



HEB

**Journal of Prosthodontics Dentistry (JOPD)**  
**An Official Publication of Bureau for Health & Education Status Upliftment**  
 (Constitutionally Entitled As Health-Education, Bureau)

JOPD

## Flexural Strength and Marginal Integrity of Conventional PMMA Versus G-CAM Graphene-Reinforced PMMA: An In Vitro Comparative Study

*Dr. Abhijeet Patra, Dr. Manoj Upadhyay, Dr. Praveen Rai*

1. Postgraduate Student, Department of Prosthodontics, Crown & Bridge, Babu Banarasi Das College of Dental Sciences, Lucknow, India.
2. Professor and Head, Department of Prosthodontics, Crown & Bridge, Babu Banarasi Das College of Dental Sciences, Lucknow, India.
3. Reader, Department of Prosthodontics, Crown & Bridge, Babu Banarasi Das College of Dental Sciences, Lucknow, India.

**Corresponding Author:** Dr. Abhijeet Patra, Department of Prosthodontics, Crown & Bridge, Babu Banarasi Das College of Dental Sciences, Lucknow, India.

**Correspondence Email ID:** [serviceheb@gmail.com](mailto:serviceheb@gmail.com)

### Abstract

**Background:** Conventional polymethyl methacrylate (PMMA) remains the most widely used material in prosthodontics because of its favorable handling characteristics, excellent biocompatibility, aesthetic qualities, and cost-effectiveness. Despite these advantages, PMMA exhibits inherent mechanical limitations—including relatively low flexural and impact strength, inadequate fatigue resistance, and susceptibility to fracture under repetitive masticatory stresses. These deficiencies can compromise the long-term durability of prostheses and increase the risk of clinical failure, particularly in high-stress or extended-service restorative applications.

**Aim:** To compare the flexural strength and marginal adaptation of conventional PMMA with graphene-reinforced PMMA (G-CAM) in an in-vitro setting.

**Methods:** Forty CAD/CAM-milled specimens were assigned to two groups: conventional PMMA (Group A) and G-CAM (Group B). Each group was subdivided by (1) marginal integrity evaluation of standardized molar crowns and (2) flexural strength testing of bar specimens. Marginal gaps were measured at four sites using stereomicroscopy (40×). Flexural strength was determined via three-point bending per ISO 20795-1:2013. Independent t-tests ( $p < 0.05$ ) assessed statistical significance.

**Results:** Marginal adaptation was comparable between groups, with mean gaps ranging from 0.205–0.360 mm ( $p > 0.05$ ). G-CAM demonstrated significantly higher flexural strength ( $155.68 \pm 6.58$  MPa) and maximum load ( $1883.03 \pm 79.30$  N) compared with conventional PMMA ( $147.05 \pm 11.49$  MPa;  $1779.43 \pm 138.97$  N) ( $p < 0.05$ ).

**Conclusions:** Graphene reinforcement improves PMMA flexural strength without compromising marginal integrity, supporting its use in load-bearing provisional restorations. Long-term clinical studies are recommended.

**Keywords:** PMMA, graphene, CAD/CAM, flexural strength, marginal integrity, provisional restorations

### Access this Article Online

Website: <http://heb-nic.in/jopd-issues/>

Quick Response Code:

Received on 01/12/2025  
 Accepted on 19/12/2025 © HEB All rights reserved

