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Review article

Effect of flowable composites on the clinical performance of non-carious cervical lesions: A systematic review and meta-analysis

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ABSTRACT

Objectives: To answer the following PICO question (participant, intervention, comparator and outcome): Does flowable resin composite restorations compared with regular resin composites improve the marginal adaptation, marginal discoloration and retention rates of restorations placed in non-carious cervical lesions [NCCLs] of adults?, through a systematic review and meta-analysis.

Source: MEDLINE, Scopus, Web of Science, LILACS, BBO, Cochrane Library and SIGLE were searched without restrictions, as well as the abstracts of the IADR, clinical trials registries, dissertations and theses in May 2016 (updated in April 2017).

Study selection: We included randomized clinical trials (RCTs) that answered the PICO question. RCTs were excluded if cavities other than NCCLs were treated; indirect restorations; polyacid-based resins instead of composite resins were employed, restorations in primary teeth and restorations were placed in carious cervical lesions. The risk of bias tool of the Cochrane Collaboration was applied in the eligible studies and the GRADE tool was used to assess the quality of the evidence.

Data: After duplicates removal, 5137 articles were identified. After abstract and title screening, 8 studies remained. Six were at "unclear" risk of bias. The study follow-ups ranged from 1 to 3 years. No significant difference was observed between groups for loss of retention and marginal discoloration in all follow-ups. Better marginal adaptation was observed for restorations performed with flowable composites. At 1-year (risk ratio = 0.27 [0.10 to 0.70]) and 3-year (risk ratio = 0.34 [0.17 to 0.71]) follow-ups, flowable composites showed a risk 73% and 66% lower than regular composites for lack of adaptation, respectively. The evidence was graded as moderate quality for loss or retention at 3 years due to risk of bias and low and very low for all other outcomes due to risk of bias, imprecision and inconsistency.

Conclusions: We have moderate confidence that the resin composite viscosity does not influence the retention rates at 3 years. Similar marginal discoloration and better marginal adaptation was observed for flowable composites but the quality of evidence is doubtful. (PROSPERO CRD42015019560).

1. Introduction

Non-carious cervical lesions (NCCLs) are among the most frequent situations affecting the dental structures: about one quarter of the population do have NCCLs. These lesions are significantly more prevalent at elderly (< 50%), with premolars being the most affected teeth [1–3]. It is consensual that the etiology of NCCLs is multifactorial due to several factors including erosion, abrasion, and abfraction [4,5], and all of them are responsible for tooth wear for different mechanisms. For instance, erosion is the dissolution of hard tissue by acidic substances, abrasion is produced by interaction between teeth with other materials and abfraction is the loss of tooth substance caused by biomechanical loading forces that result in flexure and failure of enamel and dentin at a location away from the loading [4,5]. These lesions are usually associated with dentin hypersensitivity due to the exposure of dentin in the oral environment [6].

Although the restoration with composite resins does not treat the etiology of this condition, it replaces the lost tissue, restores the dental structural integrity, reduces further wear, relieve dentin hypersensitivity (when present) and also improves esthetics [7]. Despite these advantages restorations of NCCLs are still challenging due to the presence of occluding mineral salts in dentinal tubules and the presence of a hypermineralized surface that resists self-etch primers and phosphoric acid conditioning. Furthermore, problems with restoring NCCLs include

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difficulty in controlling moisture as cervical margins are usually placed closer or even in sub-gingival areas.

This sclerotic dentin has been blamed for the significant lower bonding than in sound dentin as well as high failure rates of composite restorations placed in NCCLs [8,9] for some adhesives systems and techniques. Additionally, the poor retention rates of resin composites placed in NCCLs can also be explained by continued tooth flexure at the cervical area during mastication which contrast with the high elastic modulus of the restorative material [1,10,11].

To solve some of these challenges, some studies have suggested to fill NCCLs using flowable resins [12–14]. Flowable resin composites are low-viscosity restorative materials that differ from regular viscosity resin composites by having lower filler load and less viscous resin content [15–17]. As a result, these materials are less rigid and have an elastic modulus 20% to 30% lower than that of regular viscosity composites [17–19]. This reduced low elastic modulus can theoretically absorb the stresses generated during the polymerization shrinkage of composites and during mechanical loading in which the teeth are subjected during function.

Although some studies on this field reported that the use of flowable composites showed some advantages [14,20], other studies showed that flowable resins and regular viscosity resin composites do not differ in terms of clinical performance [8,21,22]. It worth to mention that, several materials with reduced low elastic modulus as glass-ionomer, filled adhesives or micro-filler resin composite could be also used to restore NCCLs [10–12].

To reduce the uncertainty about this issue, one may combine the results of several clinical trials into a systematic review and meta-analysis to reach a more precise answer. Based on that, we aimed to answer the following PICO (P = population; I = intervention; C = comparator; O = outcome) question: "Does flowable resin composite restorations compared with regular resin composites improve the marginal adaptation, marginal discoloration and retention rates of restorations placed in NCCLs of adults?".

2. Materials and methods

We followed the recommendations of the PRISMA statement for reporting of this systematic review [23].

2.1. Protocol and registration

We registered the study protocol at the International prospective register of systematic reviews (PROSPERO) database under the registration number CRD42015019560.

2.2. Eligibility criteria

We included only randomized clinical trials (RCTs) that compared flowable composite resins with regular resin composites when placed in NCCLs of adults. The minimum follow-up was 1 year; but studies with longer follow-ups were included. RCTs were excluded if 1) cavities other than NCCLs were treated; 2) resin cements were involved in the bonding protocol, such as for indirect restorations; 3) polyacid-based resins instead of composite resins were employed as restorative materials; 4) restorations were placed in primary teeth; 5) restorations were placed in carious cervical lesions.

2.3. Information sources and search strategy

We based our search strategy on the concepts of the PICO question. The controlled vocabulary (mesh terms) and free keywords within each concept were combined with the Boolean operator "OR" and the concepts were combined with the Boolean operator "AND". The search strategy was firstly developed for the PUBMED database and then adapted to following electronic databases: 1) Scopus; 2) Web of Science; 3) Latin American and Caribbean Health Sciences Literature database (LILACS); 4) Brazilian Library in Dentistry (BBO) and 5) CENTRAL from Cochrane Library (Table 1).

To locate unpublished and ongoing trials, we searched the following clinical trials registries: Current Controlled Trials (www.controlled-trials.com), International Clinical trials registry platform (http://apps.who.int/trialsearch/), the ClinicalTrials.gov (www.clinicaltrials.gov), Rebec (www.rebec.gov.br), and EU Clinical Trials Register (https://www.clinicaltrialsregister.eu). We augmented database searching with hand searching of the reference lists of all primary studies and the related articles linked to each primary study in the PubMed database (first page list). No restrictions were placed on the publication date or languages.

Grey literature was also investigated. The abstracts of the International Association for Dental Research (IADR) and their regional divisions (1990–2015) were also searched. The grey literature was explored using the database System for Information on Grey Literature in Europe (SIGLE) and Google Scholar. Dissertations and theses were searched using the ProQuest Dissertations and Theses Fulltext database and the Periódicos Capes Theses database.

2.4. Study selection and data collection process

Two independent review authors (A.S. and S.O.) initially screened for relevance all electronically derived citations and abstracts of papers identified by the review search strategy. We excluded studies clearly irrelevant at this stage. Articles that appeared in more than one database were considered only once.

We obtained the full texts of all potentially relevant RCTS and three reviewers checked them against the eligibility criteria outlined above. We recorded the reasons why potentially relevant studies failed to meet the eligibility criteria. Relevant information about the study design, participants, interventions and outcomes were extracted using customized extraction forms by three authors (A.S., S.O. and E.M.). The collection form was pilot tested using a sample of study to ensure that the criteria were consistent with the research question.

2.5. Data items

Data from the outcomes (retention rates, marginal discoloration and marginal adaptation) were collected at different follow-ups (1 year; 2 years and 3 years). When more than one flowable composite was included in the study, their values were combined to make a single entry. In case data from marginal discoloration and marginal adaptation were provided for dentin and enamel margins, we collected data from the worst scenario.

2.6. Risk of bias in individual studies

Quality assessments of the included trials were evaluated by three independent reviewers (A.S., S.O. and E.M.), using the Cochrane Collaboration's tool (http://handbook.cochrane.org) for assessing risk of bias in randomized trials [23]. The assessment included information about the design, conduct, and analysis of the trial. We evaluated each domain (sequence generation, allocation concealment, blinding of the outcome assessors, incomplete outcome data, selective outcome reporting) on a three-point scale: low risk of bias, unclear risk or high risk of bias [24]. Disagreements between the reviewers were resolved through discussion, and if needed, by consulting a fourth reviewer (A.L.).

At the study level, the study was at "low" risk of bias if all key domains (sequence generation, allocation concealment and blinding of the outcome assessors) were at "low" risk of bias. If one or more key domains were judged as at "unclear" risk, the study was considered at "unclear" risk of bias. And finally, if at least one domain was judged at "high" risk of bias, the study was considered at "high" risk of bias.