Original Article

Comparative Evaluation of the Sealing Ability of an Alkasite Restorative Material and Resin-Modified Glass Ionomer Cement in Primary Molars: An *In vivo* Study

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Abstract

Background: Cention N is relatively new and an "alkasite" restorative material, indicated for direct restorations. **Aim:** The aim of this study was to comparatively evaluate the sealing ability of Cention N and resin-modified glass ionomer cement (GIC) when used to restore primary molars. **Methods and Materials:** It is a split-mouth study. Twenty children having bilateral deep dentinal caries involving primary molars requiring restoration were selected. After caries excavation under the rubber dam, samples were collected from the cavity. Restorations of the teeth were done using either resin-modified GIC (RMGIC) or Cention N. Patients were recalled after 6 weeks and the restorations done previously were removed using contra angled micromotor handpiece under rubber dam isolation. The samples were collected again. The collected samples were used to estimate the total viable count. **Statistical Analysis:** The pretreatment, posttreatment colony counts, and the differences between the groups were analyzed using paired *t*-test. **Results:** No statistically significant difference was observed in the mean differences of the pre- and posttreatment colony count between alkasite restorative material and RMGIC ($P = 0.056$). **Conclusion:** Restorations done using alkasite restorative material and RMGIC performed equally in terms of sealing ability.

Keywords: *Dental restoration, glass ionomer cements, microleakage, primary teeth*

Introduction

The most advocated restorative materials in pediatric dentistry include conventional glass ionomer cement (GIC), resin-modified GIC (RMGIC), and composite resins.[1,2] Among the above-said materials, both GIC and RMGIC have fluoride releasing property, which reduces the incidence of secondary caries.[2] However, the indication of conventional GICs is limited only to low or moderate stress-bearing areas.[3] Class II cavities in primary molars restored using conventional GIC have significantly shorter longevity than the ones restored using RMGIC and compomers.[4,5]

RMGICs exhibit better performance in terms of retention.[6] But, in comparison with composite resins, they are not very much user-friendly. If the right consistency of the cement is not obtained, then RMGIC sticks to the instrument during its placement in the cavity and may set fast without giving sufficient time for contouring. Also, their overall strength and esthetic properties are still inferior to that of resin composites.[7] RMGIC restorations may even undergo polymerization shrinkage and volumetric changes.[3]

On the other hand, composite resins are known for strength. The major concern regarding this material is the polymerization shrinkage caused due to the polymerization stress along the cavity wall which often leads to microleakage.[8,9] The resultant microleakage may have consequences ranging from postoperative sensitivity to secondary caries.[10] Thus, considering the pros and cons of the available materials, pediatric restorative dentistry is in need of a material with good marginal seal, high strength, and fluoride-releasing property.

Cention N is an "alkasite" restorative material, indicated for direct restorations. Alkasites are a relatively new category of filling materials of the resin composite class. This material utilizes alkaline filler and is capable of releasing fluorides.[11] It has a self-curing property with optional additional light curing.

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For any restoration to be successful, one of the criteria is good marginal sealing ability and integrity.[2] Maintenance of the marginal seal enhances the longevity of the restoration. Thus, the purpose of the present study was to comparatively evaluate the sealing ability of Cention N and RMGIC. The null hypothesis was set as there is no significant difference in the sealing ability of Cention N and RMGIC when used as restorative materials in primary molars.

Materials and Methods

It was a split-mouth study conducted in the Department of Pediatric and Preventive Dentistry of our institution after obtaining clearance from the Institutional Ethics Committee (reference number 18027). Parents of the patients were informed about the requirements and procedure of the study using a patient information sheet following which their consent was obtained.

Sample size

Based on the values obtained in an *in vitro* study by Samanta *et al*.,[11] the expected standard deviation was 0.454. With an alpha error of 5%, and a power of 90%, and keeping an effective difference to show a clinically significant difference of 0.33, a sample size of 20 was calculated.

Thus, a total of 20 patients in the age group between 4 and 10 years, who were in good general health and having bilateral Class I or Class II deep dentinal caries involving primary molars (minimum of two teeth with ICDAS 6) requiring restorations were included in the study [Figure 1a]. While screening for the study subjects, the patients exhibiting Frankl's definitely negative behavior and those on systemic antibiotics were excluded.

Before starting the procedure, in each patient, one tooth was allocated to Group 1: alkasite restorative material Cention N (Ivoclar Vivadent Marketing Pvt. Ltd, India) and another to Group 2: RMGIC (GC Gold Label Light Cured Universal Restorative Material, GC Corporation, Tokyo, Japan) randomly using coin flip method.

Procedure

The teeth were isolated using a rubber dam [Figure 1b] under local anesthesia (LOX 2% Adrenaline, Neon Laboratories Limited, Mumbai). The margins of the cavity were refined to obtain access using a high-speed handpiece, following which a stepwise excavation of caries (removal of caries in two steps) was done using a spoon excavator. Once the excavation was complete, the sample was taken from the cavity floor using a sterile cotton pellet dipped in sterile phosphate-buffered saline (PBS) solution. This was followed by cleaning the cavity with water and oil-free air. Finally, restoration of the tooth was done with either Cention N or RMGIC as per the manufacturer's recommendations [Figure 1c].

Cention N restoration: The cavity was conditioned for a duration of 10 s following which a dentin bonding agent was applied and light cured for a duration of 20 s. The cavities were then restored using Cention N restorative material and light cured for 30 s using a light-curing unit (Elipar 2500, 3M ESPE, Dental Products, St Paul, MN, USA).

RMGIC restoration: Cavity conditioning was done for 10 s, followed by restoration using RMGIC which was light cured for a duration of 30 s using a light-curing unit (Elipar 2500, 3M ESPE, Dental Products, St Paul, MN, USA).

Following the restoration, patients were recalled after 6 weeks for complete removal of caries. During the second appointment, the restorations were removed using a sterile tungsten carbide bur in a contra-angled micromotor handpiece under rubber dam isolation, using light and intermittent pressure to avoid heat generation. A second set of sample was collected from the cavity in the similar manner as mentioned before. Following this, complete excavation of caries was done till hard dentine. The teeth were then restored with their respective restorative material.

Microbiological analysis

The collected cotton pellet was emulsified in 500 µL of PBS solution with a pH between 7.2 and 7.4. 0.01 ml of this solution was taken for bacterial counting using the surface plating method.[12] These plates were incubated at 37°C for 24 h in a carbon dioxide incubator. The number of bacterial colonies was multiplied by the dilution factor and the numbers of colonies were expressed in terms of CFU/ml.

Figure 1: (a) Class II dentinal caries with respect to 75 and 85 (b) Rubber dam isolation done with respect to 75 and 85 (c) Cention N restoration done with respect to 75 and resin-modified glass ionomer cement restoration done with respect to 85

Results

All data were analyzed using the SPSS (version 20.0) software package. The level of significance was set at 5% ($P < 0.05$). The mean colony counts and standard deviation for each group along with differences between the groups and their P value are given in Table 1. The pretreatment, posttreatment values, and the differences between the groups were analyzed using paired *t*-test.

The pretreatment values were similar in Cention N and RMGIC group ($P = 0.238$) [Figures 2a and 3a]. There was a significant fall in the post treatment values when compared to the pretreatment values in both the groups ($P < 0.001$). The posttreatment drop in the colony count was more in the Cention N group [Figure 3b], however it was not statistically significant compared to the RMGIC group [Figure 2b] ($P = 0.056$).

Out of 20 patients included in the study, 6 patients had bilateral class I cavities and 14 had bilateral class II cavities. The comparison of the sealing ability of Cention N and RMGIC used for the restoration of class I and Class II cavities was done using an independent *t*-test [Table 2], there was no statistically significant difference between the subgroups, namely class I and class II ($P = 0.479$).

Discussion

Cention N is a tooth-colored material used for direct restorations. It is self-cured with additional light-curing option.[11] It is radiopaque and releases fluoride, calcium, and hydroxide ions. Fluoride helps in preventing enamel demineralization and enhances remineralization. Calcium ion helps in remineralization, whereas the hydroxide ion acts as an acid-neutralizing ion. The liquid component comprises initiators and dimethacrylates, while the powder contains pigments, glass fillers, and initiators. They also contain isofillers that minimize the volumetric shrinkage and thereby lower the shrinkage stress.[13]

Restoration using Cention N can be done with or without the use of adhesives and this property sets them apart from the conventional composite resin restorations. A retentive cavity similar to that of amalgam filling is required if the restoration is being done without the use of adhesives. In cases wherein adhesives are used, the cavity preparation can be kept to a minimum following the principles of minimally invasive dentistry.[11] In the present study, the restoration of the cavity with Cention N was done using adhesives. RMGIC was used in the present study as a control group, as it is one of the most preferred restorative materials in children and has fluoride-releasing property.[3,14]

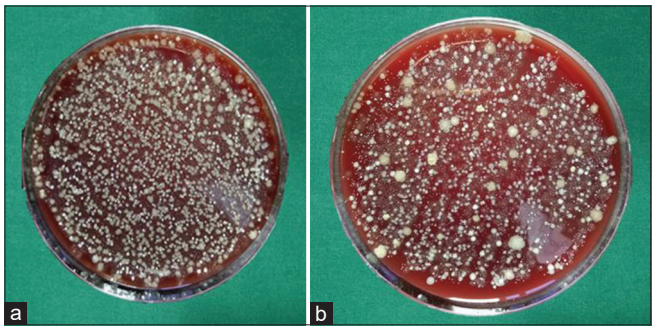

Figure 2: (a) Resin-modified glass ionomer cement pretreatment (b) resin-modified glass ionomer cement posttreatment

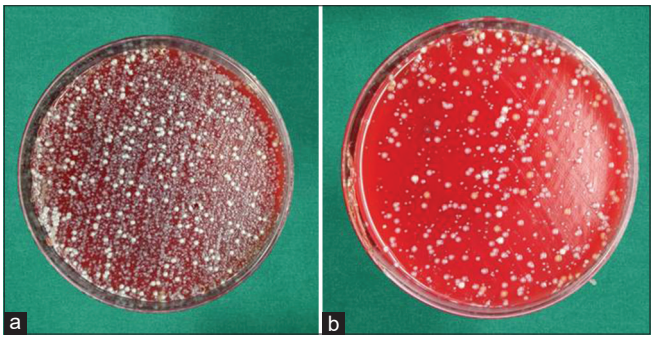

Figure 3: (a) Cention pretreatment (b) Cention posttreatment

Table 1: The mean value with standard deviation of various groups

	n	Mean	SD	Paired differences		*t*	*P*
				Mean difference	SD		
Pair 1							
RMGIC pretreatment	20	1.2112	0.409738	−0.162	0.595134	−1.217	0.238
Cention N pretreatment	20	1.3732	0.489493				
Pair 2							
Cention N pretreatment	20	1.3732	0.489493	0.3356	0.291453	5.15	<0.001
Cention N posttreatment	20	1.0376	0.292389				
Pair 3							
RMGIC pretreatment	20	1.2112	0.409738	0.17772	0.155522	5.095	<0.001
RMGIC posttreatment	20	1.034	0.359882				
Pair 4							
RMGIC difference	20	0.1772	0.155522	−0.1584	0.347933	−2.036	0.056
Cention N difference	20	0.3356	0.291453				

$P<0.001$ (high significance). RMGIC: Resin-modified glass ionomer cement, SD: Standard deviation

Table 2: Comparison of microleakage in Class I and Class II cavities

	Class I (*n*=6)		Class II (*n*=14)		*t*	df	*P*
	Mean	SD	Mean	SD			
Age	6.67	2.16	6.93	1.439	−0.321	18	0.752
RMGIC pretreatment	1.166667	0.426706	1.230286	0.417172	−0.311	18	0.76
RMGIC posttreatment	1.02533	0.404943	1.03771	0.355208	−0.069	18	0.946
RMGIC difference	0.14133	0.092422	0.19257	0.176683	−0.665	18	0.514
Cention N pretreatment	1.288	0.456547	1.40971	0.51501	−0.499	18	0.624
Cention N posttreatment	1.02533	0.399853	1.04286	0.251706	−0.12	18	0.906
Cention N difference	0.26267	0.156638	0.36686	0.333477	−0.723	18	0.479

P<0.001 (high significance). RMGIC: Resin-modified glass ionomer cement, SD: Standard deviation, df: Degree of freedom

The sealing ability of a restorative material is its ability to prevent the passage of clinically undetectable fluids, molecules, bacteria, or ions between the tooth and the restorative material.[11] Determination of microleakage is a useful indicator to detect the sealing ability of any restorative material. There are various methods used for assessing the microleakage which include radioactive isotopes, air pressure, neutron activation analysis, bacterial activity, microcomputed tomography, dye method, and scanning electron microscope. While many of them are *in vitro* methods, few others need sophisticated equipment.[15] In the present study, we used a microbiological method, in the form of estimation of total viable count beneath the restoration to evaluate the sealing ability. This method was used as it allows to assess the microleakage under natural conditions, where the restoration is subjected to the oral conditions and functions.

A stepwise excavation procedure was followed in the present study to manage the deep dentinal carious lesion. After 6 weeks, reentry was done to the cavity to remove residual caries.[16] At the same appointment, we collected the second sample from the cavity to check for the probable microleakage occurred. We collected the samples under rubber dam isolation to prevent cross contamination. Also, in the second appointment, the restoration was removed using a slow-speed contra angled micromotor under rubber dam isolation so as to prevent wetting of the cavity by the water from the air rotor which can lead to bacterial contamination.[17]

There are very few studies in the literature, which evaluated the sealing ability of Cention N. The results of the present study showed, Cention N has a comparable sealing ability to that of RMGIC. Although less number of colonies were seen postrestoration in the Cention N group than the RMGIC group, the difference was not statistically significant. When Samanta *et al*.[11] evaluated the microleakage of GIC, Cention N, and flowable composite resin in Class V cavity preparations, highest microleakage was exhibited in the flowable composite group, followed by the glass ionomer group, whereas Cention N exhibited the least microleakage. However, their study was *in vitro* and the evaluation of the microleakage was done using a stereomicroscope.

The present study was a split-mouth trial and all the selected samples had bilaterally either class I cavities or class II cavities. When subgroup analysis of the sealing ability of Cention N and RMGIC was done, no significant difference was observed between class I and class II cavities. The inclusion of both class I and class II cavities, however, created a heterogeneity in our study sample. Thus, future studies clinically evaluating the sealing ability of Cention N, which includes homogenous sample are recommended.

Conclusion

Within the limitations of this study, it can be concluded that Cention N and RMGIC performed comparably well in terms of marginal leakage following restoration in primary molars.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Chisini LA, Collares K, Cademartori MG, de Oliveira LJ, Conde MC, Demarco FF, *et al*. Restorations in primary teeth: A systematic review on survival and reasons for failures. Int J Paediatr Dent 2018;28:123-39.
2. Dias AG, Magno MB, Delbem AC, Cunha RF, Maia LC, Pessan JP. Clinical performance of glass ionomer cement and composite resin in Class II restorations in primary teeth: A systematic review and meta-analysis. J Dent 2018;73:1-13.
3. Attin T, Buchalla W, Kielbassa AM, Helwig E. Curing shrinkage and volumetric changes of resin-modified glass ionomer restorative materials. Dent Mater 1995;11:359-62.
4. Qvist V, Poulsen A, Teglers PT, Mjör IA. The longevity of different restorations in primary teeth. Int J Paediatr Den 2010;20:1-7.
5. Cehreli SB, Tirali RE, Yalcinkaya Z, Cehreli ZC. Microleakage of newly developed glass carbomer cement in primary teeth. Eur J Dent 2013;7:15-21.
6. Sidhu SK. Clinical evaluations of resin-modified glass-ionomer restorations. Dent Mater 2010;26:7-12.
7. Hse KM, Leung SK, Wei SH. Resin-ionomer restorative materials for children: A review. Aust Dent J 1999;44:1-11.

8. Ferracane JL. Resin composite-state of the art. Dent Mater 2011;27:29-38.
9. Priyalakshmi S, Ranjan M. A review on marginal deterioration of composite restoration. IOSR J Dent Med Sci 2014;13:6-9.
10. Alonso RC, Correr GM, Cunha LG, Borges AF, Puppin-Rontani RM, Sinhoreti MA. Dye staining gap test: An alternative method for assessing marginal gap formation in composite restorations. Acta Odontol Scand 2006;64:141-5.
11. Samanta S, Das UK, Mitra A. Comparison of microleakage in class V cavity restored with flowable composite resin, glass ionomer cement and cention N. Imperial J Interdiscip Res 2017;3:180-3.
12. Kalra P, Rao A, Suman E, Shenoy R, Suprabha BS. Evaluation of conventional, protaper hand and protaper rotary instrumentation system for apical extrusion of debris, irrigants and bacteria An *in vitro* randomized trial. J Clin Exp Dent 2017;9:e254-8.
13. Cention N. Available from: http://www.ivoclarvivadent.in/p/all/cention-n. [Last accessed on2019 Sep 04].
14. Qvist V, Manscher E, Teglers PT. Resin-modified and conventional glass ionomer restorations in primary teeth: 8-year results. J Dent 2004;32:285-94.
15. AlHabdan AA. Review of microleakage evaluationtools. J Int Oral Health 2017;9:141-5.
16. Bjørndal L. Indirect pulp therapy and stepwise excavation. Pediatr Dent 2008;30:225-9.
17. Prabhakar AR, Dixit K, Raju OS. Microbiologic evaluation of cotton and polytetrafluoroethylene (PTFE) tape as endodontic spacer materials in primary molars an *in vivo* study. J Clin Pediatr Dent 2018;42:21-6.