

An Evaluation of Micro Leakage Under Complete Metal Crowns Using 3 Different Luting Agents: An Invitro Study

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ABSTRACT

Background: The purpose of this study is to evaluate the microleakage at tooth cement surface and cement metal interface. The study compares the microleakage of Adhesive resin cement, Resin modified glass ionomer and conventional Glass ionomer cement in an in vitro set up with a sample size of 30 natural teeth. This sample size was sufficient to bring out the variation among the test groups.

Keywords: Tooth cement interface, metal cement interface, luting agent stereomicroscope.

INTRODUCTION

The ultimate goal of any prosthetic treatment is providing the patient with a precisely fabricated restoration which preserves the long term integrity of natural abutments of fixed partial dentures and their pulpal vitality.¹

An extra coronal restoration that has been completed precisely with attention to detail on a sound foundation has the best and most predictable prognosis². Despite the material advancements and precise laboratory techniques, cement lines are inevitable in fixed Prosthodontics and some degree of marginal discrepancy is always expected. Studies of cement dissolution and disintegration have produced varying results; hence this study was done to evaluate marginal leakage under complete metal crowns using three adhesive cements, which included: 1) Conventional glass ionomer cement 2) Resin - modified glass ionomer cement 3) Adhesive resin cement. There is no single ideal luting agent that fulfils the requirements and thus, studies comparing various luting agents are of much help to a clinician.

Fusayama et al.³ discovered that marginal adaptation of cemented crowns is never perfect and the cast restorations usually display a marginal discrepancy⁴. This leads to increased dependence on the integrity of the cement to maintain the marginal seal⁵.

MATERIALS AND METHODS

The study compares the microleakage of Adhesive resin cement, Resin modified glass ionomer and conventional Glass ionomer cement in an in vitro set up with a sample size of 30 natural teeth. This sample size was sufficient to bring out the variation among the test groups. The method used is as follows

a) Preparation of teeth:

Thirty non-carious orthodontically extracted premolar teeth of comparable crown size were selected. Each tooth was mounted on metallic rings and was prepared to receive a full cast crown. All preparations were done by a single operator.

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Silicone impressions were made and poured in type IV die stone.

b) Casting the crown:

Three layers of die-relief spacer were applied on the die and wax patterns were fabricated. Base metal alloy was used to cast the crowns using the standard lost-wax technique.

Thirty specimens were randomly divided into three groups of ten each:

Group A: Casting luted with conventional glassionomer cement

Group B: Casting luted with resin-modified glassionomer cement

Group C: Casting luted with adhesive resin cement

All the specimens were stored in artificial salivary substitute at 37° C for one month before thermal cycling.

c) Cementation of crowns:

Cementation of crowns with respective luting agents was done according to manufacturer's instructions. The cemented crowns were immediately put under 5 kg static load for 10 minutes.

d) Thermal cycling

The cemented crowns stored in tap water for one month were artificially aged by thermal cycling from 5 ° C - 55 ° C for 300 cycles with a one minute dwell time in water bath containing 0.5 % aqueous solution of basic fuschin dye. The samples were then embedded in acrylic resin base.

e) Sectioning of the samples and Evaluation of microleakage

Each tooth was sectioned longitudinally through the center of the restoration, bucco-lingually or mesio-distally with a low-speed diamond disc. Scoring was done according to the linear penetration of dye from the external margin of the luting agent with a stereomicroscope at 40X magnification.

0- No micro leakage

1- Microleakage to 1/3 rd of axial wall

2- Microleakage of 2/3rd of axial wall

3- Microleakage of full length of axial

4- Microleakage over the occlusal surface

The marginal microleakage for each crown was the average of the scores of dye penetration recorded at each surface (i.e. either buccal and lingual or mesial and distal.

The method used to test microleakage in this study is in accordance with that done by Anthony H.L et al²⁰

The data was analysed with Kruskal- Wallis One Way Analysis Of Variance (ANOVA). A Mann-Whitney U-Test was used for comparison amongst the groups. Statistical analysis was carried out using a SPSS software package.

RESULTS

The findings of the present study showed that the microleakage with all the cements was comparable with no significant difference as the (p value >0.05). The adhesive resin cement showed least microleakage followed by the resin modified glass ionomer and the conventional glass ionomer cements, although insignificant.

DISCUSSION

Marginal leakage around the dental restoration is the cause for the recurrence of caries at that site.^{21, 22} A space always exists between the casting and the tooth at the margins before and after cementation.²³ Microleakage is caused by the difference in coefficient of thermal expansion of restorative material and tooth structure.²⁴ Die spacing was done in this study as it increases the seating of crown.^{25, 26}

Multiple factors ranging from non-retentive tooth preparation, poor casting fit, poor cementing technique, weak cement, to malocclusion, excessive forces of mastication and improper prosthesis usage influence microleakage.^{27, 28} In addition to the inevitable errors at the margin of restorations, the type of luting agent and its mechanical properties also has significant effect on microleakage.^{29, 30}

CONCLUSION

The findings of present study will show if the extent of microleakage with all the cements was

comparable or not (p value > 0.05). To conclude, from the individual die penetration results, which luting cement shows least extent of microleakage, out of resin-modified glassionomer, the conventional glassionomer cements, and adhesive resin cement; and which shows the highest extent of microleakage.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

1. Baldissara P, Comin G, Martone F, Scotti R. Comparative study of the marginal leakage of six cements in fixed provisional crowns. *J Prosthet Dent* 1998; 80:417–422
2. Lindquist TJ, Connolly J. In vitro microleakage of luting cements and crown foundation materials. *J Prosthet Dent* 2001;85:292–298
3. Fusayama T, Ide K, Hosoda H. Cement thickness between cast restorations and preparation walls. *J Prosthet Dent* 1963; 13:35–64
4. Jacobs MS, Windeler AS. An investigation of dental luting cements solubility as a function of marginal gap. *J Prosthet Dent* 1991; 65:436–442
5. Myers ML, Staffanou RS, Hembree JH Jr, Wiseman WB. Marginal leakage of contemporary cementing agents. *J Prosthet Dent* 1983; 50:513–516
6. Skinnners: Science of Dental Materials. 9th edition 1992. W.B. Saunders Co. USA.
7. Tjan AH, Dunn JR, Grant BE. Marginal leakage of cast gold crowns luted with an adhesive luting agent. *J Prosthet Dent* 1992; 67:11-15.
8. Hiflett KS, White SN. Microleakage of cements for stainless steel crowns. *American Academy of Pediatric Dentistry* 1997 ; 19:4
9. Lindquist TJ, Connolly J. In vitro microleakage of luting cements and crown foundation material. *J Prosthet Dent*. 2001 Mar;85(3):292-8.