

Clinical Evaluation of Retention of a Sealant in Primary and Permanent Molars Placed using Invasive and Non Invasive Techniques – A Comparative Study

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Abstract

Aim: Aim of the present study was to evaluate the retention of a resin based sealant in primary and permanent teeth. Objectives of the study is to clinically evaluate the retention of a resin based sealant in primary, permanent molars and to compare the retention of the sealant placed using invasive and noninvasive techniques. **Materials and Methods:** The fissure sealants (DFS) were placed on all 200 primary second molars and permanent first molars in 68 children aged 3-8 years, using a split mouth design. A total of 200 FS were placed at baseline. Teeth were evaluated at 3 month, 6 month and 12 month period. The comparison of sealant retention in primary and permanent teeth at different intervals was done with Friedman's test. Chi-square test was used to compare between invasive and non-invasive techniques at different intervals. **Results:** There were statistically significant differences in the retention rates at the end of 12 month between invasive and non-invasive techniques according to the Friedman's test. The number of primary teeth showing complete retention at the end of 3 month, 6 month and 12 month are 90.8%, 84.7%, 83.7% respectively. The number of permanent teeth showing complete retention at the end of 3 month, 6 month and 12 month are 90.2% 87.3% & 82.4% respectively. **Conclusion:** On comparison of retention rates using invasive and non-invasive techniques for placement of sealant, invasive technique can be an effective tool for increasing the retention of the sealant in permanent teeth.

Keywords: Enameloplasty sealant technique; Fissurotomy; Sealant penetration

Introduction

A pit and fissure sealant is a resin material that is introduced into the Pits and fissures of caries susceptible teeth, forming a micromechanically retained physically protective layer that acts to prevent demineralization of enamel by blocking the interaction of cariogenic bacteria and their nutrient substrates, thus eliminating the harmful acidic by-products. [1]

The main principle underlying the use of sealants is that prevention is better than cure. The properties required of an ideal fissure sealant include biocompatibility, anti-carcinogenicity, adequate bond strength, good marginal integrity, resistance to abrasion and wear and cost effectiveness.[2]

Caries does not develop as long as the sealant remains in place hence the clinical efficacy of fissure sealants is directly related to their retention.

However, long term retention rates for fissure sealants are far from ideal. [3,4] Various modifications in technique of placement, materials etc., have been made in order to improve the retention. The invasive technique of placing pit and fissure sealant is one such attempt.[5]

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A lot of SEM studies have been done on invasive and non-invasive techniques used for the placement of sealants to evaluate the penetration of sealant into fissures and the marginal seal.[6,7,8].

However not many clinical studies are there comparing the retention of the sealant by invasive and non-invasive technique. So the present study aimed to evaluate the retention of a resin based sealant in primary and permanent molars placed using invasive and non-invasive techniques.

Objectives of the study are to clinically evaluate the retention of a resin based sealant in primary and

The sampling technique used was quota sampling. Dental examination was performed in department of Pediatric Dentistry using mouth mirrors and probes under artificial illumination.

A total of 200 primary second molars and permanent first molars in 68 children were included in this clinical study.

After explaining about the technique and its advantages through a pamphlet, written consent was obtained for inclusion of children in the study from their parents.

Inclusion Criteria: Children having suitable contra lateral pairs of sound mandibular and/or maxillary second primary molars and/or first permanent molars. Clinically caries free molars.

Absence of mobility due to pathological reasons, root or bone resorption. No evidence of hypoplasia.

Exclusion Criteria: Well coalesced self-cleansing pits and fissures. Clinical evidence of inter proximal caries. History of prior application of fissure sealants to any of these teeth.

Pit and fissure sealant: Delton FS+ is an opaque, flowable, fluoride releasing light-cure resin-based sealant (DENTSPLY International, York, PA 17404). The kit contained Delton syringe, EZ etch syringe, and Plastic Syringe Brush tips.

Pre-Operative assessment: A thorough medical history was taken and teeth were examined for caries with a NO: 4 plain mouth mirror and NO: 6 right angled probe.

Only those teeth that were clinically free of caries were included in this study.

Clinical procedure of sealant application

A single operator carried out scaling and sealant placement procedures for all children. Scaling was done followed by polishing using slurry of pumice, and a rubber cup to ensure removal of debris from the fissures. The occlusal surfaces of

permanent molar also to compare the retention of the sealant placed using invasive and non-invasive techniques.

Materials and Methods

The study was approved by the Institutional Ethical Review Board, College (IERB-VDC:7/2009).

The sample was drawn from a population of 3-8 year old school children (mean age of 6.5 years) attending the department of Pedodontics & Preventive Dentistry, Dental College for oral care as a part of school dental health program.

the teeth to be treated were then thoroughly flushed with water to remove all traces of pumice slurry.

In the tooth to be sealed using invasive method, pit and fissures were prepared using a Fissurotomy® Micro STF bur in a high speed airtor hand piece.

The head length of the Fissurotomy® Micro STF is 1.5 mm and diameter is 0.6 mm. The preparation was done till the entire length and depth of the bur head was inside the fissure.

Isolation of the tooth was obtained by using Rubber dam. The sealant was applied following the manufacturer's instructions as follows. The occlusal surface was dried. Delton EZ Etch etchant gel (DENTSPLY, USA) was applied to pits and fissures with a brush tip applicator and allowed a reaction time of 20 seconds (for permanent teeth) and 30 seconds (for primary teeth).

The tooth surface was rinsed with water spray for 30 seconds & dried with oil free air for 15 seconds. Etching was confirmed by a dull frosty-white appearance of the enamel. If salivary contamination occurred, the surface was again cleaned, dried and re-etched for 15 seconds..

The sealant was injected with disposable brush tip and allowed to flow into the pits and fissures. Then the sealant was cured with a QHL (Lighting electronics Pvt Ltd, Bangalore, India) Curing light for 20 seconds keeping the light exit window as near as possible to the tooth without touching it. The soft (oxygen inhibited) surface layer after light curing was removed with cotton rolls. The sealed area was checked with an explorer for complete coverage and retention. The occlusion was checked with an articulating paper and adjusted with a finishing bur if necessary. Post-operative instructions were given.

Clinical evaluation regarding the retention of sealant was performed at 3 month, 6 month and 12 month interval period. Two examiners performed these evaluations. The retention of the sealant was evaluated using a mouth mirror, blunt probe and artificial light according to the Simonsen's criteria [9] as given below:

TR-Total retention: Total retention of sealant on occlusal surface, PR 1-Partial retention type 1: presence of sealant on

2/3 of the pit extension with small fractures and losses of material, PR 2-Partial retention type 2: presence of sealant in 1/3 of the pit extension with fractures, TL-Total loss: absence of sealant on occlusal surface of teeth, no visible caries, presence of micro cavity (dia<1.5 mm across the fissure).

Statistical analysis

Data collected were entered in Microsoft excel 2007 and analyzed using SPSS, 16 software (IBM corporation). Descriptive statistics like percentage and proportion was carried

and test of significance was done using Friedman’s test, Chi-square test.

Results

In both the invasive and non-invasive techniques, on comparison of retention of sealants between intervals there was statistically significant difference between 3 month to 6 month (p=0.046) and between 3 month to 12 month (p=0.046) according to the Friedman’s test. [Table 1]

Table 1: Comparison of retention rates of sealant at different intervals in primary teeth.

	Score	Invasive		Non – invasive	
		No.	%	No.	%
3 m	0	45	91.9	44	89.8
	1	2	4.1	3	6.2
	2	1	2.0	1	2.0
	3	1	2.0	1	2.0
6 m	0	43	87.8	40	81.6
	1	3	6.1	5	10.2
	2	2	4.1	3	6.2
	3	1	2.0	1	2.0
12 m	0	43	87.8	39	79.6
	1	3	6.1	6	12.2
	2	2	4.1	3	6.2
	3	1	2.0	1	2.0
3 m – 6 m		P = 0.046, (s)		P = 0.046, (s)	
3 m – 12 m		P = 0.046, (s)		P = 0.046, (s)	
6 m – 12 m		P = 1.00, no diff		P = 0.99, NS	

On comparison of retention of sealants between intervals there was statistical significance (p = .003) between 3 month to 12 month and between 6 month to 12 month (p = 0.014)

according to the Friedman’s test in the non-invasive technique. [Table 2]

Table 2: Comparison of retention rates of sealant at different intervals in permanent teeth.

Time of assessment	Score	Invasive		Non – invasive	
		No.	%	No.	%
3 m	0	49	96.1	43	84.4
	1	2	3.9	6	11.8
	2	0	--	1	1.9
	3	0	--	1	1.9
6 m	0	47	92.2	42	82.4
	1	4	7.8	6	11.8
	2	0	--	2	3.9
	3	0	--	1	1.9

12 m	0	47	92.2	37	72.5
	1	4	7.8	9	17.6
	2	0	--	3	5.9
	3	0	--	2	3.9
3 m – 6 m		P = 0.16, NS	P = 0.08, NS		
3 m – 12 m		P = 0.16, NS	P = 0.003, (s)		
6 m – 17 m		P = 1.00, no diff	P = 0.014, (s)		

In the non-invasive technique, 90% of teeth showed complete retention (score 0) at 3rd m interval, 82% at 6th m interval and 80% at 12th m interval. 6% of teeth showed partial retention type 1 (score 1) at 3rd month interval and 10% at 6th and 12%

at 12th month interval. There was no change in the percentage of teeth showing total loss (score 3) at any of the intervals being constant at 2%. [Table 3]

Table 3: Comparisons of retention rates between invasive & non-invasive techniques in primary teeth.

Time of assessment	Score	Invasive		Non – invasive		Inv. v/s non – inv	
3 m	0	45	91.9	44	89.8	0.21	0.98, NS
	1	2	4.1	3	6.2		
	2	1	2.0	1	2.0		
	3	1	2.0	1	2.0		
6 m	0	43	87.8	40	81.6	0.81	0.85, NS
	1	3	6.1	5	10.2		
	2	2	4.1	3	6.2		
	3	1	2.0	1	2.0		
12 m	0	43	87.8	39	79.6	1.40	0.71, NS
	1	3	6.1	6	12.2		
	2	2	4.1	3	6.2		
	3	1	2.0	1	8.0		

There was statistically significant difference (p=0.04) in the number of teeth showing complete retention (score 0) at the

12th month interval between invasive and non-invasive systems. [Table 4]

Table 4: Comparisons of retention rates between invasive & non-invasive techniques in permanent teeth.

Time of assessment	Score	Invasive		Non – invasive		X ² - value	P – level
		No.	%	No.	%		
3 m	0	49	96.1	43	84.4	4.39	0.22, NS
	1	2	3.9	6	11.8		
	2	0	--	1	1.9		
	3	0	--	1	1.9		
6 m	0	47	92.2	42	82.4	3.68	0.30, NS
	1	4	7.8	6	11.8		

	2	0	--	2	3.9		
	3	0	--	1	1.9		
12 m	0	47	92.2	37	72.5	8.11	0.04, S
	1	4	7.8	9	17.6		(P <0.05)
	2	0	--	3	5.9		
	3	0	--	2	3.9		

However there was no significant difference in the retention of the sealant between primary and permanent teeth at any of the intervals. [Table 5]

Table 5: Comparison of retention scores (month wise and teeth wise).

3 M	0	89	90.8	92	90.2	1.33	0.72, NS
	1	5	5.2	8	7.8		
	2	2	2	1	1		
	3	2	2	1	1		
6 M	0	83	84.7	89	87.3	1.97	0.58, NS
	1	8	8.2	10	9.8		
	2	5	5.1	2	2		
	3	2	2	1	1		
12 M	0	82	83.7	84	82.4	1.17	0.76, NS
	1	9	9.2	13	12.7		
	2	5	5.1	3	2.9		
	3	2	2	2	2		

Discussion

Among the studies [10] with a half-mouth design, the sealant type and application technique, age of children, selection criteria, sample size, and study duration varied. Results based on percent complete sealant retention indicate that sealant retention began high, and generally, declined over time, regardless of the mix of caries risk participants. This trend is more apparent if longitudinal results of the individual studies are examined.

The current effectiveness of sealants is underestimated if based on early sealant trials because the first generation of material used, polymerized by ultraviolet light, was less effective than newer materials and is no longer in use. [11] Retention rate in any sealant trial is also dependent on the accuracy with which examiners can identify the presence of sealant. Misclassification occurs more often when a clear, compared to opaque resin is used. [12]

Long term retention rates for fissure sealants are far from ideal, [13] reported 64% retention after 6 years and [14] reported 58% retention after 6 years. A variety of fissure preparation methods has been used prior to sealant placement

in an attempt to successfully maximize retention. Enlarging the occlusal fissures with a bur, always maintaining the preparation in enamel was suggested by [15,16,17] these studies evaluated the clinical retention of sealants placed on mechanically prepared fissures. [14,15,16] A lot of SEM studies have been done on invasive and non-invasive techniques used for the placement of sealants. [5,7,15,18] Reported the retention of a light polymerized fissure sealant (Prisma-Shield) and an auto polymerized sealant (Delton) in primary molars of young children. Mean follow-up period was 2.8 years. Complete retention was found in 70.6% of the teeth sealed with Delton and in 76.5% of the teeth sealed with Prisma-Shield. In a study by [19] the overall retention rate of fissure sealants in second primary molars was 73.0% at 6 months and 64.7% at 12 months. Compared to the above studies better retention rates were obtained in the present study which could be due to the use of invasive technique in one half of the teeth. In our study, after one-year, complete retention of the resin sealant Delton FS+ was 80%, 18.4% partial retention, and 2% missing sealant in primary teeth through the non-invasive technique. The retention rates obtained in the present study are in accordance to those obtained in many studies on permanent teeth after a 1-year

observation period and indicate that fissure sealing of primary molars in young pre-school children may be an effective method of preventing caries in this age group. [20] In their study found a retention rate of 98.7% after 6 month to 1 year when experienced operators placed sealants in invasively prepared teeth. In another study by [21] Delton FS+ was placed on teeth which were prepared by invasive technique described by De Craene and others (1989) [22] and Garcia Godoy and De Araujo (1994). [5] Diamond burs in high speed instruments were used for this purpose.

Delton FS+ showed complete retention on teeth with rates of 100%, 96.6%, 86% and 71.4% at 3, 6, 12 and 24 month evaluations respectively. [23]

Similar results were found in the present study where 92% of the permanent teeth prepared by Fissurotomy bur showed complete retention at the end of 6 month and 1 year.

In the present study 82.4% of the non-invasively prepared permanent teeth showed complete retention at the end of 6 month which was further reduced to 72.5% at the end of 1 year.

Still lower retention rates were found [23] where Delton FS+ showed complete retention on teeth with rates of 93.3%, 50%, 46.2% and 30.4% at 6, 12, 24 and 36 month evaluations respectively.

Conclusion

Satisfactory retention rates were obtained through the use of both invasive and non-invasive techniques in primary teeth, indicating that fissure sealing is effective for preventing occlusal caries in primary teeth.

Delton FS+ is a good pit and fissure sealant for use in primary teeth. On comparison of retention rates between invasive and non-invasive techniques for placement of sealant it is proved that invasive technique can be an effective tool for increasing the retention of the sealant in permanent teeth.

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