ORIGINAL ARTICLE

CLINICAL EFFICACY OF THE CONVENTIONAL GLASS IONOMER CEMENT AND RESIN MODIFIED GLASS IONOMER CEMENT IN PRIMARY MOLARS

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Background: Dental caries is the most prevalent communicable disease in the world amongst the population of the children. **Objective:** To compare the outcome of restorations in primary molars using two Glass ionomer cements Ketac-Molar, a Glass ionomer cement (GIC) and Vitremer, a Resin modified glass ionomer cement (RMGIC) in small and medium sized cavities. **Methodology:** A randomized controlled trial was conducted on 27 children between ages 4–9 years who had bilateral matched pair of carious lesions in primary posterior teeth. A split mouth design was used in which two materials, Ketac Molar 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 6 months using United States Public Health Service (USPHS) criteria. Data were collected six 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 Ketac Molar and Vitemer were comparable, except for sensitivity where RMGIC performed significantly better (p=0.040). Though not significantly different, GIC 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 Ketac molar 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, Ketac Molar (Glass Ionomer Cement), Vitremer (Resin Modified Glass Ionomer Cement), USPHS criteria

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INTRODUCTION

Dental caries is the most prevalent communicable disease in the world amongst the population of the children. A WHO pathfinder survey which examined about 9000 individuals in 21 districts of Pakistan determined that dental caries was the most common chronic childhood disease in the country, i.e., five times more common than asthma and seven times more common than hay fever.[16] According to a recent study conducted in Lahore 71% of poor locality school children had dental caries.[6]

Glass ionomer cement has traditionally been the material of choice for the restoration of primary teeth because of its chemical bonding to enamel and dentin.[7–10] It is accepted that most of the failures observed are material related, since glass ionomer has lower compressive strength and wear resistance than composite and amalgam.[8–13]

Nevertheless, success of restoration is dependent both on cavity sizes and properties of restorative material.[10,13,14] There is a constant scientific work being done world over for enhancing the properties of glass ionomer cements to make it a near ideal restorative material for use. Ketac molar by 3M is one of the glass ionomer cements marketed and has shown a high success rate in primary teeth and therefore it was used for comparison of performance of restorative material.[4,9,15]

This study was done to compare the clinical outcome of Ketac molar and Vitremer in primary molars with the hypothesis that, there is a difference in clinical outcome of conventional glass ionomer cement and resin modified glass ionomer cement when used for occlusal and proximo-occlusal restorations in primary molars.

MATERIAL AND METHODS

A randomized controlled trial (RCT) was conducted in the Paedodontics section of Operative Department in Lahore Medical and Dental College, Pakistan from June 2013 till December 2013 in which random allocation of the cases was done using blocked randomization.

A total of 60 children were examined, out of which 27 children ranging from 4–10 years of age fulfilled the inclusion criteria were selected for this

study. Ten out of these were students of a Govt. Primary School of Tulspura, Lahore and the rest belonged to other schools of the same area. A total of 54 restorations were placed in the teeth of 27 children. Twenty-four out of these children appeared for re-evaluation at six months interval.

The inclusion criteria consisted of contralateral matched pair of teeth with proximo-occlusal or occlusal surface caries, with caries-free opposing and adjacent teeth. The minimum size of the carious lesion was required to be large enough to accommodate the smallest excavator head (0.9 mm diameter). 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.

Using a split mouth design the two glass ionomers, Ketac Molar and Vitremer, were used for restoring the cavities. The materials were placed on contralateral sides of the oral cavity of the same patient. Each type of Glass ionomer cement under investigation was filled on the same side of the arch in every patient. The outcome was measured by comparing the variables using USPHS criteria.

Informed consent was obtained from the parents of these children. Demographic data were documented on the pre-designed *pro formas*. Carious lesions were examined with a mirror and probe. Teeth were selected keeping the inclusion criteria in view. Length and width of the cavities were measured using a Dentarum divider. The cavity depth was measured with the CIPTN probe. Measurements were recorded for each cavity in the *pro forma*. Radiographs were prescribed for the teeth suspected of peri-apical lesions to confirm the depth of the lesion and status of peri-apical tissues. Teeth with pulp involvement were excluded from study. Finally 27 cases were included in the study. Each child received restorations on the contralateral sides with Ketac Molar and Vitremer as per the manufacturer's instructions.

Cavities with 3–6 mm mesiodistal and buccolingual width were classified as medium sized and selected. Cavities were dried with the triple syringe and cotton plugs; isolated Caries was removed with a handpiece and sharp excavator. The cements were placed in the prepared teeth according to the manufacturer's instructions.

Each type of glass ionomer under investigation was filled on the same side in every case. Mylar strip stabilized with help of wooden wedges was used to ensure proper contact formation in proximo-occlusal cavities. Ball burnisher was used to smooth out the occlusal surface of the restoration to ensure filling of all parts of the cavity. All Ketac Molar restorations were covered with petroleum jelly to avoid moisture contamination. All Vitremer restorations were cured with the curing light. It was made sure that there were no defects in the restoration placement. Patients were instructed not to take any beverages or eat for one hour after the restoration. Restorations were placed in the month of June 2013.

A total of 54 restorations were placed. These included 27 Ketac Molar and 27 Vitremer restorations. Restorations were evaluated on follow up visits; 24 patients turned up after 6 months for follow up. Rest refused to come due to their personal issues. The patients from the Government Primary schools were visited and their restorations examined with the consent of the parents and the school authorities.

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.

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 six months, many GIC restorations were lost partially or completely. Many children with GIC restorations complained of sensitivity. However, the RMGIC restorations were in better condition. Table-2 provides the outcomes of comparisons for 10 variables between the GIC and RMGIC groups. Detailed documentation of successful outcomes (alpha frequencies, shown as bold figures) for each of the ten categories.

Better clinical performance was shown by RMGIC in Secondary caries (GIC 45.0%, RMGIC 65.0% alpha frequencies respectively), Sensitivity (GIC 66.6%, RMGIC 71.4% alpha frequencies), Marginal integrity (GIC 30.0%, RMGIC 55.0% alpha frequencies) and Retention (with similar alpha frequencies but GIC 19% and RMGIC 4% Charlie frequencies respectively). RMGIC showed significantly better outcome in only Sensitivity (p=0.040) at 6 months examination.

GIC performed better in esthetic variables like Marginal discoloration (GIC 70.0%, RMGIC 20.0% of the alpha frequencies) and Surface staining (GIC 90.0%, RMGIC 70.0% of the alpha frequencies).

Both the cements produced almost similar results in four variables naming Colour match, Anatomic form, Surface texture and Proximal contact.

Table-1: Scoring system for each item

Category	Rating	Characteristics
Colour Match	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
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
Anatomic 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 defects
	Bravo	Minimum defects 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	Partial loss
	Charlie	Absent

Table-2: Comparisons of frequencies and percentages of scoring for each item

Categories	Groups	Alpha N (%)	Bravo N (%)	Charlie N (%)	Total	*p*
Colour match	GIC	**16 (84.2)**	3 (15.7)	-	19	0.33
	RMGIC	15 (78.9)	4 (21)	-	19	
Marginal discoloration	GIC	**14 (70)**	3 (15)	3 (15)	20	0.157
	RMGIC	4 (20)	15 (75)	1 (5)	20	
Surface staining	GIC	**9 (90)**	1 (10)	-	10	0.107
	RMGIC	7 (70)	3 (30)	-	10	
Anatomic form	GIC	**18 (90)**	2 (10)	-	20	0.144
	RMGIC	17 (85)	3 (15)	-	20	
Surface texture	GIC	6 (30)	14 (70)	-	20	0.793
	RMGIC	6 (30)	13 (65)	1 (10)	20	
Marginal integrity	GIC	6 (30)	14 (70)	-	20	0.492
	RMGIC	**11 (55)**	9 (45)	-	20	
Proximal contact	GIC	**4 (100)**	-	-	04	-
	RMGIC	3 (75)	1 (25)	-	04	
Secondary caries	GIC	9 (45)	11 (55)	-	20	0.279
	RMGIC	**13 (65)**	7 (35)	-	20	
Sensitivity	GIC	14 (66.6)	7 (33.3)	-	21	0.040
	RMGIC	**15 (71.4)**	6 (28.5)	-	21	
Retention	GIC	18 (85.7)	1 (4.76)	4 (19.0)	21	0.205
	RMGIC	18 (85.7)	4 (19.0)	1 (4.76)	21	

GIC=Glass Ionomer Cement, **RMGIC**=Resin Modified Glass Ionomer Cement

DISCUSSION

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.

However the results indicated that during the short duration of 6 months RMGIC showed less Sensitivity at 6 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 GIC having 19% and RMGIC 4% of Charlie frequencies respectively) showing relatively poor retention of restoration by GIC. The same can be said about Secondary caries where RMGIC performed better (GIC 45.0%, RMGIC 65.0% alpha percentages respectively).

Retention, Secondary caries and Sensitivity are important factors in determining the success of a restoration. A field trial of these two restorative materials used with ART treatment in Turkey[9] has also shown that RMGIC can be used as an alternative to GIC due to its better retention, lesser secondary caries and lesser technique sensitivity. According to the USPHS criteria used in the study, the retention rates of RMGIC and HSGIC (GIC) restorations were 100% and 80.9% for single surface, and 100% and 41.2% for multiple surface restorations after 24 months, respectively.

Another one year study conducted in Lebanon[8] for the four different dental restorative materials has shown that RMGIC (Fuji 2 LC) is a suitable alternative to Amalgam for restorations in load bearing primary molars when compared with high viscosity GIC (HVGIC), Poly acid modified resin Composite (PMC) due to its better Retention, Marginal integrity, lesser Marginal discoloration, lesser evidence of Secondary caries and lesser changes in Surface texture as compared to PMC and HVGIC. The results also suggested that restrictions should be considered for the materials with more secondary caries (HVGIC) and higher marginal discoloration (PMC). After one year only one restoration (only 3% of the evaluated restorations) with RMGIC had evidence of secondary caries.

Another 3 year study[15] was done to compare the clinical performance of two glass-ionomer cements (GICs) for Class II restorations in primary molars: conventional cement (Fuji II) and resin-modified cement (Vitremer). According to this study resin-modified GIC offered advantages over the conventional GIC for restoring approximal caries in primary molars. The cumulative success rate of the RMGIC restorations was 94% and that of the GIC (Fuji II) restorations 81%. The difference is statistically significant. The risk of a failed restoration was more than five times higher with GIC than with RMGIC as the restorative material. Of the 13 unsuccessful restorations, seven had lost their

retention, four had secondary caries, and two were fractured.

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 limitation of this study it can be concluded that use of Resin Modified Glass Ionomer cured by chargeable curing lights in primary molars can provide a good alternative to conventional GIC, may have slight edge of better restoration survival rates and may be a factor for caries control in our population.

RECOMMENDATION

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

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