

## Molar-incisor hypomineralisation (MIH) among Kurdish children in Sulaimani City, Iraq

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### Abstract

**Objectives:** The aim of this study was to determine the prevalence and distribution of molar incisor hypomineralisation among Kurdish children in Sulaimani City, Iraq.

**Method:** A cross-sectional survey was carried out on primary school students in Sulaimani City. A total of 2346 Kurdish children aged 7 to 9 years old were examined; 1194 (50.9%) males and 1152 (49.1%) females, enrolled in 20 primary public schools. The index teeth were evaluated using the European Academy of Paediatric Dentistry (EAPD) criteria for MIH.

**Results:** The prevalence of MIH was found to be 18.2% where no statistically significant association was found with age or gender ( $P > 0.05$ ). Multiple teeth involvement (13.2%) was more common than a single molar involvement (5.1%). The mean number of the affected index teeth with MIH per affected child was (3.1). Mild defects were present in 64.1% of the affected teeth with demarcated creamy-white opacities were the most common finding (33.3%).

**Conclusions:** It's been found that MIH is a prevalent pathology among Kurdish children in Sulaimani City which could result in a large number of children continuously seeking professional dental treatment. Therefore, dental practitioners who deal with child patients could encounter such cases and should be aware of the treatment choices and management protocols for coping with this particular condition.

**Keywords;** Molar-incisor hypomineralisation, prevalence, index teeth, Kurdish children.

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### Introduction:

Over the past two decades, a congenital defect of enamel mineralization commonly referred to as molar incisor hypomineralisation (MIH) has been of increasing concern to clinicians worldwide. The defect involves hypomineralisation of one to four permanent first molars and is associated frequently with similarly affected permanent incisors<sup>(1)</sup>. Idiopathic enamel hypomineralisation was first noted in Sweden in the late 1970s<sup>(2)</sup>. In view of the chronological distribution of enamel defects, Weerheijm et al. in 2001 defined MIH as a hypomineralisation of systemic origin of one to four first permanent molars frequently associated with affected incisors<sup>(3)</sup>. This description emphasizes the fact that permanent first molars are always involved in those affected, and often there is a combination of molars with demarcated opacities of the incisors<sup>(1,3,4)</sup>. On the other hand, opacities only on the permanent incisors may indicate defects from other origin such as traumatic injuries or periapical infection of the primary incisors, and these lesions should not be referred to as MIH<sup>(5)</sup>.

Although the possibility of a genetic component in the development of MIH has not been excluded, it's been postulated that MIH is a consequence of a variety of environmental factors acting systemically, which disturb the ameloblasts during their enamel production phase<sup>(1)</sup>. Clinically, the defect presents as

opaque lesions varying in color from white to yellow or brown, with a sharp demarcation between the affected and sound enamel. In severe cases, post-eruptive enamel breakdown (PEB) can occur so rapidly that it appears clinically as if the enamel has been not formed at all. When PEB occurs because of chewing forces, it is more conspicuous in the first permanent molars than in the incisors<sup>(1)</sup>.

Recent studies have emphasized that the presence of MIH can produce a number of problems for the patient including dental pain and hypersensitivity, disfigurement, encouragement of rapid plaque retention, and enhancement of caries development<sup>(6)</sup>. The need for orthodontic treatment intervention as a consequence of tooth extraction caused by MIH has also been reported<sup>(7)</sup>. Moreover, substantial challenges to dental care are caused by MIH, because of the lack of appropriate restorative management and difficulties with pain control<sup>(8)</sup>.

A wide range of prevalence rate for MIH have been reported around the world ranging from 2.9 to 38%<sup>(2,6,9-12)</sup>. Only one research study concerning prevalence and distribution of MIH is available in Iraq which focused on 7 to 9 year school children in Mosul City<sup>(13)</sup>, mainly of Arabic ethnicity. This study aims to investigate the prevalence and distribution of MIH among Kurdish children in Sulaimani City, Iraq.

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**Table 1: Criteria for diagnosing the severity of MIH among the index teeth, Alaluusua et al<sup>(16)</sup>**

Severity	Code	Description
Mild	1	Demarcated creamy-white opacity
	2	Demarcated yellow-brown opacity
Moderate	3a	Enamel loss
Severe	3b	Enamel and dentin loss
	3c	Atypical large cavities extending to pulp and covering one or more tubercle
	4	Atypical restoration
	5	Extracted tooth

**Method:**

The research approval was obtained from the ethical committee for medical research in the Faculty of Medical Sciences/ University of Sulaimani and proper authorities and primary school administrators at the city. The city was divided into 20 geographical sections and a primary school was randomly selected from each section, then at each school level a class was selected randomly for the purpose of the study. A cross-sectional survey was carried out on 2346 Kurdish primary school students (1194 males and 1152 females) aged 7-9 years from 2nd, 3rd and 4th grade students.

The children were examined in their school sitting upright in an ordinary school chair in daylight classroom lighting conditions. Teeth were examined wet, as suggested by the FDI Working Group (14), using a mouth mirror and periodontal probe and cotton rolls were used to remove food debris, as necessary.

Examination of the twelve index teeth (Four first permanent molars and eight incisors) were carried out using an index developed by Sonmez et al.<sup>(15)</sup> in line with European Academy of Pediatric Dentistry (EAPD) criteria for MIH<sup>(4)</sup>: Opacities (White-cream, 1; Yellow-brown, 2); Post-eruption structural loss (Enamel defects, 3a; Atypical small cavities with enamel and dentin loss, 3b; Atypical deep or large cavities extending to the pulp and covering one or more tubercle, 3c); Restored teeth, 4; Extracted teeth, 5. Lesion severity was recorded according to Alaluusua et al.<sup>(16)</sup> as either mild, moderate, or severe (Table 1).

Inclusion criteria for the study was children (aged 7-9 years old) of lifelong resident of Sulaimani City with at least one first permanent molar erupted or partially erupted (Any tooth with less than one third of the crown erupted were regarded as unerupted) and present on the day of examination, while, children undergoing orthodontic treatment at the time of

examination or having amelogenesis imperfecta or tetracycline staining and children with the crowns of the first permanent molars completely worn-out or lost and the cause cannot be assured to MIH were excluded from the study.

Data analysis was performed using the SPSS software program (Statistical Package for the Social Sciences, version 16.0, SSPs Inc, Chicago, Ill, USA). A descriptive analysis of the prevalence and distribution of the clinical finding was performed and the chi-square and Fisher's Exact test was used for the data analysis. Statistical significance (P-value) equal or less than 0.05 was considered to be statistically significant.

**Results:**

The total number of examined children reached 2347 child; 1194 (50.9%) males and 1152 (49.1%) females, (Table 2).

The total number of children with enamel defects (All kinds of enamel defects: hypocalcifications, hypomineralizations, Turner's teeth,...etc) were found to be 592 child (25.3%), while the total number of children with MIH only was 427 child (18.2%), (Figure 1).

**Table 2: Distribution of the sample by age and sex**

Age	Gender				Both	
	Male		Female			
	No.	%	No.	%	No.	%
7 years	405	51.07	388	48.93	793	33.8
8 years	396	51.3	376	48.7	772	32.91
9 years	393	50.32	388	49.68	781	33.29
<b>Total</b>	1194	50.9	1152	49.1	2346	100

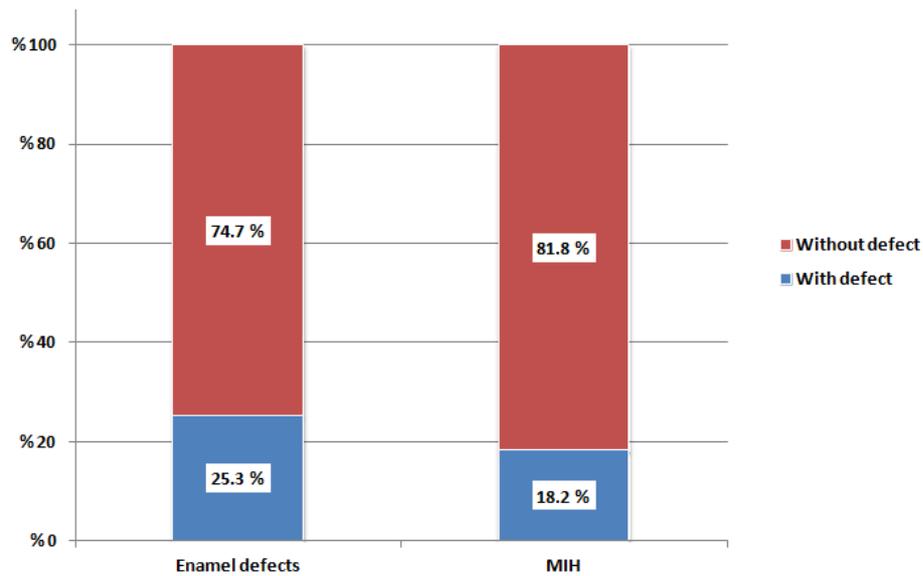


Figure 1: Prevalence of children with developmental enamel defects and MIH

Table 3: Prevalence and distribution of MIH by age

Age	MIH		No MIH		X <sup>2</sup>
	No.	%	No.	%	
7 years	136	17.2	657	82.9	X <sup>2</sup> = 1.12 df=2 P=0.5712
8 years	141	18.3	631	81.7	
9 years	150	19.2	631	80.8	
<b>Total</b>	<b>427</b>	<b>18.2</b>	<b>1919</b>	<b>81.8</b>	

Table 4: Prevalence and distribution of MIH by gender

Gender	MIH		No MIH		X <sup>2</sup>
	No.	%	No.	%	
Male	222	18.6	972	81.4	X <sup>2</sup> = 0.2 df=1 P=0.6547
Female	205	17.8	947	82.2	
<b>Both</b>	<b>427</b>	<b>18.2</b>	<b>1919</b>	<b>81.8</b>	

Younger age groups and males were slightly more affected by MIH. Although there was a small difference in the ratio of the affected children with MIH among different age groups and genders, these differences did not reach any statistically significant association, (Table 3) and (Table 4).

(Table 5) describes the distribution of the MIH affected children by the number and types of teeth affected. From the total 427 children affected, 119

(5.1%) child had only one molar affected and 163 (7%) child had more than one molar affected. The remaining 145 (6.2%) children had molars and incisors affected. The age and gender distribution of the affected children shows minor differences according to the type of teeth affected, and the majority of teeth affected were molars and multiple teeth involvement (13.2%) is more common than a single molar (5.1%) involved by the defect.

Table 5: Prevalence and distribution of MIH in the permanent index teeth by age and gender

MIH affected teeth	Male		Females		7 year		8 year		9 year		Total	
	No.	%										
Single molar	65	5.4	54	4.7	36	4.5	39	5.1	44	5.6	119	5.1
Two to four molars	81	6.8	82	7.1	52	6.6	54	7	57	7.3	163	7
Molars + Incisors	76	6.4	69	6	48	6.1	48	6.2	49	6.3	145	6.2
<b>Total</b>	<b>222</b>	<b>18.6</b>	<b>205</b>	<b>17.8</b>	<b>136</b>	<b>17.2</b>	<b>141</b>	<b>18.3</b>	<b>150</b>	<b>19.2</b>	<b>427</b>	<b>18.2</b>

Among the 1345 teeth affected, 887 teeth (65.9%) were molars and 458 teeth (34.1%) were incisors and the mean number of the affected Index teeth with MIH per affected child was (3.1). Mild defects were present in 64.1% of the affected teeth with demarcated creamy-white opacities were the most common finding (33.3%). Severe defects were found in about one-fifth (22.4%) of the total findings and moderate defects were present in the remaining 115.9%. It's also worthy to note that more molar teeth were affected by severer forms of the defect than incisors, (Table 6).

#### Discussion:

Given the significant clinical consequences of MIH, it is clearly important to assess the impact of this condition when planning dental healthcare delivery,

and the first step in this process is to establish whether MIH is a significant dental public health issue or not in the community<sup>(17)</sup>.

In this study, the overall prevalence of MIH in a sample of primary school children in Sulaimani City was found to be 18.2%. This prevalence figure was comparable to those reported by another study (18.6%) from Mosul City, Iraq<sup>(13)</sup> and with some other studies<sup>(6,18,19)</sup>, but differ from prevalence rates reported from other studies<sup>(20-22)</sup>. The differences in reported rates of MIH throughout the world have been attributed to differences in the age of study participants, geographic locations, environmental factors and evaluation criteria<sup>(15)</sup>. Although the age for examination had been recommended at over 7 to 8 years were most of the index teeth had erupted<sup>(2,4,23-25)</sup>, further standardization of the sampling model, examination criteria and indices used are needed to establish comparable results and to

Table 6: Severity distribution of MIH affected molars and incisors

Severity	Defects Code	Molars		Incisors		Total by severity code		Total by severity index	
		No.	%	No.	%	No.	%	No.	%
Mild	1	273	30.8	175	38.2	448	33.3	852	64.1
	2	248	28.0	166	36.2	414	30.8		
Moderate	3a	132	14.9	82	17.9	214	15.9	214	15.9
Severe	3b	123	13.9	12	2.6	135	10.0	269	20
	3c	76	8.6	8	1.7	84	6.2		
	4	20	2.3	15	3.3	35	2.6		
	5	15	1.7	0	0	15	1.1		
<b>Total</b>		<b>887</b>	<b>65.9</b>	<b>458</b>	<b>34.1</b>	<b>1345</b>	<b>100</b>	<b>1345</b>	<b>100</b>

determine exact epidemiological nature of the condition.

No significant differences in the prevalence rates were found among males and females, which is comparable with the findings reported by other studies (6,11,13,20,21) and this may indicate that the condition is not a gender associated disease. As reported by some other studies (13,26) no significantly different prevalence figures were found among different age groups, but the prevalence in our study was slightly increased with age and this may be related to the dynamic nature of the defects (13) where some minor defects may be overlooked in younger teeth at younger ages and these defects possibly will develop to severer forms of the defect overtime, because of the inferior quality of the enamel (27,28), and their identification become easier when staining, enamel breakdown and/or caries develops. It's been found that multiple teeth affected by MIH is more common than a single first permanent molar involvement and this result is in accordance with findings from other studies (12,13), and again emphasizing the systemic nature of the disease. These findings supports the theory that MIH is a developmental defect that occurs once the threshold level for the insult required to disturb enamel formation at a critical stage is reached (29).

The mean number of the affected index teeth with MIH per affected child was 3.1, of which about 2.1 were first permanent molars, which is near the figures found in other studies (5,9,10,20). Although the index teeth include only four molars with eight incisor teeth, it's been found that the number of molar teeth affected by MIH is about twice the number of incisor teeth indicating the concentration of the defect mainly on the first permanent molars and incisor teeth are involved when the condition become more severe (12,13).

Mild defects were present in 64.1% of the affected teeth with demarcated creamy-white opacities were the most common finding (33.3%), and these are in agreement with other studies that mild forms of the defect are the most prevalent one (12,13,18). Sever defects were found to be also prevalent, about one-fifth of the affected cases and it was noted that molars can be affected more severely than incisors which is been found by other studies where more enamel breakdown occurs in molars due to the absence of masticatory forces on the incisors (10,13,15,18).

It should be noted that MIH defects, whether mild or severe, could become more and more symptomatic over time, which can influence the general health and quality of life of the affected child and its treatment is often challenging to both the patient and the clinician (30).

## Conclusions:

It's been found that MIH is a prevalent pathology among Kurdish children in Sulaimani City which could result in a large number of children continuously seeking professional dental treatment. Therefore; dental practitioners who deal with child patients could encounter such cases and should be aware of the treatment choices and management protocols for coping with this particular condition.

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