Research, Society and Development, v. 11, n. 10, e580111033183, 2022
(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v11i10.33183

Self-conditioning adhesives in pediatric dentistry: an integrative literature review

Adesivos autocondicionantes em odontopediatria: uma revisão integrativa da literatura

Adhesivos autocondiconantes en odontopediatría: una revisión integradora de la literatura

Received: 07/20/2022 | Reviewed: 07/30/2022 | Accept: 08/02/2022 | Published: 08/11/2022

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Abstract
As clinical time must be taken into account in pediatric dental care, the use of self-etching accessories is the best alternative for restorative procedures in this population. Cons suitable accessories, which require a conditioning time, self-etching accessories and time separators with the number of steps and the number of steps required. However, this theme is still not clear in the literature. Thus, the objective of this integrative literature review was to compare, in relation to their clinical performance and their adhesive properties, self-etching accessories compared to the performance of restorations compared to primary teeth. The search was performed on Pubmed, Google Scholar and EBSCOHost with the descriptors “dentin-bondin agents OR dentin-bonding system” AND “deciduous OR primary teeth” AND “self-etch adhesive OR self-etch system” Per studies from the last five years . Thirty-six articles were obtained and five were selected. In only one study, self-etching adhesives and performance differences between their self-etching characteristics and performance differences between the evaluated characteristics. Therefore, studies selected for the selected studies, randomly selected and with study time are considered better that are not more rigid and that are more rigid in randomized trials and that have been considered as time period.
Keywords: Adhesives; Self-etching; Pediatric dentistry.

Resumo
Como o tempo clínico deve ser levado em consideração no atendimento odontopediátrico, a utilização de adesivos autocondicionantes pode ser a melhor alternativa para os procedimentos restauradores nessa população. Contrastando com os adesivos convencionais, que requerem um tempo de condicionamento separado, os adesivos autocondicionantes reduzem o número de etapas e o tempo de aplicação necessário. Entretanto, esse tema ainda não está claro na literatura. Desta forma, o objetivo desta revisão de literatura integrativa foi comparar, em relação ao seu desempenho clínico e suas propriedades adesivas, os adesivos autocondicionantes aos convencionais no desempenho de restaurações em dentina de dentes decíduos. A busca foi realizada no Pubmed, Google Acadêmico e EBSCOHost

com os descritores “dentin-bondin agentes OR dentin-bonding system” AND “deciduous tooth OR primary teeth” AND “self-etch adhesive OR self-etch system” Por estudos dos últimos cinco anos. Foram obtidos 36 artigos e cinco selecionados. Em apenas um estudo houve diferença entre os adesivos convencionais e autocondicionantes, quando comparadas suas características adesivas e de desempenho clínico. Portanto, não há tantas evidências para os adesivos autocondicionantes serem considerados melhores que os convencionais, dessa forma, são necessários estudos prospectivos de um período de tempo longo e baseados em ensaios clínicos randomizados com critérios mais rígidos, elegíveis e confiáveis.
Palavras-chave: Adesivos; Autocondicionantes; Odontopediatria.

Resumen
Como se debe tener en cuenta el tiempo clínico en la atención dental pediátrica, el uso de adhesivos de autograbado puede ser la mejor alternativa para los procedimientos restauradores en esta población. A diferencia de los adhesivos convencionales, que requieren un tiempo de grabado aparte, los adhesivos de autograbado reducen el número de pasosy el tiempo de aplicación necesarios. Sin embargo, este tema aún no está claro en la literatura. Por lo tanto, el objetivo de esta revisión integrativa de la literatura fue comparar, en relación con su desempeño clínico y sus propiedades adhesivas, los adhesivos de autograbado con los convencionales en el desempeño de las restauraciones de dentina de los dientes temporales. La búsqueda se realizó en Pubmed, Google Scholar y EBSCOHost con los descriptores “dentin-bondin agent OR dentin-bonding system” AND “deciduuous tooth OR Primary teeth” AND “self-etch adhesive OR self-etch system” Por estudios de los últimos cinco años Se obtuvieron 36 artículos y se seleccionaron cinco. En solo un estudio, hubo una diferencia entre los adhesivos convencionales y los de autograbado, cuando se compararon sus características adhesivas y su desempeño clínico. Por lo tanto, no hay mucha evidencia para considerar que los adhesivos de autograbado son mejores que los convencionales, por lo que se necesitan estudios prospectivos de un largo período de tiempo y basados en ensayos clínicos aleatorizados con criterios más estrictos, elegibles y confiables.
Palabras clave: Adhesivos; Autograbado; Odontopediatría.

1. Introduction

Restorations are the most frequently performed dental procedures in primary dentition, as their main objective is to maintain primary teeth in anatomical-functional conditions in the arch until their physiological exfoliation (Chisini, et al., 2018). For restorations to present a better clinical performance, adhesive systems are crucial, being classified, based on the adhesive strategy, according to the way in which they interact with the smear layer, removing it totally or partially (Froehlich, et al., 2021). Complete removal occurs when using some acidic substance, for example phosphoric acid, as a separate step and subsequent surface washing, this technique being called "conventional". Techniques that partially remove or modify the smear layer are called "self-etching" because the conditioning occurs simultaneously with the infiltration of the adhesive (Conceição, et al., 2010; Silva, 2016).

As fast clinical time is important when managing behavior during pediatric dental care, the use of self-etching adhesives may be the best alternative for restorative procedures in children. In contrast to conventional adhesives, which require a separate etching time, self-etching adhesives reduce the number of steps and application time required (Soares, et al., 2020). In addition, self-etching adhesives are composed of acidic monomers of lower acidity than phosphoric acid, used before the conventional technique (dos Santos Rodrigues, 2021). In this way, it avoids excessive loss of dentin matrix and apatite crystals around the collagen network, especially in primary teeth that have less mineralization and greater reactivity to acid etching. As demineralization and resin monomer infiltration occur simultaneously, the collapse of demineralized dentin will decrease; therefore, fewer potential discrepancies and gap formation, ie, gaps, can be observed. Thus, decreasing or even avoiding microleakage, secondary caries and postoperative sensitivity (Ebrahimi, et al., 2018).

Despite the advantages of using self-etching adhesives in primary dentin, it is still a controversial topic in the literature, as the use of two-step self-etching adhesives for primary dentin has similar results to those with two-step adhesive and rinse, in addition to self-etching adhesives of a step are not suitable (Ebrahimi, et al., 2018). Thus, in this integrative literature review, the influence of the use of self-etching adhesives compared to conventional adhesives on the performance of dentin restorations of primary teeth is evaluated.

2. Methodology

The study is an integrative review, research that consists of a search for relevant subjects on a given subject, which allow research, as they can identify gaps in the literature with the realization of others. (Mowbray, 2015). Thus, the report was developed according to the structuring of the Integrative Systematic Review Manual (Cunha, 2014).

The guiding question established for this integrative literature review was: "Does the use of self-etching adhesives compared to conventional adhesives influence the performance of dentin restorations of primary teeth?".

Portals for accessing PubMed, Google Scholar and EBSCOHost electronic databases were consulted between September and October 2021, using the following keywords: Deciduous Teeth, Primary Teeth, Self-etching Adhesive, Self-etching System and Dentin; according to the search strategy (Deciduous Teeth) OR (Primary Teeth) AND (Self-etch Adhesive) OR (Self-etch System) OR (Total-Etch) AND (Dentin), with the filters language in English and Portuguese and publication period between January 2007 and October 2021. Duplicate evidence was located with the help of Mendeley and excluded. The search was also performed in the gray literature and manually in the references of the selected articles.

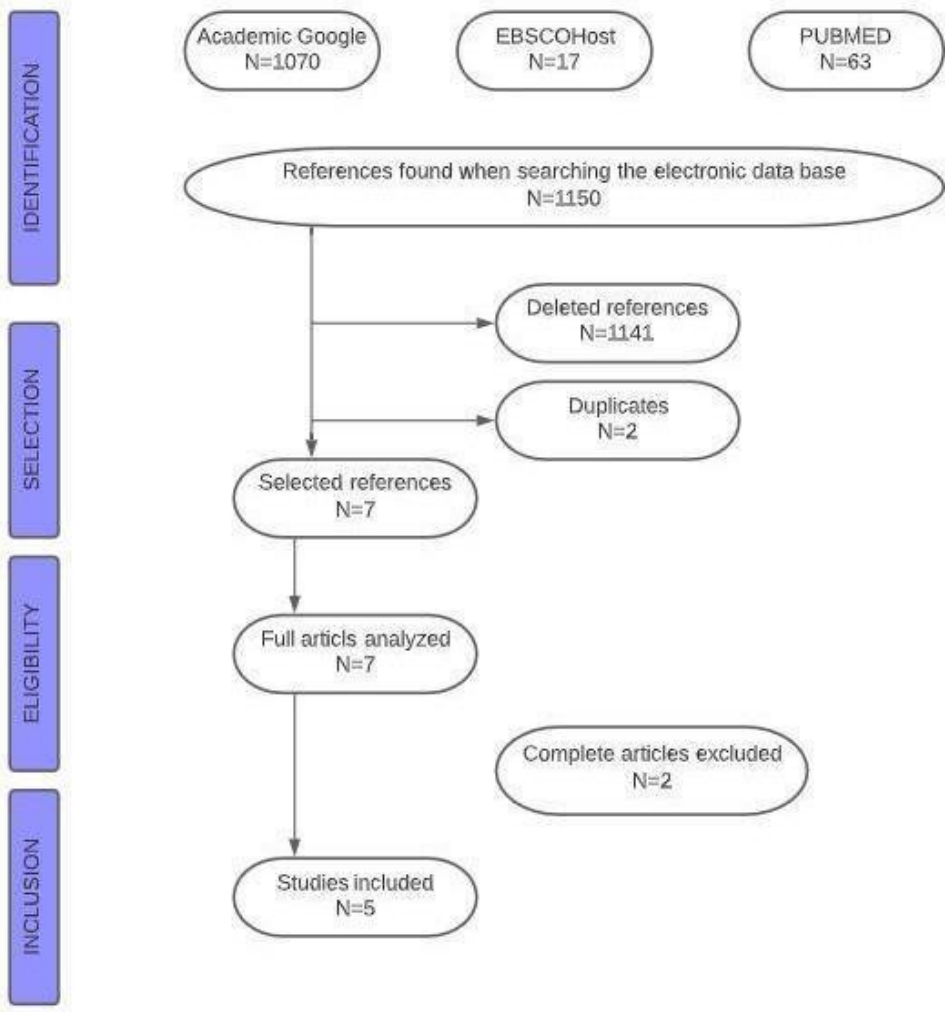
The articles identified by the initial strategy were independently evaluated by the reviewers through the analysis of titles and abstracts, according to the following eligibility criteria: Population - dentin of primary teeth, Intervention - use of self-etching adhesives, Intervention Comparison - conventional adhesives, Outcome - clinical performance of self-etching adhesives and Study Design - clinical studies.

Studies that met the eligibility criteria were summarized according to year of publication, authors, title, objective, study design, sample size, eligibility criteria, interventions, outcomes, randomization, blinding, and main conclusions.

3. Results

Figure 1 comprises the summary of the search and selection of studies. 1150 articles were identified, 7 selected, therefore 2 excluded and 5 elected in this integrative literature review.

Figure 1: Flowchart of search and selection of studies.



Source: Authors.

Table 1 shows the summary of articles included according to year of publication, authors, title, objective, study design, sample size, eligibility criteria, interventions, outcomes, randomization, blinding and main conclusions.

Table 1: Summary of articles included according to year of publication, authors, title, objective, study design, sample size, eligibility criteria, interventions, outcomes, randomization, blinding and main conclusions.

Author; Date	Objective	Study Design	Sample size	Eligibility Criteria	Interventions	Outcome	Randomization	Blinding	Main conclusions
Zulfikaroglu et al.,2008	Test different types of adhesives on Class II restorations.	Prospectiv e randomize d clinical trial.	51 children/75 restorations.	Presence of at least 1 primary molar with indication for pulpectomy; Restorable toothtissue remaining with 2 occlusal surfaces (OM or OD) after complete caries removal that does not require a metal crown for final restoration (i.e. extensive tissue loss or MOD cavity preparation).	4 restoration protocols: 1 – Amalgam fillings (negative control); 2 – Hybrid resin and universal adhesive; 3 – Polyacid modified resin and universal adhesive 3 – Restoration with Dyract and universal adhesive; 4 - Restoration with polyacid-modified resin and self-etchingadhesive.	Clinical examination: amount of restoration (discoloration and marginal adaptation, enamel loss and caries); Radiographic examination: interradicular andperiapical radiolucency,internal and external rootresorption and Pathological rootresorption.	In block.	Prize draw.	During the12-month evaluations, pulpectomized deciduous molars restored with composite resin + conventional adhesive (group 2) And F 2000 Adhesive +self-etching adhesive (group 5) had the highestclinical and radiographic success rates.
Donmez et al, 2016	To evaluate the clinical performance of restorations	Split-mouth randomize	32 children/128 restorations.	Patients with four primary first and/or second molars with interproximal caries that extends into the	4 adhesive restoration protocols: 1 – 3-step universal adhesive restorations;	FDI criteria Aesthetic properties: surface gloss and roughness, surface and marginal color, color matching and	Prize draw.	Restoration reviewer.	Better adaptation was found in restorations made with universal systems than with

	performed with different adhesive systems in primary teeth.	d clinical trial.		dentin and who have occlusal or proximal contacts.	2 – Universal 2-step adhesive; 3 – Two-stepself-etching adhesive; 4 – Single-stepself-etching adhesive.	translucency, anatomical shape. Functional properties: fracture of the restorative material, marginal adaptation, interproximal contact, radiographic examination. Biological properties: post-operative sensitivity and tooth vitality, secondary caries, dental fractures and cracks, local reactions of dental tissue in direct contact with the restoration, local and systemic symptoms.			self-etching adhesives.
Pitchika; Metz; Rothmaier, 2016.	To examine the influence of different adhesive restoration protocols on the survivalof composite resin restorations	Retrospecti ve clinical study.	601 children/ 2146 restorations.	Patients who received at least 1 filling underlocal anesthesia at the Department of Restorative Dentistry and Periodontics at Ludwig Maximilian University between January 2004 and December 2012.	6 adhesive restoration protocols: 1- Self-etching adhesive and traditionalresin; 2 - Self-etching adhesive and fluid resin;	Restore failure: survivaltime and failure reason.	There wasn't.	There wasn't.	Restorations performed withself-etching adhesives and traditional resins had less failure.The protocol with the greatest failure was the one that used acid etching,

	In primary teeth.				3 - Self-etching adhesive and fluid resin + traditional resin; 4 - Acid, adhesive and traditional resinetching; 5 - acid etching, adhesive and fluid resin; 6 - Acid etching, adhesive and fluid resin + resin traditional.				adhesive and fluid resin.
Lenzi et al., 2017.	To evaluate,in 18 months, the performance of universal adhesives, applied inself-etching and in twostages afterselective removal of carious tissue in deciduous molars.	Prospectiv e randomize d clinical trial.	44 children/90 restaurants.	Pediatric patients Who received restorations indeciduous molars at the Dental Clinic ofthe Federal University of Santa Maria, Rio Grande do Sul, Brazil, from May 2014 to March 2016.	2 adhesive protocols: 1 – Self-etching adhesives fixing Restorations indeciduous molars; 2 - Conventional adhesives fixing Restorations indeciduous molars.	Restore failure – 18month survival time.	In block.	Double blind.	Both self-etchingand double-step adhesives do not influence the clinical performance of universal adhesivesused in primary molars. There is a trend towards better clinical results with the self-conditioning technique

Soares et al., 2020.	To evaluate clinical efficacy, atsix monthsand at oneyear, of threeadhesive systems in primary dentition.	Prospectiv e randomize d clinical trial.	34 children/101 restaurants.	Patients assisted at the Pediatric Dentistry Clinic of the FMUC, between September 2016 and January 2017, with deciduous molars with carious lesions on the interproximalsurface with dental involvement, without pulp pathology, caries lesion, margins entirely in enamel and that have occlusal contact with the antagonist .	3 protocols for adhesive restorations: 1 – One-step self-etching adhesivesystem; 2 – Two-step self-etching adhesivesystem; 3 – Conventional two-step adhesivesystem.	FDI criteria Aesthetic properties: surface gloss and roughness, surface and marginal coloring, colormatching and translucency, anatomical shape. Functional properties: fracture of the restorative material, marginal adaptation, interproximal contact, radiographic examination. Biological properties: postoperative sensitivity and tooth vitality, secondary caries, tooth fractures and cracks, local reactions of dental tissue in contact with the restoration, local and systemic symptoms.	In block.	Double blind.	In the intergroup comparison, there were no significant differences between the adhesive systems in the different evaluation periods.A worsening of the “restoration retention” parameter was observed in the conventional technique at 12 months.

Source: Authors.

4. Discussion

The effective adhesion of restorative resins to the mineralized tissues of the tooth has been the subject of research for approximately 40 years. According to Buonocore, in 1955, the bond strength between the restorative resin and the dental enamel increased significantly after acid conditioning of the enamel surface with 85% orthophosphoric acid. Generally speaking, the most common basic mechanism of bonding to enamel and dentin essentially involves a process of controlled demineralization of the tissues and the infiltration of resin monomers that, after polymerization, promote a micromechanical bond (Leitão, 2008). This ability to "adhere" restorative materials to dental tissues revolutionized dentistry, allowing the adoption of more conservative and less invasive restorative procedures (Baratieri, 2003; Sofan, et al., 2017). Regarding composite resin restorations performed on deciduous teeth, it is observed that the greatest technical problems that affect longevity are related to failures during acid attack of enamel/dentin, a fact that may be a consequence of the difficulty in controlling the child behavior allied to the lack or difficulties in performing an adequate isolation of the operative field (Costa; Czernay; Vieira, 2003).

One option for these cases is the use of self-etching adhesives, which do not require the use of previous acid etching, reducing the clinical time required to perform the procedure, especially in the dentin of deciduous teeth. Despite being widely used today, the literature on clinical studies of self-etching adhesive systems in primary teeth is very limited (Ebrahimi, et al., 2018). This study aimed to evaluate the use of conventional adhesives in relation to self-etching adhesives in dentin of primary teeth with respect to their clinical performance of restorations.

Among the selected works, only the study by Pitchika, Metz and Rothmaier (2016) showed superior clinical success of self-etching adhesives in relation to other adhesive systems. In the studies included in this work, this one actually had the longest clinical evaluation time, being also the only one in an observational and retrospective nature. This factor may be decisive for the greater clinical success of self-etching adhesives, since Zulfikaroglu et al (2008) and Lenzi et al (2017) discuss the need for a longer clinical time to evaluate restorations to obtain a more satisfactory result, since in their studies there were no significant differences between self-etching adhesives and the others.

In studies conducted by Zulfikaroglu et al (2008) and Donmez et al (2016), marginal discoloration, better marginal adaptation and lower staining, respectively, were the only clinical evaluation items that showed a statistically significant difference between the adhesives, highlighting the lower performance of the self-etching adhesives. Similar to these results, Perdigao et al (2012) reported more marginal enamel deficiencies for self-etching adhesive systems and similar retention rates. However, this occurrence may be related to the presence of physiological spaces in the primary dentition, as mentioned by Donmez et al (2016). The microstructural differences between enamel and dentin require different mechanisms of action. The pH of self-etching adhesives must be low enough to condition the enamel and dissolve the smear layer, but not too low to avoid excessive demineralization of the dentin substrate. It has been suggested that self-etching adhesive systems are more suitable for primary teeth as primary dentin is less mineralized, based on the premise that these solutions cause less aggressive demineralization (Bucher, et al., 2015; Donmez, et al., 2016; Ebrahimi, et al., 2018).

Lenzi et al (2017) disagree with the other articles, as they did not find a statistically significant difference in any of the parameters evaluated. Such divergence may have occurred to the detriment of the various evaluation criteria adopted by each of the authors, generating more reliability or not of the adhesive systems studied. However, Zulfikaroglu et al (2008), Donmez et al (2016) and Soares et al (2020) were the only ones to present more rigorous evaluation criteria, using the FDI

World Dental Federation Criteria and US Public Health Service, respectively, to verify the quality of restorations, while Lenzi et al (2017) and Pitchika, Metz and Rothmaier (2016) only verified failure and survival time of restorations.

Of the five selected studies, four are randomized clinical trials (Zulfikaroglu, et al., 2008; Dommez, et al., 2016; Lenzi, et al., 2017; Soares, et al., 2020), which allowed a standard for assessing the impact of interventions of a particular clinical condition, allowing to test its effectiveness (Vinagre, et al., 2015; Reis, et al., 2018). In addition, they chose to carry out restorations in molars, which is justified by the literature because they are teeth that have a longer useful life in the primary dentition, but also have a high prevalence of caries, especially on the interproximal surfaces (Myaki, et al., 2007; Chisini, et al., 2018).

In a more recent study, the article by Soares et al (2020) it was found that in the intergroup comparison of adhesive systems, no significant differences were detected between the evaluated systems, in the different evaluation periods. In relation to intra-group longitudinal comparisons, there was a significant worsening of the scores regarding the parameter "marginal adaptation" for all groups over time. Regarding the parameters of functional, biological and aesthetic properties, there were no significant differences over the evaluation periods, results that corroborate those of Lenzi et al (2017), which showed that no significant differences were also evidenced between the study groups, both adhesive strategies gave similar results. Although there was a trend towards a better result of the self-conditioning strategy in their study. Therefore, in the study by Soares et al (2020) the same trend was observed, considering the worsening of the scores of the parameter "restoration retention" in the two-step conventional adhesive system group at 12 months of follow-up. Although not statistically significant, the loss of restorations in the conventional technique group may be related to the greater sensitivity of the adhesive technique, predisposing to an error in the operative procedure (Lenzi, et al., 2017; Chisini, et al., 2018; Ebrahimi, et al., 2018).

5. Conclusion

There was no statistical and qualitative difference between conventional and self-etching adhesives in an overview of the articles studied, with the exception of one survey. Thus, prospective studies with a long period of time and based on randomized clinical trials with stricter, more reliable and eligible criteria are needed.

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