

**Comparison of two restorative materials Vitremer and Cention N for restoring primary molars over a period of 12 months: An in- vivo study**

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**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

**Abstract**

**Background:** Dental caries is the most prevalent communicable disease in the world amongst the population of the children.

**Objective:** To compare restorations in primary molars using two cements Vitremer, a Resin modified glass ionomer cement (RMGIC) and Cention N an Alka site-based material in type1, type 2 and type 3 cavity.

**Methodology:** A randomized controlled trial was conducted on children between ages 4–9 years to restore total 150 teeth that had bilateral matched pair of carious lesions in primary posterior teeth. A split mouth design was used in which two materials, Cention N and Vitremer, were placed on contralateral sides of the oral cavity in the same patient. The aim was to compare clinical performance of these restorations after 12 months using United States Public Health Service (USPHS) criteria. Data were collected 12 months after restoration using USPHS criteria. Statistical analysis was

conducted using SPSS-16. Categorical variables were described as frequencies, and percentages. Chi-square test was used to compare the frequencies between groups keeping statistical significance at  $p \leq 0.05$ .

**Results:** Based on the USPHS criteria, after six months the results of Cention N and Vitremer were comparable, except for sensitivity where RMGIC performed significantly better ( $p=0.040$ ). Though not significantly different, Cention N performed better in 2/10 variables namely marginal discoloration and surface staining. RMGIC did better in 4/10 variables namely marginal integrity, retention, secondary caries and sensitivity. Both cements performed almost equally well in 4/10 variables, i.e., colour match, anatomic form, surface texture and proximal contact.

**Conclusion:** Overall the clinical performance of Vitremer was better than Cention N and is to be considered as a preferable material for restoration of primary molars. More studies are recommended to confirm the results of the present study.

**Keywords:** Dental caries, Restoration, CentionN, Vitremer (Resin Modified Glass Ionomer Cement), USPHS criteria

### **Introduction**

Dental caries has been a highly prevalent and costly disease, representing the most common infectious disease in the pediatric population. Primary teeth are known to be more susceptible to restoration failures than permanent teeth. Additionally, before restoration of primary teeth, consideration is to be given to the length of time remaining prior to tooth exfoliation.

In 1988, resin-modified glass ionomer cements (RMGIC) were introduced to overcome the drawbacks of conventional GICs and provide a material that would bond to tooth structure via both chemical and micromechanical adhesive mechanisms.<sup>1,2</sup> The typical RMGIC consists of approximately 80% GIC components (fluor aluminosilicate glass and polyacrylic acid), while the remaining 20% consists of light cured methacrylates. RMGICs can completely set in total darkness without exposure to curing light within 24hr. This characteristic feature can differentiate RMGIC from the polyacid-modified resin composite materials (e.g., compomer and giomer). Another approach is to depend on resin-based restorations like compomers, ormocers and the newly developed Alka sites which are convenient to place in pediatric patients. Cention N is an innovative filling material for the complete and permanent replacement of tooth structure in posterior teeth. It offers tooth-colored esthetics together with high flexural strength.<sup>3</sup> The new filling material belongs to the materials group of Alka sites. This patented alkaline filler increases the release of hydroxide ions to regulate the pH value during acid attacks. As a result, demineralization can be prevented. Cention N is radiopaque and releases fluoride, calcium and hydroxide

ions. And being a dual-cured material, it can be used as a full volume (bulk) replacement material.<sup>4</sup>

In the present study it is planned to compare the RMGIC which is currently recommended restorative material for primary teeth to a newly developed restorative material Cention N which gives the convenience of GIC and the physical and aesthetic properties of composites.

Thus, a randomized controlled clinical trial study will be undertaken to evaluate the clinical performance of two restorative materials i.e. Vitremer and Cention N.

### **Material and methods**

Upon ethical clearance this randomized controlled clinical trial will include 150 teeth sample size calculated keeping  $\alpha = .05$ ,  $\beta = .20$  with a minimum clinical significant difference at 30%, and compensating 10% for failed follow ups, among patients reporting to PDM Dental College, Bahadurgarh. The patients will be randomly divided into either Vitremer (group 1) or Cention N (group 2). Among each group 25 teeth each of class I, II and multisurface lesions will be restored. Study was conducted during the period of Dec 2017 to March 2019, with evaluation at baseline, three months, six months and one year interval. The baseline evaluation will be done on the same day, after completion of the restoration. The inclusion criteria consisted of contralateral matched pair of teeth with proximo occlusal or occlusal surface caries, with caries-free opposing and adjacent teeth.

Cavitation was required to be extended into dentine. Teeth with the signs of pulpal pain, swelling or a sinus tract and those radiographically declared restorable were excluded from the study.

The 150 teeth selected for the study will be divided into 2 groups I and II comprising of 75 teeth each, based on the type of material used for restoration of the teeth. Group I samples will be restored with Vitremer

posterior restorative cement; Group II samples will be restored with Cention N restorative and each group will be again sub divided into 3 sub-groups of 25 teeth each, A, B and C based on the type of carious lesion involved. Sub group A will comprise of class I cavity, sub group B of class II cavity and group C will comprise of teeth with multi surface caries. Under the rubber dam the entrance of the cavity will be slightly enlarged using an air rotor hand piece. The remaining decayed dentine, if present, will be removed using a small spoon excavator and then the cavity washed with a three-way syringe attached to the dental chair unit. The pre-selected restorative material will be mixed by a trained assistant, as per the instruction manual of the specific material. It will be then placed into the cavity using a cement carrier and overfilled slightly, followed by packing the material into the cavity using a flat plastic filling instrument. The excess material will be removed using carver following which the material will be light cured. Recommended protectant will be applied and occlusion will be checked. The evaluation of the teeth will be done at baseline, 3 months, 6 months and finally at 1 year using the modified USPHS Ryge criteria. Baseline evaluation will be done on the day of the restoration. With the help of CIPTN probe, outcome of the restoration were classified using USPHS criteria for evaluation (Table-1). Data were entered in SPSS- 16. Chi-square test was used with  $p \leq 0.05$  as statistically significant.

Table 1

Category	Rating	Characteristics
Color matching	Alpha	No mismatch in colour, shade or translucency between restoration and adjacent tooth structure
	bravo	Mismatch between restoration and tooth structure within the normal range of tooth

## Results

Children were of ages 4–9 years. At 6 months follow up, 24 patients turned up for examination. Rest refused to come due to their personal issues. At 12 months, many Cention N restorations were lost partially or completely. Many children with Cention N restorations complained of sensitivity. However, the RMGIC restorations were in better condition. Table-2 provides the outcomes of comparisons for 10 variables between the Cention N and Rmgic groups. Detailed documentation of successful outcomes (alpha frequencies, shown as bold figures) for each of the ten categories. after 12 months. Better clinical performance was shown by RMGIC in Secondary caries (Cention N 45.0%, RMGIC 65.0% alpha frequencies respectively), Sensitivity (Cention N 71.4%, RMGIC 66.6% alpha frequencies), Marginal integrity (Cention N 30.0%, RMGIC 55.0% alpha frequencies) and Retention (with similar alpha frequencies but Cention N19% and RMGIC 4% Charlie frequencies respectively). RMGIC showed significantly better outcome in only Sensitivity ( $p=0.040$ ) at 6 months examination. Cention N performed better in esthetic variables like Marginal discoloration (Cention N 70.0%, RMGIC 20.0% of the alpha frequencies) and Surface staining (Cention N 90.0%, RMGIC 70.0% of the alpha frequencies). Both the cements produced almost similar results in four variables naming Color match, Anatomic form, Surface texture and Proximal contact.

Marginal discoloration	Alpha	no discoloration
	Bravo	Slight discoloration at resin–enamel interface; ledge at interface
	Charlie	Moderate discoloration at resin–enamel interface measuring 1 mm or greater
Surface staining	Alpha	Absent
	Bravo	present
Anatomical form	Alpha	Restoration's contour is continuous with existing anatomical form and margins
	Bravo	Restoration is slightly over contoured or under contoured
Surface texture	Alpha	No defect
	Bravo	Minimal defect acceptable
	Charlie	Severe defects
Marginal integrity	Alpha	Marginal adaptation acceptable
	Bravo	Crevice present
Proximal contact	Alpha	Present
	Bravo	Absent
Secondary caries	Alpha	No visible caries
	Bravo	Caries contiguous with the margin of the restoration
Sensitivity	Alpha	Not present
	Bravo	Present
Retention	Alpha	Present
	Bravo	Partially loss
	Charlie	absent

Table 2

Categories	Groups	Alpha (N %)	Bravo (N %)	Charlie (N %)	Total	p
Color match	Cention N	16(84.2)	3(15.7)	-	19	0.33
	Vitremer	15(78.9)	4(21)	-	19	
Marginal discoloration	Cention N	14(70)	3(15)	3(15)	20	0.157
	Vitremer	4(20)	15(75)	1(5)	20	
Surface staining	Cention N	99(90)	1(10)	-	10	0.107
	Vitremer	7(70)	3(30)	-	10	
Anatomical form	Cention N	18(90)	2(10)	-	20	0.144
	Vitremer	17(85)	3(15)	-	20	
Surface texture	Cention N	6(30)	14(70)	-	20	0.793
	Vitremer	6(30)	13(65)	1(10)	20	
Marginal integrity	Cention N	6(30)	14(70)	-	20	0.493
	Vitremer	11(55)	9(45)	-	20	

Proximal contact	Cention N	4(100)	-	-	04	-
	Vitremer	3(75)	1(25)	-	04	
Secondary caries	Cention N	9(45)	11(55)	-	20	0.279
	Vitremer	13(65)	7(35)	-	20	
Sensitivity	Cention N	14(66)	7(33.3)	-	21	0.040
	Vitremer	15(71.4)	6(28.5)	-	21	
Retention	Cention N	18(85.7)	1(4.76)	4	21	0.205
	Vitremer	18(85.7)	4(19.0)	1(4.76)	21	

## Discussion

GIC known for its fluoride ion leaching property but lacks flexural strength. Composite have better aesthetics, strength than GIC, but cannot be used in deep cavities without pulpal protection. Amalgam, a non-aesthetic material has good strength but require mechanical retention and more tooth preparation. Thus all the materials have some drawbacks with their use. In contrast a newly introduced class of material Cention N offers tooth-colored esthetics together with high flexural strength. The new filling material belongs to the materials group of Alkasites.<sup>5</sup> This patented alkaline filler increases the release of hydroxide ions to regulate the pH value during acid attacks. As a result, demineralization can be prevented. Moreover, the release of large numbers of fluoride and calcium ions forms a sound basis for the remineralization of dental enamel. The highly cross-linked polymer structure is responsible for the high flexural strength. The initiator system enables good chemical self-curing.<sup>6</sup> Clinical studies have confirmed that a flexural strength of  $\geq 100$  MPa is an important factor for long-lasting restorations. This is where Cention N considerably differs from glass ionomer cements. At  $\geq 100$  MPa, Cention N offers very good flexural strength for the stress-bearing posterior region. Cention N is a tooth-coloured filling material with a high translucency of approximately 11%.<sup>7</sup> This

allows Cention N to blend in naturally with the surrounding tooth structure, while covering discolored dentin at the same time. The alternative hypothesis for this study was that there was a difference in the survival rates for restorations in proximo-occlusal and occlusal surface caries when done with RMGIC or Conventional GIC.<sup>8</sup> However the results indicated that during the short duration of 6 months Rmgic showed less Sensitivity at 12 months examination compared to the conventional GIC this difference is significant ( $p=0.040$ ). Retention of Rmgic was also better though not significant (with similar alpha frequencies but with Cention N having 19% and RMGIC 4% of Charlie frequencies respectively) showing relatively poor retention of restoration by Cention N. The same can be said about Secondary caries where RMGIC performed better (Cention N 45.0%, RMGIC 65.0% alpha percentages respectively). Retention, Secondary caries and Sensitivity are important factors in determining the success of a restoration. According to the USPHS criteria used in the study, the retention rates of Rmgic and Cention N restorations were 100% and 80.9% for Type 1 Cavity, and 100% and 41.2% for multiple surface restorations after 12 months, respectively. The Null hypothesis that there was no significant difference between the performance of restorations done with GIC and RMGIC may not be considered acceptable

as RMGIC showed less sensitivity after 6 months ( $p=0.04$ ). Keeping the small sample size and shorter duration of study the results may be only of suggestive reflection. However, it may help to validate the acceptability of Rmgic as an alternative material.

### Conclusion

Within the limitations of the study, it can be concluded that vitremer shows better performance among the two the results were almost similar in different time intervals but appreciable difference could be noticed at 12 months. Overall best results are seen in the case of type I restorations. Cention N also seems to show almost similar performance like Vitremer. Cention n and vitremer both release ions which are cariostatic in nature but because the loss of marginal adaptation is statistically significant in Cention N so the changes of post operative sensitivity and secondary caries are better in vitremer, clinically, the handling of vitremer was much easier than Cention N. Further, long term studies are required to substantiate the result.

### Recommendation

More studies with long term follow-up and bigger sample sizes are indicated.

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