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COMPARATIVE EVALUATION OF MICROLEAKAGE OF PIT AND FISSURE SEALANT USING CONVENTIONAL AND NOVEL ETCHANT

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ABSTRACT:
INTRODUCTION: Pit and fissure caries accounts for 80% of total caries experience. Sealant has been described as a material introduced into the occlusal pits and fissures of caries susceptible teeth, forming a micro mechanically bonded protective layer. **MATERIALS AND METHODS:** 4 molar teeth with caries or anomalies, extracted for orthodontic purposes were taken. Samples were thoroughly cleaned by water and then were preserved in normal saline. The teeth were cleaned, washed and dried prior to the sealant application. The teeth were then separated into two different groups. Group 1 and Group 2. **RESULTS AND DISCUSSION:** The current study findings shows that the surfaces were pre etched with tricalcium phosphate and citric acid - group 1; calcium phosphate and phosphoric acid- group 2. It shows that the two groups have zero microleakage. **CONCLUSION:** There is poor correlation between the extent of micro leakage found in vitro & in vivo study. Further studies are required to evaluate clinical success and to prove these effects considering the potential effects.
KEYWORDS: Pit and fissure sealant, orthophosphoric acid, etchant, microleakage.

INTRODUCTION: Pits and fissures of the occlusal surfaces of the posterior teeth are more prone to caries development than the smooth surfaces due to their morphological complexity, making dental hygiene more challenging leading to increased plaque accumulation (1). It has long been recognized that the occlusal surface represents the most caries susceptible area of the tooth structure. As per the literatures, pit and fissures classified as "V", "U", "I" and "K" out of which V & U are self cleansable and require non invasive approach, whereas I & K are considered as non self cleansable and require invasive approach' (2).

All samples collected were neither carious nor with developmental anomalies, only non invasive approach is used for the sealing pit and fissures. There are two schools of thought, if sealing is proper and no active caries beneath then one should go for non invasive approach as it leads to deprivation of substrate to microorganisms and arresting the lesion (3).

The occlusal surface of the teeth has pit and fissures which provide a good environment for microbes causing it. Sealing these areas reduces the risk of occlusal caries which is done by pit and fissure sealant. The success of pit and fissure sealant depends on the marginal sealing ability of the material. The occlusal surface of the teeth has pit and fissures which provide a good environment for microbes causing it. Sealing these areas reduces the risk of occlusal caries which is done by pit and fissure sealant. The success of pit and fissure sealant depends on the marginal sealing ability of the material. check the composition based advantage in the terms of microleakage. Fuji VII(pink) is command set material because curing can be enhanced and curing time can be reduced with the same so as to avoid any contamination to intraoral application.(4). Sealants were cured under the light cure for 30 seconds*. After thermocycling, teeth were immersed in 10% aqueous solution of methylene blue dye for 24 hours following which they were washed to remove excess dye. Approximately 1.5mm thick ground sections were made longitudinally by the lathe machine with water flow in bucco- lingual direction. The sections were then kept dry and observed for one side which gives maximum microleakage under stereomicroscope with magnification of 10X (5).

Another is an invasive approach where cavity preparation is required so as to excavate the dental caries. Careful application of pit and fissure sealant have proven successful in prevention of dental caries or progress of incipient carious lesion is halted. The purpose of this study is to investigate and compare two different materials for their microleakage.

MATERIALS AND METHODS : The study was conducted at the white lab, saveetha Dental College and Hospital. Total 4 molar teeth with caries or anomalies, extracted for orthodontic purposes were taken. Samples were thoroughly cleaned by water and then were preserved in normal saline. Cleaning of occlusal fissure surfaces was completed with pumice slurry. Samples were divided in three groups containing 1 sample in each group. Samples were etched with Tricalcium phosphate and 5m citric acid in group 1 sample for 15 seconds so as to provide more surface area with micro-porosities which allows making materials to flow in those areas which will enhance the bonding between material and tooth interface and the group 2 with calcium phosphate and phosphoric acid and then rinsed. Samples were then undergone for washing and drying with an oil free air syringe. Sealant was placed over the pit and fissure area respectively with Group - I: Composite based Pit and fissure sealant, Group -II: Composite based pit and fissure sealant. Sealants were cured under the light cure for 15 seconds curing can be intensified and curing time can be reduced with the same so as to avoid any contamination in intraoral application.

After thermocycling, teeth were immersed in 10% aqueous solution of methylene blue dye for 24 hours following which they were washed to remove excess dye. Approximately 1.5mm thick ground sections were made longitudinally by the lathe machine with water flow in bucco- lingual direction. The sections were then kept dry and observed for one side which gives maximum microleakage under stereomicroscope with magnification of 10X. The degree of microleakage was scored by a single observer using criteria by Colley et al (1990)5 as follows:

Score 0: No marginal penetration by dye.
Score 1: Marginal penetration along the enamel sealant interface
Score 2: Dye penetration to depth of sealant.

The sections were photographed to show scores of "O", "1", or "2" microleakage and the data was statistically analyzed with the non parametric test.

FIG 1: GROUP 1- Tricalcium phosphate and 5m citric acid
GROUP 2- Calcium phosphate and phosphoric acid

FIG 2: sample subjected to thermocycling

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FIG 3: Sectioning using microtome

As per the results of this study, group 1 (Tricalcium phosphate and citric acid 5M) , group Il(calcium phosphate and phosphoric acid) gives zero microleakage.

RESULTS :

A total of four extracted molar teeth were evaluated for microleakage following pit and fissure sealant application using two different enamel pretreatment agents. The samples were divided equally into two groups based on the etching protocol employed prior to sealant placement. Group 1 specimens were pre-etched using tricalcium phosphate combined with citric acid, whereas Group 2 specimens were treated using calcium phosphate with conventional phosphoric acid etching.

Following sealant application, all specimens were subjected to dye penetration analysis under stereomicroscopic examination to evaluate the extent of marginal microleakage at the tooth–sealant interface. The stereomicroscopic findings demonstrated adequate sealant adaptation in both experimental groups with minimal evidence of dye penetration.

In Group 1, the sealant exhibited close adaptation to the fissure walls with complete marginal integrity observed in most sections. No significant gaps or voids were identified at the enamel–sealant interface. Dye penetration scores were absent in the majority of the samples, indicating negligible microleakage and effective sealing ability of the experimental etchant system.

Similarly, Group 2 specimens demonstrated satisfactory sealant penetration and adaptation along the fissure morphology. Minimal discontinuity was observed at isolated regions of the interface. Although slight dye penetration was noted in one specimen, the overall microleakage score remained low, suggesting acceptable marginal sealing with the conventional etching technique.

Stereomicroscopic analysis further revealed that both groups maintained a continuous sealant layer over the occlusal fissures without evidence of material detachment or extensive interfacial breakdown. The enamel surfaces pretreated with both etching protocols exhibited favorable surface characteristics for micromechanical retention of the sealant material.

The comparative evaluation of microleakage scores between the two groups showed no statistically significant difference in median values, as both groups demonstrated a median score of 0. However, Group 2 exhibited a slightly higher maximum microleakage value when compared with Group 1, indicating marginally increased dye penetration in isolated samples.

The descriptive statistical analysis of the two groups is presented in Table 1. Group 1 showed a median microleakage score of 0 with minimum and maximum values of 0, whereas Group 2 demonstrated a median value of 0 with a maximum value of 1. The obtained p-values indicated that both etching systems produced clinically acceptable sealing performance with minimal microleakage.

FIG 4 : Stereomicroscope image of group 1

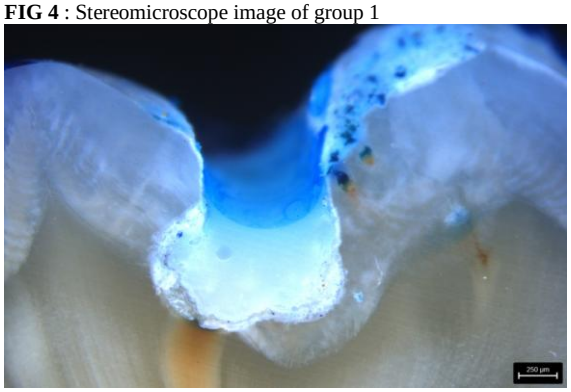

FIG 5 : Stereomicroscope image of group 2

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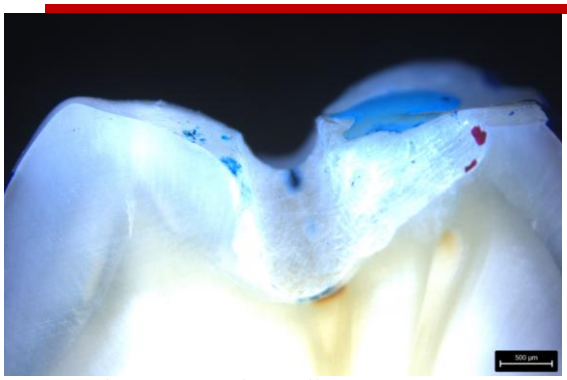

"P values of comparisons of two different groups

TABLE 1: p values of comparisons of two different groups

GROUP	MEDIAN	MINIMUM	MAXIMUM	p value
1	0	0	0	<0.005
2	0	0	1	<0.02

Stereomicroscopic images showed an almost no microleakage appearance between the enamel surface and the fissure sealant in groups 1 and group 2. Microleakage scores of group 1 ($p< 0.005$) and group 2 ($p<0.02$).

DISCUSSION :

With the evolution of restorative materials in relation to their specific properties gives better results for microleakage. In this study we have used two different etchants for group 1 and group 2. Group 1 is tricalcium phosphate and 5m citric acid and group 2 is calcium phosphate and phosphoric acid. All these groups showed zero amount of microleakage. In another study done by Theodoridou-Pahini et al and Moore et al.

(1996) stated that microleakage can be expected in all restorative materials (6). The most likely explanation for this is the thermal expansion coefficient of the sealants are significantly different from that of enamel, which is applicable to group 1 and group 2, but not group 3 as it is GIC based material whose thermal expansion coefficient is very similar to teeth (6,7).

This can be attributed to many reasons being that there was some amount of disintegration of the sealant due to its solubility. Since glass-ionomer sealant is hydrophilic, it has a tendency to absorb the dye into the material and this could give a false positive result. Hence in this study dye leakage into the material was not taken into consideration, but the presence of the dye in the interface of the sealant and the tooth was taken into consideration (8).

This methodology was also followed by Herle G. P. et. al.and Birkenfeld et. al.8. Another factor we noticed in this study regarding group III was lower retention rate as compared to both group I and group II. While making ground section 11 specimens were found with loss of sealant material, which correlates with the studies conducted by Lucia et al.*& Herle G. P. et al.

In another study done by keyur joshi et.al two different composites were used group 1 is composite restorative material and group 2 is glass ionomer cement Composite material was found better for sealant material as it was showing significantly least microleakage as compared to Glass Ionomer Cement and promising result with compomer. Apart from many researchers and inventions and nano-technology implementation in dental materials , composite material is comparatively better as compared to glass ionomer cement and compomer as sealant materials (9).

There is poor correlation between the extent of micro leakage found in vitro & in vivo studies. This elusive ability to prevent microleakage demands controlled clinical studies, which will draw conclusions about the micromechanical bond and its strength between the fissure sealant and tooth structure (10).

CONCLUSION :

In our study the two groups acid etched with GROUP 1- Tricalcium phosphate and 5m citric acid GROUP 2- Calcium phosphate and phosphoric acid showed no microleakage or least microleakage. Further study is required to evaluate clinical success and to prove these effects considering the potential effects.

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