Do glass ionomer cements prevent caries lesions in margins of restorations in primary teeth?

A systematic review and meta-analysis

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New caries lesions in restoration margins are a frequent concern in dentistry, especially when there is no patient compliance. Thus, this problem has been seen as the main reason for failure and replacement of restorations in primary teeth,[1] with reports showing approximately 8.0% of restoration failures even within 5 years when these caries lesions are filled with polyacid-modified resin composite (PMRC), resin composite (RC), or amalgam.[2,3]

These restorative materials, in the same way as glass ionomer cements (GICs), have shown satisfactory performance in restorations of primary teeth.[4,5] However, conventional GIC—a low-viscosity restorative material—has a shorter longevity than do the other materials.[4] Results of a previous systematic review showed that there is a higher number of failed restorations with the atraumatic restorative treatment (ART) technique when it was performed with conventional GIC, whereas the longevity of ART restorations performed with high-viscosity GIC (HVGIC) is higher.[6] HVGIC is also a material for which setting is an acid-based reaction; however, HVGIC performed similarly to the other materials in both occlusal and occlusoproximal restorations.[7,8] Conversely, resin-modified GIC (RMGIC)—a GIC with addition of hydroxyethylmethacrylate, similar to HVGIC—also can be considered an alternative to restore dentinal caries lesions.[5]

Fluoride interferes with the processes of demineralized and remineralization of caries lesions, and some authors suggest that the fluoride released from GICs is capable of preventing caries.[9,10] Investigators in previous

ABSTRACT

Background. Fluoride released from glass ionomer cements (GICs) is capable of preventing caries lesions. However, the preventive effect in margins of occlusal and occlusoproximal restorations have not been proved. The aim of this study was to evaluate the ability of GIC to prevent caries lesions in margins of occlusal and occlusoproximal restorations in primary teeth compared with that of other restorative materials.

Types of Studies Reviewed. The authors conducted a literature search in PubMed and MEDLINE to verify the clinical trials available on the outcome of caries lesions. The inclusion criteria were that the subject related to the scope of this systematic review, the study had a follow-up, and the study was not performed in specific groups. The authors performed all meta-analyses by considering the secondary caries rates for the restorations in clinical trials.

Results. The search strategy identified 450 potentially relevant studies, and the authors included 8 of them in the review. The main reasons for exclusion were that the studies were not related to the scope of this review or were not longitudinal trials. The secondary caries rate of the occlusal restorations was not different among the restorative materials (odds ratio, 1.2; 95% confidence interval, 0.5-3.1). For occlusoproximal analysis, GIC was associated significantly with better ability to prevent caries lesions (odds ratio, 1.7; 95% confidence interval, 1.2-2.5).

Conclusions and Practical Implications. Because new caries lesions in the margins of restorations are the main reason for failure and replacement of restorations in primary teeth, it is important to know whether there is a benefit in using GICs in both occlusal and occlusoproximal cavities.

Key Words. Dental caries; glass ionomer cements; fluoride.

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studies reported that GIC showed a higher reduction of demineralization in adjacent teeth.[11,12] However, GIC's preventive effect has not been proved when compared with all other available materials considered as definitive restorative materials, especially for the occlusal and occlusoproximal surfaces of the primary teeth.

This is important because most caries lesions occur on the proximal surface of the primary teeth,[13] and the caries progression in this area seems to be faster than on occlusal surfaces.[14] In this sense, the survival rate of restorations could be different between these surfaces. Furthermore, primary teeth have a higher tubule density and lower concentration of phosphate and calcium in peritubular and intertubular dentin than do permanent teeth,[15,16] which could interfere with the performance of restorative materials. However, to the best of our knowledge, this is the first systematic review and meta-analysis that compares the preventive effect of all restorative materials available on caries lesions in the margins of restorations in both the occlusal and occlusoproximal surfaces of primary teeth. Thus, the aim of this study was to evaluate systematically and quantitatively the ability of GIC to prevent caries lesions in the margins of occlusal and occlusoproximal restorations in primary teeth compared with that of other restorative materials.

METHODS

We conducted and reported this study according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[17] We registered it on the PROSPERO register under protocol number CRD42013006497.

Search strategy and selection criteria. We performed a comprehensive literature search through PubMed and MEDLINE to identify articles up to August 19, 2014, in which the investigators evaluated the prevention of caries lesions in the margins of occlusal and occlusoproximal GIC restorations in primary teeth. To retrieve all relevant articles, 2 authors (T.K.T. and A.F.B.C.) screened reference lists of included articles and related reviews. We used the following search strategy: ((((((((((amalgam) OR resin*) OR composite*) OR composite resin*) OR resin composite*) OR compomer*) OR polyacid modified composite resin*) OR polyacid-modified composite resin*)) AND ((((((((demineralization) OR tooth demineralization) OR teeth demineralization) OR caries) OR carious) OR tooth decay) OR teeth decay) OR dental caries) OR caries susceptibility)) AND (((((dental restoration*) OR restoration) OR dental restoration, permanent) OR tooth restoration) OR teeth restoration)) AND (((((glass ionomer cement*) OR glass-ionomer cement*) OR GIC) OR ART) OR atraumatic restorative procedure*)) AND ((clinical[Title/Abstract] AND trial[Title/Abstract]) OR clinical trials[MeSH Terms] OR clinical trial[Publication Type] OR random*[Title/Abstract] OR random allocation[MeSH Terms] OR therapeutic use [MeSH Subheading]).

Initially, both reviewers independently assessed the identified publications, which we selected by title and abstract on the basis of the inclusion criteria: to investigate occlusal and occlusoproximal GIC restorations and to be a longitudinal study with a follow-up of at least 12 months. We did not include studies performed in specific groups (for example, irradiation, special patients, and teeth with amelogenesis imperfecta). The reviewers were trained and calibrated for article selection ($\kappa = 0.929$) by a experienced researcher in studies about caries lesions in margins of restorations (D.P.R.). We resolved any discrepancies through a third reviewer (D.P.R.). We made a final decision about inclusion on the basis of the full-text articles of the potentially relevant studies in accordance with the exclusion criteria: having a dropout rate of more than 30%, not being a randomized or quasirandomized clinical trial, not having a control group (amalgam, PMRC, or RC), not evaluating GIC as a definitive restoration (HVGIC or RMGIC), not being performed in primary teeth, and not evaluating caries lesions in margins of restorations as the outcome. In the case of studies reporting the same sample, we included those that presented more information.

Data extraction. The 2 reviewers independently collected the data of the eligible studies. For each article, they systematically extracted the following data: publication details (title, authors, and year), sample characteristics (age of participants, caries experience, number of participants, number of restorations for each material), study methodology (study design, restorative materials, type of restored cavity), and outcome information (survival of restorations, follow-up, and dropout).

Afterwards, we assessed the risk of bias in the included studies ($\kappa = 0.945$) by using specific study design–related risk-of-bias assessment forms.[18] We divided the criteria into 7 main domains related to randomization, masking, outcome data, and characteristics of the sample at baseline. We evaluated the studies by rating each of the study criteria as *yes* (low risk of bias), *no* (high risk of bias), or *unclear* (no information or uncertainty about the potential for bias). For the final classification of risk of bias, we resolved disagreements between the reviewers through discussion.

Statistical methods for the meta-analysis. We performed all meta-analyses by using statistical software (MedCalc Version 12.5.0.0; Microsoft Partner). We

ABBREVIATION KEY. **ART:** Atraumatic restorative treatment. **GIC:** Glass ionomer cement. **HVGIC:** High-viscosity glass ionomer cement. **PMRC:** Polyacid-modified resin composite. **RC:** Resin composite. **RMGIC:** Resin-modified glass ionomer cement. **USPHS:** US Public Health Services.