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SUCCESS RATE OF GLASS IONOMER RESTORATIONS AND COMPOSITE RESIN IN DECIDUOUS TEETH: LITERATURE REVIEW

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ABSTRACT

Introduction: Dental caries is a disease whose prevalence is still high in early childhood and its progression can lead to early loss of the dental element. Currently, glass ionomer cement (GIC) and composite resin are the most used restorative materials in pediatric dentistry practice. **Objective:** The objective of the present literature review was to compare the success rate of restorations made with glass ionomer cement and composite resin in the deciduous teeth. **Materials and Methods**: The bibliographic research was carried out online, using the tool of search of scientific articles destined to health - PubMed and Google Academic. The search strategy included the following keywords: composite resin, glass ionomer cement and deciduous teeth. A manual survey was conducted in reference lists of included studies. Duplicate articles have been checked and deleted. Initially, 168 articles were found, of which 84 articles were excluded after reading the titles. After reading the abstracts 58 articles were excluded, leaving 18 articles to guide the construction of the present literature review. **Conclusion**: Given the paucity of clinical studies comparing the longevity of composite resin restorations and high viscosity GICs in deciduous teeth, it is not yet possible to indicate the superiority of one material over the other in clinical dental practice. The selection of the material will depend on each clinical case. It is important that the restorations ensure the esthetics and especially the function of deciduous teeth.

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INTRODUCTION

Dental caries is a disease whose prevalence is still high in early childhood and its progression may lead to early loss of the dental element. The consequences can be severe when inadequate eating habits are established, especially from the first year of life, such as high sugar consumption and nocturnal feeding, without satisfactory oral hygiene(Losso *et al*., 2009). In Brazil, approximately 53.4% of children at five years old present dental caries (Brasil, 2012). The pain caused by caries directly interferes with the daily life of the child. Due to the painful sensation, they decrease the intake of food, thus impairing its development, reducing the school performance generating than a learning deficit (Nunes and Perosa, 2017).

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When there is no pulp involvement, the carious lesions can be treated by removing the carious tissue and restoring the cavity. This restoration can be done with adhesive restorative materials such as composite resin or glass ionomer cement (GIC), depending on the amount of dental remaining, and the general oral condition of the patient (Miyata *et al*., 2014). Glass ionomer cement is commonly used because of its biocompatibility, fluoride release, and excellent coefficient of linear thermal expansion and modulus of elasticity similar to the tooth, being the only restorative material capable of chemically bonding to the dental structure (Sidhu and Nicholson, 2016). However, this material presents low mechanical resistance and limitations related to its aesthetic properties (Sidhu, 2011). The composite resin has high mechanical strength and good aesthetics, but its bioactive properties are limited, besides the formation of gaps during the polymerization contraction tension, which causes low

durability in the tooth-restoration interface(Munck *et al*., 2004). Clinical studies have found high success rates after selective removal of carious tissue in single- or multiple-faces of deciduous teeth restored with glass ionomer cement or composite resin(Casagrande *et al*., 2010; Franzon *et al*., 2015; Hilgert *et al*., 2014; de Medeiros Serpa *et al*., 2017; Pinto *et al*., 2006). A recent systematic review of clinical trials has shown that composite resin is the material with the lowest annual failure (Persici, Ribeiro, Pazinatto, 2018). In this context, the objective of the present literature review was to compare the success rate of restorations made with glass ionomer cement and composite resin, to expose the strengths and deficiencies of each material, so that dental surgeons have greater safety in the use of these materials in pediatric dentistry practice, based on scientific evidence.

MATERIALS AND METHODS

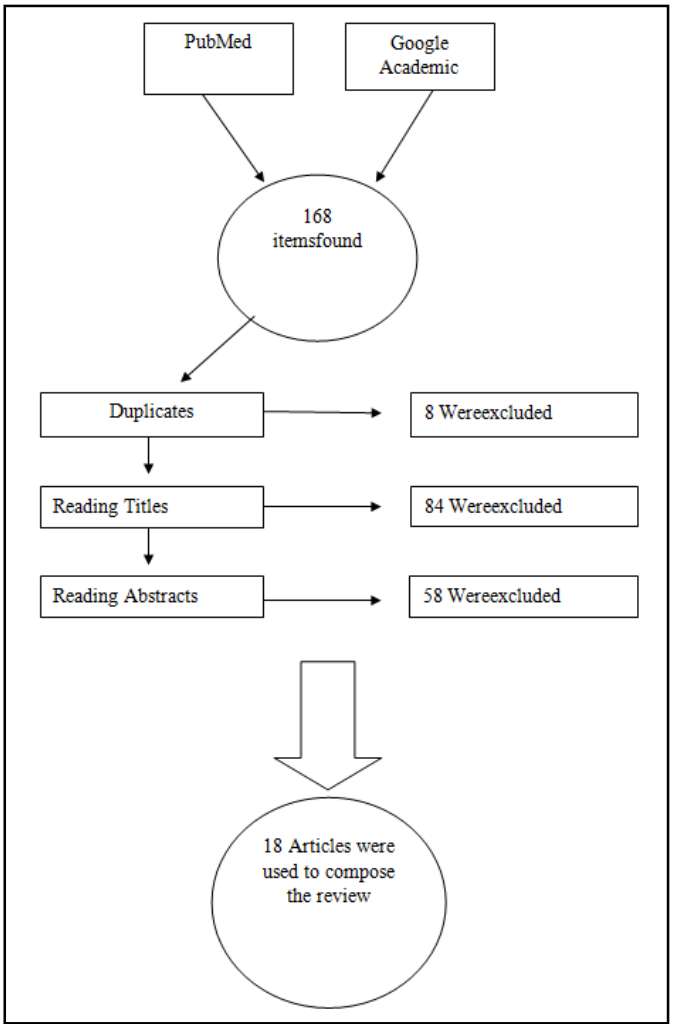
The bibliographic research was carried out online, using the tool of search of scientific articles destined to health - PubMed and Google Academic. The search strategy included the following keywords: composite resin, glass ionomer cement, and deciduous teeth. A manual survey was conducted in reference lists of included studies. Duplicate articles have been checked and deleted. It was included clinical studies published in Portuguese, English and Spanish, comparing the success rate of GIC and composite resin restorations in the deciduous dentition. In vitro studies, letters to the editor, editorials, abstracts and expanded abstracts were excluded. A descriptive analysis of the articles was performed and the data were organized in order to provide pertinent information regarding the clinical success rate of restorations with glass ionomer and composite resin in the deciduous dentition. Initially, 168 articles were found, of which 84 articles were excluded after reading the titles. After reading the abstracts 58 articles were excluded, leaving 18 articles to guide the construction of the present literature review.

Literature review

Early childhood caries (ECC) is defined as the presence of one or more decayed, missing teeth (due to caries) or restored in children up to 6 years of age. The ECC is the chronic disease that most affects preschool children, representing a great problem of global public health (Silva *et al*., 2017). Minimally Invasive Dentistry aims to preserving the healthy dental structure, practicing health promotion activities, and, therefore, the restorative process is carried out in the last instance (Tumenas *et al*., 2014). Depending on the remaining dental tissue after removal of the carious lesion, the tooth can be restored directly with composite resin or glass ionomer cement, or indirectly through the construction of prostheses. The choice of the restorative protocol will be defined by the patient's need, risk of oral cariogenic activity, lesion size, age of the patient and conditioning of the same (Abreu, Schneider and Arossi, 2013). When it is determined that a caries lesion needs to be restored, the removal of the caries with the maximum conservation of the healthy dental structure should be considered (Lucio *et al*., 2013). It is necessary to minimize the size of the restoration, limiting the cavity preparation to the size of the carious lesion. In this way, the cycle of restorations is avoided, which in the future may lead to dental fracture, endodontic and prosthetic treatment, root fracture and tooth extraction (Tumenas *et al*., 2014).

Composite resin: Composite resin has been used in dentistry for more than 50 years. Initially, the clinical applicability of this material was restricted to the use in anterior teeth due to the low resistance to wear. With the evolution of restorative dentistry, the mechanical properties of this material were improved and new formulations of this material allowed its use in posterior tooth restorations (Arhun *et al*., 2010; Cetin *et al*., 2012). However, some outcomes related to the polymerization contraction tension, such as postoperative sensitivity, enamel margins fracture, cusp deflection and secondary caries have been reported(Kuper *et al*., 2015; Nedeljkovic *et al*., 2015).
The composite resins have in their composition an organic matrix with long chain monomers generally diluted in short chain monomers(Chen, 2010). During the photoactivation, the union of these monomers and formation of polymer takes place. In this reaction, the polymerization contraction occurs, which can compromise the union of the material with the walls of the cavity, causing marginal maladjustment, and consequently, greater susceptibility to postoperative sensitivity, microleakage and development of secondary caries (de Amorim *et al*., 2018; Chen, 2010).

Glass ionomer cement: Glass ionomer cement (GIC) was developed in 1971 from a search for the union of zinc oxide and eugenol cement with the zinc phosphate cement resistance, the aesthetic and anticariogenic action of the silicate and the Polycarboxylate adhesion (Wilson and Kent, 2010). It was observed that the material presented good marginal waterproofing, as well as control of the progression of dental caries (Maldonado *et al*., 1978). The GIC is widely used in restorative procedures, coronary cementation, prostheses and orthodontic bands, base and sealant of fissures (Frencken *et al*., 2012). The powder of the glass ionomer cement consists of vitreous particles having as their basic components silica, or silicon oxide (SiO_2), aluminum oxide or alumina (Al_2O_3) and calcium fluoride (CaF_2). Other components such as magnesium and sodium also make up the product, but in smaller amounts. Its liquid is a polyalcenic acid, usually composed of polyacrylic and polymaleic acids, in addition to water. Tartaric acid is added to increase the working time of the material, and itaconic acid is incorporated into the liquid to prevent or retard the chemical reaction of the acids when stored(Bussadori *et al*., 2003; Davidson, 2007). The high viscosity GIC has improved physical characteristics and reduced setting time (Bonifácio *et al*., 2009; Calvo *et al*., 2016), and can be used successfully in areas exposed to large masticatory efforts (Vieira et a., 2006). The great difference of the high viscosity GIC for the low and medium viscosity ionomers is that in the first the powder particles are smaller and present in greater quantity (Croll and Nicholson, 2002; Lopes *et al*., 2016). However, proper handling becomes difficult to perform due to the increased amount of powder to be added to the liquid, taking into account that the correct consistency depends on the exact dosage and handling, in order to achieve better mechanical properties of the material (Frencken and Holmgren, 2014). Glass ionomer cement is high recommended in many pediatric dentistry procedures due to its ideal properties such as satisfactory adhesion to mineralized tissues, biocompatibility with adjacent tissues, thermal coefficient expansion similar to the tooth and the constant uptake and release of fluoride in the oral cavity. It is indicated for restoring cavities, sealant of and of pits and fissures, in the technique of atraumatic restorative treatment (ART), besides the cementation of crowns and fixed space maintainers (Bacchi, Bacchi and Anzileiro, 2013).



One of the most important quality of glass ionomer cements is the ability to release and recharge fluoride, being an essential tool in the prevention and control of dental caries, participating directly in the processes of remineralization of dental substrates. The presence of these fluorides places it as a material of choice in cases when it requires effective control of the buccal environment, either in the interruption of the caries process or in the presence of secondary caries in conventional restorations (Leite *et al*., 2013). Recent meta-analysis evaluated restorations performed with glass ionomer cement and concluded that the effectiveness of these single-surface restorations on deciduous posterior teeth is high, but is lower when multiple-face is involved (de Amorim *et al*., 2018). The reasons for lower success rates of these restorations with multiple faces ionomeric cement in deciduous teeth may be related to the insufficient adhesion of the glass ionomer to the dental tissues with the low flexural strength inherent to glass ionomers and the different techniques of ART execution and / or operator experience (Frencken *et al*., 2012).

Success rate of composite resin and glass ionomer cement: The composite resin and the glass ionomer cement are adhesive restorative materials widely used in the clinical routine for the restoration of deciduous molars (Chisini *et al*., 2018; De Amorim *et al*., 2018). Clinical studies with longer follow-up periods have shown that restorations in deciduous molars with glass ionomer cement present less longevity than composite resin restorations (Pinto *et al*., 2006). The composite resin and the glass ionomer cement are effective in fulfilling the role of dental sealing, being resistant materials with potential of duration. The literature presents that the composite resin has a better duration when the procedure of application of the material is in a clinical environment, avoiding to the maximum the contamination by humidity, since the duration of the composite resin is directly associated to the absence of moisture. The glass ionomer is more efficient in places where there is not much humidity control, using the relative isolation with cotton rollers (Pinheiro *et al*., 2016). A systematic review and meta-analysis compared the clinical performance of glass ionomer cement (GIC) and composite resin in class II restorations in deciduous teeth, in which it was found that regardless of patient follow-up time, type of GIC, or type of isolation (relative or absolute), the GIC presented significantly lower values of secondary caries lesions when compared to the number presented by the composite resin. However, the GIC presents a similar performance to composite resin, regarding to the general effect, marginal discoloration, marginal adaptation and anatomical shape, concluding that both materials have similar clinical performance, except in cases of development of secondary caries lesions (Sampaio *et al*., 2017). The clinical behavior and longevity of composite resin restorations performed on deciduous posterior teeth were evaluated, in which satisfactory results were obtained in relation to the success rate of the evaluated materials, confirming the indication of the composite resin for restorative treatments of deciduous teeth (Piva, Ribeiro and Souza, 2014). A study showed that, in general, the clinical performance of the two restorative materials evaluated (glass ionomer and composite resin) was similar for most of the analyzed clinical parameters (marginal discoloration, marginal adaptation, retention and wear of restorative material). However, in relation to the occurrence of secondary caries lesions, GIC restorations presented clinical performance significantly better than that observed in CR restorations (Bachi, Bachi and Anzileiro, 2013), probably due to the constant release of fluoride from the material to the buccal medium.Glass ionomer cements have a continuous release of fluoride and, therefore, have a cariostatic effect, being the material of choice, especially in patients with high caries activity.

Conclusion

Given the paucity of clinical studies comparing the longevity of composite resin restorations and high viscosity GICs in deciduous teeth, it is not possible yet to indicate the superiority of one material over the other in clinical dental practice. The selection of the material will depend on each clinical case. It is important that the restorations ensure the esthetics and especially the function of deciduous teeth.

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