

# A Comparative Study of Retention with Fissure Sealing using a Glass Ionomer and a Resin-based Sealant among School Children of 7-12 years of Age in Bangalore City

## Abstract

**Background:** In the last decade, a general decrease in caries has been observed mainly because of the preventive effect of fluoride. The caries preventive effects of fluoride are greater on smooth surfaces compared to pits and fissures. This fact indicates the need for specific protection against the occlusal surface caries and one method to protect is by the application of pit and fissure sealant. This field trial was conducted to compare the retention with fissure sealing using a glass ionomer and a resin based sealant among school children of 7-12 years of age in Bangalore city. **Materials and methods:** Collection of general information of school children was recorded in a questionnaire designed both in English and Kannada. Clinical oral examination was conducted as per WHO proforma (1997). Among 170 school children, a total of 170 Glass Ionomer sealants and 170 Resin based sealants were placed according to the split mouth design, using contra lateral teeth. **Results:** At 6 months examination 129 (75.8%) resin sealants and 102(60%) GIC sealants were completely retained .35(20.5%) while 22 (12.9%) GIC sealants and 11(6.5%) Resin sealants were absent or lost. At 12 months examination, 89 (52.3%) resin sealants and 50 (29.4%) GIC fissure sealants were completely retained, while 34 (20%) GIC sealants and 37 (21.7%) resin sealants showed absence or loss of sealant. At 18 months examination, the retention of GIC sealants dropped to 23 (13.5%) and resin sealants to 62 (36.4%).

## Key Words

Sealants; retention; school children; dental caries

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## INTRODUCTION

Dental caries has been one of the most common oral diseases ever to affect humans. Improved understanding of the disease etio-pathogenesis has revealed that it is a disease of multifactorial origin, with a complex interaction of three main factors: the microorganisms, a cariogenic substrate and a susceptible tooth.<sup>[1]</sup> Pit and fissures are usually more susceptible to dental caries than any other surface of the teeth and have been described as the single most important anatomic feature leading to the development of occlusal caries.<sup>[2]</sup> Probably the most caries susceptible period of a first molar tooth concerns the one to one and half year long eruption

phase where the teeth are at increased risk of developing caries, especially in the developmental pits and fissures.<sup>[3]</sup> Simonsen proposed that the placement of a sealant will avoid an initial occlusal restoration, which begins the 'molar life cycle', which may proceed to cuspal fracture, complex restoration and possible extraction. Since fissure sealing was introduced in dentistry in the 1960's, there have been many studies on its efficiency and the main inference is that sealants are useful in preventing dental caries in pits and fissures.<sup>[4]</sup> Any measure for caries prevention needs to take into account the aspect of cost-effectiveness and also patient recall. These aspects are more so important

in developing countries where proper utilization of scarce resources is a priority.<sup>5</sup>

### OBJECTIVES OF THE STUDY

To compare the retention of glass ionomer and resin-based fissure sealants and suggest any one of the above methods for caries prevention on occlusal surface.

### MATERIALS AND METHODS

The study was carried out at randomly selected schools in Bangalore city. The list of schools in Bangalore city was obtained from the office of Deputy Director of Public Institutions (DDPI), Bangalore. Necessary permission to carry out the study was obtained from the school authorities after informing them about the nature and procedure of the study. The required ethical approval was obtained from Government Dental College-Bangalore. A pilot study was conducted among 50 students from a school which was randomly selected from the available Deputy Director of Public Institutions (DDPI) school list. A sample of approximately 140 subjects was determined after the pilot study. However, in order to allow for an expected loss of about 20% follow up participants to follow up, 170 subjects were selected for the study. The selection of sound teeth with deep fissures and teeth with incipient caries lesion was done by utilizing the Poulsen criteria (2011).<sup>[6]</sup> The teeth selected for the application of fissure sealants were the permanent first and second premolars and the first and second molars of the maxillary and mandibular arches with sound deep fissures and initial caries. Parents or guardians of the selected children were informed about the study and a written consent was obtained. Collection of general information of school children including socio-Economic Status main staple food, sweet exposure, oral hygiene practices and other relevant information were recorded in a questionnaire designed both in English and Kannada. Clinical oral examination was conducted as per WHO proforma (1997). Among 170 school children, a total of 170 Glass Ionomer sealants and 170 Resin based sealants were placed according to the split mouth design, using contra lateral teeth. In each child, a random number was used to determine which tooth should be sealed with resin material and which tooth with glass Ionomer. The procedure of application was done by the investigator with assistance from trained house surgeons in the school premises. All the treatment procedures were done either in class rooms or in the shaded open space

with good access to natural light or when natural light is restrained, torch light was used. The sealants were applied as per manufacturer's instructions. The clinical status of the sealants was assessed by a calibrated independent examiner. Evaluations were done at six, twelve and eighteen months after the placement of the sealants. The evaluation of sealed teeth for retention was done as per RYGE G.<sup>[7]</sup> Criteria represented as follows:

A= complete extension (retention) -sealant covers all parts of the grooves and the fissures.

B= absence or loss of sealant restricted to the peripheral part of one or more grooves

C= absence or loss of sealant in one or more grooves including one fossa

D= extensive loss of sealant including grooves and two or all three fossae, or absence of sealant.

Repair/replacement of the defective sealants was carried out at the end of the study period after the final evaluation. The statistical package for social science (SPSS) version 10 was used for analysis.

### RESULTS

Totally 170 children comprised the study group. The mean age of the study group was 10.9 years + 1.49 (S.D.). Among them 85 (50%) children were males and 85 (50%) children were females. About 6 (3.5%) of study participants were 7 year old, 12 (7.1%) children were 8 year old, 9 (5.3%) children were 9 year old, 21 (12.4) children were 10 year old, 58 (34.1%) children were 11 year old, 46 (27.1%) children were 12 year old and 18 (10.6%) children were 13 year old (Table 1). Regarding the aid used for cleaning teeth, most of the children used tooth brush-158 (92.9%), few used fingers-11 (6.5%) to clean their teeth and only 1 (0.6%) participant used datun for cleaning the teeth (Table 2). The tooth wise distribution of sealants showed that the GIC and Resin-based sealants were placed on 36(21.1%) upper premolars and 45(26.4%) lower premolars each. 40(23.6%) upper molars and 49(28.8%) lower molars were sealed with GIC and Resin-based sealants each. Totally 340 sealants were sealed with both GIC and Resin-based sealants (Table 3). At 6 months examination, according to the evaluation criteria, 129 (75.8%) resin sealants and 102 (60%) GIC sealants were completely retained (score A). 35(20.5%) GIC sealants and 23 (13.5%) Resin sealant showed absence or loss of sealant restricted to the peripheral part of one or more grooves (score B), while 22 (12.9%) GIC sealants and 11 (6.5%) Resin sealants were absent or lost in one or more grooves including one fossa

**Table 1: Distribution of Study Participants According To Age and Sex**

Age (Years)	Sex		Total
	Male	Female	
7	4	2	6 (3.5)
8	7	5	12 (7.1)
9	6	3	9 (5.3)
10	11	10	21 (12.4)
11	25	33	58 (34.1)
12	21	25	46 (27.1)
13	11	7	18 (10.6)
Total	85 (50)	85 (50)	170 (100)

**Table 2: Distribution of Study Participants According To Aid Used For Cleaning Teeth**

AID USED FOR CLEANING	NUMBER	PERCENTAGE
Fingers	10	5.8
Tooth Brush	158	92.9
Datun	1	0.6
Total	170	100

**Table 3: Teeth-Wise Distribution of Sealants**

MATERIAL USED	PREMOLARS			MOLARS		
	UPPER PREMOLARS	LOWER PREMOLARS	TOTAL	UPPER MOLARS	LOWER MOLARS	TOTAL
GIC N=170	36 (21.1)	45 (26.4)	81 (47.6)	40 (23.6)	49 (28.8)	89 (52.4)
RESIN N=170	36 (21.1)	45 (26.4)	81 (47.6)	40 (23.6)	49 (28.8)	89 (52.4)
TOTAL N=340	72 (21.1)	90 (26.4)	162 (47.6)	80 (23.6)	98 (28.8)	178 (52.4)

**Table 4: Distribution of GIC and Resin-Based Fissure Sealants According To Retention At 6, 12 And 18 Months**

Material Used	6 MONTHS				12 MONTHS				18 MONTHS			
	EVALUATION SCORES*				EVALUATION SCORES*				EVALUATION SCORES*			
	Complete retention	Partial loss	Total loss	Attrition	Complete retention	Partial loss	Total loss	Attrition	Complete retention	Partial loss	Total loss	Attrition
	A	B+C	D		A	B+C	D		A	B+C	D	
GIC N=170	102 (60)	57 (33.4)	8 (4.7)	3 (1.7)	50 (29.4)	78 (45.8)	38 (22.3)	4 (2.35)	23 (13.5)	92 (54.1)	51 (30.0)	4 (2.35)
Resin N=170	129 (75.8)	34 (20)	4 (2.35)	3 (1.7)	89 (52.3)	57 (33.4)	20 (11.7)	4 (2.35)	62 (36.4)	74 (43.5)	30 (17.6)	4 (2.35)
Statistical Significance	p<0.05				p<0.01				p<0.01			

(score C). Extensive loss of sealant including grooves and two or all three fossae, or absence of sealant (score D) was seen in 8 (4.7%) GIC sealants and 4 (2.35%) Resin sealants. At 12 months examination, 89 (52.3%) resin sealants and 50 (29.4%) GIC fissure sealants were completely retained, while 34 (20%) GIC sealants and 37 (21.7%) resin sealants showed absence or loss of

sealant restricted to the peripheral part of one or more grooves (score B), 44 (25.8%) GIC sealants and 20 (11.7%) resin sealants showed absence or loss in one or more grooves including one fossa (score C). Extensive loss of sealant including grooves and two or all three fossae, or absence of sealant (score D) was seen in 38 (22.3%) GIC sealants and 20 (11.7%) resin sealants. At 18

months examination, the score A retention of GIC sealants dropped to 23 (13.5%) and resin sealants to 62 (36.4%), while the score B retention was seen in 45 (26.5%) GIC sealants and 46 (27%) resin sealants. The score of C and D was seen in 47 (27.6%) GIC sealants, 28 (16.5%) resin sealants and 71 (41.8%) GIC sealants, 30 (17.6%) resin sealants respectively (Table 4).

## DISCUSSION

Pit and Fissure sealants have been an accepted caries preventive strategy since the 1970's. The efficacy of sealants in preventing caries has been associated with duration and degree of sealant retention. Resin based sealants have been tested on many occasions and have generally been shown to be an effective method of caries prevention in children and young adults. It has been shown that pit and fissures sealed with Glass Ionomer sealant materials takes up substantial quantities of fluoride but perceived handling difficulties with GIC materials have limited their adoption and use. In the aspect of comparing the findings or the results of the present study with other clinical investigations, it is paramount to recognize that many variables like the age of the subjects, selection of the subjects, Operating conditions, expertise of the operator, exposure of the teeth to factors like fluoride and so on will exist which will have an impact on the outcome of the procedures that are being studied.

The mean age of school children included in the present study was 10.9 yrs  $\pm$  1.49 years. This is in line with the subjects taken for the studies by, Forss *et al.*,<sup>[8]</sup> (5-14 years, mean age=11 years, Arrow *et al.*,<sup>[9]</sup> (mean 7 years), Mejare *et al.*,<sup>[10]</sup> (5 -15 years), Poulsen *et al.*,<sup>[11]</sup> (7-9 years) and Leendert *et al.*,<sup>[12]</sup> (6-18 years). The Assessment of frequency and time of sweet consumption revealed that 77 (45.3%) consumed sweets twice a week and 59 (34.7%) consumed sweets once a week. About 150 (87.6%) of study participants consumed sweets in-between meals, 12 (7.1%) during meals and 8 (5.3%) during and in-between meals. The staple food consumed, nature of diet, frequency and time of sweet consumption was not assessed in any of the studies. The aid used for cleaning teeth was Toothbrush by 158 (92.9%) of the study participants. 11 (6.5%) of the study participants used finger to clean their teeth and 1 (0.6%) used Datun. About 120 (71.2%) study participants brushed their teeth once in a day, while 50 (28.8%) brushed their teeth twice daily. 151 (88%) of the study participants claimed to brush their teeth before meals and 19 (11.2%) after meals.

This study showed that the percentage of evaluated GIC sealants that were completely retained in the occlusal fissures and gradually reduced to 60% at 6 months to 29.4% at 12 months and 13.5% at 18 months. The retention rates of Resin sealants was comparatively higher than GIC sealants at 6 months (75.8%), 12 months (52.3%) and at 18 months (36.4%). This finding is similar to the studies done by Arrow *et al.*,<sup>[9]</sup> Mejare *et al.*,<sup>[13]</sup> Komatsu *et al.*,<sup>[14]</sup> and Boksman *et al.*<sup>[15]</sup> Retention rates of the Resin sealants at 6 months was comparatively higher (75.8%) than GIC sealants (60%). Almost similar findings were seen in study by Mejare *et al.*,<sup>[13]</sup> where 27% of the GIC sealant and 51% of Resin sealants were completely retained at 6-month follow up period. Comparatively studies by Komatsu *et al.*,<sup>[14]</sup> (43.2%) and Arrow *et al.*, (40.1%) showed even higher percentages of GIC sealant loss at 6 months follow up whereas the rate of partial loss of Resin sealant in these studies was similar to that of the present study. The present study showed that 4.7% of GIC sealants and 2.35% of Resin sealants were completely lost at the end of 6- months. In contrast to the present study, most of the previous studies showed a higher percentage of complete loss of sealants. In the study by Mejare *et al.*,<sup>[13]</sup> 61% GIC sealants and 7% of Resin sealants were completely lost at the end of 6-12 months. In the study by Poulsen *et al.*,<sup>[11]</sup> 52.14% of GIC sealants and 3.15% of Resin sealants were completely lost at the end of 6 months. The study showed that 29.4% of evaluated GIC sealants and 52.3% of Resin sealants were completely retained. This finding is similar to the study by Mejare *et al.*,<sup>[13]</sup> where in, 31.5% of GIC sealants and 54.5% of Resin sealants were completely retained. But in contrary, Komatsu *et al.*,<sup>[14]</sup> (27.2% and 50.1%) and Poulsen *et al.*,<sup>[11]</sup> (24.5% and 49.7%) showed a lower percentage of retention of both GIC and Resin sealants. In all the studies mentioned above, Resin sealants had better retention than GIC sealants at 12- months follow up. The percentage of partially lost sealants in the present study 45.8% for GIC and 33.4% for Resin sealants. These findings are similar to the study by Torppa-saarinen *et al.*,<sup>[16]</sup> who found a partial lost percentage of 41.2% for GIC and 32.2% for resins. At 12 months, it was seen that 22.3% of GIC sealants and 11.7% of Resin sealants were completely lost. A higher percentage of loss was found in studies by Poulsen *et al.*,<sup>[11]</sup> Arrow *et al.*,<sup>[9]</sup> and Pardi *et al.*<sup>[17]</sup> An almost similar loss of Resin sealants was (8.5%) was seen in study

by Mc Kenna *et al.*<sup>[18]</sup> As expected the retention decreased with time. According to the present study, 13.5% of GIC sealants and 36.4% of resin sealants were completely retained 18-month period. Only in study by William *et al.*,<sup>[19]</sup> evaluation has been carried out at 18 months and it showed 18.2% of GIC sealants and 56.2% of Resin sealants were completely retained. However, when compared with the 2-year evaluation results of studies by Poulsen *et al.*,<sup>[11]</sup> showed complete retention of 8.85% of GIC and 80.2% of Resin. Studies by Forss *et al.*,<sup>[8]</sup> (11.5% for GIC and 33.3% for Resin), Songpaisan *et al.*<sup>[20]</sup> (12% for GIC and 35.3% for Resin) and Williams *et al.*,<sup>[19]</sup> (10.4% for GIC and 31.1% for Resin) showed lower percentages of complete retention for both GIC and Resin sealants at 24 months follow up. Complete loss of sealants was seen in 30% of GIC and 17.6% of Resin sealed tooth surfaces was seen in the present study. Studies by Forss *et al.*,<sup>[8]</sup> (48% GIC and 16.5% Resin) and Poulsen *et al.*,<sup>[11]</sup> (82.29% GIC and 13.02% resin) showed similar findings, while Mc Kenna *et al.*,<sup>[18]</sup> (53.6% for GIC and 19.1% for Resin) and Songpaisan *et al.*,<sup>[20]</sup> (54.9% for GIC and 21.3% for Resin) showed higher rate of loss of sealants at 24 months follow up. One of the main reasons for the loss of GIC sealants could be inadequate adhesion of the cement to enamel surface. This reason has been substantiated by James E *et al.*,<sup>[21]</sup> who in vivo experimental found great variations in bond strength indicating that good wetting and sufficient chemical interaction between the GIC and the enamel was even more difficult to obtain in-vivo than in-vitro.

### CONCLUSION

Factors that most commonly pose as hurdles for access and provision of oral health care in a developing country like India are larger population, poverty, ignorance, inadequate financial resources. This further is compounded by the fact that the traditional manner of treating dental caries relies heavily on electrically driven equipments and is unaffordable and inaccessible to most of the sections of the community. The application of sealants is a time-tested technique for prevention of caries on the pit and fissure surfaces. The study findings suggests that the retention of resin sealants at 6, 12 and 18 months was better than the GIC sealants though many studies give a favorable decision to GIC sealants as far as prevention and caries development among sound teeth with deep fissures and even caries manifestation among initial

caries teeth as compared to resin sealed teeth. In the present era of minimally invasive and maximally preventive concepts in dentistry, the placement of pit and fissure sealants for preventive oral care has the potential to make significant contribution for the betterment of oral health of population groups currently receiving minimal dental care or not receiving any dental care at all.

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