

Management Of Allergy And Hypersensitivity Reactions Due To Dental Amalgam - A Scoping Review

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Abstract

Background: Due to its long clinical success, cost, and durability, dental amalgam has been widely employed in restorative dentistry. However, allergic and hypersensitive reactions affecting the oral mucosa, most frequently oral lichenoid lesions and reactions, have been linked to amalgam restorations. Clinically, these lesions often resemble oral lichen planus, making diagnosis and treatment difficult.

Objective: To assess the data that is available at present for managing allergic and hypersensitive reactions associated with dental amalgam restorations.

Methods: A scoping review was conducted using electronic databases including PubMed, Scopus, Web of Science, and Google Scholar. Studies evaluating amalgam-associated oral hypersensitivity reactions, diagnostic approaches, management strategies, and clinical outcomes were included. Data extraction focused on study design, oral condition, triggering allergen, diagnostic methods, interventions performed, and treatment outcomes.

Results: Six studies met the inclusion criteria. Oral lichenoid lesions and oral lichenoid reactions were the most commonly reported manifestations associated with amalgam restorations. Clinical topographical association between lesions and restorations was consistently identified as an important diagnostic criterion. Most studies demonstrated significant clinical improvement or complete healing following removal or replacement of amalgam restorations. Although patch testing showed variable diagnostic value, positive patch test reactions were associated with favourable outcomes in some studies.

Conclusion: Replacement or removal of implicated amalgam restorations appears to be an effective management approach for amalgam-associated hypersensitivity reactions. Clinical lesion topography remains an important diagnostic indicator, while patch testing may serve as an adjunctive tool. Further standardized studies with larger sample sizes are required to establish definitive diagnostic and management guidelines.

Keywords: Dental amalgam, Amalgam restoration, Amalgam restoration replacement, Allergy, Hypersensitivity, Amalgam allergy, Oral lichenoid lesions, Oral lichenoid reaction, Management.

Introduction

Dental amalgam has remained one of the most extensively used restorative materials in operative dentistry for more than a century due to its longevity, ease of manipulation, affordability, and excellent mechanical properties. [1] However, concerns regarding the biocompatibility of amalgam have increased over the years, particularly due to the presence of mercury and other metallic components such as silver, tin, copper, and zinc. [2,3] Although adverse reactions are relatively uncommon, amalgam restorations have been implicated in various allergic and hypersensitivity reactions affecting the oral mucosa. [3,13,16]

Among these reactions, oral lichenoid lesions (OLs) and oral lichenoid reactions (OLRs) are the most frequently reported manifestations associated with dental amalgam. [4,11,15] These lesions often appear as white striations, erythematous patches, erosions, or ulcerative lesions occurring in direct contact with amalgam restorations. [5,6] Clinically and histopathologically, they may closely resemble oral lichen planus, making diagnosis challenging. [4,7] The pathogenesis is believed to involve a delayed type IV hypersensitivity reaction mediated by T lymphocytes against amalgam components, particularly mercury compounds. [2,3]

Several diagnostic approaches have been proposed for identifying amalgam-associated hypersensitivity reactions. Clinical examination demonstrating topographical proximity between lesions and restorations remains one of the most important diagnostic indicators. [4,5,6] Patch testing has also been widely used to identify sensitivity to mercury or amalgam-related compounds, although its predictive value remains controversial. [14,15] Histopathological assessment may assist in excluding dysplastic or other immune-mediated lesions. [4,7]

Management of amalgam-associated oral hypersensitivity reactions has evolved significantly over time. Numerous studies have reported partial or complete resolution of lesions following removal or replacement of amalgam restorations with alternative restorative materials such as composite resin, ceramic restorations, or glass ionomer cement. [4-12] However, the extent of healing varies depending on lesion characteristics, lesion–restoration relationship, and individual immune response. [4,6]

Despite increasing evidence supporting amalgam replacement in selected cases, there remains variability in diagnostic criteria, treatment protocols, and long-term follow-up outcomes. [4,14,15] Therefore, a comprehensive synthesis of the available evidence is necessary to better understand current management strategies and their effectiveness.

This scoping review aims to evaluate the existing literature on allergy and hypersensitivity reactions caused by dental amalgam and to summarize the currently available management approaches and clinical outcomes.

Aim and Objectives

Aim

To review the available evidence regarding the management of allergy and hypersensitivity reactions associated with dental amalgam restorations.

Objectives

1. To identify oral lesions associated with dental amalgam hypersensitivity.
2. To evaluate the diagnostic methods used for identifying amalgam-related allergic reactions.
3. To assess the effectiveness of amalgam replacement or removal in lesion resolution.
4. To analyze the role of patch testing in diagnosis and treatment planning.
5. To summarize the clinical outcomes following various management approaches.

Methodology

Research question

What are the currently available management strategies for allergy and hypersensitivity reactions caused by dental amalgam restorations, and what clinical outcomes are associated with these interventions?

Study Design

This study was designed as a scoping review aimed at mapping the available evidence related to the management of allergy and hypersensitivity reactions caused by dental amalgam restorations.

Eligibility Criteria

Inclusion Criteria

- Studies evaluating oral hypersensitivity or allergic reactions associated with dental amalgam.
- Studies involving oral lichenoid lesions or oral lichenoid reactions.
- Clinical studies, prospective studies, pilot studies, and systematic reviews.
- Studies reporting management interventions and treatment outcomes.

Exclusion Criteria

- Animal studies.
- In vitro studies.
- Studies unrelated to amalgam-associated hypersensitivity.
- Articles without management outcomes.

Search Strategy

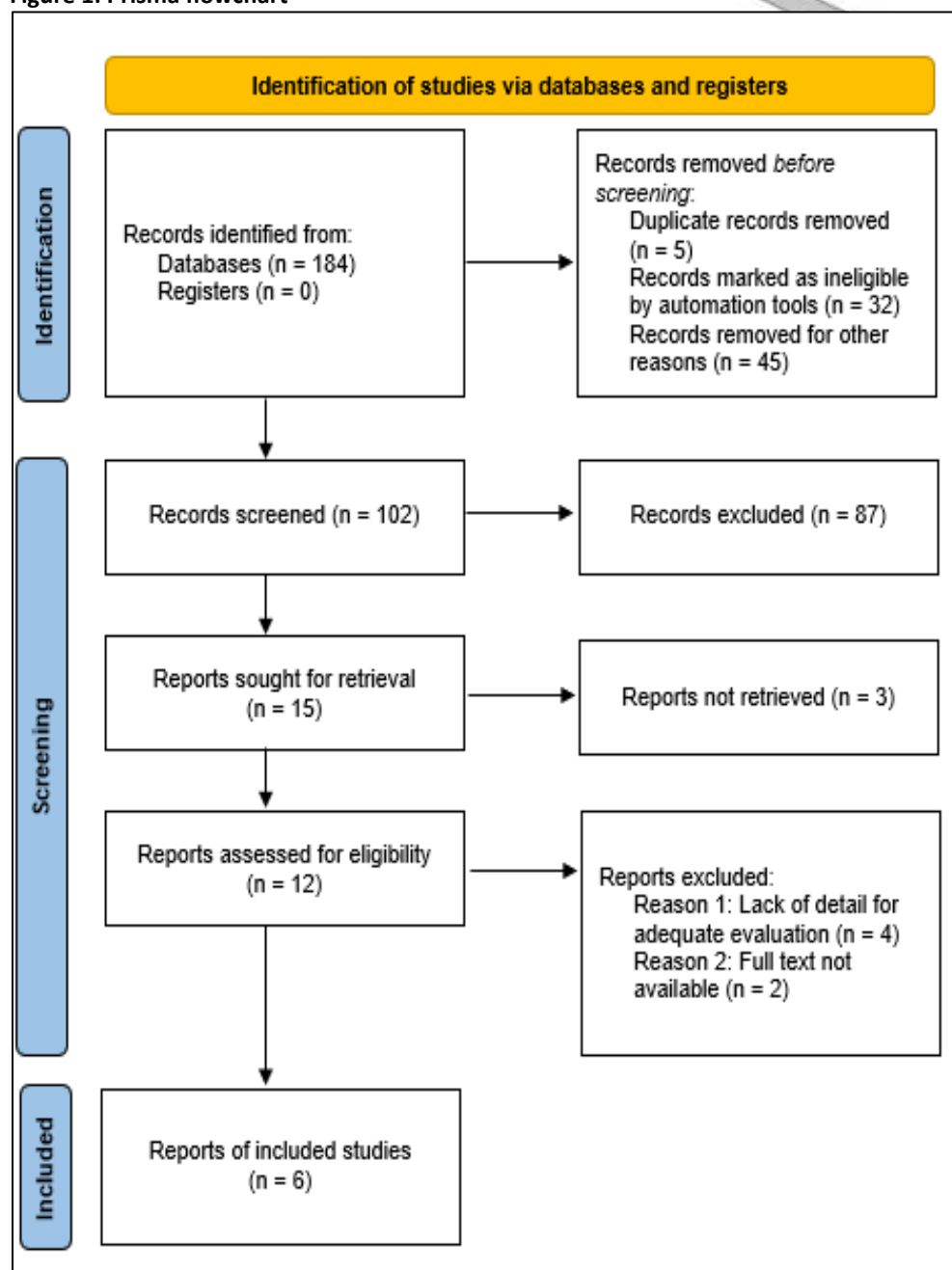
Relevant articles were identified from electronic databases PubMed, Scopus, Web of Science and Google Scholar.

- Search terms included: "Dental amalgam", "Amalgam restoration", "Amalgam restoration replacement", "Allergy", "Hypersensitivity", "Amalgam allergy", "Oral lichenoid lesions", "Oral lichenoid reaction", "Management".

Study Selection

After initial screening of titles and abstracts, full-text review was conducted for eligibility. Prisma flowchart was used for the selection of the studies.

Figure 1: Prisma flowchart



Results

A total of six relevant studies evaluating management strategies for amalgam-associated oral hypersensitivity reactions were included in this review. The majority of studies focused on oral lichenoid lesions and oral lichenoid reactions associated with amalgam restorations.

Clinical assessment demonstrating close topographical relationship between lesions and amalgam restorations was consistently identified as an important diagnostic criterion across most studies. Patch testing was used variably, with some studies reporting positive correlation between patch test positivity and lesion improvement following amalgam replacement.

Table 1: Represents data extracted from the included articles

Sl. No.	Study	Study type	Oral condition	Trigger / allergen	Diagnostic approach	Management / intervention	Main outcome relevant to review
1	Issa Y, Brunton PA, Glenny AM, Duxbury AJ, 2004	Systematic review	Oral lichenoid lesions	Amalgam restorations	Topographic relation $\pm$ patch testing	Replacement of amalgam restorations	Healing/improvement common after replacement; patch testing of limited value
2	Bratel J, Hakeberg M, Jontell M, 1996	Clinical outcome study	Oral lichenoid lesions	Dental amalgam	Clinical diagnosis with relation to restorations	Replacement of restorations	Lesions improved or disappeared in 95% of contact lesions after replacement
3	Dunsche A, Kästel I, Terheyden H, Springer IN, Christophers E, Brasch J, 2003	Clinical study	Oral lichenoid reactions	Dental amalgam	Clinical assessment $\pm$ patch testing	Amalgam removal	97.1% benefited from amalgam removal regardless of patch test results
4	Montebugnoli L, Venturi M, Gissi DB, Cervellati F, 2012	Prospective study	Lichenoid oral lesions	Amalgam	Clinical and histologic assessment, patch testing	Amalgam removal	Complete clinical healing occurred in some patients and related to lesion topography and positive patch test
5	Lartitegui-Sebastián MJ, et al., 2012	Prospective pilot study	Oral lichenoid lesions	Amalgam restorations	Clinical relation to restorations	Replacement of amalgam	Improvement at 3 months and complete resolution in all lesions by 6 months in reported cohort
6	Karatasli B, et al., 2019	Clinical interventional study	Oral lichenoid lesions	Amalgam restorations	Clinical diagnosis and lesion contact assessment	Replacement with feldspathic ceramic inlay-onlay restorations	Healing seen especially when restorations were in close contact with lesions

Issa et al. conducted a systematic review evaluating oral lichenoid lesions associated with amalgam restorations and observed that replacement of amalgam restorations commonly resulted in lesion improvement or complete healing. [4] The authors also highlighted the limited but supportive role of patch testing in diagnosis.

Bratel et al., demonstrated that replacement of amalgam restorations resulted in clinical improvement or disappearance of lesions in approximately 95% of contact lesions. [5] Similarly, Dunsche et al., reported that 97.1% of patients benefited from amalgam removal regardless of patch test outcomes, emphasizing the therapeutic value of restoration replacement. [6]

Montebugnoli et al. observed complete clinical healing in several patients after amalgam removal, particularly in lesions exhibiting positive patch tests and direct topographical association with restorations. Lartitegui-Sebastián et al. further reported complete lesion resolution within six months following amalgam replacement in their prospective pilot cohort. [7,8]

Karatsali et al. evaluated replacement using feldspathic ceramic inlay-onlay restorations and demonstrated favorable healing outcomes, especially in lesions closely associated with amalgam surfaces.

Overall, the included studies consistently indicated that replacement or removal of amalgam restorations is associated with significant clinical improvement in patients presenting with amalgam-associated hypersensitivity reactions.

Discussion

Dental amalgam has been used extensively in restorative dentistry for decades because of its durability, affordability, and satisfactory mechanical performance. [1,13] Despite these advantages, concerns regarding its biocompatibility and potential to induce hypersensitivity reactions have persisted in the literature. [2,3] The present scoping review evaluated the currently available evidence regarding allergy and hypersensitivity reactions associated with dental amalgam restorations and the various management strategies employed for these lesions.

The findings of the included studies demonstrated that oral lichenoid lesions and oral lichenoid reactions represent the most frequently reported manifestations associated with amalgam hypersensitivity. [4,5,6] These lesions commonly occur adjacent to amalgam restorations and clinically present as reticular, erosive, plaque-like, or ulcerative lesions. [11,16] Several authors have previously emphasized that oral lichenoid lesions associated with amalgam may closely resemble oral lichen planus both clinically and histopathologically, thereby complicating diagnosis. [4,7,17] However, unlike classic oral lichen planus, amalgam-associated lesions are often unilateral and demonstrate a direct topographical relationship with the restoration surface. [5,9,11]

A major observation across the reviewed studies was the consistent clinical improvement following removal or replacement of amalgam restorations. Bratel et al. reported improvement or complete disappearance in nearly 95% of lesions after replacement of amalgam restorations [5], while Dunsche et al. observed therapeutic benefit in more than 97% of patients following amalgam removal [6]. Similar findings were reported by Montebugnoli et al. and Lartitegui-Sebastián et al., who demonstrated significant lesion healing after replacement procedures. [7,8] These observations are in agreement with previous literature suggesting that elimination of the triggering allergenic stimulus results in resolution of the chronic inflammatory response. [8,9,12] Collectively, the evidence strongly supports restoration replacement as the most predictable management strategy in clinically suspicious lesions.

An important observation across the reviewed studies was the diagnostic importance of lesion topography. Lesions directly contacting amalgam restorations showed better treatment response following replacement compared to lesions without clear topographical association. [4,5,6] Several authors have suggested that clinical proximity between lesion and restoration may be more reliable than histopathology alone in identifying amalgam-associated lichenoid reactions. [7,9,11]

The role of patch testing remains controversial. Although positive patch test results were associated with favorable healing outcomes in some studies, others demonstrated lesion improvement even in patch test-negative patients. [4,6] Dunsche et al. reported high rates of clinical improvement irrespective of patch test positivity [6], indicating that patch testing should be considered an adjunctive rather than definitive diagnostic tool. [14,15]

The pathogenesis of amalgam-associated lesions is believed to involve a delayed type IV hypersensitivity reaction mediated by T lymphocytes. [2,3] Mercury and other metallic ions released from amalgam restorations may act as allergens, resulting in localized chronic inflammatory reactions within the oral mucosa. [2,17]

Despite favorable outcomes following amalgam replacement, the available literature shows considerable heterogeneity in diagnostic criteria, patch testing methods, follow-up duration, and replacement materials used. [4,6,14] Most available evidence is based on observational and prospective studies with limited sample sizes. [5,6] Therefore, further standardized multicenter studies are necessary to establish definitive diagnostic and management guidelines for amalgam-associated hypersensitivity reactions.

Conclusion

Dental amalgam-associated allergy and hypersensitivity reactions predominantly present as oral lichenoid lesions occurring adjacent to amalgam restorations. Clinical evidence strongly supports the replacement or removal of implicated restorations as an effective management strategy, resulting in significant lesion improvement or complete healing in most patients. Clinical topographical correlation remains one of the most reliable diagnostic indicators, while patch testing may serve as an adjunctive tool. Future studies with standardized diagnostic criteria and long-term follow-up are necessary to establish evidence-based management protocols for amalgam-associated hypersensitivity reactions.

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