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RESEARCH ARTICLE
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HELIOSEAL WITH OR WITHOUT BONDING AGENT TO FIND THE ROLE OF BONDING AGENT IN FLUOROSED MOLARS - AN INVIVO STUDY

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ABSTRACT:

AIM: To evaluate and compare the retention and longevity of non-fluoridated pit and fissure sealants (Helioseal) placed with and without use of bonding agents in young permanent molars affected by Dental Fluorosis in an interval of 1week, 1, 3, 6 and 12 months follow up.

OBJECTIVE: To assess and compare the retention and longevity between HELIOSEAL pit and fissure sealants with bonding agent and without bonding agent in young permanent molar affected by dental fluorosis in an interval of 1 week, 1, 3, 6 and 12 months follow up.

MATERIAL AND METHODOLOGY: The Children were selected from the age group of 7-13 years of either gender. Written informed consent was procured from parents /guardians of all participants prior to the study. A clinical intervention was done among 7-13 years old children reporting to the Department of Pedodontics and Preventive Dentistry of Vivekananda dental college for women in Namakkal Dt., the study sample consists of 45 children.

RESULTS: Comparison of Group A (With Bonding Agent) and Group B (Without Bonding Agent) in HELIOSEAL Sealant with respect to its retention at 1 week, 1, 3, 6 and 12 months by Mann–Whitney U test. The Mean$\pm$SD retention was 1$\pm$0.00 after 1 week and 1-month follow-up while at 3 month it was1.18$\pm$0.39 and 1.04$\pm$0.20 for both the groups respectively. After 6 months follow-up Mean$\pm$SD retention was 1.40 $\pm$ 0.58 and 1.11 $\pm$ 0.31 in Helioseal with and without bonding agent groups respectively. After 12 months the Mean$\pm$SD was 1.89$\pm$0.83 and 1.46$\pm$0.72 for both the groups respectively.

CONCLUSION: HELIOSEAL (Group-IB) without bonding agent showed the higher retention rate when compared to HELIOSEAL (Group-IA) with bonding agent which was more evident after 6 and 12 months and was statistically significant.

INTRODUCTION:

A pits and fissures sealant is a material that is introduced to susceptible pits and fissures to establish a tight seal, which prevents the leakage of nutrients to the biofilm in the deeper parts of the fissures. A pits and fissures sealant is most likely to be effective in preventing carious lesions on the occlusal surfaces of primary and permanent teeth.[1] The material used is mostly light-activated urethane dimethacrylate (UDMA) or bisphenol A-glycidyl methacrylate (Bis-GMA) resin that bonds to suitable enamel by using the acid-etch
technique .[2]

Preventive capability of pit and fissure sealants are related to their ability to block the pit and fissures on the tooth surface. This will prevent penetration of fermentable carbohydrates which can be used by the bacteria remaining on the fissures and also prevent colonization by new bacteria. Bis-GMA is the base of most of the fissure sealants available in the market.[3]

A fissure sealant is hydrophobic and technique-sensitive, which requires a high level of saliva control. In some situations, such as newly erupted teeth, maintaining salivary control is very challenging. Dentin/enamel adhesives allow bonding of resin-based composites and compomers to primary and permanent teeth. Adhesives have been developed with reported dentin bond strengths exceeding that of enamel.[4]

To promote the sealing capacity, new adhesive systems have been introduced and it is claimed that the use of these materials is the best way to prevent microleakage. The use of dentin bonding agents between the tooth and fissure sealant can be beneficial for reducing microleakage when there is contamination of the enamel.[5]

The first clinical study in this respect was done by Boksman et al, who demonstrated that using bonding agent had no significant effect on increasing the retention of fissure sealant.[6]Jaberi et al, in their study in 2008 on the effect of enamel bonding on retention of fissure sealant revealed that under dry, isolated conditions, application of enamel bonding agent did not have a significant effect on retention of fissure sealant .[7] Sakkas C *et al.* in a clinical trial conducted in 2013 to evaluate the sealant retention rate and caries preventive efficacy of two fissure sealing techniques adhesive technique yielded better fissure sealing performance .[8]

To promote sealing capacity dentin bonding agent is applied, consisting of bifunctional molecules which includes a functional group that is able to penetrate wet dentin surface and a methacrylate group that bond to restorative resin by chemical interaction.[9] Bonding to enamel occurs by micromechanical retention after acid etching is used to remove smear layer and preferentially dissolve hydroxyapatite crystals.[10]

Dental fluorosis, an endemic dental health problem in several countries around the world, has dramatically increased in frequency in several parts of India. Many studies have evaluated the effectiveness of sealants in normal molars, very few studies have tested the retentiveness in the fluorosed molars. Our college is in Namakkal District which is an endemically fluorosed area, thus decided to test the retention of the sealant in fluorosed molars and also to evaluate the application of bonding agent prior to the sealant application improved its retentiveness.

MATERIAL AND METHODOLOGY:

The present study was conducted among children presenting to the Department of Pedodontics and Preventive Dentistry of Vivekananda dental college for women in Namakkal district. Ethical clearance for the study was obtained by local ethical committee (IEC/VDCW/48/2016). The Children were selected from the age group of 7-13 years of either gender. Written informed consent was procured from parents /guardians of all participants prior to the study.

A clinical intervention was done among 7-13 years old children reporting to the Department of Pedodontics and Preventive Dentistry of Vivekananda dental college for women in Namakkal Dt., the study sample consists of 45 children.

INCLUSION CRITERIA

- Children belonging to the age group of 7-13 years of either gender.
- Children affected with Dental fluorosis in grades 1-4 in accordance with Tooth Surface Index of Fluorosis (TSIF). [11]
- Children free of Dental Caries.
- Fully erupted Young Permanent Molars with complete and intact tooth structure in all quadrants.

EXCLUSION CRITERIA

- Young Permanent Molars with Carious Occlusal Fissures.
- Molars unaffected by Dental Fluorosis.
- Molars with severe Fluorosis Attack (grade 5-7) according to TSIF.[11]
- Children affected with caries even in single Young Permanent Molars.

Table 1: Composition and manufacture of helioseal

	Composition	**Manufacture**
HELIOSEAL	Mixture of Bis-GMA, dimethacrylate, titanium dioxide, initiators and Stabilizers	Ivoclar Vivadent AG, Schaan, Liechtenstein

Children with mild to moderate Dental Fluorosis were randomly divided into 2 Groups A - Helioseal with bonding agent, Group B-Helioseal without bonding agent.

Fig 1: Armamentarium

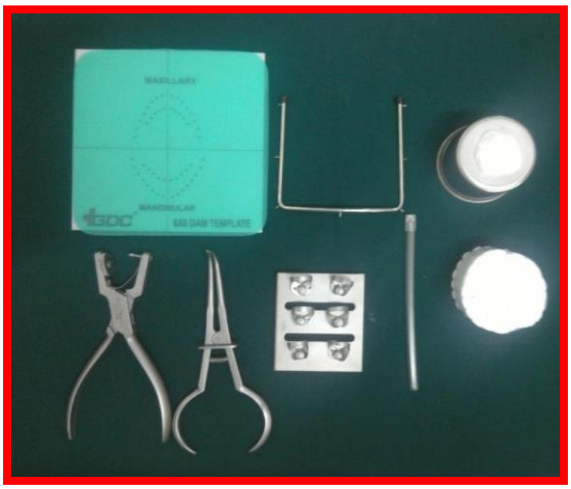


Fig 2: Armamentarium for isolation

FIG 3 : Armamentarium for polishing

Fig 4: Armamentarium for review

This study had a split-mouth design in which the young permanent molars on the right side received sealant without bonding agent and on the left with bonding agent. First, the mouth side (right or left) and then the material type was chosen using the Excel program from Windows. Previous to sealant application, the stage of eruption of the selected teeth were evaluated and the children affected with Dental fluorosis in grades 1-4 in accordance with Tooth Surface Index of Fluorosis (TSIF)[11]were included.

Routine clinical procedure for fissure sealant application was followed. The only modification in the clinical technique was that an increase in etching time to 35- 40 seconds for all the groups[12]. In all the participants, isolation of teeth has been achieved by using cotton rolls , disposable suction tips and rubber dam isolation.

Helioseal sealant (Group A & B) was placed in the occlusal pits and fissures on the right side of all patients . Each tooth was isolated with heavy-gauge rubber dam and then given a pumice prophylaxis. Each tooth was acid etched with 37% phosphoric acid gel for 45 seconds, followed by a 30 seconds water lavage. After air drying with chip blower, sealant was placed with a fine sable-hair brush, teased into the crevices with an ADA Specification No.23 explorer and cured for 20 seconds according to the manufacturer instructions. For each tooth on the left side, the, same sequence was used, except that the appropriate bonding agent was placed with a sable-hair brush and thinned with a gentle stream of air with chip blower before the placement of sealant and 20 seconds cure. Children were instructed not to eat for at least 1 hour after the procedure[13]. All the children received instructions on good oral health practices and brushing methods.
The sample of 45 patients were distributed as per category. All the sealed teeth were evaluated and scored for retention by means of a mouth mirror and explorer at 1 week, 1, 3, 6 and 12 months interval using Mascarenhas *et al.* (2008)[14]scoring criteria by another examiner, a senior faculty member.

Table:2 Mascarenhas *et al.* criteria (2008).[14]

Score	**Criteria**
Score 1	**Sealant completely covering occlusal surface and all buccal pits and palatal fissures**
Score 2a	**Sealant partly covering the tooth and the tooth is sound**
Score 2b	**Sealant partly covering the tooth and the tooth is carious**
Score 3a	**Sealant completely lost and the tooth is sound**
Score 3b	**Sealant completely lost and the tooth is carious**

A visual inspection was performed to evaluate the presence of any incipient carious lesions on the occlusal surfaces of the sealed molars at all recall intervals. The results were tabulated and were subjected to statistical analysis.

STATISTICAL ANALYSIS: The data collected were entered in an MS office Excel spreadsheet (Office 2011, Microsoft Corp., Redmond, USA) and statistically analyzed using Statistical Package for Social Sciences (SPSS), Version 16.0 (SPSS Inc., Chicago, IL, USA).The association between different categories of participants was analyzed using a Chi-square test and mann - whiteny test with $P < 0.05$ as statistically significant

RESULTS:

Table: 3 Retention rates among HELIOSEAL sealant materials at 1 week, 1, 3, 6 and 12 months.

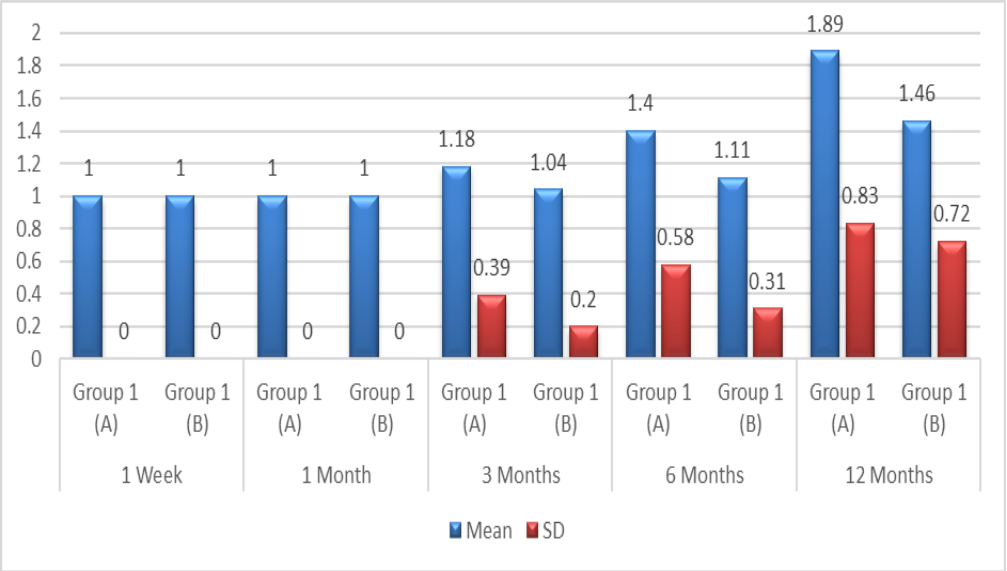
Duration	Retention	HELIOSEAL	
		N	%
1 Week	Total Retention	90	100
	Partial Retention	0	0
	Total Loss	0	0
	Total	90	100
1 Month	Total Retention	90	100
	Partial Retention	0	0
	Total Loss	0	0
	Total	90	100
3 Months	Total Retention	80	88.9
	Partial Retention	10	11.1
	Total Loss	0	0
	Total	90	100
6 Months	Total Retention	69	76.7
	Partial Retention	19	21.1
	Total Loss	2	2.2
	Total	90	100
12 Months	Total Retention	48	53.3
	Partial Retention	23	25.6
	Total Loss	19	21.1
	Total	90	100

Table: 4 Comparison of Group A (Helioseal With Bonding Agent) and Group B (Helioseal Without Bonding Agent) with respect to retention at 1 week, 1, 3, 6 and 12 months by Mann–Whitney U test

Evaluation Interval	Group	Mean	SD	Median	Sum of Ranks	U Value	Z Value	p Value
1 Week	Group A	1	0	1	2047.5	1012.5	0	1.000#
	Group B	1	0	1	2047.5			
1 Month	Group A	1	0	1	2047.5	1012.5	0	1.000#
	Group B	1	0	1	2047.5			
3 Months	Group A	1.18	0.39	1	1510	877.5	-2.001	0.045*
	Group B	1.04	0.20	1	1730			
6 Months	Group A	1.40	0.58	1	1551	760	-2.773	0.006*
	Group B	1.11	0.31	1	1530			
12 Months	Group A	1.89	0.83	2	1441.5	726	-2.550	0.011*
	Group B	1.46	0.72	1	1484.5			

***p ≤0.05 (Significant), #p >0.05 (Non-significant)**

Graph: 4 Comparison of Group IA (With Bonding Agent) and Group IB (Without Bonding Agent) in HELIOSEAL Sealant with respect to retention at 1 week, 1, 3, 6 and 12 months by Mann–Whitney U test.



From **table 3**, At the end of the study period, total retention, partial retention and total loss by using Helioseal fissure sealant group was found 53.3%,25.6% & 21.1% respectively.

Table 4 reflects the comparison of Group IA (With Bonding Agent) and Group IB (Without Bonding Agent) in HELIOSEAL Sealant with respect to its retention at 1 week, 1, 3, 6 and 12 months by Mann–Whitney U test. The Mean±SD retention was 1±0.00 after 1 week and 1-month follow-up while at 3 month it was1.18±0.39 and 1.04±0.20 for both the groups respectively. After 6 months follow-up Mean±SD retention was 1.40 ± 0.58 and 1.11 ± 0.31 in Helioseal with and without bonding agent groups respectively. After 12 months the Mean±SD was 1.89±0.83 and 1.46±0.72 for both the groups respectively.

Median was 1 after 1 week, 1, 3- and 6-months follow-up for both the groups. However, Median was found 2 and 1 after 12 months follow-up for Group IA and Group IB respectively.

p value was found statistically significant between the groups at 3, 6- and 12- months follow-up scheduled intervals. ($p \leq 0.05$).

p value was found as Non-significant between the groups at 1week and 1 month follow-up scheduled intervals. ($p > 0.05$)

DISCUSSION: The present study was carried out in a fluorosis-endemic area, based on a prevalence study conducted on the Dental Fluorosis by Ravikumar *et al*. (2015) who revealed that, the overall prevalence of dental fluorosis of 28.28 % in Thiruchengode, Namakkal District, TN, India.[15]

Pit-and-fissure sealants are applied on occlusal fissures of teeth where enamel is considered resistant to etching. This resistance is attributed to a ring of aprismatic enamel around the entrance and walls of fissures. Aprismatic enamel crystals exhibit a unidirectional orientation and are densely arranged. Acid etching of this structure

results in a relatively uniform dissolution and creation of limited porosity and resin penetration, manifested by short resinous tags. The aprismatic enamel layer has also been shown to be less conducive to bonding by self-etching adhesives[16]

In the present study, non-fluoridated pit and fissure sealants Helioseal (Group A- With bonding agent and B- without bonding agents) were used to seal the fissures on fluorosed molars.Helioseal is a pigmented, without fluoride without fillers, low viscosity easy to check retention and available in bottle system. In the present study a fifth-generation bonding agent was used and compared with the group where bonding agent was not applied.

In the present study retention of Helioseal with bonding agent after 3, 6, 12 months were 82.2% ,64.4%, 40%. Helioseal without bonding agent after 3, 6, 12 months were 95.6% 88.9% 66.7%. This is contrary to the study done by Arzu Pinar et al (2005) study on retention of pit and fissure sealant with or without bonding agents who showed that, the clinically acceptable marginal integrity rates for sealants with a bonding agent after 3, 6, 12, 24 months were 93%, 93%, 83% and 79% respectively[17]

The retention rates of present study are in contrary to the study conducted by Waggoner and Feigal in vivo studies which were carried out for two and five years respectively, dentin bonding agents increased the retention rate of sealants. This variation may be because their study was conducted in normal molars rather than fluorosed molars.

Helioseal is assumed to represent resin-based composites and compared with other types of materials, it becomes clear that the performance of Helioseal is superior to that of the compomer (combination of composite and glass ionomer cement) Ionosit Seal [18] and glass ionomer cement [19]. The retention rate of these materials was well below 50% after one and three years respectively, while Helioseal achieved a more than 90% retention rate.

The present study retention rate of Helioseal without bonding agent was 66.7% which were higher than that of study done by Chowdary N et.al who used the resin-based filled pit and fissure sealant (Helioseal F) and showed 53.57% complete retention, 37.50% partial retention and 8.93% complete missing of sealant at 12th month evaluation. The results were slightly better than the study conducted by Ganss et al., where only 42.3% of sealant was completely retained by 1-year[20]and in another study done by Bargale and Raj showed only 36.9% of complete retention of sealant after 1-year.[21]

The retention of the pit and fissure sealant is of great interest because the material effectiveness is related to its bonding to the enamel surface. Most of the failures occur within the first year of sealant application, with a loss rate estimated as 5-10% per year.

In the present study, Helioseal with Group B (without the use of bonding agent) showed the higher retention property when compared to Group A (with bonding agent), as well as the retention rate was more evident after 6 and 12 months. Although earlier studies [22] showed greater retention rate of sealants, in the present study the bonding agent did not increase the retention rate, because the sealant application was done in fluorosed molars. The variations in the composition and morphology of fluorosed teeth may be a reason. Another reason may be that the thickness of the bonding agent would have provided less room for the sealant to flow into the pits and fissures.

CONCLUSION: HELIOSEAL (Group-IB) without bonding agent showed the higher retention rate when compared to HELIOSEAL (Group-IA) with bonding agent which was more evident after 6 and 12 months and was statistically significant.

Though not contraindicated, considering the extra time and cost needed and the inconclusive importance in retention, routine use of bonding agent as part of the sealant application technique is not recommended. Further studies with more sample size will be required to study the efficacy and retentiveness of these fissure sealants on fluorosed molars.

REFERENCES:

1. Welbury, R., Raadal, M., Lygidakis, N.A., 2004. EAPD guidelines for the use of pit and fissure sealants. Eur J Paediatr Dent. 5, 179–184.
2. Beauchamp, J., Caufield, P.W., Crall, J.J., Donly, K., Feigal, R., Gooch, B., Ismail, A., Kohn, W., Siegal, M., Simonsen, R., 2008. Evidence-based clinical recommendations for the use of pit-and fissure sealants: a report of the American Dental Association Council on Scientific Affairs. J. Am. Dent. Assoc. 139, 257–268.
3. Moore K, Avery DR. Dental materials. In: McDonald, Avery, Dean. editors. Dentistry for the child and adolescent. 8th ed. Mosby: 2004. p. 35

4. Mason PN, Ferrari M, Cagidiaco MC, Davidson CL. Shear bond strength of four dentinal adhesives applied in vivo and in vitro. J Dent 1996 May;24(3):217-222.
5. Lussi A, Duangthip D. Microleakage and penetration ability of resin sealant versus bonding system when applied following contamination. Pediatr Dent 2003;25:505-11.
6. Boksman L, McConnell RJ, McCutcheon-Jones EF. A 2-year clinical evaluation of two pit and fissure sealants placed with and without the use of a bonding agent. Quintessence International. 1993 Feb 1;24(2).
7. Ansari ZJ, Hashemi SM. Effect of enamel bonding agents on pit and fissure sealant retention in an isolated situation. Journal of Dentistry of Tehran University of Medical Sciences. 2008;5(4):156-60.
8. Sakkas C, Khomenko L, Trachuk I. A comparative study of clinical effectiveness of fissure sealing with and without bonding systems: 3-year results. European Archives of Paediatric Dentistry. 2013 Apr 1;14(2):73-81.
9. Griffin SO, Jones K, Gray SK, Malvitz DM, Gooch BF. Exploring four-handed delivery and retention of resin-based sealants. The Journal of the American Dental Association. 2008 Mar 1;139(3):281-9
10. Gupta N, Kathuria N, Gulati M, Mehta LK. Bonding: foundation of dentistry. J Innov Dent. 2011 Sep;1:60-.63
11. Feigal RJ, Musherure P, Gillespie B, Levy-Polack M, Quelhas I, Hebling J. Improved sealant retention with bonding agents: a clinical study of two-bottle and single-bottle systems. Journal of Dental Research. 2000 Nov;79(11):1850-6.
12. Maher MM, Elkashlan HI, El-Housseiny AA. Effectiveness of a self-etching adhesive on sealant retention in primary teeth. Pediatric dentistry. 2013 Jul 15;35(4):351-4.
13. Tandon V, Lingesha RT, Tangade PS, Tirth A, Pal SK, Lingesha CT, Arora V, Yadav V. Effect of Adhesive Application on Sealant Success: A Clinical Study of Fifth and Seventh Generation Adhesive Systems. Journal of dentistry (Tehran, Iran). 2015 Oct;12(10):712.
14. Mascarenhas AK, Nazar H, Al-Mutawaa S, Soparkar P. Effectiveness of primer and bond in sealant retention and caries prevention. Pediatric dentistry. 2008 Jan 1;30(1):25-8.
15. Ravikumar A, Khan SM. Prevalence of Dental Fluorosis among Primary School Children in Rural Areas of Tiruchengode block, Namakkal District, TN, India. J. Environ. Nanotechnol. 2015;4(1):67-75.
16. Prabakar J, John J, Arumugham IM, Kumar RP, Sakthi DS. Comparative evaluation of the viscosity and length of resin tags of conventional and hydrophilic pit and fissure sealants on permanent molars: An In vitro study. Contemporary clinical dentistry. 2018 Jul;9(3):388.
17. Pinar A, Sepet E, Aren G, Bolukbasi N, Ulukapi H, Turan N. Clinical performance of sealants with and without a bonding agent. Quintessence Int 2005; 36(5):355–60.
18. Zimmer S, Strafela N, Bastendorf KD, Bartsch A, Lang H, Barthel CR. Klinische Erfolgsraten von Fissurenversiegelungen mit Kompomer oder bis-GMA nach drei Jahren. Oralprophylaxe & Kinderzahnheilkunde. 2009;31:8-12.
19. Skrinjaric K, Vranic DN, Glavina D, Skrinjaric I. Heat-treated glass ionomer cement fissure sealants: retention after 1 year follow-up. International journal of paediatric dentistry. 2008 Sep;18(5):368-73.
20. Ganss C, Klimek J, Gleim A. One year clinical evaluation of the retention and quality of two fluoride releasing sealants. Clinical oral investigations. 1999 Dec 1;3(4):188-93.
21. Bargale S, Raju O. The retention of glass ionomer and light cure resin pit and fissure sealant using replica technique–An in vivo study. Internet J Dent Sci. 2011;9:37-41.
22. Nogourani MK, Janghorbani M, Khadem P, Jadidi Z, Jalali S. A 12-month clinical evaluation of pit-and-fissure sealants placed with and without etch-and- rinse and self-etch adhesive systems in newly-erupted teeth. Journal of Applied Oral Science. 2012 Jun;20(3):352-6