ISSN(e) 2244-8861, ISSN(p) 1856-3201
REVISTA ODONTOLÓGICA DE LOS ANDES
VOL.17, No.1, ENERO-JUNIO 2022

RECIBIDO: 22/01/2022, **ACEPTADO**: 23/04/2022. *págs.* **56-64**
https://doi.org/10.53766/ROLA/2022.17.01.05

TRABAJO DE INVESTIGACIÓN

CARIES INCIDENCE ON PRIMARY MOLARS after Glass Ionomer Sealant Placement

Incidencia de caries en molares primarios después de la colocación de sellantes de ionómero de vidrio

POR

KAREN **BEN-ELAZAR**[1]
MARIA E **DÁVILA**[2]
SCOTT L **TOMAR**[3]

1 DMD, Pediatric Dental Resident. University of Florida, College of Dentistry, Pediatric Dental Residency. Naples Children Education Foundation (NCEF). Pediatric Dental Center. Naples, Florida. kbenelazar@gmail.com.
orcid.org/0000-0002-9571-377X

2 DDS, MPH, DrPH. Clinical Coordinator I. University of Florida, College of Dentistry, Department of Community Dentistry and Behavioral Science. Naples Children Education Foundation (NCEF). Pediatric Dental Center. Naples, Florida. mdaviladegonzalez@dental.ufl.edu.
orcid.org/0000-0001 9691-3362

3 DMD, MPH, DrPH. Associate Dean for Prevention and Public Health Sciences. College of Dentistry. University of Illinois Chicago. Chicago, Illinois. stomar@uic.edu.
orcid.org/0000-0002-3108-1945

Correspondence author: Maria E. Dávila. University of Florida, College of Dentistry, Department of Community Dentistry and Behavioral Science. Naples Children and Education Foundation (NCEF). Pediatric Dental Center. 7505 Grand Lely Dr, Naples, FL 34113, USA.
mdaviladegonzalez@dental.ufl.edu., mangue98@hotmail.com

Abstract:

The aim of this study was to determine the cumulative incidence (CI) of decay on primary molars treated with glass ionomer (GI) sealants. We hypothesized that GI sealants would decrease caries incidence in primary molars of young children at high caries risk. Data were collected from 56 children aged 1–5 years participating in a community-based sealant program in Immokalee, FL during 2018–2019. Follow-up was planned for 6 months after the initial sealant placement. The mean (±SD) age at sealant placement was 3.57 (±0.66) years. A mean (±SD) of 6.55 (±1.97) sealants were placed per child. There was a mean of 1.29 decayed primary molars per child at the initial visit. A total of 367 Fuji GI sealants were placed on non-carious/non-restored primary molars, or a mean of 6.55 sealants per child. At follow-up, there were 10 newly decayed primary molars among the teeth that had been sealed or a mean of 0.23±0.66 newly decayed teeth per child. The CI of caries among all sealed teeth was 2.7%, with the highest CI on primary mandibular second molars. Sealants were largely effective in preventing caries in primary molars. GI sealants may be an effective prevention strategy for primary molars among young children at high caries risk.

KEY WORDS: Schoolchildren, Glass Ionomer, Sealant, Primary Molars, Prevention.

Resumen

El propósito de este estudio fue determinar la incidencia acumulada (IA) de caries en molares temporarios tratados con sellantes de ionómero de vidrio (IV). La hipótesis de estudio establece que los sellantes de ionómero de vidrio disminuirían la incidencia de caries en los molares temporarios de los niños pequeños con alto riesgo de caries. Se recopilaron datos de 56 niños de 1 a 5 años que participaron en un programa comunitario de sellantes en Immokalee, FL durante 2018-2019. Se planeó un seguimiento de 6 meses después de la colocación inicial del sellante. La edad promedio (±DE) en el momento de la colocación del sellante fue de 3,57 (±0,66) años. Se colocó un promedio (±DE) de 6,55 (±1,97) sellantes por niño. En promedio, 1,29 molares temporarios estaban cariados en la visita inicial. Se colocaron un total de 367 sellantes de ionómero de vidrio-Fuji en molares temporarios no cariados/sin restauración, o un promedio 6,55 sellantes por niño. En el seguimiento, hubo 10 molares temporarios con nuevas caries en aquellos dientes que habían sido sellados o un promedio de 0,23 ± 0,66 dientes con nuevas caries por niño. La IA de caries entre todos los dientes sellados fue del 2,7%, con una IA más alta en los segundos molares temporarios mandibulares. Los sellantes fueron en gran medida efectivos para prevenir la caries en los molares temporarios. Los sellantes de ionómero de vidrio podrían ser una estrategia eficaz para la prevención de caries dental en los molares temporarios de los niños con alto riesgo de caries.

PALABRAS CLAVE: Escolares, Ionómero de Vidrio, Sellador, Molares Temporales, Prevención.

Introduction

Dental caries is the most prevalent disease in childhood, rendering 21.4% of US children ages 2-5 years subject to untreated decay, with peak prevalence on the occlusal surfaces of primary teeth. Clear health disparities are evident between populations, showing an inverse correlation between household income and incidence of caries throughout US populations[1-5]. In the state of Florida, approximately 25% of children live in poverty[2], and many suffer from oral health disparities due to social determinants and other factors that influence disease processes, including diet, oral hygiene, access to preventive measures, and parent/guardian education level of protective interventions. Approximately 23% of U.S. children ages 2-5 years have experienced caries in the primary dentition, and caries prevalence is higher among Mexican-American children (33%) and non-Hispanic African American/black children (28%), compared with non-Hispanic white children in that age group (18%)[4,6]. Although caries prevalence remains high, preventive methods may be implemented to help combat oral health disparities in low-income populations. Moreover, the application of dental sealants to retentive tooth surfaces, including pits and fissures, can prevent cariogenic processes in children at high caries risk[3,7].

It has been reported that approximately 40.5% of Florida schoolchildren had at least one sealed permanent molar in 2016-2017[6]. Among the sealant materials that can be used to cover these surfaces, glass ionomers (GIs) have been suggested[8]. GIs are derived from glass and organic acids and have been referred to as bioactive acid-base reaction cement[9,11]. GIs have a semi-sustained fluoride-releasing mechanism that may aid in preventing cariogenic processes when placed on retentive tooth surfaces such as pits, fissures, and grooves. This feature[9,10,11], in conjunction with the formation of a chemically bonded protective physical barrier, can be effective in mitigating the risk of carious disease process.

Literature investigating the cumulative incidence (CI) of caries following GI sealant placement in primary molars is currently lacking, particularly in low-income populations. The purpose of this retrospective chart review study was to determine the CI of decay in primary molars treated with GI sealants in schoolchildren ages 1-5 years enrolled in the Guadalupe Center in Immokalee, Florida from 2018-2019. It was hypothesized that GI sealant placement in young children of low-income communities will help to decrease the CI of caries in primary molars.

Methods

This study was conducted among children who attended the Guadalupe Center for Early Childhood Education Program in Immokalee, Florida. Immokalee is a low-income, rural, and predominantly immigrant community

in southwest Florida. In Immokalee in 2015-2019, an estimated 60% of adults aged 25 years or older had not graduated from high school, 37% of the population lived in poverty, and 47% of the population lacked health insurance[15]. More than 400 children who attended Guadalupe Center for Early Childhood Education Program have received the benefits of the University of Florida/ Naples Children and Education Foundation (UF/NCEF) Community Outreach Program, which includes dental preventive services four times a year. Most of these children do not have access to dental services due to cost, transportation, or lack of pediatric dental providers in the area. The Community Outreach Program was created to reduce barriers to care for low socioeconomic status communities.

This retrospective chart review study analyzed data collected from schoolchildren participating in the UF/NCEF Dental Sealant Outreach Program during 2018-2019. The aim of the study was to determine the CI of decay in primary molars treated with GI sealants in schoolchildren in the Guadalupe Center in Immokalee, Florida. Archived intraoral exam data records were retrieved from UF/NCEF's Sealant Outreach Program. Records that adhered to inclusion criteria from the years 2018–2019 were collected and stored under lock and key at the UF/NCEF Dental Clinic in Naples, Florida. Subjects included children ages 1-5 years participating in UF/NCEF's Sealant Outreach Program who were treated by a dentist or dental hygienist in the Guadalupe Center and whose parent/guardian provided documented informed consent for screening, sealant, and/or fluoride varnish application. Records were de-identified via use of assigned identification numbers, which were logged in a password-protected encrypted spreadsheet and stored separately from abstracted clinical data. GI sealants were placed on the occlusal surfaces of all fully erupted primary first and second molars without clinically visible caries or restorations. Selected teeth were cleaned with pumice, dried, and isolated by using cotton rolls and slow-speed suction. Dried teeth were etched for 20-30 seconds, and subsequently rinsed with water and dried. Fuji GI was amalgamated for 8 seconds and placed on selected teeth with Fuji applicator gun. Fuji GI material was pressed into occlusal pits, fissures, and supplemental grooves with a cotton swab. Isolation was maintained for 2-3 minutes while Fuji GI material cured. Follow-up was conducted approximately six months after initial sealant placement to assess for caries incidence, and findings were recorded in a paper chart. Charts from 2018-2019 were reviewed and selected based upon sealant placement and record of follow-up charting. Records of schoolchildren who did not receive sealants or follow-up were excluded from this study.

Data Analysis. It was conducted univariate and bivariate analysis by using the SAS v. 9.4 statistical software package (SAS Institute, Cary, NC). Baseline varia-

bles included age at sealant placement, gender, as well as number and location of carious lesions on primary molars. It was calculated the overall CI of dental caries after sealant placement as the number of sealed teeth with caries lesions at follow-up visit divided by the total number of sealants placed. It was also calculated the CI of caries for each of the eight primary molars. This study was approved by the University of Florida Health Science Center Institutional Review Board (Protocol IRB201903020).

Results

The mean age of study participants (±SD) was 3.57 (±0.66) years at sealant placement (TABLE 1). Twenty-six participants (46.4%) were male, and 30 (53.6%) were female.

An overall mean (±SD) of 6.55 (±1.97) sealants were placed, with a range of 2 to 8 sealants per child (TABLE 2).

TABLE 1. Baseline demographic characteristics. Community Dental Sealant Program, August 2018–October 2019. *Mean age (±SD): 3.57(±0.66) years old.

Age (yrs)*	Frequency	Percent (%)
1-3	22	39.3
4-5	34	60.7
Sex	**Frequency**	**Percent (%)**
Male	26	46.4
Female	30	53.6

TABLE 2. Total number of sealants placed during the initial visit. Community-based dental sealant program, August 2018–October 2019. *Mean sealants placed (±SD) = 6.55 (±1.97) sealants.

Number of Sealants Placed*	Frequency	Percent (%)
2	2	3.6
3	4	7.1
4	8	14.3
5	1	1.8
6	4	7.1
7	6	10.7
8	31	55.4
Total	56	100.0

Coverage of all eight primary molars was the most frequent pattern of sealant placement among study participants (55.4%), followed by coverage of four primary molars at (14.3%). The mean prevalence (±SD) of caries in primary molars at the initial visit was 1.29 (±1.89) teeth. The mean elapsed time between sealant placement and follow-up (±SD) was 162.87 (±71.50) days. The mean incidence of new caries (±SD) in primary molars at the follow-up visit was 0.23 (±0.66) teeth (TABLE 3).

TABLE 3. Mean and Standard Deviation of variables under investigation. Community-based Dental Sealant Program, August 2018-October 2019.

Study Variable (s)	Mean (±SD)
Decayed primary molars at first visit	1.29 (±1.89)
Sealants placed	6.55 (±1.97)
Newly decayed primary molars at follow-up visit	0.23 (±0.66)

with the highest incidence of caries seen on tooth #K and tooth #T (TABLE 4).

TABLE 4. Frequency of newly decayed primary molars by tooth number. Community-based Dental Sealant Program, August 2018-October 2019.

Tooth Number	Number	Percent (%)
A	1	10.0
B	0	0.0
I	0	0.0
J	1	10.0
K	3	30.0
L	2	20.0
S	0	0.0
T	3	30.0
Total	**10**	**100.0**

There were 10 newly decayed primary molars among the 367 teeth that had been sealed, for an estimated CI of 2.7% among all sealed primary molars. CI of caries was lowest in teeth #B, #I, and #S (FIGURE 1).

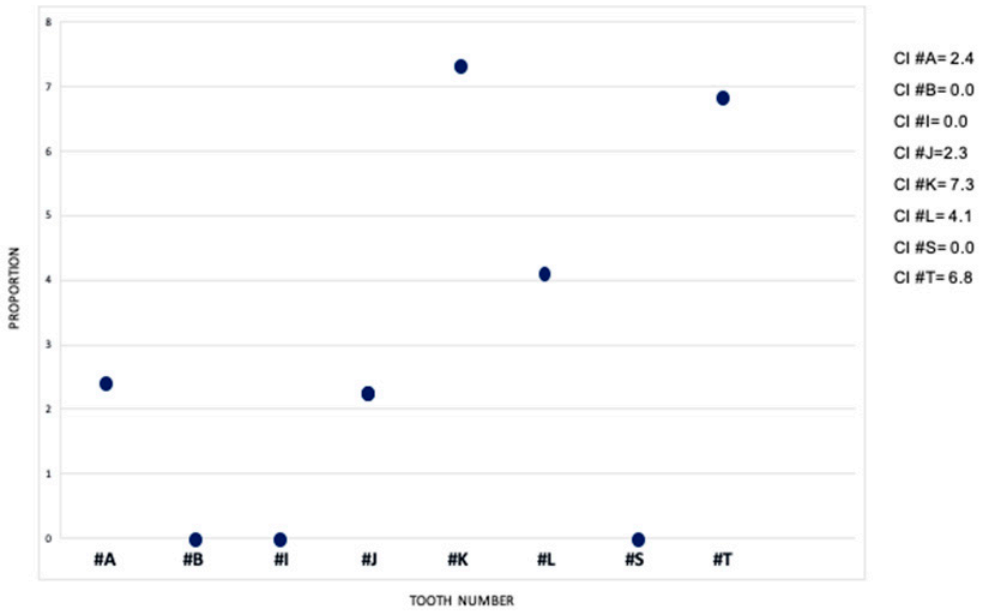

FIGURE 1. Cumulative incidence* of decay on primary molars at follow-up, by tooth number. Community-based dental sealant program, August 2018-October 2019. *Overall cumulative incidence of caries among sealed teeth= 2.7

Discussion

Prior studies have shown a high prevalence of dental caries among schoolchildren in low socioeconomic status communities[1,5]. In this study, It was found that children in a low-income community in southwest Florida experienced an average of 1.29 (±1.89) caries lesions in the primary molars by about age 3.5 years, prior to GI sealant treatment.

Disparities in the prevalence of caries in the primary dentition have been reported in many previous studies[2,4,5,9,11]. Although dental sealants have been shown to be an effective caries prevention method in permanent molars[6,9], few U.S. studies have examined their effectiveness in primary molars. In our study, GI sealants were used as a preventive method for children in the primary dentition. These findings are similar to those seen in studies that evaluated sealants as a method of caries prevention in permanent molars[6,7,9,10].

After a mean of 162.87 (±71.50) days of follow-up, this study revealed that children exhibited an average of 0.23 (±0.66) new carious lesions in primary molars, with an overall CI of 2.7% caries among primary molars sealed with GI. Another way to view those data is that 97.3% of sealed primary molars in these high-risk children did not develop caries during approximately 5.5 months of follow-up. These findings are supported by studies conducted with GI and its cariostatic effect in the primary and permanent dentitions[16,17].

Although this study did not measure sealant retention, one can infer that the relatively low rate of new caries lesions in this group of children was a result of GI sealant placement, as noted in other studies[13,14]. Moreover, GIs have a fluoride-releasing component, which may be responsible for the reduction of caries incidence, as mentioned in previous studies[12,18].

In addition, one of the benefits of using GI sealants in community-outreach sites is the ease of application. Its hydrophilic and fluoride-releasing nature makes this product ideal for consideration in situations where isolation is poor and caries risk is high, as typically exhibited in community outreach school-based sealant programs. It has been reported that the use of this material is easier, less technique-sensitive, and more moisture-friendly than alternative sealant materials[18].

The limitations faced in this study included lack of radiographic analysis for caries and limited follow-up, which could have impacted the results. Consistency of follow-up among selected patients presented as a challenge in the data collection process, as some patients lacked follow-up data due to absences, switching schools, or withdrawal of parental consent. This study also lacked a control or comparison group, so it is not possible to conclude that GI sealants reduced caries relative to a similar group of children that did not receive sealants. However, It was note that by age 3.5 years, or roughly, 18 months after the eruption of their primary first molars, a mean of 1.29 primary molars were already decayed in this group of children. That trans-

lates into a mean caries increment of about 0.43 teeth per 6-month period, a rate far higher than we observed among primary molars that had been sealed with GI (0.23 teeth).

Additional longitudinal studies are needed in order to investigate the CI of caries following GI sealant placement during longer follow-up periods.

Conclusion

Based on the results of this study, it was concluded that GI sealants were largely effective in preventing caries incidence in primary molars during the reported period. The CI of new caries lesions in primary molars was lowest in primary first molars, particularly maxillary first molars. In contrast, the highest CI of caries was observed in primary mandibular second molars.

Acknowledgments

This study was supported in part by the Naples Children and Education Foundation. The authors thank the children and staff of the Guadalupe Center in Immokalee, Florida, and the staff of the University of Florida Community-based Dental Sealant Program for their cooperation.

References

1. Benjamin RM. Oral health: the silent epidemic. Public Health Rep. 2010; 125(2): 158-9. doi:10.1177/003335491012500202.
2. Fleming E, Afful J. Prevalence of total and untreated dental caries among youth: United States, 2015-2016. NCHS Data Brief, no 307. Hyattsville, MD: National Center for Health Statistics; 2018.
3. Condò R, Cioffi A, Riccio A, Totino M, Condò SG, Cerroni L. Sealants in dentistry: a systematic review of the literature. Oral Implantol. 2013; 6.3: 67.
4. Centers for Disease Control and Prevention. Oral Health Surveillance Report: Trends in dental caries and sealants, tooth retention, and edentulism, United States, 1999-2004 to 2011-2016. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 2019. Available at: https://www.cdc.gov/oralhealth/publications/OHSR-2019-index.html.
5. Kato H, Tanaka K, Shimizu K, Nagata C, Furukawa S, Arakawa M, Miyake Y. Parental occupations, educational levels, and income and prevalence of dental caries in 3-year-old Japanese children. Environ Health Prev Med. 2017; 22(1): 80. doi:10.1186/s12199-017-0688-6.
6. Florida Department of Health Public Health Dental Program. The Oral Health Status of Florida's Third Grade Children 2016-2017. Tallahassee, FL: Florida Department of Health; 2018. Available at: http://www.floridahealth.gov/programs-and-services/community-health/dental-health/reports/_documents/oral-health-third-grade-2016-2017.pdf.
7. Sicca C, Bobbio E, Quartuccio N, Nicolò G, Cistaro A.. Prevention of dental caries: a review of effective treatments. J Clin Exp Dent. 2016; 8(5): e604.
8. Alirezaei M, Bagherian M, Sarraf Shirazi A. Glass ionomer cements as fissure sealing materials: yes or no? A systematic review and meta-analysis. J Am Dent Assoc. 2019; 149(7): 640-649.e9.
9. Wright JT, Tampi MP, Graham L, Estrich C, Crall JJ, Fontana M, Gillette EJ, Nový BB, Dhar V, Donly K, Hewlett ER, Quinonez RB, Chaffin J, Crespin M, Iafolla T, Siegal MD, Carrasco-Labra A. Sealants for preventing and arresting pit-and-fissure occlusal caries in primary and permanent molars. Pediatr Dent. 2016; 38(4): 282-308.

10. Morphis TL, Toumba KJ, Lygidakis NA. Fluoride pit and fissure sealants: a review. Int J Paediatr Dent. 2000; 10(2): 90-98.18.
11. Kim YK, Kim KH, Kwon TY. Setting reaction of dental resin modified glass ionomer restoratives as a function of curing depth and postirradiation time. J Spectrosc. 2015; 8.5: e604.
12. Petersen PE, Ogawa H. Prevention of dental caries through the use of fluoride--the WHO approach. Community Dent Health. 2016; 33(2): 66-68.
13. Colombo S, Ferrazzano GF, Beretta M. Dental caries prevention: a review on the use of dental sealants. Ital J Dent Med. 2018; 3(4): 81-86.
14. Centers for Disease Control and Prevention. Dental Sealants Prevent Cavities: Effective Protection for Children [website]. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Oral Health; 2016. Available at: https://www.cdc.gov/vitalsigns/dental-sealants/index.html.
15. US Census Bureau. QuickFacts: Immokalee CDP, Florida. Washington, DC: US Department of Commerce, US Census Bureau; 2021. Available at: https://www.census.gov/quickfacts/immokaleecdpflorida. Accessed 01 July 2021.
16. Ashley P. Glass-ionomers have cariostatic effect. Evid Based Dent. 2013; 4(79). https://doi.org/10.1038/sj.ebd.6400225.
17. Pereira AC, Pardi V, Mialhe FL, Meneghim Mde C, Ambrosano GM. A 3-year clinical evaluation of glass-ionomer cements used as fissure sealants. Am J Dent. 2003; 16(1): 23-27.
18. Mousavinasab SM, Meyers I. Fluoride release by glass ionomer cements, compomer and giomer. Dent Res J (Isfahan). 2019; 6(2): 75-81.