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Comparative Evaluation of Retentive Properties of Three Luting Agents on Complete Cast Crowns: An In-Vitro Study

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Abstract
Retention of fixed prosthodontic restorations depends on the luting agent used between the prepared tooth and restoration. Different luting cements exhibit varying retentive strengths due to their physical and chemical properties.
Aim: To compare the retentive properties of Glass Ionomer Cement (GIC), Resin Modified Glass Ionomer Cement (RMGIC), and Resin Composite Cement in complete cast crowns.
Materials and Methods: This in-vitro comparative study was conducted from February 2025 to March 2025 in the Department of Prosthodontics.Thirty freshly extracted human molars were selected and prepared with a standardized 5° taper. Complete cast crowns were fabricated and divided into three groups of ten samples each. Group A was luted with Glass Ionomer Cement, Group B with Resin Modified Glass Ionomer Cement, and Group C with Resin Composite Cement. Retention was measured using a Hounsfield tensometer before and after preparation of internal escape channels.
Results: Resin composite cement showed the highest retentive force both before and after preparation of internal escape channels, followed by RMGIC and GIC. Statistical analysis showed significant differences among the three groups.
Conclusion: Resin composite cement demonstrated superior retentive properties compared to RMGIC and GIC.

Keywords: Retention, luting agents, resin cement, glass ionomer cement, crown retention

Introduction

Retention is one of the most critical factors determining the long-term success of fixed prosthodontic restorations. The retention of a crown depends upon the geometry of tooth preparation, surface area, and the luting agent used. Among these, the luting cement acts as the link between tooth and restoration.
An ideal luting cement should possess adequate compressive strength, low solubility, biocompatibility, and sufficient adhesive properties. Conventional Glass Ionomer Cement (GIC) has been widely used

because of its chemical adhesion and fluoride release. However, it has lower tensile strength and is brittle in nature.

Resin Modified Glass Ionomer Cement (RMGIC) was introduced to improve the physical properties of conventional GIC by incorporating resin components. Resin Composite Cement has gained popularity due to superior mechanical properties and enhanced adhesion.

The present study was conducted to compare the retentive properties of these three luting agents.

Aim and Objectives

Aim: To evaluate and compare the retentive strength of complete cast crowns luted with three different luting agents.

Objectives:

1. To compare the retention of crowns cemented with GIC, RMGIC, and Resin Composite Cement.
2. To evaluate the effect of internal escape channels on retention.

Materials and Methods

This in-vitro study was conducted in the Department of Prosthodontics.

Thirty freshly extracted human molars free from caries and structural defects were selected. The teeth were cleaned and mounted in autopolymerizing acrylic resin blocks up to 2 mm below the cementoenamel junction.

Standardized tooth preparation was performed using a custom-made parallellometer with a total convergence angle of 5°. Uniform axial reduction and occlusal reduction were maintained for all samples. Impressions were made and poured in die stone. Wax patterns were fabricated and cast using Nickel-Chromium alloy. A loop attachment was prepared on the occlusal surface of each crown for tensile testing.

The samples were divided into three groups:

Group A – Glass Ionomer Cement (n=10)

Group B – Resin Modified Glass Ionomer Cement (n=10)

Group C – Resin Composite Cement (n=10)

Cementation was performed according to manufacturer's instructions under a constant load of 5 kg for 5 minutes. The specimens were stored in normal saline at 37°C for 48 hours.

Retention was tested using Hounsfield Tensometer.

After initial testing, internal escape channels were prepared on the internal surface of crowns and the samples were retested.

Statistical Analysis

The collected data were subjected to One-way ANOVA and paired t-test. A p-value less than 0.05 was considered statistically significant.

Results

Table 1: Mean Retention Force Before Internal Escape Channels

Group	Cement	Mean (lbs)
A	Glass Ionomer Cement	151.80
B	Resin Modified Glass Ionomer Cement	157.33
C	Resin Composite Cement	205.50

Table 2: One-way ANOVA Before Internal Escape Channels

Source	Sum of Squares	df	Mean Square	F	p-value
Between Groups	14421.68	2	7210.84	112.32	0.000
Within Groups	1732.44	27	64.16	-	-

The difference was statistically significant.

Table 3: Mean Retention Force After Internal Escape Channels

Group	Cement	Mean (lbs)
A	Glass Ionomer Cement	157.20
B	Resin Modified Glass Ionomer Cement	164.56
C	Resin Composite Cement	209.75

Table 4: One-way ANOVA After Internal Escape Channels

Source	Sum of Squares	df	Mean Square	F	p-value
Between Groups	13592.22	2	6796.11	104.74	0.000
Within Groups	1751.28	27	64.86	-	-

The difference was statistically significant.

Table 5: Paired t-test Before and After Internal Escape Channels

Group	t-value	p-value	Conclusion
GIC	-1.488	0.154	Not Significant
RMGIC	-2.057	0.056	Not Significant
Resin Composite	-1.704	0.111	Not Significant

Discussion

The results of the present study demonstrated that Resin Composite Cement exhibited the highest retentive strength among the three luting agents tested. This can be attributed to its superior micromechanical interlocking and chemical bonding.

Resin Modified Glass Ionomer Cement showed intermediate retentive values due to resin reinforcement, which improves the physical properties of conventional glass ionomer.

Conuventional Glass Ionomer Cement demonstrated the lowest retention values because of its lower tensile strength and brittle nature.

Althogh there was a slight increase in retention after preparation of internal escape channels, the increase was not statistically significant.

These findings are consistent with previous studies, which reported higher retention with resin-based luting agents compared to conventional cements.

Conclusion

Within the limitations of this study:

1. Resin Composite Cement showed the highest retentive strength.
2. Resin Modified Glass Ionomer Cement showed better retention than Glass Ionomer Cement.

3. Internal escape channels did not significantly improve retention.

Resin Composite Cement may be considered the preferred luting agent when maximum retention is required.

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