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Knowledge and Attitudes of Dental Professionals and Students on MIH: A Scoping Review

Znanje i stajališta stomatologa i studenata stomatologije o MIH-u: pregled opsega

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Abstract

Objective: This scoping review aimed to map the knowledge, perceptions, and attitudes of dental professionals and students regarding MIH. **Materials and Methods:** A systematic search was conducted in the electronic databases MEDLINE/PubMed, Scopus, Web of Science, and Embase up to May 2023. A search in the OpenGrey database for grey literature was also performed. The reference lists of potentially eligible studies were checked to ensure that all relevant studies were analyzed. Scientific papers were considered eligible if they met the specified inclusion criteria: (1) focused on MIH; (2) assessed the knowledge/perception/attitudes of oral health professionals. Scientific papers were deemed ineligible if they met any of the following exclusion criteria: (1) lacking data on the knowledge/perception/attitudes regarding MIH among dental health professionals and students; (2) being a literature review/expert opinion/systematic review/case report. **Results:** 207 potentially eligible studies were identified, and 35 studies were included. A clear distinction emerged between qualified dental professionals and students regarding knowledge, attitudes, and management of MIH. Globally, variability was evident: Australia/New Zealand demonstrated strong protocols, China/Chile reported substantial gaps, and the UK showed mixed performance. Treatment preferences differed, with Saudi Arabia favoring stainless steel crowns/composite resin and Malaysia using glass ionomer cement/composite resin. **Conclusion:** Knowledge, attitudes, and management of MIH differ significantly across professional levels and countries. Specialists and general dentists show greater confidence in diagnosing and treating MIH than students, though variations exist within both groups. The systematic review protocol was registered in OSF platform (doi: 10.17605/OSF.IO/NHMV2).

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Introduction

Molar Incisor Hypomineralization (MIH) is a developmental defect of enamel with a multifactorial etiology, including a genetic component that affects at least one first permanent molar and often the permanent incisors. Clinically, MIH is characterized by demarcated opacities that range in color from white-cream to yellow-brown (1). Demarcated

Uvod

Hipomineralizacija kutnjaka i sjekutića (MIH) razvojni je defekt cakline s multifaktorijalnom etiologijom, uključujući genetsku komponentu koja utječe na barem jedan prvi trajni kutnjak, a često i na trajne sjekutiće. Klinički, MIH karakterizira ograničena neprozirnost koja u boji varira od bijele do žutosmeđe (1). Ograničene neprozirnosti često prati

opacities are frequently accompanied by post-eruptive enamel breakdown, dentin hypersensitivity, the development of carious lesions, the placement of atypical restorations, and, in severe cases, may lead to the atypical extraction of permanent first molars. The complexity and high prevalence of this enamel defect, affecting an estimated 800 million people worldwide, make MIH a common reason for dental consultations in clinical practice (1,2) and have a significant and clinically relevant negative impact on oral health-related quality of life, especially in moderate and severe cases (3).

The diagnosis, classification, and management of MIH are challenging clinical tasks that can vary widely among dental professionals (4). Effective management requires advanced training and is influenced by factors such as academic background, clinical experience, continuing education, and access to relevant information, technologies, and products. A rather large volume of literature has been offered on the subject of knowledge, practices, and attitudes of undergraduate and postgraduate students, general dentists, specialists, and other healthcare professionals concerning MIH in specific countries and regions (5). A systematic analysis of information is needed to identify gaps in the education of dental professionals and opportunities for developing formal academic programs and continuing education initiatives. Additionally, such an analysis could help identify and prioritize key research areas. Therefore, the objective of this scoping review was to map the current knowledge, practices, and attitudes of dental professionals and students regarding MIH.

Materials and Methods

Protocol and registration

The study protocol was registered and is publicly available on The Open Science Framework (OSF) platform (doi: 10.17605/OSF.IO/NHMV2) and was reported in accordance with the PRISMA for Scoping review (6).

Search sources and strategy

A systematic search was conducted in the electronic databases MEDLINE/PubMed, Scopus, Web of Science, and Embase up to May 2023. A search in the OpenGrey database for grey literature was also conducted. The reference lists of potentially eligible studies were checked to ensure that all relevant studies were analyzed. The search strategy was developed based on the PCC framework (Population: Dental health professionals and students; Concept: Knowledge, perception, and attitudes about molar incisor hypomineralization; Context: Not applied) for the MEDLINE/PubMed database and then adapted for the other databases (Table 1).

Eligibility criteria

Scientific papers were considered eligible if they satisfied the specified inclusion criteria: (1) They were about MIH; (2) They assessed dental health professionals' knowledge and perceptions, including those of undergraduate and postgraduate students. This approach allowed for capturing perspectives from different levels of healthcare professionals, whether in training or not. Articles meeting the inclusion criteria

posteruptivno oštećenje cakline, preosjetljivost dentina, pojava karijesnih lezija i postavljanje netipičnih ispuna, a u težim slučajevima može biti potrebno vađenje prvih trajnih kutnjaka. Složenost i visoka prevalencija toga defekta cakline, koji pogađa otprilike 800 milijuna ljudi diljem svijeta, MIH čine čestim razlogom za stomatološke konzultacije u kliničkoj praksi (1, 2) i imaju značajan i klinički relevantan negativan utjecaj na kvalitetu života povezanu s oralnim zdravljem, posebno u umjerenim i teškim slučajevima (3).

Dijagnoza, klasifikacija i liječenje MIH-a izazovni su klinički zadatci koji se mogu uvelike razlikovati među stomatolozima (4). Učinkovito upravljanje zahtijeva naprednu edukaciju i na njega utječu čimbenici poput akademske pozadine, kliničkog iskustva, kontinuiranog obrazovanja te pristupa relevantnim informacijama, tehnologijama i proizvodima. Ponuđen je dosta velik broj istraživanja o znanju, praksi i stajalištima studenata prijediplomskih i poslijediplomskih studija, općih stomatologa, specijalista i drugih zdravstvenih djelatnika u vezi s MIH-om u određenim zemljama i regijama (5). Potrebna je sustavna analiza informacija kako bi se utvrdili nedostatci u obrazovanju stomatologa i mogućnosti za razvoj formalnih akademskih programa i inicijativa za kontinuirano obrazovanje. Uz to, takva analiza mogla bi pomoći u identificiranju i određivanju prioriteta ključnih istraživačkih područja. Zato je cilj ovog pregleda opsega bio mapirati aktualno znanje, prakse i stajališta stomatologa i studenata stomatologije o MIH-u.

Materijali i metode

Protokol i registracija

Studijski protokol registriran je i javno dostupan na platformi The Open Science Framework (OSF) (doi: 10.17605/OSF.IO/NHMV2) te je prijavljen u skladu s pregledom PRISMA za preglede opsega (6).

Izvori i strategija pretraživanja

Sustavno pretraživanje provedeno je do svibnja 2023. u elektroničkim bazama podataka MEDLINE/PubMed, Scopus, Web of Science i Embase. Također je pretražena siva literatura u bazi podataka OpenGrey. Provjereni su popisi referencija potencijalno prihvatljivih istraživanja kako bi se osiguralo da su analizirane sve relevantne studije. Strategija pretraživanja razvijena je na temelju okvira PCC (Populacija: stomatolozi i studenti stomatologije; koncept: znanje, percepcija i stajališta o hipomineralizaciji kutnjaka i sjekutića; kontekst: nije primijenjeno) za bazu podataka MEDLINE/PubMed, a zatim prilagođena za ostale baze podataka (tablica 1.).

Kriteriji prihvatljivosti

Znanstveni radovi smatrani su prikladnima ako su zadovoljavali određene kriterije za uključivanje: (1) radilo se o MIH-u; (2) procjenjivani su znanje i percepcije stomatologa, uključujući i studente prijediplomskih i poslijediplomskih studija. Taj pristup omogućio je prikupljanje perspektiva zdravstvenih djelatnika različitih razina, neovisno o tome jesu li na usavršavanju ili ne. Radovi koji su zadovoljavali kri-

Table 1 Search strategies used for each consulted database.
Tablica 1. Strategije pretraživanja korištene za svaku konzultiranu bazu podataka

PubMed/MEDLINE	((dentist OR dentists OR "general practitioner" OR "general practitioners" OR "dental health professional" OR "dental health professionals" OR clinicians OR clinician OR "dental care providers" OR "dental care provider" OR "general dental practitioners" OR "general dental practitioner" OR "dental specialists" OR "dental specialist" OR "dental surgeons" OR "dental surgeon" OR "public oral health care practitioners" OR "public oral health care practitioner" OR "dental nurse" OR "dental nurses" OR "dental technician" OR "dental technicians" OR "dental assistant" OR "dental assistants" OR "dental hygienist" OR "dental hygienists" OR "doctor of dental surgery" OR "bachelor of dental surgery") AND ("molar incisor hypomineralisation" OR MIH "molar incisor hypomineralization" OR "hypomineralized teeth" OR "hypomineralised teeth" OR "molar-incisor-hypomineralisation" OR "molar-incisor-hypomineralization") AND (knowledge OR perception OR attitudes OR practices OR "care practices" OR "oral health practices" OR "oral health knowledge" OR "oral health attitudes" OR "oral health beliefs"))
Scopus	TITLE-ABS-KEY ((dentist OR dentists OR "general practitioner" OR "general practitioners" OR "dental health professional" OR "dental health professionals" OR clinicians OR clinician OR "dental care providers" OR "dental care provider" OR "general dental practitioners" OR "general dental practitioner" OR "dental specialists" OR "dental specialist" OR "dental surgeons" OR "dental surgeon" OR "public oral health care practitioners" OR "public oral health care practitioner" OR "dental nurse" OR "dental nurses" OR "dental technician" OR "dental technicians" OR "dental assistant" OR "dental assistants" OR "dental hygienist" OR "dental hygienists" OR "doctor of dental surgery" OR "bachelor of dental surgery") AND ("molar incisor hypomineralisation" OR mih «molar incisor hypomineralization" OR „hypomineralized teeth" OR „hypomineralised teeth" OR „molar-incisor-hypomineralisation" OR „molar-incisor-hypomineralization") AND (knowledge OR perception OR attitudes OR practices OR „care practices" OR „oral health practices" OR „oral health knowledge" OR „oral health attitudes" OR „oral health beliefs"))
Web of Science	TS=((dentist OR dentists OR "general practitioner" OR "general practitioners" OR "dental health professional" OR "dental health professionals" OR clinicians OR clinician OR "dental care providers" OR "dental care provider" OR "general dental practitioners" OR "general dental practitioner" OR "dental specialists" OR "dental specialist" OR "dental surgeons" OR "dental surgeon" OR "public oral health care practitioners" OR "public oral health care practitioner" OR "dental nurse" OR "dental nurses" OR "dental technician" OR "dental technicians" OR "dental assistant" OR "dental assistants" OR "dental hygienist" OR "dental hygienists" OR "doctor of dental surgery" OR "bachelor of dental surgery") AND ("molar incisor hypomineralisation" OR MIH "molar incisor hypomineralization" OR "hypomineralized teeth" OR "hypomineralised teeth" OR "molar-incisor-hypomineralisation" OR "molar-incisor-hypomineralization") AND (knowledge OR perception OR attitudes OR practices OR "care practices" OR "oral health practices" OR "oral health knowledge" OR "oral health attitudes" OR "oral health beliefs"))
Embase	('dentist'/exp OR dentist OR 'dentists'/exp OR dentists OR 'general practitioner'/exp OR 'general practitioner' OR 'general practitioners'/exp OR 'general practitioners' OR 'dental health professional' OR 'dental health professionals' OR 'clinicians'/exp OR clinicians OR 'clinician'/exp OR clinician OR 'dental care providers' OR 'dental care provider' OR 'general dental practitioners' OR 'general dental practitioner' OR 'dental specialists' OR 'dental specialist' OR 'dental surgeons' OR 'dental surgeon'/exp OR 'dental surgeon' OR 'public oral health care practitioners' OR 'public oral health care practitioner' OR 'dental nurse'/exp OR 'dental nurse' OR 'dental nurses'/exp OR 'dental nurses' OR 'dental technician'/exp OR 'dental technician' OR 'dental technicians'/exp OR 'dental technicians' OR 'dental assistant'/exp OR 'dental assistant' OR 'dental assistants'/exp OR 'dental assistants' OR 'dental hygienist'/exp OR 'dental hygienist' OR 'dental hygienists'/exp OR 'dental hygienists' OR 'doctor of dental surgery' OR 'bachelor of dental surgery') AND (('molar incisor hypomineralisation' OR 'mih'/exp OR mih) AND ('molar incisor hypomineralization'/exp OR 'molar incisor hypomineralization') OR 'hypomineralized teeth' OR 'hypomineralised teeth' OR 'molar-incisor-hypomineralisation' OR 'molar-incisor-hypomineralization') AND ('knowledge'/exp OR knowledge OR 'perception'/exp OR perception OR 'attitudes'/exp OR attitudes OR practices OR 'care practices' OR 'oral health practices' OR 'oral health knowledge' OR 'oral health attitudes' OR 'oral health beliefs')
OpenGrey	((resin* OR composite* OR („composite resin" OR „composite resins") OR („resin composite") OR compomer* OR "polyacid modified composite resin*" OR "polyacid-modified composite resin*" OR („dental restoration" OR „dental restorations") OR restoration OR "dental restoration, permanent" OR "tooth restoration" OR "teeth restoration" OR "glass ionomer cement*" OR "glass-ionomer cement*" OR GIC OR ART OR "atraumatic restorative treatment" OR zirconia OR crown* OR "full coronal restoration" OR "hall technique" OR "metal crown" OR "stainless steel crown" OR inlay OR onlay OR CAD-CAM) AND ("enamel defect" OR "tooth formation defects" OR molar-incisor hypomineralisation OR "molar incisor hypomineralisation" OR "demarcated enamel" OR "enamel opacities" OR "enamel opacity" OR MIH OR hypomineralization OR "development enamel defect*" OR "developmental dental defect*" OR "demarcated opacity" OR "diffuse opacity" OR hypoplasia OR "cheese molar" OR "Hypomineralized second primary molar*" OR HSPM OR "Deciduous Molar Hypomineralisation" OR DMH OR "Imperfect amelogenesis") AND ("primary teeth" OR "primary tooth" OR "deciduous teeth" OR "deciduous tooth" OR "primary dentition" OR "teeth, deciduous" OR "tooth, deciduous" OR "young permanent teeth" OR "young permanent tooth" OR („permanent molars"))

or lacking accessible abstracts underwent a full-text assessment. Articles were deemed ineligible if they met any of the following exclusion criteria: (1) They did not provide data on dental health professionals' knowledge, perception, or attitudes regarding MIH; (2) They were literature reviews, expert opinions, systematic reviews, or case reports.

There were no restrictions on publication date or language. The reviewers are proficient in reading and comprehending articles in Portuguese, Spanish, and English. Therefore, when including articles in other languages, the DeepL translation platform was utilized.

terije za uključivanje, ali nisu imali dostupne sažetke, podvrgnuti su procjeni cijelog teksta. Radovi su smatrani neodgovarajućima ako su ispunjavali bilo koji od sljedećih kriterija za isključivanje: (1) nisu sadržavali podatke o znanju, percepciji ili stajalištima stomatoloških stručnjaka o MIH-u; (2) radilo se o pregledima literature, stručnim mišljenjima, sustavnim pregledima ili prikazima slučajeva.

Nije bilo ograničenja kad je riječ o datumu objave ili jeziku. Recenzenti su bili vješti u čitanju i razumijevanju radova na portugalskome, španjolskome i engleskome jeziku. Stoga je pri uključivanju radova na drugim jezicima korištena platforma za prevođenje DeepL.

Table 2 Main characteristics from the included manuscript that analyzed dental professional´s perceptions and attitudes.
Tablica 2. Glavne karakteristike iz priloženog rukopisa koje su analizirale percepcije i stajališta stomatoloških stručnjaka

Author/Year	Country	Type of Questionnaire	Application method (interview or self-administered)	Sample size	Surveyed Group: GP, PD, Other Spec, Professors, Others	Comment of conclusions
Weerheijm & Mejàre (2003) [5]	European Assoc Ped Dent	Self-developed	Self-Administered, paper ordinary mail	54	PDs no comparison	First study to evaluate MIH Perception and knowledge by paediatric dentists. Prevalence data sparse and mainly from Northern Europe. MIH is a significant factor in treatment need. Most respondents report seen it in their practice
Głódkowska *et al.* (2016) [6]	Poland	Weerheijm & Mejare (2003) modified	Self-administered, paper, during dental meetings	220	Attendants to dental meetings	MIH frequently encountered, Composite and glass ionomer are the most popular materials.
Humphreys *et al.* (2021) [8]	United Kingdom	Self-developed	Self-administered, telephone	21	PDs, GPs	The challenges of managing children with MIH was experienced as 'uncertainty'. Barriers within the general dental service made managing children with MIH difficult and participants relied on colleagues in secondary
Alkadhimi *et al.* (2022) [9]	United Kingdom	Self-developed Part 1: Eastman Dental Institute Part 2: online questionnaire	Self-administered online	236 Ortho - 200 PDs - 36	PDs, Others	Severity of MIH and complexity of malocclusion significantly influence treatment agreement. Higher severity and complexity lead to lower agreement. Severe cases of MIH should be managed in multidisciplinary clinics to incorporate specialist input into decision-making processes.
Savin *et al.* (2017) [10]	Romania	Gambetta-Tesini (2008) modified	Self-administered, paper ordinary mail	75	GPs and Other Spec	Need for basic level of knowledge of MIH. Remove any ambiguity about MIH.
Craveia *et al.* (2020) [11]	France	Self-developed, two questionnaires, one GPs other for Ortho	Self-administered, online	GPs - 336 Ortho - 32	GPs and Ortho	Questionnaire titled: "Evaluation of the current knowledge of southwest French orthodontists' (or dentists') management of structural anomalies" as to avoid bias in Dx. Misdiagnosis associated w/ year of graduation prior to 1986 ($p < 0.001$). 59% GPS applied F & 34% applied fissure sealants in moderate MIH. The application of fluoride was associated with graduation after 1986 ($p < 0.0001$).
Serna-Muñoz *et al.* (2020) [12]	Spain	Self-developed	Self-administered, online	214	GPs and PDs	Incidence of MIH has increased. Difficult or very difficult to manage MIH, since the long-term success of restorations is compromised - adhesion. RMGICs is more frequently used. Both GDPs and PDs think they need more training of MIH.
Wuollet *et al.* (2020) [13]	Finland	Self-developed	Self-administered, online	765	GPs, PDs, Other Spec	Disparity in treatment practices between different areas of Finland. SSC as a material choice was low. Patient cooperation - big role in treatment decisions and may explain why GICs were the most popular choice for restoring extensive primary tooth caries. The emphasis should be on behavioral management as well as on the evidence-based treatment recommendations.
Wall *et al.* (2020) [14]	Ireland	Weerheijm & Mejare (2003), Kopperud (2016) modified	Self-administered, online	204	GPs	PDs & Other Spec taken due to low number for analysis, previous surveys and this highlight the inconsistency between clinicians on perception and management of MIH.
Delgado et al. (2022) [15]	Portugal	Gambetta-Tessini et al. (modified by Gamboa et al.)	Self-administered, online	257	GDPs, PD, ODS	Knowledge on MIH: Overall low among participants. Pediatric Dentists (PDs): Reported higher self-confidence in clinical management of MIH. Perception and clinical experience: Generally adequate among participants. Self-reported by participants to enhance knowledge and management skills related to MIH.
Kopperud *et al.* (2017) [16]	Norway	Self-developed	Online	606	GPs	The survey shows that there is a wide disparity between clinicians' views on how MIH affected teeth should be treated.
Uhlen *et al.* (2019) [17]	Norway	Self-developed	Self-administered, online	574	PDs, GPs, Prosthodontics, Ortho, Other	Notable disparity between clinician's Tx decisions, treatment choice mostly on patient cooperation, prognosis of the tooth and own experience.
Skaare *et al.* (2021) [18]	Norway	Gambetta-Tessini et al. (2016)	Self-administered, online	100	GDPs and Dental hygienists	Molar incisor hypomineralization is common in the Public Dental Service in Oslo, encountered frequently by dentists and dental hygienists. Respondents are uncertain about MIH prevalence in their community and express interest in further investigation. Aetiological Factors: Diverse opinions on potential causes highlight the multifactorial nature of MIH, emphasizing the need for additional theoretical education. Nearly all clinicians perceive MIH as a significant clinical issue, with treatment barriers including anesthesia and behavioral management. Additional research and subsequent clinical training on MIH are suggested to address knowledge gaps and improve patient management.

Kyriaki Seremidi et al. (2022) [21]	Greece	Self-developed	Self-administered, online	185 GDPs 175 dental specialists 59 PDs 38 Ortho 78 Other Spec	GP, PD, Others	Challenges in achieving sufficient anesthesia and managing hypersensitivity were frequently reported barriers. Bulk-fill restorations and preformed metal crowns were favored for severely affected posterior teeth. Greek dentists demonstrated limited knowledge regarding the treatment of MIH-affected teeth, emphasizing the need for continuing education courses to enhance the delivery of high-quality dental care by clinicians.
Hussein et al. (2014) [22]	Malasya	Weerheijm & Mejare (2003) modified	Self-administered, paper during dental meetings	131	GPs, Dental Nurses (OHTs)	MIH identified and encountered by Malaysian GPs and DNs, considerable variation in views of occurrence, diagnosis, etiological factors and management. Yellow/ brown demarcated opacities most frequently noticed clinical presentation Composite resin and GICs were the most popular materials used.
Ghanim *et al.* (2011) [23]	Iraq	Weerheijm & Mejare (2003) modified	Self-administered, paper	146	Academicians, GPs, Other Specs.	Disparity in perception and views regarding the prevalence of MIH. Majority of respondents believe the incidence of MIH was increasing.
Karkoutly *et al.* (2022) [27]	Syrian Arabic Republic	Self-developed	Self-administered, online	1936	GPs, PDs	PDs know more about HMI than GPDs, who need more training. The most chosen materials were composite resin and steel crown. They noticed an increase in the prevalence of HMI in recent years, although there is a lack of specific data.
Upadhyay *et al.* (2018) [28]	India	Gambetta-Tesini (2008) modified	Self-administered, online	393	PDs - 217 NonPDS - 176	88.5% consider they require more information on MIH, most in. management, etiology and Dx.
Jain et al. (2018) [29]	India	Self-developed	Self-Administered	55	GPs	General dentists did not demonstrate sufficient diagnostic skills or treatment acumen of commonly seen oral conditions in children.
Alanzi et al. (2018) [30]	Kuwait	Weerheijm & Mejare (2003) modified	Self-administered, paper	221	GPS, PDs Kuwait Dental Association, provide oral health care for children.	Yellow/brown opacities most common. Most GPs unconfident diagnosing MIH. Behavior most frequent barrier to MIH management. Agreement on SSC for severely affected molars. Composite resin preferred for treating moderately affected molar.
Gamboa *et al.* (2018) [31]	Hong Kong	Gambetta-Tesini (2008) modified	Self-administered, paper ordinary mail	255	PDs, GPs	MIH frequently encountered by both GPs and PDs in Hong Kong. Higher knowledge score observed for PDs compared to GPs. More PDs received information on MIH and are more confident in the diagnosis and treatment of MIH. Variations in encounter in their practices, as preventive, restorative, and surgical treatment.
Rahmadini et al. (2022) [32]	Indonesia	-	Self-administered, online	Total - 266 GP – 122 PD – 84 DS - 60	GP, PD, Others (DS)	PD demonstrate higher knowledge, perception, and confidence in diagnosing and treating MIH compared to GD and DS. There's a need for further training and continued education on MIH, particularly for GD and DS, to improve their confidence in managing patients with MIH. Dissemination of up-to-date information on MIH, especially to GD who are primary dental care providers in Indonesia, is crucial for accurate diagnosis and treatment.
Sajadi et al. (2021) [33]	Iran	Self-developed	Self-administered under supervision	GD – 327 Spec - 73	GP, Others	Limited Awareness: Dentists in Kerman showed limited awareness of MIH prevalence and misconceptions regarding its causes. Despite encountering MIH frequently, there's a clear need for education on all aspects of diagnosis and management. Demographic Trends: Younger dental practitioners, general dentists, and females displayed higher knowledge levels regarding MIH.
Crombie *et al.* (2008) [34]	Australia & New Zealand	Weerheijm & Mejare (2003) modified.	Self-administered, paper ordinary mail	130	PDs, Other Spec	MIH recognized by members of ANZSPD, significant clinical problem, difficult high quality restorative care, variation in knowledge and opinions regarding the prevalence, etiology and the clinical management.
Gambetta-Tessini *et al.* (2016) [35]	Chile & Australia	Self-developed	Online or paper	232 Australia 798 Chile	Australia = GPs, OHTs Chile = GPs	Chilean respondents' lower knowledge scores and confidence than Australian OHCPs. Higher knowledge scores for those with postgraduate course and Australian OHCPs.
Amarante et al. (2022) [36]	Brazil	-	-	30	GP, Spec	The study showed that implementing a three-stage calibration strategy for dentists significantly improved diagnostic accuracy and Kappa values in diagnosing MIH/HSPM.
Del Toro-Hernández *et al.* (2020) [37]	Mexico	Self-developed	Self-administered, online and interview	200	PDs, GPs	GPs showed lower rates on knowledge than PDs (Not SS). Both groups had difficulties with MIH DX.
Gómez-Clavel et al. (2023) [38]	Mexico	Gambetta–Tessini et al.	Google Forms Questionnaire	391	PDs	80% observe MIH in their practice. The majority considered MIH to be of low prevalence. The most used material was GICs. The majority indicated bad behavior and lack of training as difficulties in treatment.
Tagelsir *et al.* (2018) [39]	United States of America	Weerheijm & Mejare (2003) modified	Self-administered, online	251	PDs	Mixed responses for: perceived prevalence, restorative management, and etiological factors. Gender and education differ for diagnostic and management approaches

GICs: glass ionomer cements. SSCs: stainless steel crowns. ANZSPD: Australian and New Zealand Society of Paediatric Dentistry. MIH: Molar-Incisor Hypomineralization..OHCPs: Oral Health Care Providers. HSPM: Hypomineralized Second Primary Molars. Dx: diagnosis. GP: General Practitioner. PD: Pediatric dentist. GD: General Dental Practitioner. DS: Dental Specialist. Spec: Specialist. DN: Dental Nurses. OHT: Oral Health Therapist. SS: Statistically Significant. TX: treatment. RMGIC: Resin Modified Glass Ionomer Cement. PEBD: Evidence-Based Practice. ODS: Other Dental Specialist.

Table 3 Main characteristics of the included manuscript that analyzed students' perceptions and attitudes.
Tablica 3. Glavne karakteristike priloženog rukopisa koji je analizirao percepcije i stajališta studenata

Author/Year	Country	Type of Questionnaire	Application method (interview or self-administered)	Sample size	Students, PD Studants, Postgraduates, Undergraduates	Comment of conclusions
Kalkani *et al.* (2016) [7]	United Kingdom	Self-developed	Self-administered, online	37	PD Students Graduation programs in UK 3-year full-time training + 2-year training leads to be appointed to a hospital in the National Health Service.	Comparison between PDs in training and GPs on quality of life. Both difficulties diagnosing and managing MIH. They recognize the negative effect on the quality of life of the affected children and the disruption to the families' function.
Elhennawy *et al.* (2021) [19]	Germany	Weerheijm & Mejare (2003) modified	Self-administered, paper	877	Students	Students request + theoretical and clinical training on MIH. 20% reported difficulties in differential diagnosis. > 80% uncertain clinically identify. Resin composite and preformed metal crowns preferred materials in MIH-affected teeth.
Hamza *et al.* (2021) [20]	Switzerland	Not addressed	Self-administered	113	Students	Swiss final-year dental students exhibit deficiencies in knowledge, attitudes, and beliefs regarding MIH. Swiss universities should review their curricula to incorporate additional educational content addressing the diagnosis and management of MIH-affected teeth. To enhance the confidence of future dentists in dealing with challenges related to MIH by providing comprehensive education on the topic.
Silva *et al.* (2016) [24]	Saudi Arabia	Weerheijm & Mejare (2003)	2 surveys; Professionals – Online Students - Hand delivered	230 - Professionals. 149 - Students	GPs, Other Spec, Students	MIH frequently encountered, second to dental caries as a public health concern, more experience>Dx capacity, Students, little exposure to MIH, concerns upon commencement of dental practice.
Liu & He (2022) [25]	China	Self-developed	Self-administered, online	328	Students	They lack understanding of key diagnostic and treatment aspects of MIH. The study suggests a need for comprehensive and systematic MIH training at the undergraduate level.
Hamza et al. (2022) [26]	Syrian Arabic Republic	Germany Questionary Validated	Google Link	1142	Students, Postgraduates, Undergraduates	Based on the present results, it is safe to assume that the university curricula in Syria need to be updated with more materials on MIH-affected teeth. Postgraduate studies, especially in pediatric dentistry, appear to provide young dentists with additional training on this topic.

Selection process

The results obtained from various databases were cross-referenced using Excel to identify and eliminate duplicates. Two reviewers (MR and JLU) independently conducted the study selection process in duplicate. If there were insufficient data for a decision, or when the abstract did not provide clear information, the article was selected to proceed to the next phase. Both reviewers then independently and in duplicate evaluated the full text of the eligible articles based on the exclusion criteria. In cases of discrepancies or uncertainties, the third researcher (JSL) resolved the issues.

Data extraction

The two independent reviewers and in duplicate (MR and JLU) conducted data extraction from included articles. The following data were collected: authors, year and country, type of questionnaire, application method (interview or self-administered), sample size, surveyed group, (%) per type, age, sex, years of practice, type of practice (private, public, university), outcome data.

Data synthesis

The data were summarized in descriptive tables.

Results

A systematic electronic search identified 207 potentially eligible studies. After removing duplicates and screening titles and abstracts, 40 studies remained for full-text review. Of these, 5 were excluded, leaving 35 studies eligible for inclusion (Figure 1).

Breaking down the studies by continent, the majority of them were conducted in Europe, with 16 studies. Asia followed with 13 studies, Oceania with 1, South America with 2 and North America with 3. Figure 2 illustrates the distribution of studies by country.

Thus, the synthesis of results from each study is described below.

Diagnostic and Treatment Challenges

Among the studies analyzed, approximately 20% reported greater diagnostic difficulties among students compared to dentists, while over half highlighted that even experienced clinicians lacked confidence in diagnosing or managing MIH. Additionally, several studies indicated that specialists demonstrated higher confidence and competence than general practitioners.

In the United Kingdom, both dental students and dentists struggled to diagnose and treat MIH (2016) (7), and a 2022 study with dentists emphasized that case complexity increased treatment difficulty, thus highlighting the need for a multidisciplinary approach (8). In 2021, another study surveyed specialists and general dentists, highlighting uncertainties in treatment and difficulties for general practitioners, who often referred MIH cases to specialists (9).

In Germany, about 20% of respondents reported difficulties in treating MIH, and 80% were uncertain about diagnosing it (10). A 2021 survey of final-year dental students in Switzerland showed that although 99% of respondents are

Proces odabira

Rezultati dobiveni iz različitih baza podataka uspoređeni su s pomoću Excela kako bi se identificirali i uklonili duplikati. Dva recenzenta (MR i JLU) neovisno su provela postupak odabira istraživanja. Ako nije bilo dovoljno podataka za odluku, ili kada sažetak nije sadržavao jasne informacije, rad je odabran za prelazak u sljedeću fazu. Oba recenzenta zatim su neovisno i zajedno procijenila cijeli tekst radova koji su ispunjavali uvjete na temelju kriterija za isključivanje. U slučaju neslaganja ili nesigurnosti, dvojbe je rješavao treći istraživač (JSL).

Ekstrakcija podataka

Dva neovisna recenzenta (MR i JLU) proveli su ekstrakciju podataka iz uključenih radova. Prikupljeni su sljedeći podatci: autori, godina i država, vrsta upitnika, način primjene (intervju ili samostalno ispunjavanje), veličina uzorka, ispitana skupina, postotak prema vrsti, dobi, spolu, godinama prakse, vrsti prakse (privatna, javna, sveučilišna), podatci o ishodima.

Sinteza podataka

Podatci su sažeti u opisnim tablicama.

Rezultati

Sustavnim elektroničkim pretraživanjem identificirano je 207 potencijalno prikladnih studija. Nakon uklanjanja duplikata i pregleda naslova i sažetaka, za pregled cijelog teksta preostalo je 40 studija. Od njih je 5 isključeno, a 35 ispunjavalo je uvjete za uključivanje (slika 1.).

Razvrstaju li se studije po kontinentima, većina ih je provedena u Europi, tj. njih 16. Slijede Azija s 13 studija, Oceanija s 1, Južna Amerika s 2 i Sjeverna Amerika s 3. Na slici 2. je distribucija studija po zemljama.

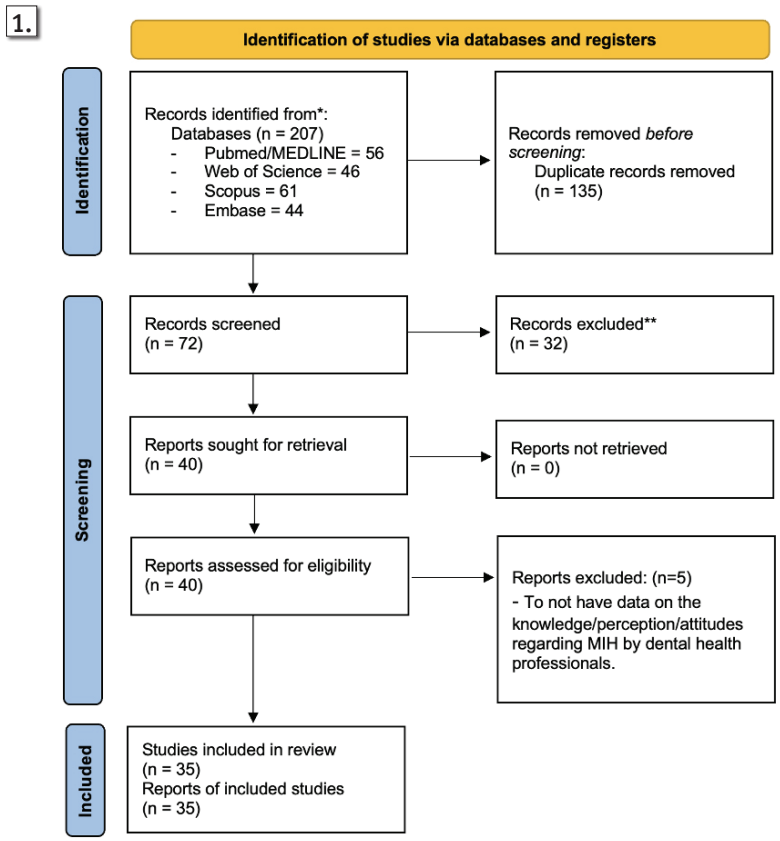
Stoga je u nastavku opisana sinteza rezultata svake studije.

Dijagnostički izazovi

Među analiziranim studijama u otprilike njih 20 % autori su izvijestili o većim dijagnostičkim poteškoćama među studentima u usporedbi sa stomatolozima, a u više od 50 % studija istaknuto je da čak ni iskusni kliničari nemaju povjerenja u dijagnosticiranje ili liječenje MIH-a. Osim toga, u nekoliko je studija istaknuto je da specijalisti pokazuju veće samopouzdanje i kompetentnost od općih stomatologa.

U Ujedinjenom Kraljevstvu imali su poteškoća s dijagnosticiranjem i liječenjem MIH-a i studenti stomatologije i stomatolozi (2016.) (7), a u studiji iz 2022. u kojoj su sudjelovali stomatolozi napomenuto je da složenost slučaja povećava poteškoće u liječenju, čime se ističe potreba za multidisciplinarnim pristupom (8). U 2021. godini, autori jedne druge studije anketirali su specijaliste i opće stomatologe te su istaknuli nesigurnost u liječenju i poteškoće za liječnike opće prakse koji su često specijalistima upućivali pacijente s MIH-om (9).

U Njemačkoj je oko 20 % ispitanika prijavilo poteškoće u liječenju MIH-a, a 80 % nije bilo sigurno u vezi s dijagnosticiranjem (10). Istraživanje studenata stomatologije završne



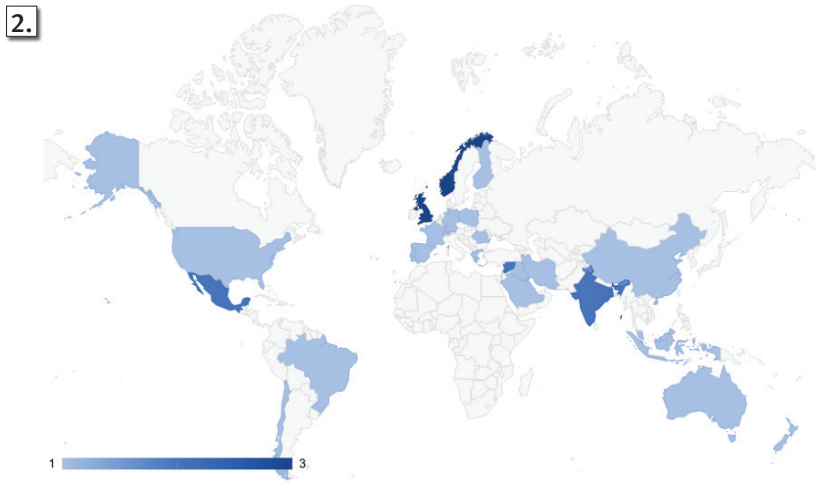


Figure 1 Flowchart of screening and eligibility of the studies.
Slika 1. Dijagram probira i prihvatljivosti studija
Figure 2 The distribution of studies by country.
Slika 2. Raspodjela studija po državama

familiar with MIH, but only 12% felt confident diagnosing and treating it (11). In France (2020), a questionnaire for orthodontists revealed that those who graduated before 1986 made more diagnostic errors, thus highlighting the need for better education (12). Similarly, in Portugal (2020), general knowledge of MIH among dentists was low, with specialists showing more confidence in treatment (13).

In China (2022) and India (2018), dental students and dentists showed insufficient skills in diagnosing MIH (14-16). A Chinese survey revealed major gaps in students' understanding of MIH (14). In India, two studies found that 88.5% of respondents wanted more information on MIH, especially those about management and causes (15), and that general dentists lacked adequate diagnostic and treatment

godine u Švicarskoj iz 2021. pokazalo je da, iako je 99 % ispitanika upoznato s MIH-om, samo 12 % osjeća se samouvjereno u dijagnosticiranju i liječenju (11). U Francuskoj (2020.) je upitnik za ortodonte otkrio da oni koji su diplomirali prije 1986. čine više dijagnostičkih pogrešaka, što ističe potrebu za boljom edukacijom (12). Slično tomu, u Portugalu (2020.) je opće znanje o MIH-u među stomatolozima bilo nisko, a specijalisti su pokazivali više kompetencije u liječenju (13).

U Kini (2022.) i Indiji (2018.) pokazali su studenti stomatologije i stomatolozi nedovoljnu vještinu u dijagnosticiranju MIH-a (14 – 16). U kineskom istraživanju otkrivene su velike manjkavosti u studentskom razumijevanju MIH-a (14). U Indiji su autori dviju studija otkrili da 88,5 % ispitanika želi više informacija o MIH-u, posebno onih o lije-

skills (16). Kuwait (2018) and Mexico (2020) reported low diagnostic confidence among dentists (17, 18), with behavioral issues cited as a main treatment barrier in Kuwait (17). In Mexico, dentists showed less MIH knowledge than specialists (18), but a 2023 study found that 80% of dentists had encountered MIH (19). In Iraq (2011), a survey of 146 dentists revealed varied opinions on MIH prevalence, though most agreed it is increasing (20). In Saudi Arabia (2016), greater professional experience was linked to more MIH exposure and concern about its treatment (21).

Treatment Preferences

Across studies, specialists showed greater confidence and a broader range of MIH treatment strategies, while students and general dentists often preferred simpler approaches or referred complex cases. Around 60–80% of specialists reported using materials such as stainless steel crowns and preventive measures, whereas less experienced clinicians relied more on glass ionomer cement or composite resin. A lack of training and a lack of patient cooperation were frequent barriers to treatment.

In Poland (2016), general dentists mostly used glass ionomer cement (GIC) for MIH (22). UK studies (2021–2022) showed that both dentists and orthodontists often referred complex cases to specialists (8, 9). In Finland (2020), treatment varied between specialists and general dentists, with patient cooperation influencing the choice of GIC for severe cases (23). In France (2020), more than half of orthodontists graduating after 1986 would use fluoride, and 34% of them preferred fissure sealants (12). In Greece (2022), general dentists reported difficulty achieving adequate anesthesia and preferred stainless steel crowns (24). In Malaysia (2003), dentists and dental nurses mainly used GIC and composite resin (25), while in Syria (2022) the specialists demonstrated a preference for the use of stainless steel crowns and composite resin (26). In Kuwait (2018) and Mexico (2023), general dentists used GIC for severe cases and composite resin for milder ones, citing poor patient behavior and insufficient training as major barriers (17, 19). In Hong Kong (2020), specialists reported more varied preventive, restorative, and surgical approaches (27). In Norway (2017; 2019; 2021), dentists showed significant disparities in treatment choices, influenced by patient cooperation, tooth prognosis, and experience (28–30).

Educational Gaps

Students generally showed good awareness of MIH but lacked confidence and deeper understanding, while dental professionals, including general dentists and specialists, reported persistent difficulties in diagnosis and management. Specialists tended to demonstrate higher knowledge than general practitioners, yet educational gaps remained. The first European study on dentists' knowledge and practices

čenju i uzrocima (15), te da općim stomatolozima nedostaju odgovarajuće dijagnostičke i terapijske vještine (16). Kuvajt (2018.) i Meksiko (2020.) izvijestili su o niskom dijagnostičkom povjerenju među stomatolozima (17, 18), a problemi u ponašanju navedeni su kao glavna prepreka liječenju u Kuvajtu (17). U Meksiku su stomatolozi pokazali manje znanja o MIH-u nego specijalisti (18), ali u studiji iz 2023. godine otkriveno je da se 80 % stomatologa susrelo s MIH-om (19). U Iraku (2011.) je u anketi sudjelovalo 146 stomatologa i otkrivena su različita mišljenja o prevalenciji MIH-a, iako se većina složila da raste (20). U Saudijskoj Arabiji (2016.) veće profesionalno iskustvo povezano je s većom izloženošću MIH-u i zabrinutošću zbog njegova liječenja (21).

Preferencije u liječenju

U svim studijama specijalisti su pokazali veće samopouzdanje i širi raspon strategija za liječenje MIH-a, a studenti i opći stomatolozi često su preferirali jednostavnije pristupe ili upućivali složene slučajeve dalje. Od 60 do 80 % specijalista izjavilo je da upotrebljava strategije poput krunica od nehrđajućeg čelika i preventivne mjere, a manje iskusni kliničari više su se oslanjali na staklenoionomerni cement ili kompozit. Nedostatak edukacije i nedostatak suradnje pacijenata bili su česte prepreke u liječenju.

U Poljskoj (2016.) su se opći stomatolozi uglavnom koristili staklenoionomernim cementom (GIC) za MIH (22). U studijama u Ujedinjenom Kraljevstvu (2021. – 2022.) istaknuto je da su i stomatolozi i ortodonti često upućivali složene slučajeve specijalistima (8, 9). U Finskoj (2020.) liječenje se razlikovalo između specijalista i općih stomatologa, pri čemu je suradnja pacijenata utjecala na izbor GIC-a za teške slučajeve (23). U Francuskoj (2020.) bi se više od pola ortodonata koji su diplomirali poslije 1986. koristilo fluoridom, a njih 34 % preferiralo je smole za pečaćenje fisura (12). U Grčkoj (2022.) su opći stomatolozi prijavili poteškoće u postizanju adekvatne anestezije i preferirali su krunice od nehrđajućeg čelika (24). U Maleziji (2003.) su se stomatolozi i stomatološke sestre uglavnom koristili glikozidnim i kompozitnim krunicama (25), a u Siriji (2022.) su specijalisti preferirali upotrebu krunica od nehrđajućeg čelika i kompozitnih krunica (26). U Kuvajtu (2018.) i Meksiku (2023.) opći stomatolozi koristili su se glikozidnim krunicama za teške slučajeve, a kompozitnima za blaže, navodeći loše ponašanje pacijenata i nedovoljnu edukaciju kao glavne prepreke (17, 19). U Hong Kongu (2020.) specijalisti su prijavili različite preventivne, restaurativne i kirurške pristupe (27). U Norveškoj (2017.; 2019.; 2021.) stomatolozi su pokazali značajne razlike u izboru liječenja, pod utjecajem suradnje pacijenata, prognoze zuba i iskustva (28 – 30).

Nedostatak edukacije

Studenti su općenito pokazali dobru svijest o MIH-u, ali im je nedostajalo samopouzdanje i dublje razumijevanje, a stomatolozi, uključujući opće stomatologe i specijaliste, izvještavali su o stalnim poteškoćama u dijagnosticiranju i liječenju. Specijalisti su obično pokazivali veće znanje od općih stomatologa, no obrazovne razlike i dalje su postojale. Prvu europsku studiju o znanju i praksi stomatologa u vezi

regarding MIH was conducted in 2003 by the EAPD, revealing limited data especially in Northern Europe despite MIH's clinical relevance (4). In Romania (2017), specialists highlighted the need for better-designed questionnaires and noted the country's limited number of experts (31). Studies from France (2020) (12), China (2022) (14), India (2018) (15), and Syria (2023) (32) emphasized the need for improved curricula; France reported significant diagnostic disparities (12), China found major gaps in student understanding (14), India identified insufficient diagnostic and treatment skills among general dentists (15), and Syria stressed updated curricula while noting that students were well-informed (32). Iran (2021) reported higher MIH knowledge among younger dentists and women (33). In Greece, limited knowledge on treatment was noted, emphasizing continuing education (24). Spanish dentists and specialists found MIH teeth challenging to restore long-term (34). Irish findings (2020) showed MIH prevalence with educational disparities among dentists (35). A 2008 survey in Australia and New Zealand confirmed MIH as a major issue with varied knowledge and opinions on its prevalence and management (36). Finally, a 2022 Brazilian study successfully calibrated dentists for MIH epidemiological research despite some limitations (37).

Students vs. Generalists vs. Specialists Differences

Across the studies analyzed, clear differences emerged between students, general dentists, and specialists. All studies comparing students to professionals reported that students had greater difficulty diagnosing and managing MIH, highlighting their lack of confidence and limited clinical preparedness. Similarly, all studies comparing general dentists and specialists found that specialists demonstrated higher knowledge, confidence, and a wider range of treatment strategies (12, 26, 38-40). Additionally, over 80% of the studies emphasized the need for updated curricula and continuing education programs to address these persistent gaps across all groups.

Discussion

A clear distinction emerges between qualified dental professionals and dental students regarding knowledge, attitudes, and management of MIH. Specialists and general dentists generally demonstrate greater familiarity and confidence in diagnosing and treating MIH than students, though notable variations persist within both groups. Specialists report the highest levels of competence, often employing more diverse and evidence-based treatments, while general practitioners frequently express uncertainty, especially with complex cases. In contrast, dental students consistently reveal significant gaps in their knowledge and clinical preparedness regarding MIH, often attributing this to inadequacies in undergraduate curricula and limited clinical exposure.

s MIH-om objavio je 2003. godine EAPD, otkrivajući ograničene podatke, posebno u sjevernoj Europi unatoč kliničkoj relevantnosti MIH-a (4). U Rumunjskoj (2017.) stručnjaci su istaknuli da su potrebni bolje osmišljeni upitnici i zabilježili su ograničeni broj stručnjaka u zemlji (31). U studijama iz Francuske (2020.) (12), Kine (2022.) (14), Indije (2018.) (15) i Sirije (2023.) (32) istaknuta je potreba za poboljšanim nastavnim planovima i programima; u Francuskoj su izvijestili o značajnim dijagnostičkim razlikama (12). U Kini su pronađeni veliki nedostatci u razumijevanju studenata (14), u Indiji su ustanovljene nedovoljne dijagnostičke i terapijske vještine među općim stomatolozima (15), a u Siriji je istaknuto da je potrebno ažurirati nastavne planove i programe, uz napomenu da su studenti dobro informirani (32). Iranski (2021.) stručnjaci izvijestili su o većem znanju o MIH-u među mlađim stomatolozima i ženama (33). U Grčkoj je pak zabilježeno ograničeno znanje o liječenju, s naglaskom na kontinuiranoj edukaciji (24). Španjolski opći stomatolozi i specijalisti smatrali su da je dugoročna restauracija zuba s MIH-om teška (34). Irski nalazi (2020.) pokazali su prevalenciju MIH-a s obrazovnim razlikama među stomatolozima (35). Istraživanje provedeno 2008. u Australiji i Novom Zelandu potvrdilo je MIH kao glavni problem te različito znanje i mišljenja o njegovoj prevalenciji i liječenju (36). Konačno, u brazilskoj studiji iz 2022. autori su uspješno odredili stomatologe za epidemiološka istraživanja MIH-a unatoč nekim ograničenjima (37).

Razlike između studenata, općih stomatologa i specijalista

U analiziranim studijama uočene su jasne razlike između studenata, općih stomatologa i specijalista. U svim studijama u kojima su uspoređivani studenti s profesionalcima uočeno je da su studenti imali veće poteškoće u dijagnosticiranju i liječenju MIH-a, što je istaknulo njihov nedostatak samopouzdanja i ograničenu kliničku pripremljenost. Slično tomu, u svim studijama u kojima su uspoređivani i opći stomatolozi i specijalisti otkriveno je da su specijalisti pokazali veće znanje, samopouzdanje i širi raspon strategija za liječenje (12, 26, 38 – 40). Osim toga, u više od 80 % studija istaknuto je da su potrebni ažurirani nastavni planovi i programi o kontinuiranom obrazovanju kako bi se riješili ovi trajni nedostatci u svim skupinama.

Rasprava

Jasna je razlika između kvalificiranih stomatologa i studenata stomatologije kad je riječ o znanju, stajalištima i liječenju MIH-a. Specijalisti i opći stomatolozi općenito pokazuju veću informiranost i samopouzdanje u dijagnosticiranju i liječenju MIH-a od studenata, iako unutar obiju skupina i dalje postoje značajne varijacije. Specijalisti izvještavaju o najvišim razinama kompetencije i često primjenjuju različite i na dokazima utemeljene tretmane, a liječnici opće prakse često pokazuju nesigurnost, posebno u složenim slučajevima. Nasuprot tomu, studenti stomatologije dosljedno otkrivaju znatne nedostatke u svojem znanju i kliničkoj pripremljenosti u vezi s MIH-om, često pripisujući to nedostatcima u dodiplomskim nastavnim planovima i programima i ograniče-

The analysis of studies on MIH reveals a varied geographic distribution of research, with most studies concentrated in Europe, followed by Asia, North America, Oceania, and South America. This distribution not only reflects regional awareness of the condition but also suggests the presence of more advanced research networks in certain continents. The studies conducted in Europe indicate a higher level of awareness towards MIH. Nevertheless, significant variations in knowledge, perceptions, and practices were observed.

The results show substantial variability in knowledge and practices related to MIH across different countries. Commonly cited limitations include a lack of systematic knowledge and the need for additional training, emphasizing the need for more robust educational frameworks starting in the undergraduate programs. Cultural, educational, and economic factors likely contribute to these regional differences. For instance, healthcare infrastructure, public health priorities, availability of training opportunities, and access to dental materials may all influence the awareness and management of MIH.

For example, in Australia and New Zealand (36), MIH is widely recognized as a significant clinical concern. In contrast, in Chile (39), professionals exhibited lower confidence in their management abilities, which may reflect differences in training and clinical experience. In China (14), dental students demonstrated insufficient understanding of relevant aspects of MIH, thus highlighting gaps in educational curricula. The disparity observed in France (12), where professionals trained before and after 1986 exhibited varying levels of diagnostic ability, further underscores the relevance of continuous education programs.

On the other hand, in places such as Hong Kong (27) and India (15,16), specialists demonstrated greater confidence and knowledge, suggesting that advanced training and/or continued education may be crucial for enhancing diagnostic competence. The gap between general practitioners and specialists emphasizes the need for more targeted training for general dentists, who often face challenges in recognizing and managing this condition.

A recurring issue reported, particularly in the United Kingdom and France, is the difficulty in diagnosing and treating MIH. In the UK (7), both undergraduate students and general practitioners reported significant challenges, often referring complex cases to specialists. This difficulty may be related to the complexity of MIH diagnosis, as it can be confused with other conditions such as amelogenesis imperfecta, fluorosis, enamel hypoplasia, and traumatic hypomineralization (41, 42).

Beyond the clinical challenges, MIH also negatively impacts the oral health-related quality of life of affected patients, especially children, affecting their self-esteem due to compromised dental aesthetics and sensitivity (3, 43). In Australia and New Zealand (36), MIH was considered a serious clinical problem, while in Saudi Arabia (21), it was recognized as a significant public health issue, second only to dental caries in prevalence and impact. Treatment preferences also varied regionally, reflecting differences in resource availability, clinical experience, and cultural factors. For instance,

noj kliničkoj izloženosti.

Analiza studija o MIH-u otkriva različitu geografsku distribuciju istraživanja, s većinom studija koncentriranih u Europi, a slijede Azija, Sjeverna Amerika, Oceanija i Južna Amerika. Ta distribucija ne samo da pokazuje regionalnu svijest o stanju, nego i sugerira prisutnost naprednijih istraživačkih mreža na određenim kontinentima. Studije provedene u Europi upućuju na višu razinu svijesti o MIH-u. Ipak, uočene su značajne varijacije u znanju, percepcijama i praksama.

Rezultati pokazuju veliku varijabilnost u znanju i praksama vezanim uz MIH u različitim zemljama. Često navedena ograničenja uključuju nedostatak sustavnog znanja i potrebu za dodatnom izobrazbom, te se ističe potreba za čvršćim obrazovnim okvirima počevši od prijediplomskih programa. Kulturni, obrazovni i ekonomski čimbenici vjerojatno pridonose tim regionalnim razlikama. Primjerice, zdravstvena infrastruktura, prioriteti javnoga zdravstva, dostupnost mogućnosti edukacije i pristup stomatološkim materijalima mogu utjecati na svijest i upravljanje MIH-om.

Primjerice, u Australiji i Novom Zelandu (36), MIH je široko prepoznat kao važan klinički problem. Nasuprot tomu, u Čileu (39) stručnjaci su pokazali manje povjerenja u svoje sposobnosti, što može odražavati razlike u izobrazbi i kliničkom iskustvu. U Kini (14) su studenti stomatologije pokazali nedovoljno razumijevanje za relevantne aspekte MIH-a, čime su istaknute praznine u obrazovnim programima. Razlika uočena u Francuskoj (12), gdje su stručnjaci educirani prije i poslije 1986. pokazali različitu razinu dijagnostičkih sposobnosti, dodatno ističe relevantnost programa za kontinuirano obrazovanje.

S druge strane, na mjestima poput Hong Konga (27) i Indije (15,16), specijalisti su pokazali veće samopouzdanje i znanje, što sugerira da bi napredna edukacija i/ili kontinuirano obrazovanje mogli biti ključni za poboljšanje dijagnostičke kompetencije. Jaz između liječnika opće prakse i specijalista ističe potrebu za ciljanom edukacijom stomatologa opće prakse koji se često suočavaju s izazovima u prepoznavanju i liječenju toga stanja.

Problem koji se ponavlja, posebno u Ujedinjenom Kraljevstvu i Francuskoj, jest poteškoća u dijagnosticiranju i liječenju MIH-a. U Ujedinjenom Kraljevstvu (7) i studenti prijediplomskog studija i liječnici opće prakse prijavili su značajne izazove, pa često upućuju složene slučajeve specijalistima. Ta poteškoća može biti povezana sa složenošću dijagnoze MIH-a, jer se može zamijeniti s drugim stanjima poput *amelogenesis imperfecta*, fluoroze, hipoplazije cakline i traumatske hipomineralizacije (41, 42). Osim kliničkih izazova, MIH također negativno utječe na kvalitetu života oboljelih pacijenata, posebno djece, zato što utječe na njihovo samopoštovanje zbog narušene estetike zuba i osjetljivosti (3, 43). U Australiji i Novom Zelandu (36), MIH se smatrao ozbiljnim kliničkim problemom, a u Saudijskoj Arabiji (21) prepoznat je kao značajan javnozdravstveni problem prema prevalenciji i utjecaju, odmah iza karijesa. Preferencije liječenja također su se regionalno razlikovale i pokazivale su razlike u dostupnosti resursa, kliničkom iskustvu i kulturološkim čimbenicima. Primjerice, u Saudijskoj Arabiji postoji preferencija

there is a preference for stainless steel crowns and composite resin restorations in Saudi Arabia. Studies from Finland (23) and Greece (24) further emphasized the role of patient behavior and the need for continuing education to improve treatment outcomes. The observed differences in treatment materials and methods highlight how local resources, training opportunities, and socioeconomic contexts influence clinical decision-making.

Geographic differences in managing MIH are evident, as shown in a recent 19-year bibliometric review covering over 500 publications (44).

In a 2022, authors recognized that MIH is globally perceived as a public health problem and suggested that its etiology may involve systemic and epigenetic factors (5). In 2020, the European Academy of Pediatric Dentistry (EAPD), the first international scientific organization to extensively report on MIH, developed a comprehensive policy document and updated guidelines. Reviewers used the GRADE system to assess the certainty of evidence, identifying preventive and treatment options based on defect severity and the patient age. However, for anterior teeth, despite the growing body of research, evidence remains limited, with conventional restorative preferences (4).

The findings of Ciocan et al. (2025) underscore the clinical relevance of MIH in dental practice, revealing that although a high percentage of practitioners (86.76%) reported encountering cases, only 35.16% of them have received formal training, while 98.63% of them acknowledged the need for further education (45). This highlights a significant educational gap that persists despite the updated EAPD guidelines (2022), reinforcing the urgent need for structured educational programs and standardized clinical protocols. The management of dentin hypersensitivity (DH) in pediatric patients with MIH remains a clinical challenge; however, the Italian study by Bardellini et al. (2024) highlights the potential of combined therapeutic approaches, particularly the synergistic use of PBMT and CPP-ACPF, in enhancing clinical outcomes (46). Future research should focus on identifying the most effective combinations to optimize treatment strategies for this vulnerable population.

The 2025 Turkish study by Soğukpınar Önsüren and Temur highlights a potential association between MIH and bone development, possibly due to shared developmental factors. The understanding of this possible association may contribute to a more comprehensive and multidisciplinary diagnostic and treatment approach, especially when considering the growth and developmental dynamics of pediatric patients (47). The Brazilian cost-effectiveness analysis by da Costa Rosa et al. (2024) evaluated eight distinct restorative strategies for severely affected first permanent molars with MIH, highlighting not only the economic impact of different treatment options within the public health system, but also indirectly revealing the lack of unified clinical protocols. The wide range of evaluated approaches underscores the current absence of standardized educational and clinical guidelines for MIH management in Brazil (48).

Critical methodological limitations further complicate comparisons between studies. Disparities in diagnostic cri-

za krunice od nehrđajućeg čelika i restauracije od kompozita. Autori studija iz Finske (23) i Grčke (24) dodatno su istaknuli ulogu ponašanja pacijenata i potrebu za kontinuiranom edukacijom kako bi se poboljšali ishodi liječenja. Prema uočenim razlikama u materijalima i metodama liječenja ističu da lokalni resursi, mogućnosti izobrazbe i socioekonomski konteksti utječu na kliničko donošenje odluka.

Geografske razlike u liječenju MIH-a očite su, što je prikazano u nedavnom 19-godišnjem bibliometrijskom pregledu koji je obuhvatio više od 500 publikacija (44).

U studiji iz 2022. godine autori su prepoznali da se MIH globalno percipira kao javnozdravstveni problem te sugeriraju da njegova etiologija može obuhvaćati sistemske i epigenetske čimbenike (5). Europska akademija za dječju stomatologiju (EAPD), prva međunarodna znanstvena organizacija koja je opsežno izvještavala o MIH-u, predložila je 2020. godine sveobuhvatni dokument o politici i ažurirane smjernice. Recenzenti su primijenili sustav GRADE za procjenu sigurnosti dokaza, identificirajući preventivne i terapijske mogućnosti na temelju težine defekta i dobi pacijenta. No za prednje zube, unatoč sve većem broju istraživanja, dokazi ostaju ograničeni, s preferiranim konvencionalnim restaurativnim pristupom (4).

Ciocani i suradnici (2025.) u svojim nalazima ističu kliničku relevantnost MIH-a u stomatološkoj praksi i otkrivaju da je, iako je visok postotak kliničara (86,76 %) prijavio da se susreo sa slučajevima, samo njih 35,16 % pohađalo formalnu edukaciju, a 98,63 % priznalo je potrebu za daljnjom edukacijom (45). To ističe značajan nedostatak edukacije koji i dalje postoji unatoč ažuriranim smjernicama EAPD-a (2022.) i pojačava hitnu potrebu za strukturiranim obrazovnim programima i standardiziranim kliničkim protokolima. Liječenje preosjetljivosti dentina (DH), kad je riječ o pedijatrijskim pacijentima s MIH-om, ostaje klinički izazov, no u studiji Bardellinija i suradnika (2024.) u Italiji ističe se potencijal kombiniranih terapijskih pristupa, posebno sinergijske upotrebe PBMT-a i CPP-ACPF-a u poboljšanju kliničkih ishoda (46). Buduća istraživanja trebala bi se usredotočiti na identificiranje najučinkovitijih kombinacija kako bi se optimizirale strategije liječenja za tu ranjivu populaciju.

U studiji turskih autora Soğukpınara Önsürena i Temura iz 2025. ističe se potencijalna povezanost između MIH-a i koštanog razvoja, možda zbog zajedničkih razvojnih čimbenika. Razumijevanje ove moguće povezanosti može pridonijeti sveobuhvatnijem i multidisciplinarnom dijagnostičkom i terapijskom pristupu, posebno kada se uzme u obzir dinamika rasta i razvoja pedijatrijskih bolesnika (47). U analizi isplativosti brazilskog stručnjaka da Costa Rose i njegovih suradnika (2024.) procijenjeno je osam različitih restaurativnih strategija za teško zahvaćene prve trajne kutnjake s MIH-om te je istaknut ne samo ekonomski utjecaj različitih mogućnosti liječenja unutar sustava javnoga zdravstva, nego je neizravno otkriven i nedostatak jedinstvenih kliničkih protokola. Širok raspon procijenjenih pristupa ističe trenutačni nedostatak standardiziranih obrazovnih i kliničkih smjernica za liječenje MIH-a u Brazilu (48).

Kritična metodološka ograničenja dodatno kompliciraju usporedbe između studija. Razlike u dijagnostičkim kri-

teria and the absence of standardized, validated questionnaires impede robust synthesis, while reliance on self-reported data introduces potential bias. To advance the field and ensure consistent, high-quality care, it is essential to develop and implement validated instruments for assessing MIH knowledge and competence and systematically incorporate comprehensive, evidence-based MIH education across undergraduate and postgraduate curricula. Understanding cultural, educational, and economic influences on regional differences can further inform tailored training programs and public health policies. Strengthening dentist training globally could improve early diagnosis, patient outcomes, and overall quality of life for MIH patients.

Conclusion

Specialists and general dentists show greater confidence in diagnosing and treating MIH than students, although variations exist within both groups. Specialists report the highest levels of competence, often employing more diverse and evidence-based treatments, while general dentists frequently express uncertainty, especially with complex cases. In contrast, dental students display significant knowledge and clinical skill gaps, mainly due to insufficient education and practical exposure.

Global variability in MIH-related knowledge, attitudes, and management practices has been observed. Countries such as Australia and New Zealand exhibit robust understanding and effective treatment protocols, whereas studies from China and Chile expose substantial educational gaps that hinder optimal care. The United Kingdom shows a mixed landscape: competent general performance with persistent challenges in complex cases, often necessitating specialist intervention. Treatment preferences also vary geographically, with Saudi Arabia favoring stainless steel crowns and composite resin, and Malaysia commonly utilizing glass ionomer cement and composite resin.

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terijima i nedostatak standardiziranih, validiranih upitnika ometaju sintezu, a oslanjanje na samoprocjenu uvodi potencijalnu pristranost. Kako bi se poboljšalo područje i osigurala dosljedna, visokokvalitetna skrb, bitno je predložiti i implementirati validirane instrumente za procjenu znanja i kompetencija o MIH-u te uključiti sveobuhvatno, na dokazima utemeljeno obrazovanje o MIH-u u dodiplomske i poslijediplomske nastavne planove i programe. Razumijevanje kulturoloških, obrazovnih i ekonomskih utjecaja na regionalne razlike može dodatno informirati prilagođene programe edukacije i politike javnoga zdravstva. Jačanje edukacije stomatologa na globalnoj razini moglo bi poboljšati ranu dijagnozu, ishode i ukupnu kvalitetu života pacijenata s MIH-om.

Zaključak

Specijalisti i opći stomatolozi pokazuju veće samopouzdanje u dijagnosticiranju i liječenju MIH-a nego studenti, iako postoje varijacije unutar obiju skupina. Specijalisti izvještavaju o najvišim razinama kompetencije, često primjenjujući različite tretmane utemeljene na dokazima, a opći stomatolozi često pokazuju nesigurnost, posebno u složenim slučajevima. Nasuprot tomu, kod studenata stomatologije uočeni su značajni nedostatci u znanju i kliničkim vještinama, uglavnom zbog nedovoljnog obrazovanja i praktičnog iskustva.

Uočena je globalna varijabilnost u znanju, stajalištima i praksama upravljanja MIH-om. Zemlje poput Australije i Novog Zelanda pokazuju snažno razumijevanje i imaju učinkovite protokole liječenja, a studije iz Kine i Čilea otkrivaju značajne edukacijske nedostatke koji ometaju optimalnu skrb. Ujedinjeno Kraljevstvo pokazuje mješovite nalaze: kompetentna opća izvedba s trajnim izazovima u složenim slučajevima, što često zahtijeva specijalističku intervenciju. Preferencije u liječenju također se geografski razlikuju, pri čemu Saudijska Arabija favorizira krunice od nehrđajućeg čelika i kompozitne restauracije, a Malezija obično primjenjuje staklenoionomerni cement i kompozit.

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Sažetak

Svrha rada: Cilj ovog pregleda bio je mapirati znanje, percepcije i stajališta stomatologa i studenata stomatologije o MIH-u. **Materijali i metode:** Sustavno pretraživanje provedeno je u elektroničkim bazama podataka MEDLINE/PubMed, Scopus, Web of Science i Embase do svibnja 2023. Također je pretražena siva literatura u bazi podataka OpenGrey. Provjereni su popisi referencija potencijalno prihvatljivih istraživanja kako bi se osiguralo da su analizirane sve relevantne studije. Znanstveni radovi smatrani su prihvatljivima ako su ispunjavali određene kriterije za uključivanje: (1) da su usmjereni na MIH i (2) da se u tekstu procjenjuju znanje/percepcija/stajališta stručnjaka za oralno zdravlje. Znanstveni radovi smatrani su neprihvatljivima ako su ispunjavali bilo koji od sljedećih kriterija za isključivanje: (1) nedostatak podataka o znanju/percepciji/stajalištima o MIH-u među stručnjacima za oralno zdravlje i studentima stomatologije i (2) ako su zapravo pregled literature/stručno mišljenje/sustavni pregled/prikaz slučaja. **Rezultati:** Identificirano je 207 potencijalno prikladnih studija, a uključeno je njih 35. Pojavila se jasna razlika između kvalificiranih stomatologa i studenata stomatologije kad je riječ o znanju, stajalištima i liječenju MIH-a. Globalno, varijabilnost je bila očita: stručnjaci iz Australije/Novog Zelanda demonstrirali su snažne protokole, oni iz Kine/Čilea izvijestili su o značajnim nedostatcima, a iz Ujedinjenog Kraljevstva pokazali su mješovite rezultate. Preferencije liječenja razlikovale su se, pri čemu su oni u Saudijskoj Arabiji favorizirali krunice od nehrđajućeg čelika/kompozit, a u Maleziji su upotrebljavali staklenoionomerni cement/kompozit. **Zaključak:** Znanje, stajališta i liječenje MIH-a značajno se razlikuju u profesionalnim razinama i zemljama. Specijalisti i opći stomatolozi samopouzdaniji su u dijagnosticiranju i liječenju MIH-a od studenata, iako su zabilježene varijacije unutar obiju skupina. Protokol sustavnog pregleda registriran je na platformi OSF (doi: 10.17605/OSF.IO/NHMV2).

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References

1. Weerheijm KL, Jälevik B, Alaluusua S. Molar-incisor hypomineralisation. Caries Res 2001;35(5):390-1.
2. Restrepo M, Rojas-Gualdrón DF, de Farias AL, Escobar A, Vélez LF, Bussaneli DG, Santos-Pinto L. Development of undergraduate students' diagnostic accuracy for the classification of molar incisor hypomineralization. Eur J Dent Educ 2024;28(1):154-160.
3. Awwad A, Hamad R, Schiffner U, Splieth CH, Schmoeckel J. Effect of Prevalence and Severity of Molar-Incisor Hypomineralization on Oral Health-Related Quality of Life: A Systematic Review and Meta-Analysis. Acta Stomatol Croat 2023;57(4):381-394.
4. Weerheijm KL, Mejàre I. Molar incisor hypomineralization: a questionnaire inventory of its occurrence in member countries of the European Academy of Paediatric Dentistry (EAPD). Int J Paediatr Dent. 2003 Nov;13(6):411-6.
5. Bussaneli DG, Vieira AR, Santos-Pinto L, Restrepo M. Molar-incisor hypomineralisation: an updated view for aetiology 20 years later. Eur Arch Paediatr Dent 2022;23(1):193-198.
6. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71.
7. Kalkani M, Balmer RC, Homer RM, Day PF, Duggal MS. Molar incisor hypomineralisation: experience and perceived challenges among dentists specialising in paediatric dentistry and a group of general dental practitioners in the UK. Eur Arch Paediatr Dent 2016;17(2):81–8.
8. Alkadhimi A, Cunningham SJ, Parekh S, Noar JH, Travess HC. Decision making regarding management of compromised first permanent molars in patients with molar incisor hypomineralisation: A comparison of orthodontists and paediatric dentists. J Orthod. 2022 Mar;49(1):7-16.
9. Humphreys J, Jarad F, Albadri S. Management of molar-incisor hypomineralisation by general dental practitioners - part two: treatment. Br Dent J 2021;1–7.
10. Elhennawy K, Anang M, Splieth C, Bekes K, Manton DJ, Hedar Z, Krois J, Jost-Brinkmann PG, Schwendicke F. Knowledge, attitudes, and beliefs regarding molar incisor hypomineralization (MIH) amongst German dental students. Int J Paediatr Dent. 2021 Jul;31(4):486-495.
11. Hamza B, Elhennawy K, van Waes H, Papageorgiou SN. Knowledge, attitudes, and beliefs regarding molar incisor hypomineralisation amongst Swiss dental students. BMC Oral Health 2021;21(1):548.
12. Craveia J, Rouas P, Carat T, Manton DJ, Boileau MJ, Garot E. Knowledge and management of first permanent molars with enamel hypomineralization among dentists and orthodontists. J Clin Pediatr Dent. 2020;44(1):20-27.
13. Delgado RM, Botelho J, Machado V, Mendes JJ, Lopes LB. Knowledge, perception, and clinical experiences on molar incisor hypomineralization amongst Portuguese dentists. BMC Oral Health 2022;22(1):250.
14. Liu Y, He M. A survey on knowledge and attitudes towards molar-incisor hypomineralization among undergraduate and postgraduate students at the School of Stomatology, Wuhan University. BMC Oral Health 2022;22(1):19.
15. Upadhyay S, Dhillon JK. Perception of Indian Dental Surgeons regarding Molar Incisor Hypomineralization. Int J Clin Pediatr Dent. 2018 Mar-Apr;11(2):116-121.
16. Jain MC, Dixit UB. Misdiagnosis: How Uncommonly Common is it? J Clin Diagn Res 2018;12(4):ZC21-ZC24.
17. Alanzi A, Faridoun A, Kavvadia K, Ghanim A. Dentists' perception, knowledge, and clinical management of molar-incisor-hypomineralisation in Kuwait: a cross-sectional study. BMC Oral Health 2018;18(1):34.
18. Del Toro-Hernández IG, Domínguez-Torres I, Ureña-Cirett JL. Percepción y actitudes de dentistas pediátricos y dentistas generales hacia la hipomineralización molar incisivo en México. Rev AMOP 2020;32(2):43-50.
19. Gómez-Clavel JF, Sánchez-Cruz FY, Santillán-Carlos XP, Nieto-Sánchez MP, Vidal-Gutiérrez X, Pineda ÁEGA. Knowledge, experience, and perception of molar incisor hypomineralisation among dentists in the metropolitan area of Mexico City: a cross-sectional study. BMC Oral Health 2023;23(1):1018.
20. Ghanim A, Morgan M, Mariño R, Manton D, Bailey D. Perception of Molar-Incisor Hypomineralisation (MIH) by Iraqi Dental Academics. Int J Paediatr Dent 2011;21(4):261–70.
21. Silva MJ, Alhowaish L, Ghanim A, Manton DJ. Knowledge and attitudes regarding molar incisor hypomineralisation amongst Saudi Arabian dental practitioners and dental students. Eur Arch Paediatr Dent. 2016 Aug;17(4):215-22.
22. Głódkowska N, Emerich K. Postrzeganie i świadomość hipomineralizacji trzonowcowo-siekaczowej (MIH) wśród polskich lekarzy dentystów. Dent Med Probl. 2016;53(3):382–93.
23. Wuollet E, Laisi S, Alaluusua S, Waltimo-Sirén J. The Association between Molar-Incisor Hypomineralization and Dental Caries with Socioeconomic Status as an Explanatory Variable in a Group of Finnish Children. Int J Environ Res Public Health 2018 Jun 25;15(7):1324.
24. Seremidi K, Amend S, Krämer N, Gizani S. A cross-sectional survey on knowledge and attitudes of Greek dentists regarding molar incisor hypomineralisation diagnosis and treatment. BMC Oral Health 2022;22(1):498.
25. Hussein AS, Faisal M, Haron M, Ghanim AM, Abu-Hassan MI. Distribution of Molar Incisor Hypomineralization in Malaysian Children Attending University Dental Clinic. J Clin Pediatr Dent 2015;39(3):219-23.
26. Karkoutly M, Hamza B, Al Batal S, Al Barazi A, Bshara N. Knowledge, perceptions, attitudes, and clinical experiences on molar incisor hypomineralization among Syrian pediatric dentists and general dental practitioners: a cross-sectional study. BMC Oral Health. 2022 Dec 1;22(1):561.

27. Gamboa GCS, Lee GHM, Ekambaram M, Yiu CKY. Knowledge, perceptions, and clinical experiences on molar incisor hypomineralization among dental care providers in Hong Kong. BMC Oral Health 2018;18(1):217.
28. Kopperud SE, Pedersen CG, Espelid I. Treatment decisions on Molar-Incisor Hypomineralization (MIH) by Norwegian dentists - a questionnaire study. BMC Oral Health. 2016 Jul 4;17(1):3.
29. Uhlen MM, Valen H, Karlsen LS, Skaare AB, Bletsa A, Ansteinsson V, Mulic A. Treatment decisions regarding caries and dental developmental defects in children - a questionnaire-based study among Norwegian dentists. BMC Oral Health 2019;19(1):80.
30. Skaare AB, Houlihan C, Nybø CJ, Brusevold IJ. Knowledge, experience and perception regarding molar incisor hypomineralisation (MIH) among dentists and dental hygienists in Oslo, Norway. Eur Arch Paediatr Dent 2021;22(5):851–60.
31. Savin C, Bălan A, Vasâlca-Gavrila L, Istrati E, Murariu A. MIH syndrome: perceptions and knowledge of a sample of dentists from Iasi County. Rom J Oral Rehabil 2017;3(3):107-13.
32. Hamza B, Karkoutly M, Papageorgiou SN, Bshara N. Molar-incisor hypomineralisation: Knowledge and perception of Syrian undergraduate and postgraduate dental students. Eur J Dent Educ 2023;27(2):343–52.
33. Sajadi FS, Hasheminejad N, Mehdizadeh A, Eskandarizadeh A, Rostamizadeh M. Dentists' Knowledge and Clinical Experience towards Molar-Incisor-Hypomineralization in Iran. Pesqui Bras Odontopediatria Clin Integr 2021;21:e0004.
34. Serna-Muñoz C, Martínez-Beneyto Y, Pérez-Silva A, Poza-Pascual A, Ibáñez-López FJ, Ortiz-Ruiz AJ. Perception, knowledge, and attitudes towards molar incisor hypomineralization among Spanish dentists: a cross-sectional study. BMC Oral Health 2020;20(1):260.
35. Wall A, Leith R. A questionnaire study on perception and clinical management of molar incisor hypomineralisation (MIH) by Irish dentists. Eur Arch Paediatr Dent 2020;21(6):703–710.
36. Crombie FA, Manton DJ, Weerheijm KL, Kilpatrick NM. Molar incisor hypomineralization: A survey of members of the Australian and New Zealand society of paediatric dentistry. Aust Dent J 2008;53(2):160–6.
37. Amarante BC, Arima LY, Pinheiro E, Carvalho P, Michel-Crosato E, Bônecker M. Diagnosis training and calibration for epidemiological studies on primary and permanent teeth with hypomineralization. Eur Arch Paediatr Dent. 2022 Feb;23(1):169-177.
38. Rahmadini E, Amir LR, Maharani D. Knowledge and perceptions on molar incisor hypomineralization among dental students in Indonesia. J Int Dent Med Res. 2022;15:243–49.
39. Gambetta-Tessini K, Mariño R, Ghanim A, Calache H, Manton DJ. Knowledge, experience and perceptions regarding Molar-Incisor Hypomineralisation (MIH) amongst Australian and Chilean public oral health care practitioners. BMC Oral Health. 2016 Aug 18;16(1):75.
40. Tagelsir A, Dean JA, Eckert GJ, Martinez-Mier EA. U.S. Pediatric Dentists' Perception of Molar Incisor Hypomineralization. Pediatr Dent 2018;40(4):272–78.
41. Almuallem Z, Busuttil-Naudi A. Molar incisor hypomineralisation (MIH) - an overview. Br Dent J. 2018 Oct 5.
42. Santos-Pinto L, Rios D. Molar Incisor Hypomineralisation: A Recent Condition or a New Perception? Monogr Oral Sci 2024;32:1-9.
43. Jawdekar AM, Kamath S, Kale S, Mistry L. Assessment of oral health-related quality of life (OHRQoL) in children with molar incisor hypomineralization (MIH) - A systematic review and meta-analysis of observational studies. J Indian Soc Pedod Prev Dent. 2022 Oct-Dec;40(4):368-376.
44. da Costa Rosa T, Pintor AVB, Magno MB, Marañón-Vásquez GA, Maia LC, Neves AA. Worldwide trends on molar incisor and deciduous molar hypomineralisation research: a bibliometric analysis over a 19-year period. Eur Arch Paediatr Dent 2022;23(1):133-146.
45. Ciocan B, Petcu LC, Luca R. Romanian dentists' perceptions on molar incisor hypomineralization—A questionnaire-based study. Children 2025;12(6):680.
46. Bardellini E, Amadori F, Rosselli L, Garo ML, Majorana A, Conti G. Molar incisor hypomineralization: Optimizing treatment protocols for hypersensitivity: A randomized clinical trial. Dent J (Basel). 2024 Jun 19;12(6):186.
47. Önsüren AS, Temur KT. Evaluation of fractal and radiomorphometric measurements of mandibular bone structure in pediatric patients with molar incisor hypomineralization. Int J Paediatr Dent 2025 Apr 1.
48. da Costa Rosa T, Cavalcanti YW, de Castro Costa M, de Almeida Neves A. Cost-effectiveness of restorative treatments for permanent molars with severe molar incisor hypomineralization: Perspectives for the Brazilian public health system. Clin Oral Investig. 2024 May 7;28(6):301.