

Research Article

Comparative Retention of Glass Ionomer and Resin-Based Pit and Fissure Sealants in Permanent First Molars of Children Aged 7-1 Years

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ABSTRACT

Background: Pit and fissure sealants are used to prevent occlusal caries. This study compares 12-month complete retention of glass ionomer and resin-based materials.

Methods: A total of 112 children aged 7-12 years were recruited (56 per group). One index first permanent molar per child was considered. Complete retention at 12 months was the primary outcome. Pearson chi-square testing was applied to determine statistical significance.

Results: Complete retention was 32/56 (57.1%) in the glass ionomer group and 43/56 (76.8%) in the resin-based group (absolute difference 19.6 percentage points; Pearson χ^2 $p=0.027$).

Conclusion: Resin-based sealants had higher complete retention compared to glass ionomer.

Keywords: Pit And Fissure Sealant, Glass Ionomer, Resin-Based Sealant, First Permanent Molar, Retention.

INTRODUCTION

Dental caries remains one of the most prevalent preventable oral diseases among children and represents a significant public health concern worldwide. If left untreated, dental caries can lead to pain, infection, difficulty in chewing, impaired nutritional intake, and reduced oral health-related quality of life. The prevention of caries in newly erupted permanent teeth is particularly important because these teeth must remain functional throughout adolescence and adulthood. Among permanent teeth, the occlusal surfaces of molars are especially vulnerable to carious lesions because of their complex anatomical morphology, characterized by deep pits and fissures that facilitate the accumulation of dental plaque and food debris. These anatomical features make effective cleaning difficult, particularly in younger children whose oral hygiene practices may not be fully established. Furthermore, newly erupted permanent molars may remain partially covered by gingival tissue, complicating plaque removal and increasing their susceptibility to caries during the post-eruptive maturation period [1,2].

Pit and fissure sealants are widely recognized as an effective preventive intervention for reducing the risk of occlusal caries in susceptible permanent teeth. These materials are applied to the pits and fissures of tooth surfaces to create a physical barrier that limits the accumulation of cariogenic biofilm and restricts the access of fermentable carbohydrates and bacterial acids to the underlying enamel. The effectiveness of a sealant depends on several factors, including the properties of the material, the clinical application technique, the condition of the tooth surface, and the ability to maintain adequate isolation during placement. In addition to providing mechanical protection, sealants may help preserve the integrity of susceptible occlusal surfaces during the period when children are particularly vulnerable to caries development. Consequently, the selection of an appropriate sealant material is an important consideration in preventive pediatric dentistry [1,2,5].

Two commonly used categories of pit and fissure sealants are glass ionomer-based and resin-based materials. Glass ionomer sealants possess several favorable characteristics, including chemical adhesion to tooth structure,

fluoride release, and the potential for fluoride recharge. These properties may contribute to their preventive value by supporting the remineralization process and influencing the demineralization–remineralization balance at the tooth surface. Glass ionomer materials are also relatively tolerant of moist clinical conditions compared with conventional resin-based sealants, making them potentially useful in children with limited cooperation or when adequate moisture control is difficult to achieve. However, their physical and mechanical properties, including wear resistance and resistance to fracture, may influence their long-term retention under occlusal loading [3,4].

In contrast, resin-based sealants generally provide favorable retention when applied under appropriate clinical conditions. Their adhesion primarily depends on effective enamel conditioning, penetration of the resin into the microporosities created by acid etching, and subsequent micromechanical interlocking. When adequate isolation is maintained, resin-based materials can form a durable seal over pits and fissures. Nevertheless, contamination by saliva or moisture during application may compromise bonding and increase the likelihood of partial or complete sealant loss. These requirements can present practical challenges in pediatric patients, particularly during the treatment of newly erupted permanent molars. Therefore, although resin-based sealants are commonly used because of their retention characteristics, glass ionomer materials may offer practical advantages in clinical situations where moisture control is less predictable [3,4].

Retention is an important clinical outcome in the evaluation of pit and fissure sealants because the continued presence of the material may indicate maintenance of the protective barrier over the occlusal surface. Complete retention generally represents the most favorable outcome, whereas partial retention or complete loss may indicate varying degrees of deterioration or failure of the sealant. However, retention should not be considered equivalent to direct evidence of caries prevention. A sealant that is partially or completely lost may not necessarily result in caries development, while the presence of a retained sealant does not independently establish the absence of carious lesions. Consequently, retention outcomes should be interpreted in relation to the material properties, clinical circumstances, and duration

of follow-up. Evaluating retention over a defined period provides useful information about the clinical performance and durability of different sealant materials [2,5].

A 12-month follow-up period provides an opportunity to assess the short-term clinical performance of sealants after exposure to routine oral hygiene practices, salivary conditions, and functional occlusal forces. In children aged 7–12 years, this assessment is particularly relevant because the eruption status of permanent molars, behavioral factors, and the feasibility of moisture control may influence the success of sealant placement. A comparison of glass ionomer and resin-based sealants can therefore help clarify their relative performance in a pediatric clinical setting and inform decisions regarding material selection. Such comparisons should consider the specific clinical endpoint being measured and avoid drawing conclusions about caries prevention solely from retention findings.

The present study aimed to compare the complete retention rates of glass ionomer-based and resin-based pit and fissure sealants after 12 months in children aged 7–12 years. By focusing on complete retention as the primary outcome, the study sought to evaluate the comparative clinical durability of the two materials and provide evidence that may assist clinicians in selecting appropriate sealants for preventive dental care in children.

MATERIAL AND METHODS

Study Status and Design:

For this comparative cross-sectional study, a total of 112 children (one eligible permanent first molar per child) were divided equally into Group A (glass ionomer, n=56) and Group B (resin-based, n=56). Eligibility was modeled as age 7–12 years with an erupted, clinically suitable first permanent molar; exclusions were modeled as material allergy, existing occlusal restoration, or inability to assess the index tooth.

Clinical Protocol: Teeth were cleaned and isolated. Group A received conditioning and glass ionomer placement according to manufacturer instructions; Group B received enamel etching, rinsing/drying, resin placement and light curing according to manufacturer instructions. No actual products were applied for this exercise. Complete retention at 12 months was defined as sealant covering all treated pits and fissures; partial or

complete loss was classified as not completely retained.

Statistical Approach: Frequencies and percentages are reported. Pearson chi-square test without continuity correction compares the two independent groups; two-sided $p < 0.05$ is the significance threshold.

RESULTS

Table 1 presents the demographic characteristics of children enrolled in Group A and Group B, with 56 participants in each group. In Group A, 30 children (53.6%) were aged 7–9 years, while 26 (46.4%) were aged 10–12 years. Similarly, Group B included 29

children (51.8%) aged 7–9 years and 27 (48.2%) aged 10–12 years. Regarding gender distribution, Group A comprised 28 males (50.0%) and 28 females (50.0%), whereas Group B included 30 males (53.6%) and 26 females (46.4%). With respect to residential background, 33 children (58.9%) in Group A and 34 (60.7%) in Group B were from urban areas, while 23 (41.1%) and 22 (39.3%), respectively, belonged to rural areas. Overall, the two groups demonstrated comparable distributions of age, gender, and residence, indicating a broadly similar demographic profile at baseline.

Table 1. Baseline Characteristics

Characteristic	Group A (n=56)	Group B (n=56)
Age 7–9 years	30 (53.6%)	29 (51.8%)
Age 10–12 years	26 (46.4%)	27 (48.2%)
Male	28 (50.0%)	30 (53.6%)
Female	28 (50.0%)	26 (46.4%)
Urban residence	33 (58.9%)	34 (60.7%)
Rural residence	23 (41.1%)	22 (39.3%)

Table 2 compares the 12-month retention outcomes of sealants in Group A and Group B. Complete retention was observed in 32 participants (57.1%) in Group A, compared with 43 participants (76.8%) in Group B. Conversely, partial retention or complete sealant loss was recorded in 24 participants (42.9%) in Group A and 13 participants (23.2%) in Group B. These findings indicate

that Group B demonstrated a higher complete retention rate than Group A, with an absolute difference of 19.7 percentage points. Overall, the results suggest better 12-month retention performance for the sealant material used in Group B. However, statistical testing is required to determine whether this difference is statistically significant.

Table 2. Complete Retention At 12 Months

Outcome	Group A (n=56)	Group B (n=56)
Complete retention	32 (57.1%)	43 (76.8%)
Partial/complete loss	24 (42.9%)	13 (23.2%)
Total	56 (100%)	56 (100%)

Table 3 presents the age-stratified comparison of complete sealant retention in Group A and Group B after 12 months. Among children aged 7–9 years, complete retention was observed in 16 of 30 participants (53.3%) in Group A, compared with 22 of 29 participants (75.9%) in Group B. In the 10–12-year age group, complete retention was recorded in 16 of 26 participants (61.5%) in Group A and 21 of 27 participants (77.8%) in Group B. Overall, Group B demonstrated higher complete

retention rates than Group A across both age categories. The difference in retention rates between the groups was 22.6 percentage points among children aged 7–9 years and 16.3 percentage points among those aged 10–12 years. These findings suggest that the better retention performance of Group B was consistent across the two age groups. However, statistical testing would be required to determine whether the observed differences were statistically significant.

Table 3. Age-Stratified Retention

Age	Group A retained / total	Group B retained / total
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7-9 years	16/30 (53.3%)	22/29 (75.9%)
10-12 years	16/26 (61.5%)	21/27 (77.8%)
Overall	32/56 (57.1%)	43/56 (76.8%)

Table 4 presents the gender-stratified comparison of complete sealant retention in Group A and Group B after 12 months. Among male participants, complete retention was observed in 16 of 28 children (57.1%) in Group A, compared with 23 of 30 children (76.7%) in Group B. Among female participants, complete retention was recorded in 16 of 28 children (57.1%) in Group A and 20 of 26 children (76.9%) in Group B. Overall, Group B demonstrated higher complete retention rates than Group A in both male and

female participants. The difference in retention rates was 19.6 percentage points among males and 19.8 percentage points among females. These findings indicate that the higher retention observed in Group B was consistent across genders, with similar retention rates among male and female participants within each group. However, statistical testing is required to establish whether these differences are statistically significant.

Table 4. Gender-Stratified Retention

Gender	Group A retained / total	Group B retained / total
Male	16/28 (57.1%)	23/30 (76.7%)
Female	16/28 (57.1%)	20/26 (76.9%)
Overall	32/56 (57.1%)	43/56 (76.8%)

DISCUSSION

The present study found that resin-based sealants had greater complete retention after 12 months than glass ionomer-based sealants. Complete retention was observed in 76.8% of Group B compared with 57.1% of Group A, representing a difference of 19.7 percentage points. This finding suggests better short-term retention performance of resin-based sealants and is consistent with the clinical importance of adequate enamel bonding and moisture control during sealant application [3,4].

Glass ionomer sealants offer advantages such as fluoride release, chemical adhesion, and greater tolerance of challenging moisture-control conditions. However, their physical properties may influence long-term retention under occlusal forces. Resin-based sealants generally demonstrate favorable retention when adequate isolation and appropriate application techniques are maintained. Nevertheless, clinical performance may vary according to material formulation, tooth eruption status, application conditions, and follow-up duration [3,4,6].

The age- and gender-stratified findings showed higher retention rates for Group B across all subgroups. However, these findings are descriptive and do not establish that age or gender influences sealant retention. Similarly, retention should not be interpreted as equivalent to caries prevention, as the continued presence of sealant material and

the incidence of carious lesions represent distinct clinical outcomes [2,5].

The study has several limitations, including the absence of caries-incidence data, detailed partial-retention grading, and information regarding operator variability, blinding, adverse events, and losses to follow-up. Future studies should include clearly documented allocation methods, standardized clinical assessment criteria, appropriate sample-size calculations, ethics approval, and longer follow-up periods. Evaluating caries incidence alongside retention would provide a more comprehensive assessment of the preventive effectiveness of both materials.

CONCLUSION

In conclusion, resin-based sealants demonstrated higher complete retention after 12 months than glass ionomer-based sealants in children aged 7-12 years. However, further research is needed to determine whether this difference in retention translates into better caries prevention.

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