ORIGINAL RESEARCH

Assessment of retention force of ZrO2, PEEK, and ZrO2-PEEK telescopic attachment for mandibular overdentures

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ABSTRACT
Background: Prolonged edentulism leads to progressive alveolar bone loss resulting in failure in complete denture treatment modality. This study compared ZrO2, PEEK, and ZrO2-PEEK telescopic attachments in terms of retention of overdenture. **Materials & Methods:** 60acrylic resin model of lower arch were divided into 3 groups of 20 each. Group I was those in which primary and secondary crown were prepared from all zirconia (ZrO2), group II were made up of all PEEK and group III were made up of ZrO2-PEEK. **Results:** The mean initial retention value in group I was 14.5 N, in group II was 15.8 N and in group III was 21.7 N. The difference was significant (P< 0.05). The mean final initial retention value in group I was 14.8 N, in group II was 14.1 N and in group III was 17.4 N. The difference was significant (P< 0.05). **Conclusion:** Authors found that zirconia resulted maximum retention as compared to other telescopic crown materials.
Key words: Dental implant, Telescopic crown, Zirconia oxide,

INTRODUCTION

Prolonged edentulism leads to progressive alveolar bone loss resulting in failure in complete denture treatment modality.[1] With the change in dietary habits, there is early loss of teeth. Few missing teeth can be replaced with either removable partial denture, fixed partial denture or using dental implants. Rehabilitation of completely edentulous patients with complete dentures has improved the quality of life. Factors such as time duration between tooth loss and fabrication of denture, ridge morphology etc.[2] play an important role in deciding treatment outcome. However, there are lots of complaints regarding complete denture and geriatric patients are never fully satisfied.[3] Denture irritation from denture flanges, poor denture stability, retention, support, pain etc. are few issues for which patients frequently visit dentists.[4] Resilient telescopic attachments are prepared from multiple materials available in the market. Zirconia is the materials of choice for primary and secondary copings.[5] The high resistance to mechanical and tensile forces makes it superior as compared to other materials. Also, Polyetheretherketone (PEEK) is useful material widely used for resilient telescopic attachments. It is a thermoplastic polymer because having sufficient biocompatibility. Implant supported overdentures with three to four implants are sufficient in offering desired results.[6]This study was conducted to compare ZrO2, PEEK, and ZrO2-PEEK telescopic attachments in terms of retention of overdenture.

MATERIALS & METHODS

This invitro study comprised of 60acrylic resin model of lower arch. Twonobel care dental implants with the dimensions 12.5 mm X 4.0 mm were placed in canine region of all models and two dual models of 4.0 mm (width) X 4.0 mm (length) and 1.5 mm gingival length was screwed in dental implants. Models were divided into 3 groups of 20 each. Group I was those in which primary and secondary crown were prepared from all zirconia (ZrO2), group II were made up of all PEEK and group III were made up of ZrO2-PEEK.

Resilient telescopic attachment having occlusal height (3 mm) and gingival height (2 mm) were prepared and scanned with CAD/ CAM technology. A 4-degree taper was given along with maintaining the parallelism. Semi-sintered ZrO2 blanks were used for milling the primary ZrO2 crowns and BioHPP blanks for primary PEEK crowns. Cementation of primary crowns was aided with zinc phosphate (ZnPo4) cement.

Primary crowns along with all models were scanned with maintaining parallelism of walls along with occlusal space (0.3 mm) and wall thickness (0.5 mm). Secondary ZrO2 crowns and PEEK crown were milled. Following same insertion path, secondary crowns were fitted on primary crowns and to the fitting surface of overdenture with auto-polymerized acrylic resin. Universal testing machine using crosshead speed of 60 mm per minute and load cell of 3.5 KN was used for measuring the retention forces. Initial retention (maximum retention) force was recorded. Data thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I: Assessment of initial retention values

Groups	Mean	P value
Group I	14.5	0.04
Group II	15.8	
Group III	21.7	

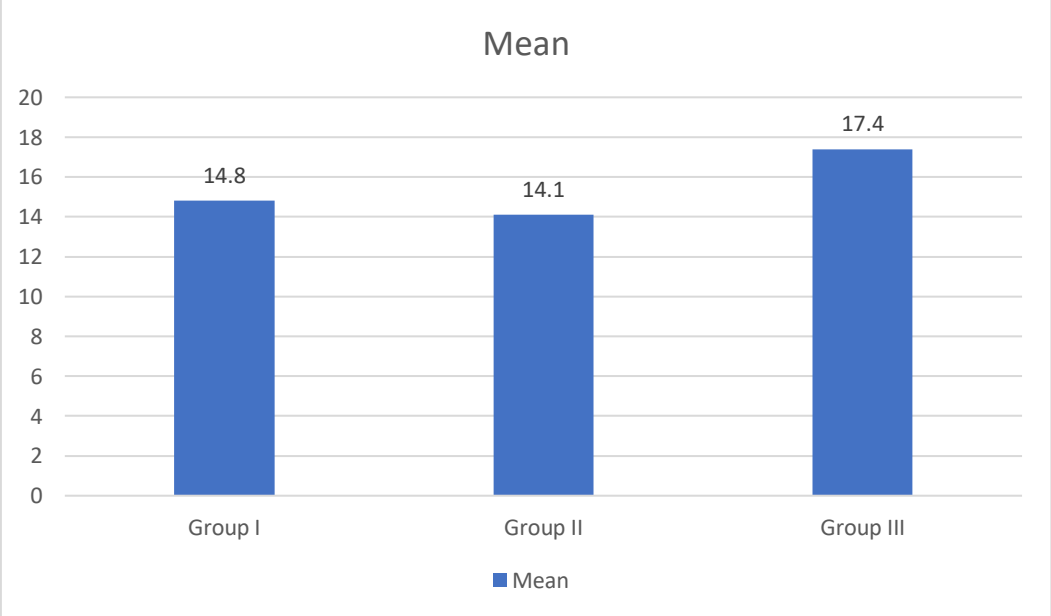
Table I shows that mean initial retention value in group I was 14.5 N, in group II was 15.8 N and in group III was 21.7 N. The difference was significant (P< 0.05).

Table II: Assessment of final retention values

Groups	Mean	P value
Group I	14.8	0.05
Group II	14.1	
Group III	17.4	

Table II, graph I shows that mean final initial retention value in group I was 14.8 N, in group II was 14.1 N and in group III was 17.4 N. The difference was significant (P< 0.05).

Graph I: Assessment of final retention values



DISCUSSION

Implant supported denture has revolutionized the field of prosthodontics. The shortcomings of conventional complete dentures have been overcome by it.[7] The denture retention, stability and support are excellent with it. Even severely resorbed ridges where conventional complete denture poses difficulties, may be well managed with implant supported denture. The stability, retention capacity of implant supported over denture is more as compared to conventional denture.[8] Bar–clip constructions or non-splinted concept attachments are used for retaining these overdentures.[9] Telescopic attachments are designated as double crowns or crown and sleeve coping (CSC). The primary telescopic coping is attached to the abutment and secondary coping is coupled to a detachable

prosthesis.[10]This study was conducted to compare ZrO2, PEEK, and ZrO2-PEEK telescopic attachments in terms of retention of over denture.

Three materials such asall zirconia (ZrO2) in group I, PEEK in group II and ZrO2-PEEK in group III were selected. Rutkunas et al[11] in their study a significant difference between the initial and final retention between all groups was shown due to significant wear occurred in all groups after simulating 6 months of overdenture use where simulation was done in the axial direction only that leaded to selective wear of certain to surfaces of attachments.

We observed that mean initial retention value in group I was 14.5 N, in group II was 15.8 N and in group III was 21.7 N. The mean final initial retention value in group I was 14.8 N, in group II was 14.1 N and in group III was 17.4 N. Hegazy et al[12] in their study on resilient versus rigid telescopic attachment for two implants assisted complete mandibular overdentures observed higher mean stress on distal, labial and mesial surfaces of the implants in the rigid design model in comparison to resilient design models I and II. The palatal surface of implant in the resilient design models I and II demonstrated more stress as compared to rigid design model and the difference found to be highly significant.

Alsabeeha et al[13] found that under invitro situations, most of attachment systems in implant supported overdentures show decrease retention force over period of time. The reason for this retention loss was wear. Besimo et al[14]investigated the long-term effects of commercially pure titanium on the retention force of telescope crowns with conical interface. Combinations of various materials for the inner and outer crowns were tested. Telescope crowns of pure titanium showed retention force characteristics comparable to telescope crowns fabricated conventionally in a precious alloy.

CONCLUSION

Authors found that zirconia resulted maximum retention as compared to other telescopic crown materials.

REFERENCES

1. B. Uludag, V. Sahin, O. Ozturk. Fabrication of zirconium primary copings to provide retention for a mandibular telescopic overdenture: a clinical report. Int J Prosthodont 2008;21:509-510.
2. M. Elsayed, K. Sultan, H. Abd EL hameed, A. Elsayed. Detection of bacterial colonization around cobalt chromium versus zirconium copings on natural teeth supporting overdenture. Two different in vitro studies. J Am Sci 2012; 8: 799-803.
3. N.M. Bühler, E. Teubner, C.P. Marinello. Zirconia in removable prosthodontics. A case report. Schweiz Monatsschr Zahnmed 2011;121: 659-678.
4. Bueno-Samper, M. Hernández-Aliaga, J.L. Calvo-Guirado. The implant supported milled bar overdenture: A literature review. Med Oral Patol Oral Cir Bucal 2010; 15:375-378.
5. M. Degidi, L. Artese, A. Scarano, V. Perrotti, P. Gehrke, A. Piattelli. Inflammatory infiltrate, microvessel density, nitric oxide synthase expression, vascular endothelial growth factor expression, and proliferative activity in peri-implant soft tissues around titanium and zirconium oxide healing caps. J Periodontol 2006;77:73-80.
6. P. Steyern, S. Ebbesson, J. Holmgren, P. Haag, K. Nilner. Fracture strength of two oxide ceramic crown systems after cyclic pre-loading and thermocycling. J Oral Rehabil 2006; 33: 682-689.
7. P. Manicone, P. Iommetti, L. Raffaelli. An overview of zirconia ceramics: basic properties and clinical applications. J Dent 2007; 35:819-826.
8. Rimondini L, Cerroni L, Carrassi A, Torricelli P. Bacterial colonization of zirconia ceramic surfaces: an in vitro and in vivo study. Int J Oral Maxillofac Implants. 2002; 17: 793-8.
9. El Charkawi H, Zekry K, Elwaked M. Stress analysis of different osseointegrated implants supporting distal extension prosthesis. J Prosthet Dent 1994;72(6):614–622.
10. Beuer F, Edelhoff D, Gernet W, et al. Parameters affecting retentive force of electroformed doublecrown systems. Clin Oral Investig 2010;14(2):129–135.
11. Rutkunas V, Mizutani H, Takahashi H. Influence of attachment wear on retention of mandibular overdenture. J Oral Rehabil 2007;34:41-51.
12. Hegazy S, Gebreel A, Emera R. Resilient versus rigid telescopic attachment for two implants assisted complete mandibular overdentures: in vitro stress analysis study. Egypt Dent J 2014;60: 725–732.
13. Alsabeeha NH, Payne AG, Swain MV. Attachment systems for mandibular tow – implant overdentures: A review of in vitro investigation on retention and wear features. Int J Prosthodont. 2009; 22(5):429-440.
14. Besimo Ch, Graber G, Fluher M: Retention force changes in implant-supported titanium telescope crowns over long-term use in vitro. J Oral Rehabil 1996;23:372-378.