

Molar incisor hypomineralization: Discernment of a group of Iranian dental academics

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Original Article

Abstract

BACKGROUND AND AIM: The objective of the present study was to evaluate the knowledge of a group of Iranian academic dentists regarding molar incisor hypomineralization (MIH) in two dental schools in Iran.

METHODS: A survey was undertaken amongst the teaching staff of the dental schools of Shiraz and Tehran Universities of Medical Sciences. The questionnaire consisted of two sections. In the first section respondents were asked to provide socio-demographic information including year and place of receiving, and type of dental qualification. The second section included questions regarding perception and recognition of the MIH defect in their clinical practice, the incidence and severity of the defect (represented by its clinical presentation), their knowledge of its prevalence, possible determinant factors, and their clinical experience with the management strategies for MIH. Data were analyzed using frequency distribution and Pearson's chi-square test for categorical data. The critical level for alpha was set at 0.05.

RESULTS: A response rate of 61.3% was achieved. The vast majority of the respondents (85.7%) had encountered MIH in their professional work, with 48.8% indicating that yellow-brown opacities were the most prevalent lesion type. A significant difference between specialists was reported in relation to the frequency of observation of MIH ($\chi^2(5) = 15.3$; $P < 0.001$). Resin composite was the most popular material used in treating teeth with MIH (62.0%). Endodontists (90.0%) and pediatric dentists (77.8%) used resin composite significantly more than other specialist groups ($\chi^2(5) = 5.8$; $P < 0.001$). Adhesion was the most commonly reported influence on material choice (62.0%).

CONCLUSION: MIH is a defect encountered by Iranian dental academic staff with a considerable disparity in knowledge and views regarding its clinical pattern.

KEYWORDS: Molar Incisor Hypomineralization, Iranian Dental Academics, Knowledge

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Different diagnostic terms such as 'cheese molars', 'non-fluoride enamel opacities', 'idiopathic enamel opacities', and 'opaque spots' have been used to define developmental enamel defects, some of which are linked to the clinical characterization of enamel, and others describe their etiological factors.^{1,2} In 2003 the term

molar incisor hypomineralization (MIH) was introduced by Weerheijm et al. to describe white or yellow-brown demarcated opacities on first permanent molars, frequently associated with affected permanent incisors.³ In severe cases with post-eruptive enamel breakdown, it may be difficult to distinguish MIH defects from enamel hypoplasia and/or

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dental caries.³ The defective enamel structure and extensive clinical problems associated with MIH may lead to complicated restorative treatments, or extraction of the affected teeth.^{4,5} Restorative treatments and management of these teeth are challenging for both the patient and dentist.⁶

Recent studies have reported the knowledge and opinions of dentists regarding the prevalence, severity, possible etiological factors, and contemporary treatment of MIH. The majority of European clinicians perceived MIH to be a clinical problem worthy of further investigation.⁷ Similar results have been reported by Crombie et al. following a survey of members of the Australian and New Zealand Society of Pediatric Dentistry and Ghanim et al. from a survey of academic dentists in Iraq.^{8,9} A further study, which investigated the views of dental care providers from 53 universities in Latin America, also supported the recognition of MIH as a significant clinical problem and the recommendation for further investigations into MIH.¹⁰

Tehran and Shiraz Universities of Medical Sciences are two major universities in Iran, including policy makers in health, particularly oral and dental health. Tehran is the capital of Iran located in the north and Shiraz in the south, both providing vast areas of healthcare services. The faculties of dentistry in both universities deliver significant oral and dental health services in these areas.¹¹ The academic staff members of these two universities are among the elite of the country, playing a significant role in training dentists; therefore, any change in their perspectives and increase in their knowledge of oral and dental health would be directly transferred their students. The degree of academics' awareness and their responses to questions may in part reflect the relevant knowledge acquired by the two schools' graduates'. Clinicians' perception of MIH can facilitate the detection and appropriate treatment of this pathological condition. On the other hand, awareness of

the dental academics regarding the frequency of MIH occurrence can assist local health authorities in framing appropriate oral health services and providing effective health promotion activities for the general public. Moreover, the ability of the oral health professionals to detect early defects and decide on the best treatment options for MIH-affected teeth can be evaluated by identifying areas of which they have poor knowledge. The results of this evaluation can also help in the improvement of their learning experiences.

The objective of this study was to investigate the perception of Iranian academic dentists in two major dental schools (Shiraz and Tehran) regarding the prevalence, frequency of observation, possible etiological factors, clinical presentation, and management of MIH defect in Iran.

Methods

The investigated population consisted of the teaching staff of dental schools of Shiraz and Tehran Universities of Medical Sciences. After receiving ethical approval from the above-mentioned dental schools, a number of the potential participating departments were identified from their staff list. Nine dental school departments were identified and included; Prosthodontics, Periodontics, Pediatric Dentistry, Orthodontics, Endodontics, Oral Surgery, Dental Radiology, Oral Pathology, and Operative Dentistry. An envelope containing an information brochure describing the aims and methods of the study along with the questionnaire was hand-delivered to all department administrative officers, who distributed these among the designated academic staff (n = 155, distributed as 95 and 60 from Tehran and Shiraz Dental Schools, respectively). Participation was anonymous and voluntary. Participants were asked to complete the questionnaire in their own time and return it in a sealed envelope within five working days to the designated administrative officer of each department.

Based on previous questionnaire surveys,

the questionnaire consisted of two sections.⁷⁻⁹ In the first section, respondents were asked to provide socio-demographic information including year and place of receiving, and type of dental qualification (both undergraduate and post-graduate degrees including the area of specialty) date of birth, and gender. The second section included questions regarding perception and recognition of the MIH defect in Shiraz and Tehran cities, the incidence and severity of the defect represented by its clinical presentation, their knowledge of the prevalence, frequency of observation, possible determinant factors, and their clinical experience of the management strategies for MIH. The questionnaire also included clinical photographs used by previous surveys.⁷⁻⁹ The questionnaire was validated in terms of applicability and repeatability by performing a pilot study amongst a group of practicing dentists. Through discussions with the participants and assessment of the results of the pilot study, the questionnaire was revised by providing a wider range of possible answers.

Statistics

Data were entered into and analyzed using SPSS for Windows (version 18.0; SPSS Inc., Chicago, IL, USA). Descriptive and comparative analysis based on the distribution of selected biographical, educational, and work experience variables using Pearson's chi-square test (χ^2) was undertaken. The results were considered significant at an alpha < 0.05.

Results

Of the 155 questionnaires distributed, 95 responses were received, a response rate of 61.3%. Participation rate from Tehran dental school was significantly higher than that from Shiraz dental school (63/95 (66.3%) vs. 32/60 (53.3%), respectively). Of the 95 respondents, 11 were not included in the analysis due to returning questionnaires with incomplete answers including general dental practitioners. Responses from both dental schools were treated as a single set in data

analysis; hence, the final sample (n = 84) comprised of six groups of specialists and distributed as follows: 18 (21.4%) pediatric dentists, 16 (19.0%) orthodontists, 15 (17.9%) specialists in operative dentistry, 14 (16.7%) periodontists, 11 (13.1%) prosthodontists, and 10 (11.9%) endodontists. No significant association was observed between length of time practicing and clinicians' perception of existence of MIH. Clinicians with less than 5 years to more than 20 years of experience had a level of perception score ranging between 80.0% to 95.0%, respectively.

Dental academic staff's perception of MIH is illustrated in table 1. The vast majority of the respondents (85.7%) had encountered MIH in their professional work, with specialist in endodontics representing the highest proportion of the whole sample (100%). The majority of the respondents who were aware of MIH (specialists in endodontics (70.0%), paediatric dentistry (55.6%), orthodontics (50.0%), and operative dentistry (46.7%)) observed affected teeth on a monthly basis. However, the majority of prosthodontists and periodontists reported that they were encountering MIH on a yearly basis (54.5% and 42.9%, respectively). There was a significant difference between specialists in relation to the frequency of observation of MIH ($\chi^2(5) = 15.3$; $P < 0.001$).

In response to the question on the clinical presentation of MIH, almost half (48.8%) of the respondents indicated that yellow-brown opacities were more prevalent in comparison to other clinical presentations. Less than one fifth (16.7%) of the respondents reported that the incidence of MIH was increasing. Most respondents (64.3%) estimated the prevalence of MIH in their practice to be less than 10.0%; however, one quarter (25.0%) anticipated MIH prevalence to be higher than 25.0%. There were no statistically significant differences in the perception, observed clinical presentation, increasing incidence, or reported prevalence of MIH between the different groups of specialists.

Table 1. Dental academic staff perception of MIH (Molar incisor hypomineralization)*

Question	Paediatric dentistry	Orthodontics	Operative dentistry	Periodontics	Prosthodontics	Endodontics	All
	Yes N (%)						
Have you ever seen hypomineralized teeth in your practice?	15 (83.3)	13 (81.3)	13 (86.7)	12 (85.7)	9 (81.8)	10 (100)	72 (85.7)
** In your clinical work, how often do you notice hypomineralised teeth?							
Weekly basis	4 (22.2)	2 (12.5)	4 (26.7)	1 (7.1)	2 (18.2)	0 (0.0)	13 (15.5)
Monthly basis	10 (55.6)	8 (50.0)	7 (46.7)	5 (35.7)	1 (9.1)	7 (70.0)	38 (45.2)
Yearly basis	1 (5.6)	3 (18.8)	2 (13.3)	6 (42.9)	6 (54.5)	3 (30.0)	21 (25.0)
Regarding severity of the defect; which of the following do you most frequently notice in your practice?							
Creamy-white	4 (22.2)	3 (18.8)	5 (33.3)	6 (42.9)	3 (27.3)	5 (50.0)	26 (31.0)
Yellow-brown	9 (50.0)	8 (50.0)	8 (53.3)	6 (42.9)	6 (54.5)	4 (40.0)	44 (48.8)
Post-eruptive enamel breakdown	2 (11.1)	2 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (10.0)	5 (6.0)
In your practice do you feel the incidence of hypomineralized teeth has increased over the last 10 years, or in the period of your practice?	5 (27.8)	4 (25.0)	1 (6.7)	4 (28.6)	0 (0.0)	0 (0.0)	14 (16.7)
Approximately what percentage of patients do you observe these teeth in?							
< 10%	12 (66.7)	6 (37.5)	9 (60.0)	10 (71.4)	9 (81.8)	8 (80.0)	54 (64.3)
10-20%	0 (0.0)	3 (18.8)	2 (13.3)	2 (14.3)	1 (9.1)	1 (10.0)	9 (10.3)
> 25%	6 (33.3)	7 (43.8)	4 (26.7)	2 (14.3)	1 (9.1)	1 (10.0)	21 (25.0)

*Percentage per each subgroup calculated from the total number of its related group. Percentage for the overall sample calculated from the total number of the sample (n = 84)

**Statistically significant difference between specialists by frequency of observation of MIH ($\chi^2(5) = 15.3$; $P < 0.001$)

Table 2. Dental academic staff diagnostic confidence and presumptions on etiological factors of MIH (Molar incisor hypomineralization)*

Question	Paediatric dentistry	Orthodontics	Operative dentistry	Periodontics	Prosthodontics	Endodontics	All
	Yes N (%)						
How confident do you feel when diagnosing MIH teeth?							
Very sure	4 (22.2)	2 (12.5)	3 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)	9 (10.7)
Sure	7 (38.9)	4 (25.0)	2 (13.3)	5 (35.7)	2 (18.2)	2 (20.0)	22 (26.2)
Almost sure	5 (27.8)	9 (56.3)	6 (40.0)	6 (42.9)	6 (54.5)	4 (40.0)	36 (42.9)
Not sure	2 (11.1)	1 (6.3)	4 (26.7)	3 (21.4)	3 (27.3)	4 (40.0)	17 (20.2)
Which factors do you think are involved in the etiology of MIH?							
Genetics	5 (27.8)	9 (56.3)	6 (40.0)	6 (42.9)	8 (72.7)	4 (40.0)	38 (45.2)
Antibiotic/medication	5 (27.8)	10 (62.5)	7 (46.7)	6 (42.9)	7 (63.6)	6 (60.0)	41 (48.8)
Acute medical conditions	13 (72.2)	6 (37.5)	7 (46.7)	8 (57.1)	7 (63.6)	5 (50.0)	46 (54.8)
Chronic medical conditions	4 (22.2)	7 (43.8)	3 (20.0)	8 (57.1)	4 (36.4)	3 (30.0)	29 (34.5)
Fluoride exposure	4 (22.2)	6 (37.5)	5 (33.3)	6 (42.9)	6 (54.5)	3 (30.0)	30 (35.7)
None	2 (11.1)	4 (25.0)	1 (6.7)	6 (42.9)	3 (27.3)	2 (20.0)	26 (31.0)

*Percentage per each subgroup calculated from the total number of its related group. Percentage for the overall sample calculated from the total number of the sample (n = 84); MIH: Molar-incisor hypomineralization

Trends of reported diagnostic confidence and the possible etiological components of MIH are presented in table 2. Less than half of the clinicians (42.9%) were 'almost sure' that they were able to diagnose MIH correctly. A variety of views were given regarding the possible etiological factors with no apparent agreement on a specific etiological factor. Acute medical conditions affecting the mother during pregnancy or the child during early childhood were reported as more important causative factors in contrast to chronic medical conditions and medications taken during gestation period or early childhood (54.8% vs 34.5% and 48.8%, respectively). A widely held view that there is genetic involvement in MIH was reported (45.2%). Fluoride ingestion was considered by 35.7% of respondents as a relevant factor, whereas 31.0% of the respondents believed absence of associated medical conditions was the cause. No significant difference was observed between the groups in terms of diagnostic confidence or opinions on the possible etiological factors.

The type of dental material utilized by the

practitioners in treating MIH teeth and the reasons given for choosing the restorative materials is summarized in table 3. Resin composite (RC) was used widely (61.9%) while other materials including glass ionomer cement (GIC), resin-modified GICs, polyacid modified RC, amalgam, prefabricated crown, and inlay restorations were less commonly used by the clinicians. Endodontists (90.0%) and pediatric dentists (77.8%) used resin composite significantly more than other specialist groups ($\chi^2(5) = 5.8$; $P < 0.001$). With regards to the reasons given for choosing the restorative materials, adhesion was largely selected by most of the clinicians regardless of their specialty (61.9%); however, there was considerable variation between respondents for other influences. Aesthetic, strength, and personal experience (47.6%, 34.5%, and 31.0%, respectively) were the most frequently cited factors following adhesion.

Discussion

This is the first study investigating the knowledge of Iranian dentists regarding MIH.

Table 3. Dental academic staff's choice of and reason to use a specific restorative material*

Question	Paediatric dentistry	Orthodontics	Operative dentistry	Periodontics	Prosthodontics	Endodontics	All
	Yes N (%)						
Materials used in MIH affected teeth							
Glass ionomer cement	6 (33.3)	5 (31.3)	6 (40.0)	3 (21.4)	3 (27.3)	7 (70.0)	30 (35.7)
Resin modified glass ionomer cement	4 (22.2)	3 (18.8)	3 (20.0)	8 (57.1)	4 (36.4)	6 (60.0)	28 (33.3)
Poly-acid modified resin composite	1 (5.6)	2 (12.5)	2 (13.3)	3 (21.4)	3 (27.3)	2 (20.0)	13 (15.5)
**Resin composite	14 (77.8)	7 (43.8)	9 (60.0)	7 (50.0)	6 (54.5)	9 (90.0)	52 (61.9)
Amalgam	3 (16.7)	1 (6.3)	4 (26.7)	2 (14.3)	4 (36.4)	3 (30.0)	17 (20.2)
Prefabricated crown	8 (44.4)	4 (25.0)	4 (26.7)	4 (28.6)	3 (27.3)	6 (60.0)	29 (34.5)
Inlay	1 (1.2)	2 (12.5)	2 (13.3)	3 (21.4)	2 (18.2)	1 (10.0)	11 (13.1)
Which factors influence your choice of restorative material?							
Adhesion	9 (50.0)	12 (75.0)	6 (40.0)	10 (71.4)	7 (63.6)	8 (80.0)	52 (61.9)
Aesthetic	7 (38.9)	5 (31.3)	5 (33.3)	3 (21.4)	4 (36.4)	6 (70.0)	40 (47.6)
Ability to promote remineralisation	3 (16.7)	4 (25.0)	4 (26.7)	7 (50.0)	4 (36.4)	0 (0.0)	22 (26.2)
Patient/parent preference	4 (22.2)	2 (12.5)	2 (13.3)	3 (21.4)	2 (18.2)	1 (10.0)	14 (16.7)
Strength	4 (22.2)	9 (56.3)	3 (20.0)	5 (35.7)	3 (27.3)	5 (50.0)	29 (34.5)
Personal experience	6 (33.3)	5 (31.3)	3 (20.0)	4 (28.6)	2 (18.2)	6 (60.0)	26 (31.0)
Research resources	6 (33.3)	3 (18.8)	5 (33.3)	2 (14.3)	6 (54.5)	0 (0.0)	22 (26.2)

*Percentage per each subgroup calculated from the total number of its related group. Percentage for the overall sample calculated from the total number of the sample (n = 84)

**Resin composite was more frequently used by endodontists and paediatric dentist than by other specialists ($\chi^2(5) = 5.8; P < 0.001$); MIH: Molar-incisor hypomineralization

In the present study, a high level of awareness of MIH amongst the majority of the participants was reported; this was consistent with the results of previous surveys.⁷⁻¹⁰

Despite the participants' ostensible level of awareness, a significant difference in the perceived frequency of observation was reported. Pediatric dentists, endodontists, orthodontists, and operative dentists reported a monthly frequency of observation of MIH-affected teeth in their clinical practice, whereas periodontists and prosthodontists reported a yearly observation. This may be explained by variation between specialists in their practical experience; pediatric dentists, endodontists, orthodontists, and operative dentists are specialists who provide dental care for children more frequently than do periodontists and prosthodontists.

In terms of the respondents' views of the prevalence rates, evident disparities were found as their estimation of the prevalence in their clinical practice which ranged from less than 10.0% to greater than 25.0%. It is worth mentioning that during the time the present survey was undertaken, a community-based survey investigating the prevalence of MIH amongst primary schoolchildren in Shiraz, Iran, was also ongoing.¹²

The prevalence was 20.0%, with demarcated creamy white opacities detected as the most frequent lesion type.¹² When comparing respondents' predictions with the true estimation figure, the actual prevalence value lies within the upper range predicted by the dental academics. This close similarity in results is supportive of clinicians having sound diagnostic abilities in practice; however, it still demonstrates the uncertainty about the true prevalence in Tehran and Shiraz cities in particular and in Iran in general.

Moreover, the statement of the yellow-brown opacities as the most frequently observed lesions and the monthly frequency of observation of MIH are in agreement with the findings of a study in Iraq.⁹ On the other hand, in comparing clinicians' observations

with the clinical survey in Shiraz, their common observation for the yellow-brown-demarcated opacities contradicted the clinical-survey findings where creamy-white opacities were the most prevalent.¹² This is not surprising, since it is severe lesion, which more likely requires surgical intervention, which in the case of MIH is represented by brownish opacities, PEB (Post Eruption Breakdown), or atypical restorations. In the present study, the majority of the respondents were cognizant that MIH is a multifactorial defect, consistent with the findings of Crombie et al. and Ghanim et al.^{8,9} Ill-health during pregnancy and during early childhood were reported as significant putative etiological factors for MIH. The compatible findings recognize early childhood and maternity illnesses as priorities when considering real risk factors.

Resin composite was the material used by the clinicians most commonly, in particular by endodontists and pediatric dentists, a finding not in accordance with the study by Crombie et al. where GIC was the material of choice.⁸ Aesthetics could partly explain the common use of the resin composite. Restoration of hypomineralized teeth with resin composite has been assessed previously and controversial results have been reported.¹³⁻¹⁵ A recent study indicated that directly placed resin composite restorations can be successful for up to 4 years after placement in young children but should be monitored carefully for marginal breakdown.¹⁵ Whereas in other studies the failure rate of such restoration ranged between 15% to 25% over a 5 year period with post-eruptive enamel breakdown, atypical caries, and loss of restoration as the most common reported reasons for failure.^{13,14}

On the other hand, in agreement with the findings of Crombie et al., adhesion was the most commonly reported influence on material choice by the respondents regardless of their specialty. There has been some investigation into the retention and the success of resin composite in restoring MIH molars. It

was reported that the reduced strength and hardness associated with the existing weakness of the hypomineralized enamel might explain the poor bond strength of the resin composite to the affected enamel.¹⁶

Similar to previous findings, in the present study, specific areas of poor knowledge about demarcated lesions (i.e. defect causes and management aspects) have been identified amongst the dental teaching staff.⁹ Although it is recognized that knowledge itself is not sufficient to reduce defect occurrence, accurate knowledge and information is necessary for the oral health professionals to identify the problem and to decide on the best treatment options. Hence, it could be argued that if clinical training programs are developed to make the dental community more acquainted with the defect and its management strategies, the dental care burden can be minimized.

The information provided in the present study has to be considered within the limitations of the study design. The most apparent shortcoming is the selectivity of the sample population which is limited to specialist dental teaching staff rather than the general dental practitioners, thus it does not reflect current MIH knowledge in general. However, academic staff members represent the role model for future oral health professionals and their views will provide assistance to local health authorities in framing appropriate oral health services and providing effective health promotion activities for the general public.

Additionally, the relatively low response rate increased the possibility of under-reporting as non-response is more likely to be negative with respect to knowledge. Nonetheless, the present study provides a reference database for a broader national survey involving a wide spectrum of dental care providers in Iran.

Conclusions

Molar-incisor hypomineralization is a defect encountered by the academic staff of Tehran and Shiraz Dental Schools with a considerable disparity in knowledge and views regarding the frequency of observation and prevalence of MIH. The majority of respondents in the present study believed that medical conditions were involved in the pathogenesis of this defect. Yellow-brown demarcated opacities were the most frequently noted clinical presentation of MIH. Resin composite was the most popular material used in treating teeth with MIH. In addition, adhesion was the most commonly reported influence on material choice.

Conflict of Interests

Authors have no conflict of interest.

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