Effectiveness of an Intervention in Schoolchildren for the Control of Dental Caries with a 5-Year Follow-up *

Efectividad de una intervención en escolares para el control de la caries dental con seguimiento de 5 años

Eficácia de uma intervenção em escolares para o controle da cárie dentária com acompanhamento de 5 anos

Rossana Sotomayor-Ortellado [a]
Universidad Nacional de Concepción, Paraguay
sotomayorr12@gmail.com
https://orcid.org/0000-0001-7566-4571

Wilma González-Cardozo [a]
Universidad Nacional de Concepción, Paraguay
wmenchi85@gmail.com
https://orcid.org/0009-0008-7436-0515

Alicia Guadalupe Saona [a]
Universidad de la República Oriental del Uruguay, Uruguay
albelu99@gmail.com
https://orcid.org/0009-0003-3908-0220

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Authors' Note: [a] **Correspondence:** sotomayorr12@gmail.com; wmenchi85@gmail.com; albelu99@gmail.com

ABSTRACT

Background: Dental caries is one of the most common chronic diseases in children. Its burden is greater in contexts with barriers to accessing dental services. **Purpose**: To evaluate the effectiveness of a set of operative and non-operative interventions implemented in an oral health project for schoolchildren in Concepción, Paraguay. **Methods**: This was an intervention study with time series analysis. A secondary database with information collected between 2013 and 2017 was used. Thirty medical records of schoolchildren who completed the follow-up were analyzed. Non-operative activities included educational workshops for students, parents, and teachers. Operative interventions included fluoride applications, pit and fissure sealants, and atraumatic restorative treatment. The baseline and final clinical assessment (2018) were compared using standardized criteria from the World Health Organization. The DMFT/dmft indices, the presence of active caries, and referrals due to pulpal involvement were calculated. Descriptive statistics and paired t-tests were applied (p=0.05). **Results**: The prevalence of caries was 80% at baseline and 66% at the final assessment. The DMFT index decreased from 4.16 to 1.86 (p=0.002). Seventeen schoolchildren (57.6%) were referred due to pulpal involvement. **Conclusions**: The combined interventions reduced the experience of caries. However, lesions persisted in more than 50% of the schoolchildren. Strategies for control and prevention need to be strengthened.
Keywords: Concepción, Paraguay; dental caries; dentistry; DMFT index; intervention; longitudinal study; primary health care; public health

RESUMEN

Antecedentes: La caries dental es una de las enfermedades crónicas más frecuentes en niños y niñas. Su carga es mayor en contextos con barreras de acceso a servicios odontológicos. **Objetivo:** Evaluar la efectividad de un conjunto de intervenciones operatorias y no operatorias implementadas en un proyecto de salud bucodental dirigido a escolares de Concepción, Paraguay. **Métodos:** Estudio de intervención con series temporales. Se usó una base de datos secundaria con información recolectada

entre 2013 y 2017. Se analizaron 30 historias clínicas de escolares que completaron el seguimiento. Las actividades no operatorias incluyeron talleres educativos para estudiantes, padres y docentes. Las operatorias incluyeron aplicaciones de flúor, sellantes de fosas y fisuras, y restauraciones atraumáticas. Se compararon la línea de base (BL) y la evaluación clínica final (FCA) con criterios estandarizados de la Organización Mundial de la Salud. Se calcularon los índices CPOD/ceod, la presencia de caries activa y las remisiones por compromiso pulpar. Se aplicó estadística descriptiva y prueba t de muestras pareadas (p=0,05). **Resultados:** La prevalencia de caries fue 80 % en BL y 66 % en FCA. El índice CPOD disminuyó de 4,16 a 1,86 (p=0,002). Se remitieron 17 escolares (57,6 %) por compromiso pulpar. **Conclusiones:** Las intervenciones combinadas redujeron la experiencia de caries. Persistieron lesiones en más del 50 % de los escolares. Se requiere fortalecer las estrategias de control y prevención.
Palabras clave: atención primaria en salud; caries dental; Concepción, Paraguay; estudio longitudinal; índice CPOD; intervención; odontología; salud pública

RESUMO

Antecedentes: A cárie dentária é uma das doenças crônicas mais comuns em crianças. Sua carga é maior em contextos com barreiras de acesso a serviços odontológicos. **Objetivo**: Avaliar a eficácia de um conjunto de intervenções operatórias e não operatórias implementadas em um projeto de saúde bucal voltado para escolares em Concepción, Paraguai. **Métodos**: Estudo de intervenção em série temporal. Foi utilizado um banco de dados secundário com informações coletadas entre 2013 e 2017. Trinta prontuários médicos de escolares que completaram o acompanhamento foram analisados. As atividades não operatórias incluíram oficinas educativas para alunos, pais e professores. As atividades operatórias incluíram aplicação de flúor, selantes de fóssulas e fissuras e restaurações atraumáticas. A avaliação clínica inicial (BL) e final (FCA, 2018) foram comparadas com os critérios padronizados da Organização Mundial da Saúde. Foram calculados os índices CPOD/ceod, a presença de cárie ativa e os encaminhamentos por envolvimento pulpar. Estatísticas descritivas e o teste t pareado foram aplicados (p=0,05). **Resultados**: A prevalência de cárie foi de 80% no grupo BL e de 66% no grupo FCA. O índice CPOD diminuiu de 4,16 para 1,86 (p=0,002). Dezessete alunos (57,6%) foram encaminhados devido ao envolvimento pulpar. **Conclusões**: As intervenções combinadas reduziram a experiência de cárie. As lesões persistiram em mais de 50% dos alunos. É necessário fortalecer as estratégias de controle e prevenção.
Palavras-chave: atenção primária à saúde; cárie dentária; Concepción, Paraguai; estudo longitudinal; índice CPOD; intervenção; odontologia; saúde pública

INTRODUCTION

Dental caries is recognized as the most prevalent chronic disease worldwide (1). In Paraguay, the situation is similar. The prevalence remains high, according to the latest National Oral Health Survey, conducted with the support of the Pan American Health Organization (PAHO) (2). The survey reported a prevalence of 63.31% in schoolchildren aged 5–6, 12, and 15 years (2).

As part of the efforts to address this issue, projects promoting health and preventing oral problems have been implemented in school settings. One example is the oral health project, whose results are presented here, which was developed within the context of a dental school at a public school in the city of Concepción, Paraguay. In this city, even in urban areas, 69% of the population from low socioeconomic backgrounds has at least one unmet basic need (3). This condition increases the risk of dental caries in the school-age population. This project integrated operative interventions (pit and fissure sealants and atraumatic restorative treatment) and non-operative interventions (oral health education and fluoride application), in accordance with recognized guidelines for the management and control of the disease (4).

A meta-analysis conducted by Akera et al. (5) evaluated the effectiveness of oral health programs in schoolchildren in low- and middle-income countries. The review of 17 studies shows that these interventions reduce the burden of disease. This analysis also indicates that interventions lasting more than two years were significantly more effective in reducing the indices of decayed, missing, and filled teeth in both permanent (DMFT) and primary (dmft) dentition than shorter-duration interventions.

Among the various possible interventions, the application of dental sealants has shown a significant decrease in these rates, with reductions of -0.65 and -1.79 in 12- and 15-year-old children, respectively, when compared to a control group (5). Regarding restorative techniques, the application of atraumatic restorative treatment (ART) is emphasized, using minimally invasive approaches to treat carious lesions

without rotary instruments or local anesthesia (5). According to Frencken et al. (6), in a review of 25 years of using this technique, ART was effective in reducing caries progression and preserving healthy tooth structures, especially in settings with limited access to conventional dental services. ART has also shown favorable results in terms of patient acceptance, cost-effectiveness, and the sustainability of community oral health programs.

As mentioned above, observational and intervention studies generally use the DMFT/dmft indices as baseline and outcome measures due to their ease of application, minimal need for specialized training, and low time and resource requirements. However, their lower diagnostic sensitivity could limit the detection of incipient lesions and underestimate the true prevalence of caries. Although the widely used International Caries Detection and Assessment System (ICDAS), which offers greater sensitivity and specificity, allows for the identification of up to 43% more lesions, including those in early stages (7), the DMFT/dmft indices were used in this program.

It was necessary to evaluate the indicators that the continuous implementation of operative and non-operative strategies, with a five-year follow-up, had contributed to improving the caries experience in the school population of Concepción, Paraguay (8). Therefore, this study presents the results of a comprehensive evaluation of the aforementioned program in a vulnerable school setting. The purpose was to generate evidence that could guide future strategies, strengthen planning, and optimize the monitoring of oral health programs in similar populations.

MATERIALS AND METHODS

This is a time series intervention study, using a secondary database with information collected over five years (2013-2017) (9). The aim was to verify the effectiveness of the set of surgical and non-surgical interventions for the control of dental caries, as part of the oral health project developed with schoolchildren in Concepción, Paraguay. First, permission was requested and obtained from the archivist of the Dental School at the National University of Concepción to review the medical records from the oral health project in question. Approval was also obtained from the ethics committee of the university's medical school, due to its connection with the graduate program in Public Health, under which the control measurements were conducted in 2018.

The sample size was calculated using the StatsDirect® software (StatsDirect Ltd. and University of Liverpool, supported by Leap of Faith Ventures) for an effect size = 2 (considering the high DMFT index in Paraguay, global average DMFT = 3.99 and dmft = 4.34 (2-3). A reduction of at least 2 units in the index was estimated), a standard deviation = 1.81 (calculated as pooled standard deviation (9), with $\alpha = 0.05$ and $1 - \beta = 0.8$, resulting in $n = 14$ for each group. In the time series study design, the intervention group corresponds to the control group; therefore, the minimum sample size for the group is 14 individuals. Initially, 38 medical records were included, corresponding to the children who had participated in the first year of the intervention (the program had a broader reach in terms of the number of beneficiaries, but the new participants were added gradually in subsequent years and were not considered for this study due to having a shorter follow-up period). Eight medical records were excluded for the following reasons: not having fully participated during the specified years of intervention (absence for one or more days on which the procedures were performed): 3 children; absence during the final clinical evaluation: 2 children; and change of institution: 3 children. Ultimately, the sample consisted of $n = 30$ children.

The program's set of annual interventions included both operative and non-operative activities. The non-operative activities were signing of informed consent forms; completion of medical history forms; and educational workshops lasting 30 to 40 minutes, which used visual aids such as typodonts of the mouth for demonstrations and posters with examples covering topics such as oral health, oral hygiene, and healthy diet. The workshops were aimed at schoolchildren, teachers, and parents. The time dedicated

to these activities was 3 months each year. The operative activities consisted of the application of 1.23% acidulated phosphate fluoride, dental sealants, and glass ionomer restorations using the ART technique, as needed. These activities were performed by third-, fourth-, and fifth-year dental students, who were trained and supervised by instructors standardized by a professional with experience and WHO/PAHO certification, who also assisted in planning every aspect of the intervention (8,10). To evaluate the agreement in the diagnosis of carious lesions by the instructors, percentage agreement tests and Cohen's Kappa coefficient were used. The standardization documentation included the percentage of agreement as well as the individual Kappa coefficient values, which ranged from 0.870 to 0.980. The overall Kappa value was 0.899.

Clinical examinations and recording of dental caries lesions were performed using the following criteria: a cavitated lesion, with evident loss of continuity of the tooth surface, in enamel or dentin. The clinical diagnosis for each student had to be confirmed and approved by one of the calibrated instructors.

During the procedure, the operators were accompanied and supervised by certified faculty members. The final clinical evaluation was conducted six years later, in 2018. Both the interventions performed each year, and the final clinical evaluation were carried out under the following conditions:

- Children lying on a table with a pillow and a mat.
- The light source used was an LED headlamp to enhance the lighting in the room.
- The inspection was performed using a flat mirror, cotton pliers, and a periodontal probe under relative isolation.
- The children received care by two students (operator and assistant).
- A dental professional and a student (assistant) conducted the evaluation.

The data obtained from the medical records were recorded in an Excel spreadsheet for analysis, included:

- Sociodemographic data: age and type of healthcare used.
- Average DMFT/dmft index from the initial (BL) and final (FCA) assessments: First, the DMFT/dmft index was recorded for each schoolchild. Since the children had mixed dentition, both indexes (DMFT/dmft) were added together to obtain each person’s index. Then, the average of the individual indices was calculated.
- Dental caries present (DCP): This was defined as having at least one active lesion present in both the buccal and lingual surfaces and in the occlusal surface.

The variations in the presence/absence of dental caries were compared in the initial and final clinical evaluations, as follows:

- The disease is present in BL but absent in FCA (BL+ and FCA-).
- The disease is absent in BL but present in FCA (BL- and FCA+).
- The disease was absent in BL and in FCA (BL- and FCA -).
- The disease was present in BL and in FCA (BL+ and FCA+).

With regard to referral due to pulp involvement as an indicator of the severity of dental caries, the following was considered:

- At least one referral during the five years due to the need for more complex treatments and evidence of irreversible pulp damage or serious disease.
- The absence of remission was considered a non-serious illness.

To compare the initial and final average DMFT/dmft indices, the paired t-test (t-Test Paired Two Sample for Means) was used.

RESULTS

In the 30 medical records reviewed, it was found that the schoolchildren who participated in the evaluated oral health project started at an average age of 6.2 years and finished at an average age of 12.2 years. Twenty-eight of them had public health coverage, three had public/private social services, and one had private health insurance. Regarding the DMFT/dmft index, the average was 4.16 in the baseline group, while in the intervention group it was 1.86. The t-test showed a significant statistical difference between the initial and final measurements of the index (p = 0.002) (Table 1).

TABLE 1
Comparison of initial and final DMFT/dmft scores of schoolchildren from the city of Concepción, Paraguay, who participated in the 5-year oral health program (n=30)

Indicators	DMFT/dmft at BL	DMFT/dmft at FCA)	p (two tails)
Average	4,166667	1,866667	
Variance	15,79885	3,6336782	0,001771

Source: the authors.

In the initial assessment conducted in 2013 (BL), 24 schoolchildren (80%) presented with at least one carious lesion. In 2018 (FCA), 20 schoolchildren (66%) showed at least one lesion. When comparing the 2013 data with the 2018 data, the following combinations regarding the presence of dental caries were found (Figure 1):

- Caries present in 2013 and absent in 2018 (BL+ y FCA-): 5 students (17 %).
- No cavities in 2013 and cavities present in 2018 (BL- y FCA+): 1 student (3 %).
- Free of cavities in both measurements (BL- y FCA-): 5 students (17 %).
- Cavities in both measurements (BL+ y FCA+): 19 students (63 %).

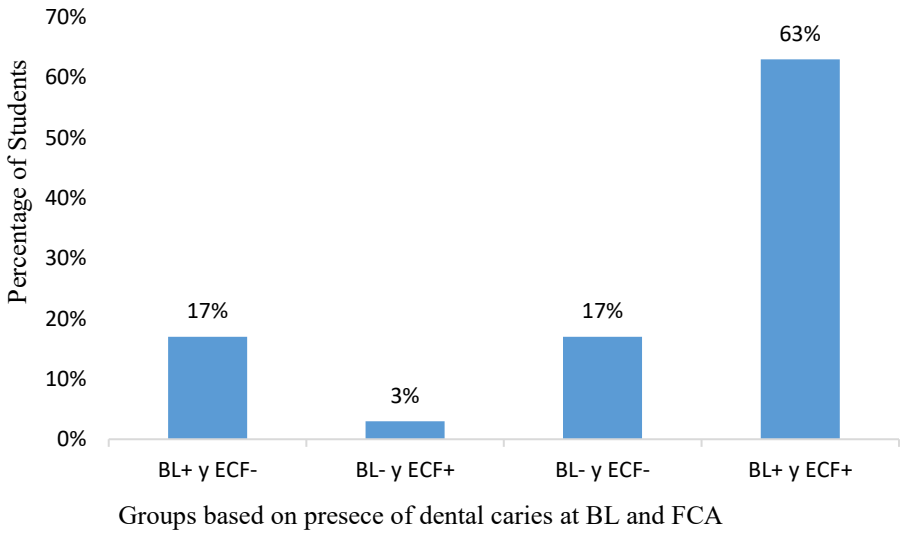

FIGURE 1
Distribution of combinations of presence/absence of caries lesions in the initial and final measurements of schoolchildren from the city of Concepción who participated in a 5-year oral health program (n=30). Source: the authors.

Regarding referrals, as an indicator of disease severity, it was found that 17 children in the sample (56.6%) had a severe form of caries.

DISCUSSION

The results of this study suggest that the interventions implemented in the 5-year oral health program influenced a 2.3-point reduction in the average DMFT/dmft index, a difference that was statistically significant ($p = 0.002$). This improvement is consistent with the findings of Akera et al. (5), who, in a systematic review with meta-analysis of 17 studies, reported a significant reduction in caries experience among schoolchildren in lower-middle-income countries in comparable programs. In their analysis, the authors found a significant effect measured by the DMFT index (95% CI: -0.56 to -0.10; $p = 0.005$).

However, some programs targeting similar school populations have not shown equivalent positive results. For example, Sanaeinasab et al. (11) conducted a randomized controlled trial with a five-week, exclusively educational intervention, but did not observe a significant reduction in the caries rate. Positive results (improvement) or negative results (no change or worsening) may be associated with factors such as the type of intervention, the content and methods used in the intervention, and its duration. It is difficult to compare studies with different designs. Likewise, factors related to different types of social determinants can affect the outcomes of an intervention.

In another study, Zandi-Ghashghai et al. (12) reported a decrease in the DMFT index from 1.47 to 1.29 after implementing a national oral health program in Iran that included education, fluoridation, dental sealants, and restorations at no cost for specific groups, including sixth-grade children. That study, which had a cross-sectional design, was replicated in 2015 and 2017. In the present investigation, the DMFT/dmft index went from 4.16 to 1.86. This suggests how intervention programs with multiple strategies can show positive results, represented by lower index values. However, comparability between studies is difficult because the study involving Iranian children used different strategies, had a national scope, and the observations at different time points were not conducted on the same group. In this study, the scope was municipal and included children who had participated in the same program for four years.

On the other hand, in a study by Gibilini et al. (8), conducted with 173 schoolchildren from a public institution in Piracicaba, Brazil, the ART restorative technique was also used as a treatment intervention. At six months of follow-up, the researchers observed that 47% of the children were free of cavitated caries, a value 19% higher than that found in this study at the end of the program (66% with active caries). Despite using a similar operative technique and the same diagnostic criteria in both studies, the results may vary due to multiple factors, such as the shorter follow-up period and the fluoridation of water, which is accessible to almost 100% of the Brazilian population studied. The latter is not the case for the population in the study presented here.

As shown, the results of school-based oral health interventions vary considerably across studies, which can be attributed to contextual and methodological differences. They include the type of intervention, the age of the participants, the follow-up period, and the indicators or measurements used. Similarly, the combination of strategies and the heterogeneous contexts make a direct and valid comparison between long-term and short-term experiences difficult.

From a methodological standpoint, it is important to distinguish between the strengths and limitations associated with the design of the present study and those inherent in the intervention itself. Regarding the former, some strengths and limitations were associated with the use of secondary data. However, despite having a small sample size, the study had the unusual advantage of annual follow-up of the same group of children over a considerable period (5 years). On the other hand, some limitations included the inability to select a different measurement method or the absence of data that could have enriched the analysis (9). Nevertheless, the necessary variables for the main analysis were available. Furthermore, when evaluating the methodology of the intervention analyzed, it can be noted that the DMFT/dmft index, used to measure the initial and final prevalence of dental caries, while widely used in epidemiological studies due to its applicability in the field, low cost, and ease of training (13), presents diagnostic weaknesses, particularly its inability to detect incipient lesions.

This aspect should be considered when comparing results with studies that use more sensitive diagnostic systems. For example, Ramírez et al. (14) conducted a cross-sectional study of 12-year-old schoolchildren in Costa Rica who participated in a preventive and restorative program with a 7-year follow-up. That study used the ICDAS system and reported a caries prevalence of 59.7%, lower than that found in the present study. However, the most frequent code was 2 (68.8%), which indicates a high proportion of non-cavitated lesions and highlights the greater diagnostic sensitivity of ICDAS. This demonstrates that direct comparisons between prevalence rates should be interpreted with caution, due to the probable underreporting of early caries in the study discussed here.

Furthermore, it would have been useful to have evaluation instruments for some of the strategies applied, such as the educational talks given to schoolchildren, their parents, and teachers, but their influence on the outcomes was not assessed. The literature highlights that the most effective approaches to promoting healthy oral health behaviors include motivational interviewing, the health belief model, gamification, social cognitive theory, and supervised toothbrushing practice, all reinforced through constant repetition (15). In a study conducted by Herrera et al. (16), despite including daily and supervised toothbrushing for six years in 220 schoolchildren, there was a decrease in the proportion of healthy teeth from 91% to 59% at the end of the study. This underscores the challenge of achieving effective disease control through basic measures such as brushing and the need for continuous evaluation of the strategies employed and access to oral health care. On the other hand, a review of the medical records in this study revealed a well-standardized procedure for recording caries lesions, placement of dental sealants and atraumatic restorations, and fluoride application. However, the annual monitoring of partial or total loss of sealants or restorations was not recorded consistently, which hindered the analysis of their survival over the course of the intervention.

Regarding the severity of the disease, the classification varies depending on the criteria used. In the present study, severe cases were considered those requiring referral due to pulpal involvement, which represented 56.6% of the sample. This percentage is considerably higher than that reported in other studies. For example, Vallejos-Sánchez et al. (17), in Mexican schoolchildren, identified only 14.4% of severe cases using a criterion based on lesion size. Similarly, Herrera et al. (18) in Ecuador reported a 7% need for pulpal treatment among 12-year-old schoolchildren, using the pulpitis, ulceration, fistula, and abscess index—PUFA index. It should be noted that the latter two studies were cross-sectional. Furthermore, moderate to severe forms of dental caries in children have been associated with family income and a low level of education among parents or caregivers (19), which could be useful in identifying these risk factors and addressing them to achieve better clinical outcomes.

Finally, the persistence of dental caries, despite the intervention, justified the development of this study by highlighting the need for a deeper analysis of the effectiveness of the actions taken in the intervention to reduce the prevalence and improve control of the disease. It also emphasized the subgroups within the sample, demonstrating the need to consider them as key when planning interventions, as different realities coexist that can show variations when evaluating the results of the interventions. In this regard, a consensus study that brought together experts from Brazil, Colombia, Mexico, Panama, Trinidad and Tobago, Puerto Rico, the United States, and England to analyze the prevalence, risk factors, prevention strategies, and management of dental caries in Latin American and Caribbean countries, emphasizes the need to pay attention to the different types of social determinants associated with the unequal distribution of the disease (16,20), which coincides with what was observed in the subgroups of this study.

CONCLUSIONS

79% of the children who started the program completed the 5-year follow-up. A reduction in DMFT/dmft index values was observed between the initial and final assessments, which was statistically

significant. The findings suggest that the annual and systematic application of the combined strategies—oral health education, fluoride application, pit and fissure sealants, and atraumatic restorative treatment—was effective in controlling caries experience.

However, at the end of the program, more than half of the children still had at least one carious lesion, suggesting the need to strengthen the strategies implemented. The analysis allowed for the identification of relevant subgroups for future interventions:

- Subgroups with a favorable outcome: 17% remained caries-free, and another 17% went from having cavities to being free of the disease.
- Subgroups with unfavorable outcomes: 3% developed cavities and 63% maintained active cavities from the beginning to the end of the project.

RECOMMENDATIONS

These findings reinforce the need to include the measurement of risk factors, and to plan not only the interventions themselves, but also the annual monitoring of their impact, in order to conduct robust research that provides feedback for the interventions and thus offer the community the best available tools for controlling dental caries.

References

1. World Health Organization. Global oral health status report: towards universal health coverage for oral health by 2030. Geneva: World Health Organization; 2022
2. Ministerio de Salud Pública y Bienestar Social, República del Paraguay. Encuesta nacional de salud bucodental del Paraguay, ENSABUD PY 2017: del diagnóstico al diseño y la ejecución de políticas públicas de salud bucodental. Asunción: OPS/OMS; 2018.
3. Instituto Nacional de Estadística (INE), República del Paraguay. Concepción: proyecciones de población por sexo y edad 2021. Asunción: INE; 2021.
4. Machiulskiene V, Campus G, Carvalho JC, Dige I, Ekstrand KR, Jablonski-Momeni A, Maltz M, Manton DJ, Martignon S, Martinez-Mier EA, Pitts NB, Schulte AG, Splieth CH, Tenuta LMA, Ferreira Zandona A, Nyvad B. Terminology of dental caries and dental caries management: consensus report of a workshop organized by ORCA and Cariology Research Group of IADR. Caries Res. 2020; 54(1): 7-14. https://doi.org/10.1159/000503309
5. Akera P, Kennedy SE, Lingam R, Obwolo M, Schutte AE, Richmond R. Effectiveness of primary school-based interventions in improving oral health of children in low- and middle-income countries: a systematic review and meta-analysis. BMC Oral Health. 2022; 22: 264. https://doi.org/10.1186/s12903-022-02291-2
6. Frencken JE, Leal SC, Navarro MF. Twenty-five-year atraumatic restorative treatment (ART) approach: a comprehensive overview. Clin Oral Investig. 2012; 16(5): 1337-1346. https://doi.org/10.1007/s00784-012-0783-4
7. Coelho MAG. ICDAS and dmft/DMFT. Sensitivity and specificity, the importance of the index used: a systematic review. J Dent Public Health. 2020; 11(2): 176-187. https://doi.org/10.17267/2596-3368dentistry.v11v2.3122
8. Gibilini C, Simpson de Paula J, Marques R, Rosário Sousa M. Atraumatic restorative treatment used for caries control at public schools in Piracicaba, SP, Brazil. Braz J Oral Sci. 2012; 11(1).
9. Sampieri RH, Collado CF, Lucio MPB. Metodología de la investigación. 6a ed. México: McGraw-Hill; 2014.
10. Organización Mundial de la Salud (OMS). Oral health surveys: basic methods. 4th ed. Geneva: OMS; 1997
11. Sanaeinasab H, Saffari M, Taghavi H, Karimi Zarchi A, Rahmati F, Al Zaben F, Koenig HG. An educational intervention using the health belief model for improvement of oral health behavior in grade-schoolers: a randomized controlled trial. BMC Oral Health. 2022; 22: 320. https://doi.org/10.1186/s12903-022-02132-2
12. Zandi-Ghashghai N, Sabokseir A, Golkari A. The change in DMFT of six-grade primary school children in Shiraz two years after implementation of the National Oral Health Reform Plan. J Dent Shiraz. 2020;21(3):234-8. https://doi.org/10.30476/DENTJODS.2020.82850.1033
13. Rocha Cruz AZ, Nakagoshi Cepeda MAA, Lopez-Martinez F, Muñuzuri Arana HL, Adams Ocampo JC, Arreguin Ceniceros FG, Vazquez Urbina IN, Solis Soto JM. A comparison of DMFT, ICDAS II and CAST. Int J Appl Dent Sci. 2023; 9(3): 231-235. https://doi.org/10.22271/oral.2023.v9.i3d.1810
14. Ramírez K, Gómez-Fernández A. Dental caries in 12-year-old schoolchildren who participate in a preventive and restorative dentistry program. ODOVTOS Int J Dent Sci. 2022; 24(2): 136-144. https://doi.org/10.15517/IJDS.2021.47337

15. Peerbhay F, Mash R, Khan S. Effectiveness of oral health promotion in children and adolescents through behaviour change interventions: a scoping review. PLoS One. 2025; 20(1): e0316702. https://doi.org/10.1371/journal.pone.0316702
16. Herrera Serna BY, López Soto OP. Evaluación a 72 meses de una estrategia de prevención en salud oral en escolares. Rev Esp Salud Publica. 2018; 92: e201809061
17. Vallejos-Sánchez AA, Minaya-Sánchez M, Casanova-Rosado JF, Casanova-Rosado AJ, Macias-Ortega J, Vera-Guzmán S, Medina-Solís CE . Gravedad de caries empleando un criterio del tamaño de la lesión y variables asociadas en una muestra de escolares mexicanos. Rev Univ Ind Santander Salud. 2015; 47(3): 291-299. http://dx.doi.org/10.18273/revsal.v47n3-2015005
18. Herrera D, Apaza F, Pariona MC, Vilca L. Necesidad de tratamiento endodóncico y prevalencia de caries en escolares de 12 años en la parroquia Yanuncay, Cuenca-Ecuador, 2016. Rev OACTIVA UC Cuenca. 2016; 1(2): 35-38.
19. Martignon S, Guarnizo-Herreño CC, Franco-Cortés AM, García-Zapata LM, Ochoa-Acosta EM, Restrepo-Pérez LF, Arango MC, Cerezo MP, Cortes A. Socioeconomic inequalities in early childhood caries: evidence from vulnerable populations in Colombia. *Braz Oral Res*. 2024; 38: e0126. https://doi.org/10.1590/1807-3107bor-2024.vol38.0126
20. Sampaio FC, Bönecker M, Paiva SM, Martignon S, Ricomini Filho AP, Pozos-Guillén A, Oliveira BH, Bullen M, Naidu R, Guarnizo-Herrreño C, Gomez J, Malheiros Z, Stewart B, Ryan M, Pitts N. Dental caries prevalence, prospects and challenges for Latin America and Caribbean countries: a summary and final recommendations from a Regional Consensus. Braz Oral Res. 2021; 35(Suppl 1): e056. https://doi.org/10.1590/1807-3107bor-2021.vol35.0056

*Original research.

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