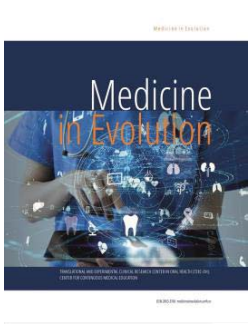
State of current knowledge of the aetiology and incidence of molar-incisor hypomineralization (MIH) - a bibliometric analysis



Luca M.M.[1], Popa M.[1], Buzatu R.[2], Penescu B.[3], Miron M.I.[4]

[1]*Department of Pediatric Dentistry, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania*
[2]*Department of Dental Aesthetics, Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania*
[3]*DMD, Timişoara, Romania*
[4]*Department of Oral Rehabilitation and Dental Emergencies, Faculty of Dentistry, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania*

Correspondence to:
Name: Buzatu Roxana
Address: Bd. Revoluţiei 1989, no. 9, Timişoara, Romania
Phone: +40 721236147
E-mail address: roxana.buzatu@umft.ro

Abstract

Molar-incisor hypomineralization (MIH) was defined in 2001 as a qualitative enamel defect of systemic origin affecting at least one permanent first molar and may also be associated with permanent incisors. Numerous papers have been published to shed light on and raise awareness of this global issue [3]. The condition can be associated with dental complications, including hypersensitive teeth, rapid caries progression, impaired mastication due to rapid wear, and aesthetic repercussions. They can affect patients' quality of life and create treatment challenges for dentists. The present study aims to carry out a bibliometric analysis on the aetiology and incidence of molar-incisor hypomineralization syndrome, this being one of the most pressing problems faced by paediatric dentistry.

Keywords: MIH, HSPM, aetiology, treatment options, VOSviewer

INTRODUCTION

Molar-incisor hypomineralization (MIH) was defined in 2001 as a qualitative enamel defect of systemic origin affecting at least one permanent first molar and may also be associated with permanent incisors [1]. The European Academy of Pediatric Dentistry noted the lack of knowledge about MIH and promoted research in this regard [2]. Numerous papers have been published to shed light on and raise awareness of this global issue [3]. The condition can be associated with dental complications, including hypersensitive teeth, rapid caries progression, impaired mastication due to rapid wear, and aesthetic repercussions. They can affect patients' quality of life and create treatment challenges for dentists. Given this lifetime burden, it clearly deserves increased attention as a global dental public health concern [4].

Regarding aetiology, many studies have investigated the association between systemic conditions, prenatal, perinatal, and postnatal drug use, early exposure to dioxins or bisphosphonates, and genetic factors. However, the available evidence is still insufficient to establish the exact cause [5,6].

Clinically, affected teeth show hypomineralization that can be seen as an alteration of enamel translucency. Hypomineralized enamel can vary in shade colour from white to yellow or brown, but always shows well-defined and distinct edges of healthy enamel. Porous enamel can fracture easily, especially under the influence of masticatory forces. Occasionally, the enamel of affected molars breaks down slightly after eruption, leaving the dentin exposed, referred to in the literature as "posteruptive enamel degradation". At the level of the permanent incisors, the affected enamel usually appears less disturbed due to much lower masticatory forces. Incisal enamel defects are, however, frequently extended to the vestibular surfaces of the teeth giving rise to aesthetic problems [7,8].

The causative mechanism of MIH is still unclear, but the clinical presentation of localized and asymmetric lesions suggests a systemic origin with disruption in the amelogenesis process that most likely occurs in the early maturation stage or even earlier in the late secretory phase [5,9].

In general, the cause appears to be multifactorial, including systemic factors such as acute or chronic diseases or exposure to environmental pollutants during the last trimester of pregnancy and the first three years of life have been suggested as causative or contributing factors. The number of affected teeth was associated with the time at which the potential systemic disorder occurred; children with prenatal, perinatal and postnatal problems have more affected teeth [5,10].

Several possible causes have been suggested in the literature, for example, respiratory tract infections, perinatal complications, dioxins, oxygen starvation, low birth weight, calcium and phosphate metabolic disorders, frequent childhood illnesses, antibiotic use, and prolonged breastfeeding [11].

Mathu-Muju and **Wright** classified MIH into three levels of severity:

1. Mild MIH:
   - delimited opacities located in unsolicited areas
   - non-association of caries with affected enamel, without hypersensitivity
   - incisor involvement is usually mild if present
2. Moderate MIH
   - limited opacities
   - present on molars and incisors
   - post-eruptive enamel damage limited to one or two surfaces without cuspid involvement

- atypical restorations may be required
- normal dental sensitivity

3. Severe MIH:

- post-eruptive enamel
- destruction of the crown, caries
- associated with affected enamel
- dental sensitivity and aesthetic concerns [12].

Aim and objectives

The present study aims to carry out a bibliometric analysis on the aetiology and incidence of molar-incisor hypomineralization syndrome, this being one of the most pressing problems faced by paediatric dentistry. It is desired to identify trends in the main research topics and groups—including authors and countries—for MIH over the years; also to explore the development of scientific evidence, possible etiological factors and types of proposed treatments that guide future research in the field.

MATERIAL AND METHODS

A. BIBLIOMETRIC ANALYSIS

The VOSviewer software is a tool for building and viewing bibliometric networks, being used in mapping and scientific research. Bibliometric charts are used to highlight the structure and network of journals, authors, universities or countries. Networks may include, for example, journals, individual publications, or researchers, and may be built on co-authorship, bibliographic coupling, or citation relationships. In order to create a network, bibliographic database files (Web of Science, Dimensions, Scopus and PubMed,) and reference management files (RIS EndNote and RefWorks files) can be provided as input to VOSviewer.

Bibliometric tools are used to study the flow of scientific publications, to rank the quality of work in a certain field, to assess the speed of its development, to identify experts, institutions and countries recognized worldwide for their contributions to scientific development and number of citations. With this data, more complex mathematical formulas can be constructed to obtain more specialized bibliometric indicators, such as a journal's impact factor or a researcher's Hirsch index.

Working steps in WoSviewer:

1. The words: "*molar incisor hypomineralisation* (MIH)", "*deciduous molar hypomineralisation*" and "*hypomineralised second primary molars (HSPM*)" were considered the most relevant words in order to carry out the study and obtain the most accurate and current potential results for all domains of knowledge in the WoS, following a selection of articles, according to the inclusion criteria, to be included in the research. Given that the results are numerous, they are closely related to incidence and prevalence.

All documents published in the period 2012-2022 were included in the study. Also, the final selection was limited to articles only, excluding oral presentations and abstracts. The sample includes 153 documents. The limitation was mainly applied to works published in English. Studies lacking demographic characteristics and those that included fluorosis were excluded. Additional reference searches were conducted against the references of the selected articles. For relevance, the collected articles were reviewed by title, abstract and text criteria.

B. CO-CITATION OF SCIENTIFIC SOURCES

This part of the analysis focuses on researching the network area of the most important sources. Regarding co-citation links, the link between them indicates the distance between two journals, thus a strong link is indicated by a small distance between them, while

a weak link is highlighted by a large distance between journals. Co-citation shows the frequency with which a document cites two other documents together.

Among the data selected in Web of Science, VOSviewer took only the names of the main sources of the works in the bibliometric map. Regarding source co-citation analysis, the unit of analysis is represented by the names of the sources in the data (set of journals) that were analyzed in VOSviewer. The data selected from the Web of Science and entered into the VOSviewer program identified the presence of 587 sources, but only 35 of them met the criterion of at least 3 citations per source. So, the journal set highlights only the 35 most productive journals in our research scope, and these journals fall into 4 different color clusters.

RESULTS

A. Bibliometric analysis of keywords

This method focuses on highlighting the most persistent keywords in terms of their coincidence (keywords that appear simultaneously in several articles). Therefore, it is important to emphasize that the keywords used by the author throughout the article are taken into account. The main aim is to observe the keywords most adopted by the authors in the field of molar-incisor hypomineralization syndrome (MIH).

In addition to the most used and relevant keywords in determining the results in Web of Science (MIH, prevalence, incidence, children), the map in Vosviewer shows us a major importance of other words that appear predominantly in the articles taken into analysis, such as: severity (with 17 occurrences), 2nd primary molars (with 16 occurrences), defects (with 15 occurrences) and enamel defects, caries, school-children (each with 18 occurrences) (Fig.1).

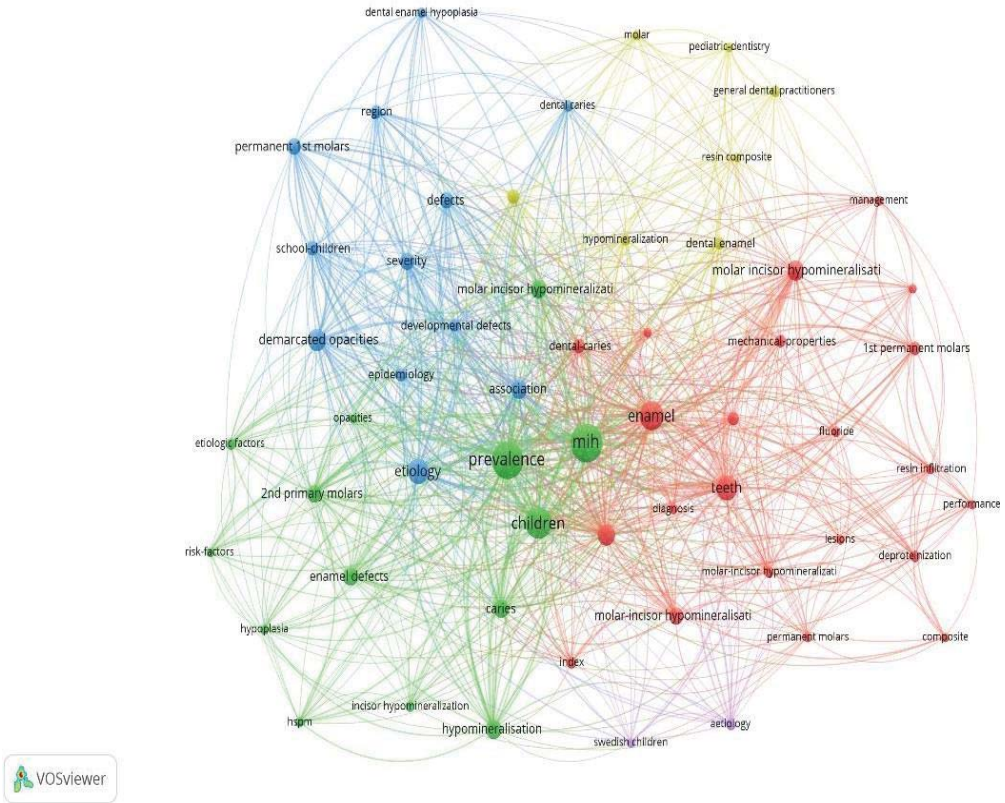


Figure 1. Word coincidence network regarding the incidence and prevalence of molar-incisor hypomineralization (MIH

The bibliometric map indicates the most important keywords and respectively the nodes between keywords:

- the bigger the keyword and the node we see, the more relevance has;
- the smaller the distance between the nodes, the stronger the relationship between them.
- we observe a more frequent co-occurrence when the lines are thicker.
- the same color indicates a series of related keywords or a group of keywords

Thus, the program identified 5 clusters.

Figure 1 represents the keywords with the most frequent matches (applying a threshold of one match).

The group containing the most keywords is group 1 (red), which is centered on words such as: 1st permanent molars, caries experience, enamel hypomineralisation and composite. Next, we have group 2 (green), which includes 14 keywords, such as: 2nd primary molars, caries, etiologic factors and hypoplasia.

Group 3 (blue) presents 2 keywords in addition to the green one, association, defects and demarcated opacities being included in it.

Group 4 (yellow) is headed by the words: dental enamel, pediatric dentistry and hypomineralization.

Further, group 5 (purple) consists of 2 objects each, but of major importance. Aetiology and Swedish children are the words the purple group is centered on. (Table 1).

Table 1. Keyword groups

Word no.	Group 1(red)	Group 2 (green)	Group 3 (blue)	Group 4 (yellow)	Group 5 (purple)
1	1st permanent molars	2nd primary molars	Association	Molar	Aetiology
2	Amorphous calcium-phosphate	Caries	Defects	Pediatric-dentistry	Swedish children
3	Caries experience	Children	Etiology	Dental enamel	
4	Composite	Enamel defects	Epidemiology	Resin composite	
5	Dental-caries	Etiologic factors	Demarcated opacities	General dental practitioners	
6	Deproteinization	Hspm	Developmental defects	Incisor hypomineralisation	
7	Diagnosis	Hypomineralisation	Severity	Hypomineralization	
8	Enamel	Hypoplasia	School-children		
9	Enamel hypomineralisation	Incisor Hypomineralization	Permanent 1st molars		
10	Fluoride	MIH	Region		
11	Index	Molar incisor hypomineralis ation	Dental enamel hypoplasia		
12	Lesions	Opacities	Dental caries		
13	Management	Prevalence			
14	Mechanical-properties	Risk factors			
15	Molar incisor hypomineralisation				
16	Molar-incisor hypomineralisation				
17	Molar-incisor hypominerazati				
18	Molar-incisor-hypomineralisation				
19	Performance				
20	Permanent molars				
21	Resin infiltration				
22	Teeth				

B. Co-citation regarding authors

Following the application of the criterion of appearing in at least 3 articles, the number of authors who published on the subject of MIH, was reduced from 587 to 35 authors.

They were grouped into 4 clusters of different colours (red, blue, green and purple) according to the approach of the topic in the articles. Among the 35 authors to whom the bibliometric map was narrowed, 19 are the ones that were most relevant to this study according to the criterion of citations and the total strength of the link (Fig.2).

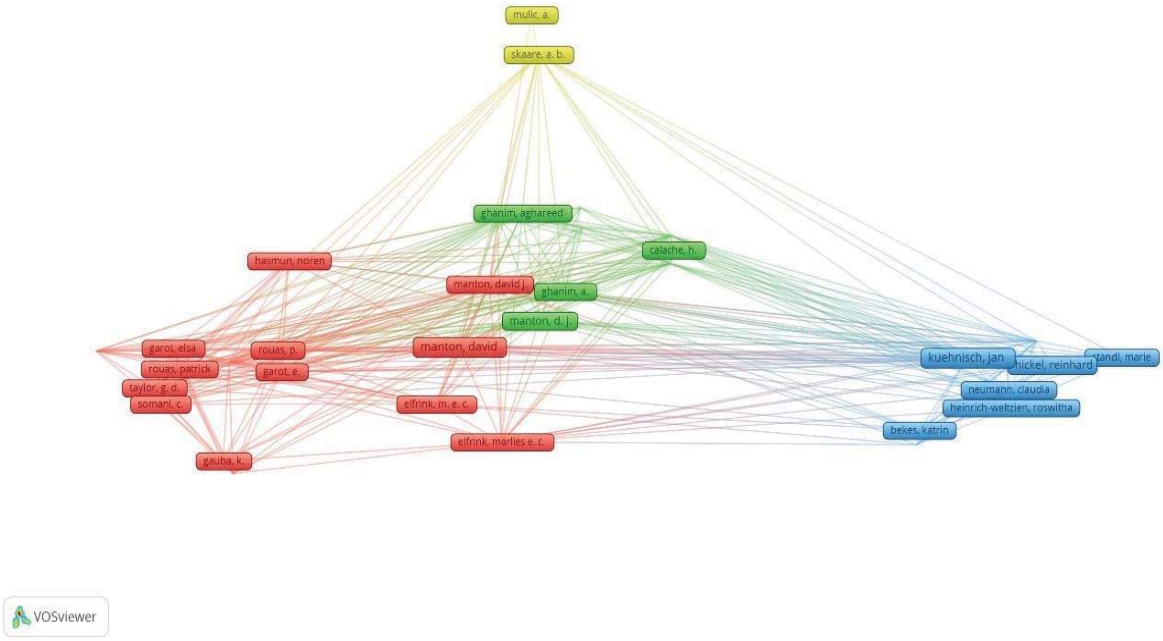


Figure 2. Bibliographic map regarding co-citation

The first three authors to publish on this topic were Manton DJ affiliated with the University of Melbourne-Australia, Kühnisch Jan and Hickel Reinhard, both affiliated with the Ludwig-Maximilians University in Munich. Thirty-five authors resulted following the criterion of being present with at least three publications on this topic. Most of them had publications in both MIH and DMH/HSPM, but the number of studies on DMH/HSPM was lower for all but one author (Elfrink ME). Further analysis of the collaboration between these authors with three or more publications on the topic of interest revealed the existence of four main geographical collaboration clusters: (1) Australia; (2) Continental Europe (Netherlands, Germany, Austria) (3) Brazil. The European Archives of Pediatric Dentistry was the most published journal, followed by the International Journal of Pediatric Dentistry and the European Journal of Pediatric Dentistry (Table 2).

Table 2. Citation groups and related link strength on the most relevant scientific authors

Group 1 (red)	Citations	Total link strength	Group 2 (blue)	Citatons	Total link strength	Group 3 (green)	Citations	Total link strength
Garot, E	11	82	Heinrich, Joachim	113	95	Ghanim, A.	95	72
Garot Elsa	45	78	Heinrich- Weltzien	93	52	Ghanim, Aghareed	123	62
Lygidakis, N.a	70	82	Heitmueller, Daniela	93	52	Manton, D.j	119	95
Manton, David	226	142	Hickel, Reinhard	122	100			
Manton, David J.	217	92	Kuehnisch, Jan	153	119			
Rouas, P	11	82	Standl, Marie	26	71			
Rouas, Patrik	45	78	Neumann, Claudia	93	52			
Somani	11	59						
Taylor, G.D	11	59						

DISCUSSIONS

A. Bibliometric keyword analysis

Molar-incisor hypomineralization (MIH) was defined in 2001 by the European Academy of Pediatric Dentistry (EAPD) as a qualitative enamel defect, ranging from demarcated yellow-white or yellow-brown opacities to severely hypomineralized damaged enamel [2,13].

Its global prevalence in 2015 was estimated at 12.9%, with 878 million reported cases and an incidence of 17.5 million new cases in 2016. In this regard, MIH has been considered a public health problem due to its impact on children's oral health and global health economy. Affected enamel is more prone to post-eruptive degradation, favouring the development of carious lesions, sensitivity, with a negative impact on their quality of life. In addition, the difficulty in obtaining adequate anaesthesia and the higher failure rate in adhesive restorations contribute to less cooperation of children during treatment. In fact, the management of the condition is still a challenge for dentists, made worse by the clinical variability of the lesions, the need for individualized treatments, and the existence of few clear clinical guidelines [13,14].

Thus, the red group is related to the treatment approaches to the lesions present in the teeth affected by MIH, depending on the stage, which can be grouped into:

- Prophylactic therapy - fluoride, amorphous calcium phosphate
- Sealing therapy - infiltration of resins
- Restoration therapy - composite materials [15,16]

Treatment is chosen according to an index that corresponds to MIH symptoms. Deproteinization with NaOCl 5% for 60 seconds after etching is considered to be a good way to increase the bond between the composite and the tooth [16].

On the other hand, the green group reveals the interrelation between MIH and HSPM, but also the most studied age group, children. Thus, children affected by HSPM are approximately five times more likely to have MIH. Especially the mild form of HSPM is considered to be a predictive factor for MIH. The reason for this may be that the aetiological factors appear at the end of the vulnerable period of the second temporary molar. Opacities are the most common feature. Discoloured areas, especially dull yellow/brown areas, are weaker and therefore more vulnerable not only to post-eruption enamel loss, but also to caries [17,18,19,20].

Regarding desensitization, laser together with fluoride varnish in the treatment combination (L + FV) had a greater desensitizing action on MIH teeth. Laser therapy demonstrated an immediate desensitizing effect, while fluoride varnish had a delayed effect. Regarding desensitization, laser together with fluoride varnish in the treatment combination (L + FV) had a greater desensitizing action on MIH teeth. Laser therapy demonstrated an immediate desensitizing effect, while fluoride varnish had a delayed effect [21].

Furthermore, the objectives of the blue group are to determine the prevalence of MIH/HSPM, the severity of caries lesions and their association in studies carried out in different regions, which had as subjects school children [22,23].

In the case of Lebanese children, it was concluded that MIH is the most prevalent enamel defect. According to the criterion of sex and location, the girls and upper arch teeth were leading in the case of children from Barcelona. The prevalence of MIH in Dubai is low. However, caries and fluorosis rates are much higher, which calls for strengthening caries prevention efforts. Complications during the mother's pregnancy, preterm birth, average duration of breastfeeding, frequency of diarrhea, diseases of the digestive system, bronchial asthma, high fever, ear infection, renal failure, rubella, and varicella were significantly

associated with MIH following the questionnaire and etiological questions asked parents of children in Istanbul [17,18,19,20].

The yellow group is focused on the management and level of understanding of general dental practitioners (GDPs) regarding MIH. They are in direct contact with small patients, children, often encountering cases of molar-incisor hypomineralization. The most frequently encountered problem was the behavioural management of the child, followed by the difficulty of anaesthesia. Despite the increase in research on MIH, a lack of understanding and management by physicians has been found [24].

It has also been shown that the preferred material of GDPs for restorative treatment is composite resin. Unanimously agreed was the need to implement continuous medical education programs in the reference field, which could contribute to the dissemination of knowledge and to a correct therapeutic and clinical management of the MIH syndrome [25].

According to the purple group, which focused on studies of children in Sweden, more consensus was reached. The incidence is higher in male than female subjects. The age of 9 is when we have the highest percentage of MIH. Also, the mandible is more affected compared to the maxilla. The prevalence in children in public schools is higher than in those who attend a private school. No significant associations with environmental, developmental or medical factors were found. It was concluded that nutrition in the first 6 months of life can influence the risk of developing severe demarcated opacities in the first permanent molars [17].

B. Co-citation regarding authors

The first group (red) presents a remarkable composition of 9 authors. From the citation point of view, we can state that this group contains the author with the highest number of citations (226) and a total link strength of 142.

The articles of these authors focused on determining the possible causality of hypomineralized lesions occurring in temporary molars - molar-incisor hypomineralization syndrome in the permanent dentition. Thus, the presence of HSPM is considered to be predictive of MIH, with a higher prevalence of MIH in the presence of mild HSPM. Early detection and preventive intervention could reduce MIH complications [26, 27, 28].

Another important group is the blue one (group 2) being led by the author Kuehnisch Jan who presents a number of 153 citations and 119 total link strength.

The interest of this cluster focused on elucidating the aetiology, which brought to light different hypotheses:

- Nutrition in the first year of life
- Bisphosphonates
- Dental caries
- Asthma (a significant association between medication-naïve asthmatic adolescents and MIH)
- Excess vitamin D supplements during pregnancy [29,30].

Group 3 (green) is built on the interest of the clinical approach of MIH, and a training manual for clinical studies and practice has been published, with the representatives of this group, Ghanim A. and Manton D., as co-authors.

Finally, we can say that these authors represent the most significant sources in our field of research, bringing the greatest emphasis, contribution and importance to scientific studies.

CONCLUSIONS

Scientific articles were retrieved by searching the Web of Science database. WOS is one of the most important sources of scientific documentation worldwide, containing valuable information about research carried out over 100 years, and is a license-based platform that, in

Romania, provides access to the abstracts of articles of over 20,000 scientific journals and over 170,000 scientific conference papers, academic books from 256 disciplines.

Web of Science offers researchers the opportunity to collect and analyze information to form an opinion on different trends and patterns in research, the opportunity to build an overview of the research phenomenon around the world, through a single platform and through a simple search sequence.

Finally, bibliometric data can be highly variable and constantly changing over time, and therefore the results presented should not be interpreted as absolute numbers, but by trends. Despite these limitations, this study provided important information that helped form a more comprehensive picture of this topic.

The continued implementation of medical education programs in the reference area could contribute to the dissemination of knowledge and the correct therapeutic and clinical management of MIH syndrome. It is necessary to continue educating primary dentists in recognizing and diagnosing this condition and offering the recommended treatment to patients with a mild clinical picture, while directing those with more serious problems to specialist doctors, pedodontists. At the same time, the multidisciplinary approach must be considered.

As aetiology, nutrition in the first year of life, bisphosphonates, dental caries, asthma (a significant association between asthmatic adolescents who do not follow medication and MIH) and excess vitamin D supplements during pregnancy were some of the relevant factors incriminated.

Composite resin was the most studied treatment option, followed by local prevention, sensitivity/pain, glass-ionomers, and other restoration materials. Extraction was the least accepted treatment option. The choice of treatment option must be made according to the severity of the defect and the age of the patient.

The Treatment Need Index has proven to be a reliable and valid tool for use in clinical and population-based screenings for the diagnosis of MIH and other enamel defects.

This bibliometric review provided a comprehensive overview of MIH research over the last 10 years. Within the limits of the present study, the following conclusions can be drawn: global trends indicate a growing peak of scientific publication, especially in the last decade, but there is a shortage of clinical studies on treatments. Finally, the multifactorial nature should be further explored by considering environmental and systemic factors together.

REFERENCES

1. Katrin Bekes, Molar Incisor Hypomineralization A Clinical Guide to Diagnosis and Treatment, Springer Nature Switzerland AG 2020
2. The Journal of Contemporary Dental Practice, July 2016;17(7):609-613)
3. Nanci A. Ten Cate's oral histology-e-book: development, structure, and function. Elsevier Health Sciences; 2017
4. Crombie FA, Manton DJ, Palamara JE, Zalizniak I, Cochrane NJ, Reynolds, EC. Characterisation of developmentally hypomineralised human enamel. J Dent. 2013;41:611-8.
5. Elhennawy K, Manton DJ, Crombie F, Zaslansky P, Radlanski RJ, Jost-Brinkmann PG, et al. Structural, mechanical and chemical evaluation of molar-incisor hypomineralization affected enamel: A systematic review. Arch Oral Biol. 2017;83:272-81
6. Silva MJ, Scurrah KJ, Craig JM, Manton DJ, Kilpatrick N. Etiology of molar incisor hypomineralization - a systematic review. Community Dent Oral Epidemiol. 2016;44(4):342-53

7. Costa Rosa T, Pintor A, Magno M, Mara√±√≥n-V√°squez G, Maia L, Neves A. Worldwide trends on molar incisor and deciduous molar hypomineralisation research: a bibliometric analysis over a 19-year period. European Archives of Paediatric Dentistry. 2021;23(1):133- 146.
8. Almuallem Z, Busuttil-Naudi A. Molar incisor hypomineralisation (MIH) - an overview. British Dental Journal. 2018;225(7):601-609.
9. Rao MH, Aluru SC, Jayam C, Bandlapalli A, Patel N. Molar Incisor Hypomineralization. J Contemp Dent Pract 2016;17(7):609-613.
10. Weerheijm KL, J√§levik B, Alaluusua S. Molar-incisor hypomineralisation. Caries Res 2011;35:390-391.
11. Craveia, J., Rouas, P., Carat, T., Manton, D. J., Boileau, M. J., & Garot, E. (2020). Knowledge and management of first permanent molars with enamel hypomineralization among dentists and Orthodontists. Journal of Clinical Pediatric Dentistry, 44(1), 20-27. https://doi.org/10.17796/1053-4625-44.1.4
12. Garot E, Couture-Veschambre C, Manton D, Beauval C, Rouas P. Analytical evidence of enamel hypomineralisation on permanent and primary molars amongst past populations. Scientific Reports. 2017;7(1).
13. Sukumaran G, Padavala S. Molar incisor hypomineralization and its prevalence. Contemporary Clinical Dentistry. 2018;9(6):246.
14. Allazzam S, Alaki S, El Meligy O. Molar Incisor Hypomineralization, Prevalence, and Etiology. International Journal of Dentistry. 2014;2014:1-8.
15. Abufarwa M, Noureldin A, Dziak R, Covell D. Efficacy of CPP-ACP fluoride varnish applied with and without acid etching in preventing enamel demineralization compared to light-curable fluoride varnish. The Angle Orthodontist. 2021;92(2):213-219.
16. 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).
17. Ridell K, Borgstr√∂m M, Lager E, Magnusson G, Brog√•rdh-Roth S, Matsson L. Oral health-related quality-of-life in Swedish children before and after dental treatment under general anesthesia. Acta Odontologica Scandinavica. 2014;73(1):1-7.
18. Al-Bluwi G. Epidemiology of dental caries in children in the United Arab Emirates. International Dental Journal. 2014;64(4):219-228.
19. Hern√°ndez M, Boj J, Espasa E, Peretz B. First Permanent Molars and Permanent Incisors Teeth by Tooth Prevalence of Molar-Incisor-Hypomineralisation in a Group of Spanish Schoolchildren. Acta Stomatologica Croatica. 2018;52(1):4-11.
20. Uhlen M, Valen H, Karlsen L, Skaare A, Bletsa A, Ansteinsson V et al. Treatment decisions regarding caries and dental developmental defects in children - a questionnaire- based study among Norwegian dentists. BMC Oral Health. 2019;19(1).
21. Muniz R, Carvalho C, Aranha A, Dias F, Ferreira M. Efficacy of low,Äêlevel laser therapy associated with fluoride therapy for the desensitisation of molar,Äêincisor hypomineralisation: Randomised clinical trial. International Journal of Paediatric Dentistry. 2019;30(3):323-333.
22. Ghanim A, Mari√±o R, Manton D. Validity and reproducibility testing of the Molar Incisor Hypomineralisation (MIH) Index. International Journal of Paediatric Dentistry. 2018;29(1):6-13.
23. Costa-Silva C, Paula J, Ambrosano G, Mialhe F. Influence of deciduous molar hypomineralization on the development of molar-incisor hypomineralizarion. Brazilian Journal of Oral Sciences. 2013;12(4):335-338.
24. Zhao D, Dong B, Yu D, Ren Q, Sun Y. The prevalence of molar incisor hypomineralization: evidence from 70 studies. International Journal of Paediatric Dentistry. 2017;28(2):170-179.
25. Bussaneli D, Restrepo M, Fragelli C, Santos-Pinto L, Jeremias F, Cordeiro R et al. Genes Regulating Immune Response and Amelogenesis Interact in Increasing the Susceptibility to Molar-Incisor Hypomineralization. Caries Research. 2018;53(2):217-227.
26. Gambetta-Tessini K, Mari√±o R, Ghanim A, Calache H, Manton D. Carious lesion severity and demarcated hypomineralized lesions of tooth enamel in schoolchildren from Melbourne, Australia. Australian Dental Journal. 2018;63(3):365-373.
27. Kopperud S, Pedersen C, Espelid I. Treatment decisions on Molar-Incisor Hypomineralization (MIH) by Norwegian dentists - a questionnaire study. BMC Oral Health. 2016;17(1).

28. Kassebaum NJ, Smith AGC, Bernab√© E, Fleming TD, Reynolds AE, Vos T, et al. Global, regional, and national prevalence, incidence, and disability-adjusted life years for oral conditions for 195 countries, 1990-2015: a systematic analysis
29. Schwendicke F, Elhennawy K, Reda S, Bekes K, Manton DJ, Krois J. Corrigendum to "Global burden of molar incisor hypomineralization" [J. Dent. 68C (2018) 10-18]. J Dent. 2019;80:89-92
30. Elfrink ME, Ghanim A, Manton DJ, Weerheijm KL. Standardised studies on molar incisor hypomineralisation (MIH) and hypomineralised second primary molars (HSPM): a need. Eur Arch Paediatr Dent. 2015;16(3):247-55.