

Comparison of Flexural Strength and Elastic Modulus of Two Different Provisional Restorative Materials used in Fixed Prosthodontics: An in-Vitro Study

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Abstract:- Provisional restorative materials are widely used in fixed partial denture prosthodontics. It should provide occlusion while offering aesthetic restoration to the abutment tooth to avoid compromising patient's social relationship. Extensive prosthetic treatment requires temporary restorations with high mechanical strength for long-term use. When restorations replace several teeth, in a long span, the strength and stability of the prostheses are critical, and fractures may occur, so that fracture strength of temporary restorations is directly related to the flexural strength and the elastic modulus.

The purpose of this study is to evaluate and compare flexural strength and elastic modulus of two different provisional restorative materials (Integrity & Revotek) are tested after storing in artificial saliva for one week, three weeks and one month. Three point flexural tests were carried out in the universal testing machine to calculate the flexural strength and elastic modulus.

Materials and Methodology: A total of 60 specimens, 25mm in length, 2mm in breadth, 2mm height will be made with 6 groups of provisional restorative material. A custom-made metallic mould is used to retrieve standard sized specimens of dimensions, 25mm in length, 2mm in breadth, 2mm height (ADA no.27). Tests were carried out for all the samples in the universal testing machine.

Results: Data was analysed by SPSS (Statistical Package for Social Sciences) version 20. [IBM SPASS statistics (IBM corp. Armonk, NY, USA released 2011)]. Inferential statistics like t- test were applied to check the statistical difference of elastic modulus and flexural strength among the groups. Anova was done to compare between the time intervals and post-hoc tukey test were done for pair-wise comparison between the groups. The level of significance was set at $p < 0.05$. There

is a statistical significant difference seen among flexural strength and elastic modulus of Integrity when compared to revotek at all the time intervals.

Conclusion: The study concluded that restorative material Integrity has more flexural strength when compared to revotek. Restorative material Integrity has more elastic modulus when compared to revotek.

Keywords:- Provisional restoration, flexural strength, elastic modulus, integrity, revote.

I. INTRODUCTION

Provisional restorative materials are widely used in fixed partial denture prosthodontics. It should provide occlusion while offering aesthetic restoration to the abutment tooth to avoid compromising patient's social relationship. A provisional restoration is kept in mouth for a short period till a final restoration or long-term fixed interim prosthesis is being fabricated. Usually provisional restorative materials are given for 20-30 days.^[1]

Flexural strength of a material is the ability by virtue of which it can oppose deformation likely to be imparted to it under application of load. Flexural strength is also important when these restorations are worn over a long period of time to assess the results of periodontal, endodontic, and temporomandibular joint dysfunction therapies and during the restorative phase of implant reconstructive procedures.^[2]

Provisional restorations serve a variety of purposes, including covering exposed dentine to prevent sensitivity and plaque build up, to prevent unintentional tooth movement, to maintain function properly, to facilitate oral hygiene, to prevent gingival overgrowth, to provide an adequate interim appearance, and to assess the impact of occlusal and aesthetic changes^[3].

II. MATERIALS AND METHODS

A. Materials

SL.NO	MATERIAL
1	Integrity® (DENTSPLY) Bis-acrylic composite based autopolymerized provisional restorative material
2	Revotek™LC- (GC DENTAL PRODUCTS CORP, JAPAN) Urethane dimethacrylate based light polymerized provisional restorative material
3	Artificial saliva

B. Sample size:

A total of 60 specimens, 25mm in length, 2mm in breadth, 2mm height was prepared with 6 groups of provisional restorative material.

C. Dimension of test specimen:

A custom made metallic mould was used to retrieve standard sized specimens of dimensions, 25mm in length, 2mm in breadth, 2mm height (ADA no.27).⁴

D. Grouping:

Group Ia : Integrity® immersed in artificial saliva for 1 week

Group Ib :Integrity® immersed in artificial saliva for 3 weeks

Group Ic: Integrity® immersed in artificial saliva for 1 month

Group Ra: Revotek™immersed in artificial saliva for 1 week

Group Rb :Revotek™immersed in artificial saliva for 3 weeks

Group Rc: Revotek™ immersed in artificial for 1 month

of 25x2x2 mm to which the materials under study is fabricated. The provisional crown materials were mixed according to manufacturer’s instructions, and were injected into the metallic mould.

The light polymerized provisional crown material was supplied in a paste form. The material was packed in the mould and after the mould was filled with resin, glass plate was placed over it and was light cured for forty seconds with a light cure unit. The glass plate was then removed and the sample was retrieved.

The auto polymerized provisional crown material was supplied in a paste form. After the mixing had commenced, the sample was retrieved from the mould. Excess resin was removed from all the three types of samples using fine grit abrasive paper and dimensions were confirmed using an electronic vernier caliper.

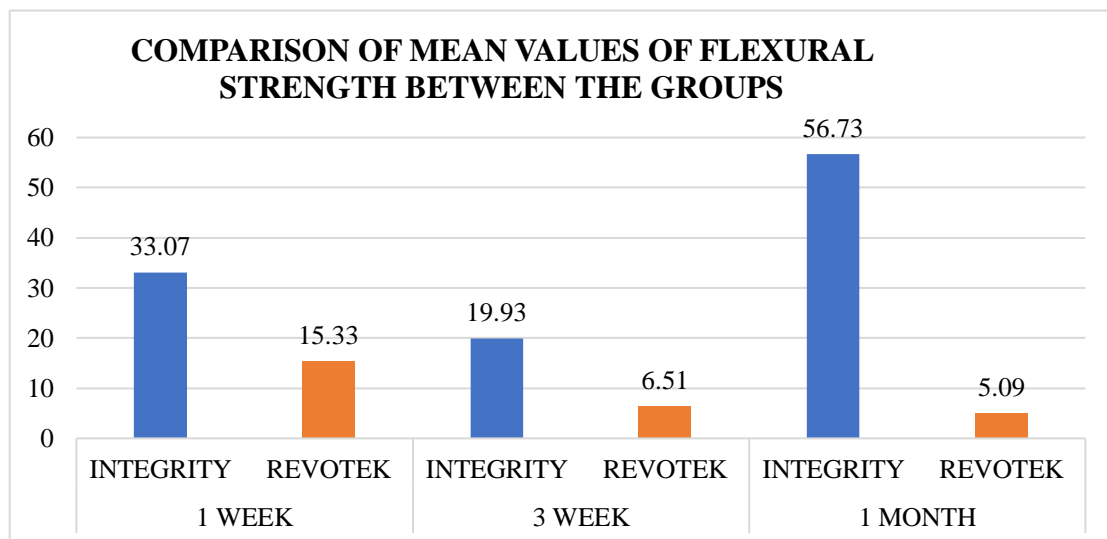
60 samples with dimensions of 25x2x2mm (American National Standards Institute/American Dental Association specification no. 27) of the two materials were prepared in a similar way.

III. METHODOLOGY

An in-vitro study was conducted to compare the flexural strength and elastic modulus of two different provisional restorative materials used in fixed prosthodontics” bis-acrylic composite based auto polymerized provisional restorative material and urethane dimethacrylate based light polymerized restorative material.A metallic master mould was made with dimension

IV. RESULTS

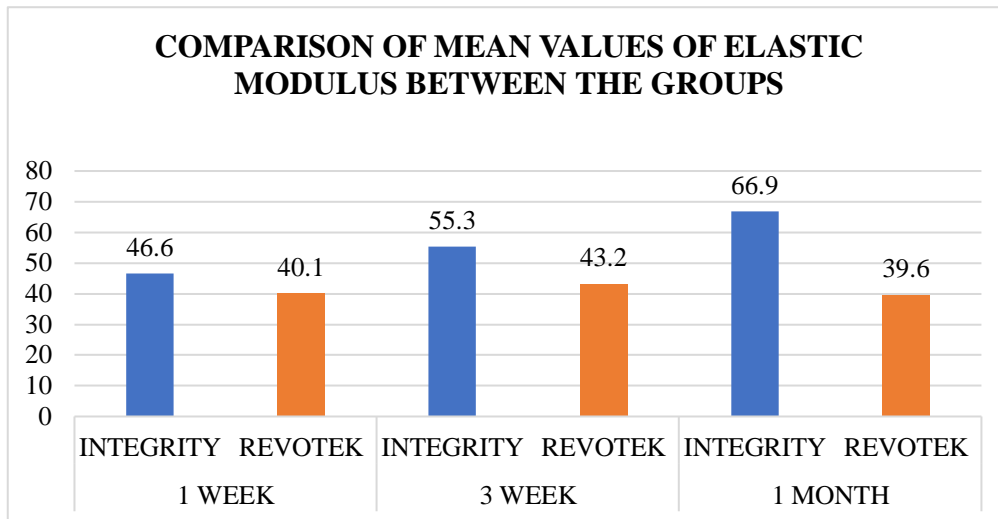
Comparison of flexural strength between the groups at different time intervals



Graph 1: Comparison of Mean Values of Flexural Strength between the Groups

- Inference:** The mean values of flexural strength of Integrity were more when compared to revotek and there is significant difference between the groups at all the time intervals.

Comparison of elastic modulus between the groups at different time intervals



Graph 2: Comparison of Mean Values of Elastic Modulus Between The Groups

- **Inference:** The mean values of elastic modulus of Integrity were more when compared to revotek and there is significant difference between the groups at 3 week and 1 month time intervals

V. DISCUSSION

Provisional restorations are essential elements of fixed prosthodontic treatment. Provisional restoration must accomplish several functions for the duration of the use in the mouth. They should shield pulpal tissue against physical, biochemical and thermal injuries, maintain positional stability and occlusal function, should provide strength, retention and aesthetics for the prepared teeth. In addition, they may be used for correcting irregular occlusal plane, altering vertical dimensions and changing the contour of the gingival tissue.⁵

The flexural strength and elastic modulus were used as these are important parameters, providing an estimate of the clinical performance of the restorations subjected to masticatory forces. Flexural strength values obtained in laboratory tests, under static loads, may not reflect the conditions present in the oral cavity, but are useful to compare materials that have been tested in controlled settings.

The elastic modulus is a constant that relates stress and strain in the linear elastic region, and it is the measurement of the stiffness of a material in relation to stress transfer. The lower the deformation for a given tension is, the higher the elastic modulus value. Materials used to fabricate temporary restorations must have high elastic modulus, because the lack of rigidity makes the polymer structure bend, causing the material to fracture. The elastic modulus of the fibres must be higher than that of the matrix, since the higher the elastic modulus of the fibre, the more stress is absorbed without deformation.⁶

In the present study the mean values of elastic modulus of Integrity were more when compared to revotek and there is significant difference between the groups at 1 week, 3 weeks and 1 month time intervals.

This present study stated that the mean value of elastic modulus of integrity at 1 week was 46.6 and it has been increased to a mean value of 66.9 by the end of 1 month. There is a statistical significant difference between the time interval of elastic modulus. The mean value of elastic modulus of Revotek at 1 week was 40.1 and it has been decreased to a mean value of 39.62 by the end of 1 month. There is no statistical significant difference between the time interval of elastic modulus.

VI. CONCLUSION

The present study was done to compare flexural strength and elastic modulus of two different provisional restorative materials integrity and revotek used in fixed prosthodontics.

- Restorative material Integrity has more flexural strength when compared to revotek
- Restorative material Integrity has more elastic modulus when compared to revotek
- There is a change in the flexural strength and elastic modulus of integrity at different time intervals.
- There is no change in the elastic modulus of revotek, but there is change in the flexural strength at different time intervals.

REFERENCES

- [1.] Regish KM, Sharma D, Prithviraj DR. Techniques of fabrication of provisional restoration: an overview. *Int J Dent.* 2011; 134659
- [2.] Anca jivanescu, dianahrelescumihutescu, lucianagoguta, liviudanielpirvulescu, *materialsplasticer* 2016 (3):56
- [3.] Krastl et al. Trauma and Endodontic management *International Endodontic Journal*, 54, 1221–1245.
- [4.] D'Souza D, Dua P. Rehabilitation strategies for partially edentulous-prosthodontic principles and

- current trends. Med J Armed Forces India. 2011 Jul;67(3):296-8.
- [5.] Singh A, Garg S. Comparative Evaluation of Flexural Strength of Provisional Crown and Bridge Materials- An Invitro Study. J Clin Diagn Res. 2016 Aug;10(8):ZC72-7.
- [6.] Orsi IA, Soares RG, Villabona CA, Panzeri H. Evaluation of the flexural strength and elastic modulus of resins used for temporary restorations reinforced with particulate glass fibre The Gerodontology Society and John Wiley & Sons A/S, Gerodontolgy2012;29: e63–e68e63).
- [7.] Poonacha V, Poonacha S, Salagundi B, Rupesh PL, Raghavan R. In vitro comparison of flexural strength and elastic modulus of three provisional crown materials used in fixed prosthodontics. J Clin Exp Dent. 2013 Dec 1;5(5):e212-7.