

# Comparing The Luting Efficiency Of Two Different Cements In Microleakage Of Metallic Copings. A Clinical Study

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## Abstract

**Aim:** To assess the microleakage of metallic copings luted using two different luting cements that are readily accessible.

**Materials and Methods:** Two sets of 40 abutment analogue replicas were machined. The fabrication of nickel chromium copings included the evaluation of the marginal gap using an optical microscope and the luting of the gap using zinc oxide non-eugenol and zinc phosphate cement. Cemented specimens were immersed in a 0.5% aqueous solution of basic fuchsin solution for 24 hours after thermocycling to allow dye penetration. Microleakage scores were calculated and sections of copings were longitudinally analyzed. Analytical Statistics Kruskal -Wallis analysis of variance (ANOVA) and the Chi-Square test were also used.

**Result:** As a result, Zinc Phosphate Cement had the lowest mean microleakage score and Zinc Oxide Non Eugenol had the highest.  $P < 0.05$  indicates that the study's findings were statistically significant.

**Conclusions:** It was discovered that all cements showed some degree of microleakage within the parameters of the investigation. The difference in the mean microleakage scores of zinc phosphate and zinc oxide non-eugenol cements was found to be negligible, indicating that the microleakage in both cements is comparable.

**Keywords:** Cement solubility, implant abutments, luting cements, microleakage

**Introduction:** The significant preference for screw-retained restorations from the 1980s to the early 1990s gave way to cement-retained restorations later on [1]. Fastening screws are the primary method of retention used in screw-retained restorations, fixing the prosthesis to the abutment and, in turn, the abutment to the implant. These are mostly recommended in situations when there is insufficient interarch space, which restricts the required height of the axial

wall for cement-retained prosthesis retention. The advantages of screw-retained prostheses include retrievable crowns, cement-free gingival sulcus areas, and good crown retention. Abutment screw loosening, fastening screw fracture, best access hole placement for exact installation, ceramic chip off surrounding access hole, abutment fracture, etc. are some of the issues [2,3].

The survival rate of implants has increased significantly since recent technological advancements, going from 50% to 90%. Fracture resistance and marginal adaptation are crucial for ensuring the durability and clinical success of crowns [4]. Crowns must be cemented in place because it closes the dead area (the cement gap), provides retention, guards against microleakage, and shields against secondary caries.

There are many different kinds of cements on the market right now, ranging from conventional cements like zinc phosphate cement to resin-based or resin-modified cements. Since the 1880s, zinc phosphate cement has been employed in dentistry. It has a proven track record that is backed up by clinical data, but because of its high solubility and low adhesion, it has higher in vitro microleakage scores than other cements. Despite this, this cement ensures the survival of crowns in the mouth, particularly metal-ceramic and metal crowns. Glass ionomer cement's usage has expanded recently since it is known for its capacity to bind to tooth structure and release fluoride. Its composition changed over time in a number of ways. The addition of resin allowed calcium, fluoride, and phosphate ions to be taken up and released in response to pH changes in the oral environment; this bioactivity allowed for better chemistry and bonds between the cement and dentin, reducing microleakage and enhancing durability and remineralization of the tooth [5].

This research compared the effectiveness of two different cements in luting metallic coping microleakage.

## Material and methods:

The institutional review board has given the study its approval. Twenty identical copies of the abutment analogue with dimensions of 5 mm in length, 4.8 mm in width, 6° in taper, a wide chamfer finish line, and three anti-rotation grooves above it that terminate 1 mm above the finish line were machined from titanium rods.

**Manufacturing of metal copings:** For stability, each abutment analogue was fixed in dental plaster along the long axis. On abutments analogues that were 1mm short of the margin, two layers of die spacer were placed. A uniformly thick 0.5 mm type II inlay wax was used to create the wax design. A putty index was made from this wax pattern to ensure a uniform thickness of wax pattern for subsequent abutment analogues. Wax was used to create a wax sprue former, and the reservoir was connected to the sprue. The wax pattern was placed around 14 inch away from the casting ring after the length of the sprue was modified. Wax patterns were cast using NiCr alloy in an induction casting machine after being invested in phosphate-bonded investment and going through the burnout phase. To remove any remaining investment material, castings were divested, desprued, and sandblasted with 110-125 micron aluminium oxide particles under 2 bar pressure. Using polishing burs, copings were completed and polished.

**Cementation:**The copings and their corresponding abutment analogues were allocated into two groups of 10 samples each at random. Two luting agents that are often used to cement implant-supported prostheses were employed for the cementation process. the following cements

I. Cement made of zinc oxide without eugenol (3M) II. Luting cement with zinc phosphate (GC).

The manufacturer's recommendations for mixing time, conditions, and the powder: liquid ratio were followed during cementation. The luting agent was thoroughly applied to the inside surfaces of the copings, and with the aid of a specially designed holding mechanism, it was then placed onto the analogue abutment with hard figure pressure for

10 seconds, followed by a 2 kg axial load for 5 minutes. After setting, hollenback carvers were used to scrape away extra cement. After being given 24 hours to set, specimens underwent visual inspection to ensure that the copings were completely seated onto the abutment analogues.

**Thermocycling:** The cemented specimens were removed from plaster blocks after 24 hours and thermocycled 5000 times between 5 and 55 degrees Celsius with dwell times of 10 seconds and transfer times of 5 seconds.

**Dye absorption:** For dye penetration, cemented specimens were submerged for 24 hours in a 0.5% aqueous solution of basic fuchsin solution after thermocycling.

**Assessment of microleakage:** For each specimen, microleakage was assessed using several surface scoring techniques. With the use of a carborundum disc, the cemented specimens were longitudinally sectioned in the bucco-lingual axis after being submerged in dye solution for 24 hours. Each section's two abutment-coping interfaces were used to record two microleakage scores, giving each specimen a total of four scores. On the axial walls, two marks were put at the 1/3 and 2/3 points of the length of the abutment analogue. To assess microleakage, the sectioned specimens were put under a stereomicroscope at 40.

The approach used by Tjan et al. These microleakage scores were used:

0	The axial wall of the sectioned specimen exhibited no microleakage.
1	On the axial wall of the sectioned specimen, microleakage was visible up to one-third of its length.
2	On the axial wall of the sectioned specimen, microleakage was visible up to two-thirds of its length.
3	The whole axial wall of the sectioned specimen exhibits microleakage.
4	On the occlusal surface of the sectioned specimen, there is microleakage.

The Kruskal-Wallis analysis of variance (ANOVA), followed by the Chi-square test, was used to tabulate and evaluate the data. The cutoff for statistical significance was  $P < 0.05$ .

## Results:

Different levels of microleakage were present in all specimens. The mean microleakage score for zinc phosphate cement was the lowest ( $1.22 \pm 0.34$ ), and the highest ( $2.34 \pm 0.22$ ) for zinc oxide non-eugenol (Tables 1 and 2).

**Table 1: Microleakage scores in specimens cemented with zinc oxide noneugenol luting cement (Group I)**

Specimen number	Microhardness score				Mean Score
	Buccal 1	Buccal 2	Lingual 1	Lingual 2	
1	1	1	2	2	1.50
2	2	1	2	2	1.75
3	1	2	2	2	1.75
4	2	2	2	2	2.00
5	2	2	2	2	2.00
6	1	1	2	2	1.50
7	1	1	2	2	1.50
8	2	2	2	2	2.00
9	2	2	2	2	2.00

10	2	2	2	2	2.00
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**Table 2: Microleakage scores in specimens cemented with zinc phosphate luting cement (Group II)**

Specimen number	Microhardness score				Mean Score
	Buccal 1	Buccal 2	Lingual 1	Lingual 2	
1	2	3	2	2	2.35
2	2	2.4	2.5	2	2.45
3	1	2	2	2	2.65
4	2	2	2	2	2.80
5	2	2	2	2	2.20
6	1	1	2	2	2.20
7	2.5	2	3	2.5	2.50
8	2.5	2	2.1	2	2.10
9	2	2.8	3	2.5	2.70
10	3	2	3	2	2.80

Following a Kruskal-Wallis ANOVA on the mean microleakage scores and a Chi-square test, the result was  $P = 0.001$ , showing that there was a significant difference between the mean microleakage scores of the groups examined ( $P < 0.05$ )

## Discussion:

In contrast to traditional fixed prosthodontics, where the tooth adheres to the metal, adhesion in implant dentistry occurs between two metallic components. As a result, luting cements come in a wider variety than real teeth. Additionally, implant abutments have a significantly better resistance and retention form than natural tooth preparations [1]. The flow of ions, fluid molecules, or bacteria between an abutment and a prosthesis is referred to as microleakage. It is widely known that luting agents do not completely seal the gap between the abutment and the prosthesis and that they include multiple micro gaps that enable solutes and solvents to flow through, encouraging the development of bacteria and their byproducts.

One of the most common and established approaches for assessing microleakage is the use of organic dyes. Basic fuchsin, methylene blue, eosin, aniline blue, crystal violet, and erythrosine B are a few examples of organic dyes [6–8]. The most often used of these dyes is basic fuchsin (0.5%–2%).

Wenner et al. discovered that if just one portion of a microleakage study is reviewed, there is a 33% chance of obtaining a false negative. So in microleakage research, multiple surface scoring system is favored [9–12]. Zinc phosphate cement showed the least microleakage in the current investigation. The numerous components that might impact their characteristics could be the cause of the variation in microleakage between cements documented in earlier investigations. A form of acid-base cement renowned for its clinical use in the regular cementation of metal-supported crowns and bridges is zinc phosphate cement [13]. It is primarily employed as a cementing agent. It has a low pH of 2 to 4, but once the powder and liquid are combined, the pH rises throughout the setting process and reaches neutrality in one to two days. An increase in solubility brought on by the initial acidic environment will result in gradual erosions brought on by a mix of abrasions and dissolutions, leading to microleakage.

Because zinc oxide non-eugenol cement demonstrated less microleakage than zinc oxide eugenol cement in the current investigation, it was chosen [14]. Solubility, set cement structure, film thickness, heat changes, sealing ability, stress resistance, and other variables might affect microleakage.

In comparison to zinc phosphate cement, which has a greater solubility in water (0.06 wt%), zinc oxide non-eugenol set cement has a solubility of 0.4 wt% [15,16]. The size of the marginal space between the abutment and the prosthesis is the other important element in microleakage.

When luting agents experience stresses due to mechanical or thermal changes that are greater than the material's cohesive or adhesive strength, microcracks and microleakage emerge. The choice of each cement is based on its varied characteristics. It is crucial for the doctor to critically evaluate their choice of cement type in light of the varied clinical circumstances. In order to estimate the values of implant abutments in the oral environment, this research was undertaken to offer details regarding microleakage in cemented copings. The ultimate assessment of these materials would need a lengthy clinical trial.

## Conclusion:

As a result, the cementation of the implant prosthesis that is kept by cement should be done gradually. Consider utilizing definitive cement if the failure occurs when using provisional cement. The ultimate choice of which luting cement to employ should be determined by the clinical situation and the clinician's discretion.

## References:

1. Misch CE. Dental Implant Prosthetics. 1<sup>st</sup> ed. Philadelphia: Elsevier Mosby; 2005.
2. Uludamar A, Ozkan YK. Cement selection of cemented implant supported restorations. *Cumhuriyet Dent J* 2012;15:166-74.
3. Hebel KS, Gajjar RC. Cement-retained versus screw-retained implant restorations: Achieving optimal occlusion and esthetics in implant dentistry. *J Prosthet Dent* 1997;77:28-35.
4. Melo Freire CA, Borges GA, Caldas D, Santos RS, Ignácio SA, Mazur RF. Marginal adaptation and quality of interfaces in lithium disilicate crowns influence manufacturing and cementation techniques. *Oper Dent*. 2017;42:185-195.
5. Vohra F, Altwaim M, Alshuwaier AS, Deeb MA, Alfawaz Y, Alra- biah M, Abduljabbar T. Influence of bioactive, resin and glass ionomer luting cements on the fracture loads of dentin bonded ceramic crowns. *Pak J Med Sci*. 2020;36:416-421.
6. Piwowarczyk A, Lauer HC, Sorensen JA. Microleakage of various cementing agents for full cast crowns. *Dent Mater* 2005;21:445-53.
7. Nascimento CD, Barbosa RE, Issa JP, Watanabe E, Ito IY, Albuquerque RF. Bacterial leakage along the implant abutment interface of pre-machined or cast components. *Int J Oral Maxillofac Implants* 2008;37:177-80.
8. Gonzalez NA, Kasim NH, Aziz RD. Microleakage testing. *Annals Dent Univ Malaya* 1997;4:31-7.
9. Yüksel E, Zaimoğlu A. Influence of marginal fit and cement types on microleakage of all-ceramic crown systems. *Braz Oral Res* 2011;25:261-6.
10. Shiva Kumar K, Boris Bhim A, Shankar S. Microleakage of two systems of glass ionomer luting agents – In vitro study. *JIADS* 2010;1:1-4.
11. Rossetti PH, Do Valle AL, De Carvalho RM, De Goes MF, Pegoraro LF. Correlation between marginal fit and microleakage in complete crowns cemented with three luting agents. *J Appl Oral Sci* 2008;16:64-9.
12. Wenner KK, Fairhurst CW, Morris CF, Hawkins IK, Ringle RD. Microleakage of root restorations. *J Am Dent Assoc* 1988;117:825-28.
13. Parameswari BD, Rajakumar M, Lambodaran G, Sundar S. Comparative study on the tensile bond strength and marginal fit of complete veneer cast metal crowns using various luting agents: An in vitro study. *J Pharm Bioallied Sci*. 2016;8:S138-S143.
14. Arora SJ, Arora A, Upadhyaya V, Jain S. Comparative evaluation of marginal leakage of provisional crowns cemented with different temporary luting cements: In vitro study. *J Indian Prosthodont Soc* 2016;16:42-8.
15. Tjan AH, Dunn JR, Grant BE. Marginal leakage of cast gold crowns luted with an adhesive resin cement. *J Prosthet Dent* 1992;67:11-5.
16. Anusavice. Philips science of dental materials. 11<sup>th</sup> ed. Philadelphia: Elsevier; 2003.