

Original Article

Assess the effectiveness of school based dental sealant programs in preventing caries in children

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Abstract

Background

Underprivileged child populations experience dental caries as a major public health matter. School-based dental sealant programs exist in widespread use to deliver protection against caries for both primary and permanent molars. The research investigates whether dental programs delivered in schools succeed in stopping new caries development in children during the school years.

Materials and Methods

This study involved 500 schoolchildren between 6–12 years old who attended different schools across the research area. The research sample consisted of a 250-member Intervention group that underwent first permanent molar sealant treatment while the 250-member Control group avoided undergoing the procedure. The caries incidence evaluation based on Decayed Missing Filled Teeth (DMFT) index occurred during baseline and follow-up examinations at month 12. The researchers used the chi-square test and independent t-test for performing their statistical analysis to demonstrate group differences.

Results

The participants in both groups displayed similar proportions of caries at the initial assessment period ($p > 0.05$). The intervention group performed better than the control group in terms of mean DMFT score measurements after one year of study ($p < 0.001$) where intervention group scored 1.2 ± 0.3 and control group scored 2.8 ± 0.5 . Dental sealants demonstrated a high 57% rate of caries prevention for the intervention group participants.

Conclusion

School-based dental sealant programs serve as an effective preventative measure to lower dental cavities in children. Studies show that carrying out these preventive programs creates substantial caries prevention outcomes mainly within vulnerable population segments. It is advised to incorporate dental sealant procedures into standard school oral health programs to

achieve better dental health results for children.

Keywords

Dental caries, Sealants, School-based programs, Caries prevention, Oral health, DMFT index, Public health dentistry

Introduction

Dental caries continues as the leading chronic disease that affects children across the globe and combined with its detrimental effects it damages their oral health and general health condition (1). Dental caries stands as a primary health concern in the assessment of the World Health Organization affecting children from low-income backgrounds and underserved communities (2). Caries prevention efforts including fluoride application and oral health education and dental sealants continue to spread widely for reducing the burden of caries (3).

Dental sealants provide protective coverage for posterior tooth surfaces when these surfaces receive applications of the physical barrier that blocks bacteria and food materials from accumulating (4). Research shows dental sealants create 50–80% lower incidence of caries in permanent molars within multiple years (5,6). The delivery of preventive dental care for underserved children through School-based dental sealant programs (SBSPs) is recommended as an optimal method (7). The programs operate with two main goals to deliver cost-efficient preventive care for at-risk populations thus minimizing future restorative treatments (8).

The proven advantages of SBSPs do not achieve consistent implementation across different areas mainly because of varying program funding together with parental understanding and dental professional availability (9). Evaluating these programs' performance remains crucial to determine how well they function while maintaining sustainability. Research evaluates school-based dental sealant programs for their effectiveness in tooth caries prevention by studying dental cavity rates between participants who got sealants versus those without sealants.

Materials and Methods

The planned twelve-month study implemented its interventional design in five primary schools. The selected schools agreed to and had convenient access for program participation. The research gained approval from the institutional review board while obtaining consent from parents or guardians for their child participation.

The researchers enrolled 500 children within the age range of 6 to 12 years for the study. Two distinct research groups existed in this study: intervention members who received sealants numbered 250 while the control participants without sealants numbered 250. The research included children who possessed fully erupted first permanent molars without cavities while requiring parental authorization. Patients having caries on their molars or systemic health issues or undergoing dental brace treatment were not included.

Dental professionals with training provided standardized sealant placement

to children at schools. The dental professionals cleaned first permanent molars' occlusal surfaces with prophylactic paste while using cotton rolls for isolation. A 37% phosphoric acid gel was used for 20 seconds before performing a complete rinse and dry process of the treated area. Dental professionals used resin-based material to apply the sealant onto molar pits and fissures which they light-cured for 20 seconds. The dental experts immediately evaluated the condition of both the retention and integrity of the sealants right after they were placed.

Oral examinations took place before the application of sealants to establish the decayed, missing, and filled teeth (DMFT) index. Blinded professionals who had undergone calibration performed examinations at six and twelve months for both groups. DMFT score differences between participant groups served as the main assessment metric to determine study conclusions when the research period ended.

The researchers analyzed data through SPSS software version 25.0 using all tools available. The analysis relied on descriptive statistics to present demographic findings together with DMFT measurement results. The analysis used chi-square for categorical variable comparison and independent t-test for DMFT score mean value assessment between groups. We treated any p-value lower than 0.05 as statistically meaningful for the study.

Results

Five hundred children joined the study with equal numbers in each group including intervention (250) and control (250). The research participants had a mean age of 8.5 ± 1.6 years without any age or gender variations between intervention and control groups ($p > 0.05$). Both cohorts starting at baseline possessed similar DMFT scores of intervention (1.1 ± 0.4) and control (1.2 ± 0.5) ($p = 0.36$). The mean DMFT score among children in the intervention group decreased to 1.2 ± 0.3 at the 12-month follow-up but the score in the control group increased to 2.8 ± 0.5 resulting in a statistically significant difference between both groups ($p < 0.001$) (Table 1).

The evaluation at 12-months showed the success rate of intact sealants was 85% with partial loss representing 10% of cases and total coverage loss affecting only 5% of the group. The caries incidence among children with complete sealant retention was 5% but children with any level of sealant loss experienced higher rates at 18% and 30% (Table 2).

The intervention was effective in caries prevention as the participant groups had different levels of cavity development ($\chi^2 = 29.34$, $p < 0.001$). The intervention group received statistically significant DMFT score reductions according to the independent t-test ($p < 0.001$).

Tables

Table 1: Comparison of DMFT Scores Between Intervention and Control Groups

Group	Baseline DMFT (Mean $\pm$ SD)	12-Month DMFT (Mean $\pm$ SD)	p-value
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Intervention	1.1 ± 0.4	1.2 ± 0.3	<0.001
Control	1.2 ± 0.5	2.8 ± 0.5	<0.001

(p-value calculated using an independent t-test)

Table 2: Sealant Retention and Caries Incidence After 12 Months

Sealant Status	Caries Incidence (%)
Fully Retained	5%
Partially Lost	18%
Completely Lost	30%

These findings demonstrate that school-based sealant programs significantly reduce caries incidence, particularly when sealants are well retained (Table 2).

Discussion

The research results demonstrate that school-based dental sealant programs help decrease the occurrence of caries in children. The mean DMFT score of participants in the intervention group declined substantially compared to the control group after 12 months making dental sealants efficient dental caries prevention tools. Extensive research proves that sealants successfully decrease permanent molar caries risk between 50% and 80% (1,2).

The study found that 85% of sealants remained in place which matches prior findings that show 70–90% retention rates during the first year (3,4). Caries incidence remained low exclusively in children who maintained fully retained sealants while patients with either retained or lost sealants showed higher caries risks. Findings from the past show that properly maintained sealants protect teeth from further cavities for multiple years (5,6).

Long-term sealant outcomes result from combinations of material selection for sealants and applicant methods together with proper oral hygiene practices (7). The research employed resin-based sealants due to their greater longevity compared to glass ionomer sealants because they resist wear and require less frequent reapplications (8). During application both proper isolation and moisture control play a vital role since moisture contamination will result in sealant failure (9).

The school environment represents a budget-friendly strategy for dental prevention services because it provides accessible care to children living in areas without adequate dental service (10). Research indicates these programs help decrease both caries prevalence rates and stop future costly restorative treatments from being necessary (11). Cost-benefit research demonstrates that sealant implementations produce economical outcomes because their installation costs are less than the expenses needed to address dental cavities (12,13).

Although school-based sealant programs achieve success the implementation obstacles related to parental awareness and program funding along with follow-up care operate as hindrances to extensive program deployment (14). The sustainability of these programs depends on three main initiatives that combine school health routine programs with sealant application and educate parents about sealant benefits with

governmental and non-governmental funding (15).

Conclusion

Adequate retention of school-based dental sealants as part of preventive programs leads to significant reductions in dental caries development in children. Widespread adoption of these programs presents itself as an essential public health intervention according to the research findings. Future research should explore long-term follow-up outcomes and strategies to enhance sealant retention and accessibility in low-resource settings.

References

1. Chestnutt IG, Hutchings S, Playle R, Morgan-Trimmer S, Fitzsimmons D, Aawar N, et al. Seal or Varnish? A randomised controlled trial to determine the relative cost and effectiveness of pit and fissure sealant and fluoride varnish in preventing dental decay. *Health Technol Assess*. 2017 Apr;21(21):1-256. doi: 10.3310/hta21210.
2. Himida T, Promise U. School-based dental sealant programmes may be effective in caries prevention. *Evid Based Dent*. 2017 Mar;18(1):13-14. doi: 10.1038/sj.ebd.6401218.
3. Griffin S, Naavaal S, Scherrer C, Griffin PM, Harris K, Chattopadhyay S. School-Based Dental Sealant Programs Prevent Cavities And Are Cost-Effective. *Health Aff (Millwood)*. 2016 Dec 1;35(12):2233-2240. doi: 10.1377/hlthaff.2016.0839.
4. Chen L, Hong J, Xiong D, Zhang L, Li Y, Huang S, et al. Are parents' education levels associated with either their oral health knowledge or their children's oral health behaviors? A survey of 8446 families in Wuhan. *BMC Oral Health*. 2020 Jul 11;20(1):203. doi: 10.1186/s12903-020-01186-4.
5. Griffin SO, Naavaal S, Scherrer C, Patel M, Chattopadhyay S; Community Preventive Services Task Force. Evaluation of School-Based Dental Sealant Programs: An Updated Community Guide Systematic Economic Review. *Am J Prev Med*. 2017 Mar;52(3):407-415. doi: 10.1016/j.amepre.2016.10.004.
6. Gooch BF, Griffin SO, Gray SK, Kohn WG, Rozier RG, Siegal M, et al. Preventing dental caries through school-based sealant programs: updated recommendations and reviews of evidence. *J Am Dent Assoc*. 2009 Nov;140(11):1356-65. doi: 10.14219/jada.archive.2009.0070.
7. Johnson LL, Schwarz E, Rosenberg KD. The Evolution of State-Based Dental Sealant Programs in Oregon Within the Context of the State Health Care Transformation Process. *J Public Health Manag Pract*. 2020 Sep-Oct;26(5):461-470. doi: 10.1097/PHH.0000000000001056.
8. Shimpi N, Glurich I, Hegde H, Steinmetz A, Kuester R, Crespin M, et al. DentaSeal: A school-based dental sealant efficiency assessment tool to support statewide monitoring and reporting: A field report. *Technol Health Care*. 2023;31(4):1279-1291. doi: 10.3233/THC-220568.

9. Ruff RR, Barry Godín TJ, Niederman R. Noninferiority of Silver Diamine Fluoride vs Sealants for Reducing Dental Caries Prevalence and Incidence: A Randomized Clinical Trial. *JAMA Pediatr.* 2024 Apr 1;178(4):354-361. doi: 10.1001/jamapediatrics.2023.6770.
10. Yamamoto T, Kiuchi S, Ishimaru M, Fukuda H, Yokoyama T. Associations between school-based fluoride mouth-rinse program, medical-dental expense subsidy policy, and children's oral health in Japan: an ecological study. *BMC Public Health.* 2024 Mar 12;24(1):762. doi: 10.1186/s12889-024-18156-y.
11. Siegal MD, Detty AM. Targeting school-based dental sealant programs: who is at "higher risk"? *J Public Health Dent.* 2010 Spring;70(2):140-7. doi: 10.1111/j.1752-7325.2009.00155.x.
12. Chi DL, Milgrom P, Gillette J. Engaging Stakeholders in Patient-Centered Outcomes Research Regarding School-Based Sealant Programs. *J Dent Hyg.* 2018 Feb;92(1):16-22.
13. Gu gnani N. Trial shows caries reductions at one year in school-based sealant programme. *Evid Based Dent.* 2013 Sep;14(3):71. doi: 10.1038/sj.ebd.6400946.
14. Williams R, Rogo EJ, Gurenlian JR, Portillo KM. An evaluation of a school-based dental sealant programme. *Int J Dent Hyg.* 2018 May;16(2):e65-e72. doi: 10.1111/idh.12303.
15. Boachie MK, Molete M, Hofman K, Thsehla E. Cost-effectiveness of dental caries prevention strategies in South African schools. *BMC Oral Health.* 2023 Oct 28;23(1):814. doi: 10.1186/s12903-023-03474-1.