



The Effects of Topical Fluoride Therapy on Microleakage of Fissure Sealants in Permanent Teeth

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ABSTRACT

Background & Objectives: The present investigation was aimed to assess the effect of pre-topical fluoride therapy on the microleakage of fissure sealants in permanent teeth. **Materials and Methods:** In this interventional in-vitro study, 45 molar teeth without decay were assessed. Samples were randomly divided into 3 groups with 15 cases. In groups one and two, acidulated phosphate fluoride (APF) topical gel was applied for four minutes. After 30 minutes, sealant therapy was performed on the occlusal surface of molar teeth. In group three (control), samples were treated with sealant therapy only. The depth of dye penetration was assessed using a calibrated stereomicroscope at 40x magnification. Data analysis was performed using the non-parametric Kruskal-Wallis test, and a p-value < 0.05 was considered significant. **Results:** In the present study, no statistically significant difference was observed between the study groups regarding the microleakage of fissure sealants and use of APF topical gel. **Conclusion:** According to the results of this investigation, use of APF gel (1.23%, pH=3.5) before sealant therapy had no effect on microleakage of fissure teeth sealed with Pulpdent resin sealant (P=0.052). Therefore, fluoride treatment could be performed before sealant therapy.

Key Words: Fissure sealant, Microleakage, Topical fluoride.

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INTRODUCTION

Tooth decay is the most frequent chronic human disease that affects half of the children aged 7-12 years. Anatomic fissures and pits of teeth are considered as areas, which are most prone to decay. According to some studies, approximately 90% of caries in children occur in pits and fissures [1, 2]. Several methods have been suggested in preventing dental caries, in which pit and fissure sealant therapy are the favorable approaches for prevention of occlusal caries [3].

Sealant has inhibitory effects against the tooth decay

through the physical closing of pits and fissures. In addition to creating a self-cleaning surface, this substance can prevent the establishment of new bacteria in dimples and grooves of teeth, as well as the penetration of fermentable carbohydrates accessible by the remaining bacteria in teeth [4-6]. One of the significant factors involved in dental microleakage is adhesion of restorative materials to the tooth surface. If the adhesion between the restorative resin and tooth enamel is lost for any reason, expected leakage will lead to secondary tooth decay [5]. According to the literature, topical administration of fluoride on enamel surface before sealant therapy could

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diminish the consistency of restorative bonding [6, 7] and fluoride in the structure of enamel will decrease its surface energy so that the surface will not easily attract other molecules [8]. However, some studies have suggested that treatment with topical fluoride before fissure sealant therapy has no adverse effect on dental leakage [9-12]. This study was aimed to assess the effect of topical fluoride administration on microleakage of permanent teeth before fissure sealant therapy.

MATERIALS AND METHODS

This interventional invitro study was conducted on 45 maxillary and mandibular third molar teeth. Initially, the extracted teeth were disinfected using sodium hypochlorite and examined using a stereo microscope with 40x magnification in order to detect any cracks or defects in crown teeth. Teeth with cracks or defects were excluded from the experiment.

Afterward, the grooves of teeth were brushed, and the samples were incubated in normal saline with 100% humidity at 37°C until the beginning of the experiment. The samples were randomly divided into 3 groups with 15 cases. In the first group, the teeth were initially coated with acidulated phosphate fluoride (APF) topical gel for four minutes (1.23% APF, pH=3.6-3.9) (Dentsply, Petropolis, RJ, Brazil, Sultan). After 30 minutes of elapsed time following fluoride therapy, the teeth were washed using normal saline for ... minutes and then the occlusal surface of teeth was etched with 35% phosphoric acid for 20 seconds. In the next stage, the teeth were entirely cleaned and mildly dried. Following that, the bonding factor was applied on the occlusal surface of teeth under the guidelines of the manufacturer (Signal Bond Adper 2 Adhesive, 3M ESPE, USA).

The adhesive was thinned with gentle air for three seconds and exposed to light for 30 seconds. Afterward, the resin sealant (Seal-Rite, Pulpdent) was applied on teeth grooves, which were exposed to light for 20 seconds using Bluephase LED optical device with 2650 mW/cm² intensity (Ivoclar Vivadent, Schaan, Liechtenstein).

Like the first group, fluoride therapy was performed on 15 teeth in the second group after the sealant placement.

In the control group (group three), the fissure sealant placement was performed without fluoride treatment. After sealant therapy, these samples were preserved at 37°C for 24 hours. Finally, the teeth were subjected to thermocycling (1000 rounds at 55 and 5°C).

In order to prevent dye penetration to the other teeth, the apex of all teeth roots was sealed with wax. Except for parts treated with sealant and one millimeter further, all tooth surfaces were thoroughly coated with two thin layers of nail polish. Afterward, the samples were floated in 0.5% fuchsin solution at room temperature for 24 hours

so that in case of microleakage, tooth dye would penetrate to the area.

In the next stage, the samples were removed from the fuchsin solution, washed under abundant running water and dried completely. Moreover, teeth roots were cut using special instruments, and two parallel buccolingual cuts were made on each tooth; from distolingual groove to distofacial cusp tip and from mesiolingual groove to mesiofacial cusp tip for maxillary molars, and for mandibular molars, from mesiolingual cusp tip to mesiofacial cusp tip and distolingual groove to distobuccal cusp tip. Four internal surfaces were examined.

The microleakage examination was performed using an optical stereomicroscope at 40x magnification, and the highest level of microleakage, observed in three sections of teeth was considered as the microleakage degree of samples.

In this study, we used the criteria proposed by Grande et al. to rate the quality of dental microleakage, as follows: 0=lack of dye penetration; 1=dye penetration to one-third of cavity depth; 2=dye penetration to two-thirds of cavity depth; 3=complete dye penetration in the cavity [12].

Data analysis was performed using the non-parametric Kruskal-Wallis test, and a P-value of <0.05 was considered significant. SPSS (IBM SPSS Statistics for Windows, Version 16.0. Armonk, NY: IBM Corp.) was used for all analyzes.

RESULTS

In this study, 45 molar teeth were evaluated in terms of microleakage, and none of them had a third-degree dental microleakage. The results of the Kruskal-Wallis test did not indicate any significant difference between the study groups regarding the presence of microleakage (P = 0.052). However, 53.3% of samples in the third group (control) had no microleakage, while in groups one and two, 93.3% and 73.3% of the samples had no microleakage, respectively (Table 1).

DISCUSSION

The simultaneous use of topical fluoride and fissure sealant therapy could have the same microleakage compared to using fissure sealant without topical fluoride. This finding is particularly beneficial in the case of children with acute tooth decay. Despite the high efficacy of topical fluoride administration in the treatment of tooth decay in children, most dentists avoid fluoride or fissure sealant therapy on the first treatment session since it is assumed that bonding consistency of sealants may gradually reduce and lead to microleakage.

Dental microleakage between the teeth and restorations plays a pivotal role in the preservation of restorative material. The sensitivity and secondary decay of tooth beneath restorations are mainly associated with the presence of microleakages.

Assessment of the effect of topical fluoride therapy on the microleakage of sealants helps dentists to decide whether treatment could be performed in one session through the retention of fluoride on the tooth surface under restoration or sealant therapy in order to increase the quality of treatment. However, if the possible outcome is undesirable, treatment should not be carried out.

To date, several studies have evaluated the effects of fluoride on fissure sealant treatment of permanent teeth. It is believed that fluoride reaction with enamel produces fluorapatite and calcium fluoride. Calcium fluoride increases the rate of enamel remineralization, but on the other side, decreases resin bonding strength to the enamel [10]. In this investigation, there was not any significant difference between the samples receiving only fissure sealant therapy and those receiving fluoride therapy before and after fissure sealant placement in terms of microleakages ($P = 0.052$).

In one study, Mirkarimi et al. [11] evaluated the level of dental microleakage in pits and fissure sealants after using 1.23% APF topical gel. They used dye penetration to determine the microleakage degree, and it showed similar results to the findings of the present study. Accordingly, the use of topical fluoride immediately before fissure sealant placement had no significant effect on the degree of dental microleakage.

Findings of other studies conducted by Nystrom [13], Warren [14], Simonsen [8], El Housseiny [15], Shabzendedar [16], Azarpazhooh [17], Sheybani [5], and Bahrololoumi [10] are consistent with the results of the current study. Accordingly, fluoride therapy did not have any significant effect on the longevity of fissure sealant. Thus, it can be suggested that if a part of a fissure sealant is lost during the examination, due to the known effects of the fluoride on the enamel, the beneath enamel may have a higher resistance to dental caries. However, the amount of fluoride released and how long it exerts its effects should be evaluated in a separate study.

In this study, the samples receiving fluoride therapy before fissure sealant placement had the lowest level of microleakage compared to the other groups, which is likely because of the use of acidic fluoride compounds.

It is recommended that future studies be conducted using different types of self-etch and total-etch bonding, as well as resin sealants with and without fluoride, and acidic and non-acidic topical fluoride compounds, in order to yield more specific results regarding the level of dental microleakages.

CONCLUSION

The use of 1.23% APF topical gel with pH of 3.5 did not have any significant effect on the level of microleakage in fissure sealant teeth with resin sealant containing 34.4% filler. Therefore, it was concluded that fluoride therapy could be performed before the fissure sealant placement.

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Table 1. Frequency of Microleakages in Study Groups

Degree of Leakage	Study Groups						Kruskal-Wallis Results P=0.052
	Fluoride Therapy Before Fissure Sealant (1)		Fluoride Therapy After Fissure Sealant (2)		Fissure Sealant without Fluoride Therapy (3)		
	N	%	N	%	N	%	
0	14	93.3	11	73.3	8	53.3	
1	1	6.7	3	20	6	40	
2	0	0	1	6.7	1	6.7	
Total	15	100	15	100	15	100	