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CORRELATION BETWEEN THE PREVALENCE AND SEVERITY OF MOLAR INCISOR HYPOMINERALIZATION AND AGE AND SEX AMONG A GROUP OF EGYPTIAN CHILDREN: A CROSS SECTIONAL STUDY

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ABSTRACT

Aim: This study was conducted to assess the correlation between the prevalence of MIH and its severity, and age and sex among a group of Egyptian children.

Methods: A total of 3084 children aged eight to twelve years diagnosed with MIH were recruited in this study. Clinical examination was carried out on the dental chair, in daylight to assess the prevalence and severity of MIH and scores were recorded in patent assessment chart. Categorical data were presented as frequencies (n) and percentages (%) and were analyzed utilizing Chi Square test.

Results: Among these children, 48.5% were males and 51.5% were females, 58.1% were ten years old or younger and 41.9% were above the age of ten. The number of examined teeth was 37008; 66.7% were incisors and 33.3% were molars. There was no significant association between age and severity of MIH while there was a significant weak association between severity of MIH and sex.

Conclusion: The study revealed female sex predilection in MIH prevalence. MIH was more common in children aged eight to ten years than the older age group. MIH severity was not correlated to age but weakly associated to sex.

KEYWORDS: Age, children, MIH, sex

INTRODUCTION

Dental enamel is the hardest tissue in human body. During tooth formation, the enamel forming cells (ameloblasts) are very sensitive to external stimuli. As enamel lacks the ability to repair, any disturbances occurring during tooth development cause a permanent defect in the tooth[1].

Molar Incisor Hypomineralization (MIH) is a developmental qualitative defect of human dentition, characterized by progressive enamel

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hypomineralization, of first permanent molars, and frequently associated with permanent incisors[2,3]. Although the exact etiology of MIH is unknown, nonetheless it is assumed that pre, peri and post-natal factors together with genetic and environmental conditions contribute to its development[4-6].

Worldwide, prevalence of MIH has been reported to range from 2.4 to 40.2% [7]. In Africa, it ranges from 2.3 to 17.7% [8, 9-11]. The correlation between MIH and age and sex remains unclear; in Germany, no significant association between MIH and age has been reported[12], while in Brazil, a higher prevalence of MIH was demonstrated among children of ten years old or older, suggesting that MIH could be a dynamic defect that changes while the child grows up[13]. In Saudi Arabia, no sex predilection has been reported for MIH[14, 15].

Unfortunately, in Egypt, to the best of our knowledge, there are no studies correlating MIH prevalence and severity with age, and sex. Thus, this study was conducted to assess the correlation between MIH prevalence and severity, and age and sex among a group of Egyptian children, aging from eight to twelve years old.

MATERIALS AND METHODS

Study settings

This study was an observational cross-sectional study, conducted on children who attended the Outpatients' Clinic of Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo University, during the period from September 2020 to May 2021.

Ethical approval

Ethical approval for the research protocol was obtained from the Research Ethics Committee in Faculty of Dentistry, Cairo University (ID: 12 3 21).

Study population

The study population included children aged eight to twelve years old, apparently healthy, and cooperative presented with MIH in one or more first permanent molars with or without incisors involvement. They were selected according to the following eligibility criteria:

Inclusion criteria

- Both genders.
- Fully erupted first permanent molars and incisors affected by MIH.
- Positive acceptance for participation in the study.

Exclusion criteria

- Presence of orthodontic appliances.
- Other types of enamel defect as enamel hypoplasia, amelogenesis imperfecta, and dental fluorosis.
- Systemic diseases which may affect tooth development.

Informed consent

Prior to dental examination, verbal assent from the children, and written consent from the parent/ guardian were obtained after a comprehensive explanation of the study protocol.

Data collection

For each child, personal data including date, name, age, gender, address, as well as the medical history and any previous dental history were recorded in a patient examination chart. Dental examination was performed by a single well-trained calibrated investigator under natural daylight, using a disposable diagnostic set (mirror, probe), while the child was seating on the dental chair. The index teeth (first permanent molars and incisors) were gently cleaned using gauze then wet with saliva; to detect the presence of MIH (demarcated white,

yellow or brown opacities, post-eruptive enamel breakdown, and extraction due to MIH), and its severity based on European Academy of Pediatric Dentistry (EAPD) diagnostic criteria[16, 17]. Scores were recorded in the chart.

Children were diagnosed with MIH when at least one molar was affected, with or without the involvement of the incisors[17, 18]. MIH severity was determined by the most severe defect found in the index teeth. Each child diagnosed with MIH was given a letter outlining his dental health status and was referred for treatment.

Before starting the study, the examiner was first trained to detect MIH using photographs of MIH-affected teeth, with different degrees of severity, followed by live patients of MIH. Kappa values for inter-examiner and intra-examiner calibration were 0.83 and 0.84, respectively.

Addressing potential sources of bias

a) Selection bias

There was no risk of selection bias as all children attending the clinic the day of examination, and fulfilling the eligibility criteria were included in the study.

b) Performance bias

Performance bias was avoided by using standardized methods by single well-trained calibrated investigator who recorded all data and performed the assessment.

c) Reporting bias

Reporting bias was avoided by reporting all data assessed.

Statistical Analysis

Categorical data were presented as frequencies (n) and percentages (%) and were analyzed utilizing Chi Square test. Due to the sensitivity of Chi Square test to large sample size, Cramer's V values were used to assess the strength of association. The significance level was set at $p \leq 0.05$ within all tests. Statistical analysis was performed with R statistical analysis software (R Foundation for Statistical Computing, Vienna, Austria) version 4.0.4 for windows.

RESULTS

A total of 3084 children diagnosed with MIH were enrolled in this study to assess the correlation between prevalence and severity of MIH, and age and sex in a group of Egyptian children. Among these children, 48.5% were males and 51.5% were females, furthermore, 58.1% of which were 10 years old or younger and 41.9% were above the age of 10. The number of examined teeth was 37008, 66.7% of which were incisors and 33.3% were molars. MIH was diagnosed in 67.7% of the teeth.

Correlation between MIH severity and age

Regarding correlation with age, MIH index teeth examination revealed no significant association between the severity of MIH and age (V=0.093, p=0.093). It was found that most children were mildly affected by MIH lesions, followed by severe MIH lesions while the least encountered were moderate lesions. Among 1029 children having MIH below 10 years old, 57.5% had mild MIH, 6.6% had moderate MIH while 35.9% suffered from severe MIH. On the other hand, 699 children above 10 years old had MIH; mild, moderate and severe lesions were observed in 54.1%, 6.2% and 39.8% of them, respectively (Table 1).

Correlation of MIH severity to age per type of teeth, revealed that there was a weak association between the severity of MIH and age of the children with regard to incisors (V=0.037, p<0.001), molars (V=0.041, p<0.001), upper (V=0.0044, p<0.001) and lower teeth (V=0.022, p=0.029). Severe MIH lesions were nearly absent on incisors, while molars exhibited severe lesions in 18.7% and 21.8% of the

children below and above 10 years old respectively. In upper and lower teeth, mild MIH lesions were the most commonly reported lesions followed by absence of any defect in the children below and above 10 years old (Table 2).

TABLE (1): Association between MIH severity and age among the study population

Status		Age		Cramer's V	p-value
		≤10 years	>10 years		
Mild	n	1029	699	0.093	0.093ns
	%	57.5%	54.1%		
Moderate	n	119	80		
	%	6.6%	6.2%		
Severe	n	643	514		
	%	35.9%	39.8%		

V from 0.1 to 0.3 weak association *; significant (p ≤ 0.05) ns; non-significant (p>0.05)

Correlation between MIH severity and sex

Concerning correlation with sex, MIH index teeth examination highlighted a significant weak association between severity of MIH and sex (V=0.078, p<0.001). Mild MIH lesions were the most commonly observed defects in 52.9% and 59% of males and females respectively, followed by severe lesions in 41.4% of males and 33.9% of females. While the least reported were moderate MIH lesions in 5.7% and 7.1% of males and females respectively (Table 3).

Correlation of MIH severity to sex per type of teeth showed a weak association between the severity of MIH and the sex of the children regarding incisors (V=0.030, p<0.001), molars (V=0.042, p<0.001), upper (V=0.027, p=0.003) and lower teeth (V=0.026, p=0.006). In incisors, mild lesions were

TABLE (2): Association between MIH severity and age among permanent incisors and molars

Teeth	Status		Age		Cramer's V	p-value
			≤10 years	>10 years		
Incisors (n=24672)	No	n	7082	4826	0.037	<0.001*
		%	49.4%	46.7%		
	Mild	n	7231	5490		
		%	50.5%	53.1%		
	Moderate	n	4	0		
		%	0.0%	0.0%		
	Severe	n	11	28		
		%	0.1%	0.3%		
Molars (n=12336)	No	n	30	18	0.041	<0.001*
		%	0.4%	0.3%		
	Mild	n	5370	3694		
		%	75.0%	71.4%		
	Moderate	n	423	333		
		%	5.9%	6.4%		
	Severe	n	1341	1127		
		%	18.7%	21.8%		

V from 0.1 to 0.3 weak association *; significant (p ≤ 0.05) ns; non-significant (p>0.05)

the most commonly observed defects in 52.4% and 50.8% of males and females respectively, followed by absence of any defect in 47.3% and 49.1% of males and females respectively. While, in molars severe MIH lesions were the second commonly occurring defect (after mild MIH) in 21.7% and 18.4% of males and females respectively. In upper and lower teeth, mild MIH lesions were the most commonly reported lesions followed by absence of any defect in both males and females (Table 4).

TABLE (3): Association between MIH severity and sex among the study population

MIH		Sex		Cramer's V	p-value
		Male	Female		
Mild	n	791	937	0.078	<0.001*
	%	52.9%	59.0%		
Moderate	n	86	113		
	%	5.7%	7.1%		
Severe	n	619	538		
	%	41.4%	33.9%		

V from 0.1 to 0.3 weak association*; significant (p ≤ 0.05) ns; non-significant (p>0.05)

TABLE (4): Association between MIH severity and sex among permanent incisors and molars

Teeth	MIH		Sex		Cramer's V	p-value
			Male	Female		
Incisors (n=24672)	No	n	5666	6242	0.030	<0.001*
		%	47.3%	49.1%		
	Mild	n	6273	6448		
		%	52.4%	50.8%		
	Moderate	n	0	4		
		%	0.0%	0.0%		
	Severe	n	29	10		
		%	0.2%	0.1%		
Molars (n=12336)	No	n	27	21	0.042	<0.001*
		%	0.5%	0.3%		
	Mild	n	4307	4757		
		%	72.0%	74.9%		
	Moderate	n	352	404		
		%	5.9%	6.4%		
	Severe	n	1298	1170		
		%	21.7%	18.4%		

V from 0.1 to 0.3 weak association*; significant (p ≤ 0.05) ns; non-significant (p>0.05)

DISCUSSION

The growing interest in MIH as a dental public health problem is attributed to its prevalence in the population, implications on children's oral health, subsequently their quality of life, as well as the financial burdens of its treatment [19, 20]. Thus, this study was performed to assess the correlation between the prevalence and severity of MIH, and age and sex among a group of Egyptian children.

The enrolled children in this study aged from 8 to 12 years old according to the recommendation given by the committee in Helsinki to examine children of different age groups at one time so as to accurately assess the distribution of MIH in population[21].

The children were selected in these age groups to ensure full eruption of the four first permanent molars and incisors**.** Moreover, older children were not included in this study to avoid the higher risk of the prolonged exposure of their teeth to the oral environment leading to post-eruptive enamel breakdown and development of dental caries which may interfere with accurate diagnosis of MIH[22].

All recruited children were apparently healthy, co-operative, and free from other enamel defects or any orthodontic appliances to guarantee proper clinical examination and precise diagnosis. In the present study, to avoid the performance bias, a single calibrated and trained examiner conducted the examination using a recording chart.

In this study, severity was clinically assessed based on EAPD criteria as this classification is the most commonly used by practitioners as it is simple and can be easily applied on large population. Furthermore, this classification was employed to achieve accurate diagnosis and consequently optimal treatment planning[6].

The results of the present study revealed that MIH was more prevalent in females than males, and that MIH severity was weakly correlated to sex. These findings agree with the results of another study conducted by Mishra and Pandey[23] in India, but contradict the results of other studies performed by Temilola et al. [24] and Padavala and Sukumaran[25], in Nigeria and India, respectively, which revealed no sex predilection for MIH.

Moreover, it was found that MIH was less prevalent in children above the age of ten years old, this comes in contrast with the results of another study carried out by Koruyucu et al. [22] in Istanbul. This conflict may be related to the difference in the sample size as the small sample size of the other study may affect the accuracy of the estimated prevalence[26].

The results showed that MIH severity was not correlated to age, this coincides with the results of another study made by Ulusoy et al. [27] in Turkey. It is worth-mentioning that mild MIH lesions were the most commonly reported in this study sample, and that severe defects were mainly observed in molars rather than incisors. This may be related to the rapid enamel loss in molars due to their chewing and grinding function. These findings come in accordance with the results of another study conducted by Da Silva et al. [28] in Brazil.

CONCLUSION

The study revealed sex predilection in MIH prevalence with slight female predominance. MIH was more common in children aged eight to ten years than the older age group. MIH severity was not correlated to age but weakly associated to sex.

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