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REVIEW ARTICLE

Comparative evaluation of restorative materials for class II cavities in posterior teeth: a critical review

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ABSTRACT

Introduction: class II cavities in posterior teeth represent a clinical challenge due to their anatomical complexity and high functional demands.
Objective: to analyze the restorative materials used in Class II cavities, evaluating strength, aesthetics, and durability.
Methods: a systematic review of the scientific literature was conducted across various databases. The search was performed using an algorithm with keywords and Boolean operators, allowing the identification of relevant sources. The selected studies, after applying inclusion and exclusion criteria, were critically analyzed considering timeliness, methodological quality, and thematic relevance, and were integrated into the final synthesis of the review.
Development: silver amalgam showed high mechanical strength and durability, although limited by its aesthetics and the potential toxicity of mercury. Composite resins offer excellent appearance and adhesion, with success rates close to 90 % at ten years, although they present risks of shrinkage and wear. Glass ionomers stand out for releasing fluoride and preventing secondary caries, but their strength is insufficient for definitive restorations. Ceramics, such as lithium disilicate and zirconia, combine superior aesthetics and high strength, although their cost and complex technique limit their use. Advances in bulk-fill resins and hybrid combinations have improved clinical efficiency and reduced microleakage.
Conclusions: the choice of restorative material must consider clinical, functional, and aesthetic factors. Although ceramics meet most excellence criteria, composite resins and modified ionomers remain valid alternatives depending on the clinical context and patient needs.

Keywords: Dental Materials; Evidence-Based Dentistry; Dental Cavity Preparation; Dental Restoration, Permanent.

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INTRODUCTION

In operative dentistry, dental restorations play a crucial role, as they focus on repairing and reconstructing teeth affected by trauma or, more commonly, by caries. Within this field, it is essential to consider the different types of cavity preparations based on the affected tooth structure. Class II cavities typically involve the proximal surfaces of posterior teeth—especially molars and premolars—and restoring them requires specific techniques and materials to achieve a proper restoration that fulfills both functional and aesthetic requirements.[1]

Among the most well-known and commonly used materials for this type of cavity is silver amalgam. For many years, it was the material of choice due to its durability and resistance to wear. Silver amalgam is an alloy of mercury with other metallic elements such as silver, tin, and copper, which provide the mechanical strength of the restoration. However, this material has disadvantages, including poor aesthetics, biocompatibility concerns, and the potential toxic effects of mercury on the patient.[2]

Another widely used material is composite resin, composed of a resin matrix filled with inorganic particles, providing a natural tooth-like appearance. In recent years, technological advances have significantly improved its wear resistance, handling, and adhesion. Nevertheless, it may still present limitations, such as reduced long-term wear resistance—particularly in posterior teeth subjected to higher masticatory forces.[3]

Glass ionomer cement is another material used for Class II cavity restorations. It consists of a mixture of fluoroaluminosilicate glass and polyacrylic acid, enabling fluoride release. This fluoride release helps prevent secondary caries—a significant benefit for patients—yet glass ionomers exhibit inadequate wear resistance and suboptimal aesthetics. Additionally, inlays fabricated from materials such as lithium disilicate or zirconia offer superior aesthetics by closely mimicking natural tooth appearance. However, important considerations include treatment cost and fabrication time.[4]

Given these points, a comparative analysis of the various restorative materials used for Class II cavities is necessary, evaluating their mechanical properties, aesthetics, and resistance to determine the most suitable option based on patient needs. This motivated the present review, which aimed to analyze restorative materials employed in Class II cavities, assessing resistance, aesthetics, and durability.

METHODS

This study was conducted as a systematic literature review following the PRISMA 2020 guidelines to ensure transparency, reproducibility, and methodological rigor. The search period spanned from 2010 to 2024 to capture the most relevant advances in restorative materials for Class II cavities in posterior teeth.

Information sources included widely recognized biomedical databases: PubMed/MEDLINE, SciELO, ScienceDirect, Google Scholar, LILACS, and BVSALUD. Secondary references from selected articles and grey literature from institutional repositories and conference proceedings were also reviewed to broaden the identification of relevant studies and minimize publication bias.

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The search strategy employed an algorithm combining keywords and Boolean operators. MeSH and DeCS terms such as "Dental Restoration," "Class II Cavities," "Posterior Teeth," "Composite Resins," "Glass Ionomer," and "Ceramic Restorations" were combined using AND and OR operators to maximize sensitivity and specificity. Publications in Spanish, English, and Portuguese were included to integrate evidence from diverse clinical and linguistic contexts.

Inclusion criteria encompassed original articles, clinical trials, cohort studies, case reports, and systematic reviews published within the defined timeframe that directly addressed the evaluation of restorative materials in Class II cavities. Duplicates, articles without full access, irrelevant documents, publications prior to 2010, as well as letters, editorials, clinical practice guidelines, and theses were excluded.

The selection process occurred in several phases: initial title and abstract screening to exclude non-relevant studies, followed by full-text evaluation of potentially eligible articles. Initially, approximately 337 records were identified; after removing duplicates and applying exclusion criteria, the sample was reduced to 224 articles; finally, 10 studies were included in the qualitative synthesis. The procedure was documented using a PRISMA flow diagram (Figure 1), illustrating each selection stage.

Data extraction and analysis were performed systematically, collecting key variables such as author, publication year, methodological design, type of restorative material, sample characteristics, and main outcomes regarding resistance, aesthetics, and durability. Information was organized into comparative matrices to facilitate interpretation. A qualitative synthesis was conducted, as methodological and outcome heterogeneity precluded formal meta-analysis. This approach enabled integration of available evidence and provided a critical, up-to-date overview of the advantages and limitations of restorative materials used in Class II cavities in posterior teeth.

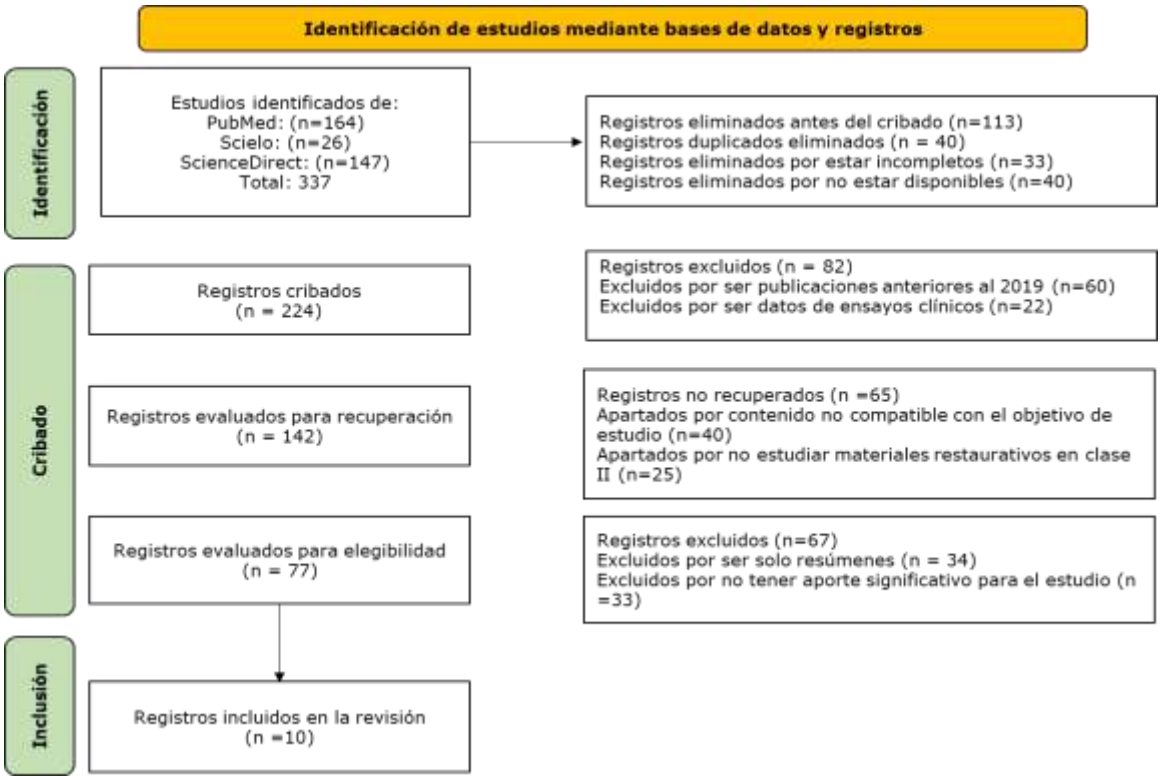

Fig. 1 Flow diagram.

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DEVELOPMENT

Class II cavities in posterior teeth represent a significant clinical challenge due to the anatomical complexity of these structures and the high functional demands they endure during mastication. In this context, the central objective of this review is to analyze restorative materials used for such cavities, focusing on key aspects such as mechanical strength, aesthetics, and durability. The comparative evaluation of amalgams, composite resins, glass ionomers, and ceramics allows identification of the advantages and limitations of each option, recognizing that the appropriate material selection must respond to both clinical characteristics and the functional and aesthetic needs of the patient.

Table 1. Results from the literature search.

Source	Objective	Results
Hurley (2022)[5]	Identify key characteristics of amalgam use in dental restorations	Amalgam has an average lifespan of 12–15 years and high fracture resistance, even in teeth under heavy masticatory loads. However, due to potential toxicity, it is no longer recommended.
Sanderson (2022)[6]	Analyze amalgam components regarding potential patient toxicity	Despite its advantages, amalgam's mercury content—even in low amounts—raises concerns about cumulative exposure and potential health risks.
Peumans et al. (2021)[7]	Evaluate composite resins as restorative materials	Composite resins now show durability comparable to amalgam, with a 90% success rate over 10 years when properly placed under optimal conditions.
Rosa et al. (2022)[8]	Assess composite resins as restorative materials	Composites are widely used due to technological advances enabling good function and aesthetics, though success depends on cavity condition and clinician technique.
Xingyun et al. (2023)[9]	Describe properties of glass ionomer for dental restorations	Glass ionomer is excellent for provisional restorations; combining it with composites improves aesthetics, function, and secondary caries prevention.
Giordano (2022)[10]	Describe the evolution of dental ceramics, especially lithium disilicate and zirconia	Ceramics offer exceptional aesthetics, biocompatibility, and durability, though use must be tailored to patient needs and clinical context.
Lempel et al. (2023)[11]	Compare composite resins vs. dental ceramics	Both materials are used in modern dentistry; selection depends on clinical case—ceramics preferred for larger defects due to superior aesthetics and function.
Hoffmann et al. (2021)[12]	Analyze advances in bulk-fill composites	Technological innovation has led to modified materials like bulk-fill composites, enabling ideal restorations in less time and with reduced effort.
Molina et al. (2019)[13]	Evaluate composite resin vs. resin-modified glass ionomer	Both show similar clinical performance in proximal caries restorations; however, resin-modified glass ionomer reduces secondary caries risk due to fluoride release.
Haddad et al. (2019)[14]	Compare glass ionomer vs. nanofilled composite regarding microleakage	Nanofilled composites with high filler load and low polymerization shrinkage showed less microleakage; resin-modified glass ionomer performed better in preventing secondary caries.

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Due to their exceptional wear resistance and durability, dental amalgams have been the preferred option for many years and remain ideal for Class II cavities because they withstand intense masticatory forces in posterior teeth. However, their major drawback is poor aesthetics due to their metallic color, which is unattractive—especially in visible areas. In contrast, while glass ionomers offer important benefits, they are more fragile and prone to fracture compared to amalgams.[3]

Composite resins are valued for their excellent aesthetics, as they can perfectly match the natural tooth shade, making them ideal for visible restorations. Their use enables direct adhesion to dental structure through bonding agents, ensuring a hermetic seal and reducing marginal leakage. Additionally, incremental layering placement helps minimize polymerization shrinkage.[15]

Despite significant improvements in strength, composite resins still exhibit greater wear than amalgams and ceramics. Postoperative sensitivity and marginal adaptation can be compromised by polymerization shrinkage. While composites may be effective long-term in low-stress areas, they may be less durable in molars and premolars.[16]

Ceramics are suitable for posterior restorations exposed to significant masticatory forces due to their high resistance to abrasion and wear. They are particularly favored when both aesthetics and strength are priorities. Ceramics offer exceptional aesthetics and high durability—ideal when appearance is crucial—though they are more brittle and costly. In contrast, composite resins are versatile and aesthetic but less durable.[17]

Amalgams, glass ionomers, composite resins, and ceramics each have advantages and limitations. Amalgams remain a solid option for posterior restorations due to their durability; glass ionomers offer biocompatibility and caries-preventive benefits; composite resins provide a versatile and aesthetic solution suitable for various clinical applications; and ceramics deliver superior aesthetics and excellent wear resistance, making them ideal for posterior restorations where appearance matters. Clinical priorities, restoration location, and patient needs must be carefully evaluated before selecting a material. Ultimately, the choice depends on the specific requirements of the patient and the clinical scenario.

CONCLUSIONS

This study evaluated various restorative materials for Class II cavities in posterior teeth, focusing on properties such as resistance, aesthetics, and durability. It can be concluded that all materials present advantages and disadvantages that must be considered during selection. However, dental ceramics fulfill most criteria required for an ideal restorative material. It should be noted that material choice depends on multiple factors, including patient needs and the specific characteristics of the clinical case.

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