The Retention Of Glass Ionomer And Light Cure Resin Pit And Fissure Sealant Using Replica Technique – An Invivo Study

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Citation

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Abstract

Aim/Objective: To evaluate the retention of glass ionomer cement and light cure resin pit and fissure sealant using tooth replica technique. Materials and Methods: 80 mandibular permanent first molars were divided into 40 teeth each, in which Group I was treated with Fuji III Glass Ionomer Sealant and Group II with Helioseal pit and fissure sealant. An elastomer impression was made, of each sealed occlusal surface using custom made acrylic trays with reprosil impression material at 6 & 12 month interval. Later tooth replicas were examined under stereomicroscope and graded according to the scoring system. Data were tabulated and statistically analyzed using Chi-square test. Results: At 6 and 12 months interval retention rates of Helioseal-F sealant (Group-2) was significantly higher than Fuji III Glass Ionomer Cement (Group-I) X^2=10.14, p<.05.Conclusion: Retention of the Helioseal-F sealant was significantly better compared to that of the Fuji III glass ionomer sealant.

INTRODUCTION

Primary prevention employs techniques and agents to forestall the onset of the disease and to arrest the disease process before treatment becomes necessary[1]. Pit and fissures in newly erupted molars are considered as highly susceptible to caries, because fissures are less benefited by topical fluoride compared to smooth surface[2]. Dental sealants have been shown to be effective in the prevention of pit and fissure caries[3].

In the recent years, fluoride containing fissure sealants have been introduced, which enhance the caries preventive effect. The micromechanical retention for the sealant is produced by conditioning the enamel with acid prior to the application of the sealant[4]. A Glass Ionomer material specifically developed for fissure sealing (Fuji III) has been introduced, which has small particle size in order to facilitate its penetration into the fissures[5]. It has a strong bond to tooth structure without the need to etch the tooth surface and has been excellent biocompatibility[6].

The key issue is that if the sealant is properly placed, it remains intact with complete retention so that the sealed surfaces are virtually impervious to decay[3]. The preventive properties of sealants are only gained and maintained as long as they remain completely intact and bonded in place[7]. The most commonly used method in evaluating the clinical performance of pit and fissure sealant is a visual tactile examination whereby the sealant is recorded as intact, partially lost and completely lost. Photometric and Scanning Electron Microscopy of tooth replica models also had been employed. These methods are useful aids in determining the extent and location of sealant coverage after a period of clinical use[8-9].

The aim of this study was to evaluate the retention of Fuji III Glass Ionomer and Helioseal – F (fluoride containing light cure resin) pit and fissure sealants using tooth replica technique at 6 months and 12 month intervals.

MATERIAL AND METHODS

Forty children in the age group of 6-10 years were selected for the study, who reported to the Department of Pedodontics and Preventive Dentistry. Informed consent of parents or guardians was obtained before the subjects were included in the study. The mandibular permanent first molars in 40 children were selected accordingly to following criteria:

1. The first permanent molars which were erupted within 4 years.

2. Completely erupted teeth with the well defined fissure system and were not carious.
3. The teeth with deep, irregular pits and fissures.
4. The teeth had not been restored previously.

A total of 80 mandibular first permanent molar was divided into two groups:

Group I: Fuji III glass Ionomer Sealant

Group II: Helioseal F pit and fissure sealant.

Prior to applying sealant, the teeth were cleaned with short bristle brush using pumice slurry. Then teeth were washed thoroughly with water spray. A sharp explorer tip was passed through all the pits and fissures to remove pumice (remaining if any). The teeth were washed and dried thoroughly. The rubber dam was then placed on the selected tooth to achieve proper isolation. Prior to sealant placement teeth were dried for 10 seconds with air spray.

In Group I, Fuji III glass ionomer sealant was mixed and applied according to manufacturer's instruction on the pits and fissures of mandibular first permanent molar with the help of the applicator provided in the kit. When glass ionomer cement lost its glossiness, Fuji varnish was applied. Then the teeth were checked for occlusion with articulating paper.

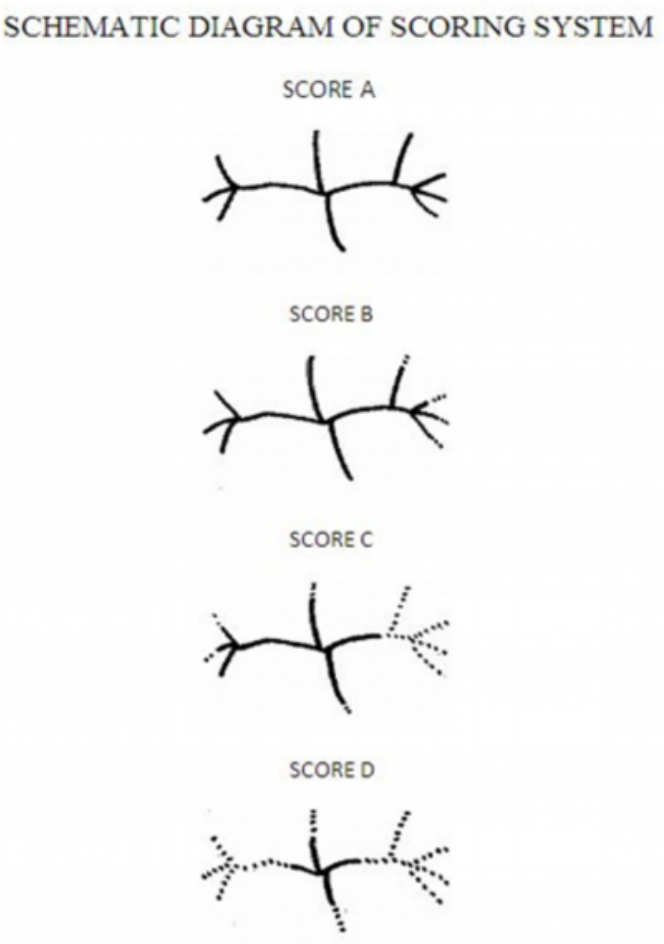
In Group II the pits and fissures of mandibular first permanent molar teeth were etched with 37% phosphoric acid for 15 seconds and then rinsed with water. The teeth were dried with water and oil free air spray to achieve a characteristic frosty white, chalky appearance of enamel. The Helioseal F sealant was directly applied with the disposable cannula on the pits and fissures of teeth. After waiting for approximately 15 seconds, the sealant was cured for 20 seconds, and the occlusion was checked using articulating paper.

The patients were instructed not to eat or drink anything for half an hour. They were recalled for assessment of sealant retention at intervals of 6 and 12 months. Then an elastomer impression (Heavy and Light body) was made, of each sealed occlusal surface using custom made acrylic trays with Reprosil (Polyviny siloxane) impression material at 6 and 12 month interval.

Later the tooth replicas were examined under stereomicroscope and graded according to following scoring system[9] [Fig.1]

Figure 1

Figure 1 Schematic illustration of main grooves and fossae of occlusal surface of permanent mandibular first molar and the criteria used for scoring extension of the sealant from score A to score D. Solid lines: Sealant present, Dotted lines: Sealant absent.



RESULTS

Out of 80 teeth assessed, 40 teeth were sealed with Fuji III glass ionomer sealant and 40 teeth with Helioseal-F fissure sealant. Of these 80 teeth, 78 teeth were available for an assessment after 6 months and 72 teeth were examined at 12 months.

The Inter-group comparison of retention at 6 month intervals [Table 1]

In Fuji Glass Ionomer Sealant (Group I), the 38 teeth were assessed out of 40 teeth. Out of the 38 teeth available for examination,15 (39.5%) teeth showed complete sealant retention (Score A), 8 (21.1%) teeth showed sealant loss

from one or more grooves (Score B), 6 (15.8%) teeth showed sealant loss from grooves and one fossae (Score C) and 9 (23.6%) teeth showed complete loss of sealant (Score D).

In Helioseal F (Group II), out of the 40 teeth, 19 (47.5%) teeth showed complete sealant retention (Score A), 16 (40%) teeth showed sealant loss from one or more grooves (Score B), 4 (10%) teeth showed sealant loss from grooves and one fossae (Score C) and 1 (2.5%) tooth showed complete loss of sealant (Score D).

At the 6 month intervals the retention rate of helioseal-F (Group II) was significantly higher than the Fuji III glass ionomer sealant (Group I) (X2 =10.14, diff. 3, P<0.05).

Figure 2

TABLE – 1 INTER-GROUP COMPARISION OF RETENTION OF FUJI III GLASS IONOMER CEMENT AND HELIOSEAL-F SEALANT AT 6 MONTH INTERVAL:

SEALANTS	NO. OF TEETH SEALED	NO. OF TEETH AVAILABLE FOR RECALL	RETENTION SCORES			
			SCORE A	SCORE B	SCORE C	SCORE D
GROUP-I (Fuji III)	40	38	15 (39.5%)	8 (21.1%)	6 (15.8%)	9 (23.6%)
GROUP-II (Helioseal F)	40	40	19 (47.5%)	16 (40.0%)	4 (10.0%)	1 (2.5%)

The Inter-group comparison of retention at 12 month intervals [Table 2]

In Fuji III glass ionomer (Group I), the 34 teeth were assessed out of 40 teeth. Out of the 34 teeth available for examination, 6 (17.7%) teeth showed complete sealant retention (Score A), 5 (14.7%) teeth showed sealant loss from one or more grooves (Score B), 8 (23.5%) teeth showed sealant loss from grooves and one fossae (Score C) and 15 (44.1%) teeth showed complete loss of sealant (Score D).

In Helioseal F (Group II), out of the 40 teeth 38 teeth were assessed. Out of 38 teeth available for examination, 14 (36.9%) teeth showed complete sealant retention (Score A), 10 (26.3%) teeth showed sealant loss from one or more grooves (Score B), 10 (26.3%) teeth showed sealant loss from grooves and one fossae (Score C) and 4 (10.5%) tooth showed complete loss of sealant (Score D).

At 12- month intervals helioseal-F sealant showed a difference in the retention rate than that of glass ionomer sealant, which was statistically significant (X2 =11.15, diff. 3, P<0.05).

Figure 3

TABLE – 2 INTER-GROUP COMPARISION OF RETENTION OF FUJI III GLASS IONOMER CEMENT AND HELIOSEAL-F SEALANT AT 12 MONTHS INTERVAL

SEALANTS	NO. OF TEETH SEALED	NO. OF TEETH AVAILABLE FOR RECALL	RETENTION SCORES			
			SCORE A	SCORE B	SCORE C	SCORE D
GROUP-I (Fuji III)	40	34	6 (17.7%)	5 (14.7%)	8 (23.5%)	15 (44.1%)
GROUP-II (Helioseal F)	40	38	14 (36.9%)	10 (26.3%)	10 (26.3%)	4 (10.5%)

The Intra-group comparisons of retention in Fuji III and Helioseal-F pit and fissure sealant at 6 and 12 month intervals [Table 3 and fig 2]

FUJI III GLASS IONOMER SEALANT

Out of the 40 teeth, 38 teeth at 6 month intervals and 34 teeth at 12 month intervals were assessed. The complete retention of the sealant (Score A) was seen in 15 (39.5%) teeth at 6 month interval and 6 (17.6%) teeth at 12 month interval. The extensive loss of sealant (Score B) was seen in 9 (23.7%) teeth and 15 (44.2%) teeth at 6 months interval respectively. At 6 and 12 month interval comparison of a retention rate for glass ionomer sealant was statistically significant (X2 =6.3, df. 3, P<0.05)

HELIOSEAL-F SEALANT

The 40 teeth assessed at 6 month interval, and 38 teeth were assessed at 12 month interval. The complete retention (Score A) was observed in 19 (47.5%) teeth at 6 month interval and 14 (36.8%) teeth at 12 month interval. The extensive loss of sealant (Score D) seen in 1 (2.5%) tooth at 6 months and in 4 (10%) teeth at 12 months. The retention rate of helioseal-F sealant assessed at 6 and 12 months interval showed statistically insignificant results (X2 =6.64, diff. 3, P>0.05).

Figure 4

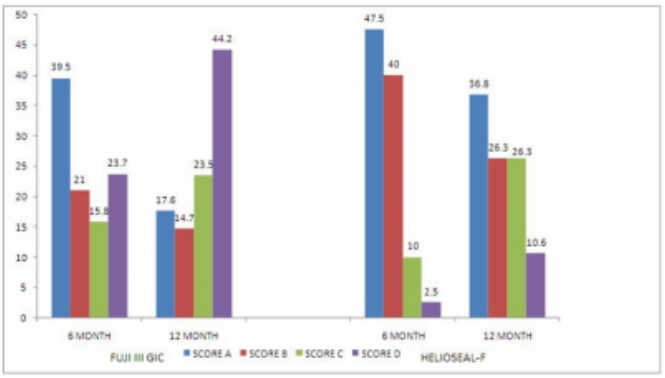
TABLE-3 INTRA-GROUP COMPARISION OF RETENTION OF FUJI III GLASS IONOMER CEMENT AND HELIOSEAL-F SEALANT AT 6 AND 12 MONTHS INTERVALS

SEALANTS	TIME INTERVAL	NO. OF TEETH SEALED	NO. OF TEETH AVAILABLE FOR RECALL	RETENTION SCORES				SIGNIFICANCE
				SCORE A	SCORE B	SCORE C	SCORE D	
GROUP-I (Fuji III)	6 MONTH	40	38	15 (39.5%)	8 (21.1%)	6 (15.8%)	9 (23.6%)	X^2 = 6.13 P>0.05 NS
	12 MONTH	40	34	6 (17.7%)	5 (14.7%)	8 (23.5%)	15 (44.1%)	
GROUP-II (Helioseal F)	6 MONTH	40	40	19 (47.5%)	16 (40.0%)	4 (10.0%)	1 (2.5%)	X^2 = 6.64 P>0.05 NS
	12 MONTH	40	38	14 (36.9%)	10 (26.3%)	10 (26.3%)	4 (10.5%)	

NS: Not Significant

Figure 5

Figure 2: COMPARISION OF RETENTION OF FUJI III GLASS IONOMER CEMENT AND HELIOSEAL-F SEALANT AT 6 AND 12 MONTH INTERVALS



DISCUSSION

In this study 40 children between the age groups of 6 to 10 years were considered because the risk of caries attack is highest in the pit and fissure of teeth for the first few years after their eruption[10].

Completely erupted permanent mandibular first molars were selected to standardize the procedure. These teeth were selected because they present a particular challenge in caries prevention as they have deep occlusal surface, and their posterior location compromises access for cleaning and removing debris[11]. In this study, the occlusal surface and fissures of the teeth were cleaned with pumice slurry and short bristle brush to make sure that these areas were free of gross plaque and debris. The clinical study by M.F. Donnan and I.A. Ball[12] showed that prophylaxis of teeth with pumice prior to etching contributes to sealant retention.

The rubber dam if placed properly provides the best and the most controllable isolation. Eidelman et al[13] applied sealant with the use of cotton rolls or rubber dam for isolation. After 24 months the teeth isolated with rubber dam isolation showed 96% of complete sealant retention where teeth isolated with cotton roll isolation showed 88% retention. Barja-Fidalgo et al[14] also found that glass ionomer cement used as a sealant can provide some level of protection against dental caries in situations where isolation is not possible.

The caries preventive effect of glass ionomer sealant depends on both retention of sealant and the release of fluoride from the sealant[15]. Glass ionomer sealants are suggested to be simple in technique (no acid etching) and low in cost. In the present study the lower retention rate was obtained with the glass ionomer cement when compared with the resin based sealants. The reasons for the loss of the glass ionomer sealants could be due to inadequate adhesion of the cement to the enamel surface[16,9] and brittle nature of the sealant material[6]. The effect of fluoride after sealant loss also must be considered. However, Torppa-Saarinen and Sepp[5] and Carey et al[17] described that despite the material loss, there were remaining retained particles of the GIC sealant in the bottom of the occlusal fissures, keeping its preventive effect. Other clinical trials on GIC sealants support this suggestion as well, providing evidence for a clearly protective effect by GIC sealant, despite the poor retention rate[5,9,15,18-19].

Helioseal – F was used in the present study, which is resin based light cure fluoride releasing pit and fissure sealant. Helioseal F offers improved caries protective effect of the sealing by an effective combination of blocking the bacteria and fluoride deposit. De Craene et al[20] also chosen Helioseal for its direct and easy application with cannula tips. The tips can be bent to allow easy access to any site and is a very economical system without waste of material.

The tooth replica technique, which is used in this study has been shown to be sufficiently sensitive to discern minor differences in wear resistance among sealants[8,9]. Gwinnett[21] reported that polyvinyl siloxane impression material can accurately reproduce the relationship between restoration and tissue.

In the present study, Helioseal- F sealant had a better retention rate than Glass ionomer sealant and this result was similar to the previous studies done[22,23,10,24,9,25]. Forss H and colleagues[10] compared the retention of glass ionomer fuji III and resin based light cured fissure sealants. After two years, 26% of the glass ionomer sealant and 82% of resin based sealant were totally present. In another study, Forss H. and Halme E[22] evaluated the retention and caries preventive efficacy of glass ionomer (Fuji IIIGIC) after 6 to7 years, 10% of the GIC and 45% of the Delton sealant were totally present.

The similar results also found comparing the LCRB and RMGIC sealants, the retention rate of LCRB sealants was markedly higher than that of RMGIC sealants between the baseline and 6, 12,18,24,30 and 36-month intervals. The preventive effect of remaining glass ionomer particles is hardly comparable to the caries-preventive effect of LCRB sealants. Retention of the sealant, providing a leak-proof

diffusion barrier, seems to be of greater importance[26]. Yildiz et al[27] showed less retention rate than the concise white sealant and caries incidence was less in Helioseal – F. Rock W.P[28] reported retention of filled sealants to be lesser than that for unfilled sealants.

A. Carlsson, M. Petersson and S. Twetman[2] suggested that Helioseal – F fluoride containing fissure sealant, could be used satisfactory for caries prevention in children. Koch M.J et al[4] and Vrbic V[29] stated that Heliseal – F sealant showed a very good retention rate after a 12 month interval. The Fuji triage showed significantly higher cumulative fluoride releasing pattern compared to resin based fissure sealant because of their less hydrophilic matrix characteristics[30,18]. Markovic D.L, Petrovic B.B, Peric T.O[31] confirm that glass ionomers are not very resistant to external agents and in low pH environments they are undergoing noticeable destruction. On the other hand, destruction of the material surface is followed by extensive fluoride release necessary to resist the caries attack.

CONCLUSION

The following conclusions were drawn from this study:

1. Helioseal – F pit and fissure sealant showed 47.5% complete retention at 6 month interval.

2. Fuji III glass ionomer sealant showed 39.5% complete retention at 6 month interval and 17.6% at 12 month interval.

3. Helioseal-F pit and fissure sealant showed a higher retention rate than the Fuji III glass ionomer sealant.

References

1. Norman OH, Garcia Godoy F. Primary preventive dentistry 5th Edition, Appleton and Lange Publication.
2. Carlsson A, Petersson M, Twetman S. 2-year clinical performance of a fluoride containing fissure sealant in young school children at caries risk. Am J Dent 1997; 10: 115-119.
3. ADA Council on Scientific Affairs Prevention and Interprofessional Relations; Dental Sealants. J am Dent Assoc 1997; 128: 485-488.
4. Koch MJ, Garcia-Godoy F, Mayer T, Staehle HJ. Clinical evaluation of Helioseal F Fissure sealant. Clin Oral invest 1997; 1:199-202.
5. Torppa Saarinen E., Seppa L. Short term retention of glass ionomer fissure sealants. Proc finn Dent Soc 1990; 86: 83-88.
6. Boksman L, Gratton DR, McCutcheon E, Plotzke OB. Clinical evaluation of a glass ionomer cement as a fissure sealant. Quintessence Int 1987;18: 707-709.
7. Garcia-Godoy F. Retention of light cured fissure sealant in a tropical environment after 12 months. Clin Prevent Dent 1986; 8: 112-13.
8. Jensen O E, Handelman S L, Diez F P. Occlusal wear of four pit and fissure sealants over two years. Pediatr Dent 1985; 7: 12-27.
9. Mcjare I, Mjor I A. Glass ionomer and resin based fissure sealants a clinical study. Eur J Oral Sci 1990; 98: 345-350.
10. Forss H, Saarni UM, Seppa L: Comparison of glass ionomer and resin based fissure sealants: A 2 year clinical trial. Community Dent Oral Epidemiol 1994; 22: 21-24.
11. Dennison JB, Straffon LH, More FG. Evaluating tooth eruption on sealant efficacy. J Am Dent Assoc 1990; 121: 610-614.
12. Donnan MF, Ball IA. A double blind clinical trial to determine the importance of pumice prophylaxis on fissure sealant retention. Br Dent J 1988; 165: 283-286.
13. Eidelman E, Fuks AB, Chosack A. The retention of fissure sealants: Rubber dam or cotton rolls in a private practice. ASDC J dent child 1983; 50:259-261.
14. Barja-Fidalgo F, Maroun S, Oliveira BH. Effectiveness of a glass ionomer cement used as a pit and ssure sealant in recently erupted permanent rst molars. J Dent Child 2009;76: 34–40.
15. Komastu H, Shimokabe H, Kawakami S, Yoshimura M. Caries preventive effect of glass ionomer sealant reapplication: Study presents three year results. J Am Dent Assoc 1994; 125: 543-549.
16. Jemt T, Stalbald PD, Oilo G. Adhesion of poloycarboxylate based dental cements to enamel: An in vivo study. J Dent Res 1986; 65: 885-887.
17. Carey CM, Spencer M, Gove RJ, Eichmiller FC. Fluoride release from a resin-modi ed glass-ionomer cement in a continuous- ow system: effect of PH. J Dent Res 2003; 82: 829–832.
18. Lobo MM, Pecharki GD, Tengan C, da Silva DD, Tagliaferro EP, Napimoga MH. Fluoridereleasing capacity and cariostatic effect provided by sealants. J Oral Sci 2005; 47: 35-41.
19. Arrow P, Riordan PJ. Retention and caries preventive effects of a GIC and a resin based fissure sealant .Community Dent Oral Epidemiol 1995; 23: 282-285.
20. De Craene GP, Martens C, Dermaut R, Surmont AS. A Clinical evaluation of a light cured fissure sealant. ASDC J Dent child 1989; 56: 97-102.
21. Gwinnett AJ. The adaptation of visible light cured calcium hydroxide liner to dentin. Quintessence Int 1984; 19: 111-115.
22. Forss H, Halme E. Retention of a glass ionomer cement and a resin-based fissure sealant and effect on carious outcome after 7 years. Community Dent Oral Epidemiol 1998; 26: 21-25.
23. Karlzen-Reuterving G, Van Dijken JW. A three year follow up of glass ionomer cement and resin sealant. ASDC J Dent Child; 1995; 62: 108-110.
24. Songapaisan Y, Bratthall D, Phantumvanit P, Somridhivej Y. Effects of glass ionomer cement, resin based pit and fissure sealant and HF applications on occulusal caries in a developing country field trial. Community Dent Oral Epidemiol; 1995; 23: 25-29.
25. Williams B, Laxton L, Holt R.D, Winter GB. Fissure sealants: A 4 year clinical trial comparing an experimental glass polyalkenoate cement with a bisglycidy1 methacrylate resin used as fissure sealants. Br Dent J 1996; 180: 104-108.
26. Baseggio W, Naufel FS, Davidoff DC, Nahsan FP, Flury S, Rodrigues JA.Caries-preventive efficacy and retention of a resin-modified glass ionomer cement and a resin-based fissure sealant: a 3-year split-mouth randomised clinical

trial. Oral Health Prev Dent 2010; 8: 261-8.
27. comparative study of two fissure sealants: a 2 year clinical follow up. J Oral Rehabil 2004; 31: 979-984.
28. Rock WP, Weatherill GDJ, Anderson RJ. Retention of three fissure resin sealants; the effects of etching agent and curing method results over 3 years. Br Dent J 1990; 168: 323-325.
29. Vrbic FV. Sealing of primary and permanent teeth with Helioseal F. J Dent Res 1997; 76: Abst. No.1421.
30. Kuşgöz A, Tüzüner T, Ulker M, Kemer B, Saray O. Conversion degree, microhardness, microleakage and fluoride release of different fissure sealants. J Mech Behav Biomed Mater 2010; 3: 594-9.
31. Markovic DL, Petrovic BB, Peric TO. Fluoride content and recharge ability of five glassionomer dental materials. BMC Oral Health 2008; 8:21.

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