Perception of Molar-Incisor Hypomineralisation (MIH) by Iraqi Dental Academics

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Background. The understanding and detection of molar-incisor hypomineralisation (MIH) is linked to its recognition by clinicians. No study has investigated dental clinicians' level of perception regarding MIH in the Middle East region including Iraq.

Aim. To determine the perception of Iraqi academic clinicians about MIH prevalence, severity and aetiological factors.

Design. A questionnaire, based on previous European and Australian/New Zealand studies was administered to the academic dental staff of Mosul University.

Results. A response rate of 77.7% was reported. General dental practitioners represented 30.8% of

Introduction

The terminology of Molar-Incisor Hypomineralisation (MIH) was introduced by Weerheijm *et al.* (2001) to describe the clinical presence of a qualitative enamel developmental defect of systemic origin that affects the first permanent molars and less frequently the incisors. Clinically, the defect may present as demarcated, opaque lesions, in severe cases with post-eruptive enamel breakdown, distinct from fluorosis and on occasion difficult to distinguish from enamel hypoplasia or dental caries¹. Second primary molars are also affected by MIH with similar clinical manifestations as those in permanent teeth^{1–3}.

In spite of the considerable number of studies on enamel hypomineralisation published

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the total respondents, whilst 65.1% were dentists with post-graduate qualification. The majority of the respondents (81.2%) encountered MIH in their clinical activities and 37.3% of them identified that the prevalence appeared to have increased in recent years. Fewer than half of the respondents observed MIH affected teeth on a monthly basis. The condition was less commonly seen in primary second molars than the first permanent molars. A variation in views was recorded about MIH specific aetiological factor/s. Respondents advocated the need for clinical training regarding MIH-aetiological and therapeutic fields. **Conclusions.** Molar-incisor hypomineralisation is a condition commonly diagnosed by Iraqi dental academics. No apparent consensus existed between the general and specialist dentists regarding the anticipated prevalence, severity and aetiology of this condition.

during the last decades, definitive causative factor/s have not been identified for either permanent or primary teeth^{4,5}. In the literature, MIH has also been referred to as: hypomineralised permanent first molars⁶, idiopathic enamel hypomineralisation^{7,8}, non-fluoride hypomineralisation in permanent first molars⁹ and cheese molars^{10,11}.

Several studies have reported the impact of MIH on patients' oral health status including rapid wear and enamel breakdown, poor success of restorations and increased dental caries^{9,12,13}. A recent United Kingdom clinic-based study reported that extraction due to MIH was the second most common cause of first permanent molar tooth loss following dental caries, 11 and 89% respectively¹⁴. However the possible under-diagnosis of hypomineralised enamel related to caries may lead to underestimation of MIH as the primary cause of extraction.

Recently, surveys of the members of European and Australian/New Zealand (ANZ)

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societies of paediatric dentistry reported that although MIH is widespread, little prevalence data are available and that the majority of clinicians perceived MIH to be a clinical problem worthy of further investigation^{15,16}. Data from the Middle East dental communities, including Iraq, are lacking.

Mosul is the second largest city in Iraq with Mosul University the second largest educational and research institution in the country after the University of Baghdad. Mosul Dental College a vital institute within the University, offers a variety of oral health care services to the public through its dental clinics¹⁷. Academic staff of Mosul Dental College provides their clinical experience, and are the role model for future oral health professionals. These academics are considered leaders in their field and their opinions will provide assistance to local health authorities in framing appropriate oral health services, funding services and providing effective health promotion activities for the general public.

However, despite the importance and prevalence of MIH, the perceptions of clinicians regarding its prevalence and significance have not been assessed in Iraq. Therefore, as a starting point to achieve this goal, and as part of a broader study aimed at assessing the prevalence of MIH amongst Iraqi children, this study aims to investigate the perception of the dental teaching staff members of Mosul University regarding the prevalence, severity and aetiological factors of MIH in the region, and to compare the outcomes of the survey tools between the groups of the academic staff [general dental practitioners (GDP) and dental specialists]. It is expected that this information could trigger clinical research into MIH elsewhere in the Middle East and enrich the international data available by providing the feedback of the Iraqi clinicians about this unclear dental condition at one of the largest Iraqi research centres.

Methods

Sample and procedures

In January 2010, a questionnaire survey was conducted amongst the teaching dental staff,

including GDP and dental specialists, of Mosul Dental College. After receiving approvals from the Human Research Ethics Committee of the University of Melbourne and from the Dental College of Mosul University, the names of the potential participants were identified from the staff list of the Dental College. A package containing an information brochure about the study, the data collection instrument, and a plain language statement describing the study was hand delivered by the first author (AG) to all potential participants (n = 188). An envelope was also included to facilitate responses. 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 a designated administrative officer at each of the five College departments. A reminder letter was sent to all participants 2 weeks after initial distribution.

Survey instrument

The questionnaire consisted of two sections. In the first section respondents were asked to provide socio-demographic information including year and place of dental qualification, type of qualification, both under and post-graduate degrees including any area of speciality. The second section included questions regarding perception and recognition of the MIH condition in Mosul City, prevalence, incidence and severity of the defect, represented by its clinical presentation, clinical experience of MIH and knowledge of possible aetiological factors. The instrument also included questions about MIH prevalence in second primary molars, respondent's confidence in diagnosing MIH, and views on the necessity for clinical training regarding enamel hypomineralisation. The questionnaire included clinical photographs as used by the European and ANZ surveys with additional photographs of second primary molar teeth^{3,15,16}

Analysis

The information from each participant was transferred onto code sheets and data entered into the spss package version 12.0 (SPSS Inc,

Chicago, IL, USA). The analysis provides comparisons between the GDP and specialist dentists based on the distribution of selected biographical, educational and work experience variables.

The independent variables included the type of qualifications (i.e. under-graduate and post-graduate); year of qualification was reclassified into five categories: '<5'; '5-10'; '11-15'; '16-20'; and 'more than 20 years'. Under-graduate qualification was represented by GDP working as demonstrators. According to the five main dental college academic departments, postgraduate qualifications were recoded into five categories: operative dentistry, prosthodontics, orthodontic/prevention, oral surgery, and oral basic sciences. In order to compare between qualification groups knowledge regarding possible aetiologies, participants were asked to report from a list of nine commonly described aetiological factors. An aetiological factor knowledge score was computed by summing up the conditions that participants indicated. Descriptive statistics were determined, Chi-square or Fisher-Freeman Halton tests were utilised for nominal or ordinal variables. Continuous variables were compared using one-way analysis of variance (ANOVA) and post-hoc comparisons using Tukey's-b Honestly Significant Differences test. The results were considered significant at an alpha level <0.05.

Results

Of the 188 questionnaires distributed, 146 responses were received, achieving a response rate of 77.7%. The majority of respondents (65.1%) had post-graduate degrees with specialties. Specialist dental practitioners (SDP); 30.8% were GDP, and the remaining (4.1%) provided incomplete qualification data. Those with SDP (n = 95) were distributed as follows: 28.4% operative dentistry, 23.2% oral surgery, 23.2% orthodontics and preventive dentistry, 13.7% prosthodontics, and 11.6% oral basic sciences. The dentists who cared for paediatric patients constituted (51.6%) of the SDP, represented by specialists in operative dentistry and in orthodontics and preventive dentistry.

A positive association was observed between length of time practicing and clinicians' perception of existence of MIH, from 59.3% of the staff with <5 years of graduation to 100% among those with more than 20 years of experience [$\chi^2(4) = 20.1$; *P* < 0.001].

Dental academic staff perception of MIH is illustrated in Table 1. The vast majority of the respondents (81.2%) had encountered MIH in their professional work. Those with post-graduate qualifications (SDP) reported a higher rate of familiarity to MIH than general dentists (GDP) [$\chi^2(1) = 28.3$; P < 0.001]. Fewer than half of respondents who were aware of MIH observed affected teeth on a monthly basis (42.0%) whereas over half of the specialists in operative dentistry reported that they were encountering MIH on a weekly basis (55.6%).

In response to the question on the clinical presentation of MIH, respondents indicated that yellow/brown opacities were more prevalent in comparison to the other clinical presentations; nevertheless, GDP highlighted the frequent occurrence of the white demarcated defects. There was a significant difference between GDP and SDP in relation to the severity of the defects diagnosed [$\chi^2(3) = 13.4$; *P* < 0.001].

A reasonable rate of the respondents (37.7%) agreed that the prevalence of MIH appeared to have increased in recent years. In particular, this was the case of specialists in operative dentistry, with (92.6%) reporting increased prevalence. Almost three quarters of the GDP group (74.4%) were unsure whether MIH prevalence had increased $[\chi^2(3) = 8.3; P < 0.001].$

The views on the frequency of second primary molar involvement with MIH and the possible aetiological components of MIH as reported by the participants are presented in Table 2. Over half of the respondents reported that MIH is less common in primary second molars than the first permanent molars (57.2%). When comparing GDP and SDP, a highly significant difference was found [$\chi^2(2)$ = 17.9; *P* < 0.001]. A larger number of SDP reported that the condition was less frequent in the second primary molar tooth; (69.5 *vs* 30.2%, respectively) (Figure not shown); whereas a larger number of GDP compared to

	N & %	6 of Yes a	nswers												
	Groul	ps of SDP													
	Opera denti	ative stry	Prosthodo	ontics	Orthoo	dontic/ ntion	Oral surgei	~	Oral b scienc	asic es	GDP		ALL		
Question	2	%	2	%	2	%	z	%	2	%	2	%	2	%	<i>P</i> -value
Do you encounter hypomineralised teeth in vour practice?	27	100	σ	69.2	21	95.5	20	90.9	11	100	24	55.8	112	81.2	<0.001*
In vour clinical work, how often do vou	u notice	hypominer	alised teeth?												
Weekly basis	15	55.6	0	0.0	2	9.5	2	10.0	2	18.2	m	12.5	24	21.4	
Monthly basis	11	40.7	2	22.2	14	66.7	14	70.0	-	9.1	ß	20.8	47	42.0	
Yearly basis	-	3.7	7	77.8	ß	23.8	4	20.0	00	72.7	16	66.7	41	36.6	
Regarding severity of the defect; which	n of the	following d	o you most f	requently n	otice in y	our practic	e?								
White demarcation	2	7.4	, -	12.5	Ъ	23.8	7	35.0	m	27.3	12	54.5	30	27.5	<0.001**
Yellow/brown demarcation	19	70.4	9	75.0	15	71.4	13	65.0	ß	45.5	∞	36.4	99	60.6	
Post-eruptive enamel breakdown	9	22.2	-	12.5	-	4.8	0	0.0	m	27.3	2	9.1	13	11.9	
In your practice do you feel the incide	ince of h	Inpomineral	ised teeth ha	s increased	over the	last 10 yea	ırs, or in	the perioo	l of your	practice?					
Yes	-	92.6	1	15.4	m	40.9	ß	36.4	2	27.3	9	11.6	18	37.7	<0.001**
No	25	3.7	2	7.7	6	13.6	00	22.7	m	18.2	ß	14.0	52	13.0	
Not sure	-	3.7	9	76.9	б	45.5	7	40.9	ъ	54.5	31	74.4	41	49.3	
*Significant difference between SDP ar **Significant difference between SDP GDP, general dental practitioners; MIH,	and GDP. and GDF , molar-i	o using Fishe incisor hypo	er Freeman H mineralisation	alton test. 1; SDP, spe	cialist der	ntal practiti	oners.								

Table 1. Dental academic staff perceptions regarding MIH.

	N 8,	% of Yes	answers												
	Grou	ps of SD	4												
	Oper dent	ative istry	Prostho	dontics	Ortho	dontic/ ntion	Oral surge	ېر ک	Oral scier	basic Ices	GDP		ALL		
Question	2	%	2	%	2	%	2	%	2	%	2	%	2	%	<i>P</i> -value
How frequently do you notice this defect in the se	econd p	orimary m	olar in com	parison to 1	the first p	ermanent i	molar too	oth?							
More frequently	0	0	4	30.8	4	18.2	m	13.6	m	27.3	14	32.6	28	20.3	<0.001*
Less frequently	26	96.3	4	30.8	14	63.6	15	68.2	7	63.6	13	30.2	79	57.2	
The same as for the first permanent molar	-	3.7	ß	38.5	4	18.2	4	18.2	-	9.1	16	37.2	31	22.5	
Which factor/s do you think are involved in the a	aetiology	/ of MIH?													
Genetic factors	ŋ	18.5	8	61.5	13	59.1	7	31.8	Ю	45.5	24	55.8	62	44.9	
Chronic medical condition/s that affect the;															
Mother during pregnancy	15	55.6	m	23.1	11	50.0	14	63.6	4	36.4	11	25.6	58	42.0	
Involved child	17	63.0	m	23.1	7	31.8	11	50.0	-	9.1	11	25.6	50	36.2	
Antibiotics/Medications taken by the;															
Mother during pregnancy	0	0	m	23.1	ŋ	22.7	9	27.3	m	27.3	Ŋ	11.6	22	15.9	
Involved child	9	22.2	m	23.1	7	31.8	9	27.3	m	27.3	6	20.9	34	24.6	
Acute medical condition/s that affect the;															
Mother during pregnancy	13	48.1	m	23.1	ъ	22.7	6	40.9	4	36.4	7	16.3	41	29.7	<0.01*
Involved child	23	85.2	4	30.8	<i></i> б	40.9	11	50.0	m	27.3	7	16.3	57	41.3	<0.001*
Environmental contaminants	7	25.9	9	46.2	14	63.6	00	36.4	4	36.4	18	41.9	57	41.3	
Fluoride exposure	6	33.3	Ъ	38.5	11	50.0	4	18.2	9	54.5	18	41.9	53	38.4	
Other	0	0	0	0	0	0	-	4.5	-	9.1	0	0	2	1.4	
None	0	0	2	15.4	0	0	0	0	0	0	m	7.0	ß	3.6	
*Significant difference between SDP and general MIH, molar-incisor hypomineralisation.	dental p	oractitione	ers.												

Table 2. Dental academic staff views regarding second primary molar involvement and anticipated aetiological components of MIH.

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SDP reported that the frequency of MIH in the second primary molar tooth was the same as for the first permanent molar tooth; (37.2 *vs* 15.8%, respectively) (Figure not shown).

A variety of opinions were given regarding the possible aetiological factors with no apparent agreement on a specific aetiological factor. Over one third of the respondents thought that genetic predisposition is linked to MIH occurrence. Chronic medical conditions affecting the mother during gestation period were reported as a more important causative factor in contrast to acute medical conditions and medications taken during pregnancy (42.0 vs 29.7 and 15.9%, respectively). On the other hand, acute medical conditions occurring during early childhood were reported as significant factors compared with chronic medical conditions or medications taken (41.3 vs 36.2 and 24.6%, respectively). When comparing SDP and GDP significant differences were found in terms of acute medical conditions affecting the mother and child during pregnancy $[\chi^2(1) = 5.8;$ $P < 0.01; \quad \chi^2(1) = 14.6; \quad P < 0.001, \quad \text{respec-}$ tively]. Environmental contaminants were implicated by over 40% of respondents. Fluoride ingestion was also implicated by 38.4% of the respondents.

A widely held view that MIH is a multifactorial condition was observed (89%). Of the total (62.3%) who anticipated one to three possible causative factors, only 11% reported one possible factor, while 21.9 and 29.5% reported two and three causative factors, respectively. The remainder (37.7%) reported between four to eight aetiological factors. The MIH aetiological factors knowledge score ranged from 1 to 8, with a mean value of 3.3 (SD = 1.5). The total knowledge score was examined in relation to the different education groups. No significant differences were found between the different education groups.

Trends of diagnostic confidence and clinical training demands amongst the different practice groups in the sample are illustrated in Table 3. In diagnostic confidence assessment, the majority of clinicians were confident that they were able to correctly diagnose MIH. When comparing level of dental education, the majority of SDP were significantly more confident regarding MIH diagnosis than GDP [70.5 vs 48.8%; $\chi^2(1) = 6.2$; P < 0.05].

In determining perceived clinical training requirements, the majority of the respondents (79.0%) agreed upon the necessity of having a clinical training program on MIH. The need for clinical diagnostic training was expressed by a minority of the respondents (24.6%, n = 34) of whom GDP were representing half; however, considerable rates of respondents advocated the need for clinical training regarding MIH-aetiological and therapeutic fields (50.0, 49.3%, respectively).

The estimates of MIH-prevalence in both dentitions are summarized in Table 4. No significant difference in anticipated MIH-prevalence in primary dentition existed between the clinician groups with expected prevalence mean values ranging between 5.3 and 13.2%; whereas there was considerable variation between GDP and SDP groups in reported MIH-prevalence in the permanent dentition. The highest MIH-prevalence (mean 17.2%) was estimated by those practicing operative dentistry compared with the lowest prevalence level indicated by GDPs (6.3%).

Discussion

This is the first published study investigating perception of Iraqi dentists regarding the MIH condition. The majority of participants had encountered teeth typical of MIH, consistent with the results of the European and ANZ surveys^{15,16}. In the present study the high level of perception of MIH amongst the majority of SDP in comparison to their GDP peers may be attributed to most simple dental conditions being treated by GDP whereas difficult to diagnose cases are usually referred to their SDP colleagues. A considerable number of the respondents indicated that the incidence of MIH is increasing which is in line with the findings of the ANZ survey¹⁶. However, there is no supporting data in the literature confirming this statement.

The conspicuous variation of estimated prevalence rates of MIH amongst participants demonstrates the uncertainty about the true prevalence in Mosul City in particular and in Iraq in general. The estimated prevalence in

Table 3. Clinicians' diagnostic confidence and clinical training demands.

	N & %	of Yes ans	wers												
	Group:	s of SDP													
	Operat dentist	tive try	Prosthoc	dontics	Orthoc preven	lontic/ tion	Oral surgery		Oral ba science	isic s	GDP		ALL		
Question	2	%	2	%	2	%	2	%	2	%	2	%	2	%	<i>P</i> -value
How confident do you fe	sel when	diagnosing N	AIH teeth?												
Very confident	10	37.0	, -	7.7	2	9.1	m	13.6	-	9.1	-	2.3	18	13.0	<0.001*
Confident	16	59.3	7	53.8	17	77.3	18	81.8	б	81.8	21	48.8	88	63.8	
Unconfident	. 	3.7	Ŀ	38.5	m	13.6	0	0	-	9.1	19	44.2	29	21.0	
Very unconfident	0	0	0	0	0	0	0	0	0	0	2	4.7	2	1.4	
Would you like clinical tr	aining rec	garding tooth	hypomine	ralisation?											
Yes	23	85.2	10	76.9	16	72.7	20	90.9	10	90.9	30	69.8	109	79.0	<0.05**
Diagnosis	2	7.4	Ŀ	38.5	4	18.2	2	9.1	4	36.4	17	39.5	34	24.6	
Aetiology	18	66.7	9	46.2	12	54.5	11	50.0	ŋ	45.5	17	39.5	69	50.0	
Treatment	10	37.0	9	46.2	11	50.0	16	72.7	9	54.5	19	44.2	68	49.3	
*Significant difference b	etween SI	DP and GDP	using Fishe	r Freeman H	alton test										
**Significant difference	between 1	SDP and GDI	P.	2		_									
GDP, general dental pra	ctitioners;	MIH, molar-	incisor hypo	omineralisatio	.uc										

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Dentition	Clinician groups	MIH prevalence (Mean & SD)	<i>P</i> -value
Permanent	GDP Operative dentist Prosthodontist Orthodontist & prevention	6.3 (8.9) 17.2 (6.7) 9.5 (6.6) 14.4 (9.4)	<0.001*
	Oral surgeon Oral basic sciences	15.7 (8.2) 8.3 (9.8)	
Primary	GDP Operative dentist Prosthodontist Orthodontist & prevention	6.3 (10.0) 8.3 (3.8) 13.3 (9.4) 12.1 (8.5)	
	Oral surgeon Oral basic sciences	10.7 (9.6) 5.4 (5.7)	

 Table 4. Estimated MIH-prevalence in both permanent and primary dentitions.

*Using ANOVA, significant difference between SDP and GDP. GDP, general dental practitioners; MIH, molar-incisor hypomineralisation.

the present survey lies within the range of the actual prevalence values in other studies. In accordance with this fact, disparities in the opinions regarding the prevalence of MIH in the primary and permanent dentitions mirror the need to determine the prevalence of MIH in both dentitions, a demand which is coincident with the necessity to map the MIH prevalence internationally using valid and reliable criteria¹⁵. A monthly frequency of observation of MIH has been reported by the majority of the respondents. This could represent a reasonable estimation of MIH prevalence and reflect ostensible existence of this condition amongst the population which inturn signify the necessity of conducting epidemiological surveys to provide reliable prevalence data.

Yellow/brown opacities were most frequently observed by the respondents, possibly due to this type of lesion being least easily confused with alternative diagnoses such as fluorosis and carious white spot lesions. Furthermore, the high rate of diagnostic confidence and the limited demand for clinical training in MIH-diagnostic field by most of the clinicians may reflect the high diagnostic awareness towards MIH; alternatively, it may indicate a lack of interest in MIH. High levels of interest in training regarding aetiological factors and therapeutic possibilities for teeth affected by MIH further emphasizes the challenges posed by the existence of ambiguity regarding MIH pathogenesis and how to determine appropriate management strategies, findings that come in accordance with the ANZ study¹⁶. It is recommended that prospective targeting of further dental resources in these areas is essential to improve clinical outcomes.

The vast majority of the respondents believed that MIH is caused by a medical condition and selected more than one possible factor supporting the common belief that MIH has a multi-factorial pathogenesis^{18,19}. In the present study a large number of participants linked MIH to a genetic pathogenesis, and the possibility of a genetic component in the development of MIH should not be underestimated²⁰. It has been hypothesised that the great clinical variability of enamel defects in permanent molars in individual patients indicated that not all teeth were equally vulnerable to the developmental disturbances, thus implicating genetic factors in the pathogenesis²¹. Fluoride has been also implicated by a number of participants as a possible aetiological factor. A need exists for the establishment of a reference aetiological factor databank for dental clinicians to achieve a better assessment for the risk factor/s and appropriate intervention strategies. It is important to point out that environmental pollutants have been identified as aetiological factors, with some studies finding a relationship between environmental toxins and enamel developmental defects; however this has been disputed recently^{22–25}.

It could be inferred that MIH is an existing dental problem in Mosul City; however, the present survey is not a clinical study of the Iraqi community. The authors suggest a broader national survey involving a wide spectrum of dental care providers to establish baseline data for MIH which is essential to the planning, implementation and evaluation of public dental health practice. Integration and dissemination of this data are essential to remove the ambiguity about MIH with more focus on providing programmed dental training for those who want to know about this condition as well as to be a reference data base for broader surveys in the Middle East Region.

Conclusions

Molar-incisor hypomineralisation is a condition encountered by the academic staff of the dental school of Mosul University with a considerable disparity in perception and views regarding the prevalence of MIH amongst the study population. In agreement with other findings the majority of respondents in the present study believed that the incidence of MIH was increasing and reported that medical conditions were involved in the pathogenesis of MIH. As a severity grade, the yellow/brown demarcated opacities were the most frequently noted clinical presentation of MIH. The involvement of the second primary molar was predicted to be less frequent than the first permanent molar tooth. The majority of the respondents indicated that they would benefit from education about MIH-aetiology and treatment.

What this paper adds

• Molar-incisor hypomineralisation reportedly occurs in Iraqi children and dental clinicians consider this to be a clinical problem.

Why this paper is important to paediatric dentists

- The findings of the current survey may increase the level of caution amongst paediatric dentists toward the appropriate management strategies of MIH-affected teeth.
- Knowledge of clinicians' level of perception could be an incentive for paediatric dentists to become more acquainted with MIH by conducting research into its different aspects.

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