

Effect of a preseating cementation protocol on the retention of implant restorations using a definitive cement

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ABSTRACT

Purpose: This investigation analyzed the effects of a preseating cementation protocol on the amount of cement excess at the crown margin and its associated tensile load using a glass ionomer definitive cement.

Materials and Methods: The independent variable in this study was the cementation technique. The first protocol involved a conventional cementation procedure and the second one preseating on an abutment replica. Ten metallic copings were cemented using a definitive cement on ten implant abutments for each cementation protocol. Cement excess at the margin was weighted (mg), and axial tensile load was measured 24 h after cementation. Results were statistically analyzed using linear regression and one-way analysis of variance ($\alpha = 0.05$).

Results: The cementation protocol with preseating resulted in a significantly smaller amount of cement excess at the crown margin ($P \leq 0.001$) without detriment on the tensile resistance when compared to the experimental group without preseating ($P = 0.41$). Linear regression failed to prove any correlation between the amount of cement excess and tensile load necessary for dislodgement.

Conclusions: A preseating protocol can be performed when using a definitive cement. This procedure reduces significantly the amount of cement excess at the margin while maintaining an acceptable tensile load resistance.

KEY WORDS: Cementation, dental restoration, implant crowns, implant restorations, preseating

INTRODUCTION

It has been reported that 2.3 million implant-supported crowns are placed every year.^[1] These restorations can be constructed using a screw retained or a cemented connection protocol. There has been a rapid switch

toward cement-retained prostheses^[2] even though there is a high risk of severe peri-implant inflammation and bone loss.^[3] Furthermore, one study showed that excess cement was not completely removed in 81% of examined cemented cases. Furthermore, approximately 80% of peri-implantitis cases are caused by bacterial colonization of extruded cement.^[4] This is the reason why all efforts to prevent excess cement at the margins should be enforced. Several approaches have been

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attempted including placing vents on the crowns^[5] and keeping cement reservoirs under the restorations.^[6] Furthermore, a popular technique consists of using an abutment duplicate to seat the cement-filled restoration just before placing it at the final position in the mouth, and in this way, a thin layer of cement is obtained all throughout the restoration intaglio.^[7,8]

A previous study compared several methods for reducing excess cement at the margins.^[9] It also correlated retention of the restoration with each method. During the experiments, it was evident that preseating the restoration, filled with temporary cement on an abutment analog, produced the least amount of excess cement extrusion at the margins. However, it also showed a marked decrease in retention. For this reason, the aim of the present *in vitro* study is to evaluate the mechanical behavior of the samples using a preseating cementation protocol and definitive cement.

MATERIALS AND METHODS

This research protocol was approved by the Research Commission of the School of Dentistry at the University of Costa Rica. Methodology was described in a previously published article.^[9]

Briefly, ten straight implant abutments (GingiHue Biomet 3i, APP454G) were screwed on ten implant analogs (Biomet 3i, ILAW5). These were fixed on acrylic resin blocks with the same path of insertion. The screw access holes were sealed with a light-cured resin (Revotek LC, GC America).

Metal copings with an incisal loop were fabricated in nonprecious alloy (Argeloy NP, Argen) for each abutment. Each coping was cemented with a definitive glass ionomer cement (RelyX Luting 2, 3M ESPE, lot N860413) with either one of two protocols ($n = 10$), whose order was assigned in a randomized manner. One protocol involved preseating of the coping with the unset cement on an abutment replica in acrylic resin (Pattern Resin LS, GC America) before seating the coping on the definitive abutment [Figure 1]. The other protocol was a regular cementing technique and did not involve preseating. In both cases, the screw access was closed.

The definitive cement was mixed with a plastic spatula and was dispensed in a plastic measuring device, which was weighed to standardize the amount of luting agent (60 mg).

After the coping was positioned on the implant abutment and seated into place, a load of 5 kg was maintained for 5 min. Following this, the cement excess was removed from the margin with a scalpel blade and



Figure 1: Preseating cementation protocol on abutment replica

was weighed on an analytical scale (Gemini Analytical Balance, Meldrum Scale Company). The specimens were then stored in distilled water at 32°C for 24 h. Tensile load tests were performed with a universal testing machine (H10KS, Tinius Olsen) at a crosshead speed of 1 mm/min, and the cement fail load (kg) was recorded.

The researcher responsible for measuring cement excess and tensile load fail did not know to which experimental group belonged the specimen, therefore this study is double-blind. Statistical analysis included the descriptive statistics as well as one-way analysis of variance (ANOVA; $P \leq 0.05$) to analyze the effect of the cementation protocols on the cement excess and tensile load failure. Furthermore, a linear regression was carried out to analyze the relationship between the two dependent variables.

RESULTS

The amount of cement excess extruded at the margins varied significantly among the two experimental groups ($P \leq 0.05$). Specimens that were not cemented with a preseating protocol had in average 62.2 mg of cement excess at the margins, whereas their counterparts had only 4.45 mg of cement extruded [Figure 2].

Regarding the tensile load necessary for failure, a Levene test showed that an ANOVA was possible ($P = 0.961$). The results of one-way ANOVA depicted that there is no significant difference between the experimental groups [Table 1] which can be explained with the increased standard deviations within each group [Figure 3].

The linear regression failed to show any correlation between the amount of cement excess and the resistance to tensile dislodgement [Table 1].

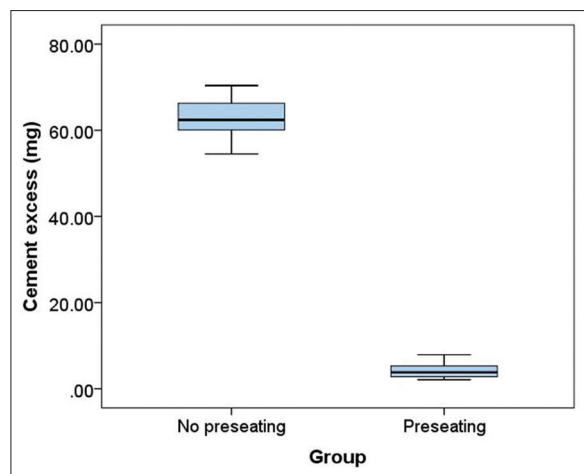


Figure 2: Amount (mg) of excess cement extruded at the abutment margin. Vertical bars on boxes = standard deviations

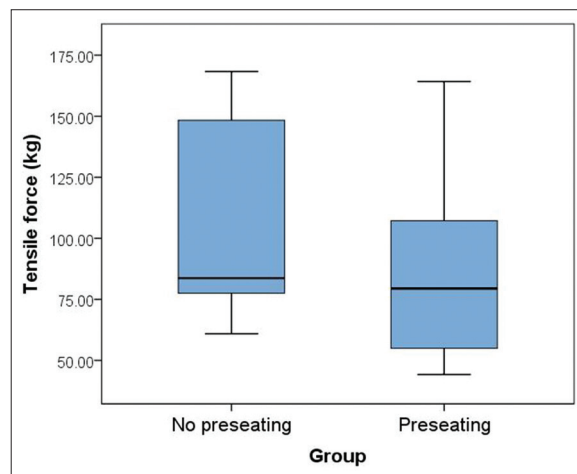


Figure 3: Retentive strength values (kg). Vertical bars on boxes = standard deviations

Table 1: Statistical tests performed in the study (n=10)	
Variable/test	Significance
ANOVA for cement excess	0.000
ANOVA for tensile force	0.412
Linear regression cement excess/tensile force	0.410

$P \leq 0.05$. ANOVA: Analysis of variance

DISCUSSION

It is a well-known fact that cement excess at the subgingival margins of implant restorations can be very detrimental to peri-implant health.^[10] Every effort must be made to prevent it or to adequately remove it but is very difficult to see and eliminate in depths greater than 3 mm.^[7] For this reason, several techniques have been developed to reduce the amount of excess cement.^[5-8] Some of these methods have been previously evaluated by the authors^[9] and the preseating protocol significantly proved to be the most efficient in reducing cement extrusion. It also showed statistically significant lower retentive strength values, using temporary cement (Freegenol, GC America).

Temporary cements have often been used in implant dentistry to allow for retrievability of the restoration.^[11] This would be ideal when removal of the restoration is needed for resericing, repairing, replacing, and salvaging it in the event of a biological or technical complication.^[12] However, the restoration should not be dislodged during normal functional forces, and this is a critical balance. On one hand, the restoration should be luted lightly enough to be easily removed without damage if the need arises, and on the other hand, it should be able to withstand all the functional stresses without being decemented. A special problem arises when a restoration is cemented, and the abutment screw loosens. Ideally, the crown

should be removed, the screw retorqued or replaced, and the crown cemented again. If the crown cannot be removed, it may have to be destroyed. It is reported that a very common problem of implant-supported single crowns is abutment screw loosening (5.8% after 5 years).^[13] However, this same systematic literature review cites that almost as frequently, loss of retention of cemented crowns (5.5%) becomes another technical complication. These facts confirm the delicate equilibrium between retention and retrievability.

Retention of the restoration can be influenced by the height and taper of implant abutments and the type of cement.^[14,15] Cement film thickness has also an influence on the retention of implant-cemented crowns. However, we are comparing this retention with excess cement as related with different cementation protocols and not retention *per SE*. In this respect, we found that there is no statistically significant difference between groups where preseating was used and groups where it was not. We also found that preseating significantly reduces excess cement at the abutment-coping margin.

There is no information in the literature regarding the minimum amount of retention of any restoration to clinically perform in an acceptable way. This is due to considerable amounts of variables that may make a restoration loose in one patient and not in another. They include occlusal forces, parafunctional habits, opposing dentition, and type of food consumed. Furthermore, the geometric characteristics of the abutment previously described will increase or decrease retention of the same cement.

CONCLUSIONS

Within the limitations of this *in vitro* study, it can be concluded that when cementing metallic crowns on

titanium implant abutments with glass ionomer cement, a preseating protocol can be employed since it reduces significantly the amount of cement excess at the margin while providing sufficient retention for the restoration.

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Conflicts of interest

There are no conflicts of interest.

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