

International Journal of Research in Health and Allied Sciences

Journal home page: www.ijrhas.com

Official Publication of "Society for Scientific Research and Studies" [Regd.]

ISSN 2455-7803

Index Copernicus value 2016 = 68.10

Original Article

Comparison of Retention of Zirconia Coping Luted with Different Cement- An in vitro study

Pranjali Dutt¹; Pooran Chand², Vidhi Srivastava³, Balendra Pratap Singh⁴

^{1,3}Senior Resident; ²HOD, ⁴Associate Professor; Department of Prosthodontics, Faculty of dental sciences, KGMU Lucknow, U.P., India

ABSTRACT:

Background: The advent of dental implants has revolutionarized the field of dentistry due to success rate with the modality. The present study was conducted to compare different luting agents with zirconia crowns. **Materials & Methods:** The present study was conducted in the department of Prosthodontics. It comprised of 4 titanium abutments with 32 zirconia copings. Titanium and zirconia abutments were torqued at 35 N/cm onto implant analogs. Samples were divided into 2 groups. Group I consisted of 2 titanium abutments with 16 zirconia copings. Group II had also similar number of abutments and copings and three luting agents were used. The cemented copings were subjected to tensile dislodgement forces. **Results:** In group A, glass ionomer cement was used as luting agent, in group B, zinc oxide noneugenol was used as luting agent and in group C, resin cement was used as luting agent. The mean tensile force (N/cm) in glass ionomer cement was 96.23, in zinc noneugenol was 18.11 and in resin was 543.17. The difference was significant ($P < 0.05$). The mean tensile force with zirconia crown was 262.3 N/cm and with titanium crown was 191.5 N/cm. The difference was significant ($P < 0.05$). **Conclusion:** Resin cement exhibited higher tensile force than other cements. Zirconia implants abutments found to have high tensile force as compared to titanium implant.

Key words: Resin, Titanium, Zirconia.

Received: 12 January 2018

Revised: 14 February 2018

Accepted: 15 March 2018

Corresponding Author: Dr. Pranjali Dutt, Senior Resident, Department of Prosthodontics, Faculty of dental sciences, KGMU Lucknow, U.P., India

This article may be cited as: Dutt P; Chand P, Srivastava V, Singh BP. Evaluation of Retention of Different Attachment System used in Implant Retained Overdenture. Int J Res Health Allied Sci 2018; 4(2):74-76.

INTRODUCTION

The management of edentulous area is now not considered to be complicated. The advent of dental implants has revolutionarized the field of dentistry due to success rate with the modality. Main goals of restorations in modern dentistry are optimal function and esthetics. Clinical decisions are not only limited to the selection of the type of implant but also the type of abutment and cement used. Initially, implant-supported prostheses were exclusively retained by screws, but with the development of new implant systems and rehabilitation techniques cement retained prostheses have become popular treatment option.¹ Zirconia, a high strength ceramic, was introduced for dental applications. This ceramic has several properties such as esthetic and high functional demands thus making it popular amongst patients as well as dentists.² There are several

challenges while inserting zirconia crowns in patients. Restoring posterior teeth with zirconium oxide ceramics is a very challenging subject, as two problems are associated with these restorations. The first is related to the abutment teeth, because results of clinical and lab studies indicated that molars were occasionally overtapered during tooth preparation, resulting in lack of resistance and retention form. The second is related to zirconia restorations. zirconia was not found to be bonded to an abutment tooth because it cannot be etched, and it does not contain silica in its structures to bond to a silane coupling agent like other all-ceramic systems.³ Limitations associated with the cement retained implant restorations include low profile retention, when there is limited interarch space, retrievability, and presence of cement in the sulcus. Commercially, pure titanium has been

widely used as an abutment material in implant therapy because of its well documented biocompatibility and mechanical properties.⁴ The present study was conducted to compare different luting agents with zirconia crowns.

MATERIALS & METHODS

The present study was conducted in the department of Prosthodontics. It comprised of 4 titanium abutments with 32 zirconia copings. The study was approved by the ethical committee of the institute.

Implant analogs were embedded in acrylic resin blocks, titanium and zirconia abutments were torqued into implant analogs. Acrylic resin blocks were fabricated to facilitate mounting the specimen on tensile strength testing machine. Implant analogs were embedded into acrylic block.

An 8 mm diameter hole was drilled at the end of acrylic block to facilitate mounting the specimen on tensile testing machine. Implant analogs were embedded, and abutments

were torqued at 35 N/cm. Samples were divided into 2 groups. Group I consisted of 2 titanium abutments with 16 zirconia copings. Group II had also similar number of abutments and copings. Both groups were randomly divided into 3 groups. In group A, glass ionomer cement was used as luting agent, in group B, zinc oxide noneugenol cement was used as luting agent and in group C, resin cement was used as luting agent.

Specimens were stored at room temperature for 24 h and immersed in artificial saliva, after which specimens were thermo cycled 100 times between 5°C and 55°C with a dwell time of 10 s, dried and subjected to retention test. The cemented copings were subjected to tensile dislodgement forces using crosshead speed of 0.5 mm/min until cement failure occurred. Results thus obtained were subjected to statistical analysis using chi- square test. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of cements

Group A	Group B	Group C
Glass ionomer	Zinc noneugenol	Resin

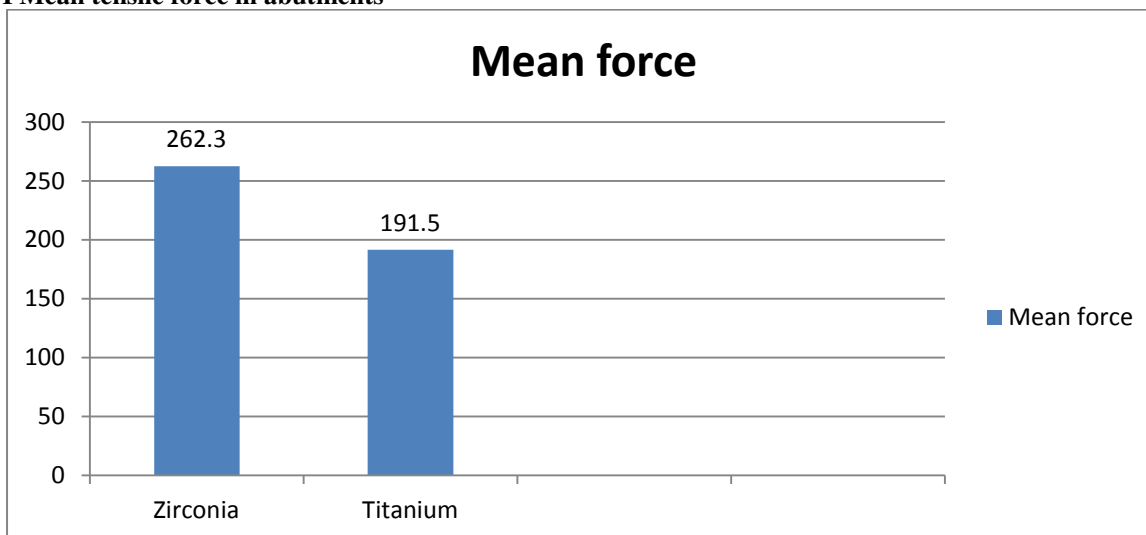
Table I shows that in group A, glass ionomer cement was used as luting agent, in group B, zinc oxide noneugenol was used as luting agent and in group C, resin cement was used as luting agent.

Table I Mean tensile force in all cements

Cement	Mean	S.D	P value
Glass ionomer	96.23	29.80	0.01
Zinc noneugenol	18.11	5.24	
Resin	543.17	114.21	

Table I shows that mean tensile force (N/cm) in glass ionomer cement was 96.23, in zinc noneugenol was 18.11 and in resin was 543.17. The difference was significant (P< 0.05).

Graph I Mean tensile force in abutments



Graph I shows that mean tensile force with zirconia crown was 262.3 N/cm and with titanium crown was 191.5 N/cm. The difference was significant (P< 0.05).

DISCUSSION

The most commonly used material in all ceramic being zirconia due to its high flexibility, fracture toughness, biocompatibility, and excellent esthetics. Zirconia abutments in comparison with titanium abutments enhance the esthetic effect especially in case of maxillary anterior implants, since they do not allow display of metal, unlike titanium abutments.⁵

The shear bond strength of different cements on a zirconium oxide surface after different pretreatments has been examined and measured; the results of these studies presented varying and controversial results. Blatz et al⁶ in their study found that resin cement containing an adhesive phosphate monomer 10-Methacryloyloxydecyl dihydrogen phosphate (MDP) provided the highest shear bond strength values. On the other hand, a shear bond strength study by Piwowarczyk et al⁷ found that after airborne-particle abrasion, RelyX Unicem resin cement provided the highest shear bond strength mean value.

In this study, in group A, glass ionomer cement was used as luting agent, in group B, zinc oxide noneugenol was used as luting agent and in group C, resin cement was used as luting agent. The mean tensile force (N/cm) in glass ionomer cement was 96.23, in zinc noneugenol was 18.11 and in resin was 543.17. This is similar to Wolfart et al.⁸

In a study by Kern M et al⁹, titanium and zirconia abutments were torqued at 35 N/cm onto implant analogs. The samples were divided into two groups. Group A consisted of four titanium abutments and 32 zirconia copings and Group B consisted of four zirconia abutments and 32 zirconia copings and four luting agents were used. The cemented copings were subjected to tensile dislodgement forces. Zirconia abutments recorded a higher mean force compared to titanium. Among the luting agents, resin cement recorded the highest mean force followed by zinc phosphate, glass ionomer, and noneugenol zinc oxide cement, respectively.

Akshay et al¹⁰ in their study, 72 extracted human molars were collected, cleaned and divided into two groups. All teeth were prepared with a 15° total convergence angle for group 1 and a 30° total convergence angle for group 2, a flat occlusal surface, and approximately 4-mm axial length. Each group was divided by surface area into three subgroups. All zirconia copings were abraded with 50- μ mAl₂O₃, then cemented using Panavia F 2.0 (PAN-1) (PAN-2) Rely X Unicem (RXU-1) (RXU-2), and Clearfil SA (CSA-1) (CSA-2). After cementation, the copings were thermocycled for 5000 cycles between 50°C and 55°C with a 15-second dwell time. Then the copings were subjected to dislodgment force in a universal testing machine at 0.5 mm/min. The force of removal was recorded, and the dislodgement stress was calculated.

Mode of failure was mixed, with cement remaining principally on the tooth for PAN. For CSA and RXU, mode of failure was mixed with cement remaining principally on the zirconia copings.

We found that mean tensile force with zirconia crown was 262.3 N/cm and with titanium crown was 191.5 N/cm. Mansour et al¹¹ found that the rank order of cement retentiveness differed when tested on implants rather than on natural teeth. Among the four types of cements used to lute Zirconia copings, resin cement showed the highest mean force when used with zirconia as well as titanium abutments. The higher mean retention of resin cement, when used along with Zirconia abutments, is due to the presence of adhesive phosphate monomer in the resin cement that enhances the bonding between them.

CONCLUSION

Zirconia implants abutments found to have high tensile force as compared to titanium implant. Similarly, resin cement exhibited higher tensile force than other cements.

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Source of support: Nil

Conflict of interest: None declared

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