

Use of Restorative Materials in Primary Teeth – A Retrospective University-Based Study

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ABSTRACT

Objective: To investigate the types of restorative materials used for restorative treatment in primary teeth through a retrospective university-based study. **Material and Methods:** The sample consisted of all clinical records of children attended at the Pediatric Dentistry Clinic at the School of Dentistry of Ribeirão Preto at the University of São Paulo in Brazil. Inclusion criteria were primary anterior and posterior teeth that received dental restorations for treatment of dental caries lesions, dental trauma or dental development defects from 2013 to 2018. Restoration repairs and interim restorations during this period were also recorded. Descriptive analyzes were performed to assess the distribution according to the type of restorative material used over the years. **Results:** A total of 5,236 restorative procedures were performed in primary teeth, including restoration repair and interim restorations. Of those, 69% were done in posterior teeth and 31% in anterior teeth. Sixty percent of the procedures performed during this period were made of composite resin and a lower percentage of glass ionomer cement (18%) followed by silver amalgam (1%). The number of interim restorations was smaller but proportional to those of composite resin over the years. **Conclusion:** A tendency to carry out restorative treatment of primary teeth with composite resin during the 6 years of follow-up was observed.

Keywords: Dental Materials; Tooth, Deciduous; Therapeutics; Dental Caries.

Introduction

Restorative treatment is one of the treatment options for teeth compromised by dental caries lesions, trauma or structural defects, being the most common procedure performed in pediatric dentistry as recommended by guidelines from national and international dental associations [1]. Although there are several types of materials and techniques used for the restoration of dental caries lesions in primary teeth, there is no consensus in the literature regarding the best restorative material for such purpose [1,2]. The material choice should consider factors that are relevant to increase the survival rate of these restorations, such as the type of cavity preparation, the operator experience, the need for rubber dam isolation, and the presence of root canal treatment [3]. In addition, the risk and severity of dental caries, oral hygiene status, presence of parafunctional habits and the age of the patient are factors that should be considered before choosing the restorative material [4].

Despite the knowledge and scientific evidence available regarding the prevention of dental caries [5], information regarding the effectiveness of the different methods proposed for the treatment of active caries injuries remains absent [6]. A recent systematic review showed that treatment for dental caries lesions in primary teeth depends on the depth of the lesion and the number of surfaces involved; however, few studies have provided strong evidence to recommend the best treatment option [6].

Composite resin restorations are a viable option for restorative treatment of primary teeth, as they present aesthetic properties, acceptable longevity and are relatively easy to handle [7]. On the other hand, a worse long-term prognosis is expected due to the need to remove dental substrate, even for a selective caries removal protocol [8]. Silver amalgam has also been an option for restoration of posterior teeth [9] and continues to be a material used mainly in low- and middle-income countries, due to high durability and relatively low cost [10]. However, there are concerns about the use of silver amalgam, mostly related to the release of mercury and its environmental impact if improperly disposed of [10]. Another restorative option is glass ionomer cement. Glass ionomer cement is the material of choice for atraumatic restorative treatment (ART) mainly because of its properties, such as chemical adhesion to enamel and dentin, fluoride release and uptake, as well as its chemical setting reaction [11,12]. Recently, high-viscosity glass ionomer cements have been developed with the advantage of a relatively slow setting time and improved mechanical properties resulting in higher longevity of the restorations [13]. Nonetheless, this treatment option is relatively expensive when compared to conventional treatments which are generally used in public health or private practice in low-income populations [14]. Aside from the specific characteristics of each restorative material, the preference of dentists regarding the use of each technique should also be considered [15].

The aim of this study was to evaluate, through a retrospective study, the types of materials chosen for restoration of primary teeth due to dental caries lesions, dental trauma or dental development defects in children, performed in a dental clinic of a university.

Material and Methods

Ethical Aspects

This study was approved by the Ethics Research Committee at the School of Dentistry of Ribeirão Preto at the University of São Paulo in Brazil (CAAE: ° 51662221.7.0000.5419). All legal guardians signed a written informed consent that information stored on the dental school database could be used for academic purposes or scientific investigation. Data was collected from the database, but the personal information of the patients was kept confidential.

Study Design, Characteristics and Participants

This transversal retrospective university-based study was conducted at the Pediatric Dental Clinic at the School of Dentistry of Ribeirão Preto at the University of São Paulo (FORP / USP) in Brazil. Children with age from 0 to 12 years that were referred by the local basic health unities within the Brazilian Public Healthy System were included in this study. The population consisted of children treated by undergraduate dentistry students, supervised by a clinical team (experienced pediatric dentists), from 2013 to 2018. To be eligible for the study, clinical records should present the type of material used during the procedure. Restorations were performed in patients that presented dental caries lesions, dental trauma or dental development defects, on either posterior or anterior primary teeth. Only records with complete restoration data were included in the analysis.

Statistical Analysis

Data analysis was performed using the STATA 20.0 software (Stata Corp., College Station, TX, USA). The descriptive analysis provided a summary of the distribution according to the type of restorative material used over the years.

Results

It was possible to observe that between the years 2013 to 2018, 4,375 patients were treated at the Pediatric Dental Clinic and those patients had one or more restorative procedures performed in primary teeth ($n= 5,236$). Of the restorative treatment performed, 69% ($n=3,612$) were made in posterior teeth and 31% ($n=1,624$) were made in anterior teeth (Figure 1).

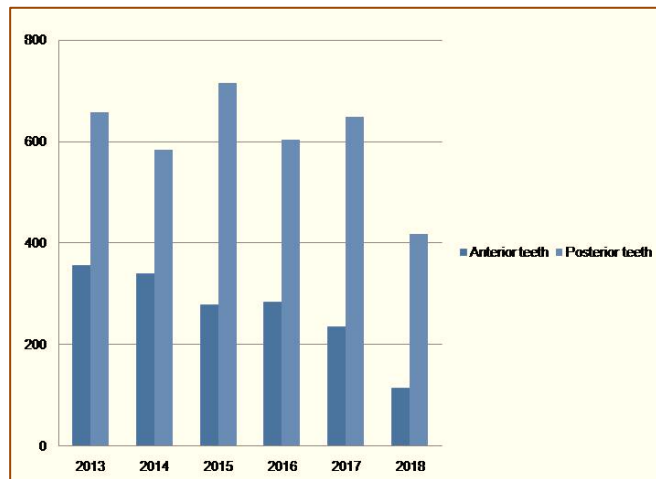


Figure 1. Total number of restorative procedures on anterior and posterior primary teeth distributed by year of treatment.

Sixty percent ($n= 3,141$) of the procedures performed during this period were made of composite resin and a lower percentage of glass ionomer cement (18%; $n= 942$), followed by silver amalgam (1%; $n= 52$). Overall, the absolute number of composite resin restorations reduced overtime, while the number of glass ionomer and amalgam restorations remained constant (Figure 2 and Table 1).

Interim restorations represented 22%, 16%, 8.5%, 19%, 18% and 15% of restorative procedures performed in 2013, 2014, 2015, 2016, 2017 and 2018, respectively. Repairs of restorations were performed in 3% of the procedures and remained constant throughout the period. Interim restoration showed a decrease in the years 2015 and 2018 compared to the other years, representing 9.6% and 9.0%, respectively (Figure 3).

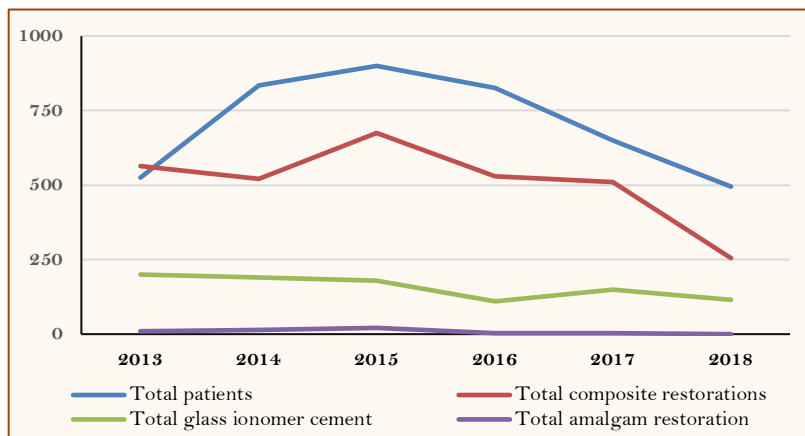


Figure 2. Number of patients and restorative procedures performed in primary teeth per year.

Table 1. Total number of each type of restorative procedure performed on anterior and posterior primary teeth from 2013-2018.

Restorative Procedure	2013		2014		2015		2016		2017		2018		Total
	A	P	A	P	A	P	A	P	A	P	A	P	
Composite restoration	196	369	206	332	220	467	185	371	162	354	64	219	3,145
Glass ionomer cement restoration	61	128	62	124	39	143	43	80	41	135	25	111	992
Silver amalgam restoration	0	10	13	0	1	20	1	3	1	2	0	0	51
Repair of restorations	7	18	4	29	0	20	2	28	5	20	10	22	165
Interim restoration	92	133	55	99	19	66	53	122	26	138	14	66	883
Total	356	658	340	584	279	716	284	604	235	649	113	418	5,236

A: Anterior teeth; P: Posterior teeth.

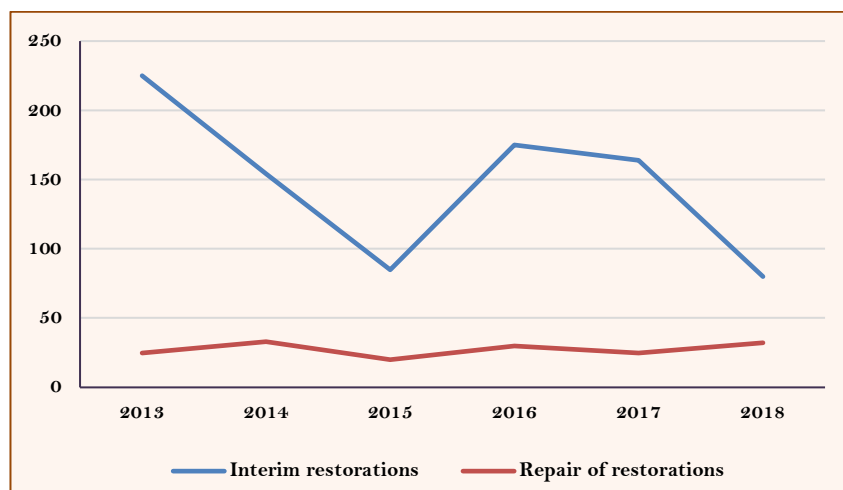


Figure 3. Number of interim restoration and repair of restoration performed in primary teeth per year.

Discussion

Dental caries is one of the most common oral health problems, especially in populations with low socioeconomic status [16,17]. In primary teeth, dental caries affects about 9% of the world population and is the tenth most prevalent disease [18]. In addition, the World Health Organization considers dental caries to be the fourth most expensive chronic non-communicable disease to perform the treatment [19], albeit there is no

standard choice of restorative materials for the lesion treatment. Similarly, developmental defects in dental structure and dental trauma can be restored using several restorative materials.

For more than 150 years, silver amalgam remained the material of choice for dental restorations [20]. Currently, the use of composite resins has overcome the use of silver amalgam due to composite characteristics such as aesthetics and adhesion to the dental structure. The results of this study show an increase in the use of composite resin for primary teeth restoration over the years, a fact that might be partially explained by the significant improvements in their physical properties recently [21]. Also, the global adoption of the minimally intervention dentistry is a philosophy that maximizes the preservation of tooth structure aiming to ensure that teeth are kept functional for a long period of life [22].

During the six years of evaluation of the clinical records, silver amalgam was the lowest used material for tooth restoration, representing only 1.2% of the total restorations performed in this period. The change in the choice of type of material used for restorative treatment over the years may be explained by the greater awareness of professionals in relation to the advantages of a minimally invasive approach in the treatment of dental caries lesions [21,23], thus avoiding the excessive removal of healthy dental tissues as part of the treatment, obtaining a better prognosis [20,23].

Currently, glass ionomer cement has been considered an innovative and minimally invasive treatment for dental caries [24]. Initially, glass ionomer treatment was recommended for vulnerable populations who were located in places where technical and operational conditions were difficult to perform routine treatment [25]. However, recently, ART has been shown to be a feasible approach and has been used in private practices, regardless of economic and social situation [14,26,27]. The results presented in this study showed that the use of glass ionomer cement restorations has remained constant over the years and represented 23% of the total treatments performed.

Replacing restorations is one of the procedures most performed by dentists in public or private offices and they have been shown to reduce the amount of remaining healthy dental structure [28,29]. In order to minimize these consequences and increase the longevity of restorations, minimal intervention procedures have been proposed to repair dental restoration [30]. This approach reduces the need for more invasive treatments that might result in future root canal treatment or tooth extractions [31]. Constant repair rates were observed over the years, which indicates the adoption of a minimally invasive intervention approach. However, it was not possible to collect data regarding to replacement of dental restorations. Therefore it is not possible to ascertain if a novel restoration referred to replacement of a defective one nor if it resulted from an unsuccessful reparative procedure.

Regarding interim restorations, there was a decrease in the number of procedures in 2015 and 2018; however, these procedures remained mostly constant throughout the years. Of note, interim restorations were made mostly with conventional glass ionomer cement due to its costs and properties. High-viscous glass ionomer cement, on the other hand, can be used as a definitive material in the restorative treatment of dental caries lesions [32].

Although dental caries is a public health problem in Brazil [33] and restorations are procedures commonly performed in pediatric dentistry [1], it was observed over the years that there was an overall decrease in the number of restorations performed. Reduced restorative procedures in clinical practice might either reflect a reduced occurrence of dental caries in the population assisted at this specific dental school or the adoption of protocols that do not involve excavation and restoration if dental caries is located solely on enamel. Nonetheless, a recent systematic review showed that caries prevalence is still high and indicates that a significant portion of







children and adolescents have cavitated carious lesions, even considering the improvement in socioeconomic conditions, preventive measures, access to fluorides or oral health education initiatives [34].

The change in the trend observed during the years within a university environment and the advances in research in relation to improving the properties of restorative materials might, in the future, directly interfere with the choice of material used for restorative treatment. Although professionals may recognize the importance of evidence-based dentistry, studies have identified barriers that hinder its implementation, such as the inaccessibility to relevant sources of evidence and lack of knowledge [35,36], with a significant gap observed between the available evidence and current dental practice [37]. Therefore, it should be emphasized the importance of using the best scientific evidence available in the educational environment to contribute to the acquisition of specific competencies by the students so they can select properly the techniques they will use in their future clinical practices.

Conclusion

It was possible to observe that composite resin was the most used material for restorative treatment in primary teeth in children during the 6-year follow-up.

Authors' Contributions

LAP		https://orcid.org/0000-0001-5024-2292	Methodology, Investigation, Resources, Data Curation and Writing - Original Draft.
RABS		https://orcid.org/0000-0002-0230-1347	Conceptualization, Data Curation and Writing - Review and Editing.
PNF		https://orcid.org/0000-0001-8802-6480	Methodology, Data Curation and Writing - Review and Editing.
LABS		https://orcid.org/0000-0001-7118-6859	Methodology and Writing - Review and Editing.
AMQ		https://orcid.org/0000-0003-2900-5000	Conceptualization and Writing - Review and Editing.
FWGSPS		https://orcid.org/0000-0001-8559-532X	Conceptualization, Methodology, Formal Analysis, Resources, Data Curation and Writing - Review and Editing.

All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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None.

Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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