

Comparison of Efficacy of Resin-Modified Glass Ionomer and Composite Restoration in Inhibition of Secondary Caries in Primary Molars

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ABSTRACT

Objective: To evaluate and compare clinical performance and caries inhibition of Resin modified glass ionomer cement and composite restoration in primary molars

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Operative Dentistry, Armed Forces Institute of Dentistry, Rawalpindi Pakistan, from Feb 2019 to Jan 2020.

Methodology: Eighty-three patients fulfilling the selection criteria having at least one carious mandibular primary molar on both sides were divided by split-mouth design. Resin-modified Glass ionomer restorations were done on one side and termed Group-A, and Composite Restorations were done on the other side and termed Group-B. Each restoration was clinically evaluated regarding the appearance of secondary caries at 3, 6 and 12 months after placement by the same operator who performed the treatment.

Results: A total of 166 conventional restorations were placed in the 83 children having carious mandibular primary molars, at least one on each side of the arch. The assessment of restorations, performed after six months, showed an 89.2% success rate of Resin modified Glass ionomer restorations and a 66% success rate of Composite Restoration. One year of follow-up showed an 80% success rate for Resin modified Glass ionomer restorations and 60% for Composite Restoration, as regards secondary caries; statistically significant differences were found in both groups.

Conclusion: The study results showed that Resin modified Glass ionomer cement used to restore primary molars affected by caries performed better clinically than composite in assessing secondary caries.

Keywords: Composite, Primary molars, Resin modified glass ionomer, Secondary caries.

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INTRODUCTION

Different types of restorative materials are used for primary teeth.¹ Traditionally amalgam was used, which is now replaced by adhesive materials such as composite resin (CR), Resin Modified Glass ionomer cement (RMGIC) and Glass ionomer cement (GIC).^{2,3} Because of the micromechanical bonding of composite with the tooth, they bond well, create well-adapted margins, reinforce remaining tooth structure and are esthetically good compared to other restorations. Problems faced during the placement of composite is difficulty in achieving complete isolation.⁴ Another major disadvantage of composite restoration is polymerization shrinkage, resulting in gap formation, which leads to crevice, staining, secondary caries, postoperative sensitivity, and pulpal damage.⁵

Glass ionomer cement used for the restoration of primary molar offers advantages of chemical adhesion to the tooth structure, release of Fluoride to the tooth structure and similar coefficient of thermal expansion

to the tooth structure. However, its compressive strength could be better compared to other restorative materials.⁶ To overcome these problems, resin modified glass ionomer cement (RMGIC) was developed, incorporating light curable resin and increased filler content. RMGIC has improved physical properties, and it has antibacterial characteristics.⁷ RMGIC can remineralise, thereby inhibiting secondary carriers at the restorative margins.⁸

Secondary caries, also known as recurrent caries, is the main reason for replacing dental restorations. Other causes include fracture, marginal deficiencies, wear and postoperative sensitivity.^{9,10}

Although many studies have been conducted comparing the clinical performance of Resin modified GIC and composite in permanent teeth, more needs to be studied in primary teeth. Hence, we conducted this study to evaluate secondary caries concerning RMGIC and composite in primary molars.

METHODOLOGY

After taking approval from the Ethical Committee (No 905/Trg-ABP1K2) the study was carried out at the

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Operative Department, Armed Forces Institute of Dentistry, Rawalpindi, from February 2019 to January 2020. The sample size was calculated using the WHO calculator keeping Population proportion-A= 80%, Population proportion-B=60%.⁹

Inclusion Criteria: All children seeking treatment for dental caries in primary molars, aged 6 to 9 years, with good general, mental, physical health and having good oral hygiene having symptoms of reversible pulpitis in the minimum of one class-2 carious lesions present in primary molars on either side of the mandibular arch not extending to the pulp verified by clinic radiographic examination were included in the study.

Exclusion Criteria: Grossly carious, already restored, mobile, and near-to-exfoliation teeth were excluded.

After taking a thorough medical history and performing a clinical examination, patients qualifying inclusion criteria were explained about the procedure, and written consent was taken from the parents/guardian. All carious tooth structure was removed from teeth on both sides by a single operator. A split-mouth design was adopted in which caries on one side of the mandibular arch was restored with RMGIC and taken as Group-A, and the other side of the arch was restored with composite and termed as Group-B. A single operator did all restorations under the isolation of cotton rolls and saliva ejectors. Postoperative instructions were given, and patients were recalled after three, six and 12 months. At these recall appointments, teeth were evaluated clinically by USPHS Ryge criteria.^{10,11} The scores assigned for secondary caries assessment were: A-clinically undetected caries; and B-clinically present caries.

Statistical Package for Social Sciences (SPSS) version 22.0 was used for the data analysis. Quantitative variables were expressed as mean±SD and qualitative variables were expressed as frequency and percentages. The chi-square test was used to compare secondary caries between the two restoration groups after 3, 6 and 12 months. The *p*-value of ≤0.05 was considered significant.

RESULTS

A total of 166 conventional restorations were placed in the 83 children having carious mandibular primary molars, at least one on each side of the arch. Eighty-three RMGIC restorations were done on one side of the mandibular arch and termed Group-A, and 83 composite restorations on the other side and termed Group-B (Table-I).

Table-I: Distribution of Treatment Groups (n=166)

Caries	Group-A (RMGIC) n=83	Group-B (Composite) n=83
Clinically Detected	49(59.0%)	45(54.2%)
Clinically Undetected	34(41.0%)	38(45.8%)

Out of 83 children, 38(45.8%) children were girls and 45(54.2%) boys and the mean age was 7.5±1.5 years. Table-II showed comparative results of RMGIC and CR restorations evaluation concerning the appearance of secondary caries in all follow-up periods. The assessment of restorations, performed after six months, showed an 89.2% success rate of RMGIC and 66% success rate of CR. 1 year of follow-up showed an 80% success rate for RMGIC and 60% for CR, as regards secondary caries. Statistically significant differences were found in both groups.

Table-II: Comparison of Success Rate Resin Modified Glass Ionomers (RMGIC) and Composite Restoration in Primary Molars(n=166)

Evaluation Period (Months)	Resin Modified Glass Ionomers (n=83)	Composite Restoration (n=83)	<i>p</i> -value
3	77(93.0%)	59(71.1%)	0.01
6	74(89.2%)	55(66.2%)	0.01
12	66(80.0%)	50(60.0%)	0.07

DISCUSSION

Restoration of primary molars affected by caries is a common procedure in dental practice where adhesive restorative materials are used. However, the survivability of restoration depends on multiple factors. Some of them are treatment-related (such as operator's skill; choice of material, handling properties of the material; use of anaesthesia and isolation method; periodical fluoridation; tooth type and its location in the dental arch; the number of restorations; cavity type; the size of the lesion) and other are patient-related (age; socioeconomic status; carious risk; bruxism; type of food consumed and dental hygiene).¹⁰

According to our study, RMGIC was more effective in primary molars than composite restoration. Our results showed an 89.2% success rate of RMGIC and a 66% success rate of CR. One year of follow-up showed an 80% success rate for RMGIC and 60% for CR. Previous reports also supported RMGIC as a restorative material in primary teeth.¹¹ The study by Dermata *et al.* in 2018 showed that RMGIC showed less annual failure rates, that is, 0.8-10%, compared to composite restoration.¹² In the prospective study of Folkesson *et al.* the failure rate in Vitremer restorations was 8.1% for the first year, 11.7% for the second and

19.8% for the third year. The most common reasons for failure were recurrent caries and retention loss, which was more noticed in composite restoration due to increased polymerization shrinkage. RMGIC adhere better to the cavity walls and exhibits fluoride-releasing property, showing less recurrent caries and retention loss.¹³

Another study by Radu *et al.* in 2019 showed that the final assessment of restorations, performed after 36 months of follow-up, showed an 80% success rate for CR and 60% for GIC regarding secondary caries.⁹ Chisini *et al.* in 2018, evaluated the survival of different restorative materials. According to which 36. failure rate was due to secondary caries. Stainless steel crown was the material with the highest success rate (96.1%), followed by RMGIC (93.6%) and compomer (91.2%).¹⁴

Ortiz-Ruiz *et al.* showed that the performance of RMGIC was the best and GIC the worst. The absence of secondary caries and anatomic form were the outcomes with the highest mean success rates.¹⁵ In a study by Webman *et al.* showed the 97.42% survival rate for RMGIC over three years.¹⁶ Similarly, Sengul *et al.* showed that the failure rate of RMGIC (28.1%) was less than Compomer (33.3%) over 24 Months.¹⁷ In a systematic review by Santos and colleagues, where eleven clinical trials were included, showed that the median survival time of Silver reinforced Glass ionomer was less than that of GIC and RMGIC ($p < 0.005$) in two studies, and two trials found that the GIC had a lower median survival rate than both RMGIC and compomer ($p < 0.05$).¹⁸

In the present study, RMGIC restorations showed better clinical performance than CR regarding the appearance of secondary caries. CR restorations displayed a 2.00 times higher estimated relative risk of the appearance of secondary caries than RMGIC restorations.

A possible explanation of our study was that the release of Fluoride or other ions and bacteriostatic effects of RMGIC prevent the demineralization of enamel and dentin. Composite restoration does not possess any antibacterial property to prevent demineralization; moreover, due to polymerization shrinkage seen in CR favours microleakage resulting in secondary caries.¹⁹

CONCLUSION

The study showed that Resin modified Glass ionomer cement used to restore primary molars affected by caries performed better clinically than composite in assessing secondary caries.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MK & TS: Study design, drafting the manuscript, data interpretation, approval of the final version to be published.

AY & SMH: Data acquisition, data analysis, data interpretation, approval of the final version to be published.

ZD & US: Critical review, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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