	Digital denture workflows
Milled Pre-polymerized PMMA	Subtractive CAD/CAM technique	Dense, wear-resistant, durable	Long-term & implant dentures
Fiber-Reinforced Acrylic	Glass/PE fiber incorporation	Enhanced strength and fracture resistance	Heavy occlusal load cases
Multilayer Acrylic-Composite	Dentin-core with composite enamel	Premium esthetics & durability	Anterior teeth in full dentures
Antibacterial Acrylic Materials	Bioactive additives in PMMA	Reduces microbial growth	Geriatric or medically compromised

The quality of complete denture prosthesis has greatly increased thanks to the development of advanced artificial tooth materials like IPN (IPS Polymer), SLM, and MRP. For patients who want lifelike restorations and long-lasting outcomes, these materials provide an exceptional combination of durability, function, and aesthetics. Clinical indications, occlusal forces, and aesthetic demands should all be taken into consideration while choosing them.

Conclusion

Complete dentures now have far better mechanical performance, aesthetics, and hygiene because to recent developments in artificial acrylic tooth materials. Every innovation, from CAD/CAM milled blocks to nano-filler additions, aims to solve clinical issues such biofilm formation, wear, fracture, and staining. The practical and aesthetic requirements of each patient should guide the material selection.

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