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A Comparative Evaluation of the Effect of APF Treatment and Tooth Mousse Treatment on the Microleakage of Resin Sealants - An Invitro Study (Original Research)

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Abstract: Pit and fissure sealants are used to seal existing pits and fissures of tooth from oral environment thereby preventing the occurrence of caries. The properties required of an ideal fissure sealant include biocompatibility, retention capacity, and resistance to abrasion and wear. On the other hand, the key consideration to success is adequate adhesion. APF and Tooth Mousse are proved to successful in reducing demineralization and improving remineralization. The purpose of this invitro study was to evaluate and compare the effects of APF gel and Tooth Mousse on the microleakage of Pit and fissure sealants.

1. Introduction

Pit and fissure sealants are defined as the application and mechanical bonding of a resin material to an acid-etched enamel surface, thereby sealing existing pits and fissures from the oral environment. The properties required of an ideal fissure sealant include biocompatibility, retention capacity, and resistance to abrasion and wear. On the other hand, the key consideration to success is adequate adhesion, (ie penetration of the material into the previously etched system of fissures). Penetration in turn depends on the positive configuration of the fissures, deposition of the material in the latter, and the physic-chemical characteristics of the sealer resin used. On the other hand, marginal integrity and micro leakage are very important factors in evaluating the clinical success of these resins. APF and Tooth Mousse are proved to successful in reducing demineralization and improving remineralization. This study evaluates the effectiveness of these materials in the microleakage of resin sealants.

2. Aims and Objectives

To Evaluate the Effect of APF Gel and Tooth Mousse on the microleakage of resin sealants

3. Materials and Methods

The purpose of this invitro study was to evaluate and compare the effects of APF gel and Tooth Mousse on the microleakage of Pit and fissure sealants. A total of forty recently extracted premolar teeth were collected. The teeth were randomly divided into 2 groups of 20 each.

a) 3M ESPE- Climpro sealants

- Meets ISO 6874 (Dental resin based pit and fissure sealant)
- Meets ANSI /ADA Spec 39
- BIS GMA /TEGDMA resin composition
- Unfilled
- Unique Color change feature

b) 3M ESPE -Scotch bond-ETCHANT

• 35 % Phosphoric acid

c) Anti Cavity Topical APF Gel (Pascal's)

1.23% W/W (+ 0.12%) Fluoride ion from NaF

d) GC Tooth Mousse

Composition – Pure water, glycerol, CPP-ACP, D-Sorbitol, propylene glycol, silicon dioxide, titanium dioxide, xylitol, phosphoric acid, zincoxide, sodium saccharin, ethyl p-hydroxybenzoate, magnesium oxide, guar gum, propyl p-hydroxy benzoate, Butyl p-hydroxybenzoate

The synthetic saliva used in this study was prepared according to the following criteria.

5g carboxymethyl cellulose was added to a solution consisting of 250 ml water,100ml 0.053% tricalcium phosphate in 0.01 N HCL, and 100ml of a mixture containing 15 g sorbitol, 0.6 g KCL, 0.42g NaCl and 0.026 g MgCl2.6H2O. After dissolution of the polymer at room temperature and adjustment of the pH to 7 with 0.05 M NaOH, sufficient water and 5 ml of 0.2 M sodium phosphate(pH 7) were added to make a volume of 500ml. A pH of 7+ -- 0.1 was verified electrometrically and the mixture was sterilized in autoclave.

(e)Hydrogen peroxide 6%

(f)Impression compound

(g)ethylene blue (Dye) 10 %

(h)Figer nail polish

Armamentarium included Air water syringe,Explorer,2 x 2 gauze squares, Cotton pellets, Forceps cotton pliers, Dappen dish with pumice, Acid etch syringe, Excavator, Sealant applicator with dispensing tip, Light cure LED unit, Burs - tapering fissure, Prophylaxis brush, Hand piece NSK – micro motor Stereomicroscope(OLYMPUS – colorplus)

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Tooth preparation

The teeth were stored in synthetic saliva for 1 week before being treated. Cleansing of surface was carried out with a low speed rotary brushing instrument and hydrogen peroxide to remove the traces of plaque with water irrigation and subsequent drying. Occlusal surface were polished with a low speed hand piece and a brush along with pumice. An explorer was used to clean debris from the pit and fissures. Teeth were then rinsed and dried.

Sealant Application

- a) First group (APF): Conventional acid etching done for 30 seconds followed by sealant application which was then stored in synthetic saliva for 24 hours then followed by APF gel application for 4 minutes and then stored in synthetic saliva for 24 hours
- b) (b)Second group (Tooth Mousse): Conventional acid etching done for 30 seconds followed by sealant application which was then stored in synthetic saliva for 24 hours then followed by Tooth Mousse application for 4 minutes and then stored in synthetic saliva for 24 hours

Thermocycling

The specimens were forced to undergo manual thermocycling in two different bath maintained at 5^{0} C & 55^{0} C .The dwell time of 10 seconds in each bath for a total of 250 cycles. The time interval between each bath was 5 seconds.

Dye penetration Study

Tooth apices were sealed with impression compound. Finger nail polish applied on the crown and root surfaces of the teeth so that one millimeter peripheral margin of sealant remain exposed. The specimen were then immersed in 10% Methylene blue dye for 24 hours. The specimens were rinsed in water to remove the dye covering the outer surface of sealant and nail polish removed. Tooth were sectioned longitudinally in bucco-lingual direction through the center of the sealant using diamond disc to be viewed under stereomicroscope to assess the degree of amount of dye penetration at sealant tooth interface.

Evaluation

Microleakage was scored according to the following criteria $\boldsymbol{0}$ - No dye penetration

- 1 Dye penetration up to one third of fissure total height
- 2 Dye penetration between one third and two thirds of fissure total height.
- 3 Dye penetration between two thirds and total height of fissure



Tooth Group



Materials



Armamentarium



Specimen after Coating with Nail Polish

4. Observation and Results

The study assessed and compared the microleakage values of pit and fissure sealants that were treated by APF and also of sealants that were treated by Tooth Mousse. The microleakage was computed on a scale of 0-3 fot the pit and fissure. The data was analysed at the sealant fissure junction using Chi square test and evaluated for significance

As evidenced from the Table 1 some samples showed some amount of microleakage in all the groups

In Table 2 comparative evaluation of APF values and Tooth Mousse values using Chi square test is given. It was not significant (p>0.05)

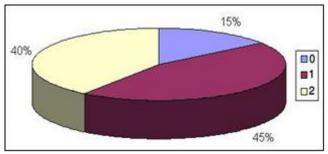
Table I: Microleakage scores of all groups

SL.NO	APF	TM	
1	2	1	
2	1	1	
3	1	2	
4	0	0	
5	2	0	
6	2	2	
7	1	1	
8	1	1	
9	2	2	
10	0	1	
11	1	1	
12	2	0	
13	1	2	
14	2	0	
15	1	0	
16	1	1	
17	2	2	
18	0	1	
19	2	1	
20	1	0	

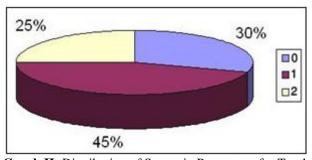
Table II: Comparative Evaluation of APF and Tooth Mousse Crosstabulation

		TM			
		.00	1.00	2.00	Total
APF	.00	1	2	0	3
	1.00	2	5	2	9
	2.00	3	2	3	8
То	tal	6	9	5	20

Chi-square=2.867 p-value=.58



Graph I: Distribution of Scores in Percentage for APF



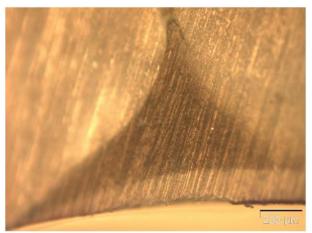
Graph II: Distribution of Scores in Percentage for Tooth Mousse



Micro Leakage at Sealant-Fissure Interface for APF (Magnification 10X)

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Micro Leakage at Sealant-Fissure Interface for Tooth Mousse (Magnification 10X)

5. Discussion

Topical fluorides have been used as a caries preventive agent in dental practice over 30 years. One among them is Acidulated phosphate fluoride, containing 1.23% available fluoride in 0.1 M phosphoric acid.

In a study conducted by Jiang Bianz Tai BJ (2007)1 in china of biannual professional application of APF in primary teeth showed effective reduction of caries.

In another study Delbem AC,Cury JA(2002)² found that APF gel formed more fluoride in enamel than neutral gel and it was more efficient in reducing demineralization

Tooth Mousse is a new safe and natural alternative for fluoride treatment. It is derived from milk protein Casein. The active ingredient is CPP-ACP (casein phosphopeptide – Amorphous calcium phosphate) a water based sugar and fluoride free cream. It rehydrates and rebuilds early enamel caries

Pai D,Bhat SS(2008)³ in an invitro study found that in remineralization of incipient lesions by CPP-ACP that remineralization was highly significant. Zhao Q Caif (2008)⁴ found that tooth Mousse can promote remineralization invitro.

Microleakage of materials are tested invitro by various laboratory tests like the dyes, radioactive isotopes, bacteria, air pressure etc. Assessing microleakage using dyes have stood the test of time and continues to be a simple, reliable, economical and convenient method. The dye used for the study was methylene blue

The specimen used for the study was freshly extracted premolars for orthodontic treatment without caries. The teeth were stored in synthetic saliva for 1 week. The sealants were then applied. Then the teeth was kept in synthetic saliva.

The purpose of the study was to evaluate the effect of APF gel as well as Tooth Mousse on the microleakage of resin sealants.

The teeth were stored in synthetic saliva for 1 week before sealant application. After sealant application the teeth were again stored in synthetic saliva for 24 hours. Thermocycling was done manually on the tooth specimen after sealant application to simulate oral environments with a temperature variation between 50C and 550C for 250 cycles with dwell time of 10 seconds and a time interval of 5 seconds between baths.

Apices of the teeth were sealed with impression compound and 2 coats of nail polish were applied on the root and crown so that with 1mm of peripheral margin of the tooth remain exposed and prevents microleakage other than the area of sealant application. This procedure has been widely adopted by various investigators in previous studies, Woody and Davis(1992)⁵. In the study most of the samples of each group showed some sort of dye penetration. But the degree of dye penetration was statistically insignificant. The reasons for statistically insignificant result can be related to several factors. One disadvantage of using dye is that of low molecular weight which is less than that of bacteria. Another reason is the level of standardization of the technique. Comparison of the results from different studies is problematic since there is no generally accepted standards for experimental parameters such as type of storage solution, duration of thermocycling, scoring criteria etc. There is no specific standards regarding the number of samples taken in each group for the study.

CPP-ACP is a casein derived peptide acts as calcium and phosphate reservoir when incorporated to dental plaque and on to tooth. It has got the ability to remineralize white spot lesions, Azarpazhooh (2008)⁶. Addition of CPP-ACP to sports drink has found to reduce erosive potential.

The CPP-ACP nano complexes releases calcium and phosphate ions in a pH or concentration gradient mechanism to maintain a supersaturated environment with respect to hydroxyapatite, thereby reducing demineralization and promoting remineralization , Azharpazhooh, Pai(2008)^{6,3}. Combined CPP-ACP and Photoactivated disinfection therapy has been proved to be successful treatment approach in arresting root surface caries, Jvaic Meyers(2007)⁷.

EI Badrawy WA(1998)⁸ has found that APF has deleterous effect on resin modified Glass Ionomers and polyacid modified resins.

In assessing the microleakage of sealants treated with APF and Tooth Mousse, observer's agreement depended on the clinical performance of the materials. There are fundamental differences between laboratory research and clinical research outcome regarding assessment of the quality of the sealant application. Laboratory research can at best only provides indications of probable technical excellence. Clinical studies can under controlled conditions provide indications of potential restorative quality. The results obtained in this study are restricted to the condition invitro and should be further substantiated by the clinical trials.

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6. Summary and Conclusion

From the statistical analysis of the results obtained it was observed that:

- 1) Sealant applied fissures showed some degree of dye penetration
- No significant dye penetration was observed in all the two groups
- 3) Even though the comparison of APF scores and Tooth Mousse scores were statistically insignificant, Tooth Mousse showed less microleakage.

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