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Comparison of Retention and Marginal Discoloration of Self-Etch and Total-Etch Adhesives before Pit and Fissure Sealant Application on Permanent Second Molars in Pediatric Patients. A 1-year follow-up Longitudinal Study

Abstract::

Objective: To compare the retention and marginal discoloration of Self-etch and Total Etch Adhesive before Pit and Fissure Sealant application at 1 month, 3 months, 6 months, and 12 months.

Materials and methods: 30 school-going children received sealants in all four permanent second molars,this study was carried out in the Department of Pedodontics and Preventive Dentistry. The fully erupted second permanent molars were randomly allocated into 2 groups: group A (Self-Etch) and B (Total etch) . According to the split-mouth design, each patient received sealant in the second molar with self-etch in one arch and total-etch in the other arch; contra-lateral molars were kept in the control group.

Results: No statistically significant difference was found in the marginal discoloration and microleakage of fissure sealants placed on occlusal surfaces following the use of a Self-Etch bonding agent and traditional Total-Etch adhesive after 12 months.

Conclusion: When Total Etch adhesive is applied before sealant, the same amount of microleakage or marginal discoloration happened in the occlusal fissure of permanent teeth as when Self Etchantadhesive was put on before sealant.

Key-words: Bonding agents, Pit and fissure sealants, Etchant, Self-etch, Total- etch, Dental caries.

Introduction:

Dental caries is a multifactorial disease leading to an imbalance between demineralization and remineralization processes and manifested by the formation of caries lesions. Pit and fissure caries account for about 90% of caries in permanent posterior teeth and 44% of caries in primary teeth in children and adolescents.[1] "A fissure sealant is a substance that is put in the pits and fissures of teeth to halt caries from evolving."[2] Maintenance of fissure sealants is important to ensure their continued effectiveness, and it is recommended that the recall interval for high-caries-risk children should not exceed 12 months.[3] The application of Pit and fissure sealants can be done with or without adhesive.

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It has been proven that the application of an adhesive before sealant placement on the enamel surface helps in reducing microleakage even after contamination.[4,5] The traditional method of total-etch adhesive required multiple steps, which increased chair side time, saliva contamination, and patient

[1]BHAVNA G SARAF, [2]NEHA SHEORAN, [3]DISHA KAPI

[1-3]Department of Pedodontics and Preventive Dentistry, Sudha Rustagi College of Dental Sciences & Research, Faridabad, Haryana

Address for Correspondence: Dr. Bhavna G Saraf, Department of Pedodontics and Preventive Dentistry, Sudha Rustagi College of Dental Sciences & Research, Faridabad, Haryana, India
Email: guptabhavna2000@yahoo.com

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discomfort. So, to reduce these problems, Self-Etch adhesive was presented, which requires one step that contained etchant primer and adhesive in a single dispenser.[6] Due to a lack of clinical studies demonstrating the clinical success of various bonding agents in sealant application the comparison of self-etch and total-etch adhesives during the application of pit and fissure sealants in permanent second molars in terms of retention and marginal discoloration till 12 months of follow-up was conducted.

Materials and Methods:

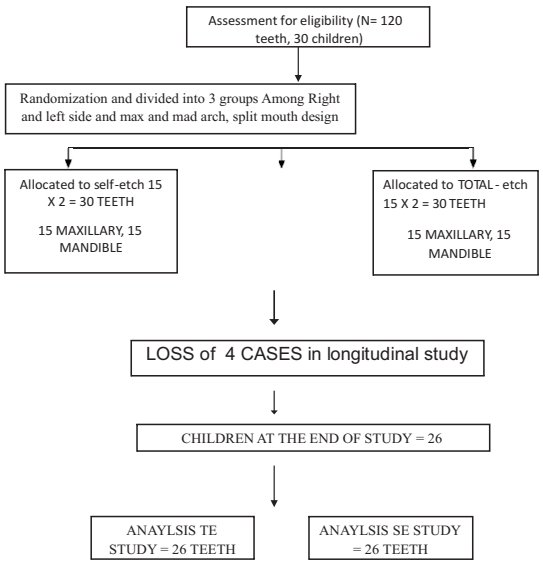
The present study was carried out in the Department of Pedodontics and Preventive Dentistry, Faridabad, with a minimum of 120 young permanent second molar teeth in 30 children at high caries risk and were examined at the interval of 1,3,6 and 12 months.. As it was a longitudinal study, there were 4 dropouts which left a total of 26 children and 104 young permanent second molars.

Subjects who on visual examination had deep occlusal fissures or high caries risk (history of previous fillings and caries in other teeth), previously untreated fully erupted permanent second molars, and pits and fissures of maxillary and mandibular permanent second molars were included in the study. The subjects who were medically ill or on long-term medication or had physical limitations, hypoplastic enamel, teeth with anomalies, and partially erupted second molars were excluded from the study.

Ethical review committee approval was obtained before the initiation of the trial. Written consent was taken from the parents of subjects on a standardization form approved by the ethics review committee.

Before the onset of the procedure, the trained examiner ensured appropriate clinical evaluation of anatomical form, marginal integrity, and marginal discoloration. ICDAS criteria for caries assessment were recorded on sheets preoperatively.[7] Simple randomization of treatment allocation was carried out by giving a random number of permanent second molars into 2 groups, i.e., Group A – Self Etch Adhesive Group (30 Teeth)Adper 3M ESPEand Group B– Total Etch Adhesive Group (30 Teeth) 3MClinpro,. (Flowchart1) Pre and post-examinations were conducted by a calibrated independent examiner. The sealant was applied by a single pediatric dentist. Selected teeth received prophylaxis with a brush using a slow-speed handpiece and pumice for cleansing of debris. Isolation of teeth was done with a rubber dam and cotton rolls. The tooth was thoroughly dried (30 seconds). For GROUP A – Adper™ Easy One Self-Etch,3M ESPE,Platz Seefeld,82229 Germany Adhesive group (30 teeth) Selected teeth received self-adhesive onto the occlusal surface with micro brushes and rubbed on the surface for 20 seconds. Then, light curing for 10 seconds, followed by application of 3M™ Clinpro™, Platz Seefeld, 82229,GermanySealant and curing for 20 seconds. For GROUP B – Total-Etch adhesive group (30 teeth) The teeth received an application of etchant gel containing 37% phosphoric acid (total-etch Ivoclar Vivadent,175Pineview Drive Amherst, NY 14228 United States) rinsed off with water for 20-30 sec. After drying the teeth, adhesive was applied to the occlusal fissure using micro brushes. After the application of the adhesive, curing was done for 10 seconds. This was followed by the application of 3M™ Clinpro™ Sealant and curing for 20 seconds. All margins of sealant were checked to make sure that they were flush within the teeth and that application was successful. The clinical evaluation for self-etch adhesive and total-etch adhesive was done for sealant retention.

Flowchart 1: Consort flowchart for the two groups.



Results:

A total of 26 subjects were enrolled in the study with inclusion and exclusion criteria. Data was entered into a Microsoft Excel spread sheet and then imported to the Statistical

Package for Social Sciences (SPSS version 21, IBM). In the current study, inter-group comparison (TotalEtch v/s Self Etch) of retention scores failed to reach the level of statistical significance at 1 month, 3 months, 6 months, and 12 months. It was found in an intragroup comparison of the retention of TotalEtch and SelfEtch adhesive that the distribution of retention scores at 12 months was significantly different from that at 1 month, 3 months, and 6 months. Also, the distribution at 6 months was also significantly different than that at 1 month. Intergroup and intragroup archwise comparison Maxillary and mandibular arch in total etch and self-etch group in 1,3,6,12 months scores failed to reach the level of statistical significance at 1 month, 3 months, 6 months, and 12 months. (Table 1,2. Graph 3,4.) Intergroup and intragroup side-wise comparison (left and right side) in total etch and self-etch group scores were statistically non-significant at 1 month, 3 month, 6 month, and 12 months. Intergroup comparison of marginal discoloration in total etch and self-etch groups at 1, 3, 6, and 12 monthscores failed to reach the level of statistical significance at 1 month, 3 months, 6 months, and 12 months. Intragroup comparison of marginal discoloration in the total etch group and self-etch group at 1,3,6,12 months It was found that the distribution of MD scores at 12 months was significantly different from that at 1 month, 3 months, and 6 months. Also, the distribution at 6 months was also significantly different than that at 1 month. (Graph 5,6)

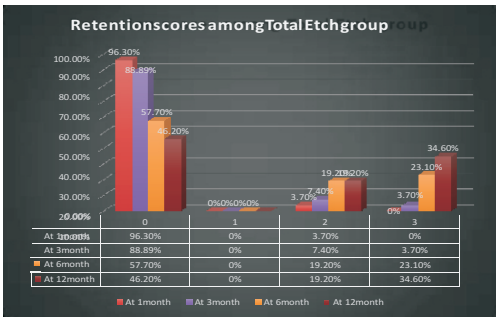
Table 1:Intergroupcomparison (Total Etchv/s Self Etch) of Retentionscoresat1. 3,6 and 12th month

Retentionscores at1 month		0	1	2	3	
Total Etchgroup	n	26	0	1	0	
	%	96.3%	0%	3.7%	0%	Pvalue 0.414,NS
Self-Etchgroup	n	16	1	0	10	
	%	59.3%	3.7%	0%	37.0%	
Retentionscores at3 months		0	1	2	3	
Total Etchgroup	n	24	0	2	1	
	%	88.89%	0%	7.4%	3.7%	Pvalue 0.934,NS
Self-Etchgroup	n	11	2	1	13	
	%	40.7%	7.4%	3.7%	48.1%	
Retentionscores at6 months		0	1	2	3	
Total Etchgroup	n	15	0	5	6	
	%	57.7%	0%	19.2%	23.1%	Pvalue 0.166,NS
Self-Etchgroup	n	6	3	2	15	
	%	23.1%	11.5%	7.7%	57.7%	
Retentionscores at12 months		0	1	2	3	
Total Etchgroup	n	12	0	5	9	
	%	46.2%	0%	19.2%	34.6%	Pvalue 0.477,NS
Self-Etchgroup	n	2	2	3	19	
	%	7.7%	7.7%	11.5%	73.1%	

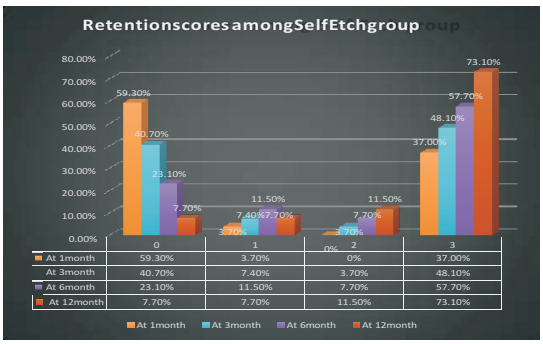
Table 2: Intergroupcomparison (Total Etchv/s Self Etch) of Marginal discolouration (MD) scoresat1,3,6 and 12th month

MarginalDiscolourationscoresat1month		0	1	2	3	4	
Total Etchgroup	n	26	1	0	0	0	
	%	96.3 %	3.7%	0%	0%	0%	Pvalue 0.370,NS
Self Etchgroup	n	17	0	0	10	0	
	%	63.0 %	0%	0%	37.0%	0%	
MarginalDiscolourationscoresat3months		0	1	2	3	4	
Total Etchgroup	n	25	0	1	0	1	
	%	96.3 %	0%	3.7%	0%	3.7%	Pvalue 0.367,NS
Self Etchgroup	n	14	0	0	13	0	
	%	51.9 %	0%	0%	48.1%	0%	
MarginalDiscolourationscoresat6months		0	1	2	3	4	
Total Etchgroup	n	17	3	1	1	4	
	%	65.4 %	11.5 %	3.8%	3.8%	15.4%	Pvalue 0.101,NS
Self Etchgroup	n	9	1	1	0	15	
	%	34.6 %	3.8%	3.8%	0%	57.7%	
MarginalDiscolourationscoresat12months		0	1	2	3	4	
Total Etchgroup	n	14	4	1	1	6	
	%	53.8 %	15.4 %	3.8%	3.8%	23.1%	Pvalue 0.361,NS
Self-Etchgroup	n	5	1	1	0	19	
	%	19.2 %	3.8%	3.8%	0%	73.1%	

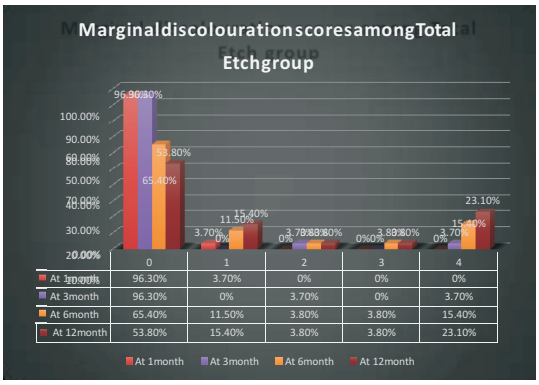
Graph 1: Intragroupcomparison of Retentionscoresamong Total Etchgroupat1month,3months, 6months &12 months.



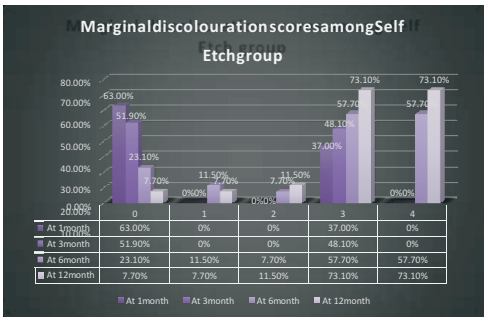
Graph 2:Intragroupcomparison of Retentionscoresamong Self-Etchgroupat1month, 3months, 6months &12 months



Graph 3:Intragroup comparison of Marginal discolouration (MD)scores among Total Etchgroup at 1month,3 months, 6months & 12months.



Graph 4 : Intragroupcomparison of Marginaldiscolouration (MD) scoresamong Self-Etchgroup at 1month,3 months,6months &12 months.



Discussion:

Pit and fissure sealants are a secure and reliable caries prevention method. Pit and fissure sealants have been acknowledged as a successful caries prevention strategy, according to Tandon et al.[6]. The most important stage in applying sealant is acid etching. Salivary contamination before sealant application will result in adherence of salivary proteins to the etched demineralized enamel, therefore, obstructing the penetration of sealant, and weakening the sealants bond.[8]

According to Simonsen RJ, one of the major concerns in dentistry is the absence of complete adherence between the restorative material and the tooth tissues.[9] Bacteria and saliva can both enter the space that has been created and harm the pulp. Utilizing different adhesive solutions has helped to lessen but not eliminate micro leaks. Even though the usage of self-etch adhesives has grown significantly over the past few years, its ability to bind to unground enamel and etch presents a hurdle. It is well known that resin tags develop in etched enamel to produce micromechanical interlocking, which is how enamel bonding is performed. In comparison to phosphoric acid, which is utilized with etch-and-rinse adhesives, the majority of one-step self-etch adhesives are not as acidic.[10]

Gregoire G et al[11] examined the etching patterns produced by self-etch and phosphoric acid etchants in an SEM analysis. It was discovered that these self-etch adhesives did not reach the same amount of demineralization as phosphoric acid and did not etch ground and unground enamel as well. Additionally, they assessed the capacity of a fissure sealer to penetrate pre-etched fissures and the impacts of applying a self-etch adhesive to those fissures. It was discovered that using an extra self-etching adhesive did not enhance the sealing performance of sealants and that the conventional etching approach was still the most efficient way to etch intact cracks. Marginal discoloration (MD) score intergroup comparison (TE vs SE) Tandon et al.[6] claim that marginal disintegration, which results in a rough and uneven surface, causes marginal discoloration. This may serve as a niche for the buildup of plaque and food particles, as well as encourage the penetration of oral fluids and result in micro-leakage and morphological shape (retention). Although at 1 & 3 months, 0 score was more common among TE & score 3 was more common among the SE group, while at 6 & 12 months, 0 score was more common among TE group & score 4 was more common among SE group, which also failed to reach the level of statistical significance, the current study's inter-group comparison (TE v/s SE) of Marginal discoloration (MD) scores failed to reach the level of statistical significance. This shows that minor discoloration in TE was not common at the end of the year.

As enamel bonding is primarily based on micromechanical interlocking of a low viscosity resin into micro porosities, Hannig M. et al.[12] and Kamaran et al.[13] stated that the extent and depth of the etching pattern logically should influence the bonding performance of an adhesive. Accordingly, a break in adhesive bonding may lead to the development of a caries lesion over time. To prepare enamel for pit and fissure sealant application, Dos Santos et al.[14] examined the penetration (tags) of adhesive materials into enamel that had been etched with phosphoric acid or treated

with a self-etch adhesive. They discovered that teeth treated with a self-etch adhesive had significantly less penetration than teeth treated with phosphoric acid etching. When compared to the use of phosphoric acid, the application of a one-step self-etch adhesive did not produce a deep enamel etching pattern, according to Pashley et al. [15] and Shinohara et al. [16]. Therefore, it is evident that self-etch adhesive has a lower penetration rate and a larger likelihood of micro leaks.

Santos Ra et al. [17], in contrast to our investigation, demonstrated that adhesive material's penetration (tags) into enamel was larger when applied to enamel etched with phosphoric acid than with self-etch adhesives. This may help to explain why the TAE group has more retention than the SE group. The TE group consequently had reduced edge discoloration. Marginal leakage was substantially lower with traditional etching than with self-etching adhesives, according to AL Homaidhi M et al [18].

The marginal leakage of self-etching adhesives was found to be significantly greater than that of the conventional phosphoric acid etch, even with enamel pre-treatment. The enamel-sealant contact must still be sealed by phosphoric acid etching of the enamel. To determine if there was a significant difference in marginal discoloration (MD) scores between various follow-ups, we compared the TE groups' intragroup marginal discoloration (MD) scores. When compared to the distribution of marginal discoloration (MD) scores at one month, three months, and six months, it was discovered that the distribution at 12 months was considerably different. It has been determined that compared to the 6-month and 3-month intervals; there is a considerable rise in marginal discoloration at a 12-month interval. Additionally, the distribution at 6 months and 1 month had quite distinct characteristics.

The application of bonding, according to Nahvi A et al. [19], significantly reduces the microleakage of fissure sealants. The quantity of minor leakage while, employing self-etch fissure sealant was the same as when using the outdated technique.

Derelioglu SS et al. [20] found that tooth enamel surface conditioning is essential for the formation of strong bonding and leak-free seals between the tooth and fissure sealant. They also showed that adhesive failure mostly happened to teeth that had been treated with self-adhesive resin, while cohesive failure mostly happened to teeth that had been etched with PA. And in the current study, an intragroup comparison of marginal discoloration (MD) scores among the SE groups was done to find out if there were any significant differences in marginal discoloration (MD) scores between different follow-ups.

It was found that the distribution of marginal discoloration (MD) scores at 12 months was significantly different from that at 1 month, 3 months, and 6 months. Also, the distribution at 6 months was significantly different from that at 1 month. It was seen that there was no statistical difference in marginal discoloration when comparing the distribution between 1 month and 3-month follow-up, while a statistically significant difference was seen when comparing the distribution of marginal discoloration from 1 month to 6 months and 12 months, as well as 3 months to 6 months and 6 months to 12 months. A gradual increase in marginal discoloration was seen by the end of 12 months.

In an in vitro study, Meller C et al.[21] assessed the marginal microleakage and infiltration potential of pit-and-fissure sealants by applying conventional sealing techniques versus using an additional bonding agent, and they concluded that a higher proportion of microleakage was found with sealants applied without the additional use of the bonding agent, whereas all samples of the group using the bonding agent were filled. Therefore, sealant treatments utilizing an extra bonding agent applied to precede considerably enhanced fissure penetration prevention and microleakage prevention. This significantly improved fissure infiltration and microleakage. This significantly improved fissure infiltration and microleakage.

According to Devarasa et al.[22], pre-etching the undamaged enamel with 37% phosphoric acid caused the resin tags of the self-etch adhesives to develop at a longer length and penetrate more deeply. Additionally, it achieved a stronger bond to sound enamel. Fissure sealants that were applied using an etch-and-rinse adhesive outlasted those that were applied using a self-etching adhesive, according to Yazici AR et

al.[23] Tehrani MH et al.[24] showed that the lowest microleakage is achieved with acid etching, bonding agent (single bond), and fissure sealer, whereas the maximum microleakage is achieved with self-etching primer, bonding agent (SE BOND), and fissure sealant. Therefore, they concluded that using acid and a bonding agent before applying the sealant is the best technique to fill cracks and holes. Because self-etching adhesives are acidic and are not washed off the tooth surface, Kamaran E et al[13] observed that they are unable to produce prolonged demineralization of the tooth structure. When utilizing self-etch as opposed to phosphoric acid etching, sealant retention was shown to be lower, according to Nirwan M et al[25]. This can be the result of improper manufacturing, as the enamel tags aren't often engraved. These novel self-adhesive solutions, according to Mohammed IP et al[26], are user-friendly since the stages for enamel/dentin acid etching, washing, and drying are removed. When treating pediatric patients, it is particularly intriguing to have fewer surgical steps and a shorter chair time. They said that to avoid cavities, sealants must be regularly repaired, maintained, or changed.

According to research by Ansari ZJ et al.[27], priming the etched enamel with a dentin bonding agent before applying a sealant might reduce the likelihood of micro leaks by increasing surface wettability and interaction between the sealant and substrate by eliminating impurities. The use of acid etching and bonding agents is the optimal method for sealant treatment in situations when saliva is contaminated and not contaminated, according to Bassir L et al [28]. When a tooth is challenging to isolate, it becomes more difficult for the tooth to fracture at the edge. Our study's findings were at odds with those of Pinar et al.[29], who claimed that there were no differences between sealants with and without bonding agents when they were compared in terms of marginal integrity, marginal discoloration, and anatomic form. They concluded that a sealant's success depends on whether it is applied under the best possible circumstances. The findings reveal that at the 2-year point, the clinical success of sealants was not significantly impacted by the use of a bonding agent below sealants.

Also, according to Nazar H et al[30], the caries prevention of teeth sealed with primer and bond sealant was not superior to that of teeth sealed with sealant alone. Their investigation was restricted by its limited sample size. These results are compared to those of our study, which likewise yielded inconclusive findings and were constrained by the small sample size of 120 teeth from 30 children and the brief timeframe of the investigation.

Conclusion:

The marginal discoloration and microleakage of fissure sealants applied to occlusal surfaces with the application of a SE bonding agent and conventional PAE method did not significantly change after a year. It may be concluded after a year that switching from phosphoric acid etching to self-etching adhesive does not affect the integrity of permanent teeth's edges. Scientifically sound and economical methods for preventing pit and fissure caries in children include applying sealants and maintaining them.

The efficiency of a sealant relies on how it is applied and is closely tied to its marginal integrity. Pit and fissure sealant failure can be attributed to moisture contamination, improper curing techniques, inadequate adhesion, improper application procedure, early age placement, variable child behavior, and visibly noticeable variations in enamel, which can, over time, result in the development of caries.

Our study showed the effectiveness of the sealant by its ability to prevent caries in the sealed surfaces of permanent second molars in children considered to be at high risk (DMFT >2) in comparison to the non-sealing of permanent second molars.

Take home message from the study:

Pit and fissure sealents are the best means for prevention of caries in a Pediatric Patient. The sustainability and life of the same plays an important role.A regular recall and check up is mandatory. Ample number of Sealents are available in the market,hence the decision to use which product becomes difficult .Hence ,

Further studies are needed for an assessment of the effect of adhesives on sealant retention and caries control.

References:

1. Beltran-Aguilar, E.D.; Barker, L.K.; Canto, M.T.; Dye, B.A.; Gooch, B.F.; Griffin, S.O.; Hyman, J.; Jaramillo, F.; Kingman, A.; Nowjack-Raymer, R.; et al. Surveillance for dental caries, dental sealants, tooth

retention, edentulism, and enamel fluorosis: United States, 1988–1994 and 1999–2002. MMWR Surveil. Summ. 2005, 54, 1–43.

2. Naaman R, El-Housseiny A, Alamoudi N. The use of pit and fissure sealants— A literature review. J Dent. 2017 Dec;5(4):34.
3. Cvikl B, Moritz A, Bekes K. Pit and Fissure Sealants— A Comprehensive Review. J Dent. 2018 Jun; 6(2):18.
4. Irish Oral Health Services Guideline Initiative. Pit and fissure sealants evidence based guidance on the use of sealants for the prevention and management of pit and fissure caries (. 2010) http//www.lenus.ie/handle/10147/296000
5. Hormati AA, Fuller JL, Denehy GE. Effects of contamination and mechanical disturbance on the quality of acid-etched enamel. J Am Dent Assoc. 1980 Jan; 100(1): 34-8.
6. 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. J Dent (Tehran, Iran). 2015 Oct; 12(10):712.
7. Shiva Kumar KM, Prasad S, Chandu GN. International Caries Detection and Assessment System: A new paradigm in detection of dental caries. J ConservDent 2009 Jan; 12(1):10
8. Feigal RJ, Donly KJ. The use of pit and fissure sealants. Pediatr Dent. 2006 Mar 1; 28(2):143-50.
9. Simonsen RJ. The clinical effectiveness of a coloured pit and fissure sealant at 36 months. J Am Dent Assoc. 1981 Mar; 102(3):323-7.
10. Peumans M, Kanumilli P, De Munck J, Van Landuyt K, Lambrechts P, Van Meerbeek B. Clinical effectiveness of contemporary adhesives: a systematic review of current clinical trials. Dent Mater. 2005 Sep; 21 (9):864-81.
11. Gregoire G, Ahmed Y. Evaluation of the enamel etching capacity of six contemporary self-etching adhesives. J Dent. 2007 May 1; 35(5):388-97.
12. Hannig M, Bock H, Bott B, Hoth-Hannig W. Inter-crystallite nano retention of self-etching adhesives at enamel imaged by transmission electron microscopy. Eur. J. Oral Sci. 2002 Dec; 110(6):464-70.
13. Kamaran E, Yazici AR, Tuncer D, Firat E, Unluer S, Baseren M. A 48-month clinical evaluation of fissure sealants placed with different adhesive systems. Oper Dent. 2013 Jun; 38(4):369-75.
14. Dos Santos KT Sundfeld RH, Garbin CA, Sundefeld ML, Ceolim BN. Length of resin tags in pit-and-fissure sealants: all-in-one self-etching adhesive vs phosphoric acid etching. CompendContinEduc Dent. (Jamesburg, NJ: 1995). 2008 Apr; 29(3):186-92.
15. Pashley DH, Tay FR. Aggressiveness of contemporary self-etching adhesives: Part II: etching effects on unground enamel. Dent Mater. 2001 Sep 1; 17(5):430-44.
16. Shinohara MS, Oliveira MT, Hipólito VD, Giannini M, Goes MF. SEM analysis of the acid-etched enamel patterns promoted by acidic monomers and phosphoric acids. J Appl Oral Sci. 2006 Dec; 14(6):427-35.
17. Santos Ra, Pontes Mm, NascimentoAb, Montes Ma, Braz R. Bond strength to dentin of total-etch and self-etch adhesive systems. RGO-RevistaGaúcha de Odontologia. 2014 Dec; 62(4):365-70.
18. Al-Homaidhi M, Al-Dlaigan YH. Microleakage of a Pit and Fissure Sealant used with Two Brands of Self-etching Adhesives: An in Vitro Study. J Int Oral Health 2016 Mar 1; 8(3):331.
19. Nahvi A, Razavian A, Abedi H, Charati JY. A comparison of micro leakage in self-etch fissure sealants and conventional fissure sealants with total-etch or self-etch adhesive systems. Eur J Dent. 2018 Apr; 12(2):242.
20. Derelioglu SS, Yilmaz Y, Celik P, Carikcioglu B, Keles S. Bond strength and Microleakage of self-adhesive and conventional fissure sealants. Dent Mater J 2014 Jul 31; 33(4):530-8.
21. Meller C, Reichenmiller K, Schwahn C, Samietz S, Blunck U. Resin-based pit and fissure sealants: microleakage reduction and infiltration enhancement using a bonding agent. J Adhes Dent 2015 Jan 1; 17(1).
22. Devarasa GM, Subba Reddy VV, Chaitra NL, Swarna YM. Self-etching adhesive on intact enamel, with and without pre-etching. Microsc. Res. Tech. 2012 May; 75(5):650 4.

23. Yazici AR, Karaman E, Baseren M, Tuncer D, Yazici E, Ünlüer S. Clinical evaluation of a nanofilled fissure sealant placed with different adhesive systems: 24-month results. Oper Dent. 2009 Nov; 34(6):642-7.
24. Tehrani MH, Birjandi N, Nasr E, Shahtusi M. Comparison of microleakage of two materials used as fissure sealants with different methods: an in vitro study Int JPrev Med. 2014 Feb;5(2):171.
25. Nirwan M, Nigam AG, Marwah N, Nayak UA, Bansal A, Gahlot MS. A comparative evaluation of retention of pit and fissure sealant bonded using sixth-, seventh-, and eighth-generation adhesives: An in vivo study J Indian SocPedodPrev Dent. 2017 Oct 1; 35(4):359.
26. Mohammed IP, Jaleel BN, Hiremath SS, Manjunath C, Amarah U, Krishnamoorthy A. Comparison of effectiveness of traditional acid etching and of the self-etching agent in sealant retention: A randomized controlled trial J. Indian Assoc. Public Health Dent. 2016 Jan 1; 14(1):4.
27. Ansari ZJ, Hashemi SM. Effect of enamel bonding agents on pit and fissure sealant retention in an isolated situation. J Dent (Tehran). 2008; 5(4):156-60.
28. Bassir L, Khanehmasjedi M, Nasr E, Kaviani A. An in vitro comparison of micro leakage of two self-etched adhesive and the one-bottle adhesive used in pit and fissure sealant with or without saliva contamination. Indian J Dent Res 2012 Nov 1; 23(6):806.
29. Pinar A, Sepet E, Aren G, Bölükbaşı N, Ulukapı H, Turan N. Clinical performance of sealants with and without a bonding agent. Quintessence Int 2005 May 1; 36(5).
30. Nazar H, Mascarenhas AK, Al-Mutwa S, Ariga J, Soparker P. Effectiveness of fissure sealant retention and caries prevention with and without primer and bond. Med PrincPract. 2013; 22(1):12-7.