ORIGINAL RESEARCH

Comparative Evaluation of Two Different Pit & Fissure Sealants and a Restorative Material to check their Microleakage – An In Vitro Study

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ABSTRACT

Background: The purpose of this study was to investigate and compare three different pit and fissure sealants with different composition to check their effectiveness for sealing ability and microleakage.

Materials & Methods: Total 120 therapeutically extracted premolars devoid of any caries, anomalies or morphogenic diversity were collected and distributed equally in three groups (40 in each). Group – I: Composite based Pit and fissure sealant, Group -II: Compomer- restorative material and GROUP-III: Glass ionomer cement based pit and fissure sealant. Samples were cleaned with slurry of pumice and etched with phosphoric acid etchant. After thorough washing and drying, teeth were treated and cured with three sealants having different composition followed by thermocycling and immersion in methylene blue dye for 24 hours. Teeth were then observed and score was given for microleakage. The sections were photographed to show score of "0", "1", or "2" microleakage and the data was statistically analyzed with the non parametric test (Kruskal Walis test).

Results: Composite material was found better for sealant material as it was showing significantly least microleakage as compare to Glass Inomer Cement and promising result with compomer.

Conclusion: Besides many inventions, researches and nano-technology implementation in dental materials, composite material is comparatively better than Glass Inomer Cement and compomer as sealant materials.

Key Words: Pit and fissure sealants, Stereomicroscope, Microleakage.

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INTRODUCTION

It has long been recognized that the occlusal surface represents the most caries susceptible area of the tooth structure. As per the literatures, pit and fissures classified as "V", "U", "I" and "K" out of which V & U are self cleansable and require non invasive approach, whereas I & K are considered as non self cleansable and require invasive approach[1]. All samples collected were neither carious nor with developmental anomalies, only non invasive approach is used for the sealing pit and fissures. There are two schools of thought, if sealing is proper and no active caries beneath then one should go for non invasive approach as it leads to deprivation of substrate to microorganisms and arresting the lesion.

Other is of invasive approach where cavity preparation is must so as to excavate the dental caries. Careful application of pit and fissure sealant have proven successful in prevention of dental caries or progress of incipient carious lesion is halted [2].Earlier studies gives the information regarding comparision between sealants related to Glass ionomers and composite based materials, but very few or none studies done with sealants and restorative materials because of presumptions that only marketing brands of sealants is appropriate for the sealing pits and fissures. The purpose of this study was to investigate and compare three different materials for their microleakage.

MATERIALS AND METHODS

The study was conducted at the Department of Pedodontics and Preventive Dentistry, K.M.Shah Dental College and Hospital. Total 120 premolar teeth devoid of any caries or anomalies, extracted for orthodontic purpose were collected. Samples were thoroughly cleaned by water and then were preserved in normal saline. Cleaning of occlusal fissure surfaces was completed with pumice slurry[3]. Samples were divided in three groups containing 40 samples in each group. Samples were etched with 35% phosphoric acid etchant gel for 60 seconds so as to provide more surface area with micro-porosities which allows making materials to flow in those areas which will enhance the bonding between material and tooth interface. Samples were then undergone for washing and drying with oil free air syringe. Sealant were placed over the pit and fissure area respectively with Group – I: (Helioseal f) Composite based Pit and fissure sealant, Group -II: (Compoglass flow) Compomer- restorative material and GROUP-III: (Fuji – VII GIC) Glass ionomer cement pit and fissure sealant. No bonding agent was used in the study as it was non invasive procedure (as no cavity preparation done). All three materials possess different composition. Helioseal f is a composite based pit and fissure sealants and having good results in different studies. Compoglass flow which is a restorative material having added advantage of inclusion of GIC and composite material with addition of higher filler particle content(>60%). Hence compoglass f was included in this study to check the composition based advantage in the terms of microleakage. Fuji VII(pink) is command set material because curing can be enhanced and curing time can be reduced with the same so as to avoid any contamination to intraoral application. Sealants were cured under the light cure for 30 seconds[4]. After thermocycling teeth were immersed in 10% aqueous solution of methylene blue dye for 24 hours following which they were washed to remove excess dye. Approximately 1.5mm thick ground sections were made longitudinally by the lathe machine with water flow in bucco- lingual direction. The sections were then kept dry and observed for one side which gives maximum microleakage under stereomicroscope with magnification of 10X. The degree of microleakage was scored by a single observer using criteria by Colley et al (1990)[5] as follows:

Score 0: No marginal penetration by dye.

Score 1: Marginal penetration along the enamel sealant interface.

Score 2: Dye penetration to depth of sealant.

The sections were photographed to show score of "0", "1", or "2" microleakage and the data was statistically analyzed with the non parametric test (Kruskal Walis test).

RESULTS

As per the results of this study, group I(composite) is the best material with least microleakage score, group II(compomer) gives the promising results whereas in contrast, group III(Glass ionomer cement) shows significant microleakage in comparison with both group I & group II.

Table 1 shows the frequency distribution of degree of microleakage for group I to III. The highest number of sections with "0" microleakage score were within group I i.e. Helioseal F (composite material – Ivoclare Vivadent) and lowest number of sections with "0" score were within group III i.e. Fuji – VII GIC (Glass ionomer cement – GC Fuji VII). The maximum number(16) of sections for highest microleakage were

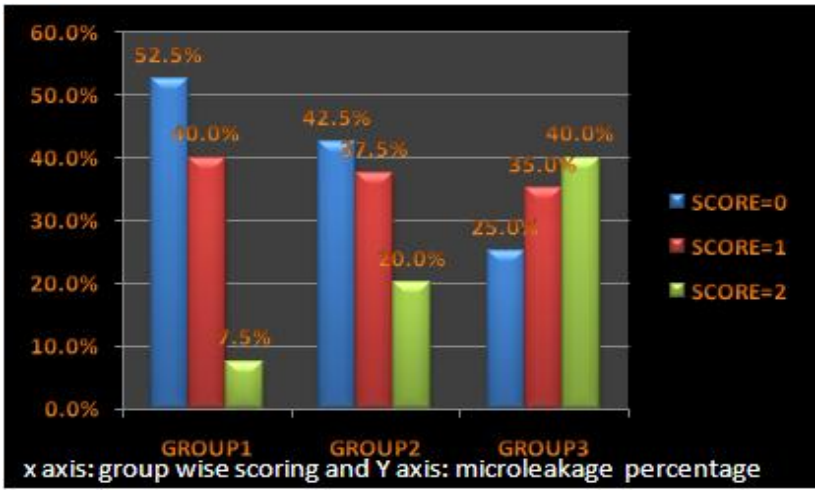
shown in group III. The total percentage of sections with microleakage score 1 was 37.5% out of all sections examined, amongst these highest number of sections were shown within group I(40%). Total percentage of sections with microleakage score "2" was 22.5% out of all the sections observed. 40% of total sections showed "0" microleakage. Table also shows group wise mean and standard deviation.

Table 2 shows 't' values for comparision of various groups under study.

Table 1: Frequency distribution of degree of microleakage and Group wise mean and standard deviation:				
Score	**Group I**	**Group II**	**Group III**	**Total %for each score**
0	21 (53%)	17 (43%)	10 (25%)	40%
1	16 (40%)	15 (37%)	14 (35%)	37.5%
2	3 (7%)	8 (10%)	16 (40%)	22.5%
Mean	0.55	0.775	1.15	
SD	0.639	0.768	0.802	

Table 2: 'T' values for comparison between various groups.			
Groups compared	**'t' - value**	**Inference**	**p – value**
I – II	0.200	Not significant	1.643
I – III	0.001	Significant	11.305
II – III	0.037	Significant	4.344
Group – I: treated with Helioseal F, Group – II: treated with Compoglass Flow, Group – III: treated with Fuji – VII			

Sealant material of group I(Helioseal F) and group II(compoglass flow) were found to be comparable as the degree of microleakage between them was not significant ('t'=0.200) (p=1.643). In contrast, when group I(Helioseal F) was compared with group III(Fuji – VII),



Graph 1: Interpretation of the three groups for scoring

it showed statistically significant values ('t'=0.001) (p=11.305).

Simillarly, when group II(compoglass flow) was compared with group III(Fuji – VII), it showed statistically significant values ('t'=0.037) (p=4.344).

Graph 1 shows comparision between three groups for microleakage scoring.

DISCUSSION:

With the revolution in preventive and restorative dental materials, especially related to physical properties such as flow leads to give better results in the term of microleakage. In this study we have used a restorative material with additional flow property to compare with the conventionally used sealants to check the microleakage so as to know that restorative materials can be used for sealing pit and fissures areas or not.

All the groups showed some amount of microleakage in present study. This finding is in accordance to those reported by Theodoridou-Pahini et al and Moore et al. (1996) stated that microleakage can be expected in all restorative materials[6]. The most likely explanation for this is the thermal expansion co-efficient of the sealants are significantly different from that of enamel, which is applicable to group 1 and group 2, but not group 3 as it is GIC based material whose thermal expansion co-efficient is very similar to teeth.

This can be attributed to many reasons being that there was some amount of disintegration of the sealant due to its solubility. Since glass-ionomer sealant is hydrophilic, it has tendency to absorb the dye into the material and this could give a false positive result. Hence in this study dye leakage into the material was not taken into consideration, but the presence of the dye in the interface of the sealant and the tooth was taken into consideration. This methodology was also followed by Herle G. P. et. al.[7] and Birkenfeld et. al.[8]. Another factor we noticed in this study regarding group III was lower retention rate as compared to both group I and group II. While making of ground section 11 specimens were found with loss of sealant material, which correlates with the studies conducted by Lucia et al.[8]& Herle G. P. et al.[7]. As application of pit & fissure sealant is technique sensitive procedure and requires lots of precautions, varying of results in each study is obvious. Even taking filled resin based material Significance between composite and Fuji – VII GIC correlates with the study done by M. Ganesh & Tandon S [9], which was done with unfilled resin. No significance between group 1 & group 2 correlates with the study conducted by F. S. Salama et. al[10]. Studies on the use of GIC [Raadal et al., 1996; Boksman et al., 1987; Forss et al., 1994] and resin modified glass ionomers [Smales and Wong, 1999] as fissure sealant indicate significantly lower retention rates than resin based ones[11].

Within the recognized limitation of an in vitro study, the above results are viewed as the theoretical level of leakage which may or may not occur in vivo but may be accepted as an aid for selection of a good sealant material before placement of a pit & fissure sealant.

The application of sealants is a recommended procedure for caries prevention. After longer follow-up the quantity and quality of the evidence is reduced caries. For high risk children, pit and fissure sealant are proven successful and in certain cases it have shown caries reduction in 48 months[12]. The relative effectiveness of different types of sealants has yet to be established. There is rapid raise in the development of restorative materials and techniques in determining the capability of each new material to adapt to the tooth without micro leakage. The direction of research will have to be involved in simulating in vitro studies on micro leakage with in vivo studies. There is poor correlation between the extent of micro leakage found in vitro & in vivo studies. In vitro studies definitely give a path to compare the sealing abilities of the materials. This elusive ability to prevent microleakage demands controlled clinical studies, which will draw conclusion about the micromechanical bond and its strength between the fissure sealant and tooth structure.

CONCLUSION

The results observed in the present study suggested that, Composite was the best material amongst three different materials in terms of least microleakage. Compomer gave the promising results where as GIC was the least successful pit and fissure sealant material.

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