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SYSTEMATIC REVIEW

Effectiveness of different anaesthetic techniques, agents and adjunctive interventions in handling pain during dental treatment of MIH-affected teeth: a systematic review

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Abstract

Background Molar incisor hypomineralisation (MIH) is frequently associated with hypersensitivity, dental anxiety and reduced efficacy of local anaesthesia, complicating pain control during dental treatment in children.

Aim To evaluate, based exclusively on randomised controlled trials (RCTs), the effectiveness of different local anaesthetic techniques, agents and adjunctive interventions in reducing pain during dental treatment of MIH-affected teeth in children.

Methods A systematic review was conducted following PRISMA 2020 guidelines and registered in PROSPERO (CRD420251150485). MEDLINE, Cochrane Central, ScienceDirect, SCOPUS, EBSCO, and LILACS were searched up to September 2025. Eligible studies were RCTs involving children and adolescents (6 – 18 years-of-age) with MIH, assessing pain outcomes during dental procedures. Risk of bias was assessed using the Cochrane RoB 2 tool, and certainty of evidence was evaluated using the GRADE approach.

Results Eight RCTs were included. Low-certainty evidence suggested that intraosseous anaesthesia and 4% articaine may reduce intra-operative pain compared with conventional techniques or 2% lidocaine. Adjunctive cryotherapy and pre-emptive ibuprofen showed potential benefits, but evidence was of very low certainty and limited to single trials. Findings for photobiomodulation were inconsistent across studies. Most trials were judged to be at high risk of bias, primarily due to lack of blinding and reliance on subjective pain outcomes.

Conclusion Current evidence supporting specific pain management strategies for MIH-affected teeth is limited and of low certainty. Whilst 4% articaine and intraosseous anaesthesia appear promising, well-designed, adequately powered RCTs with standardised pain outcomes are required to inform robust clinical recommendations.

Keywords Molar incisor hypomineralisation · MIH · Pain management · Local anaesthesia · Paediatric dentistry

Introduction

Molar incisor hypomineralisation can have profound clinical and psychosocial consequences for affected children. MIH-affected teeth are structurally compromised, predisposing them to post-eruptive enamel breakdown, increased caries lesion development, hypersensitivity, and behavioural and restorative challenges (Lygidakis et al. 2022; Somani et al. 2022; Afzal et al. 2024). Also, hypersensitivity to thermal, mechanical and osmotic stimuli often interferes with daily

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functions such as eating and oral hygiene. Dental hypersensitivity is highly prevalent in MIH-affected teeth, with recent meta-analytic evidence reporting prevalence estimates of approximately 45% at patient level and 22% at tooth level, with higher rates in more severely affected first permanent molars (FPMs) and when assessed using air stimulation (Santos et al. 2024). This hypersensitivity, especially affecting the FPMs, compounded by inadequate local anaesthetic (LA) efficacy, often attributed to chronic low-grade pulpal inflammation and the porous nature of hypomineralised enamel, may increase dental anxiety in children (Bekes et al. 2020; Jälevik et al. 2022; Afzal et al. 2024). Consequently, behaviour during treatment may deteriorate, and the quality of restorative care may be compromised, in addition to potential behavioural issues at subsequent treatment visits (Jälevik et al. 2022; Lygidakis et al. 2022).

Conventional LA techniques, such as buccal infiltration or inferior alveolar nerve block, may provide inadequate pain relief in MIH-affected teeth regardless of the anaesthetic agent used, likely due to pre-existing hypersensitivity, pulpal inflammation and altered enamel–dentine structure (Özgül et al. 2022; Rhaiem et al. 2025). Hence, alternative approaches have been proposed to improve LA success and reduce procedural pain. These include the use of different anaesthetic agents, most notably 4% articaine, alternative delivery techniques such as intraosseous anaesthesia, and adjunctive interventions including pre-emptive analgesia, cryotherapy and photobiomodulation. However, the effectiveness of these strategies remains uncertain, and their uptake in clinical practice is variable (Rhaiem et al. 2025).

Several systematic reviews have explored MIH management and, more recently, focus on the anaesthetic challenges in MIH-affected teeth (Somani et al. 2022; Rhaiem et al. 2025; Tasdemir & Ballikaya 2025). Nevertheless, many of these include heterogeneous study designs or lack comprehensive assessment of risk of bias and certainty of evidence. Therefore, the present systematic review aimed to evaluate, based exclusively on RCTs, the effectiveness of different LA techniques, agents and adjunctive interventions in reducing pain during dental treatment of MIH-affected teeth in children.

Materials and methods

Protocol and registration

The Guidelines of Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA 2020, Page et al. 2021) were used, and the review was recorded in the International Prospective Register of Systematic Reviews (Prospero) with registration number CRD420251150485.

Review question

What is the most effective method of pain management for restorative interventions in children with MIH?

Eligibility criteria

Eligible studies were selected based on PICO:

- **P (Population):** Children and adolescents (6 – 18 years) with MIH.
- **I (Exposure/Intervention)**: Any method for pain control: topical agents, local anaesthesia, systemic analgesics.
- **C (Comparator)**: Placebo or alternative treatment.
- **O (Outcome)**: Pain levels or pain experience during treatment, measured using validated self-reported or observer-rated scales (VAS scores, FLACC scale, other patient centred or proxy pain reporting scales).
- **Study type:** RCT.

Search strategy

A systematic search was conducted in the following databases: MEDLINE via PubMed, Cochrane Central, Science Direct, SCOPUS, EBSCO, LILACS. The search was performed in September 2025, for papers published between 2001 and 2025 as MIH was formally introduced in 2001, and publications since then were considered most relevant for capturing the modern MIH literature. A Boolean search was made in all databases for pain management: "molar incisor hypominerali*ation" OR "MIH" AND "pain" OR "pain management" OR "analgesia" OR "local an*sthetic" AND "children'' OR "p*diatric'' (Appendix 1). Published articles were also hand-searched for studies not included previously.

Inclusion criteria

Studies were included if they met the following criteria:

- Full-text articles published in peer-reviewed journals.
- Randomised controlled trials.
- Children aged 6–18 years diagnosed with MIH according to established criteria.
- Participants presenting with hypersensitivity or requiring operative treatment of MIH-affected teeth.
- Assessment of pain outcomes during dental treatment.

Exclusion criteria

Studies were excluded if they met any of the following criteria:

- Diagnosis of MIH not based on recognised criteria.
- Studies focussing solely on incisors.
- Case reports, narrative reviews, systematic reviews, letters or editorials.
- Non-English language publications.

In Table 1, excluded studies and reasons for exclusion are presented.

Study selection

Titles and/or abstracts of the initial search were reviewed independently by two authors (NN, DG). Included studies were assessed independently by both authors. Any discrepancies in study selection were resolved through discussion and consensus between the reviewers.

Data extraction

Data were extracted independently by two reviewers in forms designed for this research. Each study had the following information extracted: publication details (authors, year of publication, design, location of study), participant characteristics (sample size, age of children, MIH severity criteria), intervention details (anaesthesia technique/agent), comparator characteristics, pain outcome measures used and main findings.

Risk-of-bias assessment and certainty of evidence

The risk of bias of the included articles was evaluated by two independent reviewers (DG, NNL) using the Cochrane risk-of-bias tool for randomised trials (RoB 2) (Sterne et al. 2019). The certainty of evidence was rated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria: risk of bias, indirectness, imprecision, inconsistency and publication bias. Two review authors (DG, NNL) independently judged the evidence certainty (high, moderate, low or very low).

Results

Search results

In the initial search, a total of 399 articles were identified. Title/abstract screening and full-text eligibility assessment were performed independently by two reviewers, with no unresolved disagreements following discussion. After exclusion of duplicates, 351 articles were left for evaluation. After title/abstract screening, 11 articles remained, and 3 articles were subsequently excluded (Table 1). Evaluation according to the eligibility criteria resulted in eight articles to be included (Fig. 1).

Data synthesis

The main characteristics of the included articles are tabulated descriptively with rows representing each article and columns representing the general characteristics (Table 2).

Study characteristics

All the included studies were RCTs published between 2018 and 2025. Sample sizes were generally modest, and participants were children undergoing treatment of MIH-affected permanent molars. Interventions included comparisons of local anaesthetic agents, anaesthetic delivery techniques, pre-emptive analgesics, cryotherapy and photobiomodulation. Pain outcomes were assessed using validated scales, including the Wong–Baker faces pain scale, VAS (Visual Analogue Scale) and FLACC (Face, Legs, Activity, Cry, Consolability) Pain Scale. Two studies used a proxy pain scale (Dixit and Joshi 2018; Aykanat and Elbay 2024) and one study used a custom proxy pain scale (Dixit and Joshi 2018). The remaining studies used patient-centred pain scales (VAS, Wong–Baker). Further study characteristics are presented in Table 2.

Risk-of-bias assessment

Risk-of-bias assessment using the Cochrane RoB 2 tool showed that six of eight RCTs were at high overall risk, with the remaining two having some concerns (Fig. 2). High risk of bias was mainly driven by lack of blinding in the context of subjective pain outcomes, resulting in high risk

Table 1 List of excluded articles and the rationale behind

Reasons for exclusion	Authors and year	Num of articles
Not RCT	Cabasse et al., 2015; Contac et al., 2024; Discepolo et al., 2011	3
Total		3

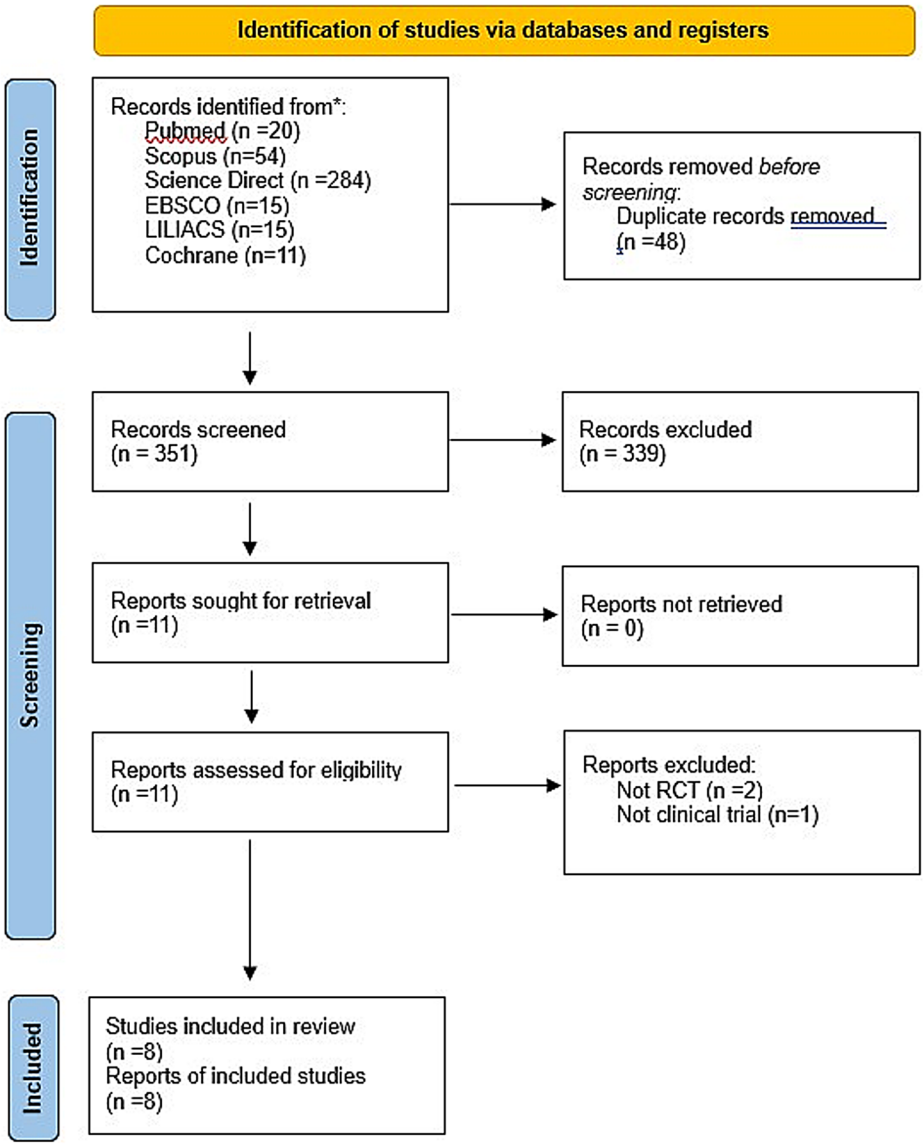

Fig. 1 PRISMA flow diagram

in the domains of deviations from intended interventions and outcome measurement. The randomisation process was generally adequate, although allocation concealment was often insufficiently reported, and missing outcome data were minimal. The predominance of trials at high risk of bias reduced confidence in effect estimates and informed downgrading of the certainty of evidence. Risk-of-bias assessments were conducted independently by two reviewers, with consensus achieved for all final domain judgements.

Outcomes

All eight RCTs investigating anaesthetic efficacy reported on pain during a dental procedure on MIH FPMs (Table 3). Overall, interventions aimed at improving pain control included modifications in anaesthetic agent, anaesthetic technique, pharmacological premedication and non-pharmacological adjuncts.

Regarding local anaesthetic agents, two studies compared LA agents/techniques. In a triple-blind cross-over comparison of 4% articaine and 2% lidocaine (both given as IANB), no between-agent differences were detected for treatment-phase pain, suggesting broadly comparable intraoperative analgesia when standard dosing and technique are used (Haidar & Raslan 2023). By contrast, a small three-arm parallel trial reported lower procedural VAS scores with articaine IANB relative to either articaine buccal infiltration or lidocaine IANB during endodontic access and instrumentation, but the sample size was small (Thomas et al. 2023).

For anaesthetic techniques, one study reported that intraosseous anaesthesia resulted in a higher proportion of pain-free procedures compared with buccal infiltration,

Table 2 Summarised characteristics of included trials

Author, year, country	Study design	Subjects (age, number, number of teeth)	MIH severity criteria	Anaesthetic agent	Anaesthesia technique	Treatment performed
Dixit and Joshi (2018), India	RCT	8—14 years old n = 29 24 Max FPMs 30 Mand FPMs	EAPD MIH diagnostic criteria	4% articaine with 1:100,000 epinephrine	C: conventional buccal local anaesthesia I: intraosseous local anaesthesia	Restorative treatment and stainless steel crowns
Vicioni-Marques et al. (2022), Brazil	RCT	6—10 years old n = 23 14 Max FPMs 9 Mand FPMs	Ghanim's index: score 3	2% mepivacaine with 1:100,000 epinephrine	Standard local infiltration	Restorative treatment
Thomas et al. (2023), India	RCT	8—12 years old n = 27 27 Mand FPMs	Not recorded	4% articaine with 1:100,000 epinephrine, 2% lidocaine with 1:100,000 epinephrine	Buccal infiltration, inferior alveolar nerve block	Endodontic treatment
Haider and Raslan (2023), Syria	RCT	6—12 years old n = 20 40 Mand FPMs	Ghanim's index: score 2,3,5	4% articaine with 1:100,000 epinephrine, 2% lidocaine with 1:80,000 epinephrine	Inferior alveolar nerve block	Restorative treatment
Aykanat and Elbay (2024), Turkey	RCT	7—12 years old n = 70 70 Max FPMs	EAPD MIH diagnostic criteria: 3,5	4% articaine with 1:100,000 epinephrine	C: standard anaesthesia I: PBM and standard anaesthesia	Pulpotomy
Peedikayil (2024), India	RCT	8—12 years old n = 27 54 Mand FPMs	MIH TNI criteria 4	2% lidocaine with 1:200,000 adrenaline	C: IANB, I: IANB and endo frost	Restorative treatment
Shahnawaz 2024, India	RCT	7—15 years old n = 70 70 Max FPMs	Not recorded	Not recorded	C: standard anaesthesia I: PBM and standard anaesthesia	Restorative treatment
Olszewska (2025), Poland	RCT	7—15 years old n = 45 90 maxillary FPMs	Not recorded	Articaine 4% with 1:100,000 epinephrine	C: standard anaesthesia I: PBM and standard anaesthesia	Invasive procedure

suggesting potential benefits where conventional techniques are insufficient (Dixit & Joshi 2018).

With respect to pharmacological adjuncts, pre-emptive ibuprofen administered before LA was evaluated in a triple-blind trial and was associated with lower intra-operative hypersensitivity and improved comfort during the operative phase compared with a placebo, supporting an analgesic priming effect that may enhance anaesthetic performance in children with severe MIH (Vicioni-Marques et al. 2022).

Amongst non-pharmacological adjuncts, three studies assessed photobiomodulation (PBM) as an adjunct to LA during operative treatment of MIH-affected FPMs. Across these, the findings varied—two trials observed statistically significant reductions in procedural pain scores with PBM compared with the control, suggesting a potential adjunctive benefit when used immediately before or alongside LA; in contrast, one parallel-group trial reported no meaningful difference in intra-operative pain between PBM and control conditions (Aykanat & Elbay 2024; Olszewska et al. 2025; Shahnawaz et al. 2024). In a split-mouth trial, the use of cryotherapy as an adjunct to LA was investigated. When cooling was applied to MIH-affected FPMs prior to restorative work, intra-operative pain decreased on both child self-report (VAS) and observer-rated FLACC compared with IANB alone, indicating improvements that were consistent across measurement methods and time points within the procedure (Peedikayil et al. 2024).

Certainty of evidence

Summary of GRADE evidence (Table 4) synthesises the certainty and magnitude of evidence relating pain management

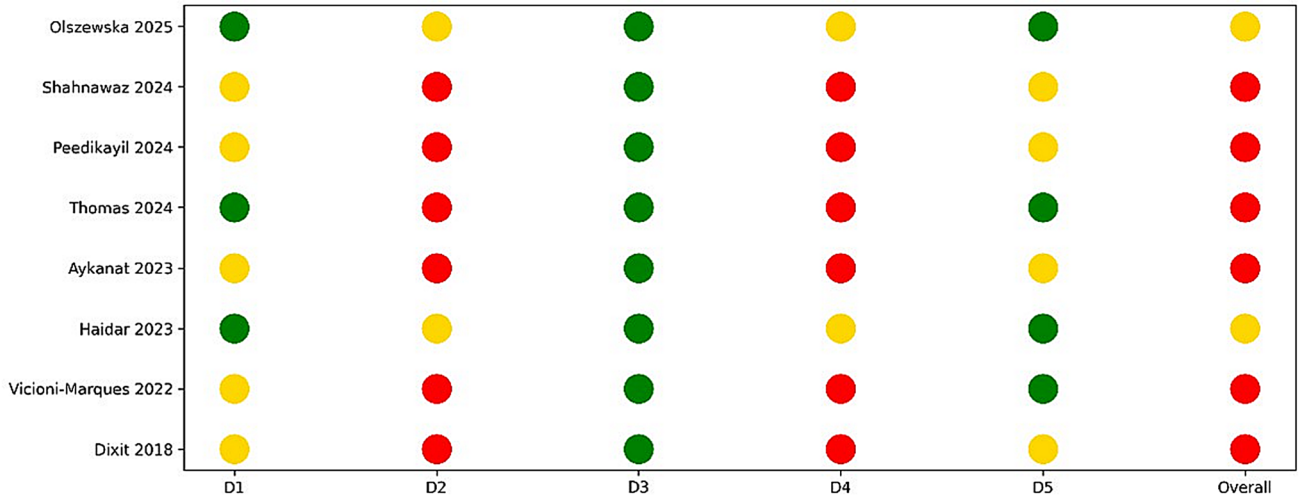

Fig. 2 Risk-of-bias assessment of included randomised controlled trials using the Cochrane RoB 2 tool

strategies with reduction in intra-operative pain. There is low-certainty evidence that cryotherapy (applied to MIH tooth surfaces after IANB) reduces intra-operative pain during restorative procedures (Peedikayil et al. 2024). There is low-certainty evidence that PBM as an adjunct to LA may reduce intra-operative pain, but results are inconsistent across the trials (Aykanat et al. 2023, Olszewska et al. 2025; Shahnawaz et al. 2024). Low-certainty evidence suggests that 4% articaine reduces procedural pain compared with lidocaine in MIH-affected teeth (Thomas et al. 2024, Haidar and Raslan 2023). Evidence comparing inferior alveolar nerve block with infiltration is limited to one single RCT and is of very low certainty, showing no consistent reduction in pain in MIH-affected teeth (Thomas et al. 2024). Intraosseous anaesthesia may yield more pain-free procedures than BI, but evidence is of very low certainty (Dixit et al. 2018). Pre-emptive ibuprofen probably lowers intra-operative hypersensitivity, but evidence is of low certainty and limited to a single small trial (Vicioni-Marques et al. 2022).

Discussion

The eight studies analysed in this review investigated various strategies to improve anaesthetic success and patient comfort in MIH cases, ranging from pharmacological enhancements to adjunctive physical therapies. Overall, the findings suggest that both pharmacological and technique-related modifications may enhance pain control. However, the strength of evidence remains limited. The observed improvements in anaesthetic efficacy with certain interventions may be explained by the underlying pathophysiology of MIH, including increased enamel porosity, dentinal hypersensitivity, and possible pulpal inflammation, all of which may reduce the effectiveness of conventional local anaesthetic approaches (Bekes et al. 2020; Afzal et al. 2024; Rhaiem et al. 2025).

Overall, comparisons between lidocaine and articaine in mandibular MIH-affected FPMs suggest that 4% articaine tends to yield deeper anaesthesia (especially with IANB) albeit with slightly higher injection discomfort, whereas 2% lidocaine produced lower injection pain but similar (or slightly inferior) intra-operative analgesia overall (Haidar and Raslan 2023, Thomas et al. 2024). Intraosseous (IO) anaesthesia clearly outperformed buccal infiltration (faster onset, lower administration pain, fewer repeats and markedly higher success) in children with MIH (Dixit Joshi 2018). Taken together, these data suggest that articaine may be considered as a preferable option in the management of anaesthesia and IO delivery as the alternative (or primary choice for highly sensitive/severe MIH), consistent with contemporary systematic reviews highlighting IO with 4% articaine as the most reliable path to profound anaesthesia in MIH-affected molars (Rhaiem et al 2025; Tasdemir and Ballikaya 2025). Finally, pre-emptive ibuprofen (10 mg/kg) increased the effectiveness of infiltrative anaesthesia and improved comfort during MIH restorations (Vicioni-Marques et al. 2022) in line with reviews recommending baseline inflammation control to raise anaesthetic success in hypersensitive teeth (Somani et al. 2022). Tooth-surface cryotherapy following IANB halved VAS and FLACC scores versus IANB alone in a split-mouth RCT, suggesting a simple, non-pharmacological way to suppress A-delta/C-fibre signalling during operative steps (Peedikayil et al. 2024). Further research is needed in this field. Findings diverge across photobiomodulation trials. A triple-blind RCT in maxillary MIH-affected FPMs observed no significant improvement in pain or supplemental anaesthesia requirement with PBM

Table 3 Summarised results of included trials

Author, year	Method	Anaesthesia/analgesia	Pain scale	Anaesthesia efficacy	Additional anaesthesia/pain during anaesthesia
Dixit and Joshi (2018)	Intraosseous anaesthesia	Conventional buccal anaesthesia with 4% articaine	Sixou and Barbosa-Rogier scale (Proxy scale)	Completed without pain: 26%	–
		Intraosseous anaesthesia with 4% articaine		Completed without pain: 88.9%*	–
Vicioni-Marques et al. (2022)	Systemic analgesic	Placebo + standard local infiltration with 2% mepivacaine	Wong–Baker scale	70%* no pain	–
		Ibuprofen 10 mg/kg + standard local infiltration with 2% mepivacaine		80% no pain	–
Haider and Raslan (2023)	Local anaesthesia	Inferior alveolar nerve block with 4% articaine	Wong–Baker scale / FLACC	2.2 (2.9)/2.8 (2.2)	Pain: 4.1 (3.6)*/4.8 (1.9)
		Inferior alveolar nerve block with 2% lidocaine		2.6 (3)/2.85 (1.7)	Pain: 2.1 (2.8) / 4.3 (2)
Thomas et al. (2023)	Local anaesthesia	Buccal infiltration with 4% articaine	VAS	Access cavity: 8.67 (1.00) Instrumentation: 9.11 (1.05)	–
		Inferior alveolar nerve block with 4% articaine		Access: 5.44* (0.72) Instrumentation: 6.22* (0.83)	–
		Inferior alveolar nerve block with 2% lignocaine		Access: 10 (0.00) Instrumentation: 10 (0.00)	–
Aykanat and Elbay (2024)	PBM	Local infiltration with 4% articaine	FLACC	No pain: 20% Mild pain: 37.1% Moderate pain: 31% Severe pain: 11.4%	Additional: 49%
		Photobiomodulation+local infiltration with 4% articaine		No pain: 28.6% Mild pain: 51.4% Moderate pain: 14% Severe pain: 5.7%	Additional: 31%
Peedikayil (2024)	Cryotherapy	Inferior alveolar nerve block with 2% lidocaine	VAS / FLACC	6.89* (0.79)/7,14* (1.04)	–
		Inferior alveolar nerve block with 2% lidocaine and endo frost		4.71 (1.46)/4.43 (1.37)	–
Shahnawaz 2024	PBM	Standard anaesthesia	VAS	4.5* (1.2)	–
		Photobiomodulation and standard anaesthesia		2.1 (0.8)	–
Olszewska 2025	PBM	Local infiltration with 4% articaine	VAS/FLACC/Heart rate	6.2* (1.2)/7*/113.2*	–
		Photobiomodulation+local infiltration with 4% articaine		2.1 (0.8)/3/84.6	–

* statistical difference between results $p < 0.05$

before infiltration (Aykanat et al. 2024), whereas two more recent RCTs reported lower pain (VAS/FLACC), faster onset and longer duration when PBM was added to standard anaesthesia (Aykanat et al. 2024, Shahnawaz et al. 2024; Olszewska et al. 2025). This discrepancy likely reflects parameter heterogeneity (wavelength, fluence, timing) and design differences. Both a MIH anaesthesia systematic review and a laser-focussed systematic review emphasise that PBM appears promising, but that protocol standardisation is necessary before strong recommendations can be implemented (Rhaiem et al. 2025; Cerqueira et al. 2025).

The findings of the present review are broadly consistent with existing systematic reviews and clinical guidelines, which highlight the challenges of achieving adequate

Table 4 Summary of GRADE findings

Outcome (pain reduction)	Studies (participants)	Effect (direction)	Certainty of evidence (GRADE)	Justification
Intraosseous anaesthesia vs conventional techniques	1 RCT (≈60)	Lower pain scores and higher likelihood of pain-free treatment	LOW ⊕⊕◯◯	⬇ Risk of bias (blinding not possible); ⬇ imprecision (single small study)
Inferior alveolar nerve block (IANB) vs infiltration	1 RCT (≈60)	Reduction in reported pain scores	VERY LOW ⊕◯◯◯	⬇ High risk of bias; ⬇ imprecision (single study); ⬇ indirectness (procedure-specific)
4% articaine vs lidocaine/lignocaine	2 RCTs (≈120)	Reduction in reported pain scores	LOW ⊕⊕◯◯	⬇ Risk of bias (some concerns in all trials); ⬇ inconsistency (different pain scales, variable effects)
Adjunctive cryotherapy	1 RCT (≈70)	Small reduction in pain	VERY LOW ⊕◯◯◯	⬇ Risk of bias; ⬇ imprecision; ⬇ indirectness (single procedure context)
Pre-emptive analgesia (ibuprofen)	1 RCT (≈60)	Reduction in procedural pain	VERY LOW ⊕◯◯◯	⬇ Risk of bias; ⬇ imprecision; ⬇ indirectness
Photobiomodulation therapy (PBM)	3 RCTs (≈180)	No consistent pain reduction	LOW ⊕⊕◯◯	⬇ Risk of bias; ⬇ inconsistency (conflicting results)

anaesthesia in MIH-affected teeth and support the use of adjunctive strategies where necessary (Somani et al. 2022; Lygidakis et al. 2022). However, important differences should be noted. Previous reviews often included heterogeneous study designs, such as observational studies and non-randomised trials, which may increase the risk of bias but also allow a broader overview of available clinical approaches. In contrast, the present review restricted inclusion to randomised controlled trials, providing a more rigorous evaluation of intervention efficacy but resulting in a smaller evidence base.

Recent anaesthesia-focussed systematic reviews (Rhaiem et al. 2025; Tasdemir and Ballikaya 2025) similarly report improved outcomes with intraosseous anaesthesia, articaine, and adjunctive strategies such as pre-emptive analgesia. However, these reviews generally rely on qualitative synthesis and do not consistently apply structured risk-of-bias assessment or certainty grading. In comparison, the present review incorporates a domain-based risk-of-bias evaluation and GRADE framework, allowing a clearer interpretation of both effect direction and confidence in the estimates.

Importantly, whilst previous reviews tend to present these interventions as clinically effective, the current analysis highlights that the certainty of evidence remains low to very low across most outcomes. This discrepancy likely reflects differences in methodological approach rather than true disagreement in clinical findings. Taken together, the available evidence suggests a consistent direction of effect favouring certain interventions, but with insufficient robustness to support definitive clinical recommendations.

Strengths, limitations and future considerations

A key strength of the present review is the exclusive inclusion of RCTs combined with risk-of-bias assessment using RoB 2 and certainty appraisal with GRADE. This approach enhances internal validity compared with earlier reviews that incorporated mixed study designs and reduces the risk of confounding compared with observational designs. Additionally, it allowed for a more reliable evaluation of intervention efficacy, although it may have limited the breadth of available evidence. Finally, the focussed assessment of anaesthetic strategies in MIH addresses a clinically relevant and underexplored aspect of paediatric dental care.

However, sample sizes were modest across all studies, with heterogeneity in MIH severity and treatment type. Moreover, variations in pain assessment tools (VAS, FLACC, Wong–Baker as well as non-standardised tools), especially the use of proxy-based outcome measures in two studies (Dixit and Joshi 2018; Aykanat and Elbay 2024) limited cross-study comparisons. This contributed to increased measurement bias and reduced confidence in pain-related outcomes.

In future research, standardisation of terminology, particularly regarding "hypersensitivity", and improved reporting of baseline patient characteristics are needed in order to strengthen the evidence base.

Conclusion

Overall, in conjunction with evidence from existing systematic reviews, the findings of this review support the preferential use of 4% articaine and consideration of intraosseous anaesthesia for MIH-affected teeth, particularly mandibular FPMs. Adjunctive measures such as pre-emptive analgesia or cryotherapy may further enhance patient comfort in selected cases; however, evidence for these interventions remains limited and is often based on single studies with low certainty. Integrating these modalities within paediatric dental practice can significantly enhance patient experience and procedural success.

Appendix

Search strategy

PubMed20 results

((molar hypominerali*ation[MeSH Terms]) OR (MIH[Text Word]) OR (MIH[Title/Abstract]) OR (molar incisor hypominerali*ation[Title/Abstract]) OR (molar incisor hypomineralization[Text Word])) AND ((an*sthesia, dental[MeSH Terms]) OR (an*sthetics[MeSH Terms]) OR (local an*sthesia[Title/Abstract])).

Filtered for clinical trial.

Scopus—54 results

(dental enamel hypoplasia OR dental enamel hypomineralization OR MIH OR molar incisor hypomineralization) AND child AND (dental anesthesia OR anesthetics).

Science Direct—284 results

(dental enamel hypoplasia OR dental enamel hypomineralization OR MIH OR molar incisor hypomineralization) AND child AND (dental anesthesia OR anesthetics).

EBSCO—15 results

(dental enamel hypomineralization OR MIH OR molar incisor hypomineralization) AND (dental anesthesia OR anesthetics).

LILACS—15 results

(dental enamel hypoplasia OR dental enamel hypomineralization OR MIH OR molar incisor hypomineralization) AND (pain).

COCHRANE—11 results

(molar incisor hypomineralisation).

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

Data availability All data supporting the findings of this study are available within the paper and its Supplementary Information.

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