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Original Research

Flexural strength of provisional crown and fixed partial denture resins

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ABSTRACT

Introduction. Provisional prostheses are subject to flexure under function. Selection of the appropriate material for their fabrication is difficult given the limited evidence-based information on the flexural strength of provisional resins. **Purpose.** This study compared the flexural strength of 1 methacrylate-based resins and 1 bis-acryl resins used to fabricate provisional crowns and fixed partial dentures. **Material and methods.** Bar-type specimens were fabricated according to American National Standards Institute/American Dental Association specification 27. After being immersed in artificial saliva at 37°C for 24 HOURS and 10 days, the specimens were fractured under 3-point loading in a universal testing machine at a crosshead speed of 0.75 mm/min. Maximal loads to fracture in Newtons were recorded. Mean flexural strengths were calculated in MPa (n = 10 per group). Comparisons were made with analysis of variance. **Results.** Mean flexural strengths ranged from 57.12 to 125 MPa. The group with the highest strengths consisted of 1 bis-acryl materials. **Conclusion.** Within the limitations of this study, flexural strengths were material- rather than category- specific. Some, but not all, bis-acryl resins demonstrated significantly superior flexural strength over traditional methacrylate resins.

Key words: Flexural strength, provisional crown, fixed partial denture resins.

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INTRODUCTION

Provisional crowns and fixed partial dentures (FPD'S) are essential components of fixed partial treatments. Provisional restorations must satisfy the biological and esthetic needs as well as mechanical requirements such as resistance to functional loads, resistance to removal forces and maintenance of abutment alignment.¹ 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.² Provisional crown and FPD materials typically are composed of methacrylate or bis-GMA. Each material has physical properties unique to its chemistry. Monomers associated with different

provisional materials impart different characteristics such as exothermic heat of reaction, polymerization shrinkage, and strength.

Considering the manipulation, ease of use, and duration, the commercially available PMMA & bis-GMA material were evaluated and tested for flexural strength at different time interval and compared with each other.³

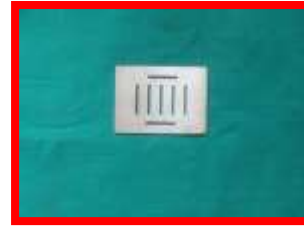
METHODOLOGY

To evaluate and compare the flexural Strength of two Provisional Crown & Bridge materials at room temperature. {DPI- Self Cure Tooth moulding Acrylic Resin(PMMA RESIN), Unifast III G C Self Cure Acrylic Resin (BIS – GMA RESIN) } And also To Study the change in Flexural Strength of above two materials at 1 hour and after storing in commercially available Artificial Saliva for 1 hour, 24 hours & 10 days.

SPECIMEN PREPARATION

A customized rectangular aluminium mould with seven slots of dimension 25X2X2 mm (American National Standards Institute/ American Dental Association specification no. 27) was used for preparation of the specimens. The mould was lubricated with separating media using a camel brush. The provisional restorative material were manipulated as per the manufacturer's instructions in a mixing jar using plastic mixing spatula. The materials were injected into the mould and sand witted between two glass slabs, the excess was

removed and polymerized under a constant load of 2.5 kg till the completion of polymerization. After the polymerization the specimens were retrieved from the mould and finished using abrasive paper.



Aluminium mold with seven cavities
(length= 25 mm, depth=2 mm, width = 2 mm)

60 specimens of each provisional materials were prepared. Total 120 specimens were prepared. Further specimens of each group were divided into three subgroups named as group A, group B and group C of 20 each.

20 specimens of group A of each material were tested for flexural strength after one hour of polymerization .

40 specimens of each material were stored in commercially available artificial saliva (1 L double distilled H₂O , 1.6802gNaHCO₃ , 0.41397 g NaH₂PO₄.h₂O, and 0.11099 g CaCl₂) at room temperature and tested for flexural strength after 24 hours and after 10 days respectively using the universal testing machine (Instron 3382-T604-449, USA.)



specimens prepared



specimen stored in artificial saliva



universal testing machine

RESULTS

Statistical Analysis:

Data was entered in Microsoft excel 2016 for Windows. Mean, standard deviation (SD), minimum and maximum values of flexural bond strength in different Provisional crown and bridge resins materials at different time intervals were calculated.

Shapiro-Wilk test showed that flexural bond strength in different Provisional Crown and bridge resins at different time intervals followed normal distribution. Hence, to test the effect of different provisional crown and bridge resins and time intervals on flexural bond strength values, Two-way Mixed Analysis of variance (2-way ANOVA) was used. After significant results of 2-way ANOVA, LSD post hoc test was applied for pairwise comparison.

P value <0.05 was considered statistically significant. Data analyses were performed using version 21.0 of the Statistical Package for Social Sciences (IBM Corporation, Armonk, New York, USA).

In DPI self-cure tooth molding acrylic resin (PMMA) group: Mean \pm SD of flexural bond strength after 1 hour, after 24 hours and after 10 days were 60.45 ± 0.43 MPa, 56.19 ± 0.57 MPa and 55.99 ± 0.53 MPa, respectively. Minimum and maximum values of flexural bond strength in after 1 hour were 59.10 MPa and 61.00 MPa, after 24 hours were 54.83 MPa and 57.11 MPa and; after 10 days were 54.85 MPa and 57.01 MPa.

In Unifast III G C self-cure acrylic resin (Bis-GMA) group: Mean \pm SD of flexural bond strength after 1 hour, after 24 hours and after 10 days were 22.60 ± 0.48 MPa, 28.48 ± 0.64 MPa and 28.59 ± 0.57 MPa, respectively. Minimum and maximum values of flexural bond strength in after 1 hour were 21.49 MPa and 23.17 MPa, after 24 hours were 27.01 MPa and 29.21 MPa and; after 10 days were 27.17 MPa and 29.31 MPa.

Comparison of flexural strength between different time intervals: -

For DPI self-cure tooth molding acrylic resin (PMMA):

1. Flexural strength after 1 hour was significantly higher than flexural strength after 24 hours and after 10 days.
2. Flexural strength after 24 hours was significantly higher than flexural strength after 10 days. {Highest after 1 hour and lowest after 10 days }

For Unifast III G C self-cure acrylic resin (Bis-GMA):

1. Flexural strength after 10 days was significantly higher than flexural strength after 1 hour and after 24 hours.
2. Flexural strength after 24 hours was significantly higher than flexural strength after 1 hour.

{Highest after 10 days and lowest after 1 hour }

DISCUSSION

In this present study, Four commercially available provisional crown and bridge resin materials (DPI tooth moulding acrylic resin, , Unifast III GC self cure acrylic resin.) were used for the study and the 20 specimens of each material were categorized into three time intervals (after 1 hour, after 24 hours , after 10 days).

For DPI self-cure tooth molding acrylic resin (PMMA): Flexural strength after 1 hour was significantly higher than flexural strength after 24 hours and after 10 days and Flexural strength after 24 hours was significantly higher than flexural strength after 10 days. {Highest after 1 hour and lowest after 10 days }

For Unifast III G C self-cure acrylic resin (Bis-GMA): Flexural strength after 10 days was significantly higher than flexural strength after 1 hour and after 24 hours and Flexural strength after 24 hours was significantly higher than flexural strength after 1 hour. {Highest after 10 days and lowest after 1 hour }

The flexural strength increases with the time interval from 1 hour<24 hour<10 days.

The strength of Bis-GMA resin increases due to the cross-linking polymerization and additional monomer molecules.

So, it is observed that with time interval, the Bis-GMA acrylic resin shows higher strength after 24 hours &10 days. It is important to choose the provisional restorative material which has higher flexural strength and lower biological degradation for predictable result.⁴

CONCLUSION

The present invitro study was conducted to evaluate the flexural strength of TWO commercially available Provisional crown and bridge resin materials (DPI tooth molding acrylic resin, Unifast III GC self cure acrylic resin(Bis-GMA) and compare their strength after three different time intervals.

Total 120 samples was prepared.60 samples of each material was tested in different time intervals, after 1 hour, after 24 hours ad after 10 days after storing in commercially available artificial saliva. Universal testing machine (Instron 3382-T604-449, USA.)

After statistical analysis, two-way ANOVA TEST, it was found that Bis-GMA based acrylic resin showed significantly superior flexural strength over PMMA based acrylic resin after 24 hours and10 days. Hence, it

is concluded that Bis-GMA materials showed higher flexural strength over PMMA material due to high cross linking polymerization and less absorption in the oral cavity.

Polymethyl methacrylate resins shows higher flexural strength after 1 hour of polymerization. The flexural strength reduces after 24 hours and 10 days when tested after storing the specimens in commercially available artificial saliva.

Bis-GMA materials shows lower flexural strength after 1 hour of polymerization.

Bis-GMA materials shows increase in the flexural strength after 24 hours & 10 days when tested after storing the specimens in commercially available artificial saliva.

REFERENCES

1. Debra R.Haselton,DDS,Ana M.Diaz-Arnold, DDS,MS, and Marcos A. Vargas,DDS,MS;Flexural Strength of Provisional Crown and fixed partial Denture Resins; Journel of Prosthet Dent; 2002;80:no2:225-228
2. Vachan Poonacha,Seema Poonacha,Basavaraj Salmagundi,Rupesh P-L,Rohit Raghavan;Invitro comparision of Flexural Strength of Three Provisional Crown Materials used in Fixed Prosthodontics J Clin Exp Dent.2013;5(5):e212-7
3. Sang -II Lee,DDS,MSD,chang-Whe Kim DDS.,MSD.,PhD.,,young-Jun LimDDS,MSD,PhD., Strength of glass fibre reinforced PMMA resin and surface roughness change;J Korean Aad Prosthodont;2007;vol45,no3,310-320
4. The effect of different Fibre reinforcements on Flexural Strength of Provisional Restorative Resins:an invitro study;J Adv Prosthodont 2012;4:1-6
5. The effect of different reinforcements on the rapture toughness of materials for interim restoration;The journal of prosthodontic dentistry,99(6):461-467
6. Comparative evaluation of flexural strength of provisional Crown and Bridge Materials- an invitro study;Journel of clinical and diagnostic research.2016 aug,vol-10(8):ZC72-ZC77
7. An invitro evaluation of flexural strength of Direct and Indirect Provisionalization Materials; The journal of Indian prosthodontic society,july 2005,vol5,issue3,132-135
8. Interim Restoration;Dent Clin N Am 48(2004)487-497
9. Flexural strength and hardness of direct and indirect composites;Braz oral res 2009;23(1);5-10;4-10
10. Vaibhav Deorao Kumble, rambhau D Parkhedkar,Tushar Krishnarao Mowade: the effect of different fibre reinforcements on flexural strength of Provisional Restorative Resins: an invitro study: J Adv Prosthodont 2012;4:1-6