



Molar Incisor Hypomineralization Prevalence and Distribution in School Going Children in UAE

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Abstract

Objective: Molar Incisor Hypomineralization (MIH) is observed on permanent molars as demarcated opacities that vary from creamy-white or yellow to yellowish-brown discoloration. MIH is of systemic origin, usually affecting one to four permanent first permanent molars. The current study was designed to determine the prevalence, pattern, and distribution of MIH in school-going children of United Arab Emirates.

Materials and Methods: A total of 1200 children with 656 boys and 544 girls were included in the study. The children belonged to the age group of 8-12 years of age. The children were examined for prevalence and distribution of MIH. The results were analyzed using SPSS version 20.

Results: The prevalence of MIH was reported at 21.16%. It was seen that MIH is more prevalent in girls when compared to boys, with the p value being <0.001. The mandibular molars had a higher prevalence when compared to the maxillary molars, with the results being statistically significant.

Conclusion: The prevalence of MIH in Arab children in Ras Al Khaimah, United Arab Emirates (UAE) was 21.6%. Mandibular molars are affected more commonly than maxillary molars. Further studies are recommended to better understand the possible etiologies of this condition in children.

Keywords: Dental opacities, first permanent molars, hypomineralization, MIH

Introduction

Molar Incisor Hypomineralization (MIH) as a term was first introduced early in 2001.[1] MIH refers to a qualitative, developmental defect of enamel that affects one to four first permanent molars (FPMs) and often involving permanent incisors (PIs).[1] This term is used to describe the presence of Hypomineralization of enamel, it is of systemic origin and affects one or more

first permanent molars (FPMs), and frequently is associated with permanent incisors.[1] This condition is also known by terms like idiopathic enamel hypomineralization, internal enamel hypoplasia, and no fluoride enamel opacities.[2] The prevalence percentage of MIH worldwide according to reports vary widely between 5.6% to 40%.[3,4]

These malformations can be found in two different stages: the secretion phase or enamel matrix formation

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and maturation phase or enamel mineralization. The resultant defect is called hypoplasia if it occurs during the Secretion phase and Hypomineralization if it occurs during the maturation phase.[5-7]

MIH affects both the maxillary and mandibular first permanent molars (FPMs) and also involves the maxillary and mandibular permanent incisors.[8] The second permanent molars and premolars are rarely affected by these enamel defects.[9] It has been reported that there can be the occasional occurrence of these defects on the permanent and deciduous second molars.[10]

The management of children with these defects are challenging due to profound difficulties in pain management of these teeth owing to the increased sensitivity of exposed dentine and also due to subclinical inflammation of the pulpal cells caused by the porosity. These children exhibit increased behavior problems because of these defects.[11]

This study was designed to determine the prevalence, clinical pattern, and distribution of MIH in children visiting schools of Ras Al Khaimah (RAK) in UAE.

Materials and Methods

This was a cross-sectional study conducted at RAK College of Dental Sciences (RAKCODS), RAK Medical and Health Sciences University (RAKMHSU), RAK, UAE. The objective of the study was to understand the prevalence and distribution of MIH in school-going children of RAK in UAE. This research was approved by the Research and Ethics committee of the university and the RAK Research and Ethics Committee, Ministry of Health and Prevention UAE (MOHAP/RAK/SUBC/NO:34-2018). Eight private schools were approached of which three private schools approved of the research. There were a total of 2300 children going to these schools between the ages of 8 and 12 years. At a 5% error and 95% confidence, the sample was calculated to be 330. The parents of the children were requested through school authorities to provide a consent for the research including intraoral examination. The parents were requested to provide their consent within three weeks of the request. Children belonging to the ages between 8 and 12 years were included in the study. Children whose parents did not provide consent or had any medical condition were not included in the study so as to prevent any bias in the findings of the study. The research was done as a part of the community outreach program of the university. Finally, screening was done for 1200 students of these schools, which was higher than the sample size determined. There were 656 boys

and 544 girls who were included in the study according to convenience. Children who were born and raised in the UAE were included.

Methodology for intraoral examination

MIH was recorded by two examiners who were trained by the Principal Investigator. The training of the examiners was done using various photographs and presentations. During this phase and during data collection, inter-examiner calibration was done, and Kappa values were calculated, with a mean value of 0.88. The Principal Investigator also re-examined every tenth participant to determine the inter-examiner value, which was calculated as 0.90.

During the examination the examiners used disposable diagnostic sets. A dental probe was initially used to gently remove dental plaque and food remnants from the tooth surfaces. The gauze was used to clean the teeth' surfaces before examining them for MIH. The index teeth (i.e., permanent first molars and incisors) for each participant were examined while wet; for the presence of demarcated opacities, post-eruptive enamel breakdown, atypical restorations (AR), and extraction due to MIH. Hypomineralization defects were recorded in accordance with EAPD scoring criteria for MIH.[10] Children were considered as having MIH when one or more PFM were affected with or without the involvement of incisors. Opacities occurring in permanent incisors but not in at least one PFM were not recorded as MIH. This examination was done as a part of the community visits of RAKCODS and these children were given oral health education in terms of presentations and tabletop demonstrations. The children who participated in the study and who required dental treatment were referred to RAKCODS for further treatment as applicable. The examination was conducted in optimal natural light with the aid of a mouth mirror, explorer, and cheek retractor. The criteria used for the diagnosis were based on those described in the European meeting held in Athens in 2003, as shown in Table 1.[10]

Statistical analysis

The prevalence of MIH was reported by age and gender and in total. The data were analyzed by the statistical program SPSS version 20 (IBM Corp., Armonk, NY). Descriptive statistics for prevalence percentages were calculated. The Chi-square test was used to test the association between MIH and gender; the difference in proportions between two groups like molars and incisors, maxillary and mandibular teeth. In all these tests,

Table 1. Diagnostic criteria used in diagnosing MIH[10]

Demarcated Opacity (DO)	Post-eruptive Enamel Breakdown (PEB)
Alterations in the translucency of the enamel, variable in degree. The defective enamel is of normal thickness with a smooth surface and can be white, yellow, or brown in color	A defect that indicates deficiency of the surface after eruption of the tooth. Loss of initially formed surface enamel after tooth eruption. The loss is often associated with a preexisting demarcated opacity.
Atypical Restoration (AR)	Extracted Molar due to MIH
The size and shape of a restoration are not conforming to the temporary caries picture. In most cases in molars there will be restorations extended to the buccal or palatal smooth surfaces. At the border of the restorations frequently an opacity can be noticed. In incisors a buccal restoration can be noticed not related to trauma.	Absence of a first permanent molar should be compared to the other teeth of the dentition. Suspected for extraction due to MIH are opacities or atypical restorations in the other first permanent molars combined with absence of a first permanent molar. Also the absence of first permanent molars in a sound dentition in combination with demarcated opacities on the incisors is suspected for MIH. It is not likely that incisors will be extracted due to MIH.

the p-value was pegged at <0.05, which was considered to be significant.

Results

A total of 1200 children (656 boys and 544 girls) were included in the study. The mean age of the children was 10.54+1.4 years. All the children included in the study were Arab nationals.

A total of 254 children were diagnosed with MIH out of the 1200 children included in the study, with a prevalence rate of 21.16%. MIH was more prevalent in girls, with 170 of them diagnosed with MIH at a prevalence percentage of 66.92% when compared to 84 (33.07%) who were diagnosed with MIH. The results were statistically significant (p<0.001) (Table 2).

When the maxillary molars were compared to the mandibular molars, the results were statistically significant (p<0.004), with a higher prevalence of mandibular molars when compared to the maxillary molars. When the maxillary incisors were compared to the mandibu-

lar incisors, the results were found to be statistically significant (p<0.002), with the maxillary incisors having a higher prevalence when compared to the mandibular incisors. When the right and left incisors or the lateral incisors were compared, there were no statistically significant results found (p=0.4)

When the pattern of MIH defects was evaluated, it was seen that out of the 254 children diagnosed with MIH, Demarcated Opacities (DO) were seen in 124 children (48.81%). Post Eruptive Breakdown (PEB) was seen in 69 children with a prevalence rate of 27.16%. Atypical Restorations (AR) were seen in 54 children with a prevalence of 21.25%. The least common defect observed was Extractions which was seen in 7 children with a prevalence rate of 2.75%. (Table 3)

In terms of distribution of MIH defects on the MIH index teeth, 88 children (34.64%) had one molar affected, 69 children (27.16%) had 2 molars, 33 children (12.99%) had 3 molars while 64 children (25.19%) had 4 molars. The mean number of affected incisors was found to increase with the increasing number of affected molars. This difference was found to be statistically significant with the p value <0.001 (Table 4).

Table 2. Comparison of MIH between males and females

Gender	MIH	Non-MIH	Total	p value
	n (%)	n (%)		
Male	84 (33.07%)	572 (66.92%)	656 (54.66%)	p<0.001*
Female	170 (66.92%)	374 (68.75%)	544 (45.33%)	

*VHS: Very highly significant

Table 3. Pattern of MIH defects

Type	n (%)
Demarcated Opacities (DO)	124 (48.81)
Post Eruptive Breakdown (PEB)	69 (27.16)
Atypical Restorations (AR)	54 (21.25)
Extractions (E)	7 (2.75)

Table 4. Self-evaluation of pain in patients aged 4 to 6 years

	n	%
Visual analogue scale		
Light (1, 2, 3)	11	25.7
Moderate (4, 5)	9	20.9
Intense (6, 7)	5	11.7
Very intense (8, 9, 10)	18	41.9
WBFPS Scale		
Light (0, 2)	6	13.9
Moderate (4)	6	14.0
Intense (6)	6	14.0
Very intense (8, 10)	25	58.1

WBFPS: Wong-Baker Face Pain Rating Scale

Discussion

Early detection of MIH is critical for patients because this condition is difficult to manage because of the hypersensitivity associated with this condition clinically. The availability of details regarding the prevalence of MIH and associated risk factors are relatively scanty in this part of the world, and therefore this study will help understand the condition and associated factors in the Arab population residing here. This was a cross-sectional study done amongst the Arab population of Ras Al Khaimah (RAK), United Arab Emirates (UAE). Hypomineralization defects were recorded in accordance with EAPD scoring criteria for MIH.[10]

Prevalence of MIH

The prevalence of MIH in the present study was found to be at 21.16%. The worldwide prevalence rates are reported between 5.6%-40%.[12-15] In a similar study reported from Dubai, UAE, the prevalence rate was at 27.2%.[16] A study from Germany reported a prevalence rate of 5.9%.[12] Studies from other parts of Europe like Bosnia-Herzegovina, Sweden, and Greece

reported having prevalence rates of 12.3%, 18.4%, and 10.2%.[14,17,18] A study from Iraq reported a prevalence rate of 18.2%.[19] Other countries of the Middle East, like Saudi Arabia, Iran, and Jordan, reported prevalence rates of 8.6%, 20.2%, and 17.6%.[20-22] The prevalence rates from UAE according to the present study is comparable to the rest of the world and is neither too high or too low.

Gender predilection

When genders were compared, it was seen that the girls have a higher prevalence rate at 66.92% when compared to boys who had a prevalence rate of 33.07%, and the results were of statistical significance with a p value <0.001 (Table 2). The findings of the present study are in agreement with a few studies which similarly reported higher prevalence rates in girls.[23-25] However there are other studies which have reported a higher prevalence rate in boys when compared with girls. [25,26] A plausible reason for finding high prevalence in girls can be owing to the fact that in girls the physiological development is faster and also that the teeth erupt earlier in girls and therefore giving it more exposure to the possible causative factors when compared to in boys where the physiological development and teeth eruption are late.[27]

Maxillary and mandibular teeth

When the maxillary and mandibular molar prevalence rates are compared it was found that the mandibular molars had a higher prevalence compared to the maxillary molars and the results were statistically significant with a p value <0.004. These findings were similar to results reported in studies done elsewhere.[22-28] The authors of the present study believe that the cause for a higher prevalence rate in the mandibular molars can be attributed to the reason that the mandibular molars develop and erupt earlier than the maxillary molars.

Table 4. Prevalence of MIH teeth type

Number of first permanent molars (FPM) affected	Number of children n (%)	Number of children with incisors also affected n (%)	p value
1	88 (34.64)	37 (42.04)	p<0.001**
2	69 (27.16)	34 (49.27)	
3	33 (12.99)	16 (48.88)	
4	64 (25.19)	54 (84.37)	
Total	254	141	

**VHS: Very Highly Significant

When the maxillary and mandibular incisors prevalence rates were compared, it was found that the maxillary incisors have a higher prevalence rate of hypomineralization when compared to the mandibular incisors. These findings are similar to studies conducted with different populations.[21-28] The authors of the present study believe that the findings of the present study maybe because of the reason that the surface area of the maxillary incisors is larger when compared to the mandibular incisors and also that the mandibular incisors could have a more protected environment owing to a greater number of minor salivary gland duct openings and also the protective shielding by the tongue.

Patterns of MIH defects

The patterns of the defect reveal that the most commonly seen type is that of the Demarcated Opacities at 48.81% followed by Post-eruptive Breakdown at 27.16%. These findings are comparable to studies done elsewhere which showed the same pattern of appearance.[4,29,30] These defects are predominantly seen in molars affected with MIH than the incisors. This is found in other studies too, the reason suggested being the masticatory forces that bring about the breakdown of the molars when compared to the incisors.[13,30-34] In the present study, the Post-Eruptive Breakdown is seen to be higher in prevalence when compared to other studies. However, this could be due to the reason of including the higher age group children in the study.[9,31]

MIH index teeth and MIH

It is seen in the present study that the FPMs are more commonly affected when compared with the Incisors and that when the number of FPMs involved increases then the involvement of incisors also increases. It is also seen that the number of molar teeth affected by MIH is about twice the number of incisor teeth suggesting that the concentration of the defect is mainly on the first permanent molars and the involvement of the incisor teeth suggest a higher severity of the condition. These findings are similar to the results of other studies.[4,30]

It is of importance to note that MIH defects, whether mild or severe, can become more and more symptomatic over time. The condition can affect the individual's quality of life, and the general health will be affected. It is important to dentistry as it becomes difficult to treat these patients because of their hypersensitivity. Therefore, it is important to identify the condition as early as possible and provide preventive care to the patient as much as possible.

Conclusion

The following can be concluded from the present study;

1. The prevalence rate of MIH is 21.16% in children of RAK, UAE.
2. The prevalence of MIH is more in girls when compared to boys and it is statistically significant.
3. MIH is more commonly found in the maxillary teeth and included the FPMs more commonly than the mandibular teeth and incisors. The results were statistically significant.
4. The most common MIH defective pattern was the Demarcated Opacities type with a prevalence rate of 48.81% followed by Post Eruptive Breakdown with a prevalence rate at 27.16%.

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Conflict of Interest: None declared.

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