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Research Article

Evaluation of Effects of Deproteinization and Intermediate Bonding on the Retention of Pit and Fissure Sealants- An In-Vivo study

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Abstract:

Aim: The aim of the study to evaluate the effect of deproteinization and intermediate bonding on the retention of pit and fissure sealants- An In-Vivo study

Material and method: After obtaining approval from the ethical committee, a randomized controlled clinical trial was performed. The study was performed on 50 young permanent mandibular first molar teeth divided into two equal groups; Group I treated with acid etching followed by pit and fissure sealant application only while in Group II deproteinization, acid etching, bonding agent application was done followed by pit and fissure sealant application. All subjects were clinically evaluated for retention after 6 and 12 months of application and retention was assessed on the basis of Simonsen's criteria.

Results and Conclusions: Enamel deproteinization along with the use of intermediate bonding layer resulted in significant enhancement of retention of pit and fissure sealants.

Keywords: *Pit and fissure caries, Pit and fissure sealants, Deproteinization*

Introduction

Pit and fissure caries account for maximum proportion (80-90%) of all caries in the permanent posterior teeth and about 44% in the primary teeth.[1] Pit and fissure sealant acts on the susceptible teeth by micromechanically bonding to the tooth and thus prevent access of cariogenic microorganisms to their source of nutrients, resulting in reduced risk of caries.[2]

Dental sealants are resin or glass ionomer cement (GIC)-based flowable materials, which are applied to occlusal surfaces of the teeth as a preventive measure to prevent the teeth from developing caries, especially in children, and to those teeth which are more prone to dental caries.[3] Retention is one of the most important property for pit and fissure sealants.[4] Debris and pellicle might not be removed by conventional prophylaxis and etching; therefore, air abrasion for fissure preparation has been advocated for sealant retention [5].

In erupting teeth with high organic content, removing the organic content could improve its adhesion due surface alterations in the enamel. Studies have showed that removing the organic content from the enamel surface with 5.2% sodium hypochlorite (NaOCl) as a deproteinizing agent doubles significantly enamel retentive surface and increased the Type 1 and 2 etched enamel.[6]

The use of sodium hypochlorite as a deproteinizing agent may be a possible alternative to optimize adhesion by removing organic components of both the enamel structure and the acquired pellicle in combination with acid etching during pit and fissure sealant application.

So this study was carried out with an objective to assess the effect of sodium hypochlorite deproteinization on the retentive property of pit and fissure sealants.

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Material and method:

The present study consisted of 50 permanent mandibular first molars in 25 children of age 6-8 years who visited the department of pedodontics and preventive dentistry. Healthy newly erupted immature first permanent molars with deep retentive, caries susceptible pits and fissures were included in the study. Teeth with enamel cracks or fractures, malformations, caries, restorations, erosions, and/or other dental pathologies were not included. Following the approval from the ethical committee of the institution, all subjects were verbally informed and written informed consent was obtained from each subject for participation in the study. All teeth were isolated with rubber dam and then divided into two equal groups.

Clinical procedure in Group I: Occlusal surface was etched for 15 s with 37% phosphoric acid, rinsed with water for 5 s, and gently air-dried for 1–2s. Two layers of bonding agent (Adper Single bond 2, 3M -ESPE) were applied using an applicator tip and photopolymerized for 10s. Pit and fissure sealant (Clinpro Sealant, 3M-ESPE) application was performed, and photopolymerization was done for 20s.

Clinical procedure in Group II: Sodium hypochlorite was applied with an applicator tip for one minute on the occlusal surface and then washed with water and air spray. Then, it was etched for 15 s with 37% phosphoric acid, washed with water for 5 s, and gently air-dried for 1–2 s. Two layers of bonding agent (Adper Single bond 2, 3M -ESPE) were applied and photopolymerized for 10s. Pit and fissure sealant (Clinpro Sealant, 3M-ESPE) application was done and photopolymerized for 20s.

All teeth were clinically evaluated for retention after 6 months and 12 months of application. The retention rate was assessed based on the criteria proposed by Simonsen; [C: complete retention, P: Partial retention, M: Missing (no retention)].

Results

This study was done to evaluate the effectiveness of deproteinization on the retentiveness of pit and fissure sealants, compare it with etching, bonding, and sealing technique. The mean age of the children included in this study was observed to be 7.0 ± 0.5 years. All patients were clinically evaluated for retention after 6, 12 months of application and retention was assessed based on Simonsen's criteria. Both groups shown complete retention after 6 months interval **(Table no. 1)**. On 12 month evaluation 4 teeth shown partial retention in group I whereas all tooth of group II shown complete retention **(Table no. 2).**

This difference in retention on 12 month evaluation was found to statistically significant ($p < 0.05$.)

Table no 1: Retention at an interval of 3 months

Groups	**N**	Retention at 3 months No. (%)			P value
		Complete	Partial	Missing	
Group I	**25**	25 (100%)	0	0	> 0.05
Group II	**25**	25(100%)	0	0	

Table no 2: Retention at an interval of 6 months

Groups	**N**	Retention at 6 months No. (%)			P value
		Complete	Partial	Missing	
Group I	**25**	21 (84%)	4 (16%)	0	< 0.05
Group II	**25**	25 (100%)	0	0	

Discussion

The initial cost of preventive measures like sealants are estimated to be higher than that of restorative materials, but in the long term they prove to be more cost-effective as the tooth would be maintained in a state of health.[7]

Although, application of pit and fissure sealants causes reduction in occlusal caries, but the effectiveness of sealant may be associated with certain technical problems during its application that includes tissue management and salivary contamination.[8]

In erupting teeth with high organic content, removing the organic content could improve its adhesion due surface alterations in the enamel. Studies have showed that removing the organic content from the enamel surface with 5.2% sodium hypochlorite (NaOCl) as a deproteinizing agent doubles significantly enamel retentive surface and increased the Type 1 and 2 etched enamel. The use of sodium hypochlorite as a deproteinizing agent may be a possible strategy to optimize adhesion by removing organic elements of both the enamel structure and the acquired pellicle in combination with acid etching during pit and fissure sealant application.[6] In the current study increased retention in Group II was observed and it may be because of sodium hypochlorite which was used as a deproteinizing agent as it removes the organic smear layer from the surface of enamel which cannot be achieved simply by acid etching with 37% phosphoric acid gel.[8]

The findings of the present study are comparable with those performed by Gomez et al. (2014) who reported that there was a significant increase in the degree of penetration of resin when sodium hypochlorite was used as a deproteinization agent for 1 minute prior to application of resin.[9]

Despite the success obtained in the retention of pit and fissure sealants in deep pits and fissures that are prone to dental caries, other factors that may interfere in the etiology of caries were not considered in the present study. So, further longer term clinical studies involving the other factors involved in the retention of pit and fissure sealant should be planned.

Conclusion

At the end of 12 months follow up period, significant differences were observed between the two groups regarding retention of the pit & fissure sealants. Enamel deproteinization along with the use of intermediate bonding layer significantly enhances the retention of pit and fissure sealants in children.

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