Influence of prophylaxis on the microleakage of sealants: *in vitro* study

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The aim of this study was to evaluate the influence of prophylaxis on the sealants microleakage in 30 premolars divided into: Group A, Group B and Group C. The teeth were analyzed using the optical microscope (OM) and at scanning electron microscope (SEM). There was a statitical significant difference among the groups regarding the presence of microleakage, but not with the presence of tags.
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INTRODUCTION

The high occurrence of carious lesions in occlusal surfaces of posterior teeth, mainly in the first year of eruption, results from plaque accumulation on pits and fissures, creating favorable conditions to bacterial development and demineralization of dental enamel.[13]

Fluoride offers a larger protection to smooth surfaces, however does not act satisfactorily on occlusal surfaces of teeth, which demonstrates the need of a specific protection for those more susceptible areas to dental decay.[13,24] The retention and the preventive effects of sealants have been well documented by last 20 years.[22] Studies also demonstrate that sealed teeth presented 50 percent less carious lesions than those not sealed.[12,31]

The role of sealants, applied on occlusal surfaces, would be to modify the cariogenic factors, impeding the stagnation of microorganisms and organic materials on the dental surface,[14] creating a physical barrier to the acid conditions that causes caries.[2]

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However, in the model of health promotion, some approaches should be observed before the indiscriminate employment of this material such as: motivation and cooperation of the patient and his family nucleus; and his susceptibility to decay, otherwise this patient could be over-treated.[15] Therefore, sealants are suitable when pits and fissures were clinically sound or when ethiologic factors of the disease cannot be controled.[15]

The sealants do not have any pharmacological action. Success depends on a firm adhesion with the enamel surface, isolating pits and fissures of the oral cavity.[29]

In ordinary situations, the enamel is quickly covered by an organic film, well-known as biofilm.[16] When studying organic deposits on the enamel surface, it was concluded that this film was derived from the saliva and, presumably, interferes on the acid etch of the teeth. The presence of biofilm, plaque and inorganic elements, blocks the natural porosity of enamel and blocks the sealant union, which makes it necessary to do a prophylaxis before application.[8,28]

The purpose of the prophylaxis is to remove plaque, biofilm and calculus that would hinder the acid etch.[6] This can take place, among other ways, by a rubber cup with a fine pumice and water or sodium bicarbonate jet. Between the two, which one would be more effective, on cleaning pits and fissures satisfactorily before the acid etch and the sealants application?

This work intended to evaluate the influence of prophylaxis with fine pumice and water with rubber cup and sodium bicarbonate jet on the sealants microleakage in young premolars.

MATERIALS AND METHODS

The sample was consisted by thirty premolars extracted for orthodontic reasons. The selected teeth were exam-

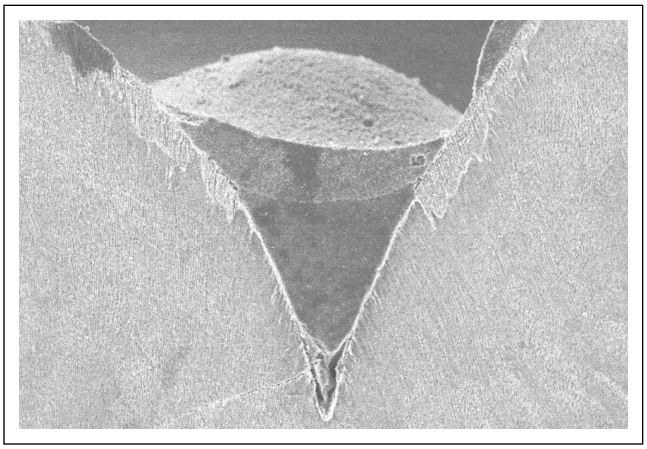

Figure 1. Electromicrography of the fissure.

ined visually, taking in consideration the presence of carious lesions due coloration of the fissures and probing. After having verified integrity of the surface, they were randomly divided into three groups:

Group A: prophylaxis with fine pumice and water in rubber cup

Group B: prophylaxis with sodium bicarbonate jet

Group C: control group (without prophylaxis)

After the prophylaxis on groups A and B, etching was done with phosphoric acid gel at 37% for 30 seconds, only on pits and fissures of all teeth. Then the samples were washed with spray for 15 seconds, and dried for 10 seconds.

The sealant was applied (Fluroshield,) on all pits and fissures of the teeth, using a probe as stated in the instructions of the manufacturer. After this, all the surfaces (except occlusals) were covered with nail varnish, from 1mm of the sealant margin, so that the dye only penetrated into the interface enamel/sealant, if it had infiltrated.

The teeth were immerged in a silver nitrate solution (AgNO3) at 50% for 2-hours, and later in radiographic developing for 30 minutes. After that, the teeth were washed, the nail varnish was removed with a scalpel and the teeth were sectioned (buccal-lingual) with a sawing machine.

After sawing, the halves of teeth were polished with a sandpaper #1000. The samples were observed at optical microscope (OM) to evaluate the dye penetration. Later, each half was properly prepared with a gold covering for the observation at scanning electron microscope (SEM) to evaluate the presence of tags (Figures 1 and 2). The criteria adopted for evaluation of the samples at optic microscope (OM) and at scanning electron microscope (SEM) was:

0-absence infiltration (OM) / tags presence (SEM) (Figure 3 and 4)

1-presence of infiltration (OM) / tags absence (SEM) (Figure 5 and 6)

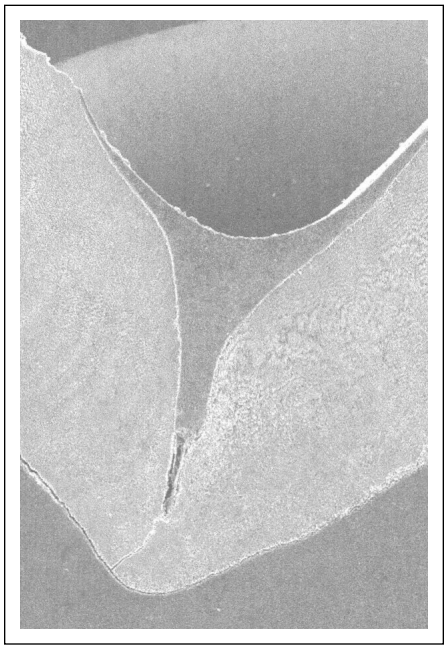

Figure 2. Electromicrography of the fissure.

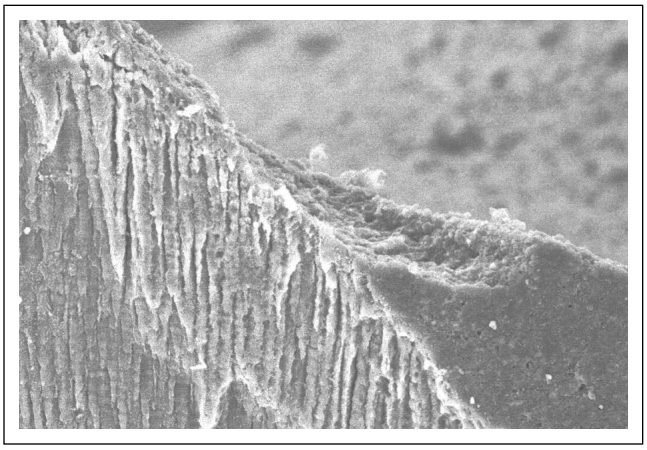

Figure 3. Presence of tags.

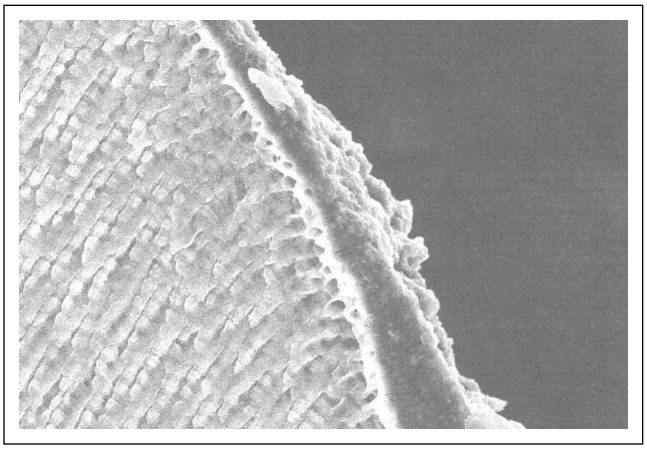

Figure 4. Presence of tags.

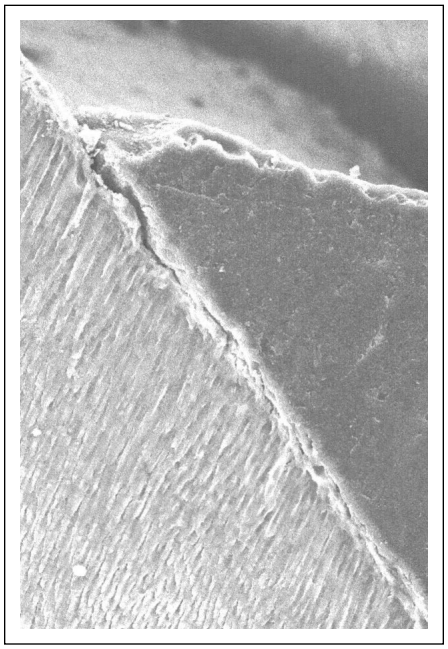

Figure 5. Absence of tags.

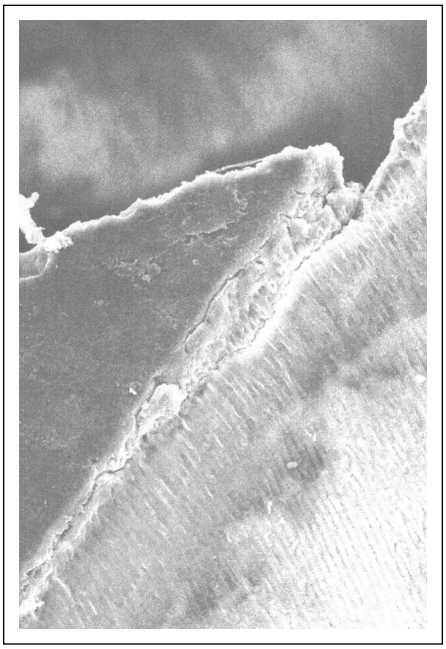

Figure 6. Absence of tags.

The halves were observed and properly evaluated by two calibrated examiners until both agreed to the determination of the score.

RESULTS

The results were evaluated by a statistical program (EpiInfo 6.04) using Chi-square and Fisher's Exact Tests. Significance was determined at the level of 5%.

The frequencies of the dye infiltration and the tags formation are demonstrated in Tables 1 and 2.

In Table 1, comparing the groups A and B, regarding the presence of infiltration, there was no significant difference, determining that both prophylaxis were effective on occlusal surface cleaning.

However, between groups A and C (Fisher's Exact Test) the result was considered statistically significant, indicating that the sealant showed a better clinical behavior when the surface received prophylaxis with a fine pumice compared to the group that did not receive any treatment.

Observing the groups B and C, using the C2 Test, the result was not statistically significant because there was no difference between the groups done with sodium bicarbonate jet prophylaxis and the control. However, the p value was close to 5%, which suggested the need of further study with a larger sample.

In Table 2, analysing groups A and B with C regarding presence of tags, the results were considered not significant. This indicated that independently of treatment applied on occlusal surface, all samples presented sealant penetration through the enamel prisms, indicating a satisfactory retention of them.

Table 1. Frequence of Infiltration between Fissure/Sealant

	Group A	Group B	Group C
Absence of Infiltration	8	7	3
Presence of Infiltration	2	3	7
Total	10	10	10

A and B p = 0,5 (Fisher's Exact Test)
A and C p = 0,03 (Fisher's Exact Test)
B and C p = 0,07 (?2 Test)

Table 2. Frequence of Tags between Fissure/Sealant

	Group A	Group B	Group C
Absence of Tags	0	0	2
Presence of Tags	10	10	8
Total	10	10	10

A and C p = 0,23 (Fisher's Exact Test)
B and C p = 0,23 (Fisher's Exact Test)

DISCUSSION

In this study, the applied sealant was Fluroshield,, which according to the manufacturer, liberates fluoride and possesses load. For Rock[23] this sealant reduced the occurrence of recurrent decay as well as favored the remineralization process. However, Strand and Radal[25] observed that, although it had a larger incorporation of fluoride ion on the enamel, that was not able to increase resistance to desmineralization.

This same sealant showed that the fluoride liberated in the saliva presented high levels in the first 30 minutes, coming back to the initial values 24-hours after the

occlusal sealing.[21,25] In another study[5] a great liberation of fluoride ions was observed by 48 hours, being still evident, even though quite reduced, after seven days application. This study verified fluoride liberation up to 30 days after the sealant application.[7]

The presence of load did not interfere with the sealant penetration to the fissure.[26] This corroborates with the discoveries that verified an excellent penetration of the sealant (Fluroshield,), even presenting fifty percent of inorganic particles loading the composition.[32] Xalabarde *et al.*[32] did not observe significant differences between sealants with or without load regarding penetration in the fissures. However, Hatibovic-Kofman *et al.*[10] observed a larger sealants penetration without load when compared to sealants with load, applied on the occlusals pits and fissures after different treatments in these surfaces.

The sealant penetration in the etched enamel forms resinous prolongations (tags) through the prisms, of approximately 50 mm.[30] These tags offers an excellent retention, due to sealant bond strength five hundred times bigger to a conditioned enamel than unconditioned enamel.[30]

Evidence shows[11,14] that sealants are retained on the enamel due the inclined planes of the cusps where tags were observed in several directions, forming a bridge over the fissures. Clinically, sometimes sealant penetrates to the bottom of fissures, but does not form tags,[11] because the presence of air, organic remains, alimentary debris and prophylatic pumice, as well as the viscosity of the sealant.[14]

The treatment of the tooth surface influences the clinical success of sealants, due the fact that is directly related to retention.[1,9,17] In agreement with the results found in this study, it is observed that the prophylaxis group with fine pumice and water in rubber cup (group A), presented a low dye penetration (Table 1), indicating that this surface treatment can be clinically applied. This corroborates with Sundfeld *et al.*[27] who observed significant differences between the group that prophylaxis was done with pumice compared to the group with no treatment before the sealants application. However, Pope *et al.*[20] found pumice particules in all fissures, suggesting that prophylaxis with a rubber cup and pumice does not allow the etching on the enamel surface.

Regarding group B (sodium bicarbonate jet), it was verified that its use provided a good sealant bonding, but without significant differences when compared to the control group, agreeing with the Brown and Barkmeier[2,3] studies that obtained similar results.

Independently of the superficial treatment, none of the teeth presented dye penetration except for the bottom of the fissures. For those that presented penetration (Table 1), most belonged to the control group, indicating that clinically, the surface treatment before the sealant application makes itself necessary. This diverges from the results of Chan *et al.*[4] that observed a larger microleakage when prophylaxis was executed.

Last, comparing groups A and B, for sealant microleakage, there was no statistically significant difference, suggesting that both prophylaxis types are clinically valid. Analysing groups A, B and C, for tag formation, seemingly the prophylaxis did not exercise any significant influence, since tag formation presence was verified in approximately 93% of the samples.

In the present study, these tags were observed along the inclined planes of cusps of the sealed teeth, independently from the cleaning method applied. This discovery diverges of Sundfeld *et al.*[27] who observed that the resin tags found in the enamel inclined planes without prophylaxis were not as uniform as those in that prophylaxis group. For these authors this happened due the biofilm presence.[19] This indicates the clinical importance of the prophylaxis prior to sealant application on pits and fissures.

Confronting the analyses (OM and SEM), the presence of dye infiltration was observed in some samples, suggesting the tags absence. However, these were present in most of the samples, suggesting the fissures enclosing. Thus, it is believed that two hypothesis can explain this nonsense: first during the sample preparation for SEM, the smear layer is removed by etching prior to being covered by gold. This conditioning may have provided the enamel superficial layer loss, showing an inferior plane having the observed tags; second the dye penetration can be due the accentuated diffusion capacity of the silver nitrate18 despites the tags presence.

CONCLUSIONS

The prophylaxis exercised influence on the microleakage of the sealants, and the use of a fine pumice and water with rubber cup and sodium bicarbonate jet in the enamel treatment, before application, presented similar clinical results.

The high level of dye microleakage in the interface fissure/sealant in group C (control group), shows the clinical importance of prophylaxis accomplishment before sealant application.

Despite tags formation observed in all groups, there was dye penetration in the interface fisure/sealant in some samples, indicating the possible absence of them along the occlusal surface.

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