



Comparative Analysis of Postcementation Hypersensitivity with Glass Ionomer Cement and a Resin Cement: An *in vivo* Study

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ABSTRACT

Aim: The aim of this clinical study was to compare the postoperative sensitivity of abutment teeth restored with full coverage restorations retained with either conventional glass-ionomer cement (GIC) or resin cement.

Materials and methods: Fifty patients received full-coverage restorations on vital abutment teeth. Of these, 25 were cemented with GIC (GC Luting and Lining cement) and the other 25 using an adhesive resin cement (Smartcem 2). A randomized single blind study was undertaken for acquiring and evaluating the data. The teeth were examined before cementation, after cementation, 24 hours postcementation and 7 days postcementation. A visual analog scale was used to help the patient rate hypersensitivity.

Results: The statistical analysis of the result was done using students paired t-test. No statistically significant difference between Smartcem 2 and GIC was observed, when tested immediately and 24 hours after cementation. Statistically significant difference was seen between Smartcem 2 and GIC when tested 7 days postcementation with a significance level of 0.05. Higher postoperative sensitivity was seen with GIC when compared to resin cement.

Conclusion: In this study, the incidence of postoperative hypersensitivity after cementation of full-crown restorations with GIC and resin cement was similar when tested immediately. However, 7 days postcementation, abutments with GIC showed higher response compared to resin cement.

Clinical significance: A self-adhesive resin cement can be the material of choice for luting if presence of postoperative sensitivity is of prime consideration. In case GIC is being used, patient should be informed about the presence of sensitivity for a more prolonged period than with resin cement.

Keywords: Resin cement, Hypersensitivity, Visual analog scale, Full-coverage restoration.

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INTRODUCTION

Fixed partial denture is one of the most popular and commonly used treatment modality for replacement of missing teeth. It often involves preparation of vital abutments to support the retainers of the fixed partial denture. Full coverage restorations or retainers, involve preparation of all the tooth surfaces of the abutments. A provisional fixed prosthesis is given for the interim period between the tooth preparation and cementation of final prosthesis.

Dentinal hypersensitivity and other pulpal adverse effects are often incurred, if the prepared tooth is left uncovered.¹ This is due to removal of the protective enamel layer while preparing the tooth. This hypersensitivity is taken care of by temporization.^{2,3} However, a small segment of patients have dentinal hypersensitivity postcementation of the definitive full coverage restorations. This has been attributed to the luting agent.

The selection of permanent luting cement for fixed partial dentures is critical as it has an important role to play in controlling the postcementation sensitivity and success of the final prosthesis.⁴ Glass ionomer luting cement is one of the most commonly used definitive luting agents for cast restorations.^{5,6} The luting agent has a low initial setting pH at the time of placement and this has been implicated as a cause of postcementation sensitivity in the past.⁷⁻⁹ Resin based luting cements which are a recent introduction in the market exhibit lower solubility in comparison to conventional GICs and their pH at placement is also higher as compared to GICs. However, resin-based luting cements have also been reported to cause postcementation

hypersensitivity because their main shortcoming is marginal defects and gaps caused by polymerization shrinkage during placement.¹⁰ Literature in regard to postcementation sensitivity is still lacking and has not yielded any definitive answers. This study was undertaken to compare the post-cementation hypersensitivity with the two luting agents.

MATERIALS AND METHODS

A randomized single blind clinical study was undertaken in Department of Prosthodontics, KLE Institute of Dental Sciences, Bengaluru. Permission from the ethical clearance committee of the institute was obtained. A duly signed and informed consent was taken from each of the study subjects.

Exclusion Criteria

1. Patients with history of
 - a. Orthodontic treatment
 - b. Pulp capping
 - c. Periodontal surgery
 - d. Bleaching
 - e. Desensitizing agent treatment
 - f. Attrition, erosion, abrasion, abfraction
2. Pregnant and lactating women
3. Psychiatric patients
4. Patients under medication.

The study had a sample size of 50 prepared vital teeth which were divided into two groups of 25 each. The subjects were randomly assigned to two groups, one group each for GIC and one for resin cement.

Clinical Steps Involved

1. *Tooth preparation*: All the abutment teeth were prepared according to standard tooth preparation protocol for metal ceramic full coverage restorations with diamonds of known diameter by a single operator.
2. *Impression*: Impressions were made with addition silicon using putty wash impression technique. First pour was utilized for making definitive restoration and second pour for temporization.
3. *Temporization*: Temporization was done with eugenol free temporary cements. Eugenol is known to interfere with polymerization and hardening of the polymeric components of the resin cement.

Laboratory Steps

1. *Casting*: Standard protocol of metal coping (Nickel-Chromium) preparation followed by ceramic (Vita) build-up with powder-slurry system was undertaken.

2. *Finishing*: Self glazing of ceramic was done. The metal fitting surface of the metal ceramic crowns was sandblasted with 50 μm Al_2O_3 for 10 seconds with microetcher at a distance of 10 mm with a 90° angle of the nozzle to surface for mechanical retention of the luting agent to the fitting surface of retainer. The crowns were then ultrasonically cleaned in distilled water for 10 minutes and dried with compressed air for 20 seconds.

The temporary crown was then removed and tooth was cleaned with a rubber cup and a prophylactic paste (Propol). The abutments were rinsed thoroughly and blotted dry with moist cotton pellet. The tooth was dried till there was no pooling of water, leaving a moist glistening surface. Desiccating the tooth surface was avoided as it is known to collapse dentinal tubules and interfere with resin adhesion. A disclosing agent called Okklean spray was utilized to identify any minor casting discrepancy in fitting surface of the restoration and to harmonise the occlusion.

For crowns luted with GIC, the GIC was mixed using powder liquid ratio recommended by the manufacturer. For the resin cement the protocol for cementation was different. Smart Cem resin cement is a self adhesive cement with a two component, dual cure polymerization mechanism. The cement was mixed using the spiral tips which ensures uniform mix, no entrapment of air bubbles and no contamination. 25 crowns were cemented using the resin cement. The cement was tack cured for not more than 10 seconds to facilitate easy removal of excess cement. LED light was used. The exposed margins were light cured for 20 to 40 seconds to assist restoration stabilization. Then it was allowed to self cure without disturbing the crown. Final set will take 6 minutes.

A subjective method was used to test dentinal hypersensitivity. The surface temperature of the restoration



Fig. 1: Application of endofrost

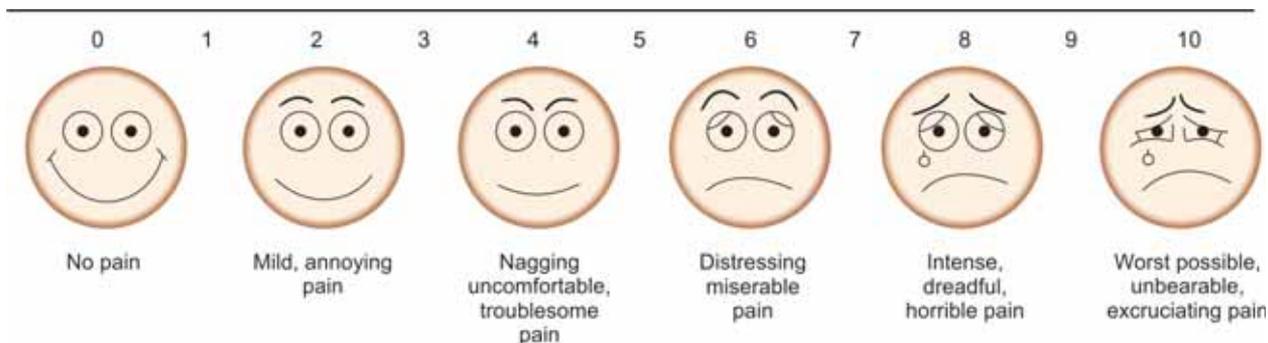


Fig. 2: Visual analog scale

was reduced to -50°C by using a spray called endofrost. Cotton pellets were taken on a tweezer (Fig. 1). Endofrost was applied on the pellet using a nozzle and the pellet was placed on the tooth surface before cementation and on the metal lingual collar after cementation, to elicit response till the patient gave a response or 6 seconds, whichever was earlier.

The sensitivity was checked before cementation, after cementation, 24 hours postcementation and 7 days postcementation. A visual analog scale¹¹ was used to help the patient rate hypersensitivity, 10 being the worst possible pain and 0 being no pain (Fig. 2).

Apart from hypersensitivity, marginal seal of the restorations was checked using modified USPHS¹² (United States Public Health Systems) criteria which was used for clinical evaluation.

- Alpha (A): Restoration closely adapted to the tooth. No crevice visible. No explorer catch at the margins. No visible evidence of crevice along the margins.
- Beta (B): Explorer catch. No visible evidence of crevice into which the explorer could penetrate.
- Charlie (C): Explorer penetrates into crevice that is of a depth that exposes dentin or base.
- Delta (D): The restoration is loose, fractured or lost.

Debonding was checked after 24 hours, 1 week and 1 month.

The statistical analysis of the result was done using students paired t-test for hypersensitivity comparison of SmartCem 2 and GIC at intervals of immediate postcementation, 24 hours and 7 days with p-value at 0.05.

RESULTS

Average age of the study subjects was 33.8 years (Tables 1 and 2, Graphs 1 and 2).

No statistically significant difference was observed between SmartCem 2 and GIC when tested immediately and 24 hours after cementation. Statistically significant difference was seen between SmartCem 2 and GIC when tested 7 days postcementation with a significance level of

0.05. Higher postoperative sensitivity was seen with GIC when compared to resin cement (Graph 3).

No debonding was observed. Two patients with GIC showed marginal discrepancy.

DISCUSSION

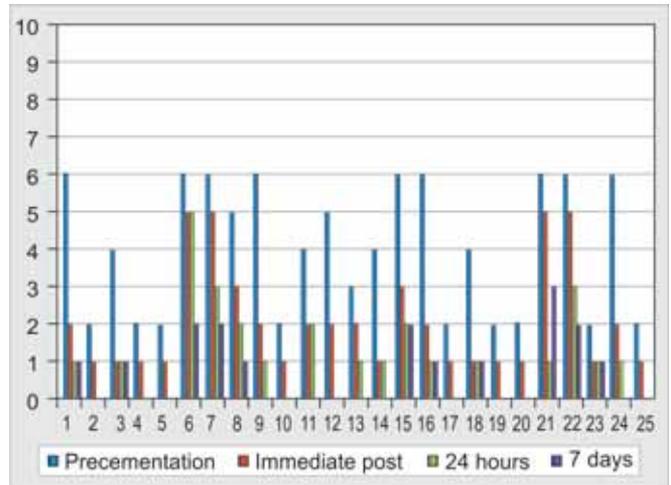
Postcementation hypersensitivity in vital abutments is a common complaint among patients receiving fixed prosthesis. Rosenstiel et al¹³ in his study, showed that the incidence of this postoperative complication is usually underestimated by most dentists. The factors considered ‘very important’ in reducing sensitivity by more than 50% of the respondents to his survey study were desiccation, luting agent, occlusion, provisional and water spray. While preparing vital abutments, the dentist may carry out elective

Table 1: Hypersensitivity values obtained with VAS with GIC cement

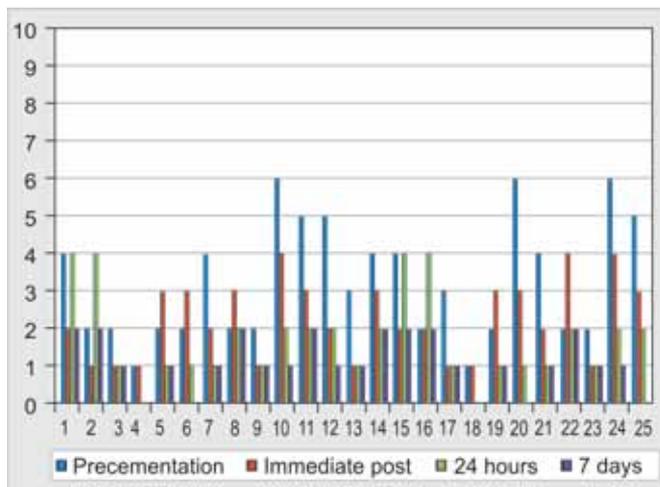
Patient	Pre-cementation	Immediate post-cementation	24 hours	7 days
1	4	2	4	2
2	2	1	4	2
3	3	1	1	1
4	1	1	0	0
5	2	3	1	1
6	6	3	1	0
7	4	2	1	1
8	2	4	2	2
9	2	1	1	1
10	6	4	2	1
11	5	3	2	0
12	5	2	2	1
13	3	1	1	1
14	4	3	2	2
15	4	2	4	2
16	2	1	4	2
17	3	1	1	1
18	1	1	0	0
19	2	3	1	1
20	6	3	1	0
21	4	2	1	1
22	2	4	2	2
23	2	1	1	1
24	6	4	2	1
25	5	3	2	0

Table 2: Hypersensitivity values obtained with VAS with resin cement

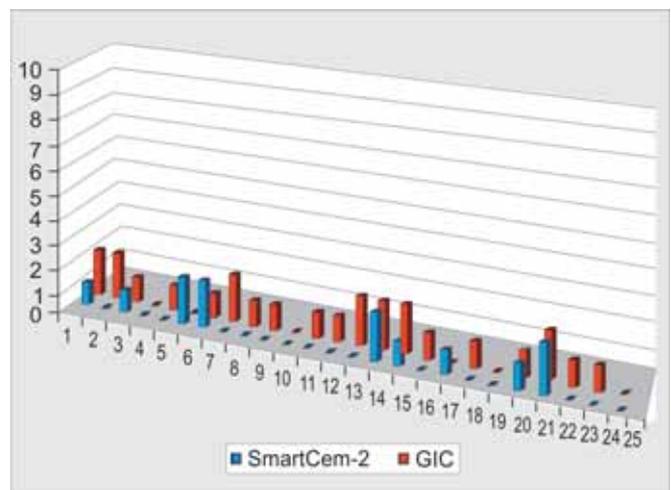
Patient	Pre-cementation	Immediate post-cementation	24 hours	7 days
1	6	2	1	1
2	2	1	0	0
3	4	1	1	1
4	2	1	0	0
5	2	1	0	0
6	6	5	5	2
7	6	5	3	2
8	5	2	1	0
9	6	2	1	0
10	2	1	0	0
11	4	2	2	0
12	5	2	0	0
13	4	2	1	0
14	4	1	1	0
15	6	4	2	2
16	6	2	1	1
17	2	1	0	0
18	4	1	1	1
19	2	1	0	0
20	2	1	0	0
21	6	5	3	1
22	6	5	3	2
23	5	2	1	0
24	6	2	1	0
25	2	1	0	0



Graph 2: Values of hypersensitivity in 25 patients (Resin cement)



Graph 1: Values of hypersensitivity in 25 patients (GIC)



Graph 3: Comparative graphs of hypersensitivity

endodontic treatment for the vital abutments or may try and preserve pulp vitality.^{14,15} The choice of luting agent is important, as they have been known to contribute to postcementation hypersensitivity. Brannstrom³ suggested certain precautions for precementation procedures to reduce the risk of an inflammatory response in the pulp: (1) The provisional crown should be well fitting, covering cervical dentin but not impinging on the periodontal tissues. The definitive crown should be cemented as soon as possible. (2) The superficial smear layer should be removed and the dentinal surface should be treated with an antibacterial solution before the provisional crown is placed. (3) To

decrease dentinal permeability under the provisional crown, the dentinal surface should be covered with a liner that can be easily removed before final cementation. (4) To ensure optimal micromechanical bonding, the dentinal surface should be thoroughly cleaned, and the dentin should be kept moist until cementation. (5) The occlusion should be carefully checked before cementation of the crown. However, postcementation hypersensitivity is still a cause for concern and GIC has been implicated in the past.

Hence, the present study was conducted to evaluate, assess and compare the postcementation response with GIC and a newer resin system. It was a single blind study wherein the result was assessed by an evaluator blind to the nature of luting agent. Postcementation response was assessed by a subjective method on a visual analogue scale. This was done precementation, immediate postcementation, 24 hours and 1 week. Along with this debonding and marginal seal was also checked. No statistically significant difference in response was seen with both cements immediately and

24 hours. However, with GIC the patients continued to show a higher response 7 days postcementation whereas with resin cement the hypersensitivity was nil in most cases after 7 days. The presence of hypersensitivity with GIC at the end of 7 days is in accordance with many of the previous studies which showed that hypersensitivity with GIC usually resolves after a few weeks.⁵

The better performance of resin cement used in our study is in contrast with studies by Denner N et al in which both the resin and GI group had decreased sensitivity 1 week postcementation.⁷ In their study, slight sensitivity was found in 13.3% of subjects with resin cement and only 5.9% subjects with GIC. This was thought to be due to the etching followed with resin cement which removes the smear layer and opens dentinal tubules. However, the resin cement used in their study was a total etch cement as compared to the self-adhesive cement used in our study. A self-adhesive cement may not open the dentinal tubules as much as a total etch cement and may also cause better occlusion of open tubules.

This study has certain limitations in that it was a short term study conducted over a period of 7 days. Long-term study with at least a 2-year follow-up is ideal. Factors other than sensitivity were not taken into consideration in this study. There are many other properties of cement which need to be considered before selecting a luting agent.

CONCLUSION

Within the limitation of the study following conclusions can be drawn:

1. None of the patients with either of the cement showed severe response.
2. With GIC the average response after 7 days was 1.04 which is not significant clinically. With resin cement most patients showed no response at all after 7 days to the cold test.

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