



ASSESSMENT OF MICROLEAKAGE UNDERLYING PIT AND FISSURE SEALANTS - AN INVITRO STUDY

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ABSTRACT

The study was conducted to compare the microleakage of resin sealants on a teeth Fissure preparation was done on 20 premolars which was freshly extracted for orthodontic treatment and kept in artificial saliva for 1 week.

The teeth were treated Acid etching followed by sealant application and storage in synthetic saliva for 24 hours.

Thermocycling was done manually 250 times with temperature variation of 50C and 550C with dwell time of 10 seconds and 5 second time interval between each bath

Apices of teeth were sealed with impression compound and surfaces of root and crown coated with 2 layers of nail polish so that 1mm peripheral margins of restoration remain exposed. Samples were immersed in 10% Methylene blue dye for 24 hours. Sectioning was done longitudinally in bucco-lingual direction through the center of the sealant to get a thin section mesiodistally. The degree of dye penetration was assessed under stereomicroscope at 10X

In this study influence of load cycling was not assessed. It has been shown that mechanical factors in the oral environment might produce asymmetric pressure on fillings and in the liquid in the microspace between filling and tooth structure.

KEYWORDS :

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. This mechanism prevents bacteria from colonizing in the pits and fissures and nutrients from reaching the bacteria already present.

A decrease has been observed in the incidence of caries in children and adolescents, on the smooth dental surfaces. This is phenomenon particularly can be attributed to the fact that this population age group is benefited in recent years from the implementation of preventive measures¹, which are becoming increasingly important in dental practice. Such measures include the optimum and rationalized use of both systemic and topical fluorides, improved health education (ie, parents increasingly concerned about the oral health of their children), an increase in human resources destined to enhance access to dental care, and a growing interest in preventive therapy among dental professionals, including the use of fissure sealants.

Fissure sealants are currently one of the most effective preventive tools available. These materials afford an immediate action physical barrier for protecting the occlusal surface, a zone most susceptible to caries, especially among young children.² In this context, since fluoride protection of the pits and fissures on this surface is weakest (indeed, two-thirds of all caries develop on the occlusal surface), the aim of sealant therapy is to isolate this surface from the oral surroundings and prevent the appearance of caries.

Since their acceptance by the American Dental Association in 1971,³ sealants have experienced a series of modifications in the materials used (cyanoacrylates, polyurethanes, polycarboxylates, Bis GMA)⁴ and application techniques involved.⁵ Their use has become increasingly widespread, and these materials are now regarded as one of the most effective preventive options in dental practice.

The sealants presently used in routine practice are resins with Bis GMA or urethane as a fundamental component.

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 physico-chemical characteristics of the sealer resin used⁶.

On the other hand, marginal integrity and micro leakage are very important factors in evaluating the clinical success of these resins.

In this sense, microleakage is defined as the clinically undetectable passage of bacteria, fluids, molecules and ions between the teeth and the sealing material. Kidd(1976)⁷. In vitro microleakage studies make it possible to predict the marginal sealing capacity of the different materials used. Most of the the invitro studies include the use of dyes.

AIMS AND OBJECTIVES

To assess the microleakage scores of a group of teeth where pit and fissure sealants are applied.

MATERIALS AND METHODS

The purpose of this invitro study was to evaluate and compare the microleakage scores of Pit and fissure sealants in a group consisting 20 number of teeth.

A total of twenty recently extracted premolar teeth for orthodontic treatment were collected from various orthodontic clinics of Calicut city.

The materials and methods used for the study have been described under following headings.

1. Selection of Material
2. Armamentarium
3. Pit & Fissure preparation
4. Sealant Application
5. Thermocycling
6. Dye penetration study
7. Evaluation method

I. Selection of Material

(1). 3MESPE- 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

(2). 3MESPE –Scotch bond-ETCHANT

- 35 % Phosphoric acid
- (3) Methylene blue (Dye) 10 %
- (4) Finger nail polish
- (5) Impression compound
- (6) Hydrogen peroxide 6%
- (7) Synthetic saliva – prepared from the College of Pharmacy, Medical college, Calicut

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.

II Armamentarium

- (1) Air water syringe
- (2) Explorer
- (3) 2 x 2 gauze squares
- (4) Cotton pellets
- (5) Forceps cotton pliers
- (6) Dappen dish with pumice
- (7) Acid etch syringe
- (8) Excavator
- (9) Sealant applicator with dispensing tip
- (10) Light cure LED unit
- (11) Burs - tapering fissure
- (12) Prophylaxis brush
- (13) Hand piece NSK – micro motor
- (14) Stereo micro scope (OLYMPUS – color plus)

III Pit and Fissure preparation

The teeth were stored in synthetic saliva for 1 week before being treated. Superficial cleaning of the sealing 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.

IV Sealant Application

Conventional acid etching done for 30 seconds followed by sealant application and stored in synthetic saliva for 24 hours.

V Thermocycling

The specimens were subjected to manual thermocycling by placing them in two different bath maintained at 5° C & 55° C with a dwell time of 10 seconds in each bath for a total of 250 cycles. The time interval between each bath was 5 seconds. The procedure was carried out at National Institute of Technology, Calicut.

VI Dye penetration Study

Apices of the teeth were sealed with impression compound. Two coats of 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. After immersion in dye all the specimens were rinsed in water to remove the dye covering the outer surface of sealant and nail polish removed.

The sectioning of teeth was done 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.

VII Evaluation method

Microleakage was scored according to the following criteria

- 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 SPECIMEN Fig 1



MATERIALS Fig 2



Fig 3



Fig 4 ARMAMENTARIUM



Fig 5 STEREO MICROSCOPE



SPECIMENS AFTER COATING WITH NAIL POLISH Fig 6



OBSERVATION AND RESULTS

The study assessed and compared the microleakage values of pit and fissure sealants. The microleakage was computed on a scale of 0-3 for the pit and fissure.

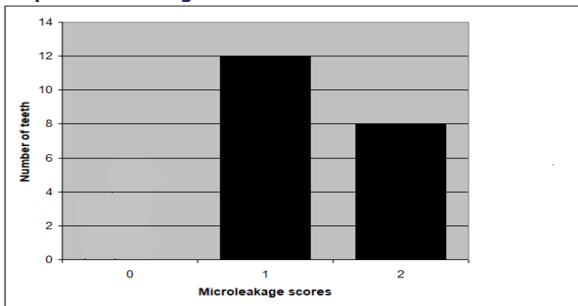
As evidenced from the Table some samples showed some amount of microleakage

TABLE Microleakage scores of all teeth

SL.NO	Tooth
1	2
2	1
3	1

4	1
5	1
6	2
7	2
8	1
9	2
10	1
11	2
12	2
13	1
14	1
15	1
16	1
17	2
18	1
19	1
20	2

Graph I Microleakage scores



Graph I1 Distribution of Scores in Percentage

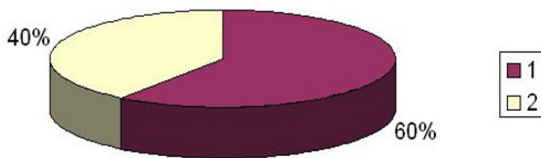
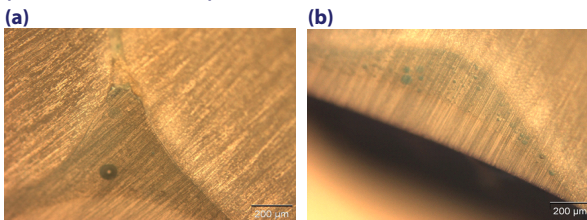


Fig 8 MICRO LEAKAGE AT SEALANT-FISSURE INTERFACE (MAGNIFICATION 10X)



DISCUSSION

Pit and fissure sealants were developed in early 1970s for occlusal caries prevention. Today sealants are regarded as a safe and effective measure in dental health care for the prevention of caries related to the pits and fissures.

Sealants are mostly resin materials that are placed on the pits, grooves and fissures of molars and premolars by means of acid etching technique.

The sealants used in the present study were Bis GMA based organic resins. The integrity of tooth sealer interface is depended on a number of factors such mechanical and chemical properties of the material, anatomy of pits and fissures, thermal conditions of oral cavity etc.

One of the major factors influencing the longevity of any restoration is the microleakage of tooth restoration interface.

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 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)8

In the study most of the samples showed some sort of dye penetration. There is no specific standards regarding the number of samples taken in a group for the study.

In assessing the microleakage of sealants the results obtained in this study are restricted to the condition invitro and should be further substantiated by the clinical trials.

SUMMARY AND CONCLUSION

The results obtained by the use of dyes, in the assessment of microleakage in the sealant, as a whole is difficult, because the longitudinal section were made in the midpoint of the restoration. From the results obtained it was observed that:

- 1) Sealant applied fissures showed some degree of dye penetration
- 2) No significant dye penetration was observed

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