

Clinical Success of Fluoride-Releasing Fissure Sealant in Permanent First Molars: 5-Year Retrospective Study

SUMMARY

Background/Aim: It is important to prevent caries on permanent first molars. Fissure sealants are very effective in protecting fissures from caries. The study aimed to determine the clinical success of fluoride-releasing fissure sealants in permanent first molars in the long term. **Material and Methods:** 64 children with 256 healthy erupted first permanent molars and followed for 5 years, comprised the study. Children who received a fluoride-releasing fissure sealant and came regularly to controls throughout 5 years were evaluated by retention rate and development of new caries and compared with a control group. **Results:** The complete retention rate of fluoride-releasing fissure sealants was 48.5% and 10.7 % of the sealed teeth had caries after 5 years. 25% of the teeth without fissure sealant were decayed after five years. There was no significant difference between the rate of retention of fissure sealants and the frequency of tooth brushing after 1 year. There was no significant difference between the rate of retention of fissure sealants and oral hygiene status of children after 1 year. **Conclusions:** The fluoride-releasing fissure sealants were effective for the prevention of caries on pit and fissures of permanent molars and long-term clinical success was satisfying.

Keywords: Fluoride Releasing Fissure Sealants, Fissure Sealants, Retention, Fluoride, Caries

Berna Kuter¹, Ece Eden², Nese Guler³

¹ Department of Paediatric Dentistry, Faculty of Dentistry, Izmir Demokrasi University, Izmir, Turkey

² Department of Paediatric Dentistry, Faculty of Dentistry, Ege University, Izmir, Turkey

³ Measurement and Evaluation in Education, Education Faculty, Izmir Democracy University, Izmir, Turkey

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Introduction

Fissure and pit surfaces are more susceptible to caries than other tooth surfaces and topical fluorides have less caries prevention effect in fissures than other surfaces. The water fluoridation, diet, and plaque controls decrease the caries prevalence. This decline is seen especially on the smooth surfaces¹. It is difficult to clean pit and fissures and the plaque retentive nature of them increase the risk of caries^{1,2}. The largest plaque accumulation is in the fissures of erupting permanent molars³. It was shown that there was a rapid progression of caries in this surface and fissure surfaces were eight times more vulnerable to tooth decay than smooth surfaces⁴.

Fissure sealant applications are a very effective preventive approach to protect fissures from caries by producing a barrier². It was reported that 74% of permanent sealed teeth were caries-free after 15 years⁵.

The American Dental Association and the American Academy of Pediatric Dentistry advised the application of fissure sealants for fissure caries^{2,6}. There are several different formulations in resin-based fissure sealants⁴. The fluoride-releasing fissure sealants (FRFS) are grouped as the fourth generation. This product includes fluoride-releasing particles to inhibit caries⁵.

Both fluoride varnish and fissure sealants showed similar protection for fissures in a recent randomized clinical study⁷. Muller-Bolla et al stated that the effects of the sealants were similar regardless of whether they contained fluoride or not⁸. However, it was stated in the literature that FRFS could have a cariostatic effect on the fissures of teeth⁹. For this reason, it is important long-term clinical studies to determine clinical retention and the cariostatic effect of FRFS. Therefore, this study aimed to evaluate the clinical success of fluoride-releasing fissure sealant using survival rate and caries as the outcomes.

Table 2. Retention-Caries Status and Frequency of Toothbrushing (1. Year)

Tooth Number	Frequency of Toothbrushing	Complete retention (no caries) (n)	Partial retention (no caries) (n)	Partial retention (caries) (n)	Missing (no caries) (n)	Missing (caries) (n)	person	<i>p</i>
16	None	1	1	0	0	0	2	0.648
	Occasionally	6	1	1	0	0	8	
	Once a day	5	3	0	0	0	8	
	Twice a day	8	4	0	0	0	12	
26	None	0	2	0	0	0	2	0.544
	Occasionally	4	3	1	0	0	8	
	Once a day	4	4	0	0	0	8	
36	Twice a day	6	6	0	0	0	12	0.137
	None	1	1	0	0	0	2	
	Occasionally	4	3	1	0	0	8	
46	Once a day	8	0	0	0	0	8	0.636
	Twice a day	11	1	0	0	0	12	
	None	1	1	0	0	0	2	
	Occasionally	6	1	1	0	0	8	
	Twice a day	6	2	0	0	0	8	
	Twice a day	10	2	0	0	0	12	

Table 3. Retention-Caries and Oral Hygiene of Children (1. Year)

Tooth Number	Oral Hygiene	Complete retention (no caries) (n)	Partial retention (no caries) (n)	Partial retention (caries) (n)	Missing (no caries) (n)	Missing (caries) (n)	person	<i>p</i>
16	poor	6	4	0	0	0	10	0.606
	medium	8	4	1	0	0	13	
	well	6	1	0	0	0	7	
26	poor	6	4	0	0	0	10	0.698
	medium	5	7	1	0	0	13	
	well	3	4	0	0	0	7	
36	poor	6	4	0	0	0	10	0.110
	medium	12	0	1	0	0	13	
	well	6	1	0	0	0	7	
46	poor	7	3	0	0	0	10	0.519
	medium	11	1	1	0	0	13	
	well	5	2	0	0	0	7	

There was no significant difference between the caries formation and the frequency of tooth brushing after 1 year in the children who applied fissure sealants was reported in Table 2. ($p>0.05$). There was no significant difference between the rate of retention of fissure sealants and the frequency of tooth brushing after 1 year. ($p>0.05$). There was no significant difference between the rate of retention of fissure sealants and oral hygiene status of children after 1 year. ($p>0.05$) Table 3.

Discussion

The risk of fissure caries formation is the highest in the first and second years after the eruption of posterior teeth^{10,11}. Fissure sealants are an effective tool for the prevention of the caries of the pit and fissures in permanent molar teeth¹². American Academy of Paediatric Dentistry declared that fissure sealants reduce the incidence of carious on pit and fissures compared to the non-use of sealants².

There are several different types of resin fissure sealants with different particle sizes, different formulations, and application methods. FRFS has the advantage of fluoride incorporated with fluoride-releasing particles within the material. However, Simonsen reported that FRFS was not a fluoride reservoir that provided a long-term release of fluoride and for this reason, this kind of sealants provide no additional clinical benefit⁴.

The retention of fluoride-containing fissure sealants could be similar to resin fissure sealants⁹. Morphis *et al.*, declared that fissure sealant retention was not adversely affected by the presence of fluoride¹³. It was reported that the fluoride content did not make a difference between the two materials in terms of the caries prevention effect. Moreover, it was stated that the sealant retention was not a valid predictor itself for caries and there was no statistically significant difference regarding caries when comparing light polymerizing resin-based sealants with FRFS at 12 months¹⁴. However, another study showed significantly better retention for light polymerizing resin-based sealants compared with FRFS at the 48-months follow-up¹⁵. Kobayashi *et al.*, also stated that resin-based sealant without fluoride exhibited the best performance regarding both retention and surface characteristics compared to FRFS for 2 years¹⁶. The percentage of retention of FRFS was 34.6%, that of the resin-based sealant without fluoride was 66.0% for 2 years in that study. The retention of FRFS was better than that of glass ionomer sealant in another study, however, their effectiveness in preventing fissure caries did not differ in 2 years period¹⁷. It was found that the percentage of

retention of FRFS was 56.7% for 2 years in the present study.

As the effectiveness of fissure sealant material is related to its bonding to the enamel, the retention of the fissure sealant is of great significance⁴. Colombo and Ferrazzano stated that sealants provide 100% caries prevention effect as long as they remain in the fissures and the retention rate after the first year was 85-100%¹⁸. Kobayashi *et al.*, reported that the percentage of retention of FRFS was 55.4% after the first year¹⁶. Ismail and Gagnon reported that most of the failure happened within the first year after the application of the fissure sealants¹⁹, similarly, most of the failure of FRFS occurred within the first year in this study, and the retention rate for FRFS was 67.5%. Colombo and Beretta showed that sealant loss was 50% after five years in their study. For this reason, they recommended replacing them after five years. Kühnisch *et al.*, reported that the five years retention rate for FRFS sealants was 69.9%²¹. However, the retention rate was 48.5 % after five years, in the present study.

Fissure sealants have been advised to reduce the incidence of dental caries in children²². It was reported that fissure sealants had a preventive effect against fissure caries in the studies^{23,24}, and should be used to high caries risk children for preventing progression of incipient caries lesions²⁴. The benefits of sealed teeth on low-caries risk children are controversial²⁵. AAPD declared that it was necessary to classify the children according to their caries risk²⁶. Oral hygiene, general health status, and fluoride prophylaxis have an important role in deciding the necessity of applying fissure sealants²⁷. In the present study, the rate of retention of fissure sealants and oral hygiene status of children after 1 year were not statistically different. Besides, the rate of retention of fissure sealants and the frequency of tooth brushing after 1 year were not statistically different.

Zin *et al.*, reported that although FRFS released a lower amount of fluoride, their anti-demineralization efficacy of them was greater than that of glass ionomer sealants²⁸. However, it was reported that both FRFS and high-viscosity glass ionomer sealants protected caries on the surface of primary molars²⁹. It was presented parallel results with this study by reporting that FRFS might provide an anti-demineralization effect on adjacent unsealed surfaces²⁸. Few of the teeth that used FRFS before were decayed after 5 years. For this reason, it was thought that FRFS could have an anti-demineralization effect and prevent caries formation. The limitations of the study are the use of only one fluoride-releasing fissure sealant and the low number of teeth.

Conclusions

In a conclusion, the present study demonstrated that the percentage of caries on the teeth was lower on sealed permanent molars. Even if the sealant was missed, its effect of preventing caries on the tooth surface could continue for a long time. Public health programs should include oral health education, effective toothbrushing and sealants for overall success.

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Correspondence

Berna Kuter
Department of Paediatric Dentistry
Faculty of Dentistry, Izmir Demokrasi University, Turkey
e-mail: berna.kuter@idu.edu.tr