

ORIGINAL RESEARCH

Evaluation of Retention among Acid-etch and Self-etch Sealants: An *in vivo* Study

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ABSTRACT

Aim: The aim of the study is to evaluate the retention of fissure sealants following the use of self-etch priming agent and traditional acid-etch method.

Materials and methods: Thirty subjects around the age 8 to 12 years old school children was recruited to this study by two dental professionals. Paired lower molars were the principal unit of analysis. Pit and fissure sealant placement lower molars followed by traditional acid-etching done on 36 and self-etch primer (3M ESPE) on 46. After 6 months the retention was evaluated using Smales RJ and Wong KC (1999) retention evaluation criteria. The Chi-square test was used to evaluate the difference in the retention rates.

Results: The total retention in the self-etch sealant group seems to be high, the difference between the groups was not statistically significant. The chi-square computed value was found to be $\chi^2 = 0.417$, $df = 1$ and $p = 0.519$. This means that there was no significance difference between the retention rate of self-etch sealant compared to conventional acid-etch technique. Hence, this study conclude that self-etch primer (3M ESPE Adper) is effective in bonding sealant to enamel and that the simplified method dramatically shortens treatment time and treatment complexity.

Keywords: Chi-square, Pit and fissure sealant, Retention, 3M ESPE Adper.

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INTRODUCTION

Dental caries is one of the most common pandemic disease in school children. Though it is a common oral disease in school

children, a general reduction in caries prevalence has been reduced.^{1,2} This was mainly because of advanced preventive techniques. This includes pit and fissure sealants, fluoride application, and preventive resin restoration. Occlusal pit and fissure are the most common area of caries initiation but the use of topical or systemic fluoride are ineffective in pit and fissure caries.³ Among all the other technique pit and fissure sealant has gained much importance in caries prevention. Fifty percent of caries of school children was in occlusal surface.³ This is due to the variation in the tooth morphology. During initiation stage of tooth development lobes were formed which later invaginates to form pit and fissures of the occlusal surface of the teeth.⁴ But it also invite plaque and microorganism accumulation where even topical and systemic fluoride is ineffective in preventing it. Many studies have shown that in fluoridated communities, over 90% of dental caries is exclusively pit and fissure caries.^{5,6} This shows that pit and fissures sealant is approximately 8 times as vulnerable as smooth surface.⁴ In order to prevent pit and fissure caries in 1926, Bodecker suggested enameloplasty procedure. From that many advancement were made in the use of pit and fissure sealant form the use of polyurethane to recently using fluorides releasing hydrophilic resin based sealants to overcome moisture contamination. Though self-etch sealant seems to have more promising results, there were no much studies pertaining to it. Hence aim of the study is to evaluate retention among acid-etch sealants and self-etch sealants—an *in vivo* study

MATERIALS AND METHODS

Ethical Approval

Ethical approval was taken from the institutional ethical committee of SRM Dental College, Chennai. Written informed consent was obtained from the parents/guardian of the children.

Subject Allocation and Recruitment

Thirty school children aged around 7 to 13 years were taken as study subjects. The students were selected from screening camp conducted at the school premises. The eligibility of children for inclusion criteria was if fissure sealant placement on contralateral lower permanent molar teeth was indicated according to British Society of Pediatric Dentistry

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recommendations.⁵ High caries risk children, children with fully erupted permanent molars were included in the study. Uncooperative children, and children who were under long term antibiotic therapy or other systemic disorders were excluded from the study.

Study Design

A prospective, double blind, randomized control clinical trial was conducted among 30 school children in Government school children, Chennai. The subjects were taken from the same school and same class in order to match the study subjects in age.

The experimental group includes 30 children. Since, split mouth technique was used, the total teeth to be sealed were 60 permanent molars. The left molars are sealed using self-etch primer (3M ESPE Adper) and right quadrant molar are sealed using conventional acid-etch technique. The randomization of the sealant technique was achieved by lottery method.

Calibration of the Examiner

Two calibrated dentist were recruited to place sealants for the clinical trial. The operators received written and verbal direction in the two fissure sealant techniques to be used from the principal researcher. And the dentists were instructed to always place the sealants in their respective segments. The kappa test was employed to inter and intraexaminer reproducibility. The values were found to be 0.67 and 0.80 respectively.

Clinical Procedure

The sealants were applied after oral prophylaxis. First the teeth were isolated with cotton rolls to avoid saliva contamination.

Control Group

The teeth are conditioned for 30 seconds with 35% phosphoric acid gel and rinsed with water. After application of etchant, the tooth was then rinsed with water for 20 seconds and dried with three way syringe to get the frosty appearance. Cotton rolls were used to avoid saliva contamination. After conditioning Delton[®] (Dentsply, Tulsa, USA) opaque light curing fissure sealant was applied to the fissure and cured for 20 seconds. The sealed teeth was then verified and adjustments of occlusal contact was done.

Test Group

In the test group after the teeth was isolated (3M ESPE Adper) self-etch primer was applied to the occlusal surface

of molar tooth, left for 20 seconds and dried using 3-1 syringe and light cured for 10 seconds. Delton[®] (Dentsply, Tulsa, USA) opaque light curing fissure sealant was applied to the fissure and cured for 20 seconds. The sealed teeth were then verified and adjustments of occlusal contact were done.

Evaluation

The clinical evaluation was carried out after 6 months. The sealants were observed by a principal examiner. Before evaluation the principal examiner was calibrated and intra examiner kappa value was 0.80 which was found to be good association. The evaluation was carried out in dental chair with mouth mirror, explorer and appropriate source of light was used. The evaluation criteria was followed by Smales et al method.⁷

Total retention: (TR) Total retention of sealant on the occlusal surface.

Partial retention type 1: (PR 1) Presence of sealant in 2/3 of pit extension with small fracture and loss of material.

Partial retention type 2: (PR 2) Presence of sealant in 1/3 of pit extension with small fracture and loss of material.

Total loss: (TL) Absence of sealant on the occlusal surface of the teeth.

Statistical Analysis

Chi-square test was employed to statistically evaluate the difference in retention rate between the test and the control group. The data was entered in Microsoft excel sheet and statistical test was done using statistical package using SPSS software version 14. The kappa test was employed to inter and intraexaminer reproducibility. The values were found to be 0.67 and 0.80 respectively.

RESULTS

The total sample size consist of 30 study subjects. Out of 30 study subjects 19 (63.3%) were males and 11 (36.7%) were females (Table 1).

Table 2 illustrates the percentage of total retention of sealants among the two groups. Out of total 60 sealed teeth, the total retention in teeth that was sealed using conventional acid-etch technique was found to be 23 (76.7%) teeth and the teeth that was sealed using self-etch technique was found to be 25 (83.3%). Though the total retention in the self-etch sealant group seems to be high, the difference between

Table 1: The gender distribution among the study subjects

Gender	N	%
Male	19	63.3
Female	11	36.7
Total	30	100

the groups was not statistically significant. The chi-square computed value was found to be $\chi^2 = 0.417$, with degree of freedom $df = 1$ and p value was found to be 0.519.

Table 3 illustrates the percentage of partial retention of sealants among the two groups. Out of total 60 sealed teeth, the partial retention¹ (presence of sealant in 2/3 of pit extension) in teeth that was sealed using conventional acid-etch technique was found to be 4 (13.3%) teeth and the teeth that was sealed using self-etch technique was found to be 3 (10%). The PR2 (presence of sealant in 1/3 of pit extension) in teeth that was sealed using conventional acid-etch technique was found to be 3 (10%) teeth and the teeth that was sealed using self-etch technique was found to be 2 (6.7%). The difference between the groups was not statistically significant. The chi-square computed value for PA1 was found to be $\chi^2 = 0.162$, with degree of freedom $df = 1$ and p value was found to be 0.68 and for PA2 was found to be $\chi^2 = 0.351$, $df = 1$, $p = 0.554$.

DISCUSSION

Pit and fissure sealant used as part of comprehensive approach in public health measures for high caries risk population. This prevents caries initiation and progression especially in pit and fissure in the occlusal surface of molars, where fluoride application seems to be ineffective. But the success of the sealant for caries prevention depends on long-term retention.⁷⁻⁹ The study done by Janet C Hitt,¹⁰ investigated bond strength *in vitro*, when bonding agent was used beneath sealants under varied conditions of contamination. Bonding agent used without contamination yielded bond strengths significantly greater than the bond strength obtained when using sealant alone without contamination. When the saliva was air dried onto the surface, there was no significant difference in bond strengths whether or not a bonding agent was used under the sealant.

Table 2: The percentage of total retention among the two groups

Total Retention (%)	Conventional acid-etch sealant (%)	Self-etch sealant (%)	Total (%)
Present	23 (76.7)	25 (83.3)	48 (80)
Absent	7 (23.3)	5 (16.7)	12 (20)
Total	30 (100)	30 (100)	60 (100)

$\chi^2 = 0.417$, $df = 1$, $p = 0.519$

Table 3: The partial retention among the two groups

Type of retention	Conventional acid-etch sealant ⁵ (%)	Self-etch sealant* (%)	Total (%)	p-value
PR1	4 (13.3)	3 (10)	7 (11.7)	0.162
PR2	3 (10)	2 (6.7)	5 (8.3)	0.554

$\chi^{25} = 0.162$, $df = 1$, $p = 0.68$; $\chi^{2*} = 0.351$, $df = 1$, $p = 0.554$

The retention mainly depends on technique sensitivity.⁸ Saliva contamination is one of major barricade for sealant retention. Hence to overcome this, newer advancement in bonding system (one-step bonding agent) which does both etching and bonding of enamel was used in this study. In the present study total retention in conventional acid-etch group was found to be 76.7% and self-etch sealants group it was 83.3%. This study shows that the total retention of self-etch group is high. The study done by Feigel and Quellas¹¹ using Prompt L-Pop (3M ESPE), reported that even though the self-etching adhesive method of fissure sealant application, has a significant advantage over time management, lowered complexity of treatment and decreased challenge of patient management, the complete retention rate of fissure sealant was 61% at occlusal surface.

In an *in vitro* study conducted by Tay et al¹² on the ultra structure of resin enamel bonds in occlusal fissure with unground enamel using phosphoric acid etching in combination with fissure sealant and two single step self-etch adhesive (Adper prompt L-pop,[®] 3MESPE and Xena III,[®] Dentsply De) they concluded that self-etch adhesive penetrate occlusal fissure better than phosphoric acid and produce more uniform etching and hybridization of fissure walls.

Similarly an *in vitro* study done by Dhillon et al¹³ on evaluation of shear bond strength of three pit and fissure sealant using conventional etch or self-etching primer concluded that bond strength of self-etch primer in conjunction with pit and fissure sealant has improved than those of conventional etch. The self-etch primer used was Xeno III. Better bond strength using self-etch primer might be due to primer which permits the pit and fissure sealant to flow and penetrate better on to the enamel thereby forming hybrid layer. This hybrid layer improves the bond strength thereby increase the retention rates. The study done by Dukic W and Glavina D¹⁴ on pit-and-fissure sealants placed with and without etch-and-rinse and self-etch adhesive systems in newly-erupted teeth, support the use of these self-etch bonding agents in pit-and-fissure sealants under both isolated and contaminated conditions. Further, Se bond seemed to be less sensitive to moisture contamination.

But the present study result was contradictory to the study conducted by Karmar et al¹⁵ on evaluation of pit and fissure sealant placed with different adhesive system states that the retention rates for sealant placed with etch and rinse adhesive technique showed better rates than those placed in self-etch adhesive.

CONCLUSION

In the present study even though the total retention of self-etch group is high the result was not statistically significant. This means that there was no significance difference between

the retention rate of self-etch sealant compared to conventional acid-etch technique. Hence, this study concludes that self-etch primer (3M ESPE Adper) is effective in bonding sealant to enamel and that the simplified method dramatically shortens treatment time and treatment complexity. This also serves great help in treating young children.

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