A comparison of retention between filled and unfilled resin in newly erupted permanent molars used a pit and fissure sealants in vivo study: A Randomized Clinical Trial.

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ABSTRACT

Objective: To compare the retention between filled and unfilled resin in newly erupted permanent molars by using a pit and fissure sealants

Study Design: A Randomized Clinical Trial

Place and Duration: At Department of Operative Dentistry Isra Dental College from 1st January 2014 to 31st December 2015.

Methodology: Total Hundred first molar teeth were selected in 25 children i.e. 100 teeth divided into 50 equal right and left side using split mouth design. Right side having both maxillary and mandibular teeth sealed with filled resins and left side teeth sealed with unfilled resins. Retention of the sealants was checked at an interval of 3, 6, 9 and 12 months using the CCC evaluation system (color, coverage and caries) and in this study coverage criteria were used for follow-ups.

Results: The results showed that filled resins were completely retained in 58%, 66%, 38.7%, 37.9%, partially retained in 8%,27.2%,54.8%,48.3% and lost completely in 34%, 45.5%, 6.5%, 13.8% at 3rd,6th,9th and 12th month follow up respectively. Similarly, unfilled resins were completely retained in 62%, 45.5%,38.1%,42.1%,partially retained in 4%, 18.2%, 52.4%, 52.6% and lost completely in 34%,36.3%,9.5%,5.3% at 3rd,6th,9th and 12th month follow up respectively. The percentage of sealant retained or partially retained in case of filled resins were more than retained or partially retained of the unfilled resins. The difference was not found to be significant (p>0.05).

Conclusion: There was no statistically significant difference in the retention rates between resin-based filled and unfilled pit and fissure sealants.

Keywords: Permanent molars, Newly erupted, Pit and fissure, Sealants, Filled resin, Unfilled resin,

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INTRODUCTION

There has been little success in the prevention of caries involving pit and fissures of teeth, though there has been a wide focus on maintaining oral hygiene and various fluoride delivery systems. Being areas of common sites for plaque and debris, pit and fissures are very vulnerable to caries and the least accessible to the tooth brush bristles. It is best advisable that the use of fissure sealants be effectively and swiftly started so as to prevent further damage. Buonocore simply focused on developing a sealant to prevent occlusal caries on posterior teeth[1]. Following this development, the clinicians and researchers are working to improve the retention of the sealants in the teeth for longer period of time through the improvement of the application techniques and the materials. At present the two kinds of important pit and fissure sealants, (sealants based on resin and glass ionomer) are available. The resin pits and fissure sealants are of many types: filled, unfilled, fluoride releasing cyanoacrylates, polyurethane resin, and bisphenol-A glycidyl (bis GMA) resins[2]. The two commonly used resin sealants are filled and unfilled. Filled resins are those in which quartz and silica particles are added as fillers to enhance bond strength and provide resistance to abrasion and wear. The filled resins are available in tooth colored and white shades. The advantage of colored resin is that they help the clinician for easier evaluation as it is esthetically accepted[3]. Their disadvantage on the other hand is there lack of equivalent penetration and occlusal adjustment[3]. The unfilled resins are made up of resin matrix. These materials are colorless or transparent. The advantage

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offered by unfilled resins is there penetration ability and thus better retention, while disadvantage is that they abrade rapidly within 24 to 48 hours if left in occlusion with the opposing cusp tip[3].

The basic role of the sealant is to penetrate within the tooth pit and fissures and then to seal them to avoid bacteria. A long duration of retention must be present within an ideal sealant along with having low solubility in the oral environment. Previously in a comparative study of 58 children on filled and unfilled resins revealed results after two years that 81% of filled resins were retained as compared to 88% of the unfilled resins[3]. Reddy also endorsed the retention capacities of filled and unfilled resins and his results showed that sealant without filler particles were retentive after 3 years[4]. Another study showed a 53% retention rate of filled resin sealant after 4 years and 80% retention rate unfilled sealant after 3 years[5]. However, other authors reported no significant differences in the retention or bond strength of filled and unfilled pits and fissure sealants. They report that both sealants have an equal and effective penetration level into fissures[4]. Previous studies show that 55-98.5% resin based filled sealants and 70- 100% unfilled had shown complete retention by the end of one year[3,4]. So, this study was conducted with an objective to compare retention of filled and unfilled resins in newly erupted permanent molars used as pit and fissure sealants.

METHODOLOGY

This Randomized clinical Trial e present was conducted at the Operative Dentistry Department /Isra Dental College Isra University; Hyderabad Pakistan from 1st January 2014 to 31st December 2015 after Ethical Approval. A total of hundred clinically caries free first molar teeth were selected in 25 children. Children between 6 to 8 years of age with no history of previous sealant application in first permanent molar teeth were included for study. Children with Medical, physical or mental disability or children having carious or restored molars teeth were excluded. Hundred teeth were divided into 50 equal right and left side using split mouth design. Right side having both maxillary and mandibular teeth sealed with filled resins and left side teeth sealed with unfilled resins.

During procedure Enamel surfaces were cleaned using toothbrush and water. After drying the enamel surface, topical anesthetic gel (Opahl benzocaine 20%) was applied and rubber dam was placed .Sealants were placed following manufacturers recommendations. 37% phosphoric acid was used for acid etching of tooth for 45 to 60 seconds and rinsed with full air/water spray and dried. Teeth were dried gently with moisture free air. Sealants were then worked into the fissures of all four first molars having filled resins (ME Dental pit and fissure sealants) on the right side and unfilled resins (Dentex seal pit and fissure sealant) on the left side (split mouth design) with the tip of applicator. Sealants were then light cured for 30 seconds using Light Emitting Diode (NEOX. Finally occlusion was checked with an articulating paper and adjusted with flexible soflex disc. Retention of the sealants was checked at an interval of 3, 6, 9 and 12 months using the CCC evaluation system that is color, coverage and caries. In this study coverage criterion was used for follow-ups. Coverage codings A, B, C, D were used in which Code A was used complete retention, Code B was used when sealant present on >50% of the fissure pattern, Code C was used when sealant present on <50% of the fissure pattern and code D was used for no sealant present. Retention was checked with the help of CPITN probe. (Michigan Probe)

Data Analysis: SPSS- 20 was used to calculate the mean age, frequency of teeth and gender distribution. Percentage (frequency) for coverage (retention) was calculated. Chi- square test was applied for comparing retention rate between filled and unfilled resin sealant at 3,6 ,9 and 12 months follow up with p-value (0.05) at 95% level of significance.

RESULTS

Among 25 children selected, 56% were male (n=14) and 44% were female (n=11) children. The mean age of the children was 7.4 (S.D. = ±0.42). There were 100 teeth taken for this study among them 25 maxillary and 25 mandibular on right side sealed with filled resins while 25 maxillary and 25 mandibular teeth on left side sealed with unfilled resins.

The results showed that filled resins were completely retained in 58%, 66%, 38.7%, 37.9%, partially retained in 8%,27.2%,54.8%,48.3% and lost completely in 34%, 45.5%, 6.5%, 13.8% at 3rd,6th,9th and 12th month follow up respectively. Similarly, unfilled resins were completely retained in 62%, 45.5%,38.1%,42.1%,partially retained in 4%, 18.2%, 52.4%, 52.6% and lost completely in 34%,36.3%,9.5%,5.3% at 3rd,6th,9th and 12th month follow up respectively (Table-I).

Table-I: Comparison of retention between filled and unfilled resin sealants at different time period in follow-up (N=100).

Months	Groups (n)	COVERAGE (Retention)			χ^2	p-value (0.05)
		Complete Loss	Partially Retained	Retained		
3 months	Filled (50)	17 (34%)	4(8%)	29(58%)	0.73	0.69
	Unfilled (50)	17(34%)	2(4%)	31(62%)		
	Total	34	6	60	100	
6 months	Filled (33)	2 (6%)	9 (27.2%)	22(66%)	9.07	0.01
	Unfilled (33)	12 (36.3 %)	6 (18.2%)	15(45.5%)		
	Total	14	15	37	66	
9 months	Filled (31)	2 (6.5%)	17 (54.8%)	12(38.7%)	0.17	0.91
	Unfilled (21)	2 (9.5%)	11 (52.4%)	8(38.1%)		
	Total	4	28	20	52	
12 months	Filled (29)	4 (13.8%)	14 (48.3%)	11 (37.9%)	0.896	0.64
	Unfilled (19)	1 (5.3%)	10 (52.6%)	8(42.1%)		
	Total	5	24	19	48	

The percentage of sealant retained or partially retained in case of filled resins were more than retained or partially retained of the unfilled resins. However, the Chi-square test revealed no significant difference (p= 0.69, 0.91, 0.64>0.05) at 3rd, 9th, and 12th month follow up. Only comparison at 6th month showed significant difference (p=0.01 < 0.05) as shown in Table-I.

DISCUSSION

Pits and fissures are generally considered as the single most important feature leading to the development of occlusal caries. Different preventive measures such as control of bacterial plaque and topical application of fluoride solutions have little effect on such surfaces[6]. More effective measures are, therefore, necessary, such as application of occlusal sealants at this age[6]. These pit and fissure sealants are largely accepted and recommended as effective noninvasive treatment method to prevent or arrest occlusal caries. The efficacy of sealants in preventing caries has been associated with the duration and degree of sealant retention[7].

The effectiveness of dental sealants in caries prevention has been proved by many researchers. The researcher described the mechanism of dental sealants in prevention of caries and revealed that sealant prevent the caries by the obturation of the fissures of teeth, or to the local presence of fluoride, or to both modes of action, but they have suggested that retention of sealants in teeth for longer period of time is a prerequisite for caries prevention[6]. A satisfactory goal might be to seal the pits and fissures of the teeth for the first few years after eruption when the risk of caries attack is highest. Therefore, it is important to apply sealants on the most susceptible surfaces of the teeth which are the susceptible to caries. The reason or philosophy of this strategy is that these teeth and surfaces are often the most difficult to clean and seal successfully, leading to high rates of failure[6]. Sealant success is positively associated with eruption status of teeth because the more fully erupted a tooth is, the greater the ability to maintain a dry field. However, sealing of the teeth should be done as soon as it erupts into the oral cavity and reapplication of the sealant should be done as soon as the sealant is lost completely to prevent further treatment necessity.

Following the split mouth design filled (ME Dental) and unfilled (Dentex) resin-based pit and fissure sealants were used in this study. Both sealants were applied in the same mouth on opposite teeth to compare directly the performance of materials under similar environmental conditions.

The results at 12-month evaluation showed that there was no statistically significant difference in retained, partially retained and complete loss ($p>0.05$) between filled and unfilled pit and fissure resin-based sealants. These results are in accordance with Koch MJ whose study reported no significant difference in retention of sealant after 12 month follow up[8]. Wendt-LK and Koch G had an opinion that if some part of the sealant is missing in the fissures there is still enough material in the deeper parts to prevent caries[9]. Complete missing of the sealant at 12th month was only 13.8% and 5.3% of resin based filled and unfilled resins respectively; these results were similar to the study conducted by Reddy et al where complete loss of unfilled resin was 3.57% and 8.93% for filled resins. **[6]** Rock et al were of the same opinion in the evaluation of retention capacities of sealants with and without filler, the sealants without filler showed significantly better results after 3 years.**[10]** This is in concordance with the present study that showed a little high retention rate of unfilled resins at 3rd month 62% and at 12th month 42.1%[10]. This observation was also highlighted by Percinoto et al who revealed that the fillers increase the viscosity of sealant and this high viscosity of the sealant material effected the penetration of the sealant into the micro channels or porosities produced by acid etching which is an important requirement for sealant placement[11].

In the present study resin based filled pit and fissure sealants showed 37.9% complete retention, 48.3% partial retention and 13.8% complete loss at 12th month evaluation. The results were slightly better in a study conducted by Ganss et al where 42.3% of sealant was retained completely by 1 year[12]. In another study by Bargale and Raju showed only 36.9% of complete retention of sealant after 1 year which is similar to the present study[13]. Similarly resin based unfilled pit and fissure showed 42.1% complete retention, 52.6% partial retention and 5.3% complete loss of the sealant at 12th month follow up, which are in contrast to and better results than a study conducted by Dhar and Chen where only 24% of the unfilled resin sealant showed complete retention by 1 year[14]. In another study conducted by V.R Reddy and colleagues showed 64.29% of unfilled resin sealant complete retention which showed better results than the present study by 1 year[6].

In the present study, retention on maxillary teeth was less as compared to mandibular teeth, and the result being non-significant ($p>0.05$). This result is in concordance with V.R Reddy and colleagues whose study results showed better retention in mandibular teeth[6]. The study reported that no statistically significant difference was found in the retention rates between filled and unfilled resin-based pit and fissure sealants. The retention of sealant on mandibular teeth was seen to be superior to that on maxillary teeth. The most important time period for sealant failure is at 6-month after application; therefore in this study follow up period was for 12-months. However, longer follow up time period is required to get more confidence about the results.

CONCLUSION

The study showed that there was no statistically significant difference in the retention rates between filled and unfilled resin-based pit and fissure sealants

AUTHOR'S CONTRIBUTION

Iqbal Z: Conceived idea, Designed methodology, Manuscript writing.

Douza J: Data collection, Literature review, Data analysis, Critical analysis

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