

# The Effectiveness and Ease of a One-step Conditioning Agent with Conventional Acid Etch and Priming in the Placement of Sealants: A 6-Month Follow-up

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## Abstract

**Objectives:** The objective of the study was to evaluate the caries incidence of occlusal surfaces sealed using the two different techniques after 6 months and the ease of placement of sealant following the two techniques, for children and operator. **Materials and Methods:** Children between the age groups of 8–11 years and only mandibular molars were involved in the study; the techniques used for enamel preparation before sealant placement on the right and left side of the mandibular arch were randomized. On one side Adper™ SE plus and on the other side phosphoric acid etches together with Adper™ Single Bond 2 were used. Clinpro™ sealants were placed on both sides. The retention with these two techniques was compared after 6-month-based Color Coverage Caries system. The opinions of the children were taken on the two techniques that were used and recorded on individual questionnaires using Facial Grimace Scale and the operator by visual analog scale. Descriptive statistics carried out using SPSS (version 17.0). **Results:** Fifty-seven (95%) of the sixty children were available for the follow-up after 6 months. The retention of the acid-etch group was significantly superior ( $P = 0.00^*$ ) as was the caries preventive effect ( $P = 0.04^*$ ). Children felt that the placement of sealants was easier following enamel preparation with Adper™ SE Plus ( $P = 0.00^*$ ) and same as the operator. **Conclusions:** The regular acid etch with placement of sealant showed less caries occurrence on the occlusal surface after 6 months. Both the operator and children opined that acid-etch method for the placement of sealants is more comfortable.

**Keywords:** Acid etch, bonding agents, occlusal caries, pit and fissure sealants

## INTRODUCTION

The prevalence of dental caries in children remains a significant clinical problem. Caries prevalence has been declined universally over the past few years; nonetheless, this regression was not constant to all the tooth surfaces.<sup>[1]</sup> However, as the overall caries level drops, the proportion of the caries is accounted for occlusal pit and fissure caries arises.<sup>[2]</sup> Occlusal caries accounts for 56%–70% of the lesions among children of age 5–17 years.<sup>[3,4]</sup> Ripa<sup>[5]</sup> reported that the occlusal surfaces represented only 12.5% of the total surfaces of the permanent dentition, they accounted for almost 50% of the caries in the study population. The occlusal surface of the first permanent molars is most vulnerable to tooth decay in children.<sup>[1-6]</sup>

The effectiveness of sealants pivots on their ability to isolate pits and fissures from the combination of bacteria and their nutrients, and the acidic metabolic products.<sup>[7]</sup> Conferring to the researchers, the benefit provided by protecting pits and fissures

is based on good retention and integrity of the sealant.<sup>[8]</sup> The success of the sealing procedure depends on the morphology of pits and fissures and on the adequate preparation of the enamel before sealant application. Pretreatment of the enamel surfaces before sealant application is mandatory to obtain access to the deepest areas of the pits and fissures and to remove stains and organic debris to increase surface roughness.<sup>[9]</sup> Failure of pretreatment of the pits and fissures may lead to an increase in microleakage.<sup>[10]</sup>

Sealants are conventionally placed after the fissure enamel is cleansed and etched with phosphoric acid. Etching

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removes contaminants and creates an irregular microporous enamel surface that is infiltrated by the resin-based sealant material.<sup>[11]</sup> Most children accept this procedure with no difficulty;<sup>[12]</sup> nonetheless, there are a number of children who find the procedure difficult, and it is often the taste, rinsing, and suction associated with the etching stage that the patients find unpleasant.<sup>[13]</sup> Hitt and Feigal<sup>[14]</sup> described the technique as a means of overcoming the negative effects of salivary contamination of etched enamel surfaces using hydrophilic materials which contain water, applied under sealants, to improve sealant retention rates. New nonrinse conditioning systems are now becoming available which enable composite-to-enamel bonding without previous phosphoric acid etching of the enamel surface. These new materials have been attributed clinically as the most promising approach in terms of both user-friendliness and technique sensitivity.<sup>[15]</sup> It is very important to know the clinician comfort using different techniques for sealants placement. However, there is a lack of evidence to find ease in placing sealants in children for operators. Hence, the objectives of the present study were (i) to compare the clinical effectiveness of a nonrinse conditioner with conventional acid-etch bonding for enamel preparation before sealant placement with 6-month follow-up and (ii) to find out comfortless of the children and operator while using these two different techniques for sealants placement.

## MATERIALS AND METHODS

Children of age 8–11 years irrespective of gender and race or socioeconomic status were included in the study from regular patients attending to the Department of Paedodontics and Preventive Dentistry. Children were included, if the fissure sealant placement was indicated on both contralateral lower permanent molar teeth, according to the British Society of Pediatric Dentistry recommendations and Scottish Intercollegiate Guideline Network guidelines i.e., children who are at high risk of caries. Parental consent and clearance from the Institutional Ethical Committee were obtained before the procedure. In addition, baseline Decayed, Missing, and Filled Teeth/decayed, missing, and filled teeth (DMFT/dmft) were recorded for all children along with age and gender. Deep pits and fissures were checked using William's probe. The techniques used for enamel preparation before sealant placement on the right and left side of the lower arch were randomized. On one side Adper™ SE plus and on the other side phosphoric acid etch together with Adper™ Single Bond 2 were used. Clinpro™ sealant was used for all the teeth. The opinions of the children recorded on individual questionnaires using Facial Grimace Scale and also of the operator using visual analog scale (VAS) on the techniques used. Paired lower first permanent molars, which were erupted sufficient enough to isolate for the placement of fissure sealant and which were caries free, are selected for the study. Children who were not cooperative to allow sealant placement were excluded from the study.

Before placement of the sealant, prophylaxis of each molar tooth was done using a dry prophylaxis brush. Tooth was isolated using cotton rolls and/or narrow bore suction (saliva ejector) and surfaces were washed and dried with a 3-in-1 tip. On one quadrant, 37% phosphoric acid was applied to occlusal surfaces of molars and left for 20 s. Teeth were rinsed with water for 20 s and then air-dried using a 3-in-1 tip. Adper™ Single Bond 2 (3M ESPE), a fifth-generation dentin bonding agent was applied, left for 20 s, then air-dried and light cured for 10 s. Clinpro™ (3M ESPE) light-curing fissure sealant was then applied to the fissures and cured for 20 s.

On the contralateral tooth, Adper™ SE Plus was used. A two-bottles, self-etch bonding adhesive with bottle-A containing the aqueous primer and bottle-B containing the acidic adhesive. Equal quantities such as 1 drop of liquid A and 1 drop of liquid B are taken in separate mix wells. Applicator brush tip is wet with liquid A and applied to the entire bonding area so that a continuous red-colored layer is obtained on the surface. Then, another applicator brush tip is wet with liquid B and scrubbed into the entire wetted surface of the bonding area. The red color will disappear quickly, indicating that the etching components have been activated and continued scrubbing for 20 s has been done to ensure a proper etch. A 3-in-1 tip used to air dry for 10 s and evaporate water. A very thin second coat of liquid B is applied to the entire bonding surface area and light cured for 10 s. Clinpro™ light-curing fissure sealant was then applied to the fissures and cured for 20 s. After the sealant placement, the occlusion was checked.

Sealants were assessed according to a modified version of the color, coverage, caries Sealant Evaluation System<sup>[16]</sup> [Table 1]. The integrity of fissure sealants was reviewed and recorded 6 months following placement. The outcome measures used were retention of sealant, presence of caries, and the ease

**Table 1: Summary of color, coverage, caries sealant evaluation criteria**

Variable	Clinical appearance
Color	
Clear material	C
Tinted material	T
Opaque material	Q
Coverage	
Sealant covering all of fissure system	A
Sealant present on >50% of fissure system	B
Sealant present on <50% of fissure system	C
No sealant present	D
Caries	
Surface sound, no caries	0
Initial enamel caries-white spot lesion	1W
Initial enamel caries-brown spot lesion	1B
Enamel caries	2
Caries into dentin-cavity <0.5 mm	3P
Caries into dentin-cavity >0.5 mm	3L
Caries with probable pulp involvement	4

of use. Questionnaires were used immediately following placement of fissure sealants to score the ease of placement of the systems used such as traditional acid-etching and self-etching techniques for the children using a Facial Grimace Scale and of the operator using a VAS.

### Statistical analysis

The data thus collected were subjected to statistical evaluation using the Statistical Package for the Social Sciences (SPSS, Chicago, USA). Comparison of duration for the sealant coverage and caries scores was assessed by Friedman ANOVA Test. Comparison of the sealant coverage scores and caries scores between the two techniques, traditional acid etching, and self-etching was done by Mann–Whitney U-test. The ease of placement of sealant of the two techniques as assessed by the children and the operator was performed using the independent samples *t*-test.

### RESULTS

Sixty children were involved in the study, among those, only 57 children appeared for 6-month follow-up. The mean age group for all the samples taken in the study was  $9.18 \pm 0.13$  and the mean dmft and DMFT were  $2.17 \pm 0.05$  and  $0.22 \pm 0.06$ , respectively. The results were found to be significant in both the duration as well as with the two techniques. The mean  $\pm$  standard error (SE) for sealant coverage scores was  $1.25 \pm 0.055$  for 6 months, respectively, as shown in Table 2. The traditional acid etching technique with fifth-generation bonding agent (Adper™ Single Bond 2) and the self-etching technique with sixth-generation bonding agent (Adper™ SE Plus) were compared for the sealant coverage scores over a duration of 6 months, respectively. After 6-month duration, the results were significant ( $P = 0.000^*$ ). The results were found to be significant in both duration as well as the two techniques.

The mean  $\pm$  SE for caries scores was  $0.04 \pm 0.02$  for 6 months, respectively, as shown in Table 3. After 6-month duration, the results were significant ( $P = 0.04^*$ ). The ease of placement of sealant using the two techniques, traditional acid etching and

the self-etching, was compared for all the sixty children using a Wong-Baker Facial Grimace Scale, and the results were significant ( $P = 0.00^*$ ) as shown in Figure 1. The ease of placement of sealant using the two techniques, traditional acid etching and the self-etching, was compared for the operator using a VAS, and the results were significant ( $P = 0.00^*$ ) as shown in Figure 2.

### DISCUSSION

Cueto and Buonocore<sup>[17]</sup> introduced fissure sealants into dentistry few decades ago to protect susceptible occlusal surfaces from dental caries. The Cochrane database of systematic reviews 2013 has confirmed the effectiveness of resin-based sealants on the occlusal surfaces of permanent molars. Most children accept this procedure with no difficulty.<sup>[18]</sup> However, there are a number of children who find the procedure difficult, and it is often the taste, rinsing, and suction associated with the phosphoric acid etching stage that patients find unpleasant.<sup>[18]</sup> The technique of including a bonding primer between etched enamel and fissure sealant resin has gained popularity since the early 1990s. Hitt and Feigal<sup>[14]</sup> described the technique as a means of overcoming the negative effects of salivary contamination of etched enamel surfaces using hydrophilic materials which contain water, applied under sealants, to improve sealant retention rates. The etch-and-rinse phase is reconsidered as it reduces clinical application time and also reduces the risk of making errors during application and manipulation. It is also possible that this technique is more forgiving of mild salivary contamination. Salivary contamination of the tooth surface after acid etching compromises the ultimate bond between resin and enamel and has been implicated in sealant failure.<sup>[19,20]</sup>

The present study was conducted with a sample size of sixty children to compare the effectiveness of a one-step conditioning agent with conventional acid etch and priming in sealant placement. Fifty-seven children were available for evaluation after a period of 6 months. The age group selected for the study was between 8 and 11 years, because in this age group, mandibular first permanent molars have completely erupted and are susceptible to carious attack. Moreover,

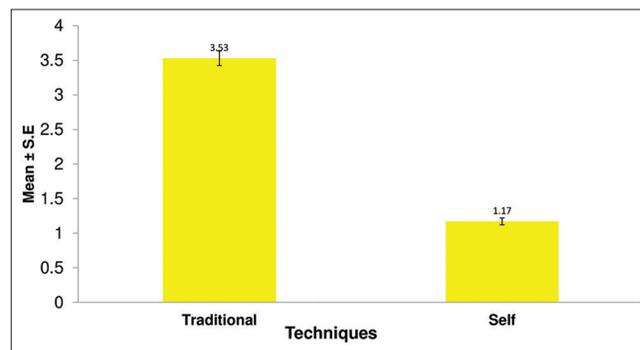
**Table 2: Comparison of sealant coverage scores using traditional acid etching and self-etching techniques for sealant placement after 6 months**

Duration	Etching technique	Sample	Mean rank	Z and P
6 months	Traditional	57	49.37	3.827
	Self	57	65.63	$P=0.00^*$

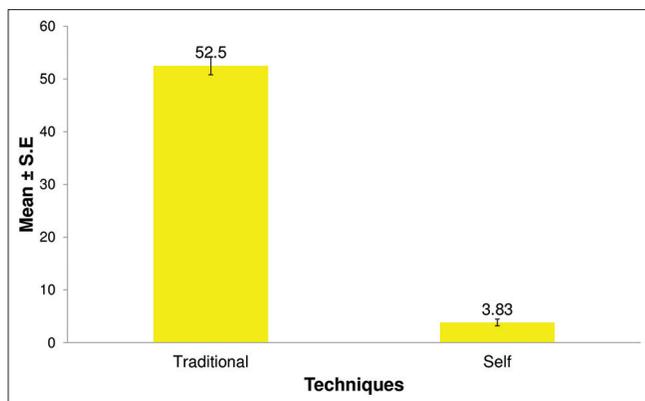
\*Significant  $P < 0.05$

**Table 3: Comparison of caries scores using traditional acid etching and self-etching techniques for sealant placement after 6 months**

Duration	Etching technique	Sample	Mean rank	Z and P
6 months	Traditional	57	55.5	2.02
	Self	57	59.5	$P < 0.05$



**Figure 1: Comparison of ease of placement of sealant with traditional acid etching and self-etching techniques as assessed by children using Wong-Baker Facial Grimace scale.**



**Figure 2:** Comparison of ease of placement of sealant with traditional acid etch and self-etching techniques using visual analog scale as assessed by operator.

complete eruption of the mandibular first permanent molars is essential to achieve proper isolation while placing sealants.<sup>[13]</sup> Bilateral lower permanent first molars were selected for the study because of the effect of clustering. A single operator randomly selected the teeth for the placement of sealant using the two techniques. Isolation using cotton-wool rolls and narrow bore suction (saliva ejector) used. It has been reported that there is a difference in clinical effectiveness of sealants placed using either rubber dam or cotton rolls.<sup>[20]</sup>

Pit and fissure sealant selected for the study was Clinpro™, an opaque light-cured fluoride releasing pit and fissure sealant. This material was selected for sealing pit and fissures because it has dual role of actions, i.e., not only mechanically sealing pits and fissures but also due to its fluoride-releasing capacity with anticariogenic action. The split-mouth design was chosen so that the two techniques which were used for placing sealant. Isolation is a key factor in a sealant's clinical success.<sup>[21]</sup> *In vitro* and *in vivo* studies report that the use of a bonding agent will improve the bond strength and minimize the microleakage.<sup>[22]</sup>

The traditional acid etching technique with fifth-generation bonding agent (Adper™ Single Bond 2) and the self-etching technique with sixth-generation bonding agent (Adper™ SE Plus) were compared for the sealant coverage scores for duration of 6 months, respectively ( $P < 0.05$ ). This shows that the sealants are better retained with the conventional acid-etching technique using fifth-generation bonding agent. On review, it was evident that the teeth in the conventional acid etch group were significantly more likely to have a sealant coverage score that reflected that a greater percentage of the fissure system remained covered by fissure sealant. When the self-etch group was evaluated, the sealant coverage scores of B, C, and D were recorded, which reflected that sealants were more likely to have been lost when this enamel preparation system had been used. Nonetheless, the results of this study are in accordance with the results of the *in vitro* study by Hannig *et al.*<sup>[23]</sup> The retrospective analysis of sealant application techniques carried out by Venker *et al.*<sup>[24]</sup> and Burbridge *et al.*<sup>[11]</sup> concluded that the

use of self-etching adhesives could not be recommended for enamel preparation before sealant placement based on their *in vivo* study. Most recently, Aman *et al.*<sup>[25]</sup> observed that fissure sealants performed with total-etch adhesives had more retention than the self-etched adhesives. Authors reevaluated 182 molars (90%) and found complete retention in 56% in total etched and 28% in self-etched groups, respectively, and these findings were in agreement with the present study.

Celiberti and Lussi have reported on an *in vitro* study, in which sealants were placed following phosphoric acid etching both with and without the subsequent use of Xeno III and concluded that the additional use of Xeno III did not improve fissure sealing under the conditions of their study.<sup>[26]</sup> In an *in vitro* investigation, it was found that, when using some self-etching adhesives, higher bond strengths to sealant materials were achieved with the application of two layers of the adhesive product.<sup>[11]</sup> The results of the present *in vivo* study appear to support the results that this group of workers achieved *in vitro*.

Regarding the caries scores, the present study found significance in both duration and the two techniques ( $P = 0.017$ ). After 6-month duration, the results were significant ( $P = 0.04^*$ ) showing that a significant difference in the caries scores between the conventional acid etch group and the self-etch group was evident. Members of the self-etch group were more likely to show early enamel caries than those in the conventional acid etch group. This result can be explained by the sealants being significantly more likely to be lost in the self-etch group, and the pit and fissure system no longer being protected by the sealant.

The ease of placement of sealant using the two techniques, traditional acid etching and the self-etching were compared for all the 60 children using a Wong-Baker Facial Grimace Scale and the results were significant ( $P = 0.00^*$ ) which showed that the children were more comfortable with the self-etch method, compared to the conventional acid-etch method. This might attribute to the fact that, whereas using self-etch system, the child is not subjected to wash and dry of a two-step procedure which is carried in conventional acid etch. The results of the present study were found significant ( $P = 0.00^*$ ) for the ease of placement of sealant using the two techniques, traditional acid etching and the self-etching were compared for the operator using a VAS. This showed that self-etch method of sealant placement is easy and comfortable, compared to the conventional acid etch method, as it is a one-step technique. It has been reported that the benefit of the knowledge related to the child's preferences before the dental procedures and implementing them to create a comfortable atmosphere, in which the child does not feel helpless.<sup>[27]</sup> The present study showed that fissure sealants using the traditional etch and bond remain the best clinical technique in terms of retention and caries prevention. In the present study, only subjects were followed for 6 months and the sample size was considerably less; hence, these two was consider as limitations for the study.

## CONCLUSIONS

This randomized sample from this study has demonstrated that enamel preparation with etch and Adper™ single bond 2 adhesive (3M ESPE) is a superior method over 6 months when compared using clinical effectiveness with the use of Adper™ SE plus for placing sealants. The sealants are retained more with the traditional acid etching technique when compared to the self-etching technique and also caries scores are high with the self-etching technique due to lost sealants. Patients and operator are more comfortable with the self-etching technique than the traditional acid etching technique, as it is a one-step procedure.

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## Conflicts of interest

There are no conflicts of interest.

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