AL-AZHAR
Dental Journal
For Girls

The Official Publication
of The Faculty of Dental
Medicine For Girls,
Al-Azhar University
Cairo, Egypt.

Print ISSN 2537-0308 • Online ISSN 2537-0316

ADJ-for Girls, Vol. 9, No. 3, July (2022) — PP. 519:524

Evaluation of Giomer Pit and Fissure Sealant as Compared to Resin Based One

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Codex : 16/22.07

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http://adjg.journals.ekb.eg

DOI: 10.21608/adjg.2022.25809.1243

Pediatric Dentistry & Orthodontics
(Pediatric Dentistry, Orthodontics)

ABSTRACT

Purpose: This study aimed to compare the antibacterial effect and microleakage of two types of fissure sealants; Beautisealant and Embrace wet Bond. **Materials and Methods**: for evaluation of the antibacterial effect, 30 saliva samples were obtained and were sent to microbiology laboratory where streptococcus mutans were isolated and the antibacterial effect of both materials was detected by the agar diffusion method. For microleakage test 30 extracted sound permanent molars were obtained. Two groups were formed (Group A &Group B) 15 teeth each. Teeth in group A were sealed with Embrace wet bond while Beautisealant was used to seal teeth in group B. Dye penetration was performed then specimens were put for 24 hours in 2% buffered methylene blue dye. Resin blocks were prepared then longitudinally sectioned buccolingually, The specimens were assessed for dye penetration with digital microscope. **Results**: For antibacterial effect it was found that Embrace wet Bond recorded higher bacterial inhibition zone than Beautisealant. Mann-Whitney-test (P=<0.0001< 0.05) was used to determine the difference between both groups and showed statistical significance. For the microleakage test it was found that Beautisealant recorded higher value of leakage than Embrace wet Bond. The difference between both groups showed statistical non-significance as determined by Mann-Whitney-test (P=0.4> 0.05).**Conclusion**: Embrace wet bond pit and fissure sealant could be better option than Beautisealant regarding the antibacterial effect however no difference was noticed between them regarding the microleakage.

KEYWORDS

Beautisealant Embrace wet bond,
Fissure sealant,
Antibacterial effect,
Microleakage

- Paper extracted from Doctor thesis titled " Evaluation of Giomer based Pit and Fissure Sealant as Compared to Resin based one"

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INTRODUCTION

Dental caries is highly found in special tooth morphology types in both mixed and primary dentitions, with pits and fissures considered the most common diseased areas. The occlusal surface of a molar is the predominant caries susceptible site, while buccal and palatal pits are the least susceptible. When preventive measures are done properly, they show appropriate results in decreasing caries. However, as the prevalence of occlusal caries is high, pit and fissure sealants are commonly used and recommended once they were introduced into the dental field[1].

Giomers have the advantages of resins and glass-ionomer cements. Moreover, they are differentiated by their content of surface pretreated glass-ionomer particles (S-PRG), particles of fluorosilicate glass that have been reacted before their introduction into the resin leading to ion release[2].

Regarding the recent concepts of Minimally Invasive Cosmetic Dentistry (MICD), and modern developments in adhesives technology, Beautisealant is an easier, faster and gentler sealant system that doesn't need phosphoric acid etch and rinse steps, while still having equal or better shear bond strengths.

Ideal requirements of fissure sealants should be biocompatible, better sealing ability, and resistance and retention to wear and abrasion. The lesser the microleakage the better will be the sealing ability[3].

More protection can be provided from any other deterioration of the bond at the tooth-resin interface if the sealant has any antibacterial effect. Streptococcus mutans is associated with the initiation of dental caries so the caries incidence could be affected by a decrease in the number of these bacteria at the resin-tooth interface. Adding some antibacterial agents to the sealant material can enhance this effect[4].Recently bioactive glass, chlorhexidine silver, zinc oxide nanoparticles, S-PRG filler and fluoride compounds were added to sealants as antibacterial agents[5].

MATERIAL AND METHODS

For the present study, the pit and fissure sealants used were as follows:

- Moisture-tolerant- resin based sealant (Embrace Wet Bond).
- Giomer based pit & fissure sealent (Beautisealant)

I- Determination of the antibacterial effects of two pit and fissure sealants:

The antibacterial effects of the two sealant groups (Group A Embrace Wet Bond & Group B Beautisealant) were studied on streptococcus mutans, which were isolated in the laboratory from the clinical samples of saliva of the participant patients before applying the sealant materials.

Thirty saliva samples were taken from healthy children by sterile disposable plastic pipette. Saliva samples were taken before breakfast and no tooth cleaning were done by the participants on the sampling days[6].Participants gave nearly 2 mL samples of unstimulated whole saliva that were collected into sterile test tubes containing 3 ml of brain heart infusion (BHI)broth transport medium. Samples were transported immediately to the laboratory and incubated at 37ºC for 48 hours. After 48 hours 10 μL was plated on Mitis-Salivarius agar. The plates were incubated at37ºC for 48 hours. Identification of Streptococcus mutans was based on gram staining and the obvious morphology of its colony which appears as coherent, hard, berry-like, and dark blue with raised colonies with varying size from 0.5 to 1 mm diameter. Two wells were prepared with a diameter of 0.5 cm into which the two different sealants (A&B) were placed (Fig.1). Then light cure is used to polymerize them for 10 seconds. After that the agar plates were incubated for 48 hours at 37°C in an anaerobic field for the growth to become detected. The antimicrobial properties of materials were detected from the circular zones of bacterial inhibition found around each material. Measurement of the diameters of these zones of bacterial inhibition were done in millimeters[7,8].

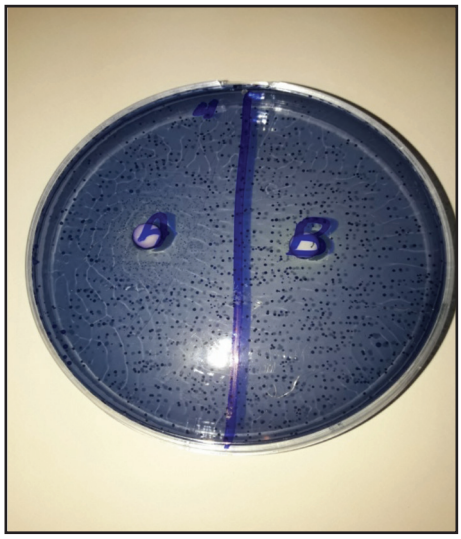

Figure (1) Antibacterial effect of pit & fissure sealants against streptococcus mutans

Group A showing antibacterial effect, Group B didn't show antibacterial effect

A : Embrace wet bond , B: Beautisealant

In Vitro determination of microleakage of different pit &fissure sealants:

Thirty human extracted permanent molars that were free of caries, restorations and cracks were included for the study. Physiological saline was used for their storage[9].The occlusal surfaces of teeth were cleaned before the study with pumice slurry by the use of brushes at low-speed handpiece for 10 seconds[10,11].

Two groups of samples with 15 teeth each were formed (Group A& Group B):

- Group A: In which Embrace Wet Bond will be applied (positive control group).
- Group B: In which Beautisealant will be applied (Test group).

Group A:

The occlusal surfaces of the molars were acid etched for 15 seconds with 37% phosphoric acid etching gel regarding manufacturer's instructions, then rinsed well with oil free water and air sprays for ten seconds for complete rinsing of the acid and lightly dried, leave tooth surface slightly moist. Embrace Wet Bond sealant was put on the occlusal surface using the provided applicator tip.

Group B:

In which Beautisealant was applied. After treating the occlusal surfaces of the teeth by the self- etching primer for 5 seconds according to the manufacturer instructions, Gentle dryness was done by oil free compressed air for 5 seconds, then the sealant was applied by the supplied applicator and light cured for 10 seconds by a LED light unit(LY-A180)[12].

Teeth were stored at 37°C and 100% humidity for 24hours. The teeth were thermocycled before testing 500 times at 5 ± 2°C to 55 ± 2°C, with a dwell time for 30seconds.Dye penetration was done by coating the surfaces of teeth with two layers of nail polish leaving one millimeter around the sealant without nail polish. Epoxy resin was used to seal the apices of the roots of the teeth. Then samples were immersed in 2% buffered methylene blue dye for 24 h, then tap water was used for rinsing. Resin blocks were prepared and longitudinally sectioned buccolingually at the distal and mesial surfaces of each tooth with an Isomet low-speed saw (TECHCUT4TM\Rancho Dominguez, California) to give three sections made of each specimen. The specimens were assessed for dye penetration with digital microscope[13].

Dye penetration was assessed using ranked scale as:

0 = absence of penetration of dye

1 = penetrationof dye up to the outer half of the sealant (good)

2 = penetration of dye reaching to the inner half of the sealant (fair)

3 = penetration of dyereachingthe underlying fissure (poor)[14,].

All the values obtained were then subjected to statistical analysis.

RESULTS

Results of Bacterial Inhibition zone:

It was found that group A recorded higher mean ± SD value of bacterial inhibition zone (2.3±0.8 mm) than group B mean ± SD value (0.00±0.00mm). The difference between both groups showed statistical significance as detected by Mann-Whitney-test (P=<0.0001< 0.05) as shown in table (1) and figure (2).

Results of in vitro microleakage score:

In group A, the highest frequently distributed score was for score 1 (42.11%) followed by score 3 (36.84%) then score 2 (21.05%) while the lowest frequently distributed score was for score 0 (0%). In group B, the highest frequently distributed score was for score 2 (48.15%) followed by score 1 (33.33%) then score 0 (18.52%) while the lowest frequently distributed score was for score 3 (0%). The difference between both groups in frequent distribution of leakage score results showed no statistical significance as detected by Chi square test (P=<0.0001< 0.05).

It was found that group B recorded higher mean ± SD value of leakage (6.75±2.78 score) than group A mean ± SD value (4.75±1.79 score). The difference between both groups was statistically non-significant as indicated by Mann-Whitney-test (P=0.4> 0.05) as shown in table (2) and figure (3).

Table (1) *Descriptive statistics of antibacterial results for both groups.*

Variable		Descriptive				
	Statistics	***Mean***	***SD***	***Median***	***Min.***	***Max.***
Groups	***Group A***	2.3	0.8	2.3	2.2	2.4
	Group B	0	0	0	0	0
Statistics	***P value***	<0.0001*				

ns; non-significant (p>0.05)

**; significant (p<0.05)*

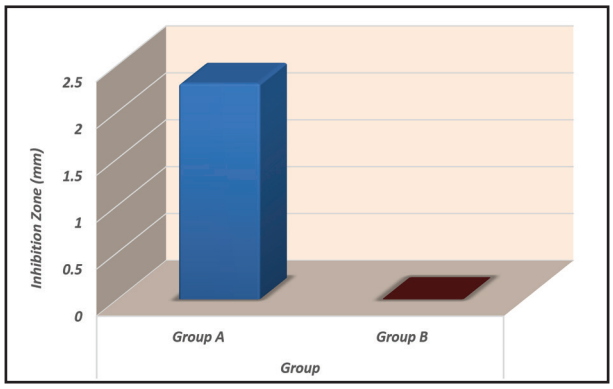

Figure (2): Column chart comparing the mean values of inhibition zone for both groups.

Table (2) *Frequent distribution and descriptive statistics of leakage score results for both groups.*

Variable		Scores				Descriptive				
	Statistics	***Score0***	***Score 1***	***Score 2***	***Score 3***	***Mean***	***SD***	***Median***	***Min.***	***Max.***
Groups	***Group A***	0%	42.11 %	21.05%	36.84%	4.75	1.79	5.5	0	8
	Group B	18.52%	33.33%	48.15%	0%	6.75	2.78	7	0	13
Statistics	***P value***	<0.0001*				0.400 ns				

ns; non-significant (p>0.05) **; significant (p<0.05)*

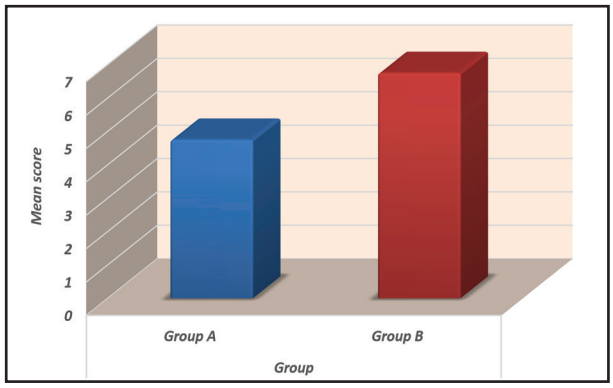

Figure (3):Column chart of the mean values of leakage for both groups

DISCUSSION

Pit and fissures caries are considered to account for about 90% of the permanent posterior teeth caries and 44% of the primary teeth caries in children and adolescents. Pits and fissures have plaque retentive nature that make them hard to clean, which results in making them more vulnerable to caries than smooth surfaces and can't be easily protected by application of fluoride[15]. Thereby other effective measures such as pit and fissure sealants are essential for the protection of pits and fissures. Application of sealant is a preventive conservative approach that involves the application of sealants into the pits and fissures of teeth susceptible to caries; the sealant then bonds micromechanically to the tooth, making a physical barrier that allows the bacteria to be away from their source of nutrients[16].

In this study we used Beautisealant from as the test group, it is a fluoride-recharging pit and fissure sealant that includes Giomer technology. Giomer have been shown to promote remineralization, slow demineralization, neutralize acid, provide fluoride uptake, and decrease cariogenic bacteria production. BeautiSealant is used for the sealing of pits and fissures in the primary and secondary dentition as a preventive treatment. It involves a self-etching primer that doesn't require phosphoric acid etchant therefore preventing the newly erupted first permanent molars from the harmful etching effects [17].

The Beautisealant was compared with Embrace wet bond from pulpdent as a positive control. Embrace wet bond is a resin based hydrophilic pit and fissure sealant that does not need dry field and sets in a moist field which is suitable for young age where proper isolation and complete dryness is difficult to be achieved due to increased salivation and the possible uncooperation of the children's age range that were included in the study.

In this study the Beautisealant showed no antibacterial effect against streptococcus mutans as compared by Embrace wet bond which showed significant higher antibacterial effect against streptococcus mutans. This is also what was concluded by certain studies[18,19]where Beautisealant showed little antibacterial effect against streptococcus mutans in comparison with other fluoride releasing sealants. In this study Embrace wet bond showed high antibacterial effect which was also proved by other studies[20,21] .

In this study the microleakage test for both groups showed that Beautisealant has higher microleakage when compared with Embrace wet bond although with no statistical significance difference between them. This finding is the same as that found in one study in which no statistical significant difference was found between Beautisealant and Clinpro sealant regarding the microleakage[22].

Another study[23] compared Embrace wet bond and Helioseal and Guardian seal regarding the microleakage and found that Embrace wet bond has the lowest microleakage scores.

CONCLUSION

Regarding the limitations in this study it was concluded that Embrace wet bond could be better option than Beautisealant regarding the antibacterial effect however no difference was noticed between them regarding the microleakage.

CONFLICT OF INTEREST

None declared.

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