Knowledge, attitudes, and beliefs regarding molar incisor hypomineralization (MIH) amongst German dental students

Karim Elhennawy1 | Mostafa Anang2 | Christian Splieth2 | Katrin Bekes3 | David John Manton | Zen Hedar1 | Joachim Krois5 | Paul-Georg Jost-Brinkmann1 | Falk Schwendicke5

1Department of Orthodontics, Dentofacial Orthopedics and Pedodontics, Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin, Humboldt-Universität, and BerlinInstitute of Health, Äßmannshauser Str. 4-6, Berlin, 14197, Germany
2Department of Preventive and Paediatric Dentistry, University of Greifswald, Greifswald, Germany
3Department of Paediatric Dentistry, School of Dentistry, Medical University of Vienna, Vienna, Austria
4Paediatric Dentistry and Cariology, Centrum voor Tandheelkunde en Mondzorgkunde, UMC, A. Deusinglaan 1, Groningen, 9700 AD, The Netherlands
5Department of Operative and Preventive Dentistry, Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin, Humboldt-Universität, and BerlinInstitute of Health, Äßmannshauser Str. 4-6, Berlin, 14197, Germany

Correspondence
Karim Elhennawy, Department of Orthodontics, Dentofacial Orthopedics and Pedodontics, Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin, Humboldt-Universität, and BerlinInstitute of Health, Äßmannshauser Str. 4-6, 14197 Berlin, Germany
Email: Karim.elhennawy@charite.de

Abstract

Background: Knowledge of molar incisor hypomineralization (MIH) has relevance for paediatric dentists.

Aim: To assess final-year German dental students’ knowledge, attitudes, and beliefs regarding MIH.

Materials and methods: A previously validated questionnaire was posted to the 31 German dental schools. Demographic covariates as well as knowledge regarding diagnosis and prevalence, and attitudes and beliefs around aetiology and management were collected.

Results: Twenty-two (71%) dental schools responded and a total of 877 students participated. Most (97%) were familiar with MIH and 88% were aware of the diagnostic criteria for MIH; however, only 42% knew how to implement them. One-third were able to identify MIH and 16% reported diagnostic confidence when doing so; 90% assumed the MIH prevalence to be <10%. Two-thirds of the respondents implicated genetic components as the main aetiological factor of MIH. Resin composite (60%) and preformed metal crowns (46%) were the dental materials most often suggested for restorative management. Almost all (98%) respondents were interested in receiving more clinical training.

Conclusion: German students were familiar with MIH; however, they reported low levels of knowledge and confidence regarding its prevalence and diagnosis. Standardized nationwide, up-to-date curricula should be implemented to educate future dentists in Germany.

KEYWORDS
awareness, knowledge, molar incisor hypomineralization, perception, students
1 | INTRODUCTION

Weerheijm and colleagues (2001) were the first to propagate the term Molar Incisor Hypomineralization (MIH), now defined as ‘qualitative, demarcated developmental hypomineralized defects of one or more first permanent molar (FPM), with or without the involvement of the incisors’. The prevalence of MIH ranges between 2% and 40% worldwide, with a global mean (95% CI) of 13.1% (11.8%-14.5%). It is likely that such variance is mainly grounded in epidemiological methods of different surveys rather than social, environmental, or geographic risk factors. Several aetiological pathways for MIH have been discussed, with factors such as maternal smoking, illness during pregnancy (especially in the last trimester), premature or prolonged birth, low birth weight and/or birth complications, childhood illness (in the first year of life) and others like vitamin D deficiency and Bisphenol A being considered. However, the most probable explanation is multifactorial pathogenesis with a putative genetic component.

Less distinct prism sheaths, disorganized enamel crystal arrangement, reduced mechanical properties, increased protein content, and decreased mineral density are histologic, morphologic, and mechanical aspects that differentiate MIH-affected enamel from sound enamel. The clinical appearance of MIH involves a wide spectrum varying from creamy/white through yellow to brown colour changes with or without enamel post-eruptive breakdown (PEB). The presence of hypersensitivity or involvement of the incisors may also have a negative effect on the child's oral health-related quality of life. Different authors have proposed different classifications for the severity of MIH, for example, according to the appearance of the lesion as mild versus severe or mild versus moderate versus severe, or furthermore, considering the hypersensitivity of a tooth in a more complex staging framework.

MIH lays a significant burden on patients and their caregivers and potentially ‘the State’ due to its high prevalence. Furthermore, it is also challenging for most practitioners. Diagnosis, staging, and managing MIH appropriately are not skills at the command of the majority of dentists worldwide. Curricular education at dental schools and universities should address this deficiency; given that MIH has been in focus for over a decade now, it could be expected that current dental students are knowledgeable on this matter. There are extremely sparse data on dental students’ knowledge on MIH, and the only study indexed in PubMed, assessing a small sample of students from a single dental school in Saudi Arabia, found the students’ knowledge to be insufficient.

We aimed to assess German dental students’ knowledge, attitudes, and beliefs towards MIH using a representative nationwide survey. The results of this study may be relevant in curriculum planning, for example in Germany, where the national undergraduate dental curriculum is to be completely overhauled for the first time in over 60 years.

2 | MATERIALS AND METHODS

2.1 | Study design

A nationwide survey of final-year dental students in Germany was conducted. An existing questionnaire was validated in German and used to assess German dental students’ knowledge, attitudes, and beliefs towards MIH. Reporting follows the STROBE checklist. This study was approved by the ethics committee of Charité - Universitätsmedizin Berlin (EA2/214/17).

2.2 | Setting, participants, sample size

A comprehensive nationwide sample of final-year students (attending 9th or 10th semester) from all dental schools in Germany was established. No formal sample size calculation was required or conducted. All dental schools (30 public universities, 1 private university) in Germany were invited via e-mail by the first and last author jointly, usually addressing the head of the paediatric dentistry department or unit in each school. An e-mail reminder was sent after four weeks. After approval, each university received their requested number of printed questionnaires and was asked to return the anonymously answered questionnaires.

2.3 | Data sources and variables

Data were collected between January and December 2019. Similar questionnaires have been published previously. The questionnaire started with a brief description of MIH, including clinical photographs, followed by item batteries on demographic data (age, gender, students’
semester), and concluded with questions on knowledge, attitudes, and beliefs towards MIH (the condition’s diagnosis and clinical presentation as well as prevalence, attitudes and beliefs towards management and educational needs).

A German native speaker translated the original English questions into German. Validation was performed via back-translation into English by another independent, English native speaker. The final questionnaire was piloted amongst faculty and 3rd-year dental students at Charité - Universitätsmedizin Berlin, ensuring that it had a valid set of questions, was easy to understand and could be completed within a reasonable period of time. After evaluating the responses, the questionnaire was considered appropriate to be used unmodified (the full questionnaire is available from the authors). To estimate the intra-rater reliability, 3rd-year dental students were asked to answer the questionnaire again after one month. Intra-rater reliability was good ($\kappa = 0.78$).

2.4 | Statistical analysis

Data were organized in a spreadsheet (Excel for Mac, Microsoft Corp., WA, USA). Data were controlled for normal distribution using the Shapiro-Wilk test and descriptive analyses performed accordingly. Statistical comparison of groups (9th semester and 10th semester) was performed using independent samples t test or chi-square test. Missing values were excluded from the analysis. Statistical significance was assumed if $P < .05$. For statistical analysis and geographic display, Python 3.6 and its scientific stack (eg, scipy, numpy, pandas, geopandas, matplotlib) were used. Statistical sub-grouping between public and private dental schools is advisable in this type of study, however, there is only one private dental school in Germany, and therefore we did not include such a sub-group for analysis.

**Figure 1** The geographic distribution of respondents at different universities. The size of the circle corresponds to the number of respondents (in parentheses: percentage of all responses)
| Question                                                                 | Total response rate | Percentage distribution of positive answers |
|-------------------------------------------------------------------------|---------------------|---------------------------------------------|
| Are you familiar with MIH?                                              | 97%                 | All students 9th Semester 10th Semester      |
| How did you hear about it?                                              |                     |                                             |
| Dental journals                                                        | 98%                 | 215 (25%) 130 (26%) 85 (24%)                |
| Lectures                                                               | 99%                 | 748 (86%) 436 (86%) 312 (86%)               |
| Lecture notes                                                          | 98%                 | 226 (26%) 129 (26%) 97 (27%)                |
| Brochures or pamphlets                                                 | 97%                 | 32 (4%) 21 (4%) 11 (3%)                     |
| Internet                                                               | 98%                 | 275 (32%) 154 (31%) 121 (34%)               |
| Books                                                                  | 98%                 | 178 (21%) 92 (18%) 86 (24%)                 |
| Dental clinic                                                          | 98%                 | 459 (53%) 266 (53%) 193 (54%)               |
| Other students                                                         | 97%                 | 61 (7%) 35 (7%) 26 (7%)                      |
| Others                                                                 | 6%                  |                                             |
| Media (newspaper, magazines, TV, Internet)                             |                     |                                             |
| Continuing education                                                   |                     |                                             |
| Internship                                                             |                     |                                             |
| Family and/or Friends                                                  |                     |                                             |
| Private practice                                                       |                     |                                             |
| Do you know the clinical features of MIH?                              | 99%                 | 765 (88%) 428 (84%) 337 (94%)               |
| Do you know if there are clinical criteria to diagnose MIH?            |                     |                                             |
| Yes, and I know how to implement them                                   | 37%                 | 138 (42%) 70 (42%) 68 (42%)                 |
| Yes, but I do not know how to implement them                            | 37%                 | 116 (32%) 60 (36%) 56 (35%)                 |
| In clinic, do you know if you can identify a patient with MIH?         |                     |                                             |
| Yes                                                                    | 98%                 | 291 (34%) 146 (29%) 145 (41%)               |
| Not sure                                                               | 98%                 | 458 (53%) 286 (57%) 172 (48%)               |
| How confident do you feel when diagnosing MIH?                         |                     |                                             |
| Very confident                                                         | 39%                 | 5 (2%) 1 (<1%) 4 (2%)                        |
| Confident                                                              | 39%                 | 49 (14%) 28 (16%) 21 (13%)                  |
| Slightly confident                                                     | 39%                 | 210 (62%) 106 (61%) 104 (63%)               |
| Not confident at all                                                   | 39%                 | 76 (22%) 40 (22%) 36 (22%)                  |
| Do you have difficulty distinguishing MIH as a developmental defect of enamel that differs from other tooth conditions? | 98%                 | 679 (79%) 405 (79%) 274 (77%)               |
| Which ones?                                                            |                     |                                             |
| Dental fluorosis                                                       | 98%                 | 294 (34%) 166 (33%) 128 (36%)               |
| Enamel hypoplasia                                                      | 98%                 | 401 (47%) 235 (47%) 166 (47%)               |
| Amelogenesis imperfecta                                                | 98%                 | 414 (48%) 250 (50%) 164 (46%)               |
| Dentinogenesis imperfecta                                             | 98%                 | 127 (15%) 79 (16%) 48 (14%)                 |
| Are you aware of the prevalence of MIH in Germany?                     | 98%                 | 192 (22%) 97 (19%) 95 (27%)                 |
| Do you think it would be worthwhile investigating the prevalence in Germany? | 98%                 | 808 (94%) 472 (94%) 336 (93%)               |
| How often do you notice these teeth in clinic?                         |                     |                                             |

(Continues)
RESULTS

Thirty-one universities were invited to join the study, of which 22 (from all parts of Germany; including the single private university), replied and contributed data (Figure 1). In total, 877 final-year dental students (59% 9th semester, 41% 10th semester) answered. Respondents were, on average, 26 years old (min. 21; max. 44), 628/877 (74%) were females and 226/877 (26%) were males.

The majority of dental students (97%) had already heard of MIH and most received their information from lectures (86%) (Table 1). Most students were familiar with the clinical features of MIH (88%), however, only 138 (42%) knew how to implement them. Moreover, one-third (33%) of the students reported clinical ability to identify MIH (Table 1); 54 (16%) reported confidence in diagnosing MIH and 79% reported difficulties distinguishing MIH from other developmental defects, especially amelogenesis imperfecta or enamel hypoplasia. In total, 192 (22%) of the students were aware of the prevalence of MIH in Germany and most of the students (808; 92%) thought it would be worthwhile investigating this in more detail (Table 1). A total of 296 (90%) students had observed MIH in fewer than 10% of their patients, 30 (9%) reported to have observed MIH in 10%-25% of their patients and four (1%) in more than 25% of their patients.

The most common defects experienced by the students were yellow/brown demarcated lesions, followed by white demarcated lesions and post-eruptive enamel breakdown. Few students (65; 19%) had encountered hypomineralized lesions in permanent teeth other than FPMs; mainly in premolars (Table 1). Approximately two-thirds (62%) of the students claimed that they had never seen demarcated hypomineralized lesions in the second primary molar tooth in comparison to the first permanent molar tooth.

Notes: Significant differences between groups (P < .05) are indicated in bold.
| Question                                                                 | Total response rate (%) | All students | 9th Semester | 10th Semester |
|-------------------------------------------------------------------------|-------------------------|--------------|--------------|---------------|
| Which factor(s) do you think are involved in the aetiology of MIH?      |                         |              |              |               |
| Genetic factors                                                         | 94                      | 549 (67%)    | 335 (70%)    | 214 (63%)     |
| Chronic medical condition(s) that affect the mother during pregnancy   | 94                      | 394 (48%)    | 223 (47%)    | 171 (50%)     |
| Chronic medical condition(s) that affect the involved child            | 94                      | 214 (26%)    | 125 (26%)    | 89 (26%)      |
| Antibiotics/medications taken by the mother during pregnancy           | 94                      | 466 (57%)    | 258 (54%)    | 208 (61%)     |
| Antibiotics/medications taken by the involved child                    | 94                      | 256 (31%)    | 148 (31%)    | 108 (32%)     |
| Environmental contaminants                                             | 94                      | 391 (48%)    | 215 (45%)    | 176 (52%)     |
| Acute medical condition(s) that affect the mother during pregnancy     | 94                      | 206 (25%)    | 112 (23%)    | 94 (28%)      |
| Acute medical condition(s) that affect the involved child              | 94                      | 137 (17%)    | 84 (18%)     | 53 (16%)      |
| Fluoride exposure                                                       | 94                      | 77 (9%)      | 43 (9%)      | 34 (10%)      |
| None                                                                    | 94                      | 14 (2%)      | 8 (2%)       | 6 (1%)        |
| Others                                                                  |                         |              |              |               |
| Aetiology not clear                                                    |                         | 38 (67%)     | 14 (61%)     | 24 (71%)      |
| Bisphenol A                                                             |                         | 13 (23%)     | 6 (26%)      | 7 (21%)       |
| Dioxins                                                                 |                         | 3 (5%)       | 3 (13%)      | 0             |
| Multifactorial diseases                                                |                         | 3 (5%)       | 0            | 3 (9%)        |
| Which material do you use MOST in treating MIH molars?                  |                         |              |              |               |
| Amalgam                                                                 | 36                      | 5 (2%)       | 3 (2%)       | 2 (1%)        |
| Composite resin                                                        | 36                      | 192 (60%)    | 81 (51%)     | 111 (70%)     |
| Flowable composite resin                                               | 36                      | 73 (32%)     | 30 (19%)     | 43 (27%)      |
| Glass Ionomer Cement                                                   | 36                      | 85 (27%)     | 43 (27%)     | 42 (27%)      |
| Compomer                                                                | 36                      | 76 (24%)     | 34 (21%)     | 42 (27%)      |
| Resin Modified Glass Ionomer Cement                                    | 36                      | 118 (37%)    | 57 (36%)     | 61 (39%)      |
| Preformed crowns                                                       | 36                      | 146 (46%)    | 84 (53%)     | 62 (39%)      |
| Other                                                                   |                         |              |              |               |
| Ceramic crowns                                                         |                         | 6 (86%)      | 3 (100%)     | 3 (75%)       |
| Gold crowns                                                            |                         | 1 (14%)      | -            | 1 (25%)       |
| Which factors influence your choice of restorative material?            |                         |              |              |               |
| Adhesion                                                                | 39                      | 250 (74%)    | 125 (71%)    | 125 (76%)     |
| Aesthetics                                                              | 39                      | 146 (43%)    | 74 (42%)     | 72 (44%)      |
| Patient/parent preference                                              | 39                      | 97 (29%)     | 50 (29%)     | 47 (29%)      |
| Durability                                                              | 39                      | 226 (67%)    | 113 (64%)    | 113 (69%)     |
| Remineralization potential                                              | 39                      | 95 (28%)     | 51 (29%)     | 44 (27%)      |
| Sensitivity                                                             | 39                      | 146 (43%)    | 65 (37%)     | 81 (49%)      |
| Personal experience                                                     | 39                      | 70 (21%)     | 39 (22%)     | 31 (19%)      |
| Research findings                                                      | 39                      | 108 (32%)    | 71 (41%)     | 37 (23%)      |
| Do you think MIH is a clinical problem?                                  | 38                      | 323 (96%)    | 163 (96%)    | 160 (96%)     |

If yes, what do you experience problems with?

(Continues)
medications taken during pregnancy (57%), chronic medical conditions (48%) that affected the mother during pregnancy, or environmental contaminants (48%) were involved (Table 2).

Adhesion (74%) and durability (67%) were relevant factors when deciding which restorative material to use in MIH. Aesthetics (43%) and sensitivity (43%) also had a relevant influence, as had research findings (32%), patient/parent preference (29%) and remineralization effects of the material (28%). The preferred treatment options were direct resin composite (60%) and preformed metal crowns (PMCs) (46%) (Table 2).

Nearly all students (96%) acknowledged MIH as a clinical problem, mainly as the long-term success of restorations (60%) and diagnosis were challenging. Achieving patient comfort and aesthetics were considered relevant by 35% and 30% of students, respectively. Approximately one quarter of the respondents noted clinical difficulties in providing adequate restorations and determining the restorative margins for the restorations (Table 2). Nearly all students expressed their wish for more clinical training on MIH, especially diagnosis (92%), treatment (91%), and aetiology (60%).

Students in their 10th semester were significantly more familiar with MIH ($P = .008$), knew the clinical features of MIH significantly better ($P = .0001$), were significantly more aware of the prevalence of MIH ($P = .011$) and could diagnose MIH better ($P = .002$) than those from 9th semester.

### DISCUSSION

With MIH increasingly being in the focus of national media and dentists being faced with questions about this conditions by their patients, there is great need to assess on what knowledge base and according to what attitudes and beliefs decisions towards MIH are made by dentists. A range of studies assessing this aspect worldwide are available.22,26,28 The foundation for this knowledge, these attitudes and beliefs are mainly laid during dental education. A sound undergraduate education on this matter and solid competence to assess and manage MIH are required if this prevalent condition is to be dealt with adequately in daily clinical routine. This study assessed, for the first time in a nationwide approach, German dental students’ knowledge, attitudes, and beliefs towards MIH. Such studies are supposed to identify educational accomplishments, but also to shed light on knowledge gaps that need to be addressed.

Almost all participants had heard about the presence of MIH teeth during their studies, which is consistent with the results of previous studies.22,26,28 More than two-thirds of the respondents were not aware or did not respond to the question regarding the prevalence of MIH in Germany. This is similar to findings of a previous European study where the prevalence data was known by only 23% of the respondents.20-23
However, the importance of MIH for dental students was highlighted since the vast majority confirmed that investigating the prevalence would be worthwhile. The overwhelming majority of respondents believed that they clinically notice MIH yearly, which may be one of the reasons why many students did not anticipate the actual prevalence of MIH in Germany. Moreover, it does not reflect the increasing prevalence reported. It should be of concern for all educational personnel to ensure that students see and deal with MIH patients during their undergraduate education. As reported previously, yellow/brown demarcated opacities were perceived by the participants as the most frequent enamel defect observed.

Approximately 20% of the students reported difficulties in differential diagnosis of MIH-affected teeth. Besides, more than 80% of the respondents were uncertain if they could clinically identify MIH. This explains the very high proportion of dental students requesting further theoretical and clinical training regarding the diagnosis of MIH in their courses; in addition to training for MIH aetiology and management. Resin composite followed by preformed metal crowns were the preferred materials used in the treatment of MIH-affected teeth, consistent with previous studies. However, Crombie et al reported that GIC was the preferred material, especially amongst oral health therapists; however, this preference had reduced somewhat 10 years later.

The results from this study revealed the shortage of clinical exposure to MIH in the German undergraduate curriculum. Despite the worldwide growing interest and awareness of MIH, it is not yet integrated in-depth in dental curricula. However, in some aspects, the students’ responses in regards to the clinical presentation indicate a good knowledge of MIH. Given that the main students’ information source on MIH was their lectures, it is possible that an acceptable theoretical base is implemented in dental curricula in Germany, however, the clinical exposure is inadequate. The lack of thorough clinical training and exposure to MIH in undergraduate training will lead to a future generation of dentists facing great challenges providing the best possible evidence-based treatment of MIH-affected patients.

5 | CONCLUSIONS

Based on a nationwide sample, German dental students are aware of MIH and had some knowledge of it. Notably, their reported clinical competence and confidence was limited, and it remains unclear if students are truly fit to self-reliantly manage MIH in their daily post-graduation practice. Our findings call for the implementation of more in-depth and practical training on MIH in curricular and post-graduation education.

ACKNOWLEDGMENTS

The authors would like to thank and acknowledge the contribution of PD Dr A. Rahman (Hannover), PD Dr M. Wicht (Köln), Prof. Dr A. J. Momeni (Marburg), Prof. Dr P. Scheutzel (Münster), Prof. Dr G. Krastl (Würzburg), Prof. Dr C. Hirsch (Leipzig), Dr P. Singh-Hüsgen (Düsseldorf), Dr A. Geiken (Kiel), Prof. Dr S. Rütttermann (Frankfurt), Prof. Dr A. Wiegand (Göttingen), Prof. Dr D. Wolff (Tübingen), Prof. Dr S. Rupf and Prof. Dr M. Hannig (Saarland), Prof. Dr S. Zimmer (Witten), Prof. Dr A. Wichelhaus (München), Prof. Dr H. Wehrbein and Dr E. Scheer (Mainz), Prof. Dr F. Stahl (Rostock), Prof. Dr Hellwig and Dr P. Fischer (Freiburg), Prof. Dr Dr S. Jepsen (Bonn) and Prof. Dr Schaller (Halle), Prof. Dr Dr P. Proff (Regensburg). Open access funding enabled and organized by Projekt DEAL.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.
AUTHORS’ CONTRIBUTIONS
The study was conceived by KE, FS, PG JB, KE, DM, KB, CS, and JK planned the analysis. MA, ZH, and KE collected the data. MA, FS, JK, and KE performed the analysis. KE, MA, ZH, and FS wrote the manuscript. All authors read and approved the manuscript.

ORCID
Karim Elhennawy https://orcid.org/0000-0002-5216-9452
Katrin Bekes https://orcid.org/0000-0002-5249-0123
David John Manton https://orcid.org/0000-0002-4570-0620

REFERENCES
1. Weerheijm KL, Jalevik B, Alaluusua S. Molar-incisor hypomineralisation. Caries Res. 2001;35:390-391.
2. Weerheijm KL. Molar incisor hypomineralisation (MIH). Eur J Paediatr Dent. 2003;4:114-120.
3. Schwendicke F, Elhennawy K, Reda S, Bekes K, Manton DJ, Krois J. Global burden of molar incisor hypomineralization. J Dent. 2018;68:10-18.
4. Schwendicke F, Elhennawy K, Reda S, Bekes K, Manton DJ, Krois J. Corrigendum to "Global burden of molar incisor hypomineralization". J Dent. 2019;80:89-92.
5. Crombie F, Manton D, Kilpatrick N. Aetiology of molar-incisor hypomineralization: a critical review. Int J Paediatr Dent. 2009;19:73-83.
6. Bussanelli DG, Restrepo M, Fragelli CMB, et al. Genes regulating immune response and amelogenesis interact in increasing the susceptibility to molar-incisor hypomineralization. Caries Res. 2019;53:217-227.
7. Jeremias F, Koruyucu M, Küchler EC, et al. Genes expressed in dental enamel development are associated with molar-incisor hypomineralization. Arch Oral Biol. 2013;58:1434-1442.
8. Elhennawy K, Manton DJ, Crombie F, et al. Structural, mechanical and chemical evaluation of molar-incisor hypomineralization-affected enamel: a systematic review. Arch Oral Biol. 2017;83:272-281.
9. Elhennawy K, Schwendicke F. Managing molar-incisor hypomineralization: a systematic review. J Dent. 2016;55:16-24.
10. Weerheijm KL. Molar incisor hypomineralisation (MIH): clinical presentation, aetiology and management. Dent Update. 2004;31:9-12.
11. Gutierrez TV, Ortega CCB, Perez NP, Perez AG. Impact of molar incisor hypomineralization on oral health-related quality of life in Mexican school children. J Clin Pediatr Dent. 2019;43:324-330.
12. Hamasn N, Lawson J, Vettore MV, Elcock C, Zaitoun H, Rood H. Change in oral health-related quality of life following minimally invasive aesthetic treatment for children with molar incisor hypomineralisation: a prospective study. Dent J (Basel). 2018;6:61.
13. Velandia LM, Alvarez LV, Mejia LP, Rodriguez MJ. Oral health-related quality of life in Colombian children with Molar-Incisor Hypomineralization. Acta Odontol Latinoam. 2018;31:38-44.
14. Mathu-Muju K, Wright JT. Diagnosis and treatment of molar incisor hypomineralization. Compend Contin Educ Dent. 2006;27:604-610; quiz 11.
15. Lygidakis NA. Treatment modalities in children with teeth affected by molar-incisor enamel hypomineralisation (MIH): a systematic review. Eur Arch Paediatr Dent. 2010;11:65-74.
16. Steffen R, Kramer N, Bekes K. The Wurzburg MIH concept: the MIH treatment need index (MIH TNI): A new index to assess and plan treatment in patients with molar incisor hypomineralisation (MIH). Eur Arch Paediatr Dent. 2017;18:355-361.
17. Weerheijm KL, Duggal M, Mejare I, et al. Judgement criteria for molar incisor hypomineralisation (MIH) in epidemiologic studies: a summary of the European meeting on MIH held in Athens, 2003. Eur J Paediatr Dent. 2003;4:110-113.
18. Lygidakis NA, Wong F, Jalevik B, Vierrou AM, Alaluusua S, Espelid I. Best Clinical Practice Guidance for clinicians dealing with children presenting with Molar-Incisor-Hypomineralisation (MIH): An EAPD Policy Document. Pediatr Dent. 2018;40:272-278.
19. Hussein AS, Ghanim AM, Abu-Hassan MI, Manton DJ. Knowledge, management and perceived barriers to treatment of molar-incisor hypomineralisation in general dental practitioners and dental nurses in Malaysia. Eur Arch Paediatr Dent. 2014;15:301-307.
20. Gambetta-Tessini K, Marino 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;16:75.
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;17:215-222.
22. Verordnung zur Neuregelung der zahnärztlichen Ausbildung. Bundesgesetzblatt. 2019:933-993.
23. 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. 2003;5:160-166.
24. Ghanim A, Morgan M, Marino R, Manton D, Bailey D. Perception of molar-incisor hypomineralisation (MIH) by Iraqi dental academics. Int J Paediatr Dent. 2011;21:261-270.
25. van Elm E, Altman DG, Egger M. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Ann Intern Med. 2007;147:573-577.
26. Gamboa GCS, Lee GHM, Ekambaram M, Yiu CKY. Knowledge, perceptions, and clinical experiences on molar incisor hypomineralisation among dental care providers in Hong Kong. BMC Oral Health. 2018;18:217.
How to cite this article: Elhennawy K, Anang M, Splieth CH, et al. Knowledge, attitudes, and beliefs regarding molar incisor hypomineralization (MIH) amongst German dental students. *Int J Paediatr Dent*. 2020;00:1–10. https://doi.org/10.1111/ipd.12715
Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:
Elhennawy, K; Anang, M; Splieth, C; Bekes, K; Manton, DJ; Hedar, Z; Krois, J; Jost-Brinkmann, P-G; Schwendicke, F

Title:
Knowledge, attitudes, and beliefs regarding molar incisor hypomineralization (MIH) amongst German dental students

Date:
2020-09-11

Citation:
Elhennawy, K., Anang, M., Splieth, C., Bekes, K., Manton, D. J., Hedar, Z., Krois, J., Jost-Brinkmann, P.-G. & Schwendicke, F. (2020). Knowledge, attitudes, and beliefs regarding molar incisor hypomineralization (MIH) amongst German dental students. INTERNATIONAL JOURNAL OF PAEDIATRIC DENTISTRY, https://doi.org/10.1111/ipd.12715.

Persistent Link:
http://hdl.handle.net/11343/252580

File Description:
Published version

License:
cc-by-nc