Cover Story

Evidence-based clinical practice guideline on restorative treatments for caries lesions

A report from the American Dental Association

Supplemental material is available online.

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ABSTRACT

Background. An expert panel convened by the American Dental Association (ADA) Council on Scientific Affairs together with the ADA Science and Research Institute's program for Clinical and Translational Research conducted a systematic review and developed recommendations for the treatment of moderate and advanced cavitated caries lesions in patients with vital, non-endodontically treated primary and permanent teeth.

Types of Studies Reviewed. The authors searched for systematic reviews comparing carious tissue removal (CTR) approaches in Ovid MEDLINE, Embase, Cochrane Database of Systematic Reviews, and Trip Medical Database. The authors also conducted a systematic search for randomized controlled trials comparing direct restorative materials in Ovid MEDLINE, Embase, Cochrane Central Register of Controlled Trials, ClinicalTrials.gov, and the World Health Organization International Clinical Trials Registry Platform. The authors used the Grading of Recommendations Assessment, Development, and Evaluation approach to assess the certainty of the evidence and formulate recommendations.

Results. The panel formulated 16 recommendations and good practice statements: 4 on CTR approaches specific to lesion depth and 12 on direct restorative materials specific to tooth location and surfaces involved. The panel conditionally recommended for the use of conservative CTR approaches, especially for advanced lesions. Although the panel conditionally recommended for the use of all direct restorative materials, they prioritized some materials over the use of others for certain clinical scenarios.

Practical Implications. The evidence suggests that more conservative CTR approaches may decrease the risk of adverse effects. All included direct restorative materials may be effective in treating moderate and advanced caries lesions on vital, nonendodontically treated primary and permanent teeth.

Key Words. Evidence-based dentistry; clinical practice guideline; direct restorative materials; caries; general dentistry; pediatric dentistry; American Dental Association.

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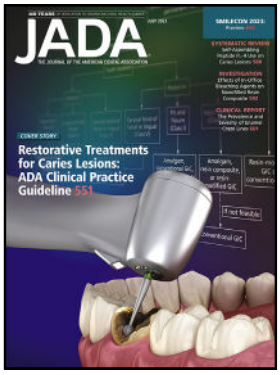

Restorative dentistry is integral to managing caries.[1] The decisions involved in restoring teeth are complex and based on the balance of several factors such as prognosis, caries risk and activity assessment, and clinical or radiographic signs of cavitation.[2,3] When indicated, various carious tissue removal (CTR) approaches (that is, the extent of carious tissue removed) and direct restorative materials are available to restore moderate and advanced (Table 1) caries lesions on vital, nonendodontically treated primary and permanent teeth.

Clinicians select a CTR approach and restorative material on the basis of their clinical experience, influenced by factors such as the goal of restoring form, function, and esthetics and reducing the likelihood of outcomes such as pulp exposure, restoration failure, and secondary caries. Commercially available restorative materials in the United States include amalgam, compomer, conventional glass ionomer cement (GIC), preformed crowns, resin composite (RC), and resin-modified GIC (RMGIC).

Although there is evidence of the success of restorative treatment after different CTR approaches and restorative materials for vital, nonendodontically treated primary and permanent teeth, there is a need for an evidence-based clinical practice guideline (CPG) to assist clinicians in making restorative choices with their patients. The American Dental Association (ADA) Council on Scientific Affairs convened a panel of general, pediatric, and public health dentists specializing in cariology, operative dentistry, and dental materials to develop this guideline on restorative treatments for caries lesions. The ADA Science and Research Institute program for Clinical and Translational Research (formerly known as the Center for Evidence-Based Dentistry) provided methodological support, led stakeholder engagement, and drafted the article. The ADA funded this guideline, but the ADA was not involved in formulating the clinical questions or recommendations.

SCOPE, PURPOSE, AND TARGET AUDIENCE

This guideline is a part of the ADA's CPG series on caries management[4] and its purpose is helping clinicians choose the most appropriate CTR approaches and direct restorative materials for treating moderate and advanced caries lesions on vital, nonendodontically treated primary and permanent teeth requiring restorations (Table 1). These recommendations apply when the decision to treat a caries lesion with a direct restoration has been made and do not inform when to treat a caries lesion using nonrestorative or restorative approaches. Furthermore, the following are not within the scope of this guideline: indirect materials (for example, inlays and onlays), the use of liners or silver diamine fluoride, the means to remove carious tissue (for example, rotary and hand instruments and chemicals), pulp therapy, or choosing between repairing or replacing a restoration. The target audience for this guideline includes dental practitioners and their support teams, dental students, and patients. Policy makers also may benefit from these recommendations.

ABBREVIATION KEY

ADA: American Dental Association.
AE: Adverse effect.
ART: Atraumatic restorative treatment.
CoE: Certainty of the evidence.
CPG: Clinical practice guideline.
CTR: Carious tissue removal.
GIC: Glass ionomer cement.
GRADE: Grading of Recommendations Assessment, Development and Evaluation.
HT: Hall technique.
NIH: National Institutes of Health.
NIDCR: National Institute of Dental and Craniofacial Research.
PMC: Preformed metal crown.
PVP: Patients' values and preferences.
RC: Resin composite.
RCT: Randomized control trials.
RMGIC: Resin-modified glass ionomer cement.
SR: Systematic review.

METHODS

We followed the Appraisal of Guidelines for Research and Evaluation Reporting Checklist II[5] and Guidelines International Network-McMaster Guideline Development Checklist.[6]

The panel and methodologists met in person in August 2019 to review conflicts of interest of all panel members and determine the guideline's scope, purpose, target audience, and clinical questions. Meetings occurred virtually to review the evidence from the associated systematic review (SR) led by ADA Science and Research Institute methodologists[7] (November 2021, January 2022) and to formulate clinical recommendations (June and July 2022). Methodologists (L.P., S.P.) facilitated the formulation of recommendations using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Evidence-to-Decision framework.[8-11] After reviewing the evidence, the panel members formulated clinical recommendations via discussion until they achieved consensus. When agreement was elusive, the panel voted on the decision. As per GRADE guidance, the strength of recommendations can be strong or conditional, and each has implications for clinicians, patients, and policy makers (Table 2).[12] Methodologists conducted stakeholder and public engagement throughout the development of this guideline. Additional details regarding the methodology can be found in the Appendix Methods, available online at the end of the article.[7]

RESULTS

How to use the recommendations

The panel developed these recommendations and good practice statements to assist clinicians (in collaboration with their patients) and policy makers in the restorative decision-making process. Clinicians should use clinical judgment to determine when the recommended course of action may not be appropriate, warranting deviation from these recommendations.

Table 1. Definitions of carious tissue removal approaches and clinical presentation of caries lesion.

CARIOUS TISSUE REMOVAL APPROACHES (THAT IS, THE EXTENT OF CARIOUS TISSUE REMOVED)	
Nonselective Caries Removal	Carious tissue is removed until hard dentin is reached. Also known as complete caries removal.
Selective Caries Removal	Carious tissue is removed until soft or firm dentin is reached. Also known as partial or incomplete caries removal.
Stepwise Caries Removal	Carious tissue is first removed until soft dentin is reached and then a temporary restoration is placed. Months later, the restoration and carious tissue are removed until firm dentin is reached and a permanent restoration is then placed. Also known as 2-step caries removal.
No Carious Tissue Removal	No carious tissue is removed prior to the placement of a definitive restoration.
CLINICAL PRESENTATION OF CARIES LESIONS	
Moderate Caries Lesion	International Caries Detection and Assessment System codes 3 and 4
Advanced Caries Lesion	International Caries Detection and Assessment System codes 5 and 6

Evidence to decisions

Question 1

In patients with vital primary teeth requiring restorative treatment without pulp therapy and regardless of direct restorative material and means to remove carious tissue (that is, mechanical or chemomechanical), should we recommend nonselective, stepwise (advanced caries lesions only), selective, or no CTR (that is, sealing lesions with a preformed crown) to treat moderate and advanced caries lesions (Table 3, Figure 1)?

Desirable and undesirable effects

One SR[13] (12 randomized controlled trials [RCTs])[14-25] identified data on caries progression, clinical failure, patient discomfort during treatment, patient satisfaction, postoperative pain and discomfort, pulp exposure, pulp necrosis, time needed to perform the restoration, and tooth loss (Appendix Results, eTable 1, eTable 2, eFigure 1, eFigure 2, available online at the end of this article).

Six RCTs[14-19] informed recommendations for CTR approaches to treat moderate caries lesions. Moderate to very low certainty evidence suggests that nonselective and selective CTR may be less effective when compared with no CTR across most outcomes (eTable 3, eTable 4, eFigure 3, eFigure 4, available online at the end of this article). Evidence also suggests that neither nonselective nor selective CTR may be more effective than the other (very low certainty; eTable 5, eFigure 5, eFigure 6, available online at the end of this article).

Six RCTs[20-25] informed recommendations for CTR approaches to treat advanced caries lesions. Moderate to very low certainty evidence suggests that selective CTR may be more effective when compared with nonselective, stepwise, and no CTR across all outcomes (eTable 6, eTable 7, eTable 8, eFigure 7, eFigure 8, eFigure 9, eFigure 10, available online at the end of this article). In addition, nonselective CTR may be less effective across all outcomes compared with stepwise (low certainty; eTable 9, available online at the end of this article).

We found no SRs meeting our selection criteria that reported undesirable effects.

Values and preferences

The panel judged that there was possibly important uncertainty or variability in patients' values and preferences (PVPs) among all CTR approaches. This judgment was based on indirect evidence from studies conducted outside of the United States among people with permanent teeth, along with panel discussion regarding the additional appointments required for stepwise and, in some instances, no CTR. Additional details are in the Appendix, available online at the end of this article.

Resources required

One potential difference in cost is that stepwise and, in some instances, no CTR requires multiple visits, increasing the procedure's cost and treatment time. Preformed crowns are often placed after

Table 2. Definitions of the certainty of the evidence and strength of recommendations and implications for stakeholders.*

DEFINITION OF CERTAINTY OF THE EVIDENCE	
Category	**Definition**
High	Very confident that the true effect lies close to that of the estimate of the effect.
Moderate	Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low	Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.
Very Low	Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.

DEFINITION OF STRONG AND CONDITIONAL RECOMMENDATIONS AND IMPLICATIONS FOR STAKEHOLDERS		
Implications	**Strong Recommendations**	**Conditional Recommendations**
For Patients	Most patients in this situation would want the recommended course of action and only a small proportion would not. Formal decision aids are not likely to be needed to help individuals make decisions consistent with their values and preferences.	Most patients in this situation would want the suggested course of action, but many would not.
For Clinicians	Most patients should receive the intervention. Adherence to this recommendation according to the guideline could be used as a quality criterion or performance indicator.	Recognize that different choices will be appropriate for individual patients and that you must help each patient arrive at a management decision consistent with his or her values and preferences. Decision aids may be useful in helping patients making decisions consistent with their values and preferences.
For Policy Makers	The recommendation can be adapted as policy in most situations.	Policy making will require substantial debate and involvement of various stakeholders.

* Source: Andrews and colleagues.[8,9] Reproduced with permission of the publisher from Balshem and colleagues.[12]

no CTR, which presents a higher cost to the patient than other direct restorations. Thus, the panel judged nonselective and selective CTR as the least costly, stepwise CTR as having intermediate costs, and no CTR as the most costly.

Acceptability

Although the panel concluded that key stakeholders probably find all CTR approaches acceptable, variation in acceptability of nonselective and selective CTR may exist owing to some clinicians having concerns about leaving carious tissues behind and other clinicians being in favor of more conservative and biological removal approaches (that is, selective).[26,27] In addition, the panel determined that on the basis of reviewed studies, no CTR is generally acceptable in cases in which a preformed metal crown (PMC) is indicated and emphasized that stepwise CTR may not be as acceptable owing to the need for a second appointment required to place a final restoration. For additional details, see the Appendix, available online at the end of this article.

Feasibility

We found no evidence regarding the feasibility of all CTR approaches. Although the panel noted that all CTR approaches are generally feasible, they judged stepwise as slightly less feasible owing to the need for a second appointment to remove more demineralized tissue and place the final restoration.

Question 2

In patients with vital permanent teeth requiring restorative treatment, without pulp therapy and regardless of direct restorative material and means to remove carious tissue (that is, mechanical or chemomechanical), should we recommend nonselective, stepwise (advanced lesions only), selective, or no CTR to treat moderate and advanced caries lesions (Table 3, Figure 2)?

Desirable and undesirable effects

One SR[13] (6 RCTs)[21,26-30] identified data on failure, patient discomfort during treatment, pulp exposure, pulp necrosis, pulpal complications due to infection, and tooth loss (Appendix Results, available online at the end of this article).

Table 3. Summary of clinical recommendations and good practice statements for carious tissue removal and direct restorative materials for caries lesions on vital, nonendodontically treated primary and permanent teeth.

CLINICAL SCENARIO	CLINICAL QUESTIONS	RECOMMENDATIONS AND GOOD PRACTICE STATEMENTS
Carious Tissue Removal Approaches in Primary Teeth	In patients with vital **primary** teeth requiring restorative treatment, regardless of direct restorative material* and means to remove carious tissue,† and without pulp therapy, which caries removal approach‡ should we recommend to treat **moderate**§ **caries lesions**?	To treat **moderate**§ **caries lesions** on vital **primary** teeth requiring a restoration, the guideline panel suggests the use of selective carious tissue removal,¶ nonselective carious tissue removal,# or no carious tissue removal (that is, sealing lesions with a preformed crown) (conditional recommendation, very low certainty).**,††,‡‡
	In patients with vital **primary** teeth requiring restorative treatment, regardless of direct restorative material* and means to remove carious tissue,† and without pulp therapy, which caries removal approach‡ should we recommend to treat **advanced**§§ **caries lesions**?	To treat **advanced**§§ **caries lesions** on vital **primary** teeth requiring a restoration, the guideline panel suggests prioritizing the use of selective carious tissue removal¶ or no carious tissue removal (that is, sealing with a preformed crown) over nonselective carious tissue removal# or stepwise carious tissue removal¶¶ (conditional recommendation, very low certainty).††,‡‡,##
Carious Tissue Removal Approaches in Permanent Teeth	In patients with vital **permanent** teeth requiring restorative treatment, regardless of direct restorative material* and means to remove carious tissue,† and without pulp therapy, which caries removal approach‡ should we recommend to treat **moderate**§ **caries lesions**?	To treat **moderate**§ **caries lesions** on vital **permanent** teeth requiring a restoration, the guideline panel suggests prioritizing the use of selective carious tissue removal¶ over nonselective carious tissue removal# (conditional recommendation, very low certainty).##
	In patients with vital **permanent** teeth requiring restorative treatment, regardless of direct restorative material* and means to remove carious tissue,† and without pulp therapy, which caries removal approach‡ should we recommend to treat **advanced**§§ **caries lesions**?	To treat **advanced**§§ **caries lesions** on vital **permanent** teeth requiring a restoration, the guideline panel suggests prioritizing the use of selective carious tissue removal¶ over stepwise carious tissue removal¶¶ or nonselective carious tissue removal# (conditional recommendation, very low certainty).##
Direct Restorative Materials for Primary Teeth	In vital **primary** teeth requiring restorative treatment, regardless of carious tissue removal approach‡ and without pulp therapy, which direct restorative material should we recommend to restore moderate§ and advanced§§ caries lesions on **anterior** teeth?	For moderate§ and advanced§§ caries lesions on vital **anterior primary** teeth requiring a **Class III** (approximal) restoration, the guideline panel suggests the use of either nanocomposite or hybrid resin composite (RC) (conditional recommendation, very low certainty).**,***
		For moderate§ and advanced§§ caries lesions on vital **anterior primary** teeth requiring a **Class V** (cervical third of facial or lingual) restoration, the guideline panel suggests the use of either conventional GIC, hybrid RC, or resin-modified GIC (conditional recommendation, very low certainty).**,***,†††,‡‡‡
	In vital **primary** teeth requiring restorative treatment, regardless of carious tissue removal approach‡ and without pulp therapy, which direct restorative material should we recommend to restore moderate§ and advanced§§ caries lesions on **posterior** teeth?	For moderate§ and advanced§§ caries lesions on vital **posterior primary** teeth requiring a **Class I** (pit and fissure) restoration, the guideline panel suggests prioritizing the use of resin-modified GIC, RCs, conventional GIC, or preformed crowns over compomer or dental amalgam (conditional recommendation, very low certainty).‡‡,##,†††,‡‡‡,§§§,¶¶¶
		For moderate§ and advanced§§ caries lesions on vital **posterior primary** teeth requiring a **Class II** (approximal) restoration, the guideline panel suggests prioritizing the use of resin-modified GIC, RCs, or preformed crowns over compomer, conventional GIC, or dental amalgam (conditional recommendation, very low certainty).‡‡,##,‡‡‡,§§§,¶¶¶,###
		For moderate§ and advanced§§ caries lesions on vital **posterior primary** teeth requiring a **Class V** (cervical third of facial or lingual) restoration, the guideline panel suggests the use of either conventional GIC, hybrid RC, or resin-modified GIC (conditional recommendation, very low certainty).**,***,†††,‡‡‡
	No corresponding clinical question	Good practice statement: The US Food and Drug Administration recommends not using dental amalgam in "children, especially those younger than six years of age; people with pre-existing neurological disease; people with impaired kidney function; [and] people with known heightened sensitivity (allergy) to mercury or other components (silver, copper, tin)" wherever possible.****

* Direct restorative materials are limited to the use of dental amalgam, compomer, conventional glass ionomer cement (GIC), preformed crowns, resin composites (RC) (that is, hybrid RC, macrofilled RC, and nanocomposite), and resin-modified GIC. † Means to remove carious tissue is defined as mechanical or chemomechanical. ‡ Carious tissue removal approach is defined as the extent of carious tissue removed. § Moderate caries lesion is defined as International Caries Detection and Assessment System codes 3 and 4. ¶ Selective carious tissue removal is defined as carious tissue being removed until soft or firm dentin is reached. Also known as partial or incomplete caries removal. # Nonselective carious tissue removal is defined as carious tissue being removed until hard dentin is reached. Also known as complete caries removal. ** The guideline panel assigned no prioritization among the recommended interventions. †† Clinicians may perform no carious tissue removal for lesions in which a preformed metal crown is indicated. Clinicians should consider the number of involved surfaces, caries risk and activity, moisture control, patient behavior, patient or caregiver preferences, and anticipated time to exfoliation when deciding whether to place a preformed metal crown using the Hall technique. ‡‡ Preformed crowns include the use of stainless steel or esthetic crowns. §§ Advanced caries lesion is defined as International Caries Detection and Assessment System codes 5 and 6. ¶¶ Stepwise carious tissue removal is defined as carious tissue being first removed until soft dentin is reached and then a temporary restoration is placed. Months later, the restoration and carious tissue are removed until firm dentin is reached and a permanent restoration is then placed. Also known as 2-step caries removal. ## The prioritization of interventions in this recommendation is a ranking determined by the panel owing to their effectiveness, patients' values and preferences, resources required, acceptability, and feasibility. *** RC and resin-modified GIC materials may be used as a conventional or strip crown restoration. ††† Conventional and resin-modified GIC may be preferable when tooth isolation cannot be achieved, in patients with special health care needs or in patients lacking predictable access to care. ‡‡‡ Conventional GIC may be preferable when light-curing is not feasible. §§§ RCs refer to hybrid RC, macrofilled RC, and nanocomposite. ¶¶¶ Clinicians should reserve preformed crowns for lesions where indicated. Clinicians should consider the extent of the lesion, caries risk and activity, moisture control, patient behavior, patient or caregiver preferences, and anticipated time to exfoliation when deciding whether to perform a single or multisurface direct restoration or place a preformed crown. ### Resin-modified GIC may be preferable when tooth isolation cannot be achieved, in patients with special health care needs or in patients lacking predictable access to care. **** US Food and Drug Administration.[53] †††† The guideline panel assigned no ranking among the prioritized interventions.

Table 3. Continued

CLINICAL SCENARIO	CLINICAL QUESTIONS	RECOMMENDATIONS AND GOOD PRACTICE STATEMENTS
Direct Restorative Materials for Permanent Teeth	In vital **permanent** teeth requiring restorative treatment, regardless of carious tissue removal approach[‡] and without pulp therapy, which direct restorative material should we recommend to restore moderate[§] and advanced[§§] caries lesions on **anterior** teeth?	For moderate[§] and advanced[§§] caries lesions on vital **anterior permanent** teeth requiring a **Class I** (lingual pit and fissure) restoration, the guideline panel suggests the use of either conventional GIC, hybrid RC, or resin-modified GIC (conditional recommendation, very low certainty).[**,†††,‡‡‡]
		For moderate[§] and advanced[§] caries lesions on vital **anterior permanent** teeth requiring a **Class III** (approximal) restoration, the guideline panel suggests the use of either nanocomposite or hybrid RC (conditional recommendation, very low certainty).[**]
		For moderate[§] and advanced[§§] caries lesions on vital **anterior permanent** teeth requiring a **Class V** (cervical third of facial or lingual) restoration, the guideline panel suggests the use of either conventional GIC, hybrid RC, or resin-modified GIC (conditional recommendation, very low certainty).[**,†††,‡‡‡]
	In vital **permanent** teeth requiring restorative treatment, regardless of carious tissue removal approach[‡] and without pulp therapy, which direct restorative material should we recommend to restore moderate[§] and advanced[§§] caries lesions on **posterior** teeth?	For moderate[§] and advanced[§§] caries lesions on vital **posterior permanent** teeth requiring a **Class I** (pit and fissure) restoration, the guideline panel suggests prioritizing the use of conventional GIC, dental amalgam, RC, or resin-modified GIC over compomer (conditional recommendation, very low certainty).[##,†††,‡‡‡,§§§,††††]
		For moderate[§] and advanced[§§] caries lesions on vital **posterior permanent** teeth requiring a **Class II** (approximal) restoration, the guideline panel suggests prioritizing the use of dental amalgam, RC, or resin-modified GIC over conventional GIC (conditional recommendation, very low certainty).[##,‡‡‡,§§§,###,††††]
		For moderate[§] and advanced[§§] caries lesions on vital **posterior permanent** teeth requiring a **Class V** (cervical third of facial or lingual) restoration, the guideline panel suggests the use of either conventional GIC, hybrid RC, or resin-modified GIC (conditional recommendation, very low certainty).[**,†††,‡‡‡]
	No corresponding clinical question	Good practice statement: The Food and Drug Administration recommends not using dental amalgam in "children, especially those younger than six years of age; people with pre-existing neurological disease; people with impaired kidney function; [and] people with known heightened sensitivity (allergy) to mercury or other components (silver, copper, tin)" wherever possible.[****]
	In vital **permanent** teeth requiring restorative treatment, regardless of carious tissue removal approach[‡] and without pulp therapy, which direct restorative material should we recommend to restore moderate[§] and advanced[§§] root caries lesions on **anterior and posterior** teeth?	For moderate[§] and advanced[§§] **root caries lesions** on vital **anterior and posterior permanent** teeth requiring a restoration, the guideline panel suggests the use of either resin-modified GIC or conventional GIC (conditional recommendation, low certainty).[**,‡‡‡]

Six RCTs[21,28-32] informed recommendations for CTR approaches to treat advanced caries lesions. Moderate to very low certainty evidence suggests that nonselective CTR may be less effective than stepwise across most outcomes (eTable 10, eFigure 11, eFigure12, available online at the end of this article), and neither nonselective nor selective CTR may be more effective than the other (eTable 11, eFigure 13, eFigure 14, available online at the end of this article). Very low certainty evidence suggests that neither stepwise nor selective CTR may be more effective than the other (eTable 12, eFigure 15, eFigure 16, eFigure 17, available online at the end of this article).

We found no studies meeting our selection criteria for CTR approaches to treat moderate caries lesions on vital permanent teeth. The panel decided to inform this clinical question using the same body of evidence summarized for advanced caries lesions on permanent teeth, rating down the certainty of the evidence (CoE) 1 level owing to serious issues of indirectness (very low).

We identified no SRs meeting our selection criteria that reported undesirable effects.

The panel used the same body of evidence on PVP, resources required, acceptability, and feasibility described for Question 1 to inform recommendations for permanent teeth.

See Appendix Results, available online at the end of this article, for a narrative summary of outcomes and comparisons for CTR approaches in primary and permanent teeth that did not allow for the calculation of treatment effect estimates and 95% CIs.

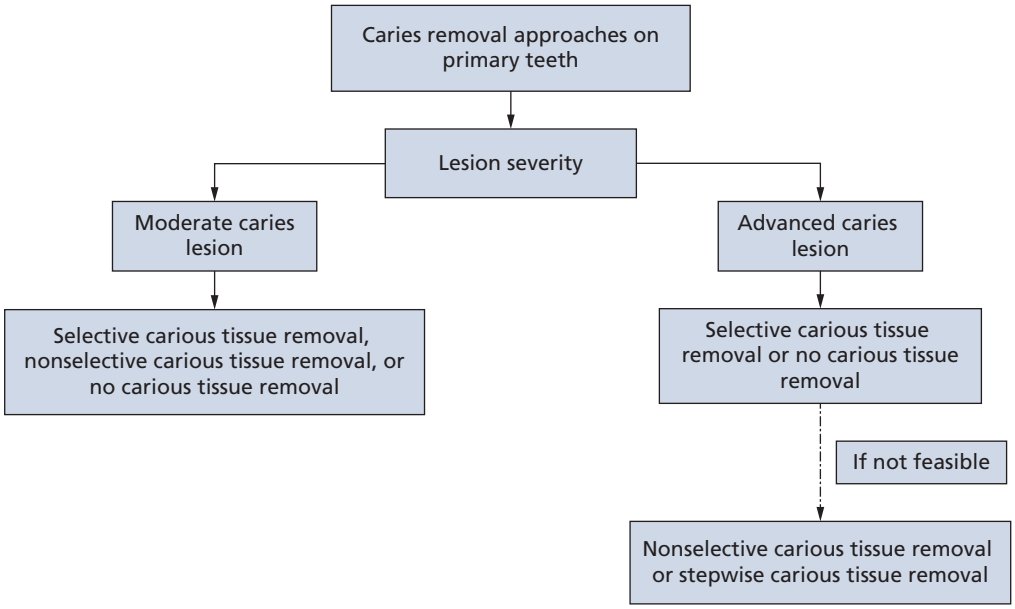

Figure 1. Clinical pathway of carious tissue removal approaches for the treatment of vital, nonendodontically treated, primary teeth. Caries removal approach is defined as the extent of carious tissue removed. Moderate caries lesion is defined as International Caries Detection and Assessment System codes 3 and 4. Advanced caries lesion is defined as International Caries Detection and Assessment System codes 5 and 6. Selective carious tissue removal is defined as carious tissue being removed until soft or firm dentin is reached, which also is known as partial or incomplete caries removal. Nonselective carious tissue removal is defined as carious tissue being removed until hard dentin is reached, which also is known as complete caries removal. No carious tissue removal is defined as sealing a caries lesion with a preformed crown. Clinicians may perform no carious tissue removal for lesions in which a preformed crown is indicated. Clinicians should consider the number of involved surfaces, caries risk and activity, moisture control, patient behavior, patient or caregiver preferences, and anticipated time to exfoliation when deciding whether to place a preformed crown. The prioritization of caries removal approaches in this recommendation is a ranking determined by the panel on the basis of their effectiveness, patients' values and preferences, resources required, acceptability, and feasibility. Stepwise carious tissue removal is defined as carious tissue being first removed until soft dentin is reached, followed by placement of a temporary restoration. Months later, the restoration and carious tissue are removed until firm dentin is reached and a permanent restoration is then placed. This is also known as 2-step caries removal.

Question 3

In patients with vital primary teeth requiring restorative treatment, regardless of CTR approach and without pulp therapy, should we recommend amalgam, conventional GIC, compomers, preformed esthetic crowns, PMCs, RMGIC, or RC to restore moderate and advanced caries lesions on anterior and posterior teeth (Table 3, Figure 3)?

Desirable and undesirable effects

Sixteen RCTs[16,33-47] informed the desirable effects, providing data on oral health–related quality of life, patient satisfaction, postoperative pain and discomfort, restoration failure, restoration fracture, restoration loss, secondary caries, unacceptable anatomic form, unacceptable color match, and unacceptable marginal adaptation.

We did not find direct evidence on direct restorative materials for Class III and Class V restorations on primary teeth. Therefore, the panel informed these recommendations using indirect evidence from 4 RCTs[33-36] on permanent teeth, rating down the CoE 1 level owing to serious issues of indirectness (very low certainty). For Class III restorations on permanent teeth, the evidence suggests that nanocomposite may be less effective for some outcomes and shows little to no difference in others compared with hybrid RC (eTable 13, available online at the end of this article). For Class V restorations on permanent teeth, very low certainty evidence suggests that when compared with hybrid RC and conventional GIC, RMGIC may be more effective for some outcomes and less effective for others (eTable 14, eTable 15, available online at the end of this article). In addition, conventional GIC may be more effective than hybrid RC (eTable 16, available online at the end of this article).

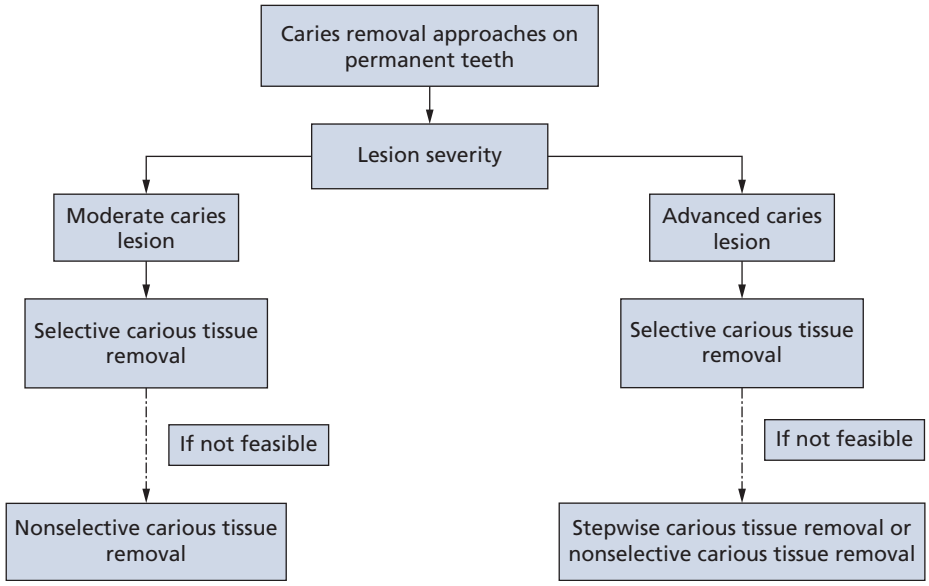

Figure 2. Clinical pathway of carious tissue removal approaches for the treatment of vital, nonendodontically treated, permanent teeth. Caries removal approach is defined as the extent of carious tissue removed. Moderate caries lesion is defined as International Caries Detection and Assessment System codes 3 and 4. Advanced caries lesion is defined as International Caries Detection and Assessment System codes 5 and 6. Selective carious tissue removal is defined as carious tissue being removed until soft or firm dentin is reached, which also is known as partial or incomplete caries removal. The prioritization of caries removal approaches in this recommendation is a ranking determined by the panel on the basis of their effectiveness, patients' values and preferences, resources required, acceptability, and feasibility. Nonselective carious tissue removal is defined as carious tissue being removed until hard dentin is reached, which also is known as complete caries removal. Stepwise carious tissue removal is defined as carious tissue being first removed until soft dentin is reached, followed by placement of a temporary restoration. Months later, the restoration and carious tissue are removed until firm dentin is reached and a permanent restoration is then placed. This is also known as 2-step caries removal.

Ten RCTs[16,37-44,47] informed recommendations for Class II restorations. Moderate to very low certainty evidence suggests that when compared with conventional GIC, amalgam, hybrid RC, macrofilled RC, nanocomposite, and RMGIC were more effective across most outcomes (eTable 17, eTable 18, eTable 19, eTable 20, eTable 21, available online at the end of this article). Neither hybrid RC nor RMGIC may be more effective than the other (very low certainty; eTable 22, available online at the end of this article). Low certainty evidence suggests that there may be little to no difference between compomer and conventional GIC (eTable 23, available online at the end of this article). PMCs placed with the Hall technique (HT) are probably more effective when compared with conventional GIC placed with atraumatic restorative treatment (ART) (moderate certainty; eTable 24, available online at the end of this article).

We did not find direct evidence on amalgam, hybrid RC, nanocomposite, PMCs, and RMGIC to restore Class I restorations on primary teeth. Therefore, the panel informed these recommendations using indirect evidence, prioritizing data on Class I and Class II restorations combined (that is, data from primary studies in which authors grouped and analyzed both posterior Class I and Class II restorations together) over Class II restorations alone. The panel acknowledged the risk of experiencing restoration failure was higher with involvement of more tooth surfaces and therefore assumed that direct materials proving effective in Class II restorations also may be effective in Class I posterior restorations (that is, a conservative risk of failure). We rated down the CoE 1 and 2 levels for Class I and Class II restorations combined and Class II restorations alone, respectively, owing to serious issues of indirectness (very low certainty).

Seven RCTs[15,37,39-41,45,46] informed recommendations for Class I restorations. Low to very low certainty evidence suggests that for Class I restorations, compomers may be less effective than conventional GIC (eTable 25, available online at the end of this article), whereas neither macrofilled RC nor conventional GIC may be more effective than the other (eTable 26, available online at the end of this article). For Class I and Class II restorations combined, indirect evidence

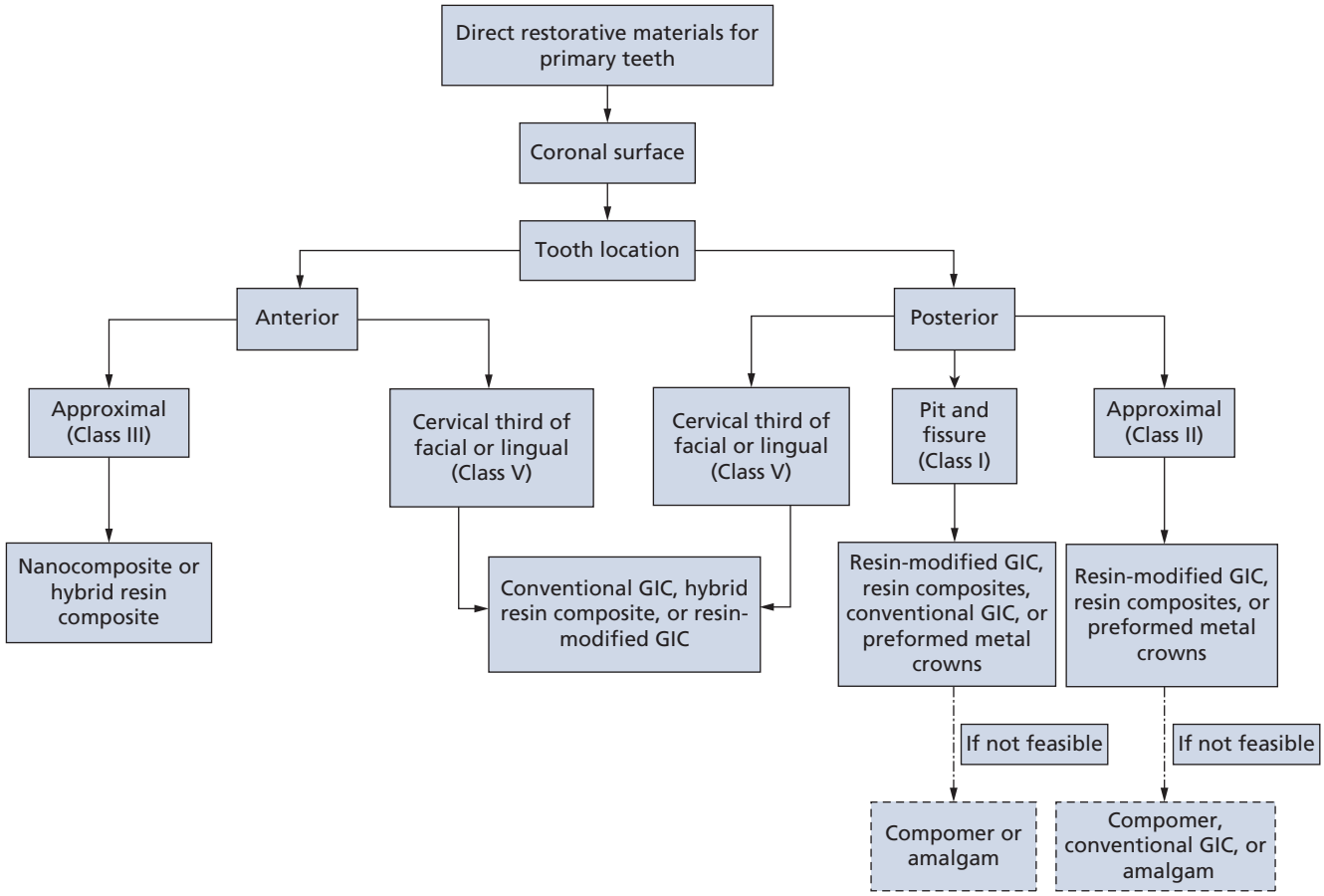

Figure 3. Clinical pathway of direct materials to restore vital, nonendodontically treated, primary teeth. The guideline panel assigned no prioritization among the recommended interventions. Conventional glass ionomer cement (GIC) may be preferable when light curing is not feasible. Conventional and resin-modified GIC may be preferable when tooth isolation cannot be achieved, in patients with special healthcare needs, or in patients lacking predictable access to care. Resin composites refer to hybrid resin composite, macrofilled resin composite, and nanocomposite. Preformed crowns include the use of stainless steel or esthetic crowns. Clinicians should reserve preformed crowns for lesions where indicated. Clinicians should consider the extent of the lesion, caries risk and activity, moisture control, patient behavior, patient or caregiver preferences, and anticipated time to exfoliation when deciding whether to perform a single-surface or multisurface direct restoration or place a preformed crown. The prioritization of interventions in this recommendation is a ranking determined by the panel based on their effectiveness, patients' values and preferences, resources required, acceptability, and feasibility. The US Food and Drug Administration recommends not using amalgam in "children, especially those younger than six years of age; people with pre-existing neurological disease; people with impaired kidney function; [and] people with known heightened sensitivity (allergy) to mercury or other components (silver, copper, tin)"[49] wherever possible. Resin-modified GIC may be preferable when tooth isolation cannot be achieved, in patients with special health care needs, or in patients lacking predictable access to care. Resin composite and resin-modified GIC materials may be used as a conventional or strip crown restoration.

suggests that when compared with amalgam and conventional GIC, RMGIC may be more effective for some outcomes and less effective for others (very low certainty) (eTable 27, eTable 28, available online at the end of this article). Indirect evidence on the use of hybrid RC (eTable 18, available online at the end of this article), nanocomposite (eTable 20, available online at the end of this article), and PMCs (HT) (eTable 24, available online at the end of this article) for Class II restorations summarized above also informed this recommendation.

We did not find direct evidence on the effect of preformed esthetic crowns for primary teeth; therefore, the panel informed these recommendations using indirect evidence from Class II, Class III, and Class V restorations as described above. In addition, we found no evidence of the effects of any direct restorative material for Class I anterior restorations.

One SR[48] informed the undesirable effects of amalgam and RCs to restore caries lesions, indicating there may be little to no difference in risk of experiencing adverse effects (AEs) (that is, anaphylaxis, neurobehavioral assessment, kidney function, psychosocial function, and physical development) among the materials. In addition to the conclusion of the SR by Worthington and colleagues,[48] a paucity of evidence on compomer, conventional GIC, PMCs, and RMGIC led to

Table 4. US national average cost to the patient for direct restorative materials.*

MATERIAL†	SURFACES INVOLVED, NO.	MEAN COST, $
Anterior Restorations		
Esthetic	1	114.01
Esthetic	2	137.71
Esthetic	3	157.73
Esthetic	≥ 4	186.51
Esthetic strip crown	Not applicable	233.63
Prefabricated esthetic crown (porcelain or ceramic)	Not applicable	190.42
Posterior Restorations		
Amalgam	1	97.78
Esthetic	1	125.07
Amalgam	2	120.40
Esthetic	2	158.74
Amalgam	3	140.70
Esthetic	3	184.78
Amalgam	≥ 4	163.56
Esthetic	≥ 4	211.50
Preformed metal crown	Not applicable	190.41
Prefabricated esthetic crown (porcelain or ceramic)	Not applicable	190.42

* Source: American Dental Association Health Policy Institute, Analysis of the IBM MarketScan Dental Database, unpublished data, 2019. † All tooth-colored restorations are coded as resin composite in the data set. Esthetic represents the resin composite treatment code and is representative of resin composites, glass ionomer cement, resin-modified glass ionomer cement, and compomer restorations.

uncertainty in the magnitude of harms for all direct restorative materials (Appendix, available online at the end of this article).

Patients' values and preferences

The panel determined there was important uncertainty or variability in PVPs regarding amalgam but probably no important uncertainty or variability regarding all other materials (Appendix, available online at the end of this article).

Resources required

On average, the cost to patients for amalgam restorations is approximately 75% of the price of esthetic restorations for the same number of surfaces (American Dental Association Health Policy Institute, Analysis of the IBM MarketScan Dental Database, unpublished data, 2019). The panel determined this difference was significant for decision making. For PMCs, the panel judged that the cost of a PMC was not significantly higher than that of amalgam or esthetic for 2-surface restorations. For single-surface restorations, however, the panel believed the cost of a PMC was substantially more than that of amalgam and esthetic restorations (Table 4).

Acceptability

Although amalgam has been recognized for its superiority in durability,[49] longevity, and affordability,[50,51] the panel highlighted that all direct restorative materials present acceptable levels of effectiveness. However, potential AEs for patients and the reported environmental harms of mercury have raised concerns, questioning the acceptability of amalgam. Although there is insufficient evidence[48,52,53] to support the hypothesis that amalgam increases the risk of AEs compared with any other restorative materials, national[54,55] and international stakeholders[56-58] have questioned the use of amalgam in general and in vulnerable populations specifically.

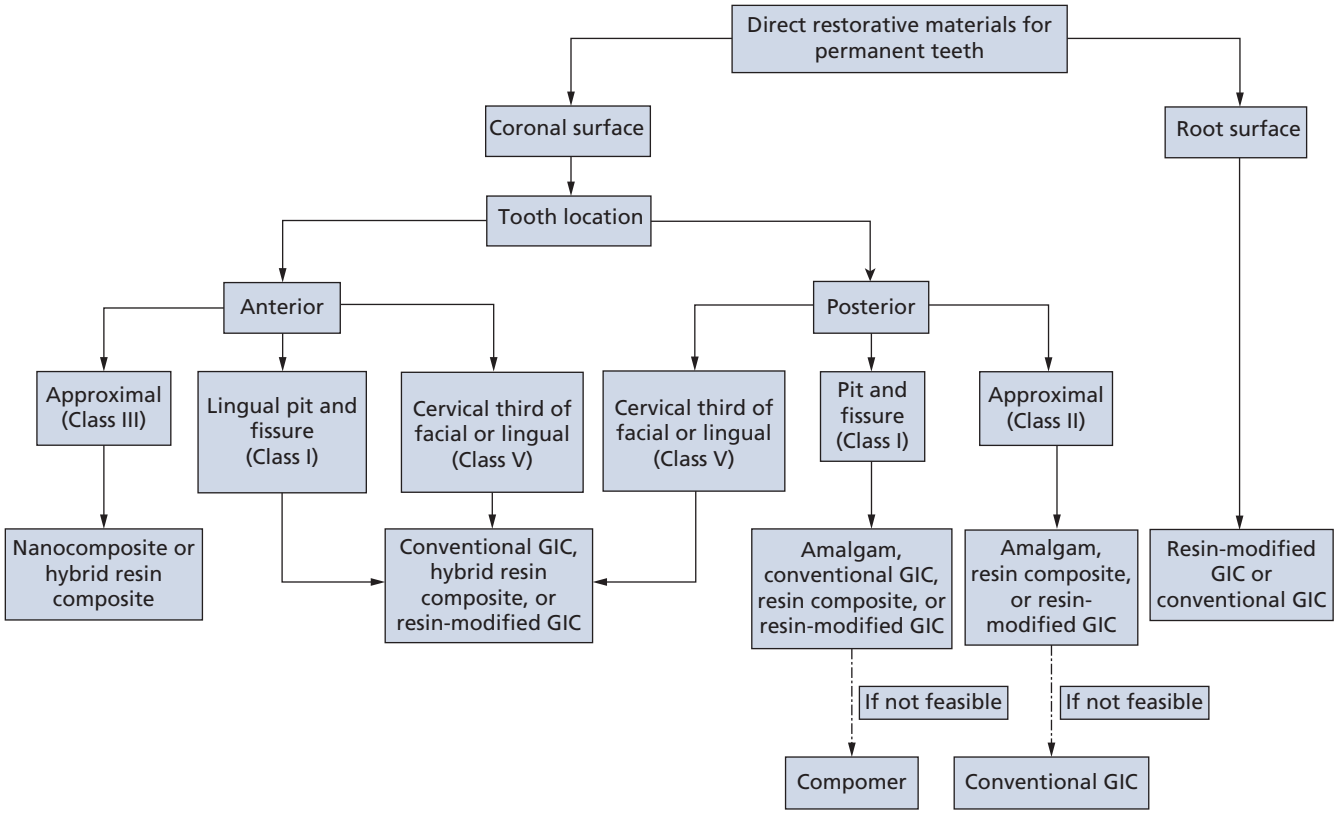

Figure 4. Clinical pathway of direct materials to restore vital, nonendodontically treated, permanent teeth. The guideline panel assigned no prioritization among the recommended interventions. Conventional glass ionomer cement (GIC) may be preferable when light curing is not feasible. Conventional and resin-modified GIC may be preferable when tooth isolation cannot be achieved, in patients with special healthcare needs, or in patients lacking predictable access to care. The US Food and Drug Administration recommends not using amalgam in "children, especially those younger than six years of age; people with pre-existing neurological disease; people with impaired kidney function; [and] people with known heightened sensitivity (allergy) to mercury or other components (silver, copper, tin)"[50] wherever possible. Resin composites refer to hybrid resin composite, macrofilled resin composite, and nanocomposite. The guideline panel assigned no ranking among the prioritized interventions. The prioritization of interventions in this recommendation is a ranking determined by the panel on the basis of their effectiveness, patients' values and preferences, resources required, acceptability, and feasibility. Resin-modified GIC may be preferable when tooth isolation cannot be achieved, in patients with special healthcare needs, or in patients lacking predictable access to care.

Feasibility

We found no evidence regarding the feasibility of any direct material to restore moderate and advanced caries lesions on primary teeth. The panel highlighted that most of these interventions already are widely used among clinicians in the United States, except for compomers.

Question 4

In patients with vital, permanent teeth requiring restorative treatment, regardless of CTR approach and without pulp therapy, should we recommend amalgam, conventional GIC, compomers, PMCs, RMGIC, or RC to restore moderate and advanced caries lesions on anterior and posterior teeth (Table 3, Figure 4)?

Desirable effects

Twenty-one RCTs[34-36,59-76] informed the desirable effects, providing data on tooth fracture (crown), patient satisfaction, postoperative pain and discomfort, restoration failure, restoration fracture, restoration loss, secondary caries, time needed to perform the restoration, unacceptable color match, and unacceptable marginal adaptation.

The panel used the same body of evidence summarized in Question 3 (eTable 13, eTable 14, eTable 15, eTable 16, available online at the end of this article) to inform recommendations for Class III and Class V restorations. In addition, we did not find direct evidence regarding the effect of direct materials for Class I anterior restorations on permanent teeth. The panel informed this

recommendation using indirect evidence from 3 RCTs[34-36] on Class V restorations on permanent teeth, as summarized in Question 3. We rated down the CoE 1 level owing to serious issues of indirectness (very low).

We did not find direct evidence regarding the effects of amalgam, macrofilled RC, and nanocomposite to restore Class I restorations alone and Class II restorations alone on permanent teeth. The panel informed these recommendations using indirect evidence from 8 RCTs[59-66] on Class I and Class II restorations combined. We rated down the CoE 1 level owing to serious issues of indirectness (very low).

Twelve RCTs[59-63,67-73] informed recommendations for Class I posterior restorations. Low certainty evidence suggests that RMGIC may be more effective than conventional GIC, and conventional GIC may be more effective than compomer across all outcomes for Class I posterior restorations (eTable 29, eTable 30, available online at the end of this article). Although conventional GIC may be less effective than hybrid RC (low certainty; eTable 31, available online at the end of this article), neither nanocomposite nor hybrid RC may be more effective than the other (low certainty; eTable 32, available online at the end of this article). Indirect evidence from Class I and Class II restorations combined showed that amalgam and macrofilled RC may be more effective than hybrid RC across most outcomes (low to very low certainty; eTable 33, eTable 34, available online at the end of this article).

Twelve RCTs[59-66,68,69,74,75] informed recommendations for Class II restorations. Low certainty evidence suggests that both hybrid RC and RMGIC may be more effective than conventional GIC across all outcomes for Class II restorations (eTable 35, eTable 36, available online at the end of this article). However, hybrid RC placed with rotary instruments may be more effective than conventional GIC placed with ART (moderate to very low certainty; eTable 37, available online at the end of this article). Indirect evidence from Class I and Class II restorations combined showed nanocomposite may be more effective than hybrid RC (eTable 38, available online at the end of this article). Indirect evidence from Class I and Class II restorations combined for amalgam (eTable 33, available online at the end of this article) and macrofilled RC (eTable 34, available online at the end of this article) summarized above also informed this recommendation.

One study[76] informed recommendations for restorations in root caries lesions. Low certainty evidence suggests that GIC may be more effective than RMGIC (eTable 39, available online at the end of this article).

The panel used the same evidence on undesirable effects, PVP, resources required, acceptability, and feasibility described for Question 3 to inform recommendations for permanent teeth.

The associated SR[7] includes a narrative summary of outcomes across comparisons for direct restorative materials in primary and permanent teeth that did not allow for the calculating treatment effect estimates and 95% CIs.

DISCUSSION

Summary of main findings

In most clinical scenarios, evidence did not show important differences between CTR approaches and direct restorative materials[7] to suggest whether 1 treatment option is superior to another. One key finding for advanced lesions was that more conservative CTR approaches were associated with fewer clinical failures. The panel identified important concerns relating to PVPs, acceptability, and feasibility, leading to prioritization of interventions within specific recommendations. For example, environmental concerns beyond the confines of dentistry influenced the acceptability factor for direct restorative materials.[57,58] It is important to emphasize that prioritizing an intervention does not equate to a recommendation against another. Very low certainty evidence resulted in conditional recommendations only. Clinicians should implement shared decision making with patients or caretakers when implementing these recommendations.

Implications for practice

Two important recommendations of this guideline highlight the prioritization of more conservative CTR to treat advanced caries lesions on primary and permanent teeth over nonconservative CTR. A paradigm shift in the last 20 years to preserve healthy tooth structure has changed how clinicians should treat advanced lesions. Although the panel acknowledges decisions regarding CTR approaches may be based on early clinical education,[77] learned behaviors, and preferences, they

suggest placing a greater emphasis on the evidence of increased risk of experiencing outcomes such as pulp exposure when all carious tissues are removed. The panel urges clinicians to use more conservative CTR approaches that align with restorative dentistry's 2 main aims: preserving healthy tooth structure[27] and protecting the pulp-dentin complex.[2]

Comparison with other guidelines

To our knowledge, this is the first CPG on CTR approaches and direct restorative materials for primary and permanent teeth informed by an SR and using the GRADE framework to assess the CoE and develop clinical recommendations. This guideline is consistent with earlier guidance and consensus documents developed by the American Academy of Pediatric Dentistry[3] and the International Caries Consensus Collaboration[2] suggesting more conservative approaches to treat moderate and advanced lesions. Regarding recommendations for direct restorative materials, the American Academy of Pediatric Dentistry also provides similar guidance to restore primary and permanent teeth in children and adolescents. Although the International Caries Consensus Collaboration did not provide recommendations for specific materials, they acknowledged that factors such as tooth location, lesion depth, and caries risk are necessary to inform the appropriate choice of direct restorative material. Guidance from other associations has not been formally assessed or endorsed by the ADA.

Implications for research

The lack of evidence on CTR approaches to treat moderate lesions on permanent teeth resulted in the panel using indirect evidence from advanced lesions to inform these recommendations. Given that moderate lesions may have a lower risk of experiencing pulpal complications regardless of CTR approaches, it is difficult to make assumptions about the true effect of CTR approaches using data from advanced lesions. Trials comparing CTR approaches in moderate lesions in permanent teeth would help address this research gap. In addition, the results regarding HT in primary teeth were challenging to consider in the context of this guideline (that is, comparing the success of the HT with conventionally placed direct restorations likely is influenced by the high success rate of PMCs and not CTR approaches). Future RCTs comparing the effectiveness of PMCs placed with the HT to preformed crowns placed conventionally is needed to evaluate the effect of CTR approaches and inform decision making.

The panel urges researchers in the field of direct restorative materials to include the evaluation of AE outcomes in their clinical studies. None of the studies in the associated SR[7] reported on AEs. There was also a lack of studies identified on preformed crowns for anterior and posterior primary teeth, which resulted in the use of limited indirect evidence to inform recommendations, warranting the conduct of new studies on this intervention. The low event rate for outcomes related to clinical failure contributed to the panel's inability to detect important differences among direct restorative materials, if a difference exists. Follow-ups over 36 months will allow more time for material longevity assessment and long-term outcomes such as secondary caries to be meaningfully evaluated. Another complication is the continual advancements in restorative materials, as materials used in trials may be obsolete when results are published. Overall, a more detailed reporting of lesion and treatment characteristics and reasons for restoration failure may enhance applicability for decision making.

CONCLUSIONS

To restore moderate and advanced caries lesions on vital, nonendodontically treated primary and permanent teeth, the panel suggests the use of more conservative, single-visit CTR approaches and various direct restorative materials. The panel acknowledges the importance of considering additional factors, such as patient and caregiver preferences and treatment costs, when developing a treatment plan. ■

SUPPLEMENTAL DATA

Supplemental data related to this article can be found at: https://doi.org/10.1016/j.adaj.2023.04.011.

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APPENDIX

METHODS

Panel configuration and conflicts of interest

In 2019, the American Dental Association (ADA) Council on Scientific Affairs convened and approved a multidisciplinary panel comprising general, pediatric, and public health dentists. Panel members completed intellectual and financial conflicts of interest disclosure forms reviewed by methodologists and the legal department at the ADA. All intellectual and financial conflicts of interest were disclosed at the beginning of the first panel meeting to define the scope, purpose, target audience, and clinical questions and at the last panel meeting to formulate recommendations. If panel members had conflicts of interest related to specific recommendations, methodologists asked them to refrain from discussing and formulating them.

Retrieving the evidence

The results of 2 systematic reviews (SRs) informed these clinical recommendations: 1 developed by the Cochrane Oral Health Group to inform recommendations regarding carious tissue removal (CTR) approaches (that is, the extent of carious tissue removed)[e1] and another led by methodologists at the ADA Science and Research Institute (ADASRI) program for Clinical and Translational Research to inform recommendations regarding direct restorative materials.[e2]

Methodologists led an SR to inform recommendations regarding CTR approaches to treat moderate and advanced caries lesions on primary and permanent teeth. We included SRs or overviews of SRs of randomized or quasi-randomized controlled trials (RCTs), including patients of any age with at least 1 caries lesion requiring a restoration on primary or permanent teeth published from 2017 through 2022. We included reviews that conducted searches in at least 2 electronic, bibliographic databases with the reporting of at least 1 search strategy and methods that are reproducible; included at least 2 interventions included in the clinical questions formulated by the panel; reported on predefined outcomes included as part of the clinical questions formulated by the panel; and provided details on study selection and data extraction. We excluded reviews that did not use the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach (or another validated tool) to assess the certainty of the evidence, did not report the extent of carious tissue removed, have been superseded by a subsequent update of the same SR or meta-analysis, only assessed the effectiveness of head-to-head comparisons of different means to remove caries (that is, mechanical or chemomechanical), and included primary studies in which a restoration was placed in an endodontically treated tooth.

This search strategy for desirable effects contained concepts for caries and caries removal. In collaboration with methodologists and the panel, an informationist (K.K.O.) built the search strategy in Ovid MEDLINE using a combination of subject headings and key words. All searches were completed in March 2022 in Ovid MEDLINE from 1946 through March 2022, Embase from 1947 through March 2022, Cochrane Database of Systematic Reviews, and Trip Medical Database. The SIGN systematic reviews filter was modified to include guideline language and applied to the MEDLINE and Embase searches.[e3] Database-supplied limits were used to limit to All Secondary Evidence in Trip and items published in the past 5 years in all databases. No language limits were applied. Complete search strategies for all 4 databases are provided below.

MEDLINE. Database: Ovid MEDLINE. Search conducted in this database on March 11, 2022.

#1 exp Dental Caries/

#2 (caries or carious).tw.

#3 ((tooth or teeth or dentin$ or dental) adj5 (decay$ or lesion$ or cavit$)).tw.

#4 #1 or #2 or #3

#5 exp Dental Cavity Preparation/

#6 “carious tissue removal”.tw.

#7 “complete caries removal”.tw.

#8 ((caries or carious or cavit$) adj5 (stepwise or excavation or excavator$)).tw.

#9 ((caries or carious or cavit$) adj5 (selective or partial or incomplete or remov$)).tw.

#10 ((caries or carious or cavit$) adj5 (nonselective or non-selective)).tw.

#11 ((caries or carious or cavit$) adj5 ('minimally invasive' or 'minimal invasion' or 'minimum invasion')).tw.

#12 (dentin$ adj3 remov$).tw.

#13 "hall technique".tw.

#14 #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13

#15 #4 and #14

#16 Meta-Analysis as Topic/

#17 meta analy$.tw.

#18 metaanaly$.tw.

#19 Meta-Analysis/

#20 (systematic adj (review$1 or overview$1)).tw.

#21 exp "Review Literature as Topic"/

#22 review.pt.

#23 #16 or #17 or #18 or #19 or #20 or #21 or #22

#24 cochrane.ab.

#25 embase.ab.

#26 (psychlit or psyclit).ab.

#27 (psychinfo or psycinfo).ab.

#28 (cinahl or cinhal).ab.

#29 science citation index.ab.

#30 bids.ab.

#31 cancerlit.ab.

#32 #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31

#33 reference list$.ab.

#34 bibliograph$.ab.

#35 hand-search$.ab.

#36 relevant journals.ab.

#37 manual search$.ab.

#38 #33 or #34 or #35 or #36 or #37

#39 exp guideline/

#40 (guideline or guidelines).ab,kw,ot,ti.

#41 ('consensus statement' or 'consensus statements').ab,kw,ot,ti.

#42 ('consensus recommendation' or 'consensus recommendations').ab,kw,ot,ti.

#43 #39 or #40 or #41 or #42

#44 selection criteria.ab.

#45 data extraction.ab.

#46 #44 or #45

#47 "Review"/

#48 #46 and #47

#49 Comment/

#50 Letter/

#51 Editorial/

#52 exp Animals/

#53 exp Humans/

#54 52 and 53

#55 #52 not #54

#56 #49 or #50 or #51 or #55

#57 #23 or #32 or #38 or #43 or #48

#58 #57 not #56

#59 #15 and #58

#60 limit #59 to last 5 years

Embase. Database: Embase via embase.com. Search conducted in this database on March 11, 2022.

#1 'dental caries'/exp

#2 caries:ti,ab,kw OR carious:ti,ab,kw

#3 ((tooth OR teeth OR dentin* OR dental) NEAR/5 (decay* OR lesion* OR cavit*)):ti,ab,kw

#4 #1 OR #2 OR #3

#5 'carious tissue removal':ti,ab,kw

#6 'complete caries removal':ti,ab,kw

#7 ((caries OR carious OR cavit*) NEAR/5 (stepwise OR excavation OR excavator*)):ti,ab,kw

#8 ((caries OR carious OR cavit*) NEAR/5 (selective OR partial OR incomplete OR remov*)):ti,ab,kw

#9 ((caries OR carious OR cavit*) NEAR/5 (nonselective OR 'non selective')):ti,ab,kw

#10 ((caries OR carious OR cavit*) NEAR/5 ('minimally invasive' OR 'minimal invasion' OR 'minimum invasion')):ti,ab,kw

#11 (dentin* NEAR/3 remov*):ti,ab,kw

#12 'hall technique':ti,ab,kw

#13 #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12

#14 #4 AND #13

#15 'meta analysis'/exp OR 'review'/exp OR 'review':it OR 'systematic review'/exp OR 'systematic review':it

#16 (meta NEXT/1 analy*) OR metaanalys*

#17 systematic* NEAR/5 (review* OR overview*)

#18 #15 OR #16 OR #17

#19 (practice NEAR/4 guideline*):ti,ab,kw

#20 (clinical NEAR/4 guideline*):ti,ab,kw

#21 'practice guideline'/exp

#22 'consensus statement':ti,ab,kw OR 'consensus statements':ti,ab,kw

#23 'consensus recommendation':ti,ab,kw OR 'consensus recommendations':ti,ab,kw

#24 #19 OR #20 OR #21 OR #22 OR #23

#25 'cancerlit':ab

#26 'cochrane':ab

#27 'embase':ab

#28 'psychlit':ab OR 'psyclit':ab

#29 'psychinfo':ab OR 'psycinfo':ab

#30 'cinahl':ab OR 'cinhal':ab

#31 'science citation index':ab

#32 'bids':ab

#33 #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32

#34 'reference lists':ab

#35 'bibliograph*':ab

#36'hand-search*':ab

#37 'manual search*':ab

#38 'relevant journals':ab

#39 #34 OR #35 OR #36 OR #37 OR #38

#40 'letter':it

#41 'editorial':it

#42 'animal'/exp

#43 'human'/exp

#44 #42 NOT (#42 AND #43)

#45 #40 OR #41 OR #44

#46 #18 OR #24 OR #33 OR #39

#47 #46 NOT #45

#48 #14 AND #47

#49 #48 AND [11-03-2017]/sd NOT [02-04-2022]/sd

Cochrane Library. Database: Cochrane Database of Systematic Reviews via Wiley. Search conducted in this database on March 11, 2022.

#1 MeSH descriptor: [Dental Caries] explode all trees

#2 ((caries or carious)):ti,ab,kw

#3 (((tooth or teeth or dentin* or dental) NEAR/5 (decay* or lesion* or cavit*))):ti,ab,kw

#4 #1 or #2 or #3

#5 MeSH descriptor: [Dental Cavity Preparation] explode all trees

#6 ('carious tissue removal'):ti,ab,kw

#7 ('complete caries removal'):ti,ab,kw

#8 (((caries OR carious OR cavit*) NEAR/5 (stepwise OR excavation OR excavator*))):ti,ab,kw

#9 (((caries OR carious OR cavit*) NEAR/5 (selective OR partial OR incomplete OR remov*))):ti,ab,kw

#10 (((caries OR carious OR cavit*) NEAR/5 (nonselective OR 'non selective'))):ti,ab,kw

#11 (((caries OR carious OR cavit*) NEAR/5 ('minimally invasive' OR 'minimal invasion' OR 'minimum invasion'))):ti,ab,kw

#12 ((dentin* NEAR/3 remov*)):ti,ab,kw

#13 ('hall technique'):ti,ab,kw

#14 #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13

#15 #4 and #14 with Cochrane Library publication date Between Mar 2017 and Apr 2022

Grey literature. Database: https://www.tripdatabase.com. Search conducted in this database on March 11, 2022.

(dental caries OR carious lesion*) AND (caries removal OR hall technique)

Dates for search: January 2017 through March 2022.

Limits: All secondary evidence; Since 2017.

Two reviewers (L.P., S.P.) independently screened the titles, abstracts, and full texts of eligible references, and another reviewer (O.U.) served as an arbiter when consensus was elusive. We prioritized the selection of 1 SR to inform clinical recommendations using this criteria: SRs assessing all interventions of interest using network meta-analysis, if possible; including data on both primary and permanent dentition; using GRADE to assess the certainty of the evidence; reporting data specific to lesion depth; only including RCTs rather than both RCTs and other study designs; and SRs "[superseding a] subsequent SR or meta-analysis."[e4] Once 1 SR was identified, the same reviewers assessed the excluded studies table to confirm references were not excluded that would fit within the scope of our guideline. One methodologist (O.U.) critically appraised all SRs used to inform the development of this guideline using A MeaSurement Tool to Assess systematic Reviews 2.[e5]

In addition, methodologists led the development of an SR to inform recommendations regarding direct restorative materials to restore caries lesions on vital, nonendodontically treated primary and permanent teeth. Detailed information specific to the methodology used to conduct this review is published elsewhere.[e2] In brief, a search strategy containing caries and restorative materials concepts was developed and run in collaboration with an informationist (K.K.O.). Eligibility criteria included RCTs or quasi-RCTs, including children or adults requiring de novo or replacement restorations on vital teeth; head-to-head comparisons of the interventions of interest; and reporting on the predefined outcomes of interest. Pairs of reviewers (L.P., S.P., A.C.-L., and 3 authors of the related SR[e2]) independently screened titles, abstracts, and full texts of eligible references. When disagreements occurred, a third reviewer (L.P., S.P.) determined the final eligibility. Four reviewers (L.P., S.P., and 2 authors of the associated SR) independently and in duplicate extracted data from primary studies. We resolved all conflicts via group discussion.

In the absence of data on the undesirable effects of CTR approaches and direct restorative materials, 1 methodologist (O.U.) conducted a supplemental search for SRs and health technology assessments (HTAs) in MEDLINE via PubMed and the TRIP database using key words related to the population and interventions of interest. Another reviewer (L.P.) conducted quality control and independently audited the eligibility of each reference. We applied the same selection criteria described above. However, we relaxed the study design criteria to include SRs or HTAs summarizing observational studies in the absence of references summarizing data from RCTs.

Evidence synthesis and measures of association

We used a fixed-effects and a random-effects model to pool data for the direct restorative materials and CTR approaches SRs, respectively. We calculated risk differences and 95% CIs for dichotomous outcomes and mean differences and 95% CIs for continuous outcomes.

Certainty of the evidence

We used the GRADE approach to assess the certainty of the evidence.[e6] The certainty of the evidence indicates the panel's confidence in the treatment effects used to support the recommendations.

Moving from evidence to decisions

The panel defined and ranked outcomes a priori. Outcomes could either be critical, important, or not important for decision making.

For CTR approaches for primary teeth, the panel ranked pulp vitality, pulpal exposure, pulpal complications due to infection, the need to treat endodontically, caries progression, tooth loss, tooth extraction, postoperative pain and discomfort, and secondary caries as critical outcomes and adverse effects (AEs) (that is, anaphylaxis, neurobehavioral assessment, kidney function, psychosocial function, and physical development), tooth fracture, cost and cost-effectiveness, patients discomfort during treatment, restoration failure, injury to adjacent tissue or tooth, time needed to perform restoration, and patient satisfaction as important outcomes.

For CTR approaches for permanent teeth, the panel ranked tooth loss, pulp vitality, pulpal exposure, pulpal complications due to infection, the need to treat endodontically, tooth extraction, caries progression, postoperative pain and discomfort, secondary caries, longevity of restoration, and tooth fracture as critical and restoration failure, cost and cost-effectiveness, injury to adjacent tissue or tooth, patient discomfort during treatment, AEs, patient satisfaction, and time needed to perform restoration as important.

For direct restorative materials for primary teeth, the panel ranked pulpal complications due to infection, pulp vitality, caries progression, pulpal exposure, oral health–related quality of life, AEs, the need to treat endodontically, tooth loss, secondary caries, postoperative pain and discomfort, restoration fracture, tooth fracture, longevity of the restoration, and restoration failure as critical outcomes and unacceptable marginal adaptation, restoration loss, time needed to perform the restoration, patient satisfaction, patient discomfort during treatment, marginal discoloration or staining, unacceptable anatomic form, and unacceptable color match as important outcomes.

For direct restorative materials for permanent teeth, the panel ranked pulpal complications due to infection, AEs, pulp vitality, pulpal exposure, the need to treat endodontically, longevity of the

restoration, postoperative pain and discomfort, caries progression, secondary caries, unacceptable marginal adaptation, restoration failure, tooth retention, tooth fracture, patient satisfaction, oral health–related quality of life, and restoration fracture as critical outcomes and unacceptable anatomic form, restoration loss, patient discomfort during treatment, marginal discoloration or staining, unacceptable color match, and time needed to perform the restoration as important outcomes.

Methodologists (L.P., S.P.) facilitated recommendation formulation using the GRADE Evidence-to-Decision (EtD) framework.[e7] This framework includes 9 factors for panels to move from evidence to clinical recommendations: problem prioritization, magnitude of desirable effects, magnitude of undesirable effects, certainty of the evidence, balance of desirable and undesirable effects, patients' values and preferences, resources required, acceptability, and feasibility. We conducted nonsystematic searches to find evidence of patients' values and preferences, acceptability, and feasibility. If multiple study types were available on the same topic, we prioritized the use of SRs and RCTs over nonrandomized and observational studies when applicable.

Methodologists adapted GRADE's EtD approach to choose from multiple interventions[e8] to compare and judge interventions across all EtD criteria and mirrored this approach after 2 clinical practice guidelines: 1 developed by the American Society of Hematology[e9] and another developed by ADASRI, University of Pittsburgh, and University of Pennsylvania (A. Carrasco-Labra, written communication, August 2021). We used a star-based system ranging from 1 through 3 stars to rank all interventions considered in the factor. In this system, 1 star is the lowest score and considered the least, or one of the least, effective interventions, and 3 stars is the highest score and considered the most, or one of the most, effective interventions.

Overall, the more stars an intervention receives, the more favorable it is judged across each criterion. These judgments are relative terms used when comparing the interventions against one another and do not imply that a material's overall effectiveness is of superior, intermediate, or inferior value. Once the panel discussed the evidence and made judgments for each factor, the panel determined the direction and strength of each recommendation.

Stakeholder and public engagement

We conducted stakeholder engagement twice during the guideline development process. We first requested internal and external stakeholders to provide feedback on the scope, purpose, clinical questions, and target audience and then on the clinical recommendations. We also invited the general public to review and provide feedback on the recommendations on the ADASRI program for Clinical and Translational Research website.[e10] We reviewed and considered all relevant feedback in the final draft of the recommendation statements and remarks.

Updating process

ADASRI program for Clinical and Translational Research will update the guideline recommendations every 5 years or when new evidence is available and could change the direction and strength of recommendations.

RESULTS

Characteristics of included studies and methodological quality assessment

We identified 372 citations from the literature search to inform recommendations for CTR approaches. After removing 84 duplicates, we screened 288 titles and abstracts and 32 full-texts of SRs. Four[e1,e11-e13] SRs met our selection criteria, and, ultimately, 1[e1] was included, which assessed the effectiveness of interventions to treat caries lesions on vital, nonendodontically treated primary and permanent teeth (eFigure 1, eTable 1, eTable 2). Although the authors included nonrestorative and restorative strategies in this SR, only studies related to nonselective, stepwise, selective, and no CTR (that is, sealing a caries lesion with a preformed metal crown [PMC]) were of interest.

We identified 3 SRs[e14-e16] and 1 HTA[e17] to inform the undesirable effects of direct restorative materials. There was overlap in the primary studies included in these reviews reporting on the outcomes of interest to the panel. Therefore, we prioritized using data from an SR by Worthington and colleagues,[e14] as the study authors used the GRADE approach, allowing for continuity in the way the certainty of the evidence was assessed across our evidence base.

Both SRs[e1,e14] were judged to be of high methodological quality (eFigure 17). In addition, because both included SRs[e1,e14] were published in 2021, methodologists decided not to update them. However, 2 reviewers (L.P., S.P.) reextracted data from the included primary studies of the SR by Schwendicke and colleagues[e1] to guarantee that the panel was presented with all critical and important outcomes for decision making.

Desirable and undesirable effects related to CTR approaches for moderate and advanced caries lesions on primary teeth

For the comparison of nonselective vs selective CTR to treat moderate caries lesions on primary teeth,[e18] there were 0 events in both arms of the study for the outcomes of loss of restoration at 12-month follow-up (very low certainty).

For the comparison of nonselective vs selective CTR to treat advanced caries lesions on primary teeth,[e19,e20] there were 0 events in both arms of the studies for the outcomes of restoration loss, postoperative pain and discomfort, and pulpal complications due to infection at 6-month follow-up (very low certainty).

Values and preferences related to CTR approaches for moderate and advanced caries lesions on primary and permanent teeth

We found no studies conducted in the United States reporting on the relative importance of various clinical outcomes that patients place when undergoing CTR (for example, pulp exposure, need for endodontic treatment, secondary caries, restorative complications) in primary or permanent teeth.

We identified 1 mixed-methods study conducted in Germany,[e21] which gathered data on patient preferences toward selective and nonselective CTR. Results from 150 patients aged 18 through 85 years showed that most participants (82.7%) preferred nonselective over selective CTR. When factoring in other variables, participants who were more emotionally stable and had university degrees were more likely to prefer selective CTR than participants who were less emotionally stable and without a university degree. In addition, a risk acceptance assessment showed that patients were more likely to accept a higher cost, the need for root canal treatment, and impaired esthetics than the outcomes of nerve damage, restoration failure, and secondary caries. The panel considered there is possible important uncertainty or variability in patients' values and preferences (PVP) for selective and nonselective CTR. Regarding stepwise and no CTR, the panel discussed that patients or caregivers may prefer not to return for a second appointment that is necessary for stepwise CTR and sometimes no CTR. On the basis of this information, the panel determined that there was possibly important uncertainty or variability in PVPs for all CTR approaches.

Acceptability related to CTR approaches for moderate and advanced caries lesions on primary and permanent teeth

From the clinician's perspective, research evidence suggests varying degrees of acceptability of nonselective, stepwise, selective, and no CTR. Two studies[e22,e23] surveyed clinicians to determine their beliefs, attitudes, and practices when treating advanced caries lesions restoratively. Most respondents stated that they would remove all carious tissue regardless of the risk of pulp exposure and that no carious tissue should be left behind to ensure the success of a restoration. Because nonselective CTR has been the reference standard over the past decades,[e24] Oen and colleagues[e22] highlighted that clinicians may emphasize their colleagues' approval and perspectives over the evidence showing the increased effectiveness of conservative CTR approaches when determining treatment.

In addition, Nascimento and colleagues[e25] evaluated the teaching practices of CTR approaches among cariology department faculty members from 43 dental schools in the United States. Study authors found slight variability in how dental schools defined principles related to caries removal and how lesion depth affects treatment planning. Most respondents (26 of 40 dental schools) agreed that infected dentin should always be removed to prevent the progression of caries under the restoration and disagreed that affected dentin should always be removed to avoid the progression of caries under the restoration (35 of 40 dental schools). Twenty-seven respondents agreed and 8 disagreed that caries removal should be minimally invasive regardless of lesion depth and only infected dentin should be removed.

Lastly, an RCT conducted in Germany assessed children's pain perception and acceptability among parents and dentists of conventional restorative treatment, Hall technique (HT), and nonrestorative caries treatment.[e26] Results suggested that more than one-half of the parents were very satisfied with their child's treatment, and almost all parents stated that they would choose the same treatment option again. In addition, clinicians noted that most HT and conventional restorative treatments were easy to perform or handle and took long to complete. However, there were differences between the provided and preferred treatment for each caries lesion. Seventy-two percent of clinicians would have performed conventional restorative treatment, whereas only 30.7% of treatments provided during the study were conventional restorative treatment. Furthermore, 17% preferred conventional restorative treatment with a PMC, and HT would not have been used as an option for treatment. However, it is important to note that "the HT was introduced to the clinic and taught to the clinicians as part of this trial, so they were unfamiliar with it…following this trial, the HT [is now] routinely performed…indicating an increased level of acceptance and use of [this technique]."[e26]

The panel discussed that although some key stakeholders may place more preference on 1 CTR approach over another, overall, key stakeholders may find all CTR approaches acceptable.

Desirable and undesirable effects related to direct restorative materials for moderate and advanced caries lesions on primary and permanent teeth

Of the 8 RCTs included in the review by Worthington and colleagues, 3[e27-e29] reported data on undesirable effects. Bernado and colleagues[e27] and Soncini and colleagues[e29] reported on outcomes related to toxicity (that is, immune, neuorologic, neuoropsychological, psychological, and renal function and physical development), whereas Kemaloglu and colleagues[e28] reported on post-operative sensitivity. No studies reported data on allergic reactions or injuries. Worthington and colleagues[e14] concluded that although there may be some differences in harm outcomes between those that received amalgam and resin composite restorations, the differences are not clinically significant (low to very low certainty).

Values and preferences related to direct restorative materials for moderate and advanced caries lesions on primary and permanent teeth

We found no studies conducted in the United States reporting on the relative importance of various clinical outcomes that patients place when receiving a dental restoration for a caries lesion. The panel judged this factor using indirect evidence from studies conducted in people with permanent dentition outside the United States.

Although we did not identify any studies examining PVP related to different esthetic restorative materials, the panel agreed that from the patient perspective, esthetic restorations often are regarded equally, with no preference for one over the other. On the basis of this information, the panel determined that there was probably no important uncertainty or variability in PVP for compomers, conventional glass ionomer cement, resin composites, and resin-modified glass ionomer cement for both primary and permanent dentition.

With respect to amalgam vs esthetic restorations, a study from Norway and Sweden suggests that patients place a higher value on the restoration's esthetics and avoid potential adverse reactions than they do on the expected longevity of the restoration.[e30] In addition, an HTA from Canada[e17] found a high degree of variation among qualitative data on experiences associated with amalgam restorations. The included studies in this report shared experiences from patients who had amalgam restorations removed after unexplained symptoms may have been associated with mercury poisoning. The experiences after removal were highly variable. The report authors note that there was a focus on potential negative outcomes associated with amalgam and a narrow set of perspectives was represented. On the basis of this information, the panel determined that there was important uncertainty or variability in PVP regarding the use of amalgam for both primary and permanent dentition.

For PMCs, the guideline panel considered a 2020 literature review[e31] on the HT and found that 77% of patients from a split-mouth trial[e32] preferred the HT over conventional restorative treatment and that using separators did not influence this preference. The same review also found that the most common reason for a parent to prefer a conventional restoration over a preformed metal

crown was esthetics. Still, most parents agreed with treating with a crown after the dentist explained the advantages. On the basis of this information, the panel determined that there was probably no important uncertainty or variability in PVP for PMCs in primary teeth.

e1. Schwendicke F, Walsh T, Lamont T, et al. Interventions for treating cavitated or dentine carious lesions. *Cochrane Database Syst Rev*. 2021:CD013039.

e2. Pilcher L, Pahlke S, Urquhart O, et al. Direct materials for restoring caries lesions: systematic review and meta-analysis—a report of the American Dental Association Council on Scientific Affairs. *JADA*. 2023;154(2):e1-e98.

e3. Search filters. Scottish Intercollegiate Guidelines Network, Healthcare Improvement Scotland. Accessed March 10, 2022. https://www.sign.ac.uk/what-we-do/methodology/search-filters

e4. Moore PA, Ziegler KM, Lipman RD, et al. Benefits and harms associated with analgesic medications used in the management of acute dental pain: an overview of systematic reviews. *JADA*. 2018;149(4):256-265.e3.

e5. Shea BJ, Reeves BC, Wells G, et al. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ*. 2017;358:j4008.

e6. Guyatt GH, Oxman AD, Kunz R, et al.; GRADE Working Group. What is "quality of evidence" and why is it important to clinicians? *BMJ*. 2008;336(7651):995-998.

e7. Alonso-Coello P, Schünemann HJ, Moberg J, et al. GRADE Evidence to Decision (EtD) frameworks: a systematic and transparent approach to making well informed healthcare choices—1, introduction. *BMJ*. 2016;353:i2016.

e8. Piggott T, Brozek J, Nowak A, et al. Using GRADE evidence to decision frameworks to choose from multiple interventions. *J Clin Epidemiol*. 2021;130:117-124.

e9. Connell NT, Flood VH, Brignardello-Petersen R, et al. ASH ISTH NHF WFH 2021 guidelines on the management of von Willebrand disease. *Blood Advances*. 2021;5(1):301-325.

e10. Clinical Practice Guidelines and Dental Evidence. American Dental Association. Accessed September 15, 2022. https://www.ada.org/resources/research/science-and-research-institute/evidence-based-dental-research

e11. BaniHani A, Santamaría RM, Hu S, Maden M, Albadri S. Minimal intervention dentistry for managing carious lesions into dentine in primary teeth: an umbrella review. *Eur Arch Paediatr Dent*. 2022;23(5):667-693.

e12. Pedrotti D, Cavalheiro CP, Casagrande L, et al. Does selective carious tissue removal of soft dentin increase the restorative failure risk in primary teeth? Systematic review and meta-analysis. *JADA*. 2019;150(7):582-590.e1.

e13. Santamaría RM, Abudrya MH, Gül G, Said Mourad MHD, Gomez GF, Zandona AGF. How to intervene in the caries process: dentin caries in primary teeth. *Caries Res*. 2020;54(4):306-323.

e14. Worthington HV, Khangura S, Seal K, et al. Direct composite resin fillings versus amalgam fillings for permanent posterior teeth. *Cochrane Database Syst Rev*. 2021;8:CD005620.

e15. Patini R, Spagnuolo G, Guglielmi F, et al. Clinical effects of mercury in conservative dentistry: a systematic review, meta-analysis, and trial sequential analysis of randomized controlled trials. *Int J Dent*. 2020;2020:8857238.

e16. Gallusi G, Libonati A, Piro M, et al. Is dental amalgam a higher risk factor rather than resin-based restorations for systemic conditions? A systematic review. *Materials (Basel)*. 2021;14(8):1980.

e17. Khangura SD, Seal K, Esfandiari S, et al. *Composite Resin versus Amalgam for Dental Restorations: A Health Technology Assessment*. Canadian Agency for Drugs and Technologies in Health; 2018.

e18. Ribeiro CC, Baratieri LN, Perdigão J, Baratieri NM, Ritter AV. A clinical, radiographic, and scanning electron microscopic evaluation of adhesive restorations on carious dentin in primary teeth. *Quintessence Int*. 1999;30(9):591-599.

e19. Lula EC, Monteiro-Neto V, Alves CM, Ribeiro CC. Microbiological analysis after complete or partial removal of carious dentin in primary teeth: a randomized clinical trial. *Caries Res*. 2009;43(5):354-358.

e20. Mello B, Stafuzza TC, Vitor L, et al. Evaluation of dentin-pulp complex response after conservative clinical procedures in primary teeth. *Int J Clin Pediatr Dent*. 2018;11(3):188-192.

e21. Schwendicke F, Mostajaboldave R, Otto I, Dörfer CE, Burkert S. Patients' preferences for selective versus complete excavation: a mixed-methods study. *J Dent*. 2016;46:47-53.

e22. Oen KT, Thompson VP, Vena D, et al. Attitudes and expectations of treating deep caries: a PEARL Network survey. *Gen Dent*. 2007;55(3):197-203.

e23. Schwendicke F, Meyer-Lueckel H, Dörfer C, Paris S. Attitudes and behaviour regarding deep dentin caries removal: a survey among German dentists. *Caries Res*. 2013;47(6):566-573.

e24. Innes NP, Frencken JE, Bjørndal L, et al. Managing carious lesions: consensus recommendations on terminology. *Adv Dent Res*. 2016;28(2):49-57.

e25. Nascimento MM, Behar-Horenstein LS, Feng X, Guzmán-Armstrong S, Fontana M. Exploring how U.S. dental schools teach removal of carious tissues during cavity preparations. *J Dent Educ*. 2017;81(1):5-13.

e26. Santamaria RM, Innes NP, Machiulskiene V, et al. Acceptability of different caries management methods for primary molars in a RCT. *Int J Paediatr Dent*. 2015;25(1):9-17.

e27. Bernardo M, Luis H, Martin MD, et al. Survival and reasons for failure of amalgam versus composite posterior restorations placed in a randomized clinical trial. *JADA*. 2007;138(6):775-783.

e28. Kemaloglu H, Pamir T, Tezel H. A 3-year randomized clinical trial evaluating two different bonded posterior restorations: amalgam versus resin composite. *Eur J Dent*. 2016;10(1):16-22.

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e30. Espelid I, Cairns J, Askildsen JE, Qvist V, Gaarden T, Tveit AB. Preferences over dental restorative materials among young patients and dental professionals. *Eur J Oral Sci*. 2006;114(1):15-21.

e31. Altoukhi DH, El-Housseiny AA. Hall technique for carious primary molars: a review of the literature. *Dent J (Basel)*. 2020;8(1):11.

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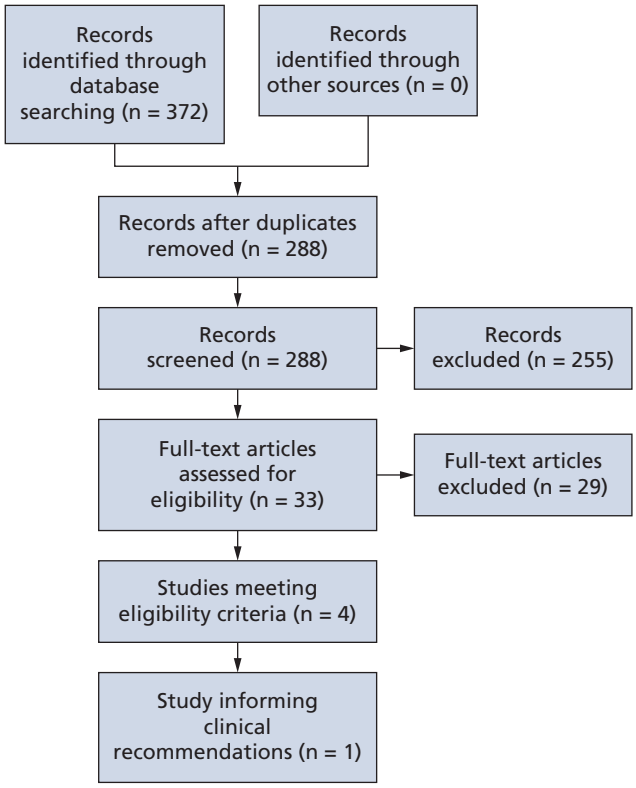
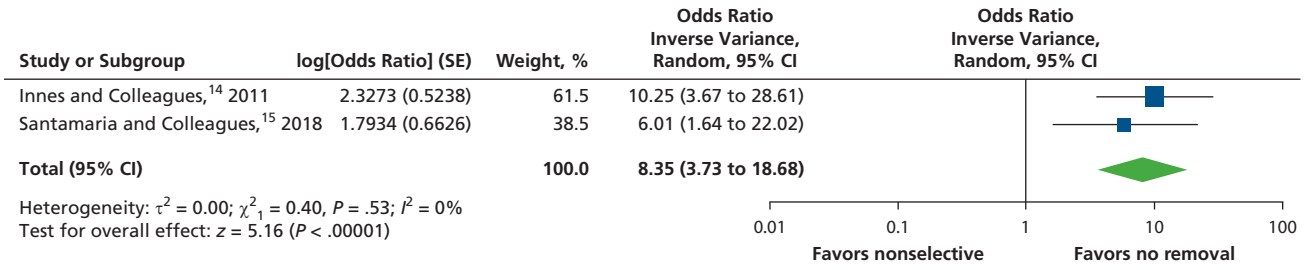


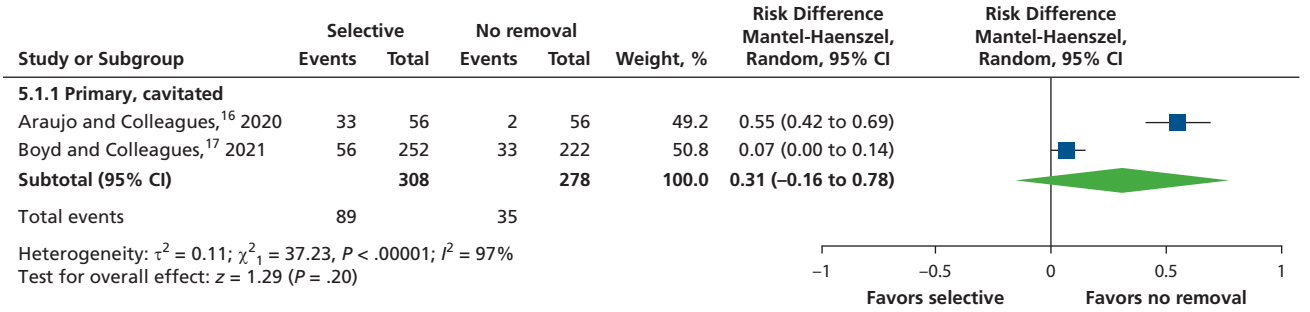
eFigure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart of the screening and study selection process for systematic reviews on carious tissue removal approaches.[e33]

	Schwendicke and Colleagues,[13] 2021	Worthington and Colleagues,[47] 2021
Did the research questions and inclusion criteria for the review include the components of?	●	●
Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the reivew and did the report justify any significant deviations from the protocol?	●	●
Did the review authors explain their selection of the study designs for inclusion in the review?	●	●
Did the review authors use a comprehensive literature search strategy?	●	●
Did the review authors perform study selection in duplicate?	●	●
Did the review authors perform data extraction in duplicate?	●	●
Did the review authors provide a list of excluded studies and justify the exclusions?	●	●
Did the review authors describe the included studies in adequate detail?	●	●
Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?	●	●
Did the review authors report on the sources of funding for the studies included in the review?	●	●
If meta-analysis was performed, did the review authors use appropriate methods for statistical combination of results (yes, no, no meta-analysis)?	●	●
If meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?	●	●
Did the review authors account for RoB in individual studies when interpreting or discussing the results of the review?	●	●
Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?	●	●
If they performed quantitative synthesis, did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?	●	●
Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?	●	●
Overall confidence (high, moderate, low, critically low)	**High**	**High**

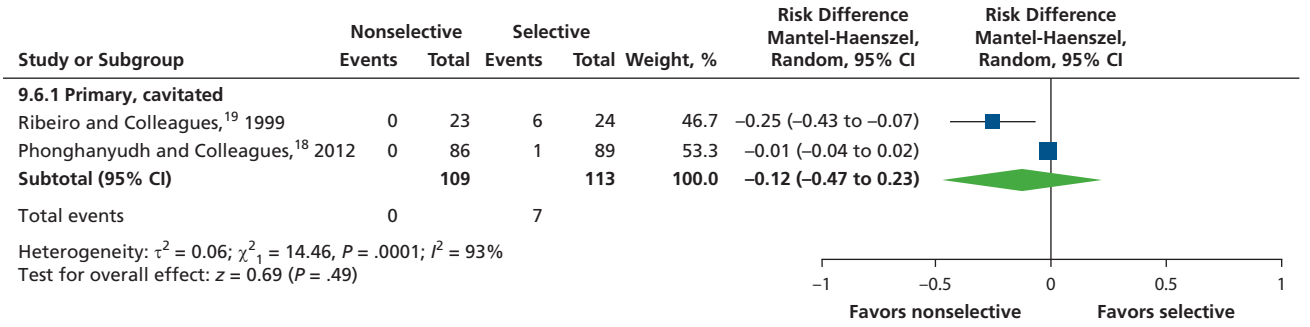
eFigure 2. A MeaSurement Tool to Assess systematic Reviews 2 assessment of included systematic reviews.[e4] Green refers to yes, and yellow refers to partial yes.



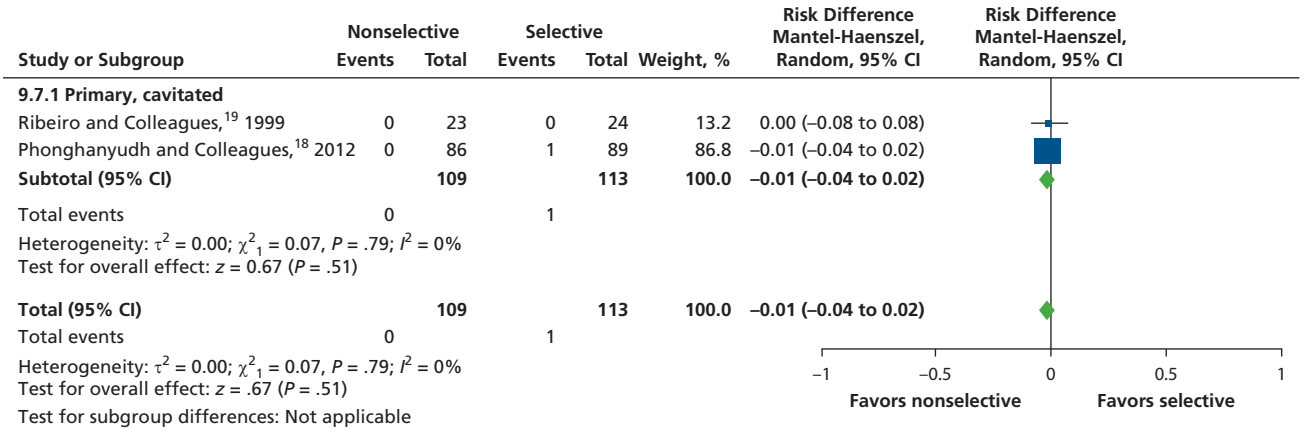
eFigure 3. Forest plot of comparison of nonselective carious tissue removal vs no carious tissue removal for moderate caries lesions on primary teeth for the outcome of failure at 30- to 60-month follow-up.



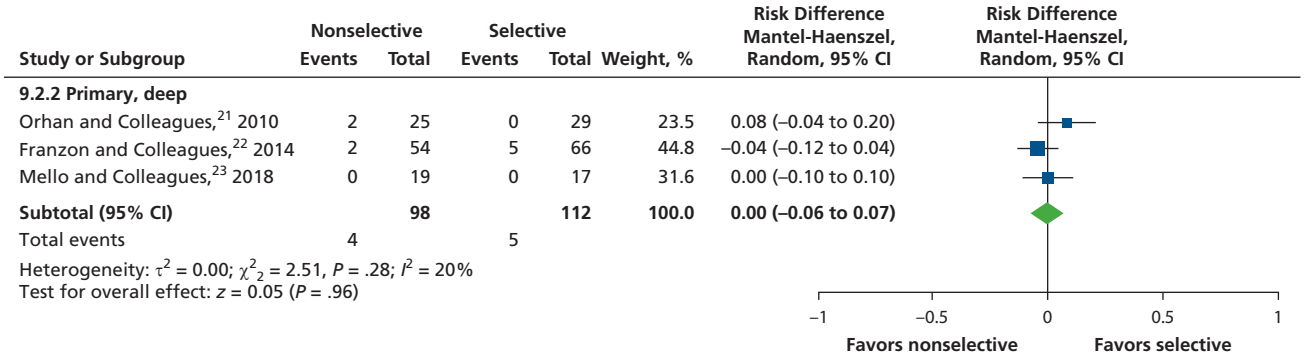
eFigure 4. Forest plot of comparison of selective carious tissue removal vs no carious tissue removal for moderate caries lesions on primary teeth for the outcome of failure at 24- to 36-month follow-up.



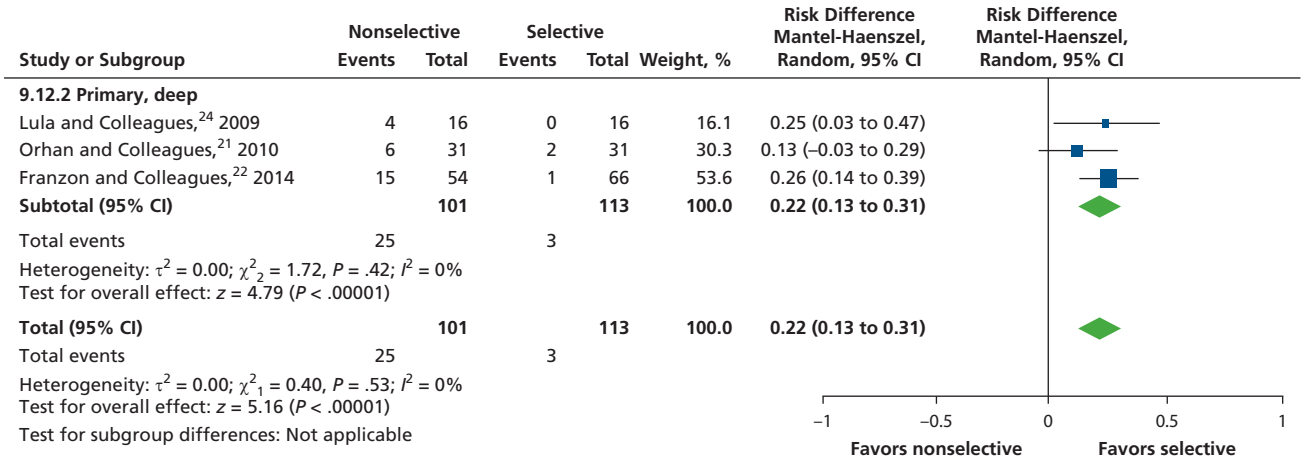
eFigure 5. Forest plot of comparison of nonselective carious tissue removal vs selective carious tissue removal for moderate caries lesions on primary teeth for the outcome of caries progression at 12-month follow-up.



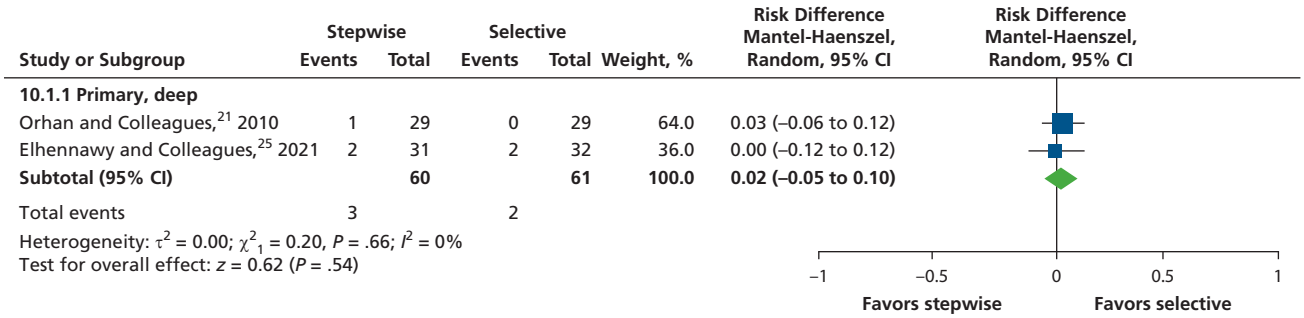
eFigure 6. Forest plot of comparison of nonselective carious tissue removal vs selective carious tissue removal for moderate caries lesions on primary teeth for the outcome of postoperative pain and discomfort at 12-month follow-up.



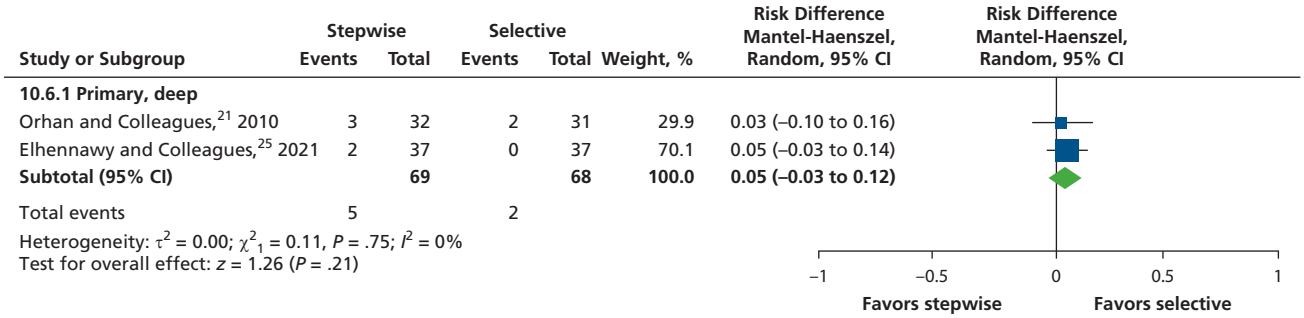
eFigure 7. Forest plot of comparison of nonselective carious tissue removal vs selective carious tissue removal for advanced caries lesions on primary teeth for the outcome of failure at 4- to 24-month follow-up.



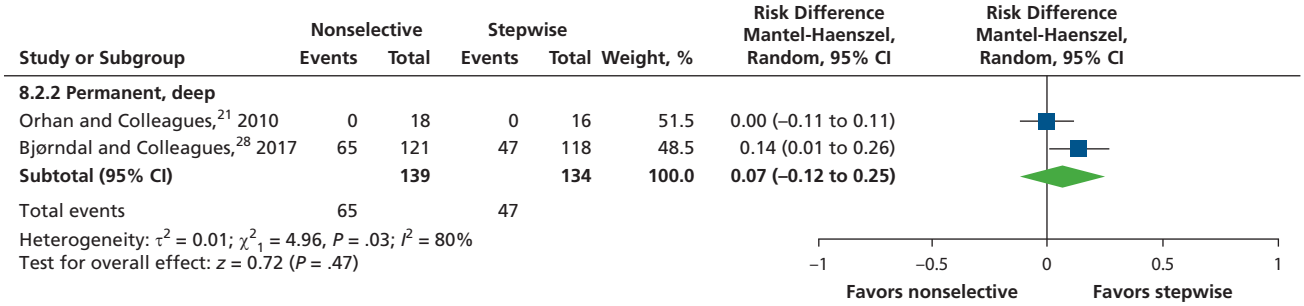
eFigure 8. Forest plot of comparison of nonselective carious tissue removal vs selective carious tissue removal for advanced caries lesions on primary teeth for the outcome of pulp exposure after treatment.



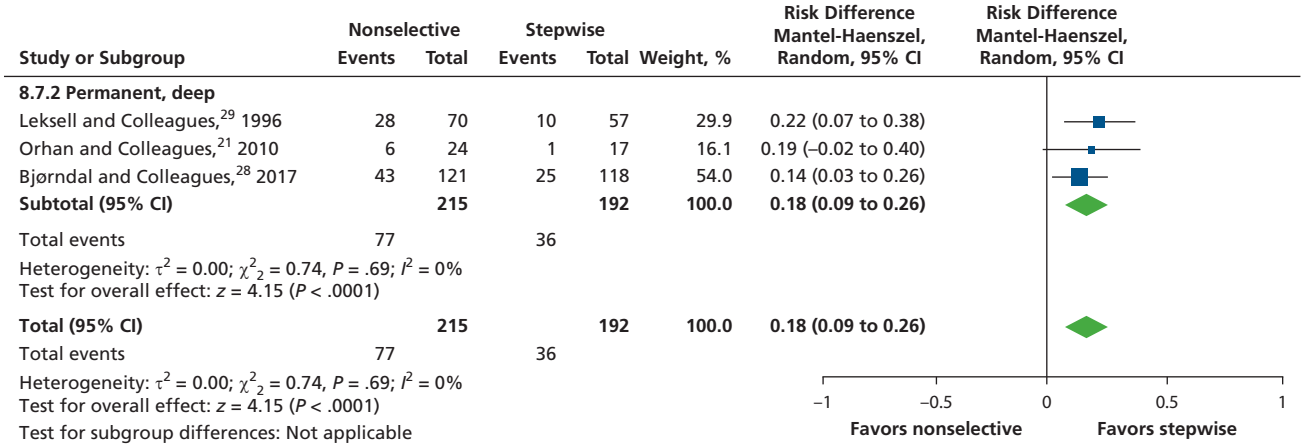
eFigure 9. Forest plot of comparison of stepwise carious tissue removal vs selective carious tissue removal for advanced caries lesions on primary teeth for the outcome of failure at 12- to 24-month follow-up.



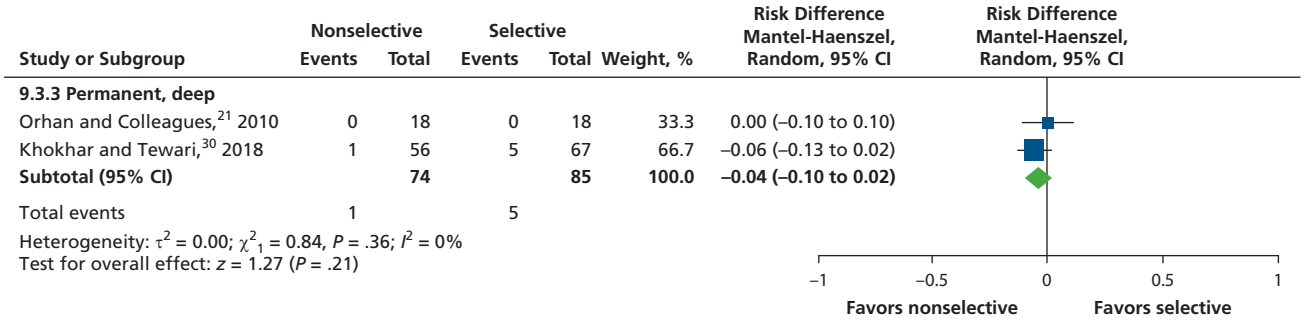
eFigure 10. Forest plot of comparison of stepwise carious tissue removal vs selective carious tissue removal for advanced caries lesions on primary teeth for the outcome of pulp exposure after treatment.



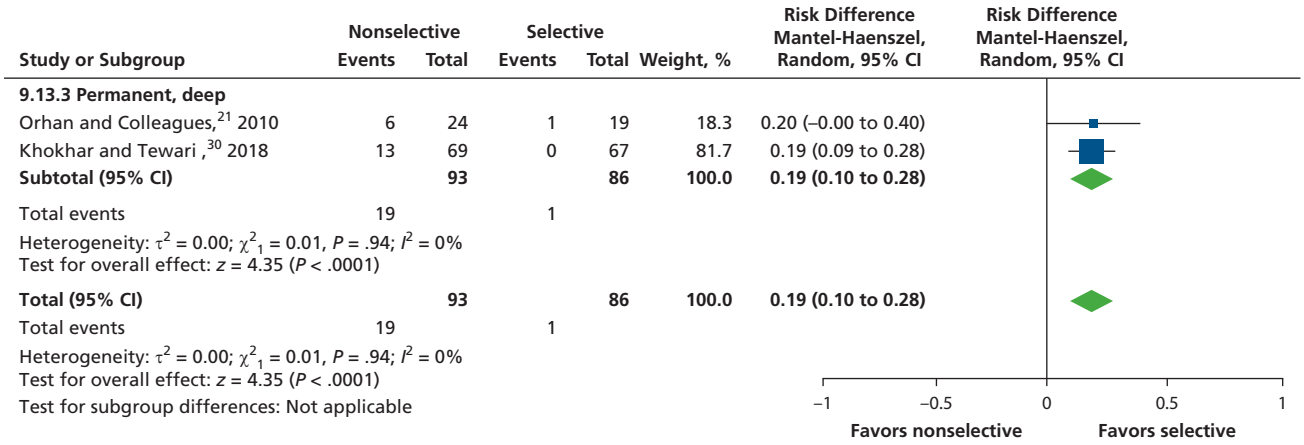
eFigure 11. Forest plot of comparison of nonselective carious tissue removal vs stepwise carious tissue removal for advanced caries lesions on permanent teeth for the outcome of failure at 12- to 60-month follow-up.



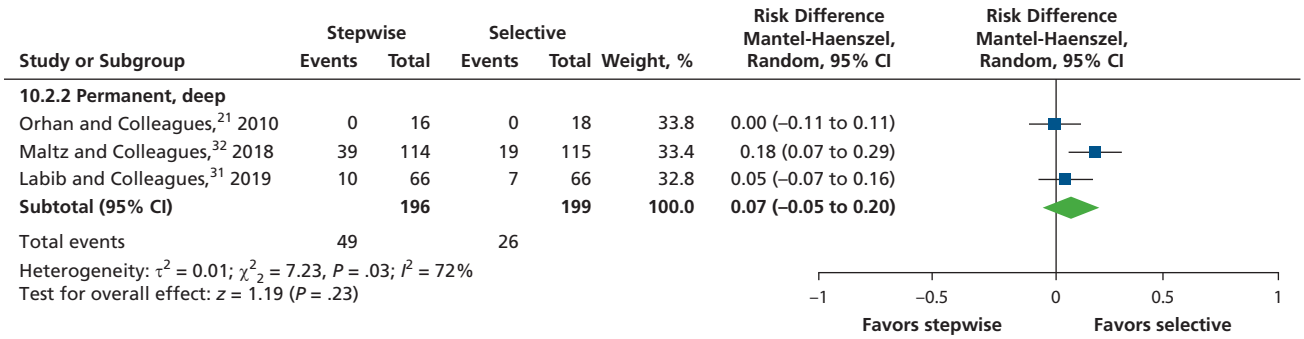
eFigure 12. Forest plot of comparison of nonselective carious tissue removal vs stepwise carious tissue removal for advanced caries lesions on permanent teeth for the outcome of pulp exposure after treatment.



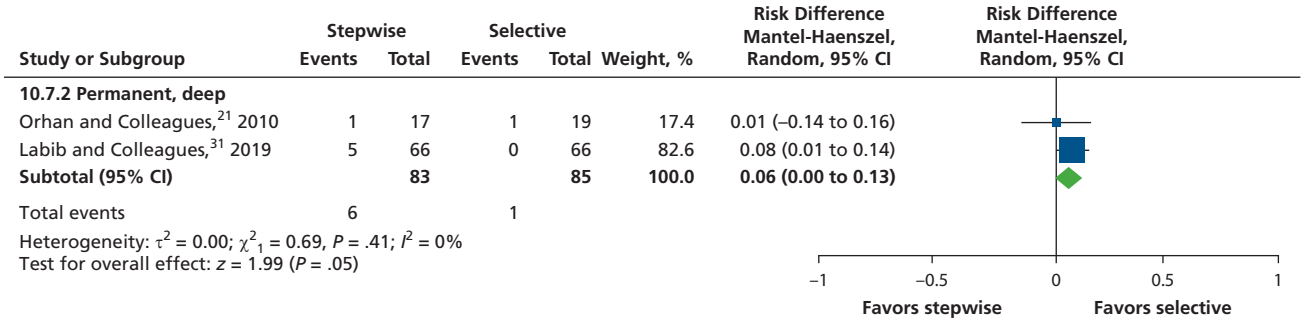
eFigure 13. Forest plot of comparison of nonselective carious tissue removal vs selective carious tissue removal for advanced caries lesions on permanent teeth for outcome of failure at 12- to 18-month follow-up.



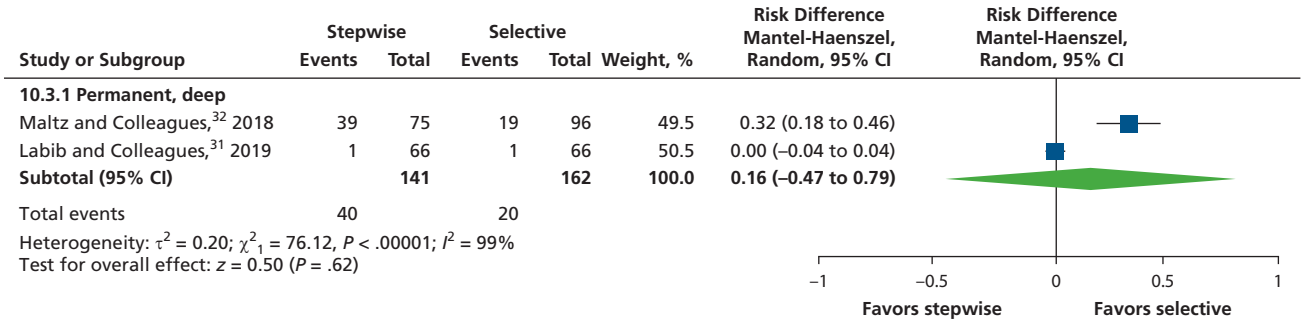
eFigure 14. Forest plot of comparison of nonselective carious tissue removal vs selective carious tissue removal for advanced caries lesions on permanent teeth for the outcome of pulp exposure after treatment.



eFigure 15. Forest plot of comparison of stepwise carious tissue removal vs selective carious tissue removal for advanced caries lesions on permanent teeth for outcome of failure at 12- to 60-month follow-up.



eFigure 16. Forest plot of comparison of stepwise carious tissue removal vs selective carious tissue removal for advanced caries lesions on permanent teeth for the outcome of pulp exposure after treatment.



eFigure 17. Forest plot of comparison of stepwise carious tissue removal vs selective carious tissue removal for advanced caries lesions on permanent teeth for outcome of pulp necrosis at 12-month follow-up.

eTable 1. Characteristics of included systematic reviews.

STUDY	OBJECTIVE	SELECTION CRITERIA	PERTINENT INTERVENTIONS	OUTCOMES	CONFLICTS OF INTEREST	FUNDING SOURCES
Schwendicke and Colleagues,[13] 2021	"To determine the comparative effectiveness of interventions [conventional restoration, selective excavation, stepwise, sealing of carious lesions using sealant materials or preformed metal crowns (Hall technique), or non-restorative cavity control] to treat carious lesions conventionally considered to require restorations (cavitated or micro-cavitated lesions, or occlusal lesions that are clinically noncavitated but clinically/radiographically extend into dentine) in primary or permanent teeth with vital (sensitive) pulps."	"…randomised clinical trials comparing different levels of carious tissue removal, as listed above, against each other, placebo, or no treatment. Participants had permanent or primary teeth (or both), and vital pulps (i.e. no irreversible pulpitis/pulp necrosis), and carious lesions conventionally considered to need a restoration (i.e. cavitated lesions, or non- or micro-cavitated lesions radiographically extending into dentine). The primary outcome was failure, a composite measure of pulp exposure, endodontic therapy, tooth extraction, and restorative complications (including resealing of sealed lesions)."	Nonselective carious tissue removal Selective carious tissue removal Stepwise carious tissue removal No carious tissue removal (Hall technique)	Primary outcomes Failure of therapy as a composite outcome including any combination of: - Signs or symptoms of irreversible pulpitis - Endodontic therapy - Tooth extraction - Restorative failure or retreatment Secondary outcomes - Lesion progression - Participant evaluation of treatment - Efficiency - Safety issues	F.S., W.A., L.B., J.G.R., G.G., C.L., A.M., D.R., M.R., R.M.S., N.P.I.: none T.W.: statistical editor with Cochrane Oral Health T.L.: editor with Cochrane Oral Health J.E.C.: coordinating editor with Cochrane Oral Health M.F.: received grant support from National Institutes of Health, Delta Dental Foundation, DentaQuest, and Colgate; served as grant reviewer for National Institutes of Health; consulted for 3M; served on National Scientific Advisory Committee for Delta Dental Foundation; former member of the Council on Scientific Affairs of the American Dental Association	The University of Manchester, Manchester Academic Health Sciences Centre; National Institute for Health Research, UK; Manchester Biomedical Research Centre, UK; Cochrane Oral Health Global Alliance

eTable 2. Excluded studies.

BIBLIOGRAPHY	REASONS FOR EXCLUSION
Papacarie is more effective in removing caries in the primary dentition and results in less pain perception by the patient. UTHSCSA Dental School CAT Library. August 22, 2018. https://cats.uthscsa.edu/found_cats_view.php?id=3323&vSearch=Papacarie%20more%20effective%20removing%20caries%20primary%20dentition%20results%20less%20pain%20perception%20patient	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
The Hall technique has a similar rate of effectiveness as conventional restorative treatments in the primary dentition. UTHSCSA Dental School CAT Library. November 26, 2019. https://cats.uthscsa.edu/found_cats_view.php?id=3399&vSearch=The%20Hall%20techniq%20effectiveness%20conventional%20restorative%20treatments%20primary%20dentition	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Aïem E, Joseph C, Garcia A, Smaïl-Faugeron V, Muller-Bolla M. Caries removal strategies for deep carious lesions in primary teeth: systematic review. *Int J Paediatr Dent*. 2020;30(4):392-404.	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Badar SB, Tabassum S, Khan FR, Ghafoor R. Effectiveness of Hall technique for primary carious molars: a systematic review and meta-analysis. *Int J Clin Pediatr Dent*. 2019;12(5):445-452.	Systematic review authors did not assess the certainty of the evidence using GRADE* or another validated tool Systematic review authors did not report or define the extent of caries remaining
Barros MMAF, Rodrigues MIdeQ, Muniz FWMG, Rodrigues LKA. Selective, stepwise, or nonselective removal of carious tissue: which technique offers lower risk for the treatment of dental caries in permanent teeth? A systematic review and meta-analysis. *Clin Oral Investig*. 2020;24(2):521-532.	Systematic review authors did not assess the certainty of the evidence using GRADE or another validated tool.
Bjørndal L, Simon S, Tomson PL, Duncan HF. Management of deep caries and the exposed pulp. *Int Endod J.* 2019l;52(7):949-973.	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Brignardello-Petersen R. Stepwise and partial caries removal probably have high success rates up to 3 years after treatment of deep carious lesions, but partial caries removal is more likely to preserve tooth vitality. *JADA*. 2017;148(4):e38.	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Cardoso M, Coelho A, Lima R, et al. Efficacy and patient's acceptance of alternative methods for caries removal: a systematic review. *J Clin Med*. 2020;9(11):3407.	Systematic review authors did not assess the certainty of the evidence using GRADE or another validated tool Systematic review authors only assessed the effectiveness of head-to-head comparisons of different means to remove caries (that is, mechanical or chemical) There are not at least 2 interventions (including comparators) included in the primary systematic review's PICO† questions that are of interest
Chałas R, Szlązak K, Wójcik-Chęcińska I, et al. Observations of mineralised tissues of teeth in X-ray micro-computed tomography. *Folia Morphol (Warsz)*. 2017;76(2):143-148.	Systematic review authors did not assess the certainty of the evidence using GRADE or another validated tool Systematic review authors only assessed the effectiveness of head-to-head comparisons of different means to remove caries (that is, mechanical or chemical)
Ferreira Zandona AG. Surgical management of caries lesions: selective removal of carious tissues. *Dent Clin North Am.* 2019;63(4):705-713.	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Giacaman RA, Muñoz-Sandoval C, Neuhaus KW, Fontana M, Chałas R. Evidence-based strategies for the minimally invasive treatment of carious lesions: review of the literature. *Adv Clin Experiment Med*. 2018;27(7):1009-1016.	Systematic review authors did not assess the certainty of the evidence using GRADE or another validated tool
Hamama HH, Yiu CK, Burrow MF, King NM. Systematic review and meta-analysis of randomized clinical trials on chemomechanical caries removal. *Oper Dent*. 2015;40(4):E167-E178.	Systematic review authors only assessed the effectiveness of head-to-head comparisons of different means to remove caries (that is, mechanical or chemical)
Hamouda M, Deery C. What is the best caries removal strategy for primary molars? *Evid Based Dent*. 2021;22(1):20-21.	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Hoefler V, Nagaoka H, Miller CS. Long-term survival and vitality outcomes of permanent teeth following deep caries treatment with step-wise and partial-caries-removal: a systematic review. *J Dent*. 2016;54:25-32.	Article was published before 2017
Keenan AV, Congiusta MA. Efficacy of using Carisolv in the removal of decayed tooth structure in primary teeth. *Evid Based Dent*. 2016;17(2):44-45.	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Li T, Zhai X, Song F, Zhu H. Selective versus non-selective removal for dental caries: a systematic review and meta-analysis. *Acta Odontol Scand*. 2018;76(2):135-140.	Follow-up time is not reported Systematic review authors did not assess the certainty of the evidence using GRADE or another validated tool
Lin GSS, Cher CY, Cheah KK, et al. Acceptability of atraumatic restorative treatment and Hall Technique among children, parents, and general dental practitioners: a systematic review and meta-analysis. *Quintessence Int*. 2022;53(2):156-169.	Outcome reported is not of interest
Masson M, Viteri-Garcia A, Verdugo-Paiva F. Stepwise removal compared to complete removal for deep carious lesions. *Medwave*. 2022;22(1):e8227.	Not a systematic review, is a systematic review protocol or an overview of systematic reviews

* GRADE: Grading of Recommendations Assessment, Development and Evaluation.[8-11] † PICO: Problem, intervention, comparison, outcome.

eTable 2. Continued

BIBLIOGRAPHY	REASONS FOR EXCLUSION
Ricketts D, Lamont T, Innes NP, Kidd E, Clarkson JE. WITHDRAWN: Operative caries management in adults and children. *Cochrane Database of Syst Rev.* 2019;7:CD003808.	Article has been withdrawn
Schwendicke F. Caries removal in primary teeth using Papacarie. *Evid Based Dent*. 2018;19(3):74.	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Schwendicke F, Göstemeyer G. Understanding dentists' management of deep carious lesions in permanent teeth: a systematic review and meta-analysis. *Implement Sci*. 2016;11(1):142.	Article was published before 2017
Schwendicke F, Paris S, Tu YK. Effects of using different criteria for caries removal: a systematic review and network meta-analysis. *J Dent*. 2015; 43(1):1-15.	Article was published before 2017
Schwendicke F, Walsh T, Fontana M, et al. Interventions for treating cavitated or dentine carious lesions. *Cochrane Database of Syst Rev.* 2018;6CD013039.	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Senthilkumar V, Ramesh S. Systematic review on alternative methods for caries removal in permanent teeth. *J Conserv Dent*. 2020;23(1):2-9.	There are not at least 2 interventions (including comparators) included in the primary systematic review's PICO question that are of interest
Tao S, Li L, Yuan H, Tao S, et al. Erbium laser technology vs traditional drilling for caries removal: a systematic review with meta-analysis. *J Evid Based Dent Prac*. 2017;17(4):324-334	Systematic review authors only assessed the effectiveness of head-to-head comparisons of different means to remove caries (that is, mechanical or chemical)
Tedesco T, Reis TM, Mello-Moura ACV, et al. Management of deep caries lesions with or without pulp involvement in primary teeth: a systematic review and network meta-analysis. *Braz Oral Res*. 2020;35:e004.	Search strategy was not conducted in at least 2 electronic databases or at least 1 search strategy was not included in the main text or the appendix of the article
Verdugo-Paiva F, Zambrano-Achig P, Simancas-Racines D, Viteri-Garcia A. Selective removal compared to complete removal for deep carious lesions. *Medwave*. 2020;20(1):e7758.	Non-English language article Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Wong YJ. Caries removal using lasers. *Evid Based Dent.* 2018;19(2):45.	Not a systematic review, is a systematic review protocol or an overview of systematic reviews
Zambrano-Achig P, Viteri-Garcia A, Verdugo-Paiva F. Chemo-mechanical removal versus conventional removal for deep caries lesion. *Medwave*. 2022;22(1):e8320.	Systematic review authors only assessed the effectiveness of head-to-head comparisons of different means to remove caries (that is, mechanical or chemical)

eTable 3. Absolute effects (95% CI) and certainty of the evidence for nonselective carious tissue removal compared with no carious tissue removal for moderate caries lesions on vital primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	RELATIVE EFFECT (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Failure‡ (30-60)	319	2 randomized controlled trials (189)§,¶	Odds ratio, 8.35 (3.73 to 18.68)	Not applicable	Moderate#	Participants receiving nonselective carious tissue removal have 8.35 times the odds of experiencing failure compared with participants receiving no carious tissue removal.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, injury to adjacent tissue or tooth, longevity of the restoration, need to treat endodontically, patient discomfort during treatment, patient or parent satisfaction, postoperative pain and discomfort, pulp necrosis, pulpal exposure, restoration loss, safety issues due to anesthesia, secondary caries, tooth loss, or time needed to perform the restoration. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Innes and colleagues[14] defined minor failure as crown associated with impaction of eruption first permanent molar, restoration fracture, restoration loss, reversible pulpitis, or secondary caries and major failure as dental abscess or irreversible pulpitis, internal root resorption, interradicular radiolucency, or restoration loss. Santamaria and colleagues[15] defined minor failure as caries progression, restoration loss, reversible pulpitis, and secondary caries and major failure as dental abscess and irreversible pulpitis. § Innes and colleagues.[14] ¶ Santamaría and colleagues.[15] # Rated down 1 level owing to serious issues of risk of bias.

eTable 4. Absolute effects (95% CI) and certainty of the evidence for selective carious tissue removal compared with no carious tissue removal for moderate caries lesions on vital primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Failure‡ (24-36)	586	2 randomized controlled trials (400)§,¶	0.31 (−0.16 to 0.78)	16 fewer to 78 more	Very low#,**,††,‡‡	There is very low certainty evidence regarding the difference between selective carious tissue removal and no carious tissue removal for the outcome of failure.
Patient Satisfaction (36)	131	1 randomized controlled trial (131)§	0.00 (−0.03 to 0.03)	3 fewer to 3 more	Moderate#	Among participants receiving selective carious tissue removal, there were 0 more events (ranging from 3 fewer to 3 more) of patient satisfaction compared with those receiving no carious tissue removal (Hall technique). There is probably little to no difference between selective carious tissue removal and no carious tissue removal for the outcome of patient satisfaction.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, injury to adjacent tissue or tooth, longevity of the restoration, need to treat endodontically, patient discomfort during treatment, postoperative pain and discomfort, pulp necrosis, pulpal exposure, restoration loss, safety issues due to anesthesia, secondary caries, tooth loss, or time needed to perform the restoration. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Araujo and colleagues[16] defined minor failure as restoration fracture or wear, restoration loss, reversible pulpitis, and secondary caries for the atraumatic restorative treatment group and crown perforation, crown loss, and reversible pulpitis for the Hall technique group. Major failure was defined as dental abscess or fistula requiring pulpotomy or extraction, irreversible pulpitis, restoration or crown loss, and tooth fracture. Boyd and colleagues[17] defined minor failure as ectopic first permanent molar adjacent to crown, restoration loss, restoration wear, and secondary caries. Major failure was defined as interradicular radiolucency, irreversible pulpitis or abscess requiring pulp treatment or extraction, and pulpally involved restoration loss. § Araujo and colleagues.[16] ¶ Boyd and colleagues.[17] # Rated down 1 level owing to serious issues of risk of bias. ** Rated down 2 levels owing to very serious issues of inconsistency ($I^2 = 92\%$). †† Rated down 2 levels owing to very serious issues of imprecision. ‡‡ Using a threshold of 1.26%, the lower bound of the confidence interval suggests an important difference favoring selective carious tissue removal, whereas the upper bound suggests an important benefit of no carious tissue removal.

eTable 5. Absolute effects (95% CI) and certainty of the evidence for nonselective carious tissue removal compared with selective carious tissue removal for moderate caries lesions on vital primary teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Caries Progression (12 Mo)	222	2 RCTs‡ (215)§,¶	−0.12 (−0.47 to 0.23)	47 fewer to 23 more	Very low#,**,††,‡‡	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and selective carious tissue removal for the outcome of caries progression.
Failure§§ (12 Mo)	177	1 RCT (177) §	−0.04 (−0.15 to 0.06)	15 fewer to 6 more	Very low#,††,¶¶	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and selective carious tissue removal for the outcome of failure.
Postoperative Pain and Discomfort (12 Mo)	222	2 RCTs (215)§,¶	−0.01 (−0.04 to 0.02)	4 fewer to 2 more	Very low#,††,##	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and selective carious tissue removal for the outcome of postoperative pain and discomfort.
Pulp Exposure (Postprocedural)	186	1 RCT (186) §	0.02 (−0.01 to 0.06)	1 fewer to 6 more	Very low#,††,***	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and selective carious tissue removal for the outcome of pulp exposure.
Pulp Necrosis (12 Mo)	48	1 RCT (38)¶	0.04 (−0.07 to 0.15)	7 fewer to 15 more	Very low#,††,***	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and selective carious tissue removal for the outcome of pulp necrosis.

* For the outcome of restoration loss, there were 0 events in both treatment arms of the included study. No studies meeting the selection criteria reported data on fracture of the crown, full tooth fracture, injury to adjacent tissue or tooth, longevity of the restoration, need to treat endodontically, patient discomfort during treatment, patient or parent satisfaction, restoration loss, safety issues due to anesthesia, secondary caries, tooth loss, or time needed to perform the restoration. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ RCT: Randomized controlled trial. § Phonghanyudh and colleagues.[18] ¶ Ribeiro and colleagues.[19] # Rated down 1 level owing to serious issues of risk of bias. ** Rated down 2 levels owing to very serious issues of inconsistency (I^2=93%). †† Rated down 2 levels owing to very serious issues of imprecision. ‡‡ Using a threshold of 0.62%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal. §§ Phonghanyudh and colleagues[18] described failure as considerable wear of the restoration requiring repair or retreatment, clinical or radiographic signs of irreversible pulpitis, marginal defect, pulp exposure, or restoration loss. ¶¶ Using a threshold of 1.80%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal. ## Using a threshold of 0.09%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal. *** Using a threshold of 0.0%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal.

eTable 6. Absolute effects (95% CI) and certainty of the evidence for nonselective carious tissue removal compared with selective carious tissue removal for advanced caries lesions on vital primary teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Failure‡ (4-24 Mo)	210	3 RCTs§ (146)¶,#,**	RD††, 0.00 (−0.06 to 0.07)	6 fewer to 7 more	Very low‡‡,§§,¶¶	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and selective carious tissue removal for the outcome of failure.
Pulp Exposure (Postprocedural)	214	3 RCTs (136)¶,**,##	RD, 0.22 (0.13 to 0.31)	13 more to 31 more	Moderate‡‡	Among participants receiving nonselective carious tissue removal, there were 22 more events (ranging from 13 more to 31 more) of pulp exposure per 100 restorations compared with those receiving selective carious tissue removal. Nonselective carious tissue removal likely increases the risk of experiencing pulp exposure by an important amount compared with selective carious tissue removal.
Pulp Necrosis (6 Mo)	31	1 RCT (26)##	RD, 0.07 (−0.10 to 0.23)	10 fewer to 23 more	Very low‡‡,§§,***	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and selective carious tissue removal for the outcome of pulp necrosis.
Time Needed to Perform the Restoration (6 Mo)	120	1 RCT (79)¶	Mean difference, 10.20 (5.42 to 14.98)	Not applicable	Moderate‡‡	Nonselective carious tissue removal increased the time needed to perform restoration by 10.20 minutes (ranging from 5.42 to 14.98 minutes longer) when compared with selective carious tissue removal. By comparison, the mean time needed to perform selective carious tissue removal was 17.9 minutes.

* For the outcomes of postoperative pain, pulpal complications due to infection, and restoration loss, there were 0 events in both treatment arms of the included studies. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, injury to adjacent tissue or tooth, longevity of the restoration, need to treat endodontically, patient discomfort during treatment, patient or parent satisfaction, postoperative pain and discomfort, safety issues due to anesthesia, secondary caries, or tooth loss. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Franzon and colleagues[22] defined failure as internal or external pathological resorption, the presence of a fistula, radiolucency at the furcation or in the periapical region, swelling, and spontaneous pain and mobility not compatible with root resorption. Orhan and colleagues[21] defined failure as abnormal tooth mobility, fistula, pathologic tooth resorption, radiolucencies at the interradicular or periapical regions, sensitivity to percussion and palpation, spontaneous pain, or swelling in periodontal tissues. Mello and colleagues[23] defined failure as abscess or fistula, advanced rhizolysis, color alteration, furcal or periapical lesion, internal or external root resorption pain, sensitivity to percussion, and tooth mobility. § RCT: Randomized controlled trial. ¶ Franzon and colleagues.[22] # Mello and colleagues.[23] ** Orhan and colleagues.[21] †† RD: Risk difference. ‡‡ Rated down 1 level owing to serious issues of risk of bias. §§ Rated down 2 levels owing to very serious issues of imprecision. ¶¶ Using a threshold of 0.45%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal. ## Lula and colleagues.[24] *** Using a threshold of 0.0%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal.

eTable 7. Absolute effects (95% CI) and certainty of the evidence for stepwise carious tissue removal compared with selective carious tissue removal for advanced caries lesions on vital primary teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERNCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Failure‡ (12-24 Mo)	121	2 RCTs§ (137)¶,#	0.02 (–0.05 to 0.10)	5 fewer to 10 more	Very low**,††,‡‡	There is very low certainty evidence regarding the difference between stepwise carious tissue removal and selective carious tissue removal for the outcome of failure.
Pulp Exposure (Postprocedural)	137	2 RCTs (137)¶,#	0.05 (–0.03 to 0.12)	3 fewer to 12 more	Very low**,††,§§	There is very low certainty evidence regarding the difference between stepwise carious tissue removal and selective carious tissue removal for the outcome of pulp exposure.
Tooth Loss¶¶ (24 Mo)	63	1 RCT (63)¶	0.03 (–0.05 to 0.12)	5 fewer to 12 more	Very low**,††,##	There is very low certainty evidence regarding the difference between stepwise carious tissue removal and selective carious tissue removal for the outcome of tooth loss.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, injury to adjacent tissue or tooth, longevity of the restoration, need to treat endodontically, patient discomfort during treatment, patient or parent satisfaction, postoperative pain and discomfort, pulp necrosis, restoration loss, safety issues due to anesthesia, secondary caries, or time needed to perform the restoration. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Orhan and colleagues[21] defined failure as abnormal tooth mobility, fistula, pathological tooth resorption, radiolucencies at the interradicular or periapical regions, sensitivity to percussion and palpation, spontaneous pain, or swelling in periodontal tissues. Elhennawy and colleagues[25] defined failure as endodontic or restorative complications. § RCT: Randomized controlled trial. ¶ Elhennway and colleagues.[25] # Orhan and colleagues.[21] ** Rated down 1 level owing to serious issues of risk of bias. †† Rated down 2 levels owing to very serious issues of imprecision. ‡‡ Using a threshold of 0.33%, the lower bound of the confidence interval suggests an important difference favoring stepwise carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal. §§ Using a threshold of 0.29%, the lower bound of the confidence interval suggests an important difference favoring stepwise carious tissue removal, whereas the upper bound suggests an important difference favoring selective carious tissue removal. ¶¶ Tooth loss was due to extraction. ## Using a threshold of 0.0%, the lower bound of the confidence interval suggests an important difference favoring stepwise carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal.

eTable 8. Absolute effects (95% CI) and certainty of the evidence for selective carious tissue removal compared with no carious tissue removal for advanced caries lesions on vital primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Failure‡ (24)	74	1 randomized controlled trial (74) §	−0.06 (−0.21 to 0.10)	21 fewer to 10 more	Very low¶,#,**	There is very low certainty evidence regarding the difference between selective carious tissue removal and no carious tissue removal for the outcome of failure.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, injury to adjacent tissue or tooth, longevity of the restoration, need to treat endodontically, patient discomfort during treatment, patient or parent satisfaction, post-operative pain and discomfort, pulp necrosis, pulpal exposure, restoration loss, safety issues due to anesthesia, secondary caries, tooth loss, or time needed to perform the restoration. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Chompu-inwai and colleagues[20] defined failure as abscess formation, postoperative pain, pathologic mobility, pain on percussion, or swelling. § Chompu-inwai and colleagues.[20] ¶ Rated down 1 level owing to serious issues of risk of bias. # Rated down 2 levels owing to very serious issues of imprecision. ** Using a threshold of 1.51%, the lower bound of the confidence interval suggests an important difference favoring selective carious tissue removal, whereas the upper bound suggests an important benefit of no carious tissue removal.

eTable 9. Absolute effects (95% CI) and certainty of the evidence for nonselective carious tissue removal compared with stepwise carious tissue removal for advanced caries lesions on vital primary teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Failure‡ (12 Mo)	54	1 randomized controlled trial (54)§	0.05 (–0.08 to 0.17)	8 fewer to 17 more	Very low¶,#,**	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and stepwise carious tissue removal for the outcome of failure.
Pulp Exposure (Postprocedural)	63	1 randomized controlled trial (63)§	0.10 (–0.07 to 0.27)	7 fewer to 27 more	Very low¶,#,††	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and stepwise carious tissue removal for the outcome of pulp exposure.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, injury to adjacent tissue or tooth, longevity of the restoration, need to treat endodontically, patient discomfort during treatment, patient or parent satisfaction, postoperative pain and discomfort, pulp necrosis, restoration loss, safety issues due to anesthesia, secondary caries, tooth loss, or time needed to perform the restoration. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Orhan and colleagues[21] defined failure as abnormal tooth mobility, fistula, pathological tooth resorption, radiolucencies at the interradicular or periapical regions, sensitivity to percussion and palpation, spontaneous pain, or swelling in periodontal tissues. § Orhan and colleagues.[21] ¶ Rated down 1 level owing to serious issues of risk of bias. # Rated down 2 levels owing to very serious issues of imprecision. ** Using a threshold of 0.34%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of stepwise carious tissue removal. †† Using a threshold of 0.94%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of stepwise carious tissue removal.

eTable 10. Absolute effects (95% CI) and certainty of the evidence for nonselective carious tissue removal compared with stepwise carious tissue removal for advanced caries lesions on vital permanent teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Failure‡ (12-60 Mo)	273	2 RCTs§ (273)¶,#	0.07 (−0.12 to 0.25)	12 fewer to 25 more	Very low**,††,‡‡,§§	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and stepwise carious tissue removal for the outcome of failure.
Pulp Exposure (Postprocedural)	407	3 RCTs (481)¶,#,¶¶	0.18 (0.09 to 0.26)	9 more to 26 more	Moderate**,§§	Among participants receiving nonselective carious tissue removal, there were 18 more events (ranging from 9 more to 26 more) of pulp exposure per 100 restorations compared with those receiving stepwise carious tissue removal. Nonselective carious tissue removal likely increases the risk of experiencing pulp exposure by an important amount compared with stepwise carious tissue removal.
Pulp Necrosis (60 Mo)	239	1 RCT (239)¶	0.02 (−0.02 to 0.07)	2 fewer to 7 more	Very low**,††,§§,##	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and stepwise carious tissue removal for the outcome of pulp necrosis.
Tooth Loss* (60 Mo)**	239	1 RCT (239)¶	0.00 (−0.03 to 0.03)	3 fewer to 3 more	Very low**,††,§§,†††	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and stepwise carious tissue removal for the outcome of tooth loss.
Patient Discomfort During Treatment	239	1 RCT (239)¶	0.01 (−0.02 to 0.04)	2 fewer to 4 more	Very low**,††,§§,‡‡‡	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and stepwise carious tissue removal for the outcome of patient discomfort during treatment.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, injury to adjacent tissue or tooth, longevity of the restoration, need to treat endodontically, patient or parent satisfaction, postoperative pain and discomfort, restoration loss, safety issues due to anesthesia, secondary caries, or time needed to perform the restoration. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Bjørndal and colleagues[28] defined failure as no pulp vitality with apical radiolucency, pulp exposure, pulp vitality with apical radiolucency, and unbearable pain. Orhan and colleagues[21] defined failure as abnormal tooth mobility, fistula, pathologic tooth resorption, radiolucencies at the interradicular or periapical regions, sensitivity to percussion and palpation, spontaneous pain, or swelling in periodontal tissues. § RCT: Randomized controlled trial. ¶ Bjørndal and colleagues.[28] # Orhan and colleagues.[21] ** Rated down 1 level owing to serious issues of risk of bias. †† Rated down 2 levels owing to very serious issues of imprecision. ‡‡ Using a threshold of 3.51%, the lower bound of the confidence interval suggests a negligible difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of stepwise carious tissue removal. §§ Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for caries removal approaches for moderate caries lesions on vital permanent teeth. ¶¶ Leksell and colleagues.[29] ## Using a threshold of 0.25%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of stepwise carious tissue removal. *** Tooth loss was due to extraction. ††† Using a threshold of 0.17%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of stepwise carious tissue removal. ‡‡‡ Using a threshold of 0.08%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of stepwise carious tissue removal.

eTable 11. Absolute effects (95% CI) and certainty of the evidence for nonselective carious tissue removal compared with selective carious tissue removal for advanced cavitated caries lesions on vital permanent teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Failure‡ (12-18 Mo)	159	2 RCTs (159)§,¶	−0.04 (−0.10 to 0.02)	10 fewer to 2 more	Very low#,**,††,‡‡	There is very low certainty evidence regarding the difference between nonselective carious tissue removal and selective carious tissue removal for the outcome of failure.
Pulp Exposure (Postprocedural)	179	2 RCTs (179)§,¶	0.19 (0.10 to 0.28)	10 more to 28 more	Moderate#,‡‡	Among participants receiving nonselective carious tissue removal, there were 19 more events (ranging from 10 more to 28 more) of pulp exposure per 100 restorations compared with those receiving selective carious tissue removal. Nonselective carious tissue removal likely increases the risk of experiencing pulp exposure by an important amount compared with selective carious tissue removal.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, injury to adjacent tissue or tooth, longevity of the restoration, need to treat endodontically, patient discomfort during treatment, patient or parent satisfaction, postoperative pain and discomfort, pulp necrosis, restoration loss, safety issues due to anesthesia, secondary caries, tooth loss, or time needed to perform the restoration. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Orhan and colleagues[21] defined failure as abnormal tooth mobility, fistula, pathologic tooth resorption, radiolucencies at the inter-radicular or periapical regions, sensitivity to percussion and palpation, spontaneous pain, or swelling in periodontal tissues. Khokhar and Tewari[30] defined failure as negative response to cold and electric pulp test, periapical alteration, or signs and symptoms of irreversible pulpitis. § Khokhar and Tewari.[30] ¶ Orhan and colleagues.[21] # Rated down 1 level owing to serious issues of risk of bias. ** Rated down 2 levels owing to very serious issues of imprecision. †† Using a threshold of 0.59%, the lower bound of the confidence interval suggests an important difference favoring nonselective carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal. ‡‡ Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for caries removal approaches for moderate caries lesions on vital permanent teeth.

eTable 12. Absolute effects (95% CI) and certainty of the evidence for stepwise carious tissue removal compared with selective carious tissue removal for advanced caries lesions on vital permanent teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENC (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Failure‡ (12-60 Mo)	395	3 RCTs§ (395)¶,#,**	0.07 (−0.05 to 0.20)	5 fewer to 20 more	Very low††,‡‡,§§,¶¶,##	There is very low certainty evidence regarding the difference between stepwise carious tissue removal and selective carious tissue removal for the outcome of failure.
Pulp Exposure (Postprocedural)	168	2 RCTs (168)¶,**	0.06 (0.00 to 0.13)	0 more to 13 more	Very low††,§§,##,***	There is very low certainty evidence regarding the difference between stepwise carious tissue removal and selective carious tissue removal for the outcome of pulp exposure.
Pulp Necrosis (12 Mo)	303	2 RCTs (303)¶,#	0.16 (−0.47 to 0.79)	47 fewer to 79 more	Very low††,§§,##,†††	There is very low certainty evidence regarding the difference between stepwise carious tissue removal and selective carious tissue removal for the outcome of pulp necrosis.
Pulpal Complications Due to Infection (12 Mo)	132	1 RCT (132)¶	−0.03 (−0.09 to 0.03)	9 fewer to 3 more	Very low††,§§,##,‡‡‡	There is very low certainty evidence regarding the difference between stepwise carious tissue removal and selective carious tissue removal for the outcome of pulpal complications due to infection.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, injury to adjacent tissue or tooth, longevity of the restoration, need to treat endodontically, patient discomfort during treatment, patient or parent satisfaction, postoperative pain and discomfort, pulp necrosis, restoration loss, safety issues due to anesthesia, secondary caries, tooth loss, or time needed to perform the restoration. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Orhan and colleagues[21] defined failure as abnormal tooth mobility, fistula, pathologic tooth resorption, radiolucencies at the interradicular or periapical regions, sensitivity to percussion and palpation, spontaneous pain, or swelling in periodontal tissues. Labib and colleagues[31] defined failure as lack of restoration integrity, pulp exposure, and pulp necrosis. Maltz and colleagues[32] defined failure as pulp necrosis. § RCT: Randomized controlled trial. ¶ Labib and colleagues.[31] # Maltz and colleagues.[32] ** Orhan and colleagues.[21] †† Rated down 1 level owing to serious issues of risk of bias. ‡‡ Rated down 2 levels owing to very serious issues of inconsistency (I^2= 72%). §§ Rated down two levels owing to very serious issues of imprecision. ¶¶ Using a threshold of 1.31%, the lower bound of the confidence interval suggests an important difference favoring stepwise carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal. ## Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for caries removal approaches for moderate caries lesions on vital permanent teeth. *** Using a threshold of 0.12%, the lower bound of the confidence interval suggests no difference between stepwise carious tissue removal and selective carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal. ††† Using a threshold of 1.23%, the lower bound of the confidence interval suggests an important difference favoring stepwise carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal. ‡‡‡ Using a threshold of 0.45%, the lower bound of the confidence interval suggests an important difference favoring stepwise carious tissue removal, whereas the upper bound suggests an important benefit of selective carious tissue removal.

eTable 13. Absolute effects (95% CI) and certainty of the evidence for nanocomposite compared with hybrid resin composite for Class III restorations on vital anterior permanent teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Postoperative Pain and Discomfort (1 Wk)	114	1 randomized controlled trial (38)‡	0.00 (−0.09 to 0.09)	9 fewer to 9 more	Low§,¶,#	Among participants receiving nanocomposite restorations, there were 0 more events (ranging from 9 fewer to 9 more) of postoperative pain and discomfort per 100 restorations compared with those receiving hybrid resin composite restorations. Nanocomposite may result in little to no difference in postoperative pain and discomfort compared with hybrid resin composite.
Unacceptable Color Match (12 Mo)	114	1 randomized controlled trial (38)‡	0.03 (−0.05 to 0.11)	5 fewer to 11 more	Low§,¶,**	Among participants receiving nanocomposite restorations, there were 3 more events (ranging from 5 fewer to 11 more) of unacceptable color match per 100 restorations compared with those receiving hybrid resin composite restorations. Nanocomposite may increase the risk of experiencing unacceptable color match by an important amount compared with hybrid resin composite.

* For the outcomes of marginal discoloration or staining, secondary caries, unacceptable anatomic form, and unacceptable marginal adaptation, there were 0 events in both treatment arms of the included studies. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration failure (or repair OR replacement of the restoration), restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Loguercio and colleagues.[33] § Rated down 2 levels owing to very serious issues of imprecision. ¶ Using a threshold of 0.53%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit of hybrid resin composite. # Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class III restorations for moderate and advanced lesions on vital primary teeth. ** Using a threshold of 0.26%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit of hybrid resin composite.

eTable 14. Absolute effects (95% CI) and certainty of the evidence for resin-modified glass ionomer cement compared with hybrid resin composite for Class V restorations on vital anterior and posterior permanent teeth combined.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Loss (36)	102	1 randomized controlled trial (30)‡	−0.08 (−0.20 to 0.05)	20 fewer to 5 more	Low§,¶,#,**	Among participants receiving resin-modified glass ionomer cement restorations, there were 8 fewer events (ranging from 20 fewer to 5 more) of restoration loss per 100 participants compared with those receiving hybrid resin composite restorations. Resin-modified glass ionomer cement may decrease the risk of experiencing restoration loss by an important amount compared with hybrid resin composite.
Unacceptable Marginal Adaptation (36)	90	1 randomized controlled trial (30)‡	−0.05 (−0.17 to 0.07)	17 fewer to 7 more	Low§,#,**,††	Among participants receiving resin-modified glass ionomer cement restorations, there were 5 fewer events (ranging from 17 fewer to 7 more) of unacceptable marginal adaptation per 100 participants compared with those receiving hybrid resin composite restorations. Resin-modified glass ionomer cement may decrease the risk of experiencing unacceptable marginal adaptation by an important amount compared with hybrid resin composite.

* For the outcomes of postoperative pain and discomfort and secondary caries, there were 0 events in both treatment arms of the included studies. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, marginal discoloration or staining, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration failure (or repair or replacement of the restoration), restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, unacceptable anatomic form, unacceptable color match, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Koc Vural and colleagues.[34] § Rated down 2 levels owing to very serious issues of imprecision. ¶ Using a threshold of 1.57%, the lower bound of the confidence interval suggests an important difference favoring resin-modified glass ionomer cement while the upper bound suggests an important benefit of hybrid resin composite. # Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class V restorations for moderate and advanced lesions on vital anterior and posterior primary teeth. ** Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class I restorations for moderate and advanced lesions on vital anterior permanent teeth. †† Using a threshold of 1.16%, the lower bound of the confidence interval suggests an important difference favoring resin-modified glass ionomer cement, whereas the upper bound suggests an important benefit of hybrid resin composite.

eTable 15. Absolute effects (95% CI) and certainty of the evidence for resin-modified glass ionomer cement compared with conventional glass ionomer cement for Class V restorations on vital anterior and posterior permanent teeth combined.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (Up to 24 Mo)	49	1 randomized controlled trial (not reported)§	0.23 (−0.01 to 0.46)	1 fewer to 46 more	Very low¶,#,**,††,‡‡	There is very low certainty evidence regarding the difference between resin-modified glass ionomer cement and conventional glass ionomer cement for the outcome of restoration failure.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, unacceptable color match, marginal discoloration, pulp vitality, pulpal complications due to infection, pulpal exposure, unacceptable anatomic form, unacceptable marginal adaptation, secondary caries, restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Restoration failure was defined as unacceptable anatomic form and unacceptable marginal adaptation by McComb and colleagues.[35] § McComb and colleagues.[35] ¶ Rated down 2 levels owing to very serious issues of risk of bias. # Rated down 2 levels owing to very serious issues of imprecision. ** Using a threshold of 6.67%, the lower bound of the confidence interval suggests a negligible benefit of resin-modified glass ionomer cement, whereas the upper bound suggests an important benefit of conventional glass ionomer cement. †† Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class V restorations for moderate and advanced lesions on vital anterior and posterior primary teeth. ‡‡ Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class I restorations for moderate and advanced lesions on vital anterior permanent teeth.

eTable 16. Absolute effects (95% CI) and certainty of the evidence for conventional glass ionomer cement compared with hybrid resin composite for Class V restorations on vital anterior and posterior permanent teeth combined.

OUTCOME (FOLLOW-UP, MO)*	RESTORATION, NO	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (24)	54	1 randomized controlled trial (27)§	0.19 (0.01 to 0.36)	1 more to 36 more	Very low¶,#,**,††,‡‡	There is very low certainty evidence regarding the difference between conventional glass ionomer cement and hybrid resin composite for the outcome of restoration failure.
Secondary Caries (24)	54	1 randomized controlled trial (27)§	−0.19 (−0.38 to 0.01)	38 fewer to 1 more	Very low¶,#,††,‡‡,§§	There is very low certainty evidence regarding the difference between conventional glass ionomer cement and hybrid resin composite for the outcome of secondary caries.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, marginal discoloration or staining, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, unacceptable anatomic form, unacceptable color match, unacceptable marginal adaptation, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Reasons for restoration failure were not specified by De Moor and colleagues.[36] § De Moor and colleagues.[36] ¶ Rated down 1 level owing to serious issues of risk of bias. # Rated down 2 levels owing to very serious issues of imprecision. ** Using a threshold of 7.78%, the lower bound of the confidence interval suggests a negligible benefit of hybrid resin composite, whereas the upper bound suggests an important benefit of hybrid resin composite. †† Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class V restorations for moderate and advanced lesions on vital anterior and posterior primary teeth. ‡‡ Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class I restorations for moderate and advanced lesions on vital, anterior, permanent teeth. §§ Using a threshold of 2.59%, the lower bound of the confidence interval suggests an important difference favoring conventional glass ionomer cement, whereas the upper bound suggests a negligible benefit of hybrid resin composite.

eTable 17. Absolute effects (95% CI) and certainty of the evidence for amalgam compared with conventional glass ionomer cement for Class II restorations on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Secondary Caries (25)	64	1 RCT‡ (not reported)§	−0.01 (−0.11 to 0.10)	11 fewer to 10 more	Very low¶,#,**	There is very low certainty evidence regarding the difference between amalgam and conventional glass ionomer cement for the outcome of secondary caries.
Unacceptable Anatomic Form (25)	64	1 RCT (not reported)§	−0.43 (−0.58 to −0.27)	58 fewer to 27 fewer	Very low¶,††	There is very low certainty evidence regarding the difference between amalgam and conventional glass ionomer cement for the outcome of unacceptable anatomic form.
Unacceptable Marginal Adaptation (25)	57	1 RCT (not reported)§	−0.26 (−0.47 to −0.05)	47 fewer to 5 fewer	Very low¶,††	There is very low certainty evidence regarding the difference between amalgam and conventional glass ionomer cement for the outcome of unacceptable marginal adaptation.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration failure (or repair or replacement of the restoration), restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ RCT: Randomized controlled trial. § Fuks and colleagues.[38] ¶ Rated down 2 levels owing to very serious issues of risk of bias. # Rated down 2 levels owing to very serious issues of imprecision. ** Using a threshold of 0.50%, the lower bound of the confidence interval suggests an important difference favoring conventional glass ionomer cement, whereas the upper bound suggests an important benefit from amalgam. †† Rated down 2 levels owing to very serious issues of imprecision due to low sample size.

eTable 18. Absolute effects (95% CI) and certainty of the evidence for hybrid resin composite compared with conventional glass ionomer cement for Class II restorations on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Loss (12-24)	199	2 randomized controlled trials (116)‡,§	−0.09 (−0.16 to −0.02)	16 fewer to 2 fewer	Moderate¶,#	Among participants receiving hybrid resin composite restorations, there were 9 fewer events (ranging from 16 fewer to 2 fewer) of lack of restoration retention per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Hybrid resin composite probably decreases the risk of experiencing restoration loss by an important amount compared with conventional glass ionomer cement.
Secondary Caries (12-24)	184	2 randomized controlled trials (116)‡,§	0.02 (−0.02 to 0.06)	2 fewer to 6 more	Low#,**,††	Among participants receiving hybrid resin composite restorations, there were 2 more events (ranging from 2 fewer to 6 more) of secondary caries per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Hybrid resin composite may increase the risk of experiencing secondary caries by an important amount compared with conventional glass ionomer cement.

* For the outcomes of postoperative pain and discomfort, unacceptable anatomic form, and unacceptable marginal adaptation, there were 0 events in both treatment arms of the included studies. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration failure (or repair or replacement of the restoration), restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Kupietzky and colleagues.[39] § Akman and colleagues.[40] ¶ Rated down 1 level owing to serious issues of inconsistency ($I^2 = 49\%$). # Rated down 2 levels owing to very serious issues of indirectness when used to inform clinical recommendations for Class I restorations for moderate and advanced caries lesions on vital posterior primary teeth. ** Rated down 2 levels owing to very serious issues of imprecision. †† Using a threshold of 0.0%, the lower bound of the confidence interval suggests an important difference favoring hybrid resin composite, whereas the upper bound suggests an important benefit from conventional glass ionomer cement.

eTable 19. Absolute effects (95% CI) and certainty of the evidence for macrofilled resin composite compared with conventional glass ionomer cement for Class II restorations on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (24)	147	1 RCT§ (not reported)¶	−0.05 (−0.18 to 0.09)	18 fewer to 9 more	Low#,**	Among participants receiving macrofilled resin composite restorations, there were 5 fewer events (ranging from 18 fewer to 9 more) of restoration failure per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Macrofilled resin composite may increase the risk of experiencing restoration failure by an important amount compared with conventional glass ionomer cement.
Secondary Caries (24)	147	1 RCT (not reported)¶	−0.04 (−0.18 to 0.10)	18 fewer to 10 more	Low#,††	Among participants receiving macrofilled resin composite restorations, there were 4 fewer events (ranging from 18 fewer to 10 more) of secondary caries per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Macrofilled resin composite may decrease the risk of experiencing secondary caries by an important amount compared with conventional glass ionomer cement.
Unacceptable Anatomic Form (24)	147	1 RCT (not reported)¶	−0.06 (−0.19 to 0.08)	19 fewer to 8 more	Low#,‡‡	Among participants receiving macrofilled resin composite restorations, there were 6 fewer events (ranging from 19 fewer to 8 more) of unacceptable anatomic form per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Macrofilled resin composite may decrease the risk of experiencing unacceptable anatomic form by an important amount compared with conventional glass ionomer cement.
Unacceptable Marginal Adaptation (24)	147	1 RCT (not reported)¶	−0.06 (−0.20 to 0.07)	20 fewer to 7 more	Low#,**	Among participants receiving macrofilled resin composite restorations, there were 6 fewer events (ranging from 20 fewer to 7 more) of unacceptable marginal adaptation per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Macrofilled resin composite may decrease the risk of experiencing unacceptable marginal adaptation by an important amount compared with conventional glass ionomer cement.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Restoration failure was defined as restoration loss, secondary caries, and other unspecified reasons by Ersin and colleagues.[41] § RCT: Randomized controlled trial. ¶ Ersin and colleagues.[41] # Rated down 2 levels owing to very serious issues of imprecision. ** Using a threshold of 2.50%, the lower bound of the confidence interval suggests an important difference favoring macrofilled resin composite, whereas the upper bound suggests an important benefit from conventional glass ionomer cement. †† Using a threshold of 2.78%, the lower bound of the confidence interval suggests an important difference favoring macrofilled resin composite, whereas the upper bound suggests an important benefit from conventional glass ionomer cement. ‡‡ Using a threshold of 2.43%, the lower bound of the confidence interval suggests an important difference favoring macrofilled resin composite, whereas the upper bound suggests an important benefit from conventional glass ionomer cement.

eTable 20. Absolute effects (95% CI) and certainty of the evidence for nanocomposite compared with conventional glass ionomer cement for Class II restorations on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Loss (12)	68	1 randomized controlled trial (26)‡	−0.03 (−0.11 to 0.05)	11 fewer to 5 more	Low§,¶,#	Among participants receiving nanocomposite restorations, there were 3 fewer events (ranging from 11 fewer to 5 more) of restoration loss per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Nanocomposite may decrease the risk of experiencing restoration loss by an important amount compared with conventional glass ionomer cement.

* For the outcomes of postoperative pain and discomfort, secondary caries, unacceptable anatomic form, and unacceptable marginal adaptation, there were 0 events in both treatment arms of the included study. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration failure (or repair or replacement of the restoration), restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † GRADE: Grading of Recommendations Assessment, Development and Evaluation. The GRADE Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Akman and Tosun.[40] § Rated down 2 levels owing to very serious issues of imprecision. ¶ Using a threshold of 0.29%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit from conventional glass ionomer cement. # Rated down 2 levels owing to very serious issues of indirectness when used to inform clinical recommendations for Class I restorations for moderate and advanced caries lesions on vital posterior primary teeth.

eTable 21. Absolute effects (95% CI) and certainty of the evidence for resin-modified glass ionomer cement compared with conventional glass ionomer cement for Class II restorations on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABOSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (36)	114	1 RCT§ (not reported)¶	−0.14 (−0.25 to −0.03)	25 fewer to 3 fewer	Moderate#	Among participants receiving resin-modified glass ionomer cement restorations, there were 14 fewer events (ranging from 25 fewer to 3 fewer) of restoration failure per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Resin-modified glass ionomer cement probably decreases the risk of experiencing restoration failure by an important amount compared with conventional glass ionomer cement.
Restoration Fracture (36)	114	1 RCT (not reported)¶	0.00 (−0.05 to 0.05)	5 fewer to 5 more	Very low#,**,††	There is very low certainty evidence regarding the difference between resin-modified glass ionomer cement and conventional glass ionomer for the outcome of restoration fracture.
Restoration Loss (36)	114	1 RCT (not reported)¶	−0.08 (−0.16 to 0.004)	16 fewer to 0 more	Very low#,**,‡‡	There is very low certainty evidence regarding the difference between resin-modified glass ionomer cement and conventional glass ionomer for the outcome of restoration loss.
Secondary Caries (36)	114	1 RCT (not reported)¶	−0.07 (−0.14 to 0.004)	14 fewer to 0 more	Very low#,**,§§	There is very low certainty evidence regarding the difference between resin-modified glass ionomer cement and conventional glass ionomer for the outcome of secondary caries.

* For the outcome of pulpal complications due to infection (36-month follow-up), there were 0 events in both treatment arms of the included studies. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal exposure, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, unacceptable anatomic form, unacceptable marginal adaptation, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Restoration failure was defined as restoration loss, restoration fracture, and secondary caries by Hübel and Mejàre.[42] § RCT: Randomized controlled trial. ¶ Hübel and Mejàre.[42] # Rated down 1 level owing to serious issues of risk of bias. ** Rated down 2 levels owing to very serious issues of imprecision. †† Using a threshold of 0.16%, the lower bound of the confidence interval suggests an important difference favoring resin-modified glass ionomer cement, whereas the upper bound suggests an important benefit of conventional glass ionomer cement. ‡‡ Using a threshold of 0.98%, the lower bound of the confidence interval suggests an important difference favoring resin-modified glass ionomer cement, whereas the upper bound suggests a negligible benefit of conventional glass ionomer cement. §§ Using a threshold of 0.66%, the lower bound of the confidence interval suggests an important difference favoring resin-modified glass ionomer cement, whereas the upper bound suggests a negligible benefit of conventional glass ionomer cement.

eTable 22. Absolute effects (95% CI) and certainty of the evidence for hybrid resin composite compared with resin-modified glass ionomer cement for Class II restorations on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (24)	241	2 RCTs§ (not reported)¶,#	0.02 (−0.07 to 0.11)	7 fewer to 11 more	Very low**,††,‡‡	There is very low certainty evidence regarding the difference between hybrid resin composite and resin-modified glass ionomer cement for the outcome of restoration failure.
Restoration Fracture (24)	127	1 RCT (not reported)¶	−0.02 (−0.06 to 0.03)	6 fewer to 3 more	Very low**,††,§§	There is very low certainty evidence regarding the difference between hybrid resin composite and resin-modified glass ionomer cement for the outcome of restoration fracture.
Restoration Loss (24)	231	2 RCTs (not reported)¶,#	0.03 (−0.02 to 0.07)	2 fewer 7 more	Very low**,††,¶¶	There is very low certainty evidence regarding the difference between hybrid resin composite and resin-modified glass ionomer cement for the outcome of restoration loss.
Secondary Caries (12-24)	329	3 RCTs (not reported)¶,#,##	0.05 (−0.003 to 0.10)	0 fewer to 10 more	Very low**,††,***	There is very low certainty evidence regarding the difference between hybrid resin composite and resin-modified glass ionomer cement for the outcome of secondary caries.
Unacceptable Anatomic Form (12-24)	200	2 RCTs (not reported)¶,##	0.02 (−0.07 to 0.04)	7 fewer to 4 more	Very low**,††,†††	There is very low certainty evidence regarding the difference between hybrid resin composite and resin-modified glass ionomer cement for the outcome of anatomic form.
Unacceptable Marginal Adaptation (12-24)	300	3 RCTs (not reported)¶,#,##	−0.02 (−0.06 to 0.03)	6 fewer to 3 more	Very low**,††,‡‡‡	There is very low certainty evidence regarding the difference between hybrid resin composite and resin-modified glass ionomer cement for the outcome of marginal adaptation.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Restoration failure was defined as restoration loss, restoration fracture, secondary caries, unacceptable anatomic form, and unacceptable marginal adaptation by Andersson-Wenckert and Sunnegårdh-Grönberg.[43] Reasons for restoration failure were not specified by Dermata and colleagues.[44] § RCT: Randomized controlled trial. ¶ Andersson-Wenckert and Sunnegårdh-Grönberg.[43] # Dermata and colleagues.[44] ** Rated down 1 level owing to serious issues of risk of bias. †† Rated down 2 levels owing to very serious issues of imprecision. ‡‡ Using a threshold of 1.27%, the lower bound of the confidence interval suggests an important difference favoring hybrid resin composite, whereas the upper bound suggests an important benefit from resin-modified glass ionomer cement. §§ Using a threshold of 0.15%, the lower bound of the confidence interval suggests an important difference favoring hybrid resin composite, whereas the upper bound suggests an important benefit from resin-modified glass ionomer cement. ¶¶ Using a threshold of 0.17%, the lower bound of the confidence interval suggests an important difference favoring hybrid resin composite, whereas the upper bound suggests an important benefit from resin-modified glass ionomer cement. ## El-Housseiny and colleagues.[47] *** Using a threshold of 0.35%, the lower bound of the confidence interval suggests a negligible difference favoring hybrid resin composite, whereas the upper bound suggests an important benefit from resin-modified glass ionomer cement. ††† Using a threshold of 0.49%, the lower bound of the confidence interval suggests an important difference favoring hybrid resin composite, whereas the upper bound suggests an important benefit from resin-modified glass ionomer cement. ‡‡‡ Using a threshold of 0.51%, the lower bound of the confidence interval suggests an important difference favoring hybrid resin composite, whereas the upper bound suggests an important benefit from resin-modified glass ionomer cement.

eTable 23. Absolute effects (95% CI) and certainty of the evidence for compomer compared with conventional glass ionomer cement for Class II restorations on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (36)	184	1 randomized controlled trial (184)§	0.00 (−0.14 to 0.14)	14 fewer to 14 more	Low¶,#	Among participants receiving compomer restorations, there were 0 more events (ranging from 14 fewer to 14 more) of restoration failure per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Compomer may result in little to no difference in restoration failure compared with conventional glass ionomer cement.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, secondary caries, time needed to perform the restoration, tooth loss, unacceptable anatomic form, unacceptable marginal adaptation, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Restoration failure was defined as defined as restoration loss, secondary caries, unacceptable anatomic form, unacceptable marginal adaptation by Olegário and colleagues.[37] § Olegário and colleagues.[37] ¶ Rated down 2 levels owing to very serious issues of imprecision. # Using a threshold of 4.35%, the lower bound of the confidence interval suggests an important difference favoring compomer, whereas the upper bound suggests an important benefit from conventional glass ionomer cement.

eTable 24. Absolute effects (95% CI) and certainty of the evidence for preformed metal crowns (Hall technique) compared with conventional glass ionomer cement (atraumatic restorative treatment) for Class II restorations on vital posterior primary teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RD† OR MEAN DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE‡)	WHAT HAPPENS
Oral Health–Related Quality of Life (OHRQoL) Assessed With Scale From 0 to 100, in Which a Higher Score Is Associated With a Lower OHRQoL and a Positive Mean Difference Is Associated With a Greater Improvement in OHRQoL in the Intervention Group (Posttreatment)	123	1 RCT§ (123)¶	Mean difference, 0.73 (−4.70 to 6.10)	4.70 points fewer to 6.10 points more	Moderate#,**	Among participants receiving preformed metal crowns (Hall technique), the mean improvement from baseline in oral health–related quality of life was greater by 0.73 points (of 100) compared with participants receiving conventional glass ionomer cement restorations (atraumatic restorative treatment). Preformed metal crowns probably result in a negligible improvement in oral health–related quality of life compared to conventional glass ionomer cement restorations (atraumatic restorative treatment).
Patient Satisfaction (Postoperative)	131	1 RCT (131)¶	RD, 0.00 (−0.03 to 0.03)	3 fewer to 3 more	Moderate#,**	Among participants receiving preformed metal crowns (Hall technique), there were 0 more events (ranging from 3 fewer to 3 more) of patient satisfaction compared with those receiving conventional glass ionomer cement restorations (atraumatic restorative treatment). Preformed metal crowns (Hall technique) probably result in little to no difference in patient satisfaction compared with conventional glass ionomer cement restorations (atraumatic restorative treatment).
Restoration Failure†† (36 Mo)	112	1 RCT (112)¶	RD, −0.55 (−0.69 to −0.42)	69 fewer to 42 fewer	Moderate#,**	Among participants receiving preformed metal crowns (Hall technique), there were 55 fewer events (ranging from 69 fewer to 42 fewer) of restoration failure form per 100 restorations compared with those receiving conventional glass ionomer cement restorations (atraumatic restorative treatment). Preformed metal crowns (Hall technique) probably decreases the risk of restoration failure by an important amount compared with conventional glass ionomer cement restorations (atraumatic restorative treatment).

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, patient discomfort during treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, secondary caries, time needed to perform the restoration, tooth loss, unacceptable anatomic form, unacceptable marginal adaptation, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † RD: Risk difference. ‡ The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. § RCT: Randomized controlled trial. ¶ Araujo and colleagues.[16] # Rated down 1 level owing to serious issues of risk of bias. ** Rated down 2 levels owing to very serious issues of indirectness when used to inform clinical recommendations for Class I restorations for moderate and advanced caries lesions on vital posterior primary teeth. †† Restoration failure was defined as restoration loss, restoration fracture, and other unspecified reasons by Araujo and colleagues.[16]

eTable 25. Absolute effects (95% CI) and certainty of the evidence for compomer compared with conventional glass ionomer cement for Class I restorations on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (36)	162	1 randomized controlled trial (162)§	0.05 (−0.07 to 0.17)	7 fewer to 17 more	Low¶,#	Among participants receiving compomer restorations, there were 5 more events (ranging from 7 fewer to 17 more) of restoration failure per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Compomer may increase the risk of experiencing restoration failure by an important amount compared with conventional glass ionomer cement.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, secondary caries, time needed to perform the restoration, tooth loss, unacceptable anatomic form, unacceptable marginal adaptation, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Restoration failure was defined as restoration loss, secondary caries, unacceptable anatomic form, and unacceptable marginal adaptation by Olegário and colleagues.[37] § Olegário and colleagues.[37] ¶ Rated down 2 levels owing to very serious issues of imprecision. # Using a threshold of 1.67%, the lower bound of the confidence interval suggests an important difference favoring compomer, whereas the upper bound suggests an important benefit from conventional glass ionomer cement.

eTable 26. Absolute effects (95% CI) and certainty of the evidence for macrofilled resin composite compared with conventional glass ionomer cement for Class I restorations on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (24)	177	1 RCT§ (not reported)¶	0.05 (–0.02 to 0.12)	2 fewer to 12 more	Low#,**	Among participants receiving macrofilled resin composite restorations, there were 5 more events (ranging from 2 fewer to 12 more) of restoration failure per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Macrofilled resin composite may increase the risk of experiencing restoration failure by an important amount compared with conventional glass ionomer cement.
Secondary Caries (24)	177	1 RCT (not reported)¶	–0.05 (–0.14 to 0.05)	14 fewer to 5 more	Low#,††	Among participants receiving macrofilled resin composite restorations, there were 5 fewer events (ranging from 14 fewer to 5 more) of secondary caries per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Macrofilled resin composite may decrease the risk of experiencing secondary caries by an important amount compared with conventional glass ionomer cement.
Unacceptable Anatomic Form (24)	177	1 RCT (not reported)¶	–0.01 (–0.06 to 0.04)	6 fewer to 4 more	Low#,**	Among participants receiving macrofilled resin composite restorations, there were 1 fewer event (ranging from 6 fewer to 4 more) of unacceptable anatomic form per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Macrofilled resin composite may decrease the risk of experiencing unacceptable anatomic form by an important amount compared with conventional glass ionomer cement.
Unacceptable Marginal Adaptation (24)	177	1 RCT (not reported)¶	0.002 (–0.04 to 0.05)	4 fewer to 5 more	Low#,‡‡	Among participants receiving macrofilled resin composite restorations, there were 0 more events (ranging from 4 fewer to 5 more) of unacceptable marginal adaptation per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Macrofilled resin composite may increase the risk of experiencing unacceptable marginal adaptation by a negligible amount compared with conventional glass ionomer cement.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Restoration failure was defined as restoration loss, secondary caries, and other unspecified reasons by Ersin and colleagues.[41] § RCT: Randomized controlled trial. ¶ Ersin and colleagues.[41] # Rated down 2 levels owing to very serious issues of imprecision. ** Using a threshold of 0.33%, the lower bound of the confidence interval suggests an important difference favoring macrofilled resin composite, whereas the upper bound suggests an important benefit from conventional glass ionomer cement. †† Using a threshold of 1.52%, the lower bound of the confidence interval suggests an important difference favoring macrofilled resin composite, whereas the upper bound suggests an important benefit from conventional glass ionomer cement. ‡‡ Using a threshold of 0.22%, the lower bound of the confidence interval suggests an important difference favoring macrofilled resin composite, whereas the upper bound suggests an important benefit from conventional glass ionomer cement.

eTable 27. Absolute effects (95% CI) and certainty of the evidence for amalgam compared with resin-modified glass ionomer cement for Class I and Class II restorations combined on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (24)	44	1 RCT§ (not reported)¶	0.05 (−0.10 to 0.20)	10 fewer to 20 more	Very low#,**,††,‡‡	There is very low certainty evidence regarding the difference between amalgam and resin-modified glass ionomer cement for the outcome of restoration failure.
Secondary Caries (24)	44	1 RCT (not reported)¶	−0.03 (−0.25 to 0.18)	25 fewer to 18 more	Very low#,**,‡‡,§§	There is very low certainty evidence regarding the difference between amalgam and resin-modified glass ionomer cement for the outcome of secondary caries.
Unacceptable Anatomic Form (24)	44	1 RCT (not reported)¶	0.05 (−0.10 to 0.20)	10 fewer to 20 more	Very low#,**,††,‡‡	There is very low certainty evidence regarding the difference between amalgam and resin-modified glass ionomer cement for the outcome of unacceptable anatomic form.
Unacceptable Marginal Adaptation (24)	44	1 RCT (not reported)¶	0.05 (−0.10 to 0.20)	10 fewer to 20 more	Very low#,**,††,‡‡	There is very low certainty evidence regarding the difference between amalgam and resin-modified glass ionomer cement for the outcome of unacceptable marginal adaptation.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Reasons for restoration failure were not specified by Daou and colleagues.[45] § RCT: Randomized controlled trial. ¶ Daou and colleagues.[45] # Rated down 2 levels owing to very serious issues of risk of bias. ** Rated down 2 levels owing to very serious issues of imprecision. †† Using a threshold of 0.43%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests an important benefit from resin-modified glass ionomer cement. ‡‡ Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class I restorations for moderate and advanced caries lesions on vital posterior primary teeth. §§ Using a threshold of 1.74%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests an important benefit from resin-modified glass ionomer cement.

eTable 28. Absolute effects (95% CI) and certainty of the evidence for conventional glass ionomer cement compared with resin-modified glass ionomer cement for Class I and Class II restorations combined on vital posterior primary teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Postoperative Pain and Discomfort (6)	42	1 RCT‡ (24)§	0.05 (−0.23 to 0.33)	23 fewer to 33 more	Very low¶,#,**,††	There is very low certainty evidence regarding the difference between conventional glass ionomer cement and resin-modified glass ionomer cement for the outcome of postoperative pain and discomfort.
Restoration Loss (6)	46	1 RCT (24)§	0.00 (−0.24 to 0.24)	24 fewer to 24 more	Very low¶,#,††,‡‡	There is very low certainty evidence regarding the difference between conventional glass ionomer cement and resin-modified glass ionomer cement for the outcome of restoration loss.
Secondary Caries (6)	40	1 RCT (24)§	0.20 (−0.10 to 0.50)	10 fewer to 50 more	Very low¶,#,††,§§	There is very low certainty evidence regarding the difference between conventional glass ionomer cement and resin-modified glass ionomer cement for the outcome of secondary caries.
Unacceptable Anatomic Form (6)	40	1 RCT (24)§	−0.05 (−0.25 to 0.15)	25 fewer to 15 more	Very low¶,#,††,¶¶	There is very low certainty evidence regarding the difference between conventional glass ionomer cement and resin-modified glass ionomer cement for the outcome of anatomic form.
Unacceptable Marginal Adaptation (6)	40	1 RCT (24)§	0.25 (−0.05 to 0.55)	5 fewer to 55 more	Very low¶,#,††,##	There is very low certainty evidence regarding the difference between conventional glass ionomer cement and resin-modified glass ionomer cement for the outcome of marginal adaptation.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration failure (or repair or replacement of the restoration), restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ RCT: Randomized controlled trial. § Mufti.[46] ¶ Rated down 2 levels owing to very serious issues of risk of bias. # Rated down 2 levels owing to very serious issues of imprecision. ** Using a threshold of 2.86%, the lower bound of the confidence interval suggests an important difference favoring conventional glass ionomer cement, whereas the upper bound suggests an important benefit of resin-modified glass ionomer cement. †† Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class I restorations for moderate and advanced caries lesions on vital posterior primary teeth. ‡‡ Using a threshold of 2.17%, the lower bound of the confidence interval suggests an important difference favoring conventional glass ionomer cement, whereas the upper bound suggests an important benefit of resin-modified glass ionomer cement. §§ Using a threshold of 3.5%, the lower bound of the confidence interval suggests an important difference favoring conventional glass ionomer cement, whereas the upper bound suggests an important benefit of resin-modified glass ionomer cement. ¶¶ Using a threshold of 1.5%, the lower bound of the confidence interval suggests an important difference favoring conventional glass ionomer cement, whereas the upper bound suggests an important benefit of resin-modified glass ionomer cement. ## Using a threshold of 4.5%, the lower bound of the confidence interval suggests an important difference favoring conventional glass ionomer cement, whereas the upper bound suggests an important benefit of resin-modified glass ionomer cement.

eTable 29. Absolute effects (95% CI) and certainty of the evidence for compomer compared with conventional glass ionomer cement for Class I restorations on vital posterior permanent teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Loss (6)	60	1 randomized controlled trial (60)‡	0.10 (–0.02 to 0.22)	2 fewer to 22 more	Low§,¶	Among participants receiving compomer restorations, there were 10 more events (ranging from 2 fewer to 22 more) of restoration loss per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Compomer may increase the risk of experiencing restoration loss by an important amount compared with conventional glass ionomer cement.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration failure, restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, secondary caries, time needed to perform the restoration, tooth loss, unacceptable anatomic form, unacceptable marginal adaptation, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Mundada and colleagues.[67] § Rated down 2 levels owing to very serious issues of imprecision. ¶ Using a threshold of 0.0%, the lower bound of the confidence interval suggests an important difference favoring compomer, whereas the upper bound suggests an important benefit of conventional glass ionomer cement.

eTable 30. Absolute effects (95% CI) and certainty of the evidence for resin-modified glass ionomer cement compared with conventional glass ionomer cement for Class I restorations on vital posterior permanent teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (24)	50	1 randomized controlled trial (not reported)§	−0.19 (−0.37 to −0.02)	37 fewer to 2 fewer	Low¶,#	Among participants receiving resin-modified glass ionomer cement restorations, there were 19 fewer events (ranging from 37 fewer to 2 fewer) of restoration failure per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Resin-modified glass ionomer cement may decrease the risk of experiencing restoration failure by an important amount compared with conventional glass ionomer cement.

* For the outcome of restoration loss, there were 0 events in both treatment arms of the included study. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, secondary caries, time needed to perform the restoration, tooth loss, unacceptable anatomic form, unacceptable marginal adaptation, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Reasons for restoration failure were not specified by Ercan and colleagues.[68] § Ercan and colleagues.[68] ¶ Rated down 2 levels owing to very serious issues of imprecision. # Using a threshold of 1.90%, the lower bound of the confidence interval suggests an important difference favoring resin-modified glass ionomer cement, whereas the upper bound suggests a negligible difference favoring conventional glass ionomer cement.

eTable 31. Absolute effects (95% CI) and certainty of the evidence for conventional glass ionomer cement compared with hybrid resin composite for Class I restorations on vital posterior permanent teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Postoperative Pain and Discomfort (Up to 9 Mo)	118	2 randomized controlled trials (79)‡,§	−0.03 (−0.10 to 0.03)	10 fewer to 3 more	Low¶,#	Among participants receiving conventional glass ionomer cement restorations, there were 3 fewer events (ranging from 10 fewer to 3 more) of postoperative pain and discomfort per 100 restorations compared with those receiving hybrid resin composite restorations. Conventional glass ionomer cement may decrease the risk of experiencing postoperative pain and discomfort by an important amount compared with hybrid resin composite.

* For the outcomes of restoration failure, restoration loss, secondary caries, unacceptable anatomic form, and unacceptable marginal adaptation, there were 0 events in both treatment arms for the included studies. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Gurgan and colleagues.[69] § Kharma and colleagues.[70] ¶ Rated down 2 levels owing to very serious issues of imprecision. # Using a threshold of 0.34%, the lower bound of the confidence interval suggests an important difference favoring conventional glass ionomer cement, whereas the upper bound suggests an important benefit of hybrid resin composite.

eTable 32. Absolute effects (95% CI) and certainty of the evidence for nanocomposite compared with hybrid resin composite for Class I restorations on vital posterior permanent teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Postoperative Pain and Discomfort (1 Wk-24 Mo)	245	3 RCTs‡ (not reported)§,¶,#	−0.01 (−0.05 to 0.03)	5 fewer to 3 more	Low**,††	Among participants receiving nanocomposite restorations, there was 1 fewer event (ranging from 5 fewer to 3 more) of postoperative pain and discomfort per 100 restorations compared with those receiving hybrid resin composite restorations. Nanocomposite may decrease the risk of experiencing postoperative pain and discomfort by an important amount compared with hybrid resin composite.
Restoration Failure‡‡ (18-36 Mo)	182	2 RCTs (59)§,#	−0.02 (−0.08 to 0.05)	8 fewer to 5 more	Low**,§§	Among participants receiving nanocomposite restorations, there were 2 fewer events (ranging from 8 fewer to 5 more) of restoration failure per 100 restorations compared with those receiving hybrid resin composite restorations. Nanocomposite may decrease the risk of experiencing restoration failure by an important amount compared with hybrid resin composite.
Restoration Fracture (36 Mo)	80	1 RCT (24)§	−0.05 (−0.16 to 0.06)	16 fewer to 6 more	Low**,¶¶	Among participants receiving nanocomposite restorations, there were 5 fewer events (ranging from 16 fewer to 6 more) of restoration fracture per 100 restorations compared with those receiving hybrid resin composite restorations. Nanocomposite may decrease the risk of experiencing restoration fracture by an important amount compared with hybrid resin composite.
Secondary Caries (18-36 Mo)	242	3 RCTs (not reported)§,¶,#	0.01 (−0.03 to 0.04)	3 fewer to 4 more	Low**,##	Among participants receiving nanocomposite restorations, there was 1 more event (ranging from 3 fewer to 4 more) of secondary caries per 100 restorations compared with those receiving hybrid resin composite restorations. Nanocomposite may increase the risk of experiencing secondary caries by an important amount compared with hybrid resin composite.
Unacceptable Anatomic Form (18-36 Mo)	242	3 RCTs (not reported)§,¶,#	0.02 (−0.03 to 0.06)	3 fewer to 6 more	Low**,***	Among participants receiving nanocomposite restorations, there were 2 more events (ranging from 3 fewer to 6 more) of unacceptable anatomic form per 100 restorations compared with those receiving hybrid resin composite restorations. Nanocomposite may increase the risk of experiencing unacceptable anatomic form by an important amount compared with hybrid resin composite.
Unacceptable Marginal Adaptation (18-36 Mo)	242	3 RCTs (not reported)§,¶,#	−0.01 (−0.07 to 0.04)	7 fewer to 4 more	Low**,†††	Among participants receiving nanocomposite restorations, there was 1 fewer event (ranging from 7 fewer to 4 more) of unacceptable marginal adaptation per 100 restorations compared with those receiving hybrid resin composite restorations. Nanocomposite may decrease the risk of experiencing unacceptable marginal adaptation by an important amount compared with hybrid resin composite.

* For the outcome of restoration loss, there were 0 events in both treatment arms for the included studies. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ RCT: Randomized controlled trial. § Shi and colleagues.[71] ¶ Atabek and colleagues.[72] # Sadeghi and colleagues.[73] ** Rated down 2 levels owing to very serious issues of imprecision. †† Using a threshold of 0.19%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit of hybrid resin composite. ‡‡ Restoration failure was defined as restoration fracture and other unspecified reasons by Shi and colleagues[71] and was defined as secondary caries and other unspecified reasons by Sadeghi and colleagues.[73] §§ Using a threshold of 0.68%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit of hybrid resin composite. ¶¶ Using a threshold of 1.0%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit of hybrid resin composite. ## Using a threshold of 0.0%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit of hybrid resin composite. *** Using a threshold of 0.38%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit of hybrid resin composite. ††† Using a threshold of 0.58%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit of hybrid resin composite.

eTable 33. Absolute effects (95% CI) and certainty of the evidence for amalgam compared with hybrid resin composite for Class I and Class II restorations combined on vital posterior permanent teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RD† OR MD‡ (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE§)	WHAT HAPPENS
Fracture of the Crown (12)	98	1 RCT¶ (not reported)#	RD, 0.02 (−0.03 to 0.08)	3 fewer to 8 more	Very low**,††,‡‡,§§,¶¶	There is very low certainty evidence regarding the difference between amalgam and hybrid resin composite for the outcome of fracture of the crown.
Patient or Parent Satisfaction With Treatment Assessed With Scale From 0 to 10, in Which 0 Is Very Pleased and 10 Is Dissatisfied (12)	98	1 RCT (not reported)#	Participants receiving both amalgam and composite restorations were less satisfied with the appearance of amalgam restorations (average score, 2.5) compared with hybrid resin composite restorations (average score, 0.9) (MD, 1.6) at 12-months follow-up. Standard deviations and exact *P* values were not provided. However, study authors reported a statistically significant difference between the interventions.		Very low**,§§,¶¶,##	–
Postoperative Pain and Discomfort (12-36)	264	2 RCTs (not reported)#,***	RD, −0.01 (−0.04 to 0.02)	4 fewer to 2 more	Very low††,§§,¶¶,†††,‡‡‡	There is very low certainty evidence regarding the difference between amalgam and hybrid resin composite for the outcome of postoperative pain and discomfort up.
Postoperative Pain and Discomfort Assessed With Visual Analog Scale From 0 to 10, in Which 0 Is Very Comfortable and 10 Is Uncomfortable (12)	98	1 RCT (not reported)#	Participants receiving both amalgam and composite restorations experienced more discomfort with amalgam restorations (average score, 1.4) compared with the hybrid resin composite (average score, 1.2) (MD, 0.2) at 12-months follow-up. Standard deviations and exact *P* values were not provided. However, study authors reported no statistically significant difference between the interventions.		Very low**,§§,¶¶,##	–

* No studies meeting the selection criteria reported data on caries progression, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † RD: Risk difference. ‡ MD: Mean difference. § The Grading of Recommendations Assessment, Development and Evaluation(GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ¶ RCT: Randomized controlled trial. # Wilson and colleagues.[59] ** Rated down 1 level owing to serious issues of risk of bias. †† Rated down 2 levels owing to very serious issues of imprecision. ‡‡ Using a threshold of 0.0%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests an important benefit of hybrid resin composite. §§ Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class I restorations for moderate and advanced caries lesions on vital posterior permanent teeth. ¶¶ Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class II restorations for moderate and advanced caries lesions on vital posterior permanent teeth. ## Rated down 2 levels owing to very serious issues of imprecision due to low sample size. *** Bryant and Hodge.[60] ††† Rated down 2 levels owing to very serious issues of risk of bias. ‡‡‡ Using a threshold of 0.13%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests a negligible benefit of hybrid resin composite. §§§ Restoration failure was defined as pulpal complications, restoration fracture, unacceptable anatomic form, unacceptable marginal adaptation, secondary caries, and unspecified reasons by Wilson and colleagues[59] and Bryant and Hodge.[60] ¶¶¶ Rated down 1 level owing to serious issues of inconsistency ($I^2 = 82\%$). ### Using a threshold of 0.50%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests an important benefit of hybrid resin composite. **** Collins and colleagues.[61] †††† Using a threshold of 1.59%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests a negligible benefit of hybrid resin composite. ‡‡‡‡ Using a threshold of 0.27%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests an important benefit of hybrid resin composite. §§§§ Using a threshold of 0.47%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests an important benefit of hybrid resin composite. ¶¶¶¶ Using a threshold of 0.09%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests an important benefit of hybrid resin composite. #### Using a threshold of 0.56%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests an important benefit of hybrid resin composite. ***** Using a threshold of 0.18%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests an important benefit of hybrid resin composite. ††††† Using a threshold of 0.65%, the lower bound of the confidence interval suggests an important difference favoring amalgam, whereas the upper bound suggests an important benefit of hybrid resin composite.

eTable 33. Continued

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RD† OR MD‡ (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE§)	WHAT HAPPENS
Restoration Failure§§§ (12-36)	264	2 RCTs (not reported)#,***	RD, −0.04 (−0.08 to 0.004)	8 fewer to 0 more	Very low††,§§,¶¶,†††,¶¶¶,###	There is very low certainty evidence regarding the difference between amalgam and hybrid resin composite for the outcome of restoration failure at 12-36 month follow-up.
Restoration Failure§§§ (96)	159	1 RCT (52)****	RD, −0.10 (−0.20 to −0.01)	20 fewer to 1 fewer	Very low††,§§,¶¶,†††,††††	There is very low certainty evidence regarding the difference between amalgam and hybrid resin composite for the outcome of restoration failure at 96-month follow-up.
Restoration Fracture (36)	166	1 RCT (48)***	RD, −0.03 (−0.07 to 0.01)	7 fewer to 1 more	Very low ††,§§,¶¶,†††,‡‡‡‡	There is very low certainty evidence regarding the difference between amalgam and hybrid resin composite for the outcome of restoration fracture at 36-month follow-up.
Restoration Fracture (96)	159	1 RCT (52)****	RD, −0.01 (−0.07 to 0.06)	7 fewer to 6 more	Very low††,§§,¶¶,†††,§§§§	There is very low certainty evidence regarding the difference between amalgam and hybrid resin composite for the outcome of restoration fracture at 96-month follow-up.
Secondary Caries (36)	166	1 RCT (48)***	RD, −0.01 (−0.04 to 0.02)	4 fewer to 2 more	Very low††,§§,¶¶,†††,¶¶¶¶	There is very low certainty evidence regarding the difference between amalgam and hybrid resin composite for the outcome of secondary caries at 36-month follow-up.
Secondary Caries (96)	159	1 RCT (52)****	RD, −0.04 (−0.09 to 0.02)	9 fewer to 2 more	Very low††,§§,¶¶,†††,####	There is very low certainty evidence regarding the difference between amalgam and hybrid resin composite for the outcome of secondary caries at 96-month follow-up.
Unacceptable Anatomic Form (36)	166	1 RCT (48)***	RD, −0.25 (−0.41 to -0.10)	41 fewer to 10 fewer	Low§§,¶¶,†††	Among participants receiving amalgam restorations, there were 25 fewer events (ranging from 41 fewer to 10 fewer) of unacceptable anatomic form per 100 restorations compared with those receiving hybrid resin composite restorations at 36-month follow-up. Amalgam may decrease the risk of unacceptable anatomic form by an important amount compared with hybrid resin composite at 36-month follow-up.
Unacceptable Anatomic Form (96)	143	1 RCT (46)****	RD, −0.02 (−0.09 to 0.06)	9 fewer to 6 more	Low§§,¶¶,†††	Among participants receiving amalgam restorations, there were 2 fewer events (ranging from 9 fewer to 6 more) of unacceptable anatomic form per 100 restorations compared with those receiving hybrid resin composite restorations at 96-month follow-up. Amalgam may decrease the risk of unacceptable anatomic form by a negligible amount compared with hybrid resin composite at 96-month follow-up.
Unacceptable Marginal Adaptation (36)	166	1 RCT (48)***	RD, −0.02 (−0.05 to 0.02)	5 fewer to 2 more	Very low††,§§,¶¶,†††,*****	There is very low certainty evidence regarding the difference between amalgam and hybrid resin composite for the outcome of unacceptable marginal adaptation at 36-month follow-up.
Unacceptable Marginal Adaptation (96)	143	1 RCT (46)****	RD, −0.03 (−0.10 to 0.05)	10 fewer to 5 more	Very low††,§§,¶¶,†††,†††††	There is very low certainty evidence regarding the difference between amalgam and hybrid resin composite for the outcome of unacceptable marginal adaptation at 96-month follow-up.

eTable 34. Absolute effects (95% CI) and certainty of the evidence for macrofilled resin composite compared with hybrid resin composite for Class I and Class II restorations combined on vital posterior permanent teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Loss (36)	59	1 randomized controlled trial (14)‡	−0.03 (−0.12 to 0.06)	12 fewer to 6 more	Very low§,¶,#,**,††	There is very low certainty evidence regarding the difference between macrofilled resin composite and hybrid resin composite for the outcome of restoration loss.
Unacceptable Anatomic Form (168)	14	1 randomized controlled trial (7)‡‡	−0.14 (−0.46 to 0.18)	46 fewer to 18 more	Low¶,**,††,§§	Among participants receiving macrofilled resin composite restorations, there were 14 fewer events (ranging from 46 fewer to 18 more) of unacceptable anatomic form per 100 restorations compared with those receiving hybrid resin composite restorations. Macrofilled resin composite may decrease the risk of experiencing unacceptable anatomic form by an important amount compared with hybrid resin composite.

* For the outcomes of postoperative pain and discomfort (36-month follow-up), secondary caries (12-, 36-, and 168-month follow-ups), unacceptable anatomic form (12- and 36-month follow-ups), and unacceptable marginal adaptation (12-, 36-, and 168-month follow-ups), there were 0 events in both treatment arms of the included studies. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration failure (or repair or replacement of the restoration), restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Loguercio and colleagues.[62] § Rated down 1 level owing to serious issues of risk of bias. ¶ Rated down 2 levels owing to very serious issues of imprecision. # Using a threshold of 0.34%, the lower bound of the confidence interval suggests an important difference favoring macrofilled resin composite, whereas the upper bound suggests an important benefit from hybrid resin composite. ** Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class I restorations for moderate and advanced caries lesions on vital posterior permanent teeth. †† Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class II restorations for moderate and advanced caries lesions on vital posterior permanent teeth. ‡‡ Espindola-Castro and colleagues.[63] §§ Using a threshold of 1.43%, the lower bound of the confidence interval suggests an important difference favoring macrofilled resin composite, whereas the upper bound suggests an important benefit for hybrid resin composite.

eTable 35. Absolute effects (95% CI) and certainty of the evidence for hybrid resin composite compared with conventional glass ionomer cement for Class II restorations on vital posterior permanent teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (24)	53	1 RCT§ (not reported)¶	−0.47 (−0.64 to −0.30)	64 fewer to 30 fewer	Low#	Among participants receiving hybrid resin composite restorations, there were 47 fewer events (ranging from 64 fewer to 30 fewer) of restoration failure per 100 restorations compared with those receiving conventional glass ionomer cement restorations at 24-month follow-up. Hybrid resin composite may decrease the risk of experiencing restoration failure by an important amount compared with conventional glass ionomer cement at 24-month follow-up.
Restoration Failure ** **(120)**	60	1 RCT (26)††	−0.07 (−0.17 to 0.04)	17 fewer to 4 more	Low‡‡,§§	Among participants receiving hybrid resin composite restorations, there were 7 fewer events (ranging from 17 fewer to 4 more) of restoration failure per 100 restorations compared with those receiving conventional glass ionomer cement restorations at 10-year follow-up. Hybrid resin composite may decrease the risk of experiencing restoration failure by an important amount compared with conventional glass ionomer at 10-year follow-up.
Restoration Loss (24)	67	1 RCT (not reported)¶	−0.44 (−0.61 to −0.26)	61 fewer to 26 fewer	Low#	Among participants receiving hybrid resin composite restorations, there were 44 fewer events (ranging from 61 fewer to 26 fewer) of restoration loss per 100 restorations compared with those receiving conventional glass ionomer cement restorations at 24-month follow-up. Hybrid resin composite may decrease the risk of experiencing restoration loss by an important amount compared with conventional glass ionomer cement at 24-month follow-up.
Restoration Loss (120)	60	1 RCT (26)††	−0.07 (−0.17 to 0.04)	17 fewer to 4 more	Low‡‡,§§	Among participants receiving hybrid resin composite restorations, there were 7 fewer events (ranging from 17 fewer to 4 more) of restoration loss per 100 restorations compared with those receiving conventional glass ionomer cement restorations 120-month follow-up. Hybrid resin composite may decrease the risk of experiencing restoration loss by an important amount compared with conventional glass ionomer cement 120-month follow-up.
Unacceptable Anatomic Form (24-36)	105	2 RCTs (not reported)¶,††	−0.02 (−0.09 to 0.04)	9 fewer to 4 more	Low‡‡,¶¶	Among participants receiving hybrid resin composite restorations, there were 2 fewer events (ranging from 9 fewer to 4 more) of unacceptable anatomic form per 100 restorations compared with those receiving conventional glass ionomer cement composite restorations. Hybrid resin composite may decrease the risk of experiencing unacceptable anatomic form by an important amount compared with conventional glass ionomer cement.
Unacceptable Marginal Adaptation (24-36)	105	2 RCTs (not reported)¶,††	−0.02 (−0.09 to 0.04)	9 fewer to 4 more	Low‡‡,¶¶	Among participants receiving hybrid resin composite restorations, there were 2 fewer events (ranging from 9 fewer to 4 more) of unacceptable marginal adaptation per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Hybrid resin composite may decrease the risk of experiencing unacceptable marginal adaptation by an important amount compared with conventional glass ionomer cement.

* For the outcomes of postoperative pain and discomfort (1-week and 24-month follow-ups), secondary caries (24-, 36-, 72-, and 120-month follow-ups), unacceptable anatomic form (72- and 120-month follow-ups), and unacceptable marginal adaption (72- and 120-month follow-ups), there were 0 events in both treatment arms of the included studies. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Restoration failure was defined as restoration loss and restoration fracture by Balkaya and colleagues.[74] § RCT: Randomized controlled trial. ¶ Balkaya and colleagues.[74] # Rated down 2 levels owing to very serious issues of imprecision due to low sample size. ** Restoration failure was defined as restoration loss and restoration fracture by Gurgan and colleagues.[69] †† Gurgan and colleagues.[69] ‡‡ Rated down 2 levels owing to very serious issues of imprecision. §§ Using a threshold of 0.67%, the lower bound of the confidence interval suggests an important difference favoring hybrid resin composite, whereas the upper bound suggests an important benefit of conventional glass ionomer cement. ¶¶ Using a threshold of 0.22%, the lower bound of the confidence interval suggests an important difference favoring hybrid resin composite, whereas the upper bound suggests an important benefit of conventional glass ionomer cement.

eTable 36. Absolute effects (95% CI) and certainty of the evidence for resin-modified glass ionomer cement compared with conventional glass ionomer cement for Class II restorations on vital posterior permanent teeth.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (24)	38	1 RCT§ (not reported)¶	−0.71 (−0.93 to −0.48)	93 fewer to 48 fewer	Low#	Among participants receiving resin-modified glass ionomer cement restorations, there were 71 fewer events (ranging from 93 fewer to 48 fewer) of restoration failure per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Resin-modified glass ionomer cement may decrease the risk of experiencing restoration failure by an important amount compared with conventional glass ionomer cement.
Restoration Loss (24)	38	1 RCT (not reported)¶	−0.35 (−0.58 to −0.12)	58 fewer to 12 fewer	Low#	Among participants receiving resin-modified glass ionomer cement restorations, there were 35 fewer events (ranging from 58 fewer to 12 fewer) of restoration loss per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Resin-modified glass ionomer cement may decrease the risk of experiencing restoration loss by an important amount compared with conventional glass ionomer cement.
Unacceptable Anatomic Form (24)	38	1 RCT (not reported)¶	−0.48 (−0.74 to −0.23)	74 fewer to 23 fewer	Low#	Among participants receiving resin-modified glass ionomer cement restorations, there were 48 fewer events (ranging from 74 fewer to 23 fewer) of unacceptable anatomic form per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Resin-modified glass ionomer cement may decrease the risk of experiencing unacceptable anatomic form by an important amount compared with conventional glass ionomer cement.
Unacceptable Marginal Adaptation (24)	38	1 RCT (not reported)¶	−0.48 (−0.74 to −0.23)	74 fewer to 23 fewer	Low#	Among participants receiving resin-modified glass ionomer cement restorations, there were 48 fewer events (ranging from 74 fewer to 23 fewer) of unacceptable marginal adaptation per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Resin-modified glass ionomer cement may decrease the risk of experiencing unacceptable marginal adaptation by an important amount compared with conventional glass ionomer cement.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, secondary caries, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Reasons for restoration failure were not specified by Ercan and colleagues.[68] § RCT: Randomized controlled trial. ¶ Ercan and colleagues.[68] # Rated down 2 levels owing to very serious issues of imprecision due to low sample size.

eTable 37. Absolute effects (95% CI) and certainty of the evidence for hybrid resin composite (conventional restorative treatment) compared with conventional glass ionomer cement (atraumatic restorative treatment) for Class II restorations on vital posterior permanent teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE OR MEAN DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (24 Mo)	271	1 randomized controlled trial (not reported)§	Risk difference, −0.02 (−0.05 to 0.02)	5 fewer to 2 more	Very low¶,#,**	There is very low certainty evidence regarding the difference between hybrid resin composite restorations (conventional restorative treatment [CRT]) and conventional glass ionomer cement restorations (atraumatic restorative treatment [ART]) for the outcome of restoration failure.
Time Needed to Perform Restoration (Posttreatment)	272	1 randomized controlled trial (not reported)§	Mean difference, 0.87 min (0.32 to 1.42)	0.32 more to 1.42 more	Moderate¶	Hybrid resin composite (CRT) increased the time needed to perform restoration by 0.87 minutes (52.2 seconds) (ranging from 0.32 to 1.42 minutes longer) when compared with conventional glass ionomer cement (ART) restorations. By comparison, the mean time needed to perform restoration in the conventional glass ionomer cement (ART) arm was 20.5 minutes.

* For the outcome of pulpal exposure (immediately following treatment), there were 0 events in both treatment arms of the included study. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, marginal need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, secondary caries, restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, tooth loss, unacceptable anatomic form, unacceptable marginal adaptation, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Restoration failure was defined as marginal discoloration or staining, unacceptable anatomic form, and unacceptable marginal adaptation by Molina and colleagues.[75] § Molina and colleagues.[75] ¶ Rated down 1 level owing to serious issues of risk of bias. # Rated down 2 levels owing to very serious issues of imprecision. ** Using a threshold of 0.31%, the lower bound of the confidence interval suggests an important difference favoring hybrid resin composite (CRT), whereas the upper bound suggests an important benefit of conventional glass ionomer cement (ART).

eTable 38. Absolute effects (95% CI) and certainty of the evidence for nanocomposite compared with hybrid resin composite for Class I and Class II restorations combined on vital posterior permanent teeth.

OUTCOME (FOLLOW-UP)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Postoperative Pain and Discomfort (Up to 1 Mo)	157	3 randomized controlled trials (77)‡,§,¶	0.00 (−0.06 to 0.06)	6 fewer to 6 more	Very low#,**,††,‡‡	There is very low certainty evidence regarding the difference between nanocomposite and hybrid resin composite for the outcome of postoperative pain and discomfort.
Unacceptable Marginal Adaptation (Up to 36 Mo)	157	3 randomized controlled trials (77)‡,§,¶	−0.02 (−0.09 to 0.04)	9 fewer to 4 more	Very low#,**,‡‡,§§	There is very low certainty evidence regarding the difference between nanocomposite and hybrid resin composite for the outcome of unacceptable marginal adaptation.

* For the outcomes of restoration failure, restoration loss, secondary caries, and unacceptable anatomic form, there were 0 events in both treatment arms of the included studies. No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration survival reported as a hazard ratio, time needed to perform the restoration, tooth loss, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Hoseinifar and colleagues.[64] § Palaniappan and colleagues.[65] ¶ Dresch and colleagues.[66] # Rated down 1 level owing to serious issues of risk of bias. ** Rated down 2 levels owing to very serious issues of imprecision. †† Using a threshold of 0.38%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit of hybrid resin composite. ‡‡ Rated down 1 level owing to serious issues of indirectness when used to inform clinical recommendations for Class II restorations for moderate and advanced caries lesions on vital posterior permanent teeth. §§ Using a threshold of 0.51%, the lower bound of the confidence interval suggests an important difference favoring nanocomposite, whereas the upper bound suggests an important benefit of hybrid resin composite.

eTable 39. Absolute effects (95% CI) and certainty of the evidence for resin-modified glass ionomer cement compared with conventional glass ionomer cement for root surface caries lesions on vital anterior and posterior permanent teeth combined.

OUTCOME (FOLLOW-UP, MO)*	RESTORATIONS, NO.	STUDIES (PARTICIPANTS), NO.	ABSOLUTE EFFECT, RISK DIFFERENCE (95% CI)	ANTICIPATED ABSOLUTE EFFECTS, 95% CI	CERTAINTY OF THE EVIDENCE (GRADE†)	WHAT HAPPENS
Restoration Failure‡ (12-24)	147	1 randomized controlled trial (not reported)§	0.01 (−0.11 to 0.13)	11 fewer to 13 more	Low¶,#	Among participants receiving resin-modified glass ionomer cement restorations, there was 1 more event (ranging from 11 fewer to 13 more) of restoration failure per 100 restorations compared with those receiving conventional glass ionomer cement restorations. Resin-modified glass ionomer cement may increase the risk of experiencing restoration failure by a negligible amount compared with conventional glass ionomer cement.

* No studies meeting the selection criteria reported data on caries progression, fracture of the crown, full tooth fracture, longevity of the restoration, marginal discoloration or staining, need to treat endodontically, oral health–related quality of life, patient discomfort during treatment, patient or parent satisfaction with treatment, postoperative pain and discomfort, pulp vitality, pulpal complications due to infection, pulpal exposure, restoration fracture, restoration longevity reported in unit of time, restoration loss, restoration survival reported as a hazard ratio, secondary caries, time needed to perform the restoration, tooth loss, unacceptable anatomic form, unacceptable color match, unacceptable marginal adaptation, anaphylaxis, kidney function, neurobehavioral assessment, physical development, or psychosocial function. † The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence are as follows: High certainty: Very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: Moderately confident in the effect estimate; the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: Confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect. Very low certainty: Very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect. ‡ Restoration failure was defined as restoration loss, restoration fracture, and secondary caries by Hayes and colleagues.[76] § Hayes and colleagues.[76] ¶ Rated down 2 levels owing to very serious issues of imprecision. # Using a threshold of 1.51%, the lower bound of the confidence interval suggests an important benefit of resin-modified glass ionomer cement, whereas the upper bound suggests an important benefit of conventional glass ionomer cement.