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SYSTEMATIC REVIEW

Non- and minimally invasive management of hypersensitivity in molar-incisor hypomineralisation (MIH) at home and in clinical practice: a systematic review

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Abstract

Purpose The aim of this systematic review was to search the literature to evaluate the effect of various minimally invasive treatments to relieve hypersensitivity in teeth affected by molar-incisor hypomineralisation (MIH).

Methods An electronic search in the databases MEDLINE via PubMed, Cochrane Central, clinicaltrials.gov, SCOPUS and EMBASE was performed in September 2025. The PRISMA guidelines were followed.

Results Of 320 potential articles, seven were included in the systematic review. All were RCTs investigating hypersensitivity reduction measured after application of a remineralising agent or a minimally invasive restorative approach. The agents tested were fluoride toothpaste, hydroxyapatite toothpaste, casein phosphopeptide-amorphous calcium phosphate nano-complexes (CPP–ACP) paste, photobiomodulation (PBM), silver diamine fluoride (SDF), fissure sealants with or without SDF and reinforced glass ionomer filling materials.

Conclusions All tested treatments gave reduced hypersensitivity at follow-up compared to baseline mainly in molars with MIH. However, the evidence is limited due to the few included studies having risk of bias resulting from lack of blinding, small samples and lack of information for previous daily hygiene habits.

Keywords Molar-incisor hypomineralisation · MIH · CPP–ACP · SDF · Hypersensitivity · Silver diammine fluoride · Sealants

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Introduction

Molar-incisor hypomineralisation (MIH) is a common condition with an estimated worldwide average prevalence of 13–15.5% (Ammar et al. 2025; Schwendicke et al. 2018). However, large regional differences are seen with reported prevalences of 26% and 28% in recent studies from Scandinavia and 17.5% in Germany (Gaballah et al. 2025; Haque Afzal et al. 2023; Nørrisgaard et al. 2023). Hypomineralised teeth are characterised by porous enamel that frequently breaks down under normal chewing forces. The porous or fractured enamel may allow microorganisms to penetrate into the dentinal tubules causing low-grade pulpal inflammation rendering teeth hypersensitive to daily stimuli such as tooth brushing, eating and drinking (Fagrell et al. 2008; Rodd et al. 2007). Dental hypersensitivity is often measured using the Schiff Cold Air Sensitivity Scales (SCASS), a four-point scale used to assess the effect of a standardised air blast towards the affected tooth, considered to be a reliable and reproducible method to detect hypersensitivity, although some consider that this method causes undue pain for the child (Schiff et al. 2009). Some studies rely on proxy reports or simply ask the child—in such cases, the VAS scale, Faces Pain Scale or Wong–Baker faces have been used to assess the level of experienced hypersensitivity or pain, as being the appropriate methods for children (Tomlinson et al. 2010). Dental hypersensitivity in teeth with MIH has been reported in several studies, as shown in a recent systematic review and meta-analysis—the included studies demonstrated increased hypersensitivity or toothache in around half of the MIH cases via self-report, proxy report or air-blast using SCASS (Santos et al. 2024). However, the review detected methodological weaknesses in most of the studies leading to a low grade of evidence. In particular, the use of proxy reports by asking the parents whether their child experienced pain or hypersensitivity has the potential to both underestimate and overestimate the findings; and by asking the child, answers might be influenced by recall bias (Santos et al. 2024).

Having MIH may pose a significant problem for many children and dental hypersensitivity and pain has been shown to reduce Oral Health Related Quality of Life (OHRQoL) (Jalevik et al. 2021). OHRQoL is defined as 'a multidimensional construct that reflects (amongst other things) people's comfort when eating, sleeping and engaging in social interaction; their self-esteem; and their satisfaction with respect to their oral health' according to the World Dental Federation (FDI 2016). Several measuring instruments with different approaches exist to assess OHRQoL in children and adolescents (Shields et al. 2024). Using the Child Perceptions Questionnaire (CPQ8-10), a questionnaire developed for children 8–10 years of age, it was found that children with severe MIH had reduced OHRQoL compared to children with milder forms (Gadallah et al. 2024) and children with MIH were more affected than controls (Reissenberger et al. 2022). In the study by Reissenberger and colleagues, children with MIH were divided into one group that had hypersensitive molars and a second group with affected incisors and non-symptomatic molars; both groups had reduced OHRQoL compared to controls, but the largest difference was seen in the group with hypersensitive molars. A negatively affected OHRQoL was also found for children with MIH compared to controls using the Child Oral Health Impact Profile (COHIP-19) (Elhennawy et al. 2022; Sekundo et al. 2024).

Many clinicians are confronted with patients that suffer from MIH-related pain and hypersensitivity, and there is a demand for minimally invasive treatments that can decrease hypersensitivity. Several treatments have been proposed, such as toothpaste, sealer, varnish, photobiomodulation (PBM), silver (diammine) fluoride (SDF) or a covering material. Toothpastes and topical creams containing hydroxyapatite, calcium and phosphate and fluoride claim to promote remineralisation to relieve hypersensitivity. The effect of topical fluoride in remineralising enamel caries is well documented (Gao et al. 2016), and later studies show a positive effect of hydroxyapatite-based materials as well (Chatzidimitriou et al. 2025). However, in teeth with MIH, remineralisation is not an appropriate term, as these teeth were hypomineralised from the beginning. What is sought by using these agents in hypomineralised teeth is a mineral gain that potentially can relieve hypersensitivity, increase enamel strength, and improve appearance. A systematic review showed some evidence that SDF is effective in reducing dentine hypersensitivity in adults, but none of the studies included hypomineralised teeth (Chan et al. 2024). Toothpastes with casein phosphopeptide–amorphous calcium phosphate nano-complexes (CPP–ACP) being widely used with or without fluoride (900 ppm F) to enhance remineralisation in enamel carious lesions have also been proposed in MIH cases to reduce hypersensitivity, however with limited evidence (Cochrane and Reynolds 2012; Somani et al. 2022). Photobiomodulation (PBM) using low-level laser has been used in dentistry for treating dental hypersensitivity for decades with varying, but promising recent results (Cerqueira et al. 2025; Shan et al. 2021).

A systematic review by Somani et al. (2022) evaluated treatment modalities for MIH-affected teeth in children and adolescents and included four studies on hypersensitivity. All studies had concerns regarding risk of bias. No strong evidence for any treatment on hypersensitivity was found; however, the use of fluoride and CPP–ACP-based products seemed to have beneficial effects. Based on the systematic review, a best clinical practice guidance was published by the EAPD (Lygidakis et al. 2022) recommending the use of fluoride-based products along with enhanced oral hygiene instruction and dietary advice. The aim of the present systematic review was to search the literature published after the previous reviews from 2021 to evaluate the effect of various treatments proposed for the relief of hypersensitivity in MIH.

Materials and methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis tool (Page et al. 2021) was used as a guideline in the present systematic review. The review was registered in PROSPERO (2025 CRD420251150485) before starting the data collection.

Research question

The present systematic review of the literature was structured to evaluate current information and evidence regarding the management of hypersensitivity in all MIH teeth, at home, and in clinical practice, using minimally invasive techniques.

Eligibility criteria

Only randomised-controlled trials (RCTs) including cluster RCTs in children and adolescents receiving treatment for MIH were included in the review. The research questions for this systematic review were conducted using PICO characteristics (population, intervention, control, outcome), as follows:

Population: Children and adolescents (6–18 years) with MIH affecting all teeth.

Intervention: Any method for hypersensitivity control with minimally invasive approaches at home and in clinical practice.

Treatments aimed at reducing hypersensitivity in MIH-affected teeth with a minimum of 6 week follow-up.

Comparator/Control: Placebo, no intervention or alternative treatment.

Outcomes: Reduction in hypersensitivity using the Schiff Cold Air Sensitivity Scale (SCASS).

Information sources and research strategies

A systematic search was conducted using the databases: MEDLINE via PubMed, Cochrane Central, clinicaltrials.gov, SCOPUS, EMBASE. The search was performed in September 2025. References of the published articles were also searched to identify studies not identified previously. English language literature since 2021 was searched, as previous studies were thoroughly reviewed by the previous EAPD review (Somani et al. 2022). The following search terms (Boolean) were used for the investigated topic in every database:

((molar incisor hypominerali*ation[MeSH Terms]) OR (MIH[Text Word]) OR (MIH[Title/Abstract]) OR (molar incisor hypominerali*ation[Title/Abstract]) OR (molar incisor hypominerali*ation[Text Word])) AND sensitivity) *filtered for clinical trial*

Studies inclusion and exclusion criteria

Inclusion criteria

Full-text articles published in peer-reviewed journals. Diagnosis of MIH according to established EAPD criteria (Lygidakis et al. 2022). Articles regarding studies in humans written in the English language. Children and adolescents aged 6–18 years diagnosed with MIH. Only randomised-controlled trials (RCT).

Exclusion criteria

MIH diagnosis not in accordance with established by EAPD diagnostic criteria. Publications other than RCTs, as systematic reviews, letters to the editor, case reports, *in vitro* studies, animal studies. Studies without measurable clinical outcomes and those with no comparison with baseline data.

Additionally, studies not using the SCASS for hypersensitivity measurement, and studies with follow-up of less than 6 weeks based on the Cochrane review (Poulsen et al. 2006).

Study selection

Titles and/or abstracts of the initial search were reviewed by two of the authors. The studies selected for inclusion in the review were then assessed by authors (IB, NNL). Any discrepancies were resolved by discussion and if that was not possible, by a third author/reviewer (NAL).

Data extraction

Data were extracted in forms designed for this research. Each study had the following information extracted: publication details (authors, year of publication, design, location of study), sample characteristics (sample size, age of children, MIH severity criteria, sensitivity scale), and outcome.

Risk-of-bias assessment and certainty of evidence

The risk of bias of the included articles was also evaluated by the two authors (IB, NNL), using the Cochrane risk-of-bias tool for randomised trials (RoB 2) (Sterne et al. 2019). Differences occurring during evaluation were discussed and resolved in consultation with a third author (NAL). Moreover, the certainty of current evidence was rated using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) criteria (Guyatt et al. 2025): risk of bias, indirectness, imprecision, inconsistency and publication bias. The two review authors (IB, NNL) independently judged the evidence certainty (high, moderate, low, or very low) and resolved any disagreements by discussion with a third reviewer (NAL).

Results

Search results

In the search for articles on management of hypersensitivity of MIH, a total of 320 articles were identified. After exclusion of duplicates, 293 articles remained for evaluation. After title-abstract screening, 18 articles remained, and 11 articles were subsequently excluded for various reasons (Fig. 1). Evaluation according to the eligibility criteria resulted in seven included articles (Fig. 1, Table 1).

Data characteristics

The main characteristics of the included seven articles are presented descriptively in a summary table with rows representing each article and columns representing the general characteristics (Table 1). All the studies included were RCTs published between 2021 and 2025. All studies recorded hypersensitivity at baseline and at least 6 weeks after application of the intervention using the SCASS. All studies except one, evaluated only MIH molars. The study by Butera et al. (2022) evaluated incisors in addition to molars (Table 1).

Outcomes

All seven RCTs investigated hypersensitivity reduction after application of a remineralising agent or a minimally invasive restorative approach (Table 2). No significant differences between groups were observed in any of the RCTs; however, within groups, there was a reduction in hypersensitivity at certain timepoints for all interventions. In the split-mouth trial comparing 38% silver diammine fluoride (SDF) with CPP–ACPF varnish, hypersensitivity did not differ between groups at any of the recall visits. In addition, all participants received oral hygiene instructions, dietary advice, toothbrushes and 1000 ppm fluoride toothpaste. Oral hygiene habits before the study started were not reported. There were statistically significant within-group reductions from baseline to 3 and 6 months in both groups, but no change from 9 to 12 months (Al-Nerabieah et al. 2024). In the three-arm RCT of Photobiomodulation (PBM) vs Fuji TRIAGE

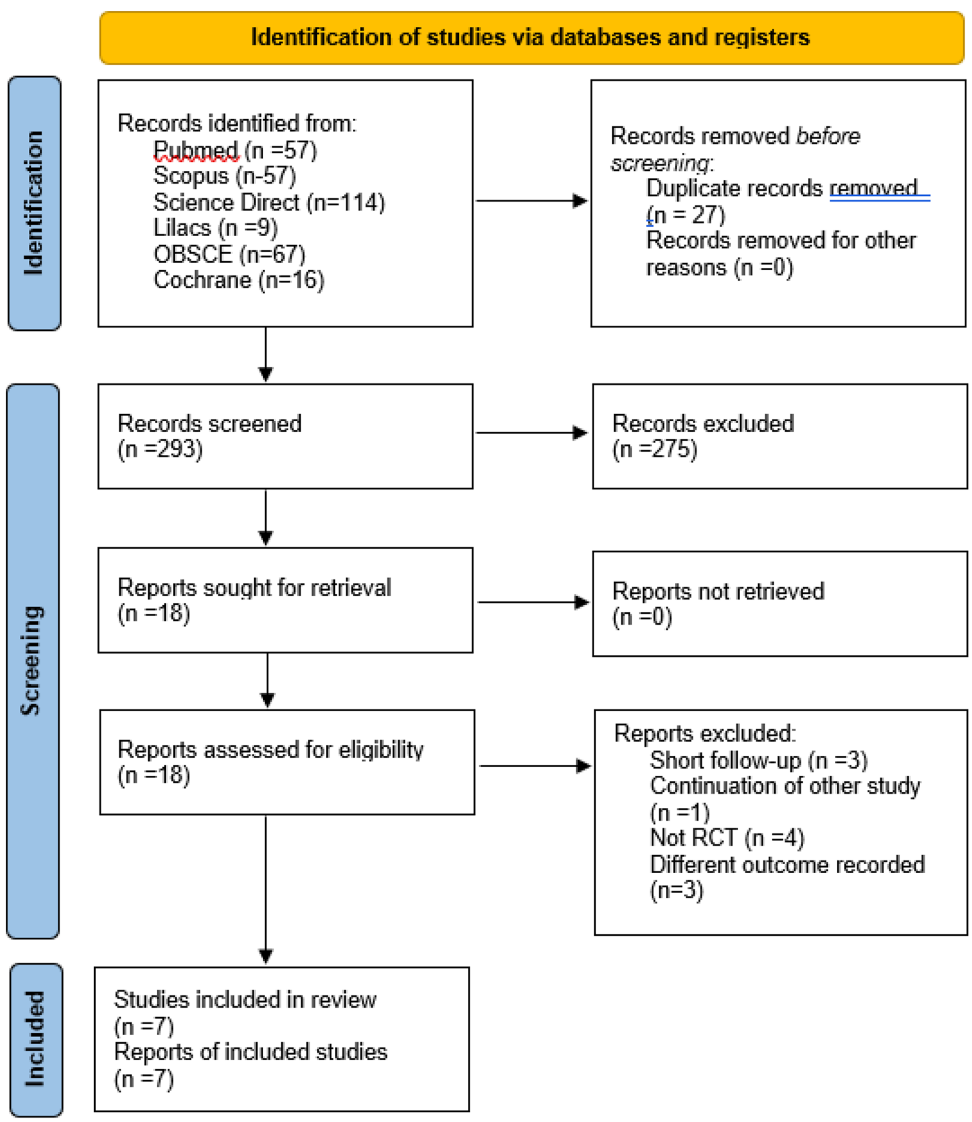

Fig. 1 PRISMA flow diagram. Source: Page MJ, et al. BMJ 2021;372:n71. https://doi.org/10.1136/bmj.n71. This work is licenced under CC BY 4.0. To view a copy of this licence, visit (https://creativecommons.org/licenses/by/4.0/)

Table 1 Summarised characteristics of included trials

Author, year, country	Subjects (age, number, number of teeth)	Study design and duration	MIH severity criteria	Inclusion criteria	Sensitivity scale	Treatment performed
Butera et al. (2022), Italy	6–10 years old $n = 25$ 18 FPM, 32 incisors	RCT, split mouth, 9 months	MIH-TNI	SCORES 2A,4A of MIH-TNI	SAI	HA toothpaste vs control (no intervention)
Ehlers et al. (2021), Germany	6–16 years old $n = 21$ C: 25 FPM, I:23 FPM	RCT, 56 weeks	Not recorded	tactile stimulus scoring > 0 on WBFS, 2 or 3 on SCASS	SCASS, WBFS, VAS	Microcrystalline Hydroxyapatite toothpaste vs control toothpaste
Al-Nerabieah (2024), Syria	6–9 years old $n = 100$ 200 FPM	RCT, split mouth, 1 year	EAPD criteria	mildly affected by MIH	SCASS	SDF vs CPP–ACPF varnish
Ballikaya et al. (2022), Turkey	6–13 years old $n = 45$ 106 FPM	RCT, split mouth, 1 year	EAPD criteria	2 or 3 on SCASS	SCASS	SDF vs SMART sealants
Saad et al. (2024), Egypt	6–10 years old $n = 28$ 56 FPM	RCT, 12 months	No criteria, moderate and severe	ICDAS 3–5	SCASS	SMART vs HVGIC Both used MI paste® after
Baraka et al. (2025), Egypt	6–8 years old $n = 45$ 45 FPM	3 arm RCT, 6 months	EAPD diagnostic criteria; hypersensitive FPMs	EAPD diagnostic criteria; hypersensitive FPMs SCASS ≥2	SCASS + Wong Baker FPS	PBM vs Fuji TRIAGE® vs Fisseal®
Mahfouz et al. (2025), Egypt	7–10 years old $n = 88$ 88 FPM	RCT, 12 months	MIH-TNI scores 2a, 2b, 4a, 4b	carious molars ICDAS 5–6	SCASS	ZrGIC vs GhGIC

RCT randomised-controlled trial, *C* control, *FPM* first permanent molar, *TNI* treatment need index, *SCASS* the Schiff Cold Air Sensitivity Scales, *FPS* Faces pain scale, *WBF* Wong–Baker faces, *VAS* Visual analogue scale, *SDF* Silver diammine fluoride, *SMART* Silver modified atraumatic restoration, *CPP–ACPF* casein phosphopeptide–amorphous calcium phosphate nano-complexes, *PBM* Photobiomodulation, *HA* Hydroxyapatite

(GC Corp., Japan) vs. Fisseal (Promedica GmbH, Germany), no between-group differences were detected for SCASS at any timepoint; by the end of the study at 6 months, all groups had similarly low scores. All participants were also instructed to floss and brush teeth regularly with fluoride toothpaste. Previous oral hygiene habits were not reported. All three groups showed significant within-group decreases over time in SCASS and Wong–Baker Faces Pain Rating Scale (FPS) over 6 months (Baraka et al. 2025). In addition, OHRQoL increased in all groups after the intervention measured by a significantly reduced $CPQ_{8\text{-}10}$ score. For SDF vs. SMART sealants, the 1-year results likewise showed no between-group difference in SCASS at 12 months (Ballikaya et al. 2022). In the RCT comparing zirconia-reinforced glass ionomer cement (GIC) (ZrGIC) with glass-hybrid GIC (GhGIC) in carious and hypomineralised teeth with and without hypersensitivity, 12-month hypersensitivity medians were comparable, with $p = 0.344$ for the between-group difference. Reduction in hypersensitivity vs. baseline was statistically significant at most recalls for both materials (Mahfouz et al. 2025). However, the caries treatment is a confounding factor that may also affect the measured reduction in hypersensitivity. The toothpaste trial (microcrystalline hydroxyapatite vs. amine fluoride) was designed for non-inferiority; at 56 days (final), hydroxyapatite was non-inferior to regular toothpaste containing amine fluoride in the Intention-To-Treat analysis but not in the per-protocol analysis, and non-inferiority was not demonstrated. Study results show descending, but no statistically significant SCASS figures over time in both groups (Ehlers et al. 2021). In the split-mouth study of a zinc hydroxyapatite paste vs. no paste, hypersensitivity using the Schiff Air Index improved early in the test sites; the authors concluded that there was no difference in hypersensitivity between-groups at the final recall of 9 months. Test teeth had a significantly lower hypersensitivity at 1 and 3 months vs. baseline; control teeth showed no statistically significant within-group change (Butera et al. 2022). In the silver-modified atraumatic restorative treatment (SMART) vs. GIC and fluoride varnish split-mouth trial, hypersensitivity decreased over time in all subgroups and pairwise within-group tests showed no further change between 6 and 12 months; the authors did not report a clear between-group difference in hypersensitivity at 12 months (Saad et al. 2024). However, the presence of

Table 2 Summarised results of included trials

Author, year	Method	Treatment group	Hypersensitivity before treatment: mean (SD)	Hypersensitivity after treatment: mean (SD)	*p* value: total hypersensitivity reduction	P value: difference in hypersensitivity reduction: control and study group
	Toothpastes					
Butera et al. 2022	Toothpaste	HA toothpaste	SAI: 8% score 0, 16% score1, 24% score2, 52% score3	SAI 9 months: 84% score0, 16% score1	$p < 0.05$	$p < 0.05$
		Control	SAI: 12% score 0 8% score1, 24% score2, 56% score3	SAI 9 months: 16% score0, 44% score1, 40% score2		18 molars only
Ehlers et al. 2021	Toothpaste	HA toothpaste	WBFS mean 5.6; SCASS grade 2.2	WBFS mean 2.6; SCASS grade 1 (56d)	$p < 0.05$	NS (non-inferior)
		Amine fluoride toothpaste	WBFS mean 5.1; SCASS 2	WBFS mean 3.4; SCASS grade 0.96 (56d)	$p < 0.05$	Regular toothpaste works just as well
	Varnish and/or seal					
Al-Nerabieah et al. 2024	SDF vs varnish	38% SDF	SCASS baseline mean rank 16	SCASS mean rank 11 (12 months)	$p < 0.05$	$p = 0.122$ (NS)
		CPP–ACPF varnish	SCASS baseline mean rank 15	SCASS mean rank 10 (12 months)	$p < 0.05$	
Ballikaya et al. 2022	Sealants	SDF	SCASS: 1.77 (0.83)	SCASS: 0.15 (0.38)	$p < 0.001$	$p < 0.05$
		SMART	SCASS: 1.77 (0.83)	SCASS: 0.08 (0.28)	$p < 0.001$	
Baraka et al. 2025	PBM & sealants	PBM	SCASS 1.88±0.93; FPS 3.00±1.12	SCASS 0.58±0.94; FPS 1.00±1.37 at 6 months	$p < 0.001$	NS
		low viscosity GIC (Fuji TRIAGE®)	SCASS 2.47±0.52; FPS 2.40±1.06	SCASS 0.60±1.06; FPS 1.20±1.66 at 6 months	$p < 0.001$	
		Resin based fissure seal (Fisseal®):	SCASS 1.69±0.63; FPS 2.77±1.01	SCASS 0.46±0.88; FPS 1.15±1.52 at 6 months	$p < 0.001$	
	Restorations					
Mahfouz et al. 2025	Restorations (ART)	ZrGIC (Zircono-mer®)	Median Q3 7.0 1y	Median Q3 5.0 1 year	$p < 0.05$	$p = 0.344$
		GhGIC (Equia Forte®)	Median Q3 6.0 1y	Median Q3 3.5 1 year	$p < 0.05$	
Saad et al. 2024	SMART vs conventional	SMART (SDF + HVGIC)	SCASS Median 3 for Severe and 1.5 for moderate	median 0 at 1 year	$p < 0.001$	NS
		HVGIC + fluoride varnish	SCASS Median 3 for Severe and 1.5 for moderate	median 0 at 1y	$p < 0.001$	

SCASS the Schiff Cold Air Sensitivity Scales, *FPS* Faces pain scale, *WBF* Wong–Baker faces, *VAS* Visual analogue scale, *SDF* Silver diammine fluoride, *SMART* Silver modified atraumatic restoration, *CPP–ACPF* casein phosphopeptide–amorphous calcium phosphate nano-complexes, *PBM* Photobiomodulation, *HA* Hydroxyapatite, *ZrGIC* zirconia-reinforced GIC, *GhGIC* Glass-hybrid GIC, *HVGIC* High-viscosity GIC, *NS* Not significant caries lesions in the treated teeth may be a confounder as the treatment of caries per se might be the factor to decrease hypersensitivity.

Risk-of-bias assessment and certainty of evidence

Risk-of-bias assessment using the Cochrane RoB2 tool showed that two of the seven trials had overall low risk of bias, whilst five had some concerns (Fig. 2). However, the GRADE analysis (Table 3) shows in detail that there is low certainty of evidence for the effectiveness of desensitising agents on hypersensitivity in MIH. Risk-of-bias assessment using the Cochrane RoB 2 tool showed that two of seven trials had overall low risk of bias, whilst five had some concern (Fig. 2).

Discussion

The seven RCTs analysed in the present review collectively highlight the efficacy of both mineralising agents, fluoride and hydroxyapatite toothpaste and minimally invasive restorative or sealant-based approaches for achieving sustained hypersensitivity reduction compared to baseline.

Hydroxyapatite-based materials showed promising results in desensitising MIH-affected teeth. One clinical trial reported significantly reduced hypersensitivity after 3 months of hydroxyapatite toothpaste use, whilst in another study, hydroxyapatite toothpaste was probably non-inferior to regular fluoride toothpaste (Butera et al. 2022; Ehlers et al. 2021). Al-Nerabieah et al. (2024) demonstrated that both 38% SDF and fluoride varnish with CPP–ACP effectively reduced hypersensitivity over 9 months. These results align with prior systematic reviews indicating that both bioactive calcium phosphate and silver-based agents may occlude dentinal tubules and enhance mineralisation (Hjertberg et al. 2025; Somani et al. 2022), mechanisms that collectively can help the protection of the pulp from sensitising stimuli.

Another RCT compared PBM with GIC and resin-based sealants and concluded that all approaches significantly decreased SCASS, with PBM and resin sealants maintaining superior long-term effects (Baraka et al. 2025). Consistent with these findings, a systematic review by Rhaiem et al. (2025) concluded that PBM, as a protective barrier, offers promising pain reduction benefits in MIH, although further standardisation of wavelength and dosage is required (Rhaiem et al. 2025).

Ballikaya et al. (2022) and Saad et al. (2024) both reported that SDF and SMART significantly reduced pain and maintained restoration integrity up to 12 months (Ballikaya et al. 2022; Saad et al. 2024). Likewise, Mahfouz et al. (2025) found that ZrGIC achieved similar hypersensitivity reduction and success rates to GhGICs, confirming the sustained desensitising capability of ion-releasing restorative materials (Mahfouz et al. 2025). However, no comparison to other restorative materials was included, leaving a question of whether the material itself or the covering of the surface was giving the effect. Also, the presence and treatment of caries lesions may affect hypersensitivity and must be regarded as confounding factors in these studies (Mahfouz et al. 2025; Saad et al. 2024). Altogether these outcomes correspond with the EAPD (2022) best practice guidance, which endorses fluoride varnishes, GICs, and minimally invasive restorative methods as first-line management for MIH hypersensitivity (Lygidakis et al. 2022).

Additionally recent systematic reviews have highlighted the utility of CPP–ACP, SDF, and GICs for symptomatic control and structural stabilisation but emphasised limited high-quality data (Hjertberg et al. 2025; Somani et al. 2022). The current review reinforces these findings with more recent RCTs demonstrating measurable and lasting hypersensitivity reduction. Moreover, the integration of PBM as an adjunct represents a significant advance beyond earlier studies. However, evidence is still of low quality despite the new RCTs that have been published.

A recent meta-analysis report identified a 45% prevalence of hypersensitivity or toothache amongst patients diagnosed

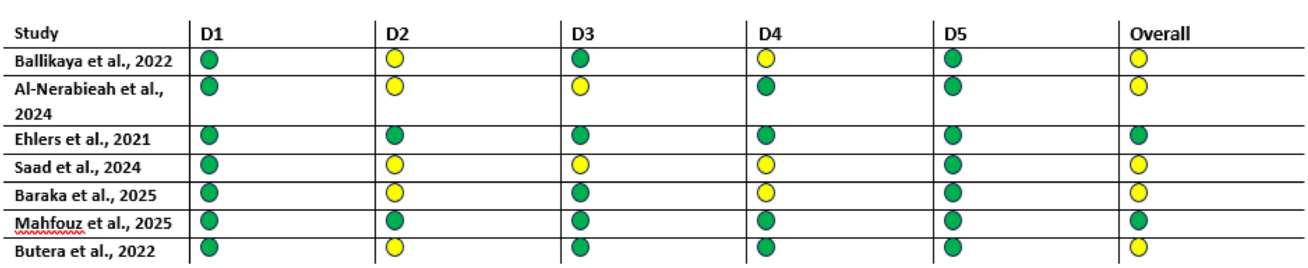

Fig. 2 Risk-of-bias assessment of included randomised-controlled trials using the Cochrane RoB 2 tool. Green: Low risk of bias, Yellow: Some concerns. D1=Risk of bias from the randomisation process, D2=Risk of bias due to deviations from the intended interventions, D3=Risk of bias due to missing outcome data, D4=Risk of bias in measurement of the outcome, D5=Risk of bias in selection of the reported result

Table 3 Summary and details of GRADE evidence

Outcome (scale)	Comparison	No. of studies	Findings at final timepoint	Reasons for rating	Certainty (GRADE)
Hypersensitivity reduction (SCASS)	Various active interventions vs active comparators (toothpastes, SDF/SMART, sealants GIC/resin, PBM)	7 RCTs	Consistent within-group improvement across arms; between-group differences mostly non-significant at final follow-up	Downgraded for risk of bias (− 1): several trials with unblinded operators/participants in procedural arms, split-mouth carryover potential, or unclear assessor blinding. Downgraded for imprecision (− 1): small samples and wide/NS between-group effects at final timepoints. Downgraded for indirectness (− 1): No information on previous hygiene habits and use of fluoride toothpaste. No downgrades for inconsistency; publication bias undetected/unclear	⨁⨁◯◯ Low

Details of GRADE evidence rating

Risk of bias → downgraded one level. Five of seven trials had RoB 2 "some concerns," chiefly unblinded operators/participants in procedural arms (Butera et al. 2022; Saad et al. 2024; Baraka et al. 2025; Ballikaya et al. 2022), split-mouth designs with potential carryover (Al-Nerabieah et al. 2024; Butera et al. 2022; Saad et al. 2024; Ballikaya et al. 2022), and unclear assessor blinding (Saad et al. 2024; Baraka et al. 2025; Ballikaya et al. 2022). These issues may overestimate within-group improvement and/or attenuate between-group differences; for this reason, we downgraded one level for risk of bias

Inconsistency → not downgraded. Across trials, the direction of effect is coherent (within-group hypersensitivity decreases), and the frequent lack of between-group superiority is itself consistent; heterogeneity in interventions, follow-up times, and scales precluded pooling but did not produce conflicting effects

Indirectness → downgraded one level. Populations (children with MIH), interventions/comparators (toothpastes, SDF/CPP–ACP varnish, PBM/sealants, GI restorations), and outcomes (WBFS) directly match the question. Lack of report of previous oral hygiene habits and use of fluoride toothpaste (Al-Nerabieah et al. 2024; Baraka et al. 2025; Butera et al. 2022; Ehlers et al. 2021; Ballikaya et al. 2022; Mahfouz et al. 2025; Saad et al. 2024)

Imprecision → downgraded one level. Most trials are small with few participants/teeth per arm, and several report non-significant between-group effects at the final timepoint, indicating that the optimal information size is not met

Publication bias → undetected/unclear. With only a few small RCTs and heterogeneous designs, formal assessment is not informative; trial registration exists for some studies, but small-study effects cannot be excluded, so we did not downgrade with MIH (Santos et al. 2024). Furthermore, individuals with severe MIH exhibited a significantly increased risk, approximately four times higher, of experiencing these symptoms compared to those with mild MIH (odds ratio = 4.38; $p = 0.03$). These findings confirm the substantial clinical burden associated with MIH and reinforce the imperative for early desensitisation and preventive, regarding PEB and caries lesion development, interventions.

Limitations

Most trials had limited sample sizes, inadequate control groups, heterogeneous MIH severity rating, and rather short follow-up periods. None of the studies reported oral hygiene habits or the use of fluoride products before the intervention. This represents a potential source of reporting bias, as part of the observed effect could have resulted from study participation and oral hygiene instructions rather than the intervention itself. In particular, in the study by Butera and colleagues (2022), both the intervention group and the control group using regular fluoride toothpaste demonstrated similar effects. In the other studies, a control group brushing with regular fluoride toothpaste only was not included. In addition, only one of the included studies evaluated the effect of the intervention on OHRQoL (Baraka et al. 2025).

Future trials should explore a combination of protocols such as SDF + PBM or CPP–ACP + sealant applications in addition to including an appropriately selected control group. How the intervention affects OHRQoL should also be evaluated using a validated tool. Long-term and cost-effectiveness analyses will additionally help to refine clinical management guidelines.

In addition to the included studies, the search strategy also had some limitations. The symptoms in the search strategy were limited to “sensitivity”. This included studies reporting “hypersensitivity” also, but we might have missed studies using terms as “pain” or “toothache”. Future systematic reviews should consider including these terms. Also, as this was an update of a previous SR (Somani et al. 2022), studies published before 2021 were not included in the present review. That is a limitation, as three more RCTs mentioning treatments for hypersensitivity in MIH were included in the previous SR. However, these were not readily comparable to the newer RCTs leaving evidence for the treatment still of low quality. In addition, the study by Somani et al. (2022) also included non-RCT studies making the previous search broader. Studies published in other than English language were not included in the search, which may have excluded important studies. To compare results of interventions and to avoid proxy reports, the use of SCASS in reporting was a criterion; however, this might have decreased the specificity of the search.

Conclusions

Consistent across the randomised-controlled trials and other systematic reviews was the observation that bioactive potentially remineralising agents (hydroxyapatite, CPP–ACP, SDF), sealants, and PBM can reduce hypersensitivity in MIH-affected teeth compared to baseline, even though the evidence is still low. These approaches—minimally invasive, biocompatible, and patient-friendly—should be considered as first-line measures to alleviate hypersensitivity and improve quality of life in affected children.

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Author contributions Ferranti Wong and Nick A. Lygidakis conceived the idea. Ingvild J. Brusevold, Nikos N. Lygidakis, and David Gillam did the study selection, data extraction, and screened the papers. Ingvild J. Brusevold and Nikos N. Lygidakis drafted the paper. Ferranti Wong, David Gillam, Nick A. Lygidakis, and David Manton reviewed and revised the paper. All authors approved the final version.

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