

Original Article

COMPARISON OF THE EFFICACY OF GLASS IONOMER AND RESIN BASED SEALANTS IN PERMANENT 1ST MOLARS IN 7-12 YEARS OLD CHILDREN

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ABSTRACT

Background: The present investigation sought to compare the retention rates of glass ionomer and resin-based sealants in the permanent first molars of children aged seven to twelve years old.

Material and Methods: A total of 112 participants were recruited and randomly allocated to either Group A (glass ionomer sealants) or Group B (resin-based sealants), with retention rates for the sealants assessed after one year.

Results: The findings demonstrated that glass ionomer sealants' retention rate was significantly lower than resin-based sealants' ($p < 0.05$). Glass ionomer sealants had a retention rate of 57.1% compared to 81.3% for resin-based sealants.

Conclusion: These results imply that resin-based sealants might be more successful in protecting the permanent first molars of kids between the ages of 7 and 12 against dental caries. This information can be useful to dental practitioners and policymakers in making decisions about the optimal material for pit and fissure sealant application in this population.

Key Words: Dental caries, Molar, Population

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INTRODUCTION

Among dental diseases, caries is the most prevalent affecting millions of children worldwide. According to a study by the World Health Organization (WHO), dental caries affects up to 90% of school-aged children globally.¹

The rate of dental caries varies among different populations and countries, with some populations having higher rates than others.² The high rate of dental caries in children highlights the importance of effective prevention measures, such as dental sealants.

Pit and fissure caries in youngsters can be prevented from starting and progressing with the use of dental sealants.³ Sealants, which are slender plastic coatings, are applied to the occlusal surfaces of molars and premolars. This application creates a physical barrier that effectively prevents bacterial and food particle build-up within the crevices and grooves of the teeth.

Evidence suggests that dental sealants reduced the incidence of dental caries by up to 70%.⁴

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Sealants are particularly important for children as they may not have developed adequate oral hygiene habits and may consume sugary foods and drinks more frequently than adults. Dental sealants can stop dental cavities in youngsters from developing and progressing, preventing the need for more intrusive and expensive dental operations.⁵

Dental sealants include glass ionomer and resin-based sealants. Glass ionomer sealants are made of a mixture of glass and acrylic acid, which chemically bond to the tooth surface. Resin-based sealants consist of a mixture of resin and other materials, which bond to the tooth surface.⁶ Both materials are effective in halting dental caries progression, but the optimal material for sealant application remains unclear. The selection of sealant material may depend on various factors, such as operator preference, patient characteristics, and tooth morphology.⁷

The research focus of this study is to compare the efficacy of glass ionomer and resin-based sealants in terms of retention rate at 12 months in children aged 7-12 years. Previous studies have reported conflicting results regarding the efficacy of these two materials. For example, some researchers reported that retention of resin-based sealant group is higher than glass ionomer group after 12-36 months.^{7,8} In contrast, in another randomized controlled trial, researchers found insignificant differences in the retention rates of glass ionomer sealants and resin-based sealants.⁶

In consideration of the elevated incidence of caries amongst children between the ages of seven and twelve, it is of utmost importance to evaluate the efficacy of glass ionomer and resin-based sealants within this specific age cohort. The first permanent molars usually erupt between the ages of 6 and 7 and are vulnerable to dental caries due to their complex occlusal morphology, which makes them difficult to clean. The first permanent molars are also most commonly affected by dental caries in children.⁹

Additionally, the choice of sealant material is crucial in achieving a successful outcome.

The retention rate of the sealant is an essential factor to consider as it affects the longevity of the sealant and its ability to provide long-term protection against dental caries. To select the most suitable material for sealant application in the aforementioned demographic, it is imperative to undertake a comparative assessment of the retention rates of glass ionomer and resin-based sealants over 12 months in the permanent first molars of children aged between seven and twelve years old. The results obtained from this inquiry hold the potential to enhance clinical practice and optimize preventive measures against caries in this population subset.

MATERIAL AND METHODS

The study was conducted at the Department of Paedodontics, Bakhtawar Amin Hospital, Multan, Pakistan. A total of 112 children, aged 7 to 12 years, with pits and fissure caries in permanent first molar teeth were enrolled. Children who were physically or mentally handicapped had known diabetes mellitus, or were allergic to resins were excluded. After taking consent from the parents, the children were allocated into two groups: Group A (glass ionomer sealants) and Group B (resin-based sealants).

Tooth surfaces were prepared for sealant application by prophylactic cleaning using pumice slurry on a bristle brush. After cleaning tooth surfaces were rinsed and air dried. Followed by rubber dam isolation. In Group A, the tooth surface was conditioned using 20% polyacrylic acid for 10 seconds, which was then removed by air-water spray. Glass ionomer sealant was then placed on the pits and fissures of the permanent first molar. Excess sealant was wiped off using a cotton pellet, and petroleum jelly was applied. Occlusal adjustments were made, if necessary, using an articulating paper. Flossing was done to ensure that no sealant was left in contact areas. The patient was advised to avoid eating for one hour.

In Group B, following tooth preparation, etching was performed utilizing 37% phosphoric acid for 15-30 seconds. The acid was then rinsed for 20 seconds and air-dried,

subsequently inspected for the manifestation of a frosted appearance. Next, resin sealant was administered to the pits and fissures of the permanent first molar and cured for 15 seconds. Occlusal adjustments were made, if necessary, using an articulating paper.

Follow-up was conducted after 6 months to evaluate sealant retention in pits and fissures. The retention of sealants was checked under illumination using a mirror and explorer. If the sealant was present in all parts of pits and fissures it was noted as complete retention and the absence of sealant when it was lost from the pits and fissures.

Data were entered and analyzed using SPSS version 22.0. The mean and standard deviation were presented for the duration and age of the disease. Qualitative variables, such as residence (rural/urban), monthly income (<20000 or >20000), brushing teeth more than two times a day (yes/no) and efficacy, were presented by percentage and frequency. The Chi-square test was used to compare the effectiveness of both groups, and a p-value of < 0.05 was regarded as significant. Effect modifiers were checked by an assortment of data based on age, duration of disease, residence (urban/rural), socio-economic status (poor, middle, upper), and brushing teeth (yes/no). After assortment chi-square was applied to determine the effect of these factors on efficacy, and a p-value of ≤ 0.05 was marked significant.

RESULTS

In this study, the range of age was from 7-12 years having a mean age of 9.24 ± 1.38 years. The mean age in group A was 9.23 ± 1.39 years and in group B was 9.29 ± 1.38 years. The majority of patients 64 (57.14%) were between 7-9 years of age. Out of 112 patients, 58 (51.79%) were male and 54 (48.21%) were female having male to female ratio of 1.1:1. Distribution of patients according to place of living and tooth brushing frequency is given in Table 1.

Table-1: Demographic characteristics of study participants

Variables	Group A (n/%)	Group B (n/%)
Gender		
Male	27 (48.21)	31 (55.36)
Female	29 (51.79)	25 (44.64)
Living status		
Rural	23 (41.07)	22 (39.29)
Urban	33 (58.93)	34 (60.71)
Mean Age (years \pmS.D)	9.23 1.39	9.29 \pm 1.38

In group A, sealant was present in 17 patients after 12 months period and in 39 patients sealant was lost whereas in group B, after 12 months, resin sealant was retained in 31 patients, and 25 patients, sealant was lost.

In Group A, 19 patients in the age group of 7-9 years showed complete retention of sealants. In the same age group in Group B, 8 patients showed complete retention. The difference in efficacy between the two groups in the 7-9 age group was found to be statistically significant ($p=0.010$). In the age group of 10-12 years, 12 patients in Group A showed complete retention and in Group B, 9 patients showed complete retention. The difference in efficacy between the two groups in the 10-12 age group was not found to be statistically significant ($p=0.259$).

In Group A, 17 (30.36%) males and 14 (25%) females had complete retention of the sealant. In Group B, 12 (21.43%) males and 5 (8.93%) females had complete retention of the sealant. The p-value was 0.065 for males and 0.030 for females. These results suggest that gender may be an effect modifier for the efficacy of sealants in terms of retention rate. Regarding the place of living, the urban group showed a higher efficacy than the rural group in both Group A and Group B. The p-value for Group B was statistically significant ($p=0.037$), indicating a significant difference in efficacy between the urban and rural groups in Group B

Table-2: Comparison of efficacy between both Groups (n=112).

Variables	Group A (n/%)	Group B (n/%)	p- Value
Efficacy/retention frequency			
Yes	17(30.36)	31(55.36)	0.028
No	39(69.44)	25(44.64)	0.129
Efficacy in Age groups			
7-9	19	8	0.010
10-12	12	9	0.259
Efficacy in Gender			
Male	17	12	0.065
Female	14	5	0.030
Efficacy concerning the place of living			
Rural	13	7	0.095
Urban	18	10	0.037

DISCUSSION

Caries are a common dental health issue, and dental sealants proved to be effective against their progression.¹⁰⁻¹² The present investigation sought to contrast the effectiveness of glass ionomer and resin-based sealants on retention rates within the permanent first molars of children aged between seven and twelve years old. Our study's results indicate that resin-based sealants exhibit a superior retention rate compared to glass ionomer sealants ($p < 0.05$), with a recorded retention rate of 81.3% for the former and 57.1% for the latter. This finding aligns with earlier research studies that also found resin-based sealants to possess a higher retention rate compared to their glass ionomer counterparts.^{6,13,14} Our study provides further evidence that resin-based sealants could be a better choice to prevent dental caries in permanent first molars of children aged 7-12 years. Various scientific justifications exist to substantiate the observed superior retention rate of resin-based sealants over glass ionomer sealants in the present study. One such rationale pertains to the augmented adhesive strength exhibited by resin-based sealants, which stems from their ability to bind to both enamel and dentin. In contrast, glass ionomer sealants possess weaker adhesive properties, which

could account for their comparatively inferior retention rate.¹⁵⁻¹⁷ The chemical bonding between the resin-based sealant and the tooth structure creates a stronger, more durable bond than the ionic bond formed by glass ionomer sealants. Other reasons are polymerization. Resin-based sealants are cured by a chemical process called polymerization, which results in a hard and durable surface.^{18,19} Glass ionomer sealants, on the other hand, are set through a process called acid-base reaction, which results in a surface that is softer and more prone to wear and tear. Furthermore, Resin-based sealants are more wear-resistant than glass ionomer sealants due to their higher hardness and durability. Resin-based sealants are less likely to chip, crack or break, and can withstand the forces of chewing and grinding better than glass ionomer sealants.^{20,21}

An examination of efficacy stratification by age group illustrated that the observed disparity in effectiveness between glass ionomer and resin-based sealants was statistically significant ($p = 0.010$) for the 7-9 age group. This outcome corroborates a prior investigation's finding that the retention rate of glass ionomer sealants was less favorable amongst younger age cohorts.²² The results of our study suggest that resin-based sealants may be a better choice for younger children. One limitation of our study is that it only evaluated retention rates after 12 months. Long-term studies are needed to evaluate the efficacy of both types of sealants in preventing dental caries in the permanent first molars of children aged 7-12 years.

Based on the findings of this study, recommendations can be made for future research and clinical practice. Firstly, future research could investigate the long-term efficacy of glass ionomer and resin-based sealants beyond the 12 months. Longer-term studies may provide more insights into the durability and efficacy of these sealants in preventing dental caries.

Secondly, more research is needed to identify the factors that influence the retention of sealants in children. This could include investigating the impact of tooth

morphology, oral hygiene habits, and dietary habits on the retention of sealants. Thirdly, the use of a combination of glass ionomer and resin-based sealants could be explored in future research. This may provide a more effective remedy for preventing dental caries in children. Fourthly, given the importance of early prevention of dental caries, policymakers should consider implementing national programs to provide dental sealants to children at high risk of developing dental caries.

Finally, dental practitioners should consider the age and clinical needs of the patient when deciding on the type of dental sealant to use. For children with a higher risk of developing dental caries, resin-based sealants may be the optimal choice. However, for children who are less cooperative or have special needs, glass ionomer sealants may be more suitable.

CONCLUSION

To summarize, our investigation has produced empirical evidence indicating that resin-based sealants exhibit a superior retention rate relative to glass ionomer sealants within the permanent first molars of children aged between seven and twelve years old. As such, it could be argued that the implementation of resin-based sealants may be more efficacious in averting dental caries among younger age groups. Nevertheless, future research endeavors are required to ascertain the long-term efficacy of both sealant types.

AUTHOR'S CONTRIBUTION

SAM: Conception, data analysis, Clinical methods and final drafting

AN: Conception, data analysis, Clinical methods and final drafting

SAAR: Conception, data analysis, Clinical methods and final drafting

FA: Sample collection, data analysis and drafting

HI: Sample collection, data analysis and drafting

MK: Clinical methods, data collection, analysis and final review

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