

**Original Article**

# Knowledge, awareness, and perception regarding Molar-incisor hypo mineralization (MIH) among a group of dental students in Egypt

Manal ElShiekh<sup>1</sup>

<sup>1</sup>Department of pediatric dentistry and dental public health, Faculty of dentistry, Cairo University

**Email:** manal.elshiekh@dentistry.cu.edu.eg

## Abstract

**Aim:** this study was to determine knowledge, awareness, and perception regarding the distribution, severity, etiology, and treatment modalities of MIH among a group of dental students in Egypt.

**Material and method:** a validated google form questionnaire was distributed among final year dental students in different universities in Egypt, with the help of the pediatric dentistry department clinical course coordinator in each university. **Results:** 624 students replied, 70.7% of the replied students were familiar with MIH and 64.9 % were aware of the clinical features of MIH, Only 22.3% reported clinical ability to identify MIH, and the majority 76.0% showed difficulty in differentiating between MIH and other developmental defects, regarding the etiology of MIH, the response varied among the students, as for treatment of MIH 23.3% of students use composite resin restoration & 23.3% use preformed crowns, 93.2% of the student suggest clinical training on MIH in their dental course. **Conclusion:** dental students participating in this study showed good responses regarding the knowledge of MIH and limited response about the clinical, practice, and management of MIH.

**Keywords:** Molar incisor hypomineralization, dental students in Egypt MIH, knowledge.

## Introduction

Over the past decades, there is a rising number of patients with congenital defects affecting enamel mineralization in the form of Molar-incisor Hypomineralization (MIH). (MIH) is defined as a spectrum of qualitative, demarcated developmental defects of systemic origin

affecting the enamel of one or more first permanent molars with or without the affection of the incisors, this condition was formally termed MIH in 2001 and hastened growing attention in the dental community ever since<sup>1</sup>. These defects are distributed asymmetrical and have discernible variations in severity, ranging from demarcated

white, yellow, or brown opacities to severe defects<sup>2</sup>. A comprehensive analysis of 70 prevalence MIH studies showed that the problem is very common, with a global estimate of approximately 14 percent and the highest prevalence seen in South America and Spain<sup>3</sup>.

The condition is attributed to the disruption of ameloblastic function during the transitional and maturational stage of amelogenesis<sup>4</sup>

MIH should not be confused with enamel hypomineralization, fluorosis, and amelogenesis imperfecta. In hypoplasia, the borders of the deficient enamel are smooth, MIH has well-demarcated borders, while in enamel fluorosis borders are diffuse. In addition fluorosis enamel is caries resistant, while MIH is caries prone due to porous enamel. Amelogenesis imperfecta affects all teeth, MIH affects the first permanent molar with or without the involvement of the incisors<sup>5</sup>.

The etiology of MIH is not clear yet, theories such as illness during pregnancy, premature birth, childhood illness, and other research have concentrated on an environmental insult occurring in the first four years of life<sup>5,6</sup>.

MIH on oral health status includes, hypersensitivity, enamel breakdown, increased dental caries, and extraction this affects negatively the child's oral health-related quality of life, accordingly based on previous studies MIH was considered the second most common cause of first permanent molar loss following dental caries<sup>7</sup>.

Diagnosis, staging, and managing MIH appropriately are not skills at the command of the majority of dentists worldwide<sup>8</sup>. Previously conducted surveys concerning diagnosis and management of MIH. Many of these concluded that there is a great variation in the management of MIH, perhaps due to the lack of contemporary guidelines in this area<sup>9,10</sup>.

Consequently, the present study aimed to assess the knowledge and perception regarding the distribution, severity, etiology, and treatment modalities of MIH in final-year dental students in different universities in Egypt

## Material and methods

### Study Design

A cross-sectional study in the form of a survey of final-year dental students at different universities in Egypt was conducted. An e-mail-based validated questionnaire was used<sup>11,12,13,14</sup> to assess undergraduate dental student knowledge attitudes and perception toward MIH.

### Setting, participants, sample size

Sample size calculation was performed utilizing the single proportion formula devised by Steven K. Thompson based on the research question regarding the prevalence of MIH knowledge among dental students. By adopting a confidence interval of (95%), a margin of error of (5%) and an MIH knowledge prevalence of (42.0%)—based on the results of a previous study -; The predicted sample size (n) was found to be (374) student<sup>14,15</sup>.

The questionnaire was distributed via the student official mail through the clinical pediatric dentistry course coordinator, after permission from the head of the pediatric dentistry department in each participating university.

### Data, source, and variables

Data were collected between, April 2020 to December 2021. The questionnaire was in google form <https://forms.gle/vZoauVzF71pThwqj8> The questionnaire started with an introductory section clarifying that participants are invited to

participate in this research project, explaining the aim of the research and a brief discretion of MIH including clinical photographs, and assuring that participation is voluntary and data is anonymous and filling the questionnaire is an agreement to participate followed by a series of 18 multiple choice questionnaires including three sections. The first section was the demographic data (age, gender, student semester), the second section assessed the knowledge, attitudes, and perception towards MIH (diagnosis, clinical presentation, etiology, and prevalence), and the final section concentrated on the clinical application, management and educational needs toward MIH.

**Statistical analysis:** Categorical data were presented as frequency and percentage values. Data were tabulated and organized using Microsoft Excel 2016 for windows<sup>16</sup>.

## Results

The MIH questionnaire was sent to the final year dental students in 17 universities (8 public universities & 9 private universities). A total of 624 dental students responded to the questionnaire, out of which 456 (73.1%) students from public universities and 168 (26.9%) students from private universities in Egypt, respondents were 198/624 (31.7%) males and 426/624 (68.3%) females (Table 1&2) (Figure 1&2)

The majority of the dental students 441/624 (70.7%) were familiar with MIH, and most of them received their information from lectures (34.7%) dental clinics & internet (22.1%) (Table 3) (Figure 3). Most of the students know the clinical features of MIH (64.9%), however, 76% reported difficulties distinguishing MIH from other developmental defects such as enamel hypoplasia and amylogenesis imperfecta.

Regarding the etiology of MIH 528/624 participants responded to this question with a response rate of 84.6%. The most common etiological factor of MIH expressed by the students was the genetic factor (23.5%) followed by the chronic medical conditions that affect the mother during pregnancy (15.5%). Environmental contaminants were also concerned by 13.3% of the students' responses.

Unfortunately, 465 (74.5%) were not aware of the prevalence of MIH in Egypt, accordingly, most of the students (86.9%) thought it would be worthwhile investigating the prevalence in Egypt. (Table 3) (Figure 3)

A total of 427 (68.4%) of the students were not sure if they can identify patients with MIH in the clinic and 139 (22.3%) of the students can identify those patients (Table 4) (Figure 4).

The response rate of the other questions regarding the clinical application of MIH was varied as regarding the most frequent feature regarding the severity of the defect was answered only by 137 students with a response rate of 21.9%, and the most common feature reported by them was yellow-brown demarcation (43.1%).

The result showed that 137/624 (21.9% response rate) students responded to the question if they know the clinical criteria to diagnose MIH, 71 (51.8%) students answered yes but they do not know how to implement them. 133/624 (21.3% response rate) students' response to the question regarding the material do they use most in treating MIH molars was the same response percent regarding both composite resin and preformed crowns (23.3%).

The question regarding if the student thinks that MIH is a clinical issue 131/624 (response rate

20.9%) answered that question whereas 90.1% of them think it is a clinical issue.

Only 88/624 students (14.1% response rate) expressed that the clinical issue problem with MIH is the long-term success of restoration (27.3%) and the aesthetic problem (22.7 %) is considered a challenging issue of MIH(Table4)(figure 4).

A total of 617 students (98.8% response rate) answered the question including implementation of clinical training regarding MIH in their dental course, 93.2% of the students agreed. Regarding their suggestion about which is the important topic to be added in their clinical training, 448/624 response to this question and refer that diagnosis is an important concern to be involved in their training clinical dental course (37.1%). (Table 5)(Figure 5)

**Discussion**

MIH is recognized as a significant clinical problem from the perspective of pediatric dental practitioners and is considered a concrete step involved in exploring this problem, especially in

areas where the actual prevalence of the problem is scarce.

Accordingly, it is important to determine the state of awareness and, knowledge .among the dental student mainly the undergraduate ones, to explore the teaching needs and dental curriculums reshaping and lighting up the knowledge gap in the field of MIH. This cross-sectional study was based on an online questionnaire investigating the awareness knowledge and perception of MIH among a group of final-year dental students, from public and private universities in Egypt.

Almost all the participants’ dental studies 441/624 (70.7%) were familiar with MIH, which is in agreement with other previous studies <sup>11,12,13,14</sup>

The majority of the students (76.6%) had difficulty in distinguishing MIH as a developmental defect of enamel and other defects mainly enamel hypoplasia and amylogenesis imperfecta

This was the same as in a previous survey among Saudi Arabia and German undergraduate students <sup>12,14</sup>, this suggests that further work is needed to assess the lack of pointing out the clinical features of MIH and differentiation from other dental defects.

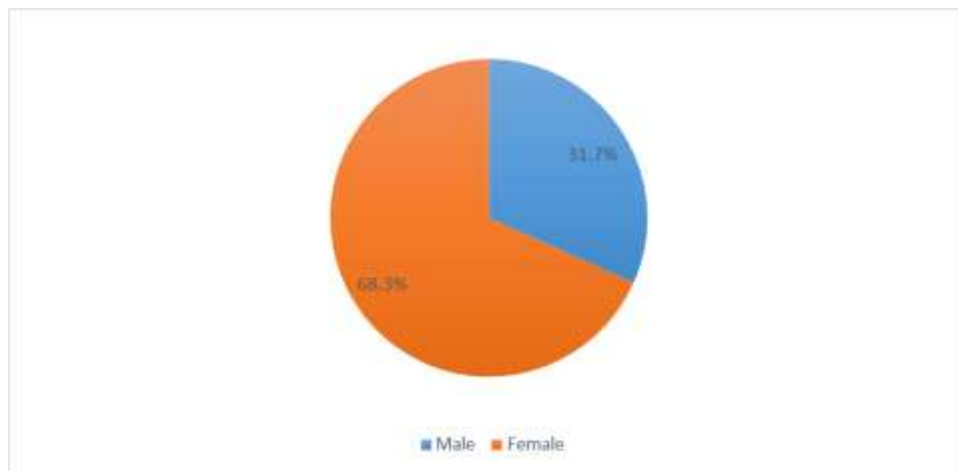
**Table (1):** Demographic data

| <i>Question</i>   | <i>Answer</i>  | <i>n</i> | <i>%</i> | <i>Total</i> |
|-------------------|----------------|----------|----------|--------------|
| <i>Gender</i>     | <i>Male</i>    | 198      | 31.7%    | 624          |
|                   | <i>Female</i>  | 426      | 68.3%    |              |
| <i>University</i> | <i>Public</i>  | 456      | 73.1%    | 624          |
|                   | <i>Private</i> | 168      | 26.9%    |              |

**Table (2):** The respondents at different universities

| <i>University</i>                                   | <i>n</i> | <i>%</i> | <i>Total</i> |
|---|----------|----------|--------------|
| <i>Suez canal university</i>                        | 153      | 24.5%    | 624          |
| <i>Cairo university</i>                             | 191      | 30.6%    |              |
| <i>Ahram Canidian university</i>                    | 2        | 0.3%     |              |
| <i>Ain Shams university</i>                         | 2        | 0.3%     |              |
| <i>Azhar university</i>                             | 17       | 2.7%     |              |
| <i>Assiut university</i>                            | 6        | 1.0%     |              |
| <i>British university</i>                           | 10       | 1.6%     |              |
| <i>Minia university</i>                             | 80       | 12.8%    |              |
| <i>Russian university</i>                           | 2        | 0.3%     |              |
| <i>Fayoum university</i>                            | 6        | 1.0%     |              |
| <i>Future university</i>                            | 14       | 2.2%     |              |
| <i>Mansoura university</i>                          | 1        | 0.2%     |              |
| <i>Misr International university</i>                | 14       | 2.2%     |              |
| <i>Misr university for science &amp; technology</i> | 5        | 0.8%     |              |
| <i>Modern science &amp; art university e</i>        | 107      | 17.1%    |              |
| <i>6<sup>th</sup> October university</i>            | 10       | 1.6%     |              |
| <i>Sinai university</i>                             | 4        | 0.6%     |              |

Public university
  Private university



**Figure (1):** Pie chart showing gender of the participants

**Table (3):** Students' response on Awareness, knowledge, and perceptions toward MIH etiology and prevalence.

| <i>Question</i>   | <i>Answer</i>   | <i>n</i> | <i>%</i> | <i>Total</i> |
|---|---|----------|----------|--------------|
| <b>1. Are you familiar with MIH?</b>  | <b>Yes</b>  | 441      | 70.7%    | 624          |
|   | <b>No</b>   | 183      | 29.3%    |              |
| <b>1B. If yes, how did you hear about it?</b>   | <b>Dental journals (print or electronic)</b>                                | 6        | 6.3%     | 95           |
|   | <b>Lectures/Lecture notes</b>   | 33       | 34.7%    |              |
|   | <b>Brochures/Pamphlets</b>  | 1        | 1.1%     |              |
|   | <b>Internet</b>   | 21       | 22.1%    |              |
|   | <b>Books (print or electronic)</b>  | 6        | 6.3%     |              |
|   | <b>Dental clinic/clinical supervisor</b>                                    | 21       | 22.1%    |              |
|   | <b>Other students</b>   | 2        | 2.1%     |              |
|   | <b>Other</b>  | 5        | 5.3%     |              |
| <b>2. Do you know the clinical features of MIH?</b>   | <b>Yes</b>  | 405      | 64.9%    | 624          |
|   | <b>No</b>   | 219      | 35.1%    |              |
| <b>3. Do you have difficulty distinguishing MIH as a developmental defect of enamel that differs from other tooth conditions?</b> | <b>Yes</b>  | 474      | 76.0%    | 624          |
|   | <b>No</b>   | 150      | 24.0%    |              |
| <b>3B. If yes, which ones? (select all that apply)</b>  | <b>Dental fluorosis</b>   | 64       | 23.5%    | 272          |
|   | <b>Enamel hypoplasia</b>  | 98       | 36.0%    |              |
|   | <b>Amelogenesis imperfecta</b>  | 86       | 31.6%    |              |
|   | <b>Dentinogenesis imperfecta</b>  | 24       | 8.8%     |              |
| <b>4. Which factor(s) do you think are involved in the etiology of MIH? (select all that apply)</b>                               | <b>Genetic factors</b>  | 122      | 23.1%    | 528          |
|   | <b>Chronic medical condition(s) that affect the mother during pregnancy</b> | 82       | 15.5%    |              |
|   | <b>Chronic medical condition(s) that affect the involved child</b>          | 54       | 10.2%    |              |
|   | <b>Antibiotics/medications taken by the mother during pregnancy</b>         | 78       | 14.8%    |              |
|   | <b>Acute medical condition(s) that affect the mother during pregnancy</b>   | 42       | 8.0%     |              |
|   | <b>Acute medical condition(s) that affect the involved child</b>            | 36       | 6.8%     |              |
|   | <b>Environmental contaminants</b>   | 70       | 13.3%    |              |
|   | <b>Fluoride exposure</b>  | 18       | 3.4%     |              |
|   | <b>None</b>   | 6        | 1.1%     |              |
|   | <b>Other</b>  | 20       | 3.8%     |              |
| <b>5. Are you aware of the prevalence of MIH in Egypt?</b>  | <b>Yes</b>  | 159      | 25.5%    | 624          |
|   | <b>No</b>   | 465      | 74.5%    |              |
| <b>6. Do you think it would be worthwhile investigating the prevalence in Egypt?</b>  | <b>Yes</b>  | 542      | 86.9%    | 624          |
|   | <b>No</b>   | 82       | 13.1%    |              |

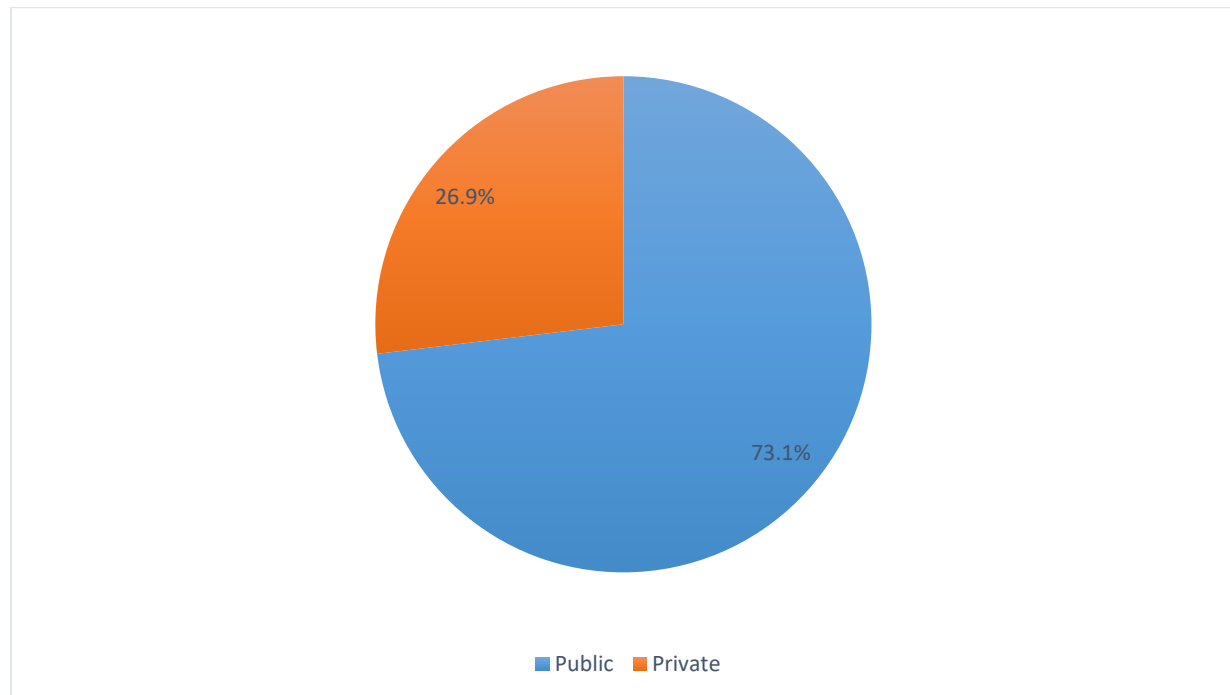
**Table (4): students' response on diagnosis, clinical applications and management of MIH**

| <i>Question</i>   | <i>Answer</i>                               | <i>n</i> | <i>%</i> | <i>Total</i> |
|---|---|----------|----------|--------------|
| 7. In clinic, do you know if you can identify a patient with MIH?   | Yes   | 139      | 22.3%    | 624          |
|   | No  | 58       | 9.3%     |              |
|   | Not sure                                    | 427      | 68.4%    |              |
| 8. How often do you notice these teeth in clinic?   | On a weekly basis                           | 29       | 21.5%    | 135          |
|   | On a monthly basis                          | 50       | 37.0%    |              |
|   | On a yearly basis                           | 56       | 41.5%    |              |
| 9. Approximately what proportion of patients do you observe these teeth in?   | <10%  | 70       | 51.5%    | 136          |
|   | 10-25%                                      | 61       | 44.9%    |              |
|   | >25%  | 5        | 3.7%     |              |
| 10. Which of the following features do you most frequently notice regarding the severity of the defect?   | White demarcation                           | 40       | 29.2%    | 137          |
|   | Post-eruptive enamel breakdown              | 35       | 25.5%    |              |
|   | Yellow/brown demarcation                    | 59       | 43.1%    |              |
|   | Other                                       | 3        | 2.2%     |              |
| 11. How confident do you feel diagnosing MIH?   | 1   | 9        | 6.6%     | 136          |
|   | 2   | 20       | 14.7%    |              |
|   | 3   | 64       | 47.1%    |              |
|   | 4   | 37       | 27.2%    |              |
|   | 5   | 6        | 4.4%     |              |
| 12. Do you know if there are clinical criteria to diagnose MIH?   | Yes and I know how to implement them        | 54       | 39.4%    | 137          |
|   | Yes but I do not know how to implement them | 71       | 51.8%    |              |
|   | No  | 12       | 8.8%     |              |
| 13. In clinic, have you encountered demarcated hypomineralised defects in permanent teeth other than the first permanent molars and incisors?           | Yes   | 43       | 31.9%    | 135          |
|   | No  | 92       | 68.1%    |              |
| 14. How frequently do you notice demarcated hypomineralised lesions in the second primary molar tooth in comparison to the first permanent molar tooth? | More frequently                             | 17       | 12.8%    | 133          |
|   | Less frequently                             | 56       | 42.1%    |              |
|   | The same as for the first permanent molar   | 6        | 4.5%     |              |
|   | I have never seen it                        | 54       | 40.6%    |              |
| 15. Which material do you use MOST in treating MIH molars?  | Amalgam                                     | 3        | 2.3%     | 133          |
|   | Composite resin                             | 31       | 23.3%    |              |
|   | Flowable composite resin                    | 7        | 5.3%     |              |
|   | High fluoride glass ionomer cement          | 21       | 15.8%    |              |
|   | Glass ionomer cement                        | 9        | 6.8%     |              |
|   | Compomer                                    | 2        | 1.5%     |              |
|   | Resin modified glass ionomer cement         | 29       | 21.8%    |              |
|   | Preformed crowns                            | 31       | 23.3%    |              |
|   | Adhesion                                    | 22       | 23.4%    |              |
| Aesthetics  | 14  | 14.9%    |          |              |
| Patient/parent preference   | 6   | 6.4%     |          |              |
| Durability  | 12  | 12.8%    |          |              |
| Remineralization potential  | 18  | 19.1%    |          |              |
| Sensitivity   | 6   | 6.4%     |          |              |
| Personal experience   | 4   | 4.3%     |          |              |
| Research findings   | 12  | 12.8%    |          |              |
| 17. Do you think MIH is a clinical issue?   | Yes   | 118      | 90.1%    | 131          |
|   | No  | 13       | 9.9%     |              |

| <i>Question</i>   | <i>Answer</i>   | <i>n</i> | <i>%</i> | <i>Total</i> |
|---|---|----------|----------|--------------|
| <i>17B. If yes, what do you experience problems with?<br/>(select all that apply)</i> | <i>Diagnosis</i>  | 10       | 11.4%    | 88           |
|   | <i>Aesthetics</i>   | 20       | 22.7%    |              |
|   | <i>Achieving adequate local anesthesia</i>                    | 4        | 4.5%     |              |
|   | <i>Determining the restorative margins of affected enamel</i> | 18       | 20.5%    |              |
|   | <i>Long-term success of restorations</i>                      | 24       | 27.3%    |              |
|   | <i>Achieving patient comfort (for function)</i>               | 12       | 13.6%    |              |

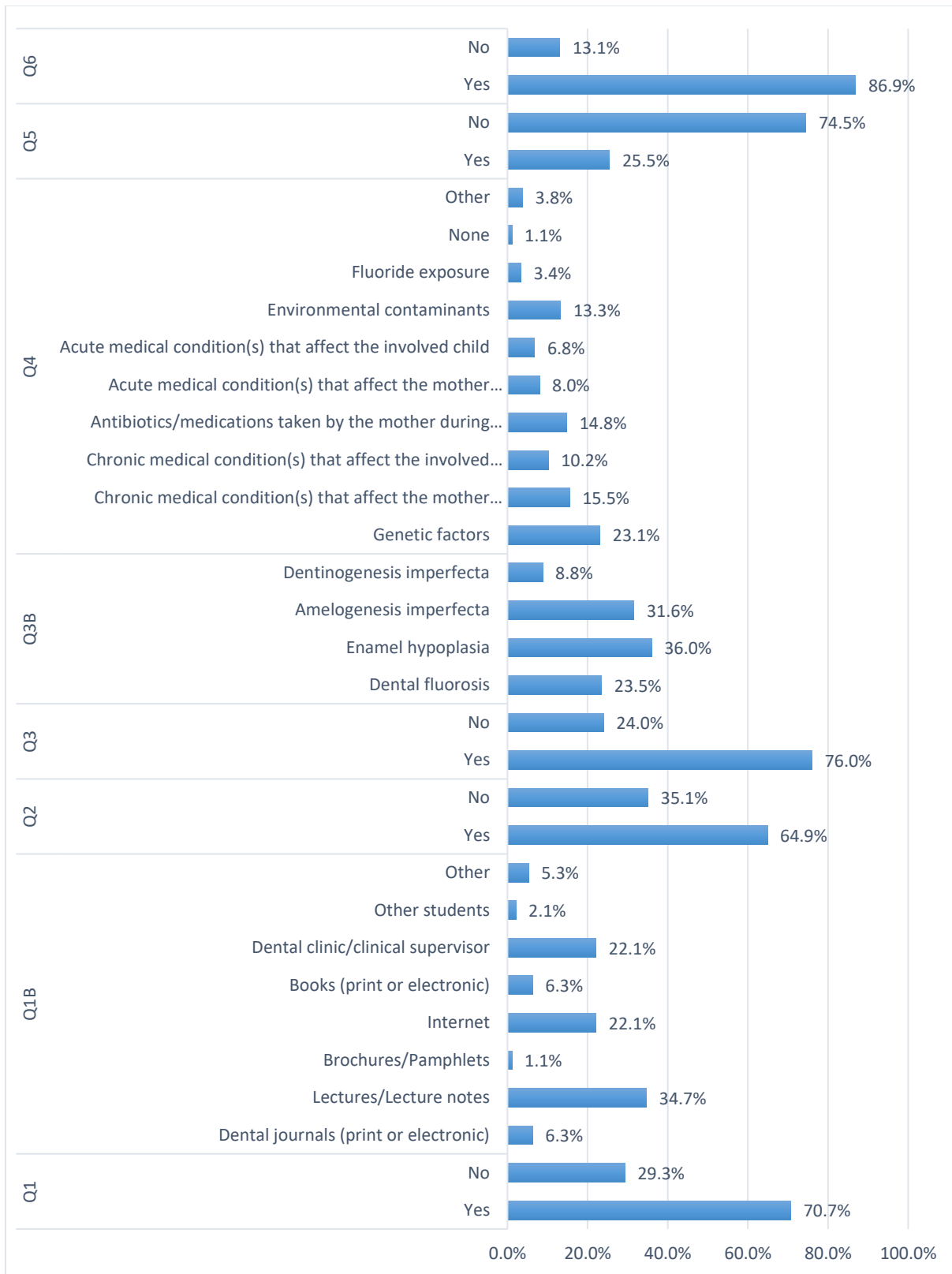
**Table (5):** students’ suggestions of education needs toward MIH

| <i>Question</i>   | <i>Answer</i>    | <i>n</i> | <i>%</i> | <i>Total</i> |
|---|------------------|----------|----------|--------------|
| <i>18. Would you suggest including clinical training regarding MIH in your dental course?</i>                                       | <i>Yes</i>       | 575      | 93.2%    | 617          |
|   | <i>No</i>        | 42       | 6.8%     |              |
| <i>18B. If yes, what would you suggest including clinical training regarding MIH in your dental course? (select all that apply)</i> | <i>Diagnosis</i> | 166      | 37.1%    | 448          |
|   | <i>Etiology</i>  | 63       | 14.1%    |              |
|   | <i>Treatment</i> | 76       | 17.0%    |              |
|   | <i>Other</i>     | 143      | 31.9%    |              |



**Figure (2):** Pie chart showing respondents’ percent in public & private universities





**Figure (3):** Bar chart showing students’ responses to Awareness, knowledge, and perceptions toward MIH etiology and prevalence.

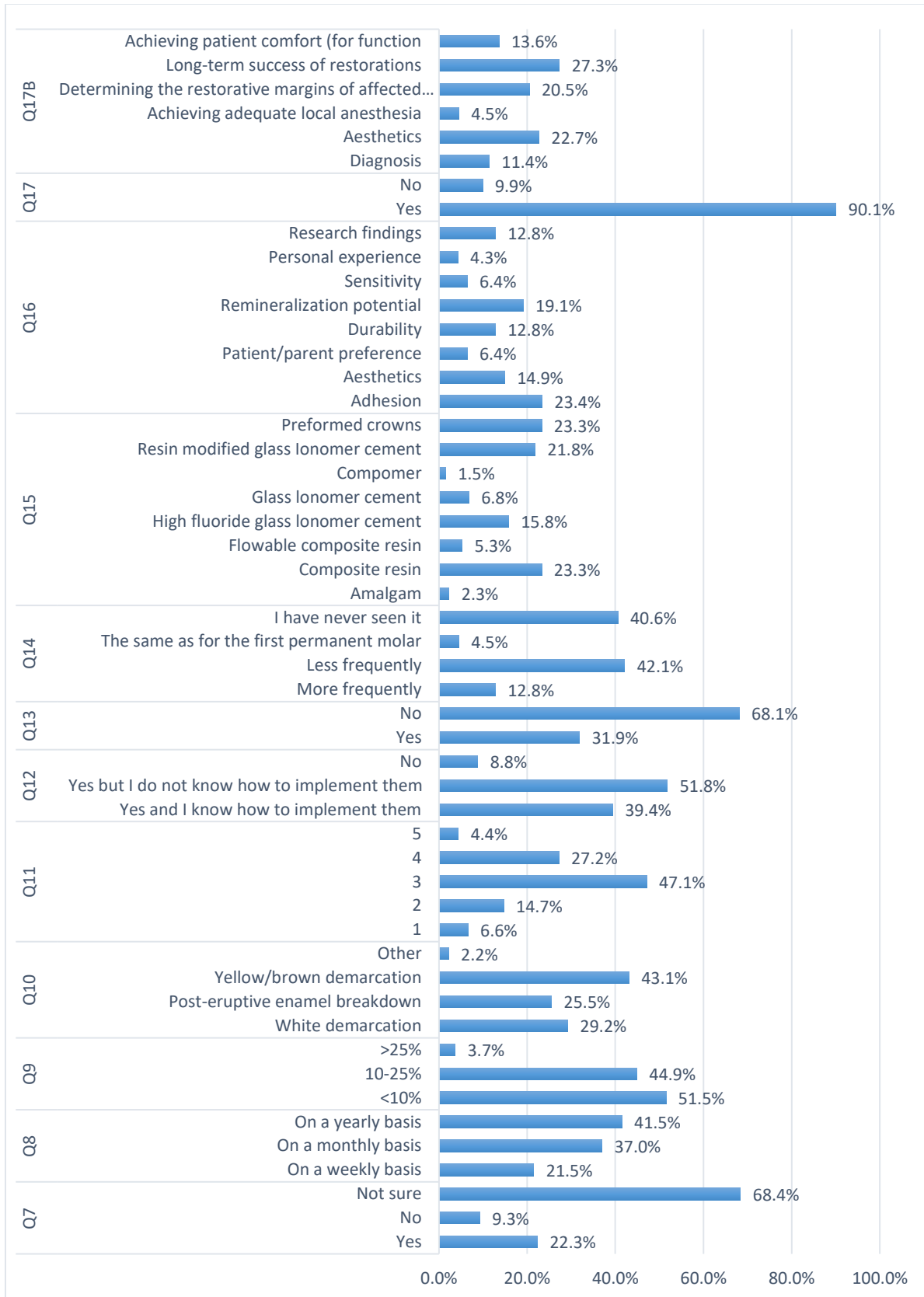
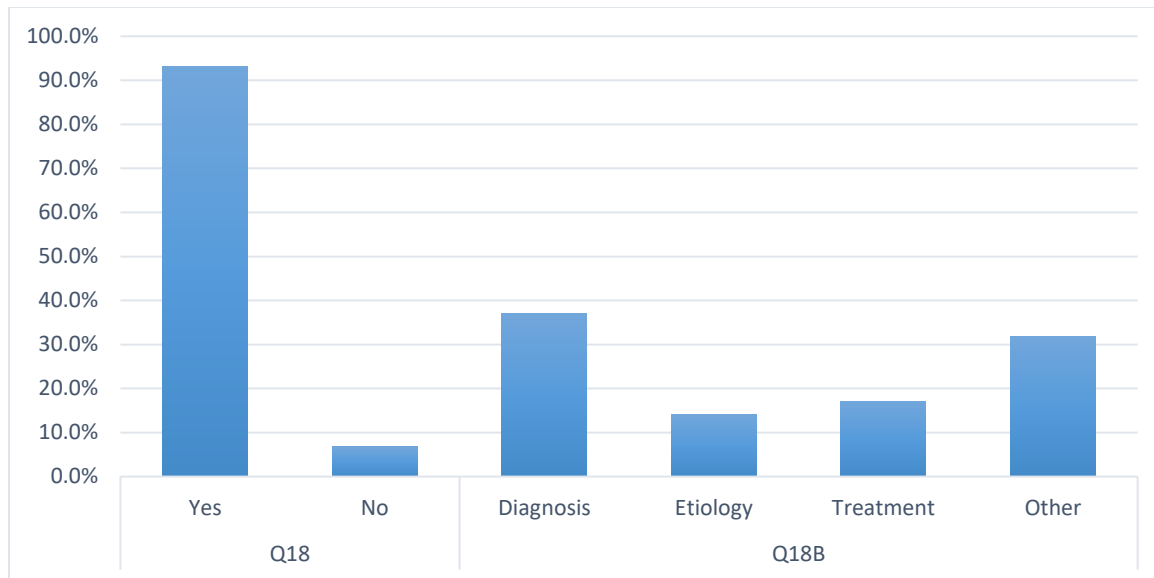


Figure (4): Bar chart showing students' response to the diagnosis, clinical applications of MIH



**Figure (5):** Bar chart showing students' suggestions of education needs for MIH

The etiological factor of MIH is still controversial this was reflected in the response of the dental student, with specific concerns about the genetic factors (Table3) this goes in agreement with another previous study<sup>14</sup>, students need to have more knowledge about the prevalence of MIH in Egypt, more than two-thirds of the respondents were not aware (74.5%) and the prevalence was known only by 25.5%, in similarity with other European studies<sup>13,14,17</sup> where the response to the prevalence awareness was known by only 23% of the respondents, accordingly, the majority of the students think it would be worthwhile investigating the prevalence of MIH in Egypt.

The majority of the students 68.4% reported that they aren't sure about their ability to identify MIH in the clinic this is in the agreement with previous studies<sup>12, 14</sup> and only 22.3% of them can identify it clinically, a possible explanation for this might be the lack of clinical training programs for the undergraduate students regarding MIH, this rise up the need of reshaping the dental training programs for this upcoming dental problem and should not be underestimated.

In agreement with other studies<sup>12,14</sup> yellow brown demarcation was reported by the students to be the most frequent notice regarding the severity of the defect .composite resin followed by performed metal crowns were the material used in treating MIH-affected molars, consistent with previous studies<sup>12,14,17,18</sup>.

The number of participants who responded to the questionnaire regarding the clinical application and management of MIH was a variable response rate of nearly about 21.8% (Table 4), this explains the need for more clinical training in their educational programs, as feeling confident in the diagnosis of MIH were variable between participant, this is much more expressed by the suggestion of the students to include the clinical training on MIH in their dental course (Table5) as previously suggested by other dental students in the previous studies<sup>12,14,18,19</sup>

The results of this study deduced that there is sufficient knowledge and awareness about MIH taking their knowledge mainly from lectures, but there is a shortage in the prevalence, clinical application, and management, in the clinical training programs for the participants,

accordingly MIH as an upcoming dental problem should be much more integrated into the dental curricula of undergraduate dental students in Egypt.

### Conclusion:

The response of the participant undergraduate dental students showed good knowledge regarding MIH, but the awareness about the prevalence of MIH in Egypt, the clinical application, and management was limited.

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**Conflict of interest:** The author declares that there are no competing interests.

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