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Original Research

Comparative evaluation of flexural strength of different provisional crown material used in fixed prosthodontics

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ABSTRACT
Background: Fabrication of provisional restorations is an important procedure in fixed prosthodontics. The present study was conducted to assess the flexural strength of different provisional crown materials used in fixed prosthodontics. **Materials & Methods:** The present study was conducted in the department of Prosthodontics. In this study, three restorative materials such as methyl methacrylate based autopolymerized provisional crown material, bis-acrylic composite based autopolymerized provisional crown material and a urethane dimethacrylate based light polymerized provisional crown material was used. Ethical approval from institutional ethical committee was obtained prior hand. A total of 90 specimens were thus obtained with 30 each of three provisional materials. Further 10 samples of each group were tested after storing for one hour at room temperature and again at intervals of 24 hours and 7 days after storing in artificial saliva. Three point flexural tests were carried out in the universal testing machine to calculate the flexural strength. **Results:** The mean flexural strength of methyl methacrylate after fabrication was 62.4 N, after 24 hours was 54.2 N and after 1 week was 57.1 N. Bis-acrylic composite had 23.6 N after fabrication, 28.2 N after 24 hours and 29.4 N after 1 week. Urethane dimethacrylate had 38.5 N after fabrication, 35.1 N after 24 hours and 38.7 N after 1 week. The difference was significant (P< 0.05). **Conclusion:** The highest flexural strength was found with methyl methacrylate followed by Urethane dimethacrylate and Bis-acrylic composite.

Key words: flexural strength, methyl methacrylate, Urethane dimethacrylate

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INTRODUCTION

Fabrication of provisional restorations is an important procedure in fixed prosthodontics. Provisional restorations must satisfy the requirements of pulpal protection, positional stability, occlusal function, ability to be cleansed; margin accuracy, wear resistance, strength, and esthetics.[1] A provisional restoration must fulfill several functions, not least of which is that it must be strong enough to resist fracture. A number of studies have examined the mechanical properties of resins found to be acceptable for use as provisional restorations, but there has been little consistency in the methods used.[2] The strength of a material can be a determinant of how well these requirements are met. Flexural strength, also known as transverse strength, is a measurement of the strength of a bar (supported at each end) under a static load. The flexural strength test is a combination of tensile and compressive strength tests and includes elements of proportional limit and elastic modulus measurements. The flexural strength of provisional materials is important, particularly when the patient must use the provisional restoration for an extended period, when the patient exhibits parafunctional habits, or when a long-span prosthesis is planned.[3] Temporary materials have changed immensely since their early days in the 1930s-from acrylics and premade crown forms to newer bis-acryl materials and computer-aided design/computer-aided manufacturing (CAD/CAM) generated restorations.[4] The present study was conducted to assess

the flexural strength of different provisional crown materials used in fixed prosthodontics.

MATERIALS & METHODS

The present study was conducted in the department of Prosthodontics. In this study, three restorative materials such as methyl methacrylate based autopolymerized provisional crown material, bis-acrylic composite based autopolymerized provisional crown material and a urethane dimethacrylate based light polymerized provisional crown material was used.
Ethical approval from institutional ethical committee was obtained prior hand. A metal master mould with four slots of dimensions 25x2x2 mm was fabricated to obtain samples of standard dimensions. A total of 90 specimens were thus obtained with 30 each of three provisional materials. Further 10 samples of each group were tested after storing for one hour at room temperature and again at intervals of 24 hours and 7 days after storing in artificial saliva. Three point flexural tests were carried out in the universal testing machine to calculate the flexural strength. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Materials used in study

S. no	Materials	Type of resins
1	Methyl methacrylate	Autopolymerized
2	Bis-acrylic composite	Autopolymerized
3	Urethane dimethacrylate	Light polymerized

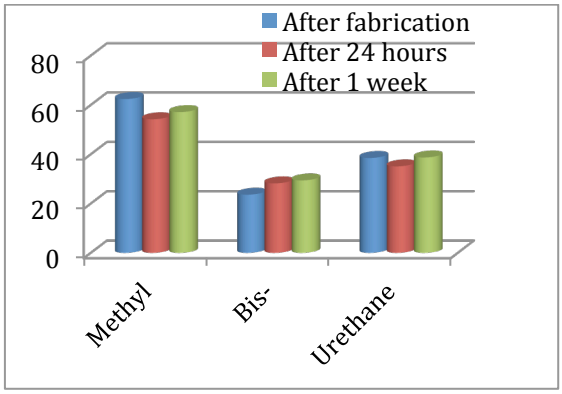
Table I shows that material used was methyl methacrylate based autopolymerized provisional crown material, bis-acrylic composite based autopolymerized provisional crown material and a urethane dimethacrylate based light polymerized.

Table II Flexural strength

Materials	After fabrication	After 24 hours	After 1 week	P value
Methyl methacrylate	62.4	54.2	57.1	0.01
Bis-acrylic composite	23.6	28.2	29.4	
Urethane dimethacrylate	38.5	35.1	38.7	

Table II, graph I shows that mean flexural strength of methyl methacrylate after fabrication was 62.4 N, after 24 hours was 54.2 N and after 1 week was 57.1 N. Bis-acrylic composite had 23.6 N after fabrication, 28.2 N after 24 hours and 29.4 N after 1 week. Urethane dimethacrylate had 38.5 N after fabrication, 35.1 N after 24 hours and 38.7 N after 1 week. The difference was significant (P< 0.05).

Graph I Flexural strength



DISCUSSION

Materials commonly used to fabricate interim restorations are heat polymerizing Poly Methyl Metacrylate (PMMA), autopolymerising Poly Ethyl Metacrylate (PEMA), auto polymerizing Poly Methyl Metacrylate (PMMA), Bis-acryl composite resin and light cured composite resin. They were chosen for esthetics, micro hardness, fabricating methods, economics and the other reason is fracture strengths.[5] In patients with bruxism or patients whose treatment plan requires long-term use of provisional restorations, provisional restorations with improved physical properties are required. Several attempts have been made to reinforce provisional Fixed Partial Dentures (FPDs).[6] These included the use of metal wire, a lingual cast metal reinforcement, a processed acrylic resin interim restoration, and different types of fibers, e.g., carbon, polyethylene, and glass.[7] The present study was conducted to assess the flexural strength of different provisional crown materials used in fixed prosthodontics. In present study, materials used were methyl methacrylate based autopolymerized provisional crown material, bis-acrylic composite based autopolymerized provisional crown material and a urethane dimethacrylate based light polymerized. Ireland et al[8] conducted a study in which the specimens are divided into 5 groups according to the type of resin used (Tetric Ceram, Charisma, Dentalon Plus, TAB 2000, Protemp 3) and then each group was divided into 3 subgroups according to the type of fiber reinforcement (Construct, Fiber-splint ML). Specimens are loaded in a universal testing machine until the point of fracture. The mean flexural strength (MPa) was compared using one-way analysis of variance, followed by Duncan's multiple range tests. The highest average flexural strength value was found in the Charisma with Construct fiber reinforcement (442.00 MPa). The lowest average flexural strength value was found in the Dentalon Plus without fiber reinforcement (70.50 MPa). There was significant difference between Fiber-splint ML, Construct and control group. We found that mean flexural strength of methyl methacrylate after fabrication was 62.4 N, after 24 hours was 54.2 N and after 1 week was 57.1 N. Bis-acrylic composite had 23.6 N after fabrication, 28.2 N after 24 hours and 29.4 N after 1 week. Urethane dimethacrylate had 38.5 N after fabrication, 35.1 N after 24 hours and 38.7 N after 1 week. Vachan et al[9] found that the highest values for

fracture resistance were displayed by Snap poly (ethy1 methacrylate) material. However, two of the 11 samples of this material displayed markedly lower values for fracture resistance. This finding warrants further investigation, because inconsistency has clinical implications. In decreasing order, the fracture resistance of the other materials was as follows: the poly (methy1 methacrylate) materials, Caulk temporary bridge resin and G-C Unifast temporary resin; the composite material, Protemp; and the epimine material, Scutan. Duymus et al[10] in their study evaluated and compared the flexural strength and the elastic moduli of three provisional crown materials (methyl methacrylate based autopolymerized resin, bis acryl composite based autopolymerized resin and urethane dimethacrylate based light polymerized resin) after storing in artificial saliva and testing at intervals of 24 hours and 7 days. They found that methacrylate based autopolymerizing resin showed the highest flexural strength and elastic moduli after fabrication and after storing in artificial saliva and for 24 hours and 7 days. Bis-acrylic composite resin showed the least flexural strength and elastic moduli.

CONCLUSION

The highest flexural strength was found with methyl methacrylate followed by Urethane dimethacrylate and Bis-acrylic composite.

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