# TO EVALUATE AND COMPARE THE FLEXURAL STRENGTH OF PROVISIONAL RESTORATIVE MATERIALS IN FIXED PARTIAL DENTURE

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## Abstract

This study was conducted to evaluate and compare the flexural strength of various provisional restorative materials used for provisionalization available commercially. Also to evaluate and compare the flexural strength of various provisional restorative materials after their repair Provisional restorations in an important part of the fixed prosthodontic rehabilitation. These materials should not only satisfy the mechanical requirements such as strength and resistance to wear but also meet the biologic and aesthetic demands.

**Keywords:** Flexural Strength, Provisional Restorative Materials, Fixed Partial Denture, Prosthodontics

## Introduction

Fixed prosthodontic treatment, whether involving complete or partial coverage and natural tooth or dental implant abutments, commonly relies on fabrication of definitive prosthesis in the dental laboratory "Flexural strength is a measurement of the strength of a bar of any particular material under static load.[1-3] Flexural strength is a combination of tensile and compressive strengths and includes elements of proportional limit and elastic modulus

measurements. It's also called transverse strength or modulus of rupture".[4-8] This study was conducted to evaluate and compare the flexural strength of various provisional restorative materials used for provisionalization available commercially.

## Materials and Methods

This study was conducted in the department of Prosthodontics of Shree Bankey Bihari Dental College and Research Centre, Ghaziabad, Uttar Pradesh, India. The sole aim was to evaluate and compare the flexural strength of various provisional restorative materials used for provisionalization available commercially. Four commercially available temporary fixed partial denture materials were considered. They were: Poly methyl methacrylate based provisionalization materials available in powder liquid form namely Al. DPI self-cure tooth material A2. Trulon acrylic crown and bridge, Bis-acryl composite based temporization materials available as cartridge with dispensing gun and mixing tips. Bl. Protemp 4 temporization material, B2. Luxatemp fluorescenc, Artificial saliva


**Figure 1:** Luxatemp fluorescenc

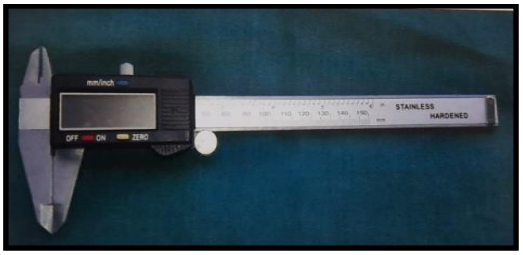



**Figure 2:** Digital Venire Calliper

**Figure 3:** Metal Die

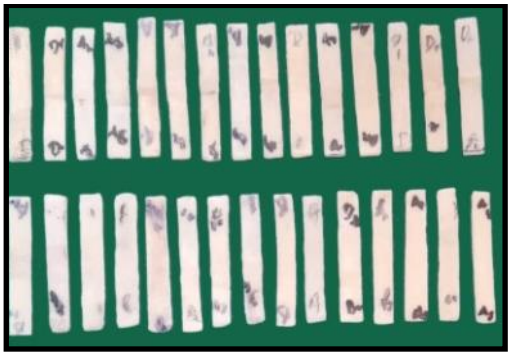


**Figure 4:** Specimens

**Equipments**

Custom made metal die for making specimens to determine flexural strength. It was a rectangular metal mold of with 5 slots of dimensions 64x10x2.5milimeter. It was open on one side with adjustable screws on the end to carefully remove the samples. Instron Universal Testing Machine (lOOKN) as per ASTMD 790 with a crosshead speed of 5mm/minute. The force at fracture is recorded in Newtons and converted to $N/mm^2$, Digital vernier calliper, Dappen dish, Glass-slab, handle and blade, Separating disks, Pencil/Marker, Micromotor with straight hand piece.

**Methodology**

This study was conducted in the department of Prosthodontics of Shree Bankey Bihari Dental College and Research Centre, Ghaziabad, Uttar Pradesh, India. Methodology described under following headings: A. preparation of specimens, b. grouping of specimens, c. testing of specimens

**Statistical Analysis and Results**

**Table1:** Grouping of specimens for evaluation of flexural strength

| **Groups** | **Materials** | **Subgroups** | | |
|---|---|---|---|---|
| | | **24 hours** | **7days** | **Repair** |
| PMMA | DPI (Al) | 5 | 5 | 5 |
| | TRULON (A2) | 5 | 5 | 5 |
| BIS-ACRYL COMPOSITE | PROTEMP (Bl) | 5 | 5 | 5 |
| | LUXATEMP (B2) | 5 | 5 | 5 |
| | | 20 | 20 | 20 |

**Table 2:** Statistical comparison between the flexural strength of samples fabricated using DPI cold cure acrylic Polymer powder at various time intervals by one way ANOVA and POST HOC test.

| Group A: DPI Polymer | | | |
|---|---|---|---|
| Samples | Duration | | |
| | 24 hours | 7 days | Repair |
| Sample 1 | 47.23 | 35.23 | 44.51 |
| Sample 2 | 48.00 | 33.81 | 42.32 |
| Sample 3 | 49.67 | 34.01 | 46.01 |
| Sample 4 | 46.53 | 37.23 | 43.61 |
| Sample 5 | 50.82 | 36.67 | 41.23 |

**Table 3:** Descriptive Analysis

| Group A: Descriptives | | | | | | |
|---|---|---|---|---|---|---|
| Time | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | |
| | | | | | Lower Bound | Upper Bound |
| 24 hours | 5 | 48.45 | 1.77 | 0.79 | 46.26 | 50.64 |
| 7 days | 5 | 35.39 | 1.54 | 0.69 | 33.48 | 37.30 |
| Repair | 5 | 43.54 | 1.86 | 0.83 | 41.22 | 45.85 |

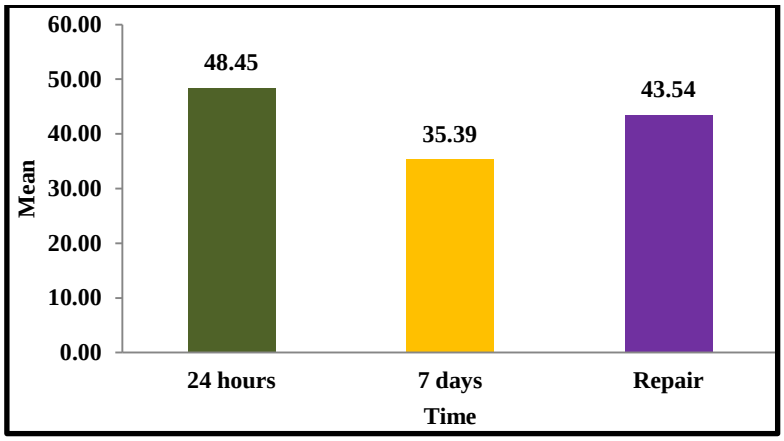
**Table 4:** ANOVA Analysis

| **ANOVA** | | | | | | |
|---|---|---|---|---|---|---|
| | Sum of Squares | df | Mean Square | F | P value | Result |
| Between Groups | 435.114 | 2 | 217.557 | 72.916 | 0.000 | Significant |
| Within Groups | 35.804 | 12 | 2.984 | | | |
| Total | 470.918 | 14 | | | | |
| [Statistical Analysis: ANOVA one way test. Statistically significant if P≤0.05. NS: Not significant; S: Significant ] | | | | | | |

**Table 5:** Multiple Comparisons of Group A flexural strengths at different time intervals.

| (I) TIME | (J) TIME | Mean Difference (I-J) | Std. Error | P value | 95% Confidence Interval | | Result |
|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | |
| 24 hours | 7 days | 13.06 | 1.09 | 0.000 | 10.024 | 16.097 | S |
| | Repair | 4.91 | 1.09 | 0.002 | 1.878 | 7.951 | S |
| 7 days | 24 hours | -13.06 | 1.09 | 0.000 | -16.097 | -10.024 | S |
| | Repair | -8.15 | 1.09 | 0.000 | -11.183 | -5.110 | S |
| Repair | 24 hours | -4.91 | 1.09 | 0.002 | -7.951 | -1.878 | S |
| | 7 days | 8.15 | 1.09 | 0.000 | 10.024 | 16.097 | S |

**Graph 1:** Mean comparison of flexural strength (Newtons) for Group A provisional materials at different time intervals.




## Discussion

Provisional restorations in an important part of the fixed prosthodontic rehabilitation.[9-12] These materials should not only satisfy the mechanical requirements such as strength and resistance to wear but also meet the biologic and esthetic demands.[13-18] Provisional materials generally exhibit low fracture strengths, particularly when the patient needs to use the provisional restoration for an extended period, when the patient has: para functional habits, or when a long-span prosthesis is planned. The purpose of this study was to compare the flexural strength of four temporary restorative materials available commercially at 24 hours, 7 days and after repair. Two poly methyl methacrylate based materials (DPI and Trulon) and two bis-acrylic based composite resins (Protemp, and Luxatemp) were chosen. A total of 60 specimens of specific dimensions were prepared from these materials and were divided into 2 groups (based on the type of material). All specimens were stored in artificial saliva and divided into 2 sub-groups based on the duration of immersion in artificial saliva. The first set of samples was fractured after 24 hours and the second, after 7 days of storage in the medium using Universal Testing machine. The fractured samples from the 7 day study were then subjected to repair. A uniform space of 2 millimeter and a 45° bevel was maintained for all the repaired specimens for better distribution of forces. Flexural strength of these repaired samples was recorded using the same machine. Results were recorded and statistically analyzed by one way Anova and Bonferroni Post hoc tests. Results revealed that the highest flexural strength exhibited by protemp a bis-acryl composite resin material, However, there was no significant difference between the poly methyl methacrylate and bis-acrylic resins materials at 24 hours and 7 days time intervals. A substantial decrease was noticed in the strength of bis-acrylic composite resins after repair.

## Conclusion

Within the limitations of this study, following conclusions can be drawn: At 24 hour interval, the differences between the flexural strength of all the materials was insignificant. However, the highest flexural strength was exhibited by Protemp, a bis acryl composite resin material. At 7 day interval, no difference in flexural strength was seen for all the materials except protemp which displayed a significant decrease in the flexural strength at this time interval. A

non significant difference inflexural strength wasseenforallthematerials (both PMMA based and bis-acrylic based materials) from 24 hours to 7 days. A highly significant difference in flexural strength was noted between both the groups, PMMA and bis-acrylic materials after repair. Bis-acryl composite resins demonstrated a significant reduction in the mean of flexural strength values as compared to the PMMAbased materialswhenthey were subjected to repair. Within the limitation of the current study, it can be concluded that since poly methyl methacrylate and bis-acryl composite resins have similar flexural strengths at 24 hours and7days, both can be used to fabricate the provisional restorations. However, in the event of a fracture of a bis-acrylic provisional restoration, it may be more advantageous to make a new provisional restoration than to repair the fractured one.

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