



Use of Glass Ionomer Sealants in The Prevention of Occlusal Caries in Pediatric Permanent Teeth

Merniwati Sherly Eluama^{a,1*}, Leny Marlina A. Pinat^a, Mery Novaria Pay^a, Applonia Leu Obi^a, Agusthinus Wali^a

^a Department of Dental Health, Poltekkes Kemenkes Kupang, Kupang, Indonesia

¹ sherlyeluama@gmail.com*

* Corresponding Author

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ABSTRACT

In Indonesia, according to the Riskesdas data, only 0.1% of 15-year-old children received fissure sealant treatment. Glass ionomer sealants can prevent caries on newly erupted permanent molars and are a good alternative because they are cheaper, painless, and easy to apply. The study aimed to evaluate the retention of glass ionomer sealants in preventing occlusal caries on permanent molars in children. The research method used an experimental design. The independent variable was the filling of deep fissures with Fuji VII glass ionomer, and the dependent variable was the occlusal status of the left and right lower first permanent molars, which included teeth that had been sealed with glass ionomer (intact sealant, partially lost, completely lost, either caries-free or carious). The population consisted of primary school children in Manefu, East Baumata Village. The research sample was selected using purposive sampling, targeting primary school children aged 7-10 years at SD Manefu who had deep fissures and were willing to participate. Data collection involved clinical trials, including sealing the left and right lower first permanent molars with Fuji VII glass ionomer and evaluating the sealant retention after six months. Data were processed and analyzed using descriptive statistical tests. The results showed that nine molars had good retention (23.68%), five molars had partially lost their sealant (13.15%), 31.57% of molars were caries-free despite losing their entire sealant, and 31.57% of molars developed caries after losing their entire sealant. Overall, 26 molars (68.42%) treated with fissure sealing were protected from caries. Initial enamel caries lesions occurred in 31.58% of sealed molars whose sealants had dislodged. In conclusion, the use of glass ionomer sealants demonstrated a retention effect and prevented occlusal caries on permanent molars in children by up to 68.42%.

INTRODUCTION

Dental caries is the most common chronic disease worldwide, characterized by a multifactorial etiology and a slow evolution that causes damage to the hard tissues of the teeth (Veiga et al., 2016). According to Paula, Tôrres, Ambrosano, & Mialhe, (2012), dental caries significantly impact the quality of life related to children's oral health. The most caries-prone surfaces in young patients are the occlusal surfaces of the first and second permanent molars, with pits and fissures accounting for more than 80% of caries in children (Siegal, Farquhar, & Bouchard, 1997; Feigal & Donly, 2006).

Current clinical evidence indicates that pit and fissure sealant treatments are effective for preventing dental caries, particularly when used in high-risk children (Locker, Jokovic, & Kay, 2003; Albert, 1999). Most sealants are applied in private dental clinics, which can be relatively expensive. The highest risk of caries is among children who find it difficult to access dental care in private clinics due to financial constraints (Siegal et al., 1997). This lack of access to preventive dental care means many children do not receive sealant treatments (Devlin & Henshaw, 2011). Consequently, preventive dental services are underutilized by both patients and dental health professionals, leading to fewer than one-fifth of children aged 5-17 years receiving sealant treatments (Albert, 1999).

In Indonesia, according to Riskesdas data, the percentage of children aged 5 and 12 years who received fissure sealant treatment is 0%, while only 0.1% of 15-year-old children have ever received fissure sealant treatment. This indicates the low reach of dental and oral disease prevention programs in the community, despite the high caries rate among children (DMF-T for 12-year-olds is 1.9) and increasing with age (Badan Penelitian dan Pengembangan Kesehatan, Kementerian Kesehatan Republik Indonesia, 2019)

Based on an initial survey, it was found that 100% of the community in East Baumata Village only use dental health services when experiencing toothache and do not engage in routine dental check-ups. This situation could lead to caries in children with high caries risk if no early preventive measures are taken. One preventive measure for school children is the application of glass ionomer sealants. Glass ionomer sealants can prevent caries on newly erupted permanent molars (Markovic, Peric, & Petrovic, 2018) and can be a good alternative when resources for resin sealant placement are unavailable (Liu, et al., 2014). Glass ionomer has also proven to be a simple, painless caries management approach that can improve the quality of life-related to oral health in school children (Feigal & Donly, 2006). This study aims to evaluate the retention of glass ionomer sealants in preventing occlusal caries on children's permanent molars.

METHOD

The research design used is a quasi-experimental study with a single-subject design, where a single group of samples will be treated by sealing the fissures on permanent molars using glass ionomer and evaluating the sealant retention after six months. The independent variable in this study is the application of glass ionomer sealant on deep fissures, and the dependent variable is the condition of the occlusal surfaces of the lower left and right permanent molars, categorized as teeth with intact glass ionomer sealant, partially lost glass ionomer sealant, or completely lost glass ionomer sealant (with the condition of the tooth being either caries-free or carious).

The population in this study consists of 91 children from Manefu Elementary School in East Baumata Village, Taebenu District. The sample was selected using purposive sampling, targeting primary school children aged 7 to 10 years at Manefu Elementary School who have deep fissures and are willing to participate in the study. The sample size is 30 students, consisting of 19 boys and 11 girls. Data collection involved clinical testing methods, including sealing the deep fissures on permanent molars with glass ionomer and evaluating sealant retention six months later. Ethical approval was obtained from the ethics committee of Poltekkes Kemenkes Kupang with No.LB.02.03/1/0145/2023.

In the implementation phase, school children with healthy lower left and right first permanent molars with deep fissures were recruited. The subjects were informed about the

procedures, including data collection on respondent identity (gender, age, address), the application of glass ionomer sealant to deep fissures, and an evaluation of the sealant retention on the occlusal surfaces of the lower left and right first permanent molars after six months (whether the sealant is intact, partially lost, or completely lost, and whether the tooth is caries-free or carious). The collected data were then processed and analyzed using descriptive statistical tests to assess the retention of glass ionomer sealant in preventing occlusal caries in children's permanent molars.

RESULTS AND DISCUSSION

A total of 38 teeth from 30 students, consisting of 19 boys and 11 girls, received glass ionomer sealant treatment. The sealant was applied to the first permanent lower left and right molars, with 20 applications on the lower left permanent first molar and 18 applications on the lower right permanent first molar. The average age of the individuals at the time of treatment ranged from 7 to 10 years. Data were obtained from evaluations conducted six months post-treatment. The results were tabulated to assess the retention of the glass ionomer sealant applied earlier, categorized as the sealant intact, partially lost, or completely lost. These results were statistically compared using descriptive statistical tests. The evaluation results after six months of follow-up are as follows:

Table 1. Evaluation results of fissure sealant using Glass Ionomer Cement Fuji VII after six months

No	Tooth element	Whole		Partially Missing		Missing Entirely			
		N	%	N	%	Caries-free		Caries	
						N	%	N	%
1	36	6	15,79	0	0,00	6	15,79	6	15,79
2	46	3	7,89	5	13,16	6	15,79	6	15,79
Total		9	23,68	5	13,16	12	31,58	12	31,58

Follow-up evaluation after six months showed that nine molars had good retention (23.68%), five molars had partially lost their filling material (13.15%), 31.57% of the molars were caries-free even though they had lost all their filling material, and 31.57% of the molars had developed caries after losing all their filling material. This study indicates that 26 molars (68.42%) treated with fissure sealant were protected against occlusal caries. Initial caries formation in the enamel occurred in 31.58% of the sealed teeth where the filling had come off.

DISCUSSION

The use of pit and fissure sealants provides a physical barrier that prevents the accumulation of microorganisms and food particles, thereby preventing the initiation and progression of caries (Liu et al., 2019; Beauchamp et al., 2008). Glass ionomer sealants have been proposed for sealing pits and fissures since 1974 (Perondi, Oliveira, Cassoni, Reis, & Rodrigues, 2014). They contain fluoride, which helps prevent caries through its long-term release (Ahovuo-Saloranta et al., 2017). Sealant retention can be evaluated through visual and tactile examination (Beauchamp et al., 2008). In this study, evaluations were conducted using visual and tactile methods six months post-fissure sealing. The results showed that 23.68% of the first permanent lower molars had good retention, 13.15% had partially lost their filling material, 31.57% were caries-free despite losing all their filling material, and 31.57% had developed caries after losing all their filling material.

The evaluation found that nine first permanent lower molars had good retention (23.68%). This is consistent with the findings of Markovic et al., (2018), who reported that glass ionomer material for fissure sealing can prevent caries in 65% of newly erupted permanent molars. According to Cvikl, Moritz, & Bekes (2018), sealing pits and fissures in both primary and permanent teeth is safe and effective in preventing and stopping caries.

Five molars had partially lost their filling material (13.15%). The loss of glass ionomer sealant material is attributed to its low strength against occlusal forces, leading to faster disintegration, thinning of the sealant, and eventually breaking of the enamel surface (Ninawe, Ullal, & Khandelwal, 2012). According to Beauchamp et al. (2008), about 5% to 10% of sealants require repair or replacement annually, and if the sealant is partially lost, reapplication is necessary.

A total of 31.57% of the molars were caries-free despite losing all the sealant material, indicating that while the retention of glass ionomer sealants is lower compared to resin-based sealants, they are still effective in preventing dental caries (Liu et al., 2014). This also demonstrates that sealants can be effectively used to prevent the initiation and early progression of dental caries (Beauchamp et al., 2008). The American Academy of Pediatric Dentistry recommends that glass ionomer sealants be used as a temporary measure and replaced with resin-based sealants when proper isolation is feasible (Wright et al., 2016). Sreedevi et al., (2022) also suggest that glass ionomer sealants can be used temporarily for caries prevention when resin sealant placement is not possible.

The study shows that 68.42% of the teeth treated with fissure sealants were protected against occlusal caries. This is because the material releases fluoride and is bioactive, gradually developing a strong and durable ion exchange layer with the tooth (Ramamurthy et al., 2022). These findings align with the research of Markovic et al. (2018), which found that fissure sealant treatment can prevent caries in 65% of newly erupted permanent molars evaluated after thirteen years. Additionally, Mathew et al. (2016) reported that sealants are highly effective in preventing damage to the occlusal surfaces of teeth, with 92% to 96% of sealants remaining intact one year later. Liu et al. (2014) found that 93% of molars showed no caries development after receiving ART sealants.

Initial caries formation in the enamel occurred in 31.58% of sealed teeth where the filling had come off. This may be due to the low retention rate of glass ionomer material for fissure sealing (Markovic et al., 2018). Chen et al. (2012) also found dentine caries lesions in 25 children who had sealants. This could be due to the multifactorial nature of caries, including diet, oral hygiene maintenance, behavioural, psychological, and social factors (Zero, 2004). Therefore, caries can still occur in sealed teeth if these other factors are not adequately managed. Long-term success depends on regular check-ups and reapplication of the sealant if needed. Moreover, fissure sealing should be accompanied by other preventive measures for patients at high risk of caries (Naaman, El-Housseiny, & Alamoudi, 2017).

CONCLUSION

The use of glass ionomer sealant has a retention effect and prevents occlusal caries in permanent molars of children up to 68.42% over six months.

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