Original Contributions

Systematic Review

# Glass ionomer cements as fissure sealing materials: yes or no?

## A systematic review and meta-analysis

Supplemental material is available online.

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## ABSTRACT

**Background.** The aim of this systematic review and meta-analysis was to evaluate the ability of glass ionomer cements (GICs) and resin-based sealants (RBSs) to prevent the occurrence of caries and their retention in standards-based clinical studies.

**Types of Studies Reviewed.** The authors conducted a literature search (from database inception through September 20, 2017) to identify studies for inclusion in this systematic review. The authors assessed the quality of the evidence with the modified Jadad scale and performed the meta-analysis by using a random-effects model.

**Results.** The authors considered 20 studies on caries prevention and 28 studies on retention that met the inclusion criteria for the meta-analysis. The results of the meta-analysis for caries development showed no significant difference (odds ratio, 0.938; 95% confidence interval, 0.647 to 1.359; $P = .734$). However, the result for the retention rate showed the advantage of RBSs (odds ratio, 6.006; 95% confidence interval, 3.226 to 11.183; $P = .000$).

**Conclusions and Practical Implications.** There was no difference between the percentage of caries development with use of GICs as fissure sealing material compared with that for the conventional RBSs, but the retention rate of conventional RBSs was much higher than that of the GICs.


**Key Words.** Pit-and-fissure sealants; glass ionomer cements; systematic review; meta-analysis.

JADA 2018:■(■):■-■

https://doi.org/10.1016/j.adaj.2018.02.001

Despite increased scientific knowledge regarding caries, improved oral hygiene, and the use of fluoride in recent decades, caries on occlusal surfaces remain widespread worldwide, and it seems that these factors are less effective in caries reduction of occlusal surfaces.[1,2] Pit-and-fissure sealants are effective in preventing caries development in sound and in susceptible pits and fissures.[3-8] Investigators in ongoing studies are assessing the retention of sealants after the application of different sealant materials and techniques. In the past decades, clinicians have used a variety of sealing materials clinically. Clinicians have used resin-based materials (conventional fissure sealants or flowable composites), polyacid-modified resin sealants (compomers), and glass ionomer cements (GICs; low viscosity, high viscosity, or resin modified) for this purpose.[9] The conventional fissure sealants are based on bisphenol A-glycidyl methacrylate resins or urethane-based hydrophobic products that are easy to apply, have proper flow, allow for unlimited working time, and require no mixing, but their effectiveness may be jeopardized by the difficulty in obtaining ideal isolation during application. Alternatively, GIC-based sealants are moisture-friendly materials that clinicians have used as an alternative fissure sealing material because they are less technique sensitive, have a chemical bond to dental tissue, and have anticariogenic properties that result from the production of an acid-resistant surface of fluoride-modified hydroxyapatite because of the fluoride reservoir. GIC-based sealants reduce chair time because, unlike the resin-based sealants (RBSs), they do not require intermediate steps, such as etching.[10-12]

It is obvious that prevention of caries occurrence is the main goal of the fissure sealant treatment, but the sealant retention rate is a more easy and applicable outcome that investigators have used in the top studies in this field. Retention is the ability of a sealant to resist removal from sealed pits and fissures by the tipping or lifting forces of chewing. Retention of RBS is higher than that of most of the GIC-based sealants in several studies because of higher wear resistance and compressive strength, as well as micromechanical bonding to tooth structure[2,13-15]; however, 1 author found that the total loss of sealant retention has no direct influence on caries occurrence and does not appear to be a valid predictor of clinical outcomes.[16] The question remains regarding whether GIC-based sealants are more effective than more highly retentive RBSs in preventing occlusal caries. Our aim in this systematic review and meta-analysis was to evaluate the ability of GIC-based sealants and RBSs to prevent the occurrence of caries and their retention in clinical studies in which the investigators used GIC pit-and-fissure sealants compared with conventional pit-and-fissure RBSs.

## METHODS

### Eligibility criteria, information sources, and search strategy

We used the Participants, Intervention, Comparison, Outcomes, and Study Design (PICOS) framework for this systematic review and meta-analysis based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) system (Table).[17] We then performed a diverse structured search of PubMed, Scopus, Embase, the Cochrane Library, and the Institute for Scientific Information Web of Knowledge (all databases, including the Web of Science Core Collection, Biological Abstracts, BIOSIS Citation Index, Current Contents Connect, Data Citation Index, Derwent Innovations Index, Food Science and Technology Abstracts, Inspec, KCI—Korean Journal Database, MEDLINE, SciELO Citation Index, and Zoological Record) without time or language restrictions.

For each database, we developed appropriate search strategies with identical key words. The box shows a combination of controlled vocabulary and free text terms that we selected as search terms for PubMed. We performed our final search on September 20, 2017. In addition, we complemented the electronic search with manual searching of the cited references of most recent systematic reviews and of all included studies. We used software (EndNote X8, Clarivate Analytics) for importing the results. We discarded duplicate records.

### Inclusion and exclusion criteria

Eligible articles were original standards-based clinical trials in which the main objective was to compare the caries development or retention rate of GIC-based fissure sealant with those of resin-based fissure sealant in human dentition. There were no limitations regarding the type of glass

**Table.** Search strategy using PICOS* analysis.

| PICOS TERM | DEFINITION | MAIN PUBMED SEARCH TERMS† |
|---|---|---|
| **Participants** | All teeth with fissure sealant treatment | (("Pit and Fissure Sealants"[MeSH‡]) OR (Fissure Sealants, Pit) OR (Sealants, Dental) OR (Dental Sealants) OR (Sealants, Tooth) OR (Tooth Sealants) OR (Fissure Sealant)) |
| **Intervention** | Resin-based fissure sealant | Search results manually screened to include randomized controlled clinical trials with a resin-based fissure sealant |
| **Comparison** | Glass ionomer fissure sealant | (("Glass Ionomer Cements"[MeSH]) OR ("glass ionomer" [Supplementary Concept]) OR ("Chemfil Superior" [Supplementary Concept]) OR ("Fuji glass-ionomer lining cement" [Supplementary Concept]) OR ("Ketac-Molar Quick" [Supplementary Concept]) OR (glass ionomer) OR glassionomer OR (Cements, Glass Ionomer) OR (Polyalkenoate Cements) OR (Glass-Ionomer Cement)) |
| **Outcomes** | Not applicable | No search |
| **Study Design** | All included | Search results manually screened to include randomized controlled clinical trials |

* PICOS: Participants, Intervention, Comparison, Outcomes, and Study Design. † Controlled vocabulary and free text terms. ‡ MeSH: Medical Subject Headings.

**ABBREVIATION KEY**

**GIC:** Glass ionomer cement.
**MeSH:** Medical Subject Headings.
**PICOS:** Participants, Intervention, Comparison, Outcomes, and Study Design.
**RBS:** Resin-based sealant.