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Determining the Best Long-Term Luting Cement for Implant Retained Prosthesis Based on Bond Strength and Surface Integrity

Sanno Singh[1], Pronob Kumar Sanyal[2*], Abhijeet Kore[3], Karuna Pawashae[4], Shivsagar Tewary[5], Amit Jadav[6]

Abstract

Implant-retained prostheses play a crucial role in modern dentistry, necessitating reliable luting cements to ensure their longevity and functionality. This study aimed to determine the best long-term luting cement for implant-retained prostheses based on bond strength and surface integrity. The success of implant-retained prostheses relies heavily on the quality of the luting cement used to secure the restoration to the implant abutment. The investigation will employ a series of standardized bond strength tests, such as shear and tensile bond strength assessments, to evaluate the adhesive properties of each luting cement when applied to implant abutments and prosthesis components. Five commonly used luting cements were evaluated for their bond strength and surface integrity over an extended period. A series of laboratory tests, including tensile bond strength testing and surface analysis, were conducted to assess the performance of each luting cement. Results revealed significant variations in bond strength and surface integrity among the tested cement. The findings of this study provide valuable insights into selecting the most suitable luting cement for the long-term stability and durability of implant-retained prostheses.

Keywords: Luting cement, implant-retained prosthesis, bond strength, surface integrity, long-term stability, dental materials, Polymerised.

INTRODUCTION

Implant-supported fixed prostheses are commonly recommended by clinicians and sought after by patients. When attaching implant prostheses to implants, there are primarily two systems available: screw-retained and cement-retained implant-supported restorations.[1]

Each system, whether screw-retained or cement-retained, possesses distinct advantages and disadvantages that are contingent upon the specific clinical scenario. In certain cases, one retention type may be more suitable than the other based on various factors. [2].

Screw-retained implant-supported prostheses have the disadvantage of screws loosening or breakage and the aesthetics of screw-retained prostheses might be compromised if the access opening is situated close to the facial surface. With cement-retained implant-supported prostheses damage to implant and superstructures

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during Re-trievation of the cast restoration is the main disadvantage. Sometimes, retrieval is necessary for intervention therapy and for the maintenance of supporting tissues and implants. The use of either a provisional luting agent or a screw should facilitate easy retrieval.[3] Proper retention of prostheses in cement-retained implant-supported prostheses predominantly relies on the luting cement utilized for cementation. The clinical success and longevity of dental prostheses can be influenced by various factors, including the luting cement and the cementation procedure. These factors rely on the chemical composition of the cementing agent and the surface texture of both the adhesive surface and the strength of the luting cement. [4] Selection of the best cement with balanced properties which is required for a particular prosthesis is an integral part of success of any cement retained prosthesis. So, through knowledge about cement 's mechanical properties and effects of cement on the physical properties of prosthesis is necessary which can affect longevity of Cementation and prosthesis.

The shear strength of a material refers to its capacity to withstand forces that induce sliding of the material's internal structure against itself. It can be measured in vertical and horizontal direction. Surface corrosion can influence the shear strength of an object, due to Thinning resulting in reduction of cross-sectional area of component, thus causing reduction in its shear strength.[5]

There are studies on different aspects of luting cements used for implant, [6] the most important part of any luting cements used with implant retained prosthesis is their bond strength and effect of luting cements on longevity of implant abutment and prostheses.

Effect of luting cements chemical properties on surface texture of titanium abutment and cobalt chromium alloys are the most important aspect that should be evaluated or should be known for making the right choice for luting cements for implant retained prostheses.[5]

This in-vitro study aims to comparatively assess the bonding resistance and surface texture, post-thermocycling and aging, of cobalt-chromium alloy duplication luted to titanium alloy fixture using various luting cements.

In this study most commonly used luting cements - glass polykenoate cement (gc gold lable), zinc phosphate cement (de trey zinc) and non-eugenol zinc oxide cement (templute) are used, these three are the most common luting cements which will be evaluated in this study. In this study thermocycling and autoclave aging will be done to evaluate effect of long-term using time on bonding resistance of luting cements and surface texture of Co-Cr coping and titanium alloy abutment.[7]

Null hypothesis is – there is no difference among bonding resistance and effect on surface texture of titanium alloy with three used luting cements glass inomoer cement (gc gold lable), zinc phosphate cement (de trey zinc) and non-eugenol zinc oxide cement (templute). The aim of this study is to evaluate and compare the bonding resistance of three distinct luting agents following one year of thermocycling, as applied for the cementation of Co-Cr crowns on titanium alloy abutments. Additionally, the study aims to analyze and contrast the surface texture of titanium alloy abutments after luting and one year of thermocycling. Furthermore, the study aims to assess and compare the bonding resistance of the same three luting agents after five years of aging, also for cementation of Co-Cr crowns on titanium alloy abutments. Finally, the study seeks to evaluate and contrast the surface texture of titanium alloy abutments following luting and five years of aging. These objectives are crucial for understanding the long-term performance and durability of different luting agents and their impact on the integrity of dental restorations.

MATERIALS AND METHODS

This research was carried out to comparatively evaluate the bonding resistance and surface texture after thermocycling and aging of cobalt-chromium alloy coping luted to titanium alloy abutment using various luting cements: an in-vitro investigation.

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This study was conducted in the Department of Prosthodontics and Crown and Bridge, School of Dental sciences, KIMSDU, Karad, Maharashtra and.

Material

The study utilized the following materials, instruments, and equipment:

a. ***Materials used.***

- Titanium alloy abutment (genesis, Aktiv straight titanium with 2mmLCollar-H)
- Implant analog (genesis)
- Cobalt-chromium alloy coping
- Glass polykenoate cement (gc gold label)
- zinc phosphate cement (de trey zinc)
- Non-eugenol zinc oxide cement (templute)
- Gutta Purchas
- DPI cold cure acrylic denture base resin

b. ***Instruments & types of equipment used.***

- Hex and Ratchet
- Mixing spatula and pad (GDC, India))
- Universal testing machine
- Autoclave unit
- Thermocycling unit (praj Metallurgy labs, Pune, India)
- Surface roughness (Ra) profilometer (Mitutoyo SJ-210, Mitutoyo Corporation, Tokyo, Japan)

c. ***Methodology***

It was carried out in several steps described below:

1. Description of sample used in the study.
2. Sample size determination.
3. Sample distribution for the study.
4. Mounting of implant analog (genesis) on cold cure-polymerized acrylic resin block.
5. Attachment of Implant abutment (genesis) on implant analog (genesis).
6. Fabrication of cobalt -chromium alloy coping.
7. Cementation of Cobalt-chromium alloy coping Co-Cr Coping on Implant abutment (genesis) with luting cements.
8. Thermocycling of group A specimens.
9. Autoclave of group B specimens.
10. Shear bond test by Universal testing machine.
11. Evaluation of surface textures through stereomicroscope.
12. Tabulation of the results.
13. Statistical analysis.

1) Description of sample used in the study

The samples included various types of commercially available luting cements ie,

- Glass polykenoate cement (gc gold label)
- zinc phosphate cement (de trey zinc)
- Non-eugenol zinc oxide cement (templute)
- Two types of samples i.e

a. Thermocycling
b. Autoclave aging.

2) *Sample size determination*

- SAMPLE SIZE: Sample size determination done by using the formula.

$$n = \frac{(Z\alpha + Z_{\beta})^2 \; (S1^2 + S2^2)}{(m2 - m1)^2}$$

- Total sample size for each group will be -20.
- Total sample size for each subgroup will be-10.
- Total sample size – 60

3) *Sample distribution for the study*

- Samples will be divided in to three groups (for each group n=20)
  - Group-1 glass polykenoate cement (gc gold label)
  - Group-2 zinc phosphate cement (de trey zinc)
  - Group-3 non-eugenol zinc oxide cement (templute)

- Each group will be divided into two Subgroups (a) and (b). For each subgroup n-10
  - Subgroup 1 (A) – samples (n=10) after cementation with glass polykenoate luting cement will be thermos-cycled for one year.
  - Subgroup 2 (A) –samples (n=10) after cementation with zinc phosphate luting cement will be thermos-cycled for one year.
  - Subgroup3 (A)–samples(n=10) after cementation with non-eugenol zinc oxide luting cement will be thermos-cycled for one year.

1. Assess and contrast the bonding resistance of three luting agents after thermo cycling of one year used for cementation of Co-Cr crown on titanium alloy abutment with universal testing machine.
2. Assess and contrast the surface texture of titanium alloy abutment after luting and thermo cycling of one year used for cementation of Co-Cr crown on titanium alloy abutment with stereomicroscopy.
   - SUBGROUP 1(B) **–** Samples (n=10) after cementation with glass polykenoate luting cement will be aged for 5year in autoclave
   - SUBGROUP 2(B) **-** Samples (n=10) after cementation with zinc phosphate luting cement will be aged for 5 years in autoclave
   - SUBGROUP (B) **–**Samples (n=10) after cementation with non-eugenol zinc oxide luting cement will be aged for 5year in autoclave.

1. Assess and contrast the bonding resistance of three luting agents after aging of 5 years used for cementation of Co-Cr crown on titanium alloy abutment with universal testing machine.
2. Assess and contrast the surface texture of titanium alloy abutment after luting and aging of five year used for cementation of Co-Cr crown on titanium alloy abutment with stereomicroscope.

4) *Mounting of implant analog (genesis) on cold cure-polymerized acrylic resin block*

The research study was conducted using a cold cure-polymerized acrylic resin block on which implant analog (genesis) mounting was done. In this research study sixty implant analog was mounted on sixty auto-polymerized acrylic resin blocks.

5) *Attachment of Implant abutment (genesis) on implant analog (genesis)*

The titanium abutment was secured onto each implant analog using a hexagonal connection torqued to 35 N, and the occlusal openings of the abutments were sealed with gutta percha. The dimensions of the Genesis straight abutment were 7mm in length with a 2mm collar and an average diameter of 3.2mm.

6) *Fabrication of cobalt-chromium alloy coping*

The abutment scanning was performed using a laboratory scanner. Copings were then designed with software based on the scanned abutment, with a cement gap of 0.05 mm and a standardized metal

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thickness of 0.8 mm. Additionally, a loop attachment was incorporated onto the occlusal surface of each coping, with a loop diameter of 8.5 mm for testing on a universal testing machine.

7) *Cementation of Cobalt-chromium alloy coping Co-Cr Coping on Implant abutment (genesis) with luting cements*

Copings were cemented on the abutment by using luting cements according to recommendation of manufactures and cements were used according to sample distribution. In group A and group B- 1^{st} sub-group were cemented by glass polykenoate luting cements, 2^{nd} sub-group were cemented by zinc phosphate luting cement and 3^{rd} sub-group was cemented by non-eugenol zinc oxide cement.
49 N load were applied on each assembly by using universal testing machine for 10 min at room temperature on coping after cementation.

8) *Thermocycling (group-A specimens)*

Group-A samples underwent thermocycling, an internationally recognized aging procedure. This process involves subjecting test specimens to repeated cycles, alternating between immersion in 5°C cold water and 55°C hot water over a significant number of cycles. All n-30 sample of group-A were Thermo-cycled with Test Conditions:1000 Cycles, 5ºC & 55ºC, Dwell time 30 Seconds. i) 5º C: Make: LG, Model: 051SA ii) 55º C: Mahavir, India 1000 Cycles, 5ºC & 55ºC, Dwell time 30 Seconds. 1000 cycles simulate use of 1 year.

9) *Autoclave (group-B specimens)*

Group-B samples were subjected to autoclaving for aging, simulating accelerated aging conditions. The autoclave operated at 134°C under 2 bars of pressure for 1 hour, corresponding to approximately 3-4 years of aging at 37°C in the human body. Additionally, a subset of Group-B samples underwent autoclaving for 1 hour and 45 minutes, equivalent to 5 years of aging at 37°C.

10) *Shear bond test by Universal test.*

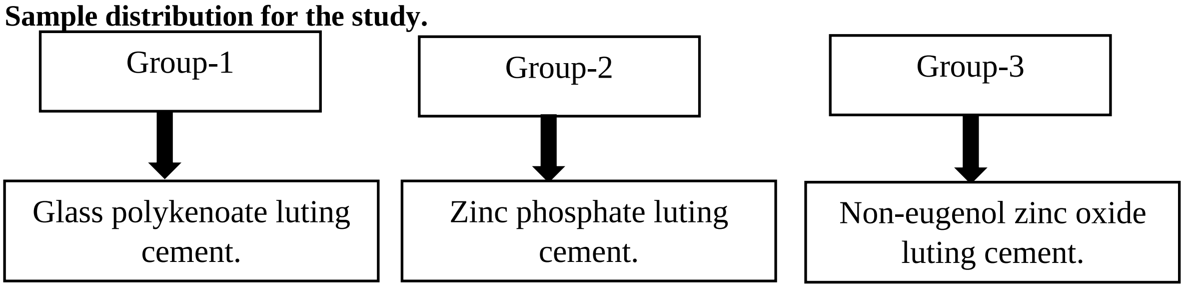
The bonding strength of all samples (n=60) was studied using a Universal Testing Machine (UTM). Each assembly was affixed to the UTM (Computerized, Software Based) manufactured by ACME Engineers, India, with the model UNITEST 10. The perfection of the machine was ±1%, and the testing speed was set at 1 mm/minute. Forces were applied to each assembly, and the resultant forces were recorded in Newtons (N). The recorded forces for debonding of coping with each abutment was divided by the area of abutment which is approximately 89.6mm² to record bonding resistance in MPa.

11) *Evaluation of surface textures through stereomicroscope.*

Surface texture of all samples titanium alloy abutment was evaluated after luted to cobalt chromium alloy using luting cements after thermocycling of group-A (n-30) and autoclaving of group -B (n-30). Each abutment was evaluated under Surface roughness (Ra) profilometer (Mitutoyo SJ-210, Mitutoyo Corporation, Tokyo, Japan) to compare and see the effects of luting cement after thermocycling (in group-A) and luting cement after autoclave (in group-B) under stereomicroscope.

12) *Tabulation of the results*
13) *Statistical analysis*

Sample distribution for the study.



Each group was divided in two subgroups.
- Subgroup -A (undergo thermocycling)
- Subgroup -B (undergo autoclave)

OBSERVATION AND RESULTS

Descriptive statistics for bonding resistance (in MPa) after thermocycling of cobalt-chromium alloy coping luted to titanium alloy abutment among Group A (Group 1) in which minimum, maximum, average value, SD & standard error were shown in Figure 1.

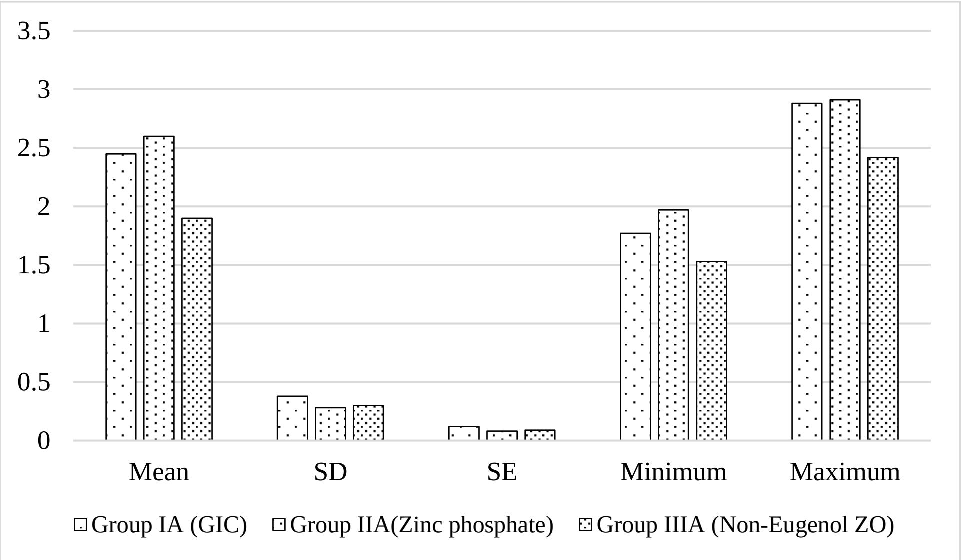
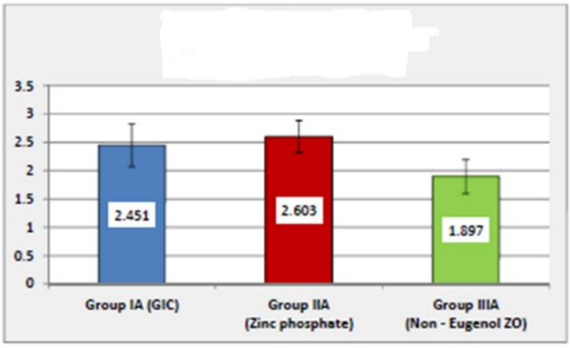


Figure 1. Descriptive Statistics of Bonding Resistance.



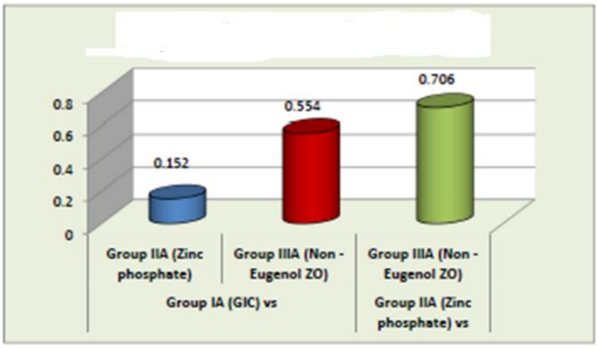


Figure 2. Comparative Statistics of Bonding Resistance.

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In Group A after thermocycling, the bonding resistance of zinc phosphate cement was found to be greater than that of glass polykenoate cement, followed by non-eugenol zinc oxide cement. Therefore, the order of bonding resistance of the cements observed was zinc phosphate cement > glass polykenoate cement > non-eugenol zinc oxide cement. But bonding resistance differences between zinc phosphate cement and glass polykenoate is not significant ($p>0.05$). Bonding resistance differences between zinc phosphate cement and non-eugenol zinc oxide is highly significant (**$p<0.001$). Bonding resistance differences between glass polykenoate cement and non-eugenol zinc oxide is significant (*$p<0.05$ – significant) which is shown in Figure 2.

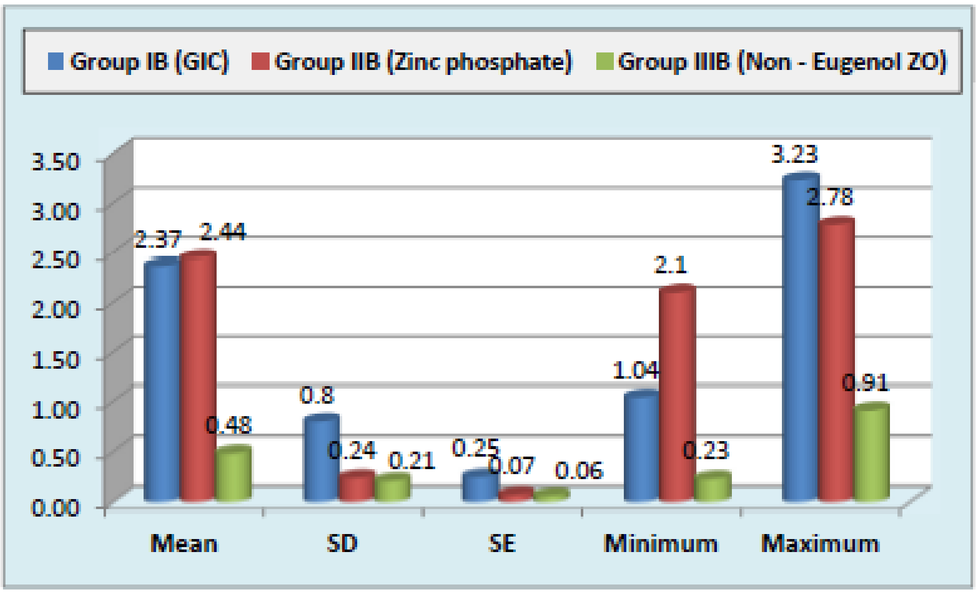

Figure 3. Descriptive statistics of bonding resistance.

Descriptive statistics for bonding resistance (in MPa) after autoclaving of cobalt-chromium alloy duplication luted to titanium alloy fixture among Group B (Group IB: Glass polykenoate cement, Group IIB: Zinc Phosphate cement, Group IIIB: Non-eugenol zinc oxide) in which minimum, maximum, Average value, SD & standard error was shown in Figure 3.

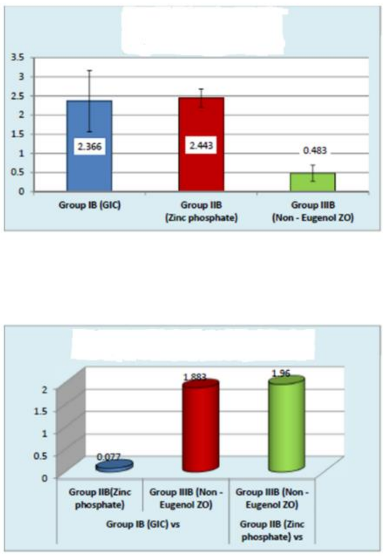

Figure 4. Comparative statistics of bonding resistance.

In Group B after autoclaving, the bonding resistance of zinc phosphate cement was found to be greater than that of glass polykenoate cement, followed by non-eugenol zinc oxide cement. Therefore, the order of bonding resistance of the cements observed was zinc phosphate cement > glass polykenoate cement > non-eugenol zinc oxide cement. But bonding resistance differences between zinc phosphate cement and glass polykenoate is not significant (p>0.05). Bonding resistance differences between zinc phosphate cement and non-eugenol zinc oxide is highly significant (**p<0.001). Bonding resistance differences between glass polykenoate cement and non-eugenol zinc oxide is highly significant (**p<0.001) depicted in Figure 4.

Table 1. Descriptive statistics of surface texture.

Group A (Thermocycling)	**Mean**	**SD**	**SE**	**Minimum**	**Maximum**
Group IA (GIC)	0.434	0.066	0.02	0.36	0.53
Group IIA (Zinc Phosphate)	0.568	0.065	0.02	0.49	0.71
Group III A (Non –Eugenol Zinc Oxide)	0.322	0.124	0.003	0.31	0.35

Descriptive statistics for surface texture (surface roughness in µm) after thermocycling of cobalt-chromium alloy coping luted to titanium alloy abutment among Group A (Group IA: Glass polykenoate cement, Group IIA: Zinc Phosphate cement, Group IIIA: Non-eugenol zinc oxide) in which minimum, maximum, average value, SD & standard error was shown Table 1.

Table 2. Comparative statistics of surface texture.

Group A (Thermo cycling)	**Average**	**SD**	**One wayAnova ‘F’ test value**	**p value, Significance**
Group IA (GIC)	0.434	0.066	F = 51.26	p < 0.001**
Group IIA (Zinc Phosphate)	0.568	0.065		
Group III A (Non –Eugenol Zinc Oxide)	0.322	0.124		
Tukey’s post hoc test to find pairwise comparisons				
Group	**Comparison Group**		**Mean Difference**	**p value, Significance**
Group IA (GIC)vs	Group IIA (Zinc Phosphate)		0.133	p <0.001**
	Group III A (Non –Eugenol Zinc Oxide)		0.112	p <0.001**
Group IIA (Zinc Phosphate) vs	Group III A (Non –Eugenol Zinc Oxide)		0.245	p <0.001**

In group A after thermocycling surface texture i.e. surface roughness (in µm) zinc phosphate cement is greater than glass polykenoate cement followed by non-eugenol zinc oxide surface texture i.e. surface roughness (in µm) of cements (zinc Phosphate cement > glass polykenoate>non-eugenol zinc oxide). But surface texture i.e. surface roughness (in µm) differences between zinc phosphate cement and glass polykenoate is highly significant (**p<0.001). Surface texture i.e. surface roughness (in µm) differences between zinc phosphate cement and non-eugenol zinc oxide is highly significant (**p<0.001). Surface texture i.e. surface roughness (in µm) differences between glass polykenoate cement and non-eugenol zinc oxide is highly significant shown in Table 2.

Table 3. Descriptive statistics of surface texture.

Group B (Autoclaved)	**Mean**	**SD**	**SE**	**Minimum**	**Maximum**
Group I B (GIC)	0.452	0.043	0.013	0.40	0.53
Group II B (Zinc Phosphate)	0.547	0.022	0.007	0.53	0.59
Group III B (Non –Eugenol Zinc Oxide)	0.389	0.050	0.015	0.32	0.44

Descriptive statistics for surface texture (surface roughness in µm) after autoclaving of cobalt-chromium alloy duplication luted to titanium alloy fixture among Group B (Group IB: Glass polykenoate cement, Group IIB: Zinc Phosphate cement, Group IIIB: Non-eugenol zinc oxide) in which minimum, maximum, average value, SD & standard error was shown Table 3.

Table 4. Comparative Statistics of Surface Texture, Specifically Surface Roughness (in µm).

Group B (Autoclaved)	**Average**	**SD**	**One way Anova 'F' test value**	**p value, Significance**
Group I B (GIC)	0.452	0.043	F = 38.502	p <0.001**
Group II B (Zinc Phosphate)	0.547	0.022		
Group III B (Non –Eugenol Zinc Oxide)	0.389	0.050		
Tukey's post hoc test to find pairwise comparisons				
Group	**Comparison Group**		**Average Difference**	**p value, Significance**
Group I B (GIC) vs	Group II B (Zinc Phosphate)		0.095	p < 0.001**
	Group III B (Non –Eugenol Zinc Oxide)		0.063	p = 0.005*
Group II B (Zinc Phosphate) vs	Group III B (Non –Eugenol Zinc Oxide)		0.158	p<0.001**

In group B after autoclave surface texture i.e. surface roughness (in µm) zinc phosphate cement is greater than glass polykenoate cement followed by non-eugenol zinc oxide surface texture i.e. surface roughness (in µm) of cements (zinc Phosphate cement > glass polykenoate>non-eugenol zinc oxide). But surface texture i.e. surface roughness (in µm) differences between zinc phosphate cement and glass polykenoate is highly significant (**p<0.001). Surface texture i.e. surface roughness (in µm) differences between zinc phosphate cement and non-eugenol zinc oxide is highly significant (**p<0.001). Surface texture i.e. surface roughness (in µm) differences between glass polykenoate cement and non-eugenol zinc oxide is significant depicted in Table 4.

Table 5. Comparison among Groups A (Thermocycling) and B (Autoclaved)

	Group A (Thermo cycling)	**Group B (Autoclaved)**	**Unpaired t test value**	**p value, Significance**
Subgroup I (GIC)	0.434 (0.066)	0.452 (0.043)	t = -0.719	p =0.481
Subgroup II (Zinc Sulphate)	0.568 (0.065)	0.547 (0.022)	t =0.919	p =0.370
Subgroup III (Non–Eugenol Zinc Oxide)	0.322 (0.124)	0.389 (0.05)	t = -4.075	p =0.001*

In intergroup comparison of surface texture i.e., surface roughness produced by all three cements in group B (i.e. five year autoclave aging) is more than surface roughness in group A (i.e. one year thermocycling) but surface roughness difference produced in sub –group I (GIC) and Sub Group II (Zinc Phosphate) is not significant (p>0.05) and surface roughness difference produced Sub- group III (non-eugenol zinc oxide) is significant(*p<0.05) shown in Table 5.

DISCUSSION

Implant-supported crowns are primarily available in two types: screw-retained and cement-retained. While each type has its advantages, cement-retained restorations are favored for their improved esthetic appearance and are often preferred by clinicians for this reason. However, determining the optimal type of cement for luting implant-supported restorations remains a subject of debate within the dental community. [8, 9, 10]. In this study, three types of luting cements were utilized: glass polykenoate cement, zinc phosphate cement, and non-eugenol zinc oxide cement. It is noted that zinc oxide eugenol cement offers adequate retention for cement-retained implant-supported prostheses. [11]

In this study non-eugenol zinc oxide cement was used instead of eugenol zinc oxide cement because it has few advantages over eugenol zinc oxide. It has Hypoallergenic properties, has low incidence of peri-implantitis [11]. Zinc Phosphate cement was used in this study as it is commonly used in 19% dental schools as Zinc Phosphate cement is chosen for cementations of cement retained implant - supported restorations. Zinc phosphate cement continues to be included in the curriculum of approximately 70% of dental schools and advanced education programs, alongside other luting cements. [12, 13]

A significant drawback associated with cement-retained restorations is the challenge in removing excess cement, which can subsequently lead to the development of peri-implant diseases such as peri-implant mucositis and peri-implantitis [9]. One advantage of using zinc phosphate cement is its radio-opacity, which facilitates the removal of excess cement. It is notably more radio-opaque than most resin cements. Additionally, both zinc oxide eugenol and non-eugenol zinc oxide cements also possess radio-opacity.[14]. In various literature glass polykenoate cement was used for comparison with zinc Phosphate cements for retention evaluation and which gave similar retentive result as zinc Phosphate [10, 15].

CONCLUSION

In present study all the standard for cementation, bonding resistance testing and surface texture testing were followed. This study concluded that the increased surface roughness also increases bonding resistance. The findings of this study indicated that zinc phosphate luting cement exhibited higher retention compared to glass polykenoate and zinc oxide eugenol luting cement. This higher retention may be attributed to the fact that zinc phosphate luting cement caused greater surface roughness than glass polykenoate and zinc oxide eugenol luting cement when cobalt-chromium alloy coping was attached to the titanium alloy abutment using luting cement. Glass polykenoate luting cement was more retentive than zinc oxide eugenol luting cement when cobalt-chromium alloy duplication was attached to the titanium alloy fixture using luting cement as glass polykenoate luting cement produces more surface roughness than zinc oxide eugenol**.** Conclusion of study is zinc phosphate and glass polykenoate both can be used as luting cement for better retention and surface integrity for long term use in case of implant retrained prosthesis in which cobalt-chromium alloy duplication was attached to the titanium alloy fixture using luting cement.

REFERENCES

1. Alvarez-Arenal A, Gonzalez-Gonzalez, deLlanos-Lanchares H, Brizuela-Velasco A, Pinés-Hueso J, Ellakuria-Echebarria J. Retention strength after compressive cyclic loading of five luting agents used in implant-supported prostheses. BioMed research international. 2016;
2. R. Shadid and N. Sadaqa, “A comparison between screw- and cement-retained implant prostheses. A literature review,” *Journal of Oral Implantology*, vol. 38, no. 3, pp. 298–307, 2012
3. Ramp MH, Dixon DL, Ramp LC, Breeding LC, Barber LL. Tensile bond strengths of provisional luting agents used with an implant system. The Journal of prosthetic dentistry. 1999 May 1;81(5):510-4.
4. Ayyildiz S, Emir F, Tunc EP, Sen D. Bonding resistance of various luting cements to fixed prosthodontic restorative materials. Applied Adhesion Science. 2015 Dec;3(1):1-0
5. https://www.corrosionpedia.com/Shear Strength
6. Kim Y, Yamashita J, Shotwell JL, Chong KH, Wang HL. The comparison of provisional luting agents and abutment surface roughness on the retention of provisional implant-supported crowns. The Journal of prosthetic dentistry. 2006 Jun 1;95(6):450-5.
7. Kunt GE, Ceylon G, Yilmaz N. Effect of surface treatments on implant crown retention. Journal of Dental Sciences. 2010 Sep 1;5(3):131-5.
8. Sathish S, Lakshmi S, Patel P, Annapoorni H. Effect of thermocycling on the micro-tensile bond strength between self-adhesive resin cement and nonphosphate monomer cements on zirconium-oxide ceramics. Indian Journal of Dental Research. 2019 Jan 1;30(1):73.
9. Rani S, Verma M, Gill S, Gupta R. Comparative evaluation of bonding strength of computer aided machined ceramic, pressable ceramic, and milled metal implant abutment copings and effect of

surface conditioning on bonding strength: An in vitro study. The Journal of the Indian Prosthodontic Society. 2016 Apr;16(2):142.

10. Imthiyas SM, Subramanian B, Karupiah P, Kirubakaran A, Karthik VC, Ganesan S. Effect of various luting agents on retention of cement-retained implant restorations with different modifications-An in-vitro study. Indian Journal of Multidisciplinary Dentistry. 2018 Jul 1;8(2):82.
11. Frisch E, Ratka-Kruger P, Weigl P, et al. Extraoral cementation technique to minimize cement-associated peri-implant marginal bone loss: can a thin layer of zinc oxide cement provide sufficient retention? Int J Prosthodont 2016;29(4):360–2.
12. Wadhwani CPK, editor. Chapter 4: Implant luting cements. In: WadhwaniCPK, Schwedhelm ER, Tarica DY, Chung K-H, editors. *Cementationin Dental Implantology – An Evidence Based Guide*. New York:Springer; 2015:47–82.
13. Wadhwani CPK, editor. Chapter 5: Residual excess cement detection.In: Wadhwani CPK, Schwedhelm ER, Tarica DY, Chung K-H, editors.*Cementation in Dental Implantology – An Evidence Based Guide*. NewYork: Springer; 2015:83–99.
14. Wadhwani C, Hess T, Faber T, Piñeyro A, Chen CS. A descriptive study of the radiographic density of implant restorative cements. J Prosthet Dent. 2010;103(5):295–302.
15. Sathyanarayan S, Balavadivel T, Guru RC, Sande AR, Rajendran V, Sengottaiyan AK. Retention of various luting agents used with implant-supported crowns. Journal of Pharmacy and Bioallied Sciences. 2021 Nov 1;13(Suppl 2):S1206-9.

