




NATIONWIDE TRENDS IN RESTORATIVE TREATMENT FOR PRIMARY MOLARS: REGISTER-BASED EVIDENCE FROM BRAZIL'S PUBLIC DENTAL SERVICES

Tendências nacionais no tratamento restaurador de molares decíduos:
evidências baseadas em registros dos serviços públicos de saúde
bucal do Brasil

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Autores:

Vitória Caroline Carvalho de Souza Santos

Graduando em Odontologia pela Faculdade Uninassau - Petrolina

Mikaely Lafaiette de Brito Silva

Graduando em Odontologia pela Faculdade Uninassau - Petrolina

Ana Victória Rodrigues Dias

Graduando em Odontologia pela Faculdade Uninassau - Petrolina

Taíssa Cássia de Souza Furtado

Faculdade de Odontologia de Ribeirão Preto - Universidade de São Paulo

Larissa Dias Vilela

Faculdade de Odontologia de Ribeirão Preto - Universidade de São Paulo

Daniella dos Anjos Rodrigues Barauna

Faculdade de Odontologia de Ribeirão Preto - Universidade de São Paulo

Paula Iáddia Zarpellon Barbosa

Faculdade de Odontologia de Ribeirão Preto - Universidade de São Paulo

Ricardo Barbosa Lima - DDS, PhD

Professor do Colegiado de Odontologia da Faculdade Uninassau - Petrolina

Coordenador do Núcleo de Ensino e Pesquisa em Epidemiologia Aplicada à Odontologia (NEPIO)

Instituição onde o trabalho foi realizado: Faculdade Uninassau - Petrolina

Endereço para correspondência: Dr. Ricardo Barbosa Lima, Faculdade Uninassau, Colegiado de Odontologia, Avenida Cardoso de Sá, número 950, Vila Eduardo, CEP: 56328020 - Petrolina, PE - Brasil

E-mail para correspondência: dentistaricardolima@gmail.com



RESUMO

As abordagens restauradoras são essenciais para o controle da cárie dentária. Entretanto, a provisão desse tipo de tratamento em molares decíduos ainda não havia sido analisada. Portanto, o objetivo deste estudo foi avaliar a oferta de tratamentos restauradores para molares decíduos nos serviços públicos de saúde bucal do Brasil. Foi realizada uma análise de série temporal ao longo de 42 meses (de agosto de 2020 a janeiro de 2024), utilizando dados referentes aos quantitativos mensais de restaurações em molares decíduos, padronizadas por 1.000 procedimentos. Foram avaliados os materiais restauradores disponíveis (resina composta – RC, cimento de ionômero de vidro – CIV ou amálgama – AMG) e os tipos de profissionais executores (cirurgiões-dentistas generalistas ou especialistas em Odontopediatria ou Odontologia para Pacientes com Necessidades Especiais). As comparações entre tipos de profissionais e materiais restauradores foram testadas por meio de modelos lineares generalizados, além de correlações e testes de tendência. O nível de significância adotado foi de 5% em todos os testes. No total, foram registrados 1.713.484 procedimentos restauradores, dos quais 77,6% realizados por cirurgiões-dentistas generalistas. O CIV foi o material restaurador mais utilizado em ambos os grupos profissionais ($p < 0,001$). Entre os generalistas, o uso da RC aumentou ($p < 0,001$), enquanto o uso de CIV ($p = 0,001$) e AMG ($p < 0,001$) diminuiu. Entre os especialistas, a RC também apresentou aumento ($p = 0,043$), o uso de AMG diminuiu ($p < 0,001$) e o CIV permaneceu estável ao longo do tempo ($p = 0,853$). Concluiu-se que a provisão de tratamento restaurador para molares decíduos sofreu modificações ao longo do tempo no sistema público de saúde bucal do Brasil.

Palavras-chave: Molares Decíduos; Restauração Dentária; Assistência Odontológica para Crianças; Materiais Dentários; Odontologia em Saúde Pública.

ABSTRACT

Restorative approaches are essential for caries disease control. However, the provision of this type of treatment in primary molars has not yet been analyzed. Therefore, the objective of this study was to evaluate the provision of restorative treatments for primary molars within Brazil's public dental services. A time-series analysis was conducted over 42 months (from August 2020 to January 2024), using data on monthly counts of restorations in primary molars, standardized per 1,000 procedures. Available dental materials (composite resin – CR, glass



ionomer cement – GIC, or amalgam – AMG) and provider types (general dental practitioners or specialists in Pediatric or Special Care Dentistry) were evaluated. Comparisons between provider types and dental materials were tested using generalized linear models, in addition to correlations and trend tests. The significance level was set at 5% in all tests. A total of 1,713,484 restorative procedures were recorded, with 77.6% performed by general practitioners. GIC was the most used dental material across both provider groups ($p < 0.001$). Among general dental practitioners, CR use increased ($p < 0.001$), while GIC ($p = 0.001$) and AMG ($p < 0.001$) decreased. Among specialized dental practitioners, CR also increased ($p = 0.043$), AMG decreased ($p < 0.001$), and GIC remained stable over time ($p = 0.853$). It was possible to conclude that the provision of restorative treatment for primary molars has changed over time in Brazil's public dental system.

Keywords: Primary Molars; Dental Restoration; Dental Care for Children; Dental Materials; Public Health Dentistry.

INTRODUCTION

Dental caries in childhood, particularly in the primary dentition, remains a global public health issue, especially among socioeconomically vulnerable children. Its impact includes reduced oral health-related quality of life (ZAROR et al., 2022; ZOU et al., 2022). Despite global efforts, control remains unsatisfactory, particularly in underserved areas where service-related and professional barriers persist. Additionally, socioeconomic determinants contribute to the burden of oral disease, requiring interventions beyond dentistry-related clinical actions (ZAROR et al., 2022; ZHANG et al., 2020). However, among other relevant needs for children with dental caries, restorations stand out as a significant part of the clinical treatment (AMEND et al., 2022a; AMEND et al., 2022b).

Cariou lesions frequently affect primary molars, underscoring the need for adequate restorations and broader caries control in children (VARSHINI; GURUNATHAN; PADMAPRIYA, 2022; HARINI; GURUNATHAN; PADMAPRIYA, 2022). Direct restorative approaches can involve dental materials such as composite resin (CR), glass ionomer cement (GIC), and amalgam (AMG), each with distinct technical, economic, and clinical features. However, success depends not only on the material but also on availability, cost-effectiveness, and professional experience (AMEND et al., 2022a; AMEND et al., 2022b).



This perspective highlights the relevance of real-world data to support healthcare decision-making, particularly regarding dental materials used in primary molars by different dental practitioners, also corroborating an evidence-based perspective, whether they are specialists or not (SCHWENDICKE; KROIS, 2022; ZISIS et al., 2024). Brazil's public dental services offer such data, with monthly records of restorations. Since August 2020, dental materials used in each procedure have been separately registered (BRAZIL, MINISTRY OF HEALTH, 2024a; BRAZIL, MINISTRY OF HEALTH, 2024b). It is noteworthy that Brazil also has one of the world's largest public healthcare systems, offering free general and specialized dental care nationwide through an integrated service network (QUEIROZ et al., 2022; FREIRE et al., 2021).

To date, no study has evaluated restorative treatments for primary molars within Brazil's public dental services or compared material use between general and specialized practitioners. Therefore, this study aimed to assess these patterns, focusing on trends in dental material use and provider types (general and specialized dental practitioners, GDPs and SDPs, respectively). Three null hypotheses (H_0) were tested: (H_{01}) there is no difference in the proportion of dental materials (GIC, CR, and AMG) used on primary molars between GDPs and SDPs; (H_{02}) there is no temporal trend in the use of each restorative material by provider type throughout the study period; and (H_{03}) there is no correlation between the incidence of restorations in primary molars and the incidence of other caries-related dental procedures across Brazilian states.

METHOD

ETHICS

To achieve the proposed objective, a nationwide register-based study was designed, considering a time-series approach (longitudinal, retrospective, and quantitative study), similar to previous studies (MOURA et al., 2024; LIMA et al., 2024a). This study was based exclusively on publicly available aggregated data, with no access to identifiable patient information (population-level source). For this reason, submission to an ethics committee was not required. This approach complies with current ethical regulations in Brazil, particularly National Resolution No. 510 of April 7, 2016, from the National Health Council – Ministry of Health (BRAZIL, MINISTRY OF HEALTH, 2016).



DESIGN

The time factor was outlined to cover the widest period with information available in the data source, spanning from August 2020 to January 2024, constituting a 42-month analysis. The spatial scope was defined to encompass the entire national territory of Brazil. There were no restrictions regarding location or the type of public dental services, considering all restorations in primary molars provided in outpatient settings during this period. However, considering primary molars, the provision of restorations was stratified into two levels for dental practitioners: GDPs and SDPs. The eligible specialties were Pediatric Dentistry and Special Care Dentistry.

SOURCE

The primary source of this study was the Outpatient Productivity Bulletins (OPBs) recorded by Brazil's public healthcare system (National Outpatient Information System). The monthly productivity of outpatient dental procedures provided, such as restorations in primary molars, is aggregated through the OPBs, which are publicly accessible in Brazil (BRAZIL, MINISTRY OF HEALTH, 2024a; BRAZIL, MINISTRY OF HEALTH, 2024b).

OUTCOMES

The primary variable of the study was the monthly quantity of direct restorations in primary molars, considering GDPs and SDPs, as well as the applied dental materials. To enable comparisons between monthly values and correct for discrepancies in the quantity of GDPs and SDPs operating in Brazil's public dental services, the monthly proportion of each dental material used per 1,000 procedures was used. The dental materials applied to restorations in primary molars were CR, GIC and AMG.

As secondary variables, person-year incidence of restorations in primary molars (without stratification by dental material or dental practitioner) was obtained per 100,000 residents aged zero to fourteen years in all Brazilian states. In addition, the incidence of other caries-related relevant outpatient dental procedures were collected: pulpectomy in primary teeth, extraction of primary teeth, topical fluoride application and supervised toothbrush (per collective action), cariostatic or sealant application (per tooth), and first programmatic dental appointments.

ACQUISITION

All datasets were imported between March and April 2024. The methodological procedure for acquiring the variables of interest in this study is similar to that employed in several previous studies using this data source (QUEIROZ et al., 2022; FREIRE et al., 2021; MOURA et al., 2024; LIMA et al., 2024a). The aggregated data from the OPBs was retrieved using the TabNet tool on its virtual webpage on the internet (BRAZIL, MINISTRY OF HEALTH, 2024a). The monthly productivity was stratified according to the month and the type of dental practitioners. The content was defined as approved quantity, referring to the evaluated outpatient dental procedure (restorations in primary molars). In addition, the period was selected between August 2020 and January 2024.

A filter adjustment was applied to the type of provider, considering GDPs and SDPs and the Brazilian Classification of Occupations (BRAZIL, MINISTRY OF HEALTH, 2024a; BRAZIL, MINISTRY OF HEALTH, 2024b). Therefore, GDPs were identified based on dental practitioners assigned to the specified codes: #2232B1 + #223293 (Family Health Strategy), #223272 (Collective Health), and #223208 (General Practice). Similarly, SDPs were retrieved by dental practitioners assigned to the specified codes: #223236 (Pediatric Dentistry) and #223288 (Special Care Dentistry). Another filter adjustment was applied to restorations in primary molars with different dental materials: #0307010082 (restoration of posterior primary tooth with composite resin/), #0307010104 (restoration of posterior primary tooth with glass ionomer cement), and #0307010090 (restoration of posterior primary tooth with amalgam).

The same procedure was applied to acquire the secondary variables, considering their respective codes: pulpectomy in primary teeth (#0307020037), extraction of primary teeth (#0414020120), topical fluoride application and supervised toothbrush (per action) (#0101020015 and #0101020023), cariostatic or sealant application (per tooth) (#0101020058 and 0101020066), and first programmatic dental appointment (#0301010153). Ultimately, to obtain the person-year incidence for the study period, population estimates were obtained from the intercensal projections of the Brazilian Institute of Geography and Statistics, also using the TabNet tool.

ANALYSIS

All datasets were exported into spreadsheets for further processing and statistical analysis, using JAMOVI software (version 2.3.15, Sydney, Australia) for descriptive and inferential analyses. The significance level was set at 5% ($\alpha = 0.05$), considering all $p < 0.05$ as a statistically significant outcome. The descriptive

analysis was conducted using absolute frequencies (f – monthly quantity of restorations in primary molars) and relative frequencies (fr – percentage), along with obtaining the mean monthly proportion and its 95% confidence interval (CI). Moreover, correlations between the proportions were checked using the Spearman's rank correlation matrix, considering the coefficient ρ .

Comparisons between proportions among the types of dental practitioners or applied dental materials were conducted using generalized linear models (GLMs). Since the datasets exhibited greater variance in relation to the mean (indicating overdispersion), a negative binomial regression model was employed (proportion ratio), considering the maximum likelihood estimator with a logarithmic link-function (*Log-likelihood estimation*). Ultimately, The trend over time of the proportions was assessed using the Mann-Kendall approach, considering the sign of the S -value to determine the direction (increasing or decreasing) and magnitude.

RESULTS

Between August 2020 and January 2024, Brazil's public dental services provided 2,043,273 restorations in primary teeth, of which 1,713,484 (83.9%) were primary molars. The person-year incidence of restorations in primary molars was 3,899 *per* 100,000 residents between August 2020 and January 2024. Regarding the providers, 1,329,931 (77.6%) were GDPs and 383,553 (22.4%) were SDPs. As dental materials for restorations in primary molars, 1,104,343 (64.5%) were GIC, 523,294 (30.5%) were CR, and 85,847 (5%) were AMG.

In addition, Table 1 presents the proportion of restorations in primary molars between GDPs and SDPs. The relative frequencies were similar between GDPs and SDPs for GIC restorations (64.7% *versus* 63.6%), CR restorations (31.1% *versus* 32.2%), and AMG restorations (5.2% *versus* 4.2%), respectively, as detailed in Figure 1. However, slight variations in the proportions *per* 1,000 procedures were observed between GDPs and SDPs, as thoroughly addressed in Table 2.

Table 1. Proportion of restorations in primary molars between general and specialized dental practitioners within Brazil's public dental services between August 2020 and January 2024 (every 1,000 restorations).

Dental materials	f	fr (%)	Proportion/1,000
<i>General Dental Practitioners – GDPs</i>			
GIC	860,502	64.7	654 [644 – 664]

CR	399,929	30.1	293 [283 – 302]
AMG	69,500	5.2	53.4 [49.8 – 57.0]
<i>Specialized Dental Practitioners – SDPs</i>			
GIC	243,841	63.6	630 [616 – 644]
CR	123,365	32.2	322 [310 – 334]
AMG	16,347	4.2	47.2 [42.4 – 52.0]

f.: absolute frequency (restorations). *fr.*: relative frequency (percentage). GIC: glass ionomer cement. CR: composite resin. AMG: amalgam. []: 95% confidence interval.

Table 2. Comparison of the proportions of restorations in primary molars between general and specialized dental practitioners within Brazil's public dental services between August 2020 and January 2024 (every 1,000 restorations).

Comparison	PR	Limits		z-score	p
		Lower	Upper		
<i>General Dental Practitioners – GDPs</i>					
Intercept	217	212	221		<0.001*
GIC	<i>ref</i>				
CR	0.447	0.432	0.463	-45.5	<0.001*
AM	0.082	0.076	0.086	-96.3	<0.001*
<i>Specialized Dental Practitioners – SDPs</i>					
Intercept	212	207	218		<0.001*
GIC	<i>ref</i>				
CR	0.511	0.485	0.538	-25.6	<0.001*
AM	0.075	0.070	0.080	-77.5	<0.001*
<i>Glass ionomer cement – GIC</i>					
Intercept	642	634	651		<0.001*
GDPs	<i>ref</i>				
SDPs	0.964	0.939	0.990	-2.7	0.006*
<i>Composite resin – CR</i>					
Intercept	307	300	314		<0.001*
GDPs	<i>ref</i>				
SDPs	1.10	1.05	1.15	4.0	<0.001*

Amalgam					
Intercept	50.2	47.6	52.9		<0.001*
GDPs	ref				
SDPs	0.885	0.796	0.984	-2.2	0.024*

PR: proportion ratio. *ref.* reference category (PR = 1). *: $p < 0.05$ (statistically significant outcome).
 GIC: glass ionomer cement. CR: composite resin. AMG: amalgam. GDPs: General Dental Practitioners. SDPs: Specialized Dental Practitioners.

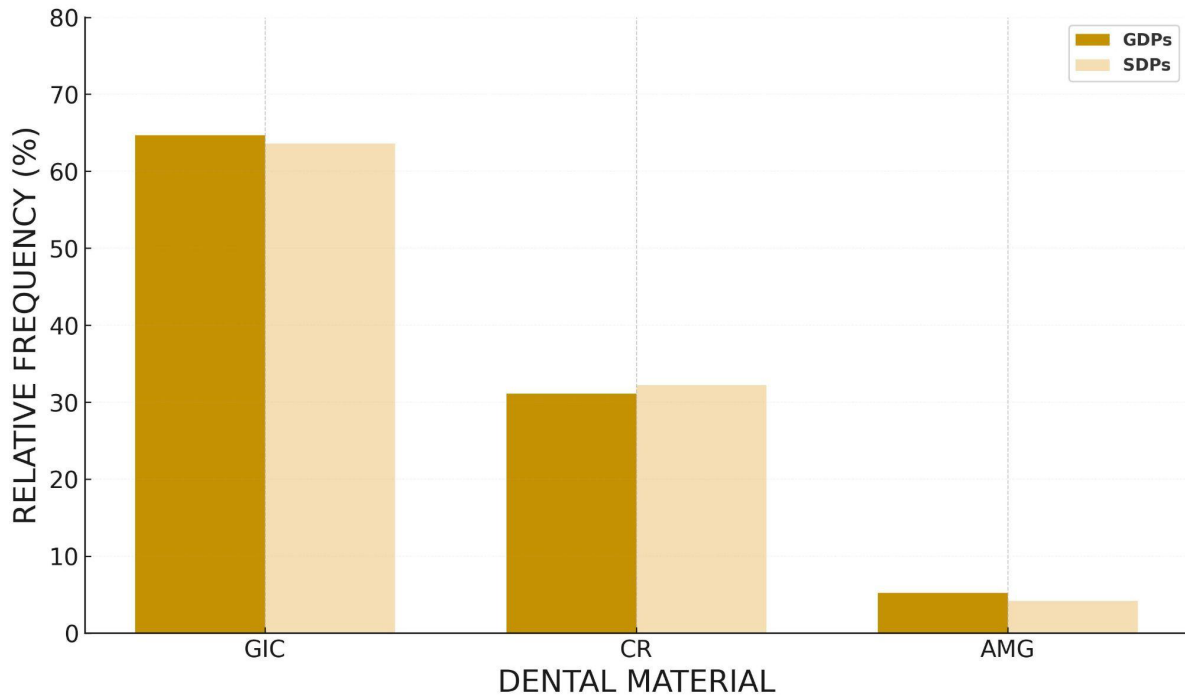


Figure 1. Relative frequency (%) of restorative materials used on primary molars, comparing general dental practitioners (GDPs) and specialized dental practitioners (SDPs) in Brazil’s public dental services (August 2020 to January 2024). GDPs are represented in ochre and SDPs in beige. The graph shows the proportion of glass ionomer cement (GIC), composite resin (CR), and amalgam (AMG) used by each provider category.

Table 2 presents the comparison of the proportion of restorations in primary molars between GDPs and SDPs. Considering all restorations provided by GDPs, using GIC as the reference category (as it had the highest proportion *per* 1,000 procedures), the proportion of restorations using CR was 55.3% lower (95%CI = 53.7 – 56.8%), and using AMG was 91.8% lower (95%CI = 91.4 – 92.4%) (R^2 -adjusted = 0.987 in this model). Likewise, considering all restorations provided by SDPs, also adjusting GIC as the reference category, the proportion of restorations using CR was 48.9% lower (95%CI = 46.2 – 51.5%), and using AMG was 92.5% lower (95%CI = 92 – 93%) (R^2 -adjusted = 0.975 in this model).

In addition, compared to GDPs (reference category), the proportion of GIC restorations provided by SDPs was 3.6% lower (95%CI = 1.0 – 6.1%, R^2 -adjusted = 0.069), and the proportion of AMG restorations was 11.5% lower (95%CI = 1.6 – 20.4%, R^2 -adjusted = 0.046). However, for CR, the proportion of restorations provided by SDPs was 10% higher (95%CI = 5.0 – 15.0%, R^2 -adjusted = 0.152) when compared to GDPs.

Table 3, as well as Figures 2 and 3, present the temporal trend in the proportion of restorations in primary molars performed by GDPs and SDPs. It was observed that the proportion of AMG restorations in primary molars showed a significant decreasing trend over the 42 months evaluated, both among GDPs and SDPs. However, the *S*-value was more pronounced among SDPs than GDPs (-485 *versus* -405, respectively). Furthermore, among GDPs, there was a significant decreasing trend in the proportion of GIC restorations, while there was a significant increasing trend in the proportion of CR restorations. Moreover, among SDPs, there was also a significant increasing trend in the proportion of CR restorations, but with a lower *S*-value compared to GDPs (187 *versus* 474, respectively). However, GIC restorations showed no significant temporal variation over the 42 months evaluated. These combined trends are simultaneously illustrated in Figure 4.

Table 3. Temporal trend of the proportions of restorations in primary molars between general and specialized dental practitioners within Brazil's public dental services between August 2020 and January 2024 (every 1,000 restorations).

Dental materials	S-value	z-score	p	Trend
<i>General Dental Practitioners – GDPs</i>				
GIC	-300	-3.2	0.001*	Decreasing
CR	474	5.1	<0.001*	Increasing
AMG	-405	-4.4	<0.001*	Decreasing
<i>Specialized Dental Practitioners – SDPs</i>				
GIC	-18	-0.2	0.853	Stationary
CR	187	2.0	0.043*	Increasing
AMG	-485	-5.2	<0.001*	Decreasing

*: $p < 0.05$ (statistically significant outcome). GIC: glass ionomer cement. CR: composite resin. AMG: amalgam.

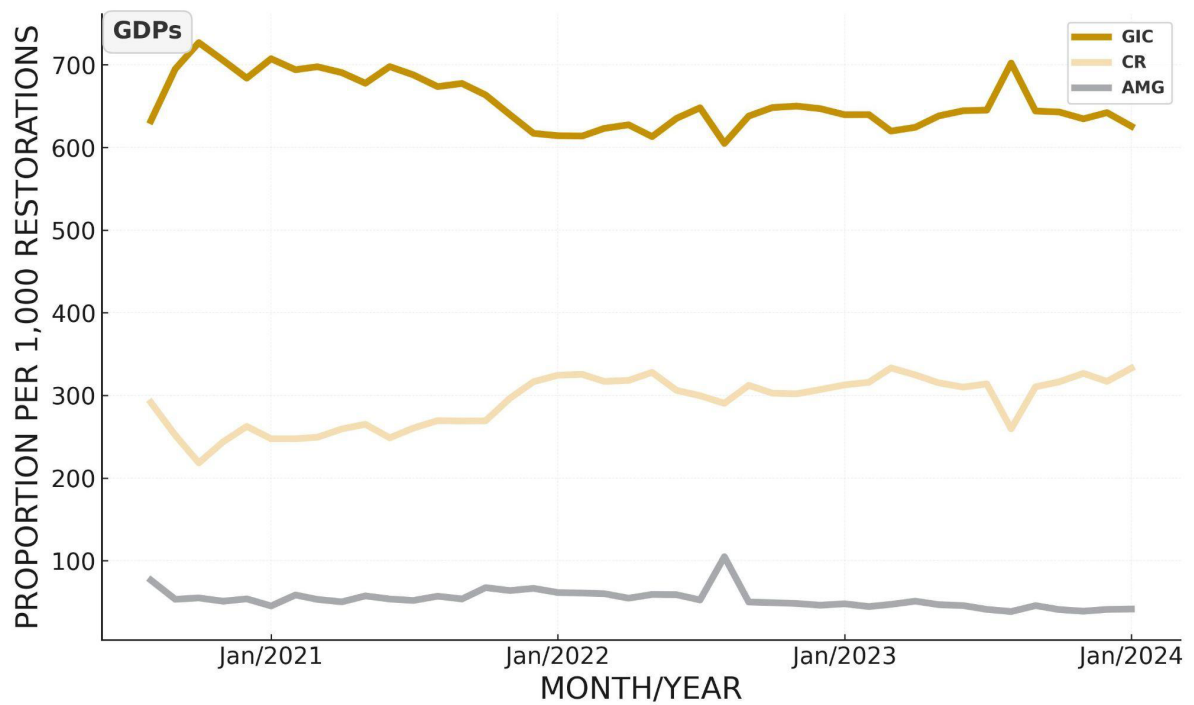


Figure 2. Temporal variation in the proportion of restorative treatments on primary molars performed by general dental practitioners (GDPs) in Brazil's public dental services, from August 2020 to January 2024 (per 1,000 restorations), considering glass ionomer cement (GIC), composite resin (CR), and amalgam (AMG) as the dental materials.

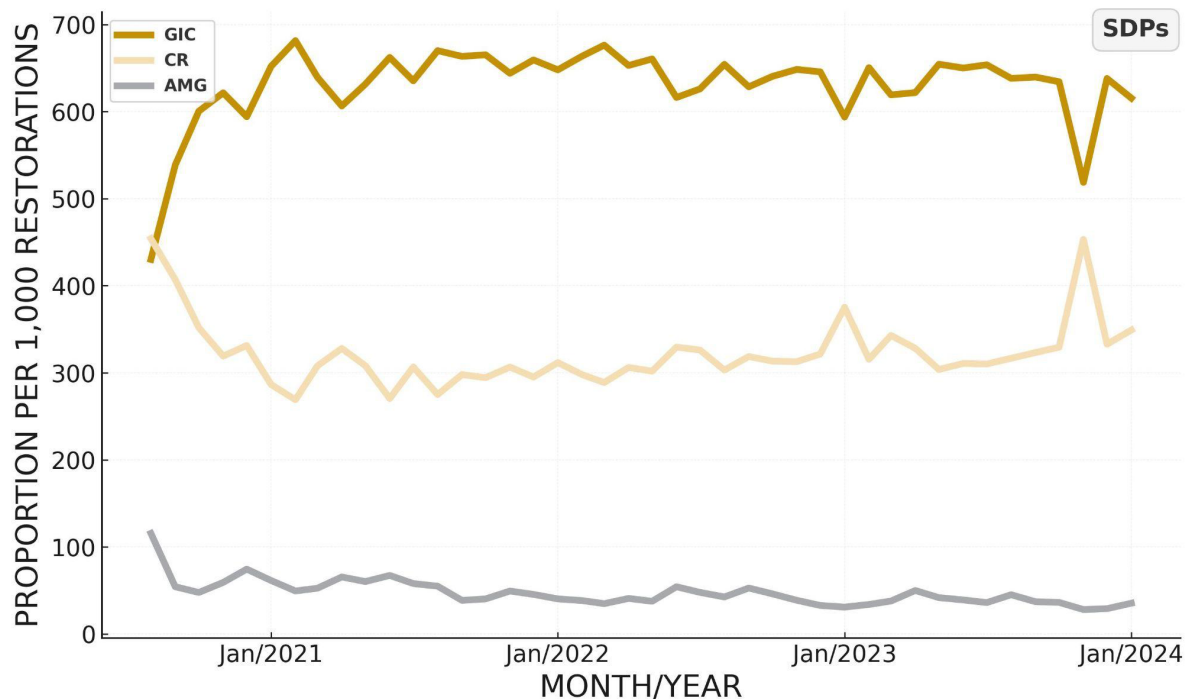


Figure 3. Temporal variation in the proportion of restorative treatments on primary molars performed by specialized dental practitioners (SDPs) in Brazil's public dental services, from August 2020 to January 2024 (per 1,000 restorations), considering glass ionomer cement (GIC), composite resin (CR), and amalgam (AMG) as the dental materials.

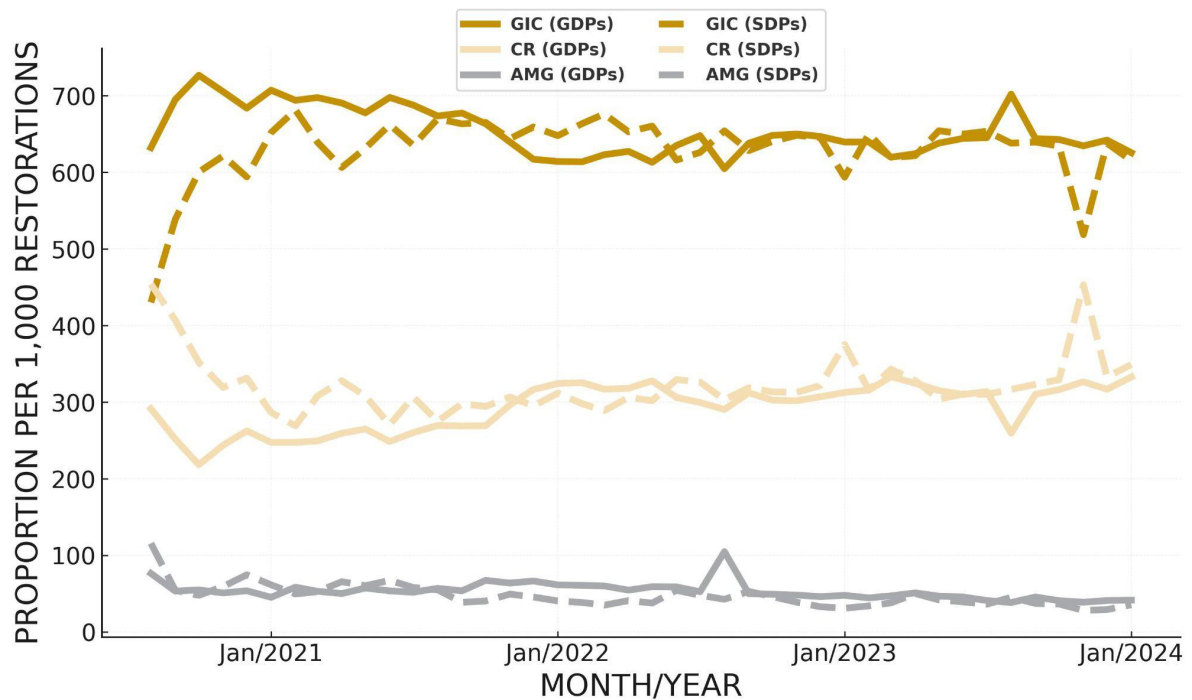


Figure 4. Overlapping temporal trends in the proportion of restorative treatments on primary molars performed by general dental practitioners (GDPs) and specialized dental practitioners (SDPs) in Brazil's public dental services, from August 2020 to January 2024 (*per* 1,000 restorations), considering glass ionomer cement (GIC), composite resin (CR), and amalgam (AMG) as the dental materials. Continuous lines represent GDPs, and dashed lines represent SDPs.

Correlating the proportions between GDPs and SDPs, no significant difference was found in GIC ($p = 0.479$) and CR ($p = 0.268$) restorations in primary molars. However, significant but weak and positive correlation was found for AMG restorations ($p = 0.008$, $\rho = 0.410$) over the 42 months evaluated.

Ultimately, Table 4 presents the correlation between the incidence of restorations in primary molars and the incidence of other caries-related outpatient dental procedures. In the state-level approach, there was a significant, positive, and weak correlation with the incidence of cariostatic or sealant application (*per* tooth) and first programmatic dental appointments (*per* patient). Moreover, there was a significant, positive and moderate correlation with the incidence of extractions of primary teeth and topical fluoride application and supervised toothbrush (*per* action).

Table 4. The correlation between the incidence of restorations in primary molars and the incidence of other caries-related outpatient dental procedures within Brazil's public dental services between August 2020 and January 2024 (every 100,000 residents).

Caries-related outpatient dental procedures	ρ	ρ
Pulpectomies in primary teeth (per tooth)	0.120	N/A
Extractions of primary teeth (per tooth)	0.004*	0.545
Topical fluoride application and supervised toothbrush (per action)	<0.001*	0.794
Cariostatic or sealant application (per tooth)	0.018*	0.443
First programmatic dental appointment (per patient)	0.027*	0.424

*: $p < 0.05$ (statistically significant outcome). ρ : rho coefficient. N/A: not applicable.

DISCUSSION

This study evaluated restorative treatments for primary molars in Brazil's public dental services, focusing on dental materials (CR, GIC and AMG) and provider types (GDPs and SDPs). Restorations were frequent over the 42-month period, with GDPs performing most procedures. GIC was the most used material among both provider types, followed by CR, while AMG had the lowest frequency. AMG use decreased over time in both groups, CR increased, and GIC declined only among GDPs. H_01 was rejected due to significant differences in material use between GDPs and SDPs, despite low effect sizes (R^2). H_02 was partially accepted, since CR and AMG showed temporal trends, while GIC remained stable among SDPs. Lastly, H_03 was also partially accepted, with significant but weak-to-moderate correlations between primary molar restorations and other caries-related procedures.

After comparing the proportions between GDPs and SDPs (for the same dental material), GLMs captured discrete significant differences, in which GDPs provided restorations in primary molars using GIC or AMG more frequently than SDPs, while SDPs provided restorations in primary molars using composite resin (CR) more frequently than GDPs. However, the adjusted coefficients of determination (R^2) in each model indicate that, although statistically significant, these differences account for only a small proportion of the overall variance. These findings should be interpreted with caution, as the models poorly explained the variability in restoration proportions when provider type was the only predictor.



Although statistically significant differences were identified between GDPs and SDPs, these differences were modest and may reflect operational or contextual factors rather than distinct clinical approaches for primary molars.

The slight differences between GDPs and SDPs may be influenced by temporal variations in material use. Among GDPs, the proportions of GIC and AMG restorations declined over the 42-month period, while CR use increased (Table 3), potentially masking initial contrasts between provider types. This is supported by Table 1, where GDPs show higher proportions of GIC (654 *versus* 630) and AMG (53.4 *versus* 47.2) restorations *per* 1,000 procedures, whereas SDPs present a higher proportion of CR (322 *versus* 293). The confidence intervals in this analysis also reveal the closeness of values between groups. These patterns help explain the observed differences and are visually summarized in Figure 4, which illustrates overlapping temporal trends and subtle distinctions in restorative dental materials choices across provider types.

Addressing the results, it is important to consider that the high number of restorations in primary teeth, particularly in primary molars, may reflect persistent challenges in controlling dental caries, especially in socioeconomically vulnerable settings. In fact, restorative procedures address cavities, and controlling the disease requires actions focused on sugar consumption and lifestyle habits, including oral hygiene (ZAROR et al., 2022; ZOU et al., 2022). Although the prevalence of dental caries varies according to territory and population, it has significantly decreased in recent years. However, the persistence of untreated carious lesions remains a significant issue in Brazil, especially in socioeconomically vulnerable contexts (KARAM et al., 2023; MELO; SOUZA; GOES, 2019). Recent population-based investigations have further demonstrated how territorial disparities and structural barriers within Brazil's public healthcare system contribute to unequal access to dental care for children (LIMA et al., 2025; LIMA et al., 2024b). These findings reinforce the need for integrated policies that go beyond clinical treatment, addressing systemic inequalities in the provision of oral health services.

For instance, Karam et al. (2023), evaluating data related to primary dentition from three birth cohorts in Brazil, reported that the prevalence of untreated dental caries was 63.4%, 45.5% and 15.6%, in 1993 (children aged 6), 2004 (children aged 5) and 2015 (children aged 4), respectively. Melo et al. (2019) also reported a significant increase in dental caries among children enrolled in a prospective study between 2006 and 2010 (recall), ranging from 28.6% to 68.9%, respectively. In both cases, there was an association between unfavorable socioeconomic status and the dental caries prevalence. Therefore, it is understandable that restorations in primary molars have been so common in



Brazil's public dental services, as well as corroborating the correlated incidences with other dental caries-related procedures, portraying the efforts made to deal with the disease in a real-world setting.

The predominance of GIC restorations is an important outcome in the state of the art. The use of this dental material in the context of Public Health is widely disseminated due to its practicality compared to CR and AMG (which is particularly important during dental care for children due to uncooperative behavior in dental settings) (YUNUS et al., 2021; OLEGÁRIO et al., 2020), as well as its relative low cost and satisfactory clinical performance (cost-effectiveness), whether through restorations involving removal of carious tissue or Atraumatic Restorative Treatments (ARTs) (INNES et al., 2019; SOUZA et al., 2022).

However, it is important to highlight that GIC, as a restorative material, has limitations, particularly in cases of extensively destroyed teeth or carious lesions involving multiple surfaces, which may require the use of alternative materials, such as composite resin, to achieve better adhesion and clinical outcomes. Furthermore, the longevity of restorations in primary molars is not solely limited to the type of restorative dental material used, but also involves operative technique and individual characteristics of the children, such as oral hygiene levels (AMEND et al., 2022a; AMEND et al., 2022b).

In parallel, AMG was not as common in restorations in primary molars in Brazil's public dental services. The decreasing trend in the use of this material may be attributed to multiple factors, including the international agreement to reduce mercury use due to environmental concerns (Minamata Convention, 2017) and a growing emphasis in dental education on adhesive restorative techniques, particularly following the dissemination of minimal intervention concepts (AMEND et al., 2022a; AMEND et al., 2022b; MIRANDA et al., 2024). In addition, there are concerns within the scientific community regarding the potential toxicity of mercury to human health, which have led to questions about whether amalgam restorations represent a risk factor. Nevertheless, aesthetic considerations have become relevant in recent years, which may have contributed to this outcome. As pointed out by Miranda et al. (2024), AMG restorations are facing a "phase down".

Ultimately, in addressing the differences between GDPs and SDPs productivity, in addition to the statistical issues already mentioned, it has been demonstrated that there are limitations in dental care for children within primary health care services where GDPs work. Among these challenges, managing the behavior of uncooperative children stands out, limiting dental care and contributing to



referrals to secondary health care (GOUVÊA; RODRIGUES, 2023; ESSVEIN et al., 2019). Consequently, it is possible that the practicality of using GIC as a restorative dental material (unlike CR) (YUNUS et al., 2021; OLEGÁRIO et al., 2020) may be somewhat associated with GDPs over SDPs, justifying the slightly higher proportion when comparing them. Similarly, it is also reasonable to hypothesize that the specialized training of SDPs favors the use of CR to a greater extent than GDPs.

Beyond the dental material-related choices, the clinical settings and patient profiles encountered by SDPs, particularly those in Pediatric Dentistry and Special Care Dentistry, tend to be more complex and demand tailored strategies. These specialists are predominantly allocated to dental specialty centers, which operate within the secondary care level of Brazil's public health system. In this context, SDPs are more likely to treat children with uncooperative behaviour or disabilities, often requiring advanced resources, individualized planning, and greater technical control. Therefore, the slight differences between GDPs and SDPs likely reflect not only professional training, but also the clinical feasibility afforded by the structured nature of secondary care services (QUEIROZ et al., 2022; MOURA et al., 2024; LIMA et al., 2024a; LIMA et al., 2025).

The limitations of this study design should be considered when interpreting the results and applying them to future research or policy planning. One important limitation is the inability to identify which specific primary molar was restored, as well as the clinical condition of each tooth at the time of treatment. The aggregated data were analyzed from a population (ecological) perspective, and analyses at an individual (local) level may reflect different panoramas. In addition, there is no categorization based on data sources regarding dental materials applied to restorations, such as properties or composition (e.g., viscosity level or resin-modified GIC, respectively), as well as the availability of them in each public dental service. Therefore, a new investigation could explore how GDPs and SDPs are selecting and applying restorative dental materials on primary molars, as well as associating these outcomes with the features of the services and the dental practitioners linked to Brazil's public healthcare system, expanding the state of the art.

CONCLUSION

The approach to restoring primary molars in Brazil's public dental services has changed over time, with GIC remaining predominant and time trends showing increased CR use and reduced AMG use by both GDPs and SDPs. These



patterns suggest shifts in clinical decision-making regarding restorative materials, with variations across provider types.

REFERENCES

1. ZOU, J. et al. Expert consensus on early childhood caries management. **International Journal of Oral Science**, v. 14, n. 1, e35, 2022. Disponível em: <https://doi.org/10.1038/s41368-022-00186-0>. Acesso em: 26 set. 2025.
2. ZAROR, C. et al. Impact of early childhood caries on oral health-related quality of life: a systematic review and meta-analysis. **International Journal of Dental Hygiene**, v. 20, n. 1, p. 120-135, 2022. Disponível em: <https://doi.org/10.1111/idh.12494>. Acesso em: 26 set. 2025.
3. ZHANG, M. et al. Assessment of risk factors for early childhood caries at different ages in Shandong, China and reflections on oral health education: a cross-sectional study. **BMC Oral Health**, v. 20, n. 1, e139, 2020. Disponível em: <https://doi.org/10.1186/s12903-020-01104-8>. Acesso em: 26 set. 2025.
4. AMEND, S. et al. Clinical effectiveness of restorative materials for the restoration of carious lesions in pulp treated primary teeth: a systematic review. **European Archives of Paediatric Dentistry**, v. 23, n. 5, p. 761-776, 2022. Disponível em: <https://doi.org/10.1007/s40368-022-00744-4>. Acesso em: 26 set. 2025.
5. AMEND, S. et al. Clinical effectiveness of restorative materials for the restoration of carious primary teeth without pulp therapy: a systematic review. **European Archives of Paediatric Dentistry**, v. 23, n. 5, p. 727-759, 2022. Disponível em: <https://doi.org/10.1007/s40368-022-00725-7>. Acesso em: 26 set. 2025.
6. VARSHINI, A.; GURUNATHAN, D.; PADMAPRIYA, S. Prevalence of class I caries in the second mandibular primary molar in 3-6-year-old children. **Journal of Advanced Pharmaceutical Technology & Research**, v. 13, supl. 1, p. 72-75, 2022. Disponível em: https://doi.org/10.4103/japtr.japtr_235_22. Acesso em: 26 set. 2025.
7. HARINI, B.; GURUNATHAN, D.; PADMAPRIYA, S. Prevalence of class I caries in the second maxillary primary molar in 3-6-year-old



- children: a retrospective study. **Journal of Advanced Pharmaceutical Technology & Research**, v. 13, supl. 1, p. 190-193, 2022. Disponível em: https://doi.org/10.4103/japtr.japtr_185_22. Acesso em: 26 set. 2025.
8. SCHWENDICKE, F.; KROIS, J. Data Dentistry: how data are changing clinical care and research. **Journal of Dental Research**, v. 101, n. 1, p. 21-29, 2022. Disponível em: <https://doi.org/10.1177/00220345211020265>. Acesso em: 26 set. 2025.
 9. ZISIS, K. et al. Real-world data: a comprehensive literature review on the barriers, challenges, and opportunities associated with their inclusion in the health technology assessment process. **Journal of Pharmacy & Pharmaceutical Sciences**, v. 27, n. 1, e12302, 2024. Disponível em: <https://doi.org/10.3389/jpps.2024.12302>. Acesso em: 26 set. 2025.
 10. BRAZIL. Ministry of Health. **Department of Informatics of the Unified Health System – Health Information**. Brasília: Ministry of Health, 2024. Disponível em: <https://datasus.saude.gov.br/>. Acesso em: 26 set. 2025.
 11. BRAZIL. Ministry of Health. **Department of Informatics of the Unified Health System – Management System of Procedures, Medicines and OPMs**. Brasília: Ministry of Health, 2024. Disponível em: <http://sigtap.datasus.gov.br/>. Acesso em: 26 set. 2025.
 12. QUEIROZ, R. C. S. et al. Oral health care for people with disabilities in Brazil: transition from the specialized dental services between 2014 and 2018. **Community Dentistry and Oral Epidemiology**, v. 50, n. 1, p. 48-57, 2022. Disponível em: <https://doi.org/10.1111/cdoe.12719>. Acesso em: 26 set. 2025.
 13. FREIRE, D. B. L. et al. Dental imaging procedures in the Unified Health System and the expansion of secondary care: series between 2000-2016. **Ciência & Saúde Coletiva**, v. 26, n. 10, p. 4727-4736, 2021. Disponível em: <https://doi.org/10.1590/1413-812320212610.15172020>. Acesso em: 26 set. 2025.
 14. MOURA, A. P. G. et al. Outpatient and inpatient dental care for patients with disabilities in Brazil's public healthcare system: a population-based



- approach from 2014 to 2023. **Special Care in Dentistry**, v. 44, n. 6, p. 1642-1650, 2024. Disponível em: <https://doi.org/10.1111/scd.13030>. Acesso em: 26 set. 2025.
15. LIMA, R. B. et al. Territorial disparities in dental care for disabled persons and oral health-related indicators: a population-level approach in Brazil's public healthcare system from 2014 to 2023. **International Journal of Environmental Research and Public Health**, v. 21, n. 5, e632, 2024. Disponível em: <https://doi.org/10.3390/ijerph21050632>. Acesso em: 26 set. 2025.
 16. BRAZIL. Ministry of Health. **Resolution no. 510 – April 7, 2016**. Provides guidelines for research in human and social sciences. Diário Oficial da União, Brasília, Seção 1, p. 44, 24 maio 2016.
 17. KARAM, S. A. et al. Two decades of socioeconomic inequalities in the prevalence of untreated dental caries in early childhood: results from three birth cohorts in southern Brazil. **Community Dentistry and Oral Epidemiology**, v. 51, n. 2, p. 355-363, 2023. Disponível em: <https://doi.org/10.1111/cdoe.12747>. Acesso em: 26 set. 2025.
 18. MELO, M. M. D. C.; SOUZA, W. V.; GOES, P. S. A. Increase in dental caries and change in the socioeconomic profile of families in a child cohort of the primary health care in Northeast Brazil. **BMC Oral Health**, v. 19, n. 1, e183, 2019. Disponível em: <https://doi.org/10.1186/s12903-019-0871-9>. Acesso em: 26 set. 2025.
 19. LIMA, R. B. et al. Macro-regional disparities in specialized dental care for children in the Brazilian Unified Health System: an ecological study. **Pesquisa Brasileira em Odontopediatria e Clínica Integrada**, v. 25, n. 1, e230211, 2025. Disponível em: <https://doi.org/10.1590/pboci.2025.043>. Acesso em: 26 set. 2025.
 20. LIMA, R. B. et al. Outpatient dental procedures carried out by Pediatric Dentists within Brazil's public healthcare system. **Brazilian Oral Research**, v. 38, n. 1, e047, 2024. Disponível em: <https://doi.org/10.1590/1807-3107bor-2024.vol38.0047>. Acesso em: 26 set. 2025.
 21. SOUZA, T. F. et al. Worldwide research trends on the use of chemical-mechanical caries removal products over the years: a critical review. **European Archives of Paediatric Dentistry**, v. 23, n. 6, p. 869-883,



2022. Disponível em: <https://doi.org/10.1007/s40368-022-00726-6>. Acesso em: 26 set. 2025.
22. NNES, N. P. T. et al. A century of change towards prevention and minimal intervention in cariology. **Journal of Dental Research**, v. 98, n. 6, p. 611-617, 2019. Disponível em: <https://doi.org/10.1177/0022034519837252>. Acesso em: 26 set. 2025.
23. YUNUS, G. Y. et al. A comparative survival analysis of high viscosity glass ionomer restorations using conventional cavity preparation and atraumatic restorative treatment technique in primary molars: a randomized clinical trial. **Dental Research Journal**, v. 18, n. 1, e95, 2021. Disponível em: <https://doi.org/10.4103/1735-3327.330876>. Acesso em: 26 set. 2025.
24. OLEGÁRIO, I. C. et al. Is it worth using low-cost glass ionomer cements for occlusal ART restorations in primary molars? 2-year survival and cost analysis of a randomized clinical trial. **Journal of Dentistry**, v. 101, e103446, 2020. Disponível em: <https://doi.org/10.1016/j.jdent.2020.103446>. Acesso em: 26 set. 2025.
25. MIRANDA, D. A. et al. The “phase down” of dental amalgam restorations - what are the criteria for replacement and indication? **Pesquisa Brasileira em Odontopediatria e Clínica Integrada**, v. 24, n. 1, e220172, 2024. Disponível em: <https://doi.org/10.1590/pboci.2024.028>. Acesso em: 26 set. 2025.
26. GOUVÊA, D. B.; RODRIGUES, J. A. Access and resolubility in oral health care in early childhood: an integrative literature review. **Revista da Faculdade de Odontologia de Porto Alegre**, v. 63, n. 1, p. 91-97, 2023. Disponível em: <https://doi.org/10.22456/2177-0018.113873>. Acesso em: 26 set. 2025.
27. ESSVEIN, G. et al. Dental care for early childhood in Brazil: from the public policy to evidence. **Revista de Saúde Pública**, v. 53, n. 1, p. 15, 2019. Disponível em: <https://doi.org/10.11606/S1518-8787.2019053000540>. Acesso em: 26 set. 2025.