

Resin-modified glass ionomer cement versus resin-based material as a pit and fissure sealant: split mouth randomized clinical trial.

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Abstract

Introduction: Occlusal surfaces of first permanent molar are the most susceptible areas for development of carious lesions and caries risk is higher during the first few years after tooth eruption. Pit and fissure sealants have become accepted as an effective measure for the prevention of occlusal caries in the permanent molars. Two types of sealant materials are frequently used: Resin-based sealant and Glass ionomer sealant (conventional or resin-modified glass ionomer). Resin-based fissure sealants are most commonly used but they

are easily affected by saliva contamination thus reducing micro-retention and their caries preventive effect. When saliva contamination is expected in the oral cavity, resin-modified glass ionomer cement offers an effective alternative to resin sealants. Hence the aim of the study was to compare the retention rate and marginal staining of a resin modified glass ionomer cement sealant with a resin-based sealant.

Material and Methods: We included 30 patients aged 6 to 8 years who had bilateral erupted permanent first molars. Split mouth design was used, permanent first

molar on one side of mouth was sealed with resin modified glass ionomer cement (Group A) and contralateral permanent first molar was sealed with resin-based sealant (Group B). Sealants were evaluated for retention rate and marginal staining after 6 months. Statistical analysis was completed using SPSS software, with significance level set at <0.05 .

Results: Completely retained sealant rates at 6 months were 56.7% and 30% for group A and group B respectively. No significant differences ($P>0.05$) in sealant retention rate. For marginal staining, resin-based sealants showed statistically higher marginal staining than resin modified glass ionomer sealant ($P<0.05$).

Conclusion: Resin modified glass ionomer showed more retention rate compared to resin-based sealant but difference was not statistically significant. However, marginal staining was lower in the resin modified glass ionomer group, difference was statistically significant.

Keywords: Pit and fissure sealant, glass ionomer sealant, resin based sealant.

Introduction

Dental caries is a multifactorial disease. Despite all efforts at controlling it in recent decades, it affects billions of people worldwide [1]. At tooth level, occlusal surface are the most susceptible areas for carious lesion development [2] as well as caries risk is higher during the first few years after tooth eruption [3]. Sealants were introduced in the 1960 as a caries preventive measure for avoiding caries occurrence or progression and consequently reducing the treatment requirements. Pit and fissure sealant is used as a material that is placed into the retentive occlusal pits and fissures of caries susceptible teeth, thus forming a protective layer cutting access of caries producing bacteria from their source of nutrients. The occlusal pits and fissures of posterior teeth are highly susceptible to caries because of the anatomy

of pits and fissures, which favors stagnation of bacteria and substrates [4]. Use of pit and fissure sealants has become accepted as an effective measure for the prevention of occlusal caries in the permanent molars of young children [5]. The location of the permanent molars in the posterior region of the child's mouth also complicates his or her ability to properly clean these areas and remove food debris. All of these factors contribute to the increase in occlusal pits and fissures caries rate of permanent first molars. Resin based fissure sealants (Prevest Denpro PF seal) are most commonly used and are regarded as the gold standard for sealing pits and fissures [6]. Caries preventive effect of resin based sealant relies on the sealing of pits and fissures through micro-retention, created through tags after acid etching of enamel. Sealants have been shown to be a highly effective strategy for preventing the development and progression of occlusal caries, but the relative effectiveness of different sealant materials remains unclear [7]. Two types of sealant materials are used predominantly: Resin-based sealant and Glass ionomer sealant (either conventional or resin-modified glass ionomer). For a proper seal, resin-based sealants need a completely dry environment and proper isolation. However, they are easily affected and destroyed by saliva contamination thus reducing micro-retention and their caries preventive effect [8]. In uncooperative children and in erupting permanent molars, isolation is difficult to achieve. Under these wet conditions in the oral cavity, resin-modified glass ionomer cement (GC Light cure universal restorative) offers an effective alternative to resin sealants. Although the retention rate of resin-based sealants is higher than that of GIC based sealants, the caries preventive effects of both materials are similar [9]. Several studies have shown that, retention of resin based sealant is higher than GIC based

sealants because of its higher wear resistance and compressive strength as well as micromechanical bonding to tooth structure [10-12]. Therefore, the aim of our study was to compare the retention rate and marginal staining of a resin modified glass ionomer cement as a sealant with a resin-based sealant. The null hypothesis was that the retention rate and marginal staining of the two sealants would not be different.

Objectives -

1. To evaluate retention rate of RMGIC sealant and resin-based sealant.
2. To check marginal staining of RMGIC sealant and resin-based sealant.
3. To compare retention rate and marginal staining of resin modified glass ionomer cement with resin based sealant.

Materials and method

After obtaining ethical and institutional research committee approval, this split mouth randomized clinical study was carried out with a follow-up after 6 months. Patients' parents/guardians were explained in detail about the study procedure and informed consent was obtained from each parent/guardian before including patient in the study. This split mouth clinical study was carried out involving a total of 30 children, aged 6 to 8 years, providing a sample size of 60 teeth. This study was carried out in the department of Pediatric and Preventive Dentistry of MGV's KBH Dental College and Hospital, Nashik. All the treatment was carried out by the same trained operator. Two independent investigators were present during this study. The first investigator performed randomization and treatment and the second investigator evaluated retention rate and marginal staining.

Inclusion criteria

1. Children with general good health.

2. Children with age group of 6 – 8 years.
3. Permanent first molars with retentive deep pits and fissure.
4. Absence of previous restoration or sealant on permanent molar.

Exclusion criteria

1. Medically compromised child.
2. Permanent first molars without retentive deep pits and fissures.
3. Previous restoration or sealant present on molars.
4. Hypoplastic or carious permanent first molars.

Clinical procedure: In this split mouth design, permanent first molar on one side of mouth was planned to seal with resin modified glass ionomer cement (Group A) and contralateral permanent first molar was planned to seal with resin-based sealant (Group B).

Prophylaxis of occlusal surfaces of molar using slurry of pumice was done for removal of debris from the fissures before sealant placement in both the groups. Isolation of teeth was achieved using cotton rolls and saliva ejector. For RMGIC (Group A), the occlusal surface was dried with cotton pellets followed by GC cavity conditioner application for 15 seconds. After that water rinse for 20 seconds followed by cavity was dried with cotton pellets. Then RMGIC (GC Light-cured Universal restorative cement) was mixed according to manufacturer's instructions and applied to the occlusal surface using a plastic filling instrument. We used probe to push the material into the pits and fissures followed by light cure for 20 seconds. Excess material was removed with an explorer.

After successful placement of appropriate sealant on one side, the contralateral tooth was sealed with other material in the same appointment. The occlusal surface of tooth that was sealed with resin-based sealant (PF Seal) was etched with 37% phosphoric acid for 15

seconds, followed by water rinse for 10 seconds and then tooth surface was dried with cotton pellets until whitened surface with frosty appearance occurred followed by bonding agent application with applicator tip and was light cured for 20 seconds. Thereafter using tip of resin-based sealant syringe sealant was applied and pushed into pits and fissures by probe. It was then light cured for 20 seconds.

Evaluation

Teeth were examined by the second independent evaluator after 6 months follow-up period and evaluated according to the criteria. To evaluate retention of sealant, a blunt probe was used. The retention rate was assessed by following criteria proposed by Simonsen RJ et al. [3,4]: Sealant completely retained, sealant partially lost and sealant completely lost. A visual inspection was carried out to check marginal staining. The marginal staining was assessed by following criteria proposed by Sibel A et al. [3]: No marginal staining, partial marginal staining and complete marginal staining.

Statistical analysis

After 6 months the data was inserted into a database, and all statistical analyses were performed with SPSS software (version 21.0). Chi-square test was performed to determine whether there was difference between two groups. For all tests, statistical significance was set at $p < 0.05$.

Results

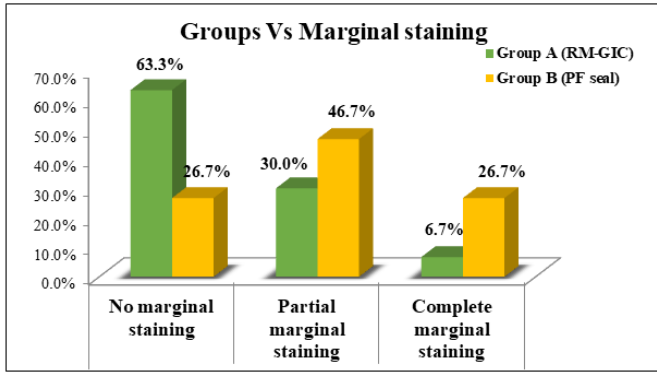
The study was conducted on 30 children aged between 6 to 8 years comprising of 18 males and 12 females. Table 1 presents the sealant retention rate showing completely retained sealant was present in 56.7% (n=17) sealed teeth in group A (RMGIC) and 30% (n=9) sealed teeth in group B (resin-based sealant). Partially lost sealant was present in 36.7% (n=11) sealed teeth in group A (RMGIC) and 46.7% (n=14) sealed teeth in group B (resin-based sealant). Completely lost sealant was present in 6.7% (n=2) sealed teeth in group A (RMGIC) and 23.3% (n=7) sealed teeth in group B (resin-based sealant). There was a no significant differences ($P > 0.05$) in sealant retention rates with group A and group B. So, the proportion of sealant retention was more with RMGIC sealant than resin based sealant.

Table 1: Distribution of sealant retention rates

Groups * Sealant retention			Sealant retention			Total
			Completely lost	Partially lost	Completely retained	
Groups	Group A (RM-GIC)	Count	2	11	17	30
		% within Groups	6.7%	36.7%	56.7%	100.0%
	Group B (Resin-bases sealant)	Count	7	14	9	30
		% within Groups	23.3%	46.7%	30.0%	100.0%
Total	Count	9	25	26	60	
	% within Groups	15.0%	41.7%	43.3%	100.0%	

Chi-square (χ^2) = 5.60, df = 2, P value = 0.061; Not significant

Graph 1: Distribution of sealant retention rates



Discussion

Pits and fissures sealant have been accepted as a caries-preventive treatment modality, and are considered noninvasive treatment to prevent or arrest occlusal caries. The preventive effect of the sealants is maintained only as long as it remains completely intact and bonded in place. Resin-based sealants have been mostly used but glass ionomer sealants are an acceptable alternative owing to their high fluoride release, moisture-friendly features and less chair side time requirement [13,14]. Adequate retention of sealants requires the sealed tooth to have a maximum surface with deep, irregular pits and fissures, and to be clean and dry at the time of procedure [15]. A major drawback of sealing fissures with resin based sealant is that the clinical procedure is extremely sensitive to moisture, which also makes difficult to etch partially erupted molars [17]. RMGIC seemed to be an alternative to resin based sealant because of good biocompatibility, release of fluoride and easy application without intermediate steps such as etching, primer and bonding application [19]. This study compared the retention rate and marginal staining of resin modified glass ionomer cement with resin based material.

Retention rates

The result of present study showed that completely retained sealant was present in 56.7% (n=17) with

RMGIC sealant group and 30% (n=9) with resin based sealant group. Partially lost sealant was present in 36.7% (n=11) with RMGIC sealant group and 46.7% (n=14) with resin based sealant group. Completely lost sealant was present in 6.7% (n=2) with RMGIC sealant group and 23.7% (n=7) with resin based sealant group. The study showed no significant difference ($P > 0.05$) in sealant retention rates with RMGIC sealant and resin based sealant. So, the proportion of sealant retention was more with RMGIC sealant than resin based sealant. Sibel A et al. [3] in their study, observed similar retention rates for resin-based sealant and glass ionomer sealant. They used cavity conditioner before placement of glass ionomer sealant. This product contains polyacrylic acid, which produces a chelation reaction with the calcium of the enamel, thus providing a hybrid layer for the glass ionomer to establish a more stable bonding surface. The conditioner also acts as a wetting agent. P Subramaniam et al. [15] concluded that retention of the resin-based sealant was superior to that of glass ionomer cement at the end of 1 year. The retention of sealants on mandibular teeth was superior to that on maxillary teeth. Karlzén-Reuterving G et al. [16] conducted a study and observed more retention rates of resin based sealant than glass ionomer sealants. Raadal M et al. [17] and Smales RJ et al. [18] found higher retention of resin based sealants as compared to glass ionomer sealants. However, newly erupted molar need to be sealed, resin based sealant showed less retention rate because of difficulty of tooth isolation, lack of patient cooperation and saliva contamination [20]. In our study, lower retention rates obtained with resin-based sealants might be the result of inadequate moisture control.

Marginal staining

The result of present study showed that no marginal staining was present in 63.3% (n=19) with RMGIC

sealant group and 26.7% (n=8) with resin based sealant (PF seal) group. Partial marginal staining was present in 30% (n=9) with RMGIC sealant group and 46.7% (n=14) with resin based sealant (PF seal) group. Complete marginal staining was present in 6.7% (n=2) with RMGIC sealant group and 26.7% (n=8) with resin based sealant (PF seal) group. There was a significant difference ($P<0.05$) in marginal staining between group A and group B. So, the proportion of marginal staining was significantly less with RMGIC sealant as compared to resin based sealant (PF seal). Sibel A et al. [3] in their study, observed more marginal staining with resin based sealants as compared to glass ionomer sealants. Prismless enamel present on partially erupted permanent molars might affect the etching efficacy of the acid in resin-based sealants. The marginal sealing ability of sealant materials is also important for the success of treatment. Lack of sealing allows marginal leakage that leads to carious lesions development beneath the sealant. Winkler M et al. [21] in their study observed retention of the RMGIC was significantly less than the resin based sealant, but the RMGIC had significantly fewer marginal discrepancies. Al-Jobair et al. [22] found that glass ionomer sealant showed less leakage under wet conditions and resin based sealant exhibited less leakage under dry conditions.

Conclusion

It can be concluded that resin modified glass ionomer cement showed less marginal staining (clinically significant) and more retention rate (clinically not significant) compared to resin based sealant. Resin modified glass ionomer cement can be a better choice as sealant with following advantages like less steps and working time, minimal cooperation required, fluoride release, moisture friendly nature.

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