ORIGINAL RESEARCH

Prevalence of Molar Incisal Hypomineralization and its Association with Dental Caries, Oral hygiene Status, and Body Mass Index

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Abstract

Aim: To determine the prevalence of molar incisal hypomineralization (MIH) in 8–12-year-old children of Chengalpattu population, Tamil Nadu, India. This study also attempts to find the association of MIH with body mass index (BMI), dental caries, and oral hygiene status.

Materials and methods: A total of 430 schoolchildren between 8 and 12 years of age participated in this cross-sectional study. For MIH diagnosis, the European Academy of Pediatric Dentistry (EAPD) standards were used. The other parameters measured were height, weight, OHI-S score, and decayed, missing or filled teeth (DMFT) index. A descriptive summary of data was obtained and the Chi-square test and Pearson's correlation test were performed.

Results: The prevalence of MIH is 10.9%. Children aged 10 displayed the highest prevalence (48.9%) of any age-group. Statistically significant differences and strong correlations were achieved among the children with MIH pertaining to dental caries, BMI, height, debris index, and OHI-S score.

Conclusion: The prevalence of MIH in the Chengalpattu district was 10.9% with no gender predilection. Yellow/brown demarcated opacities, with posteruptive breakdown being the most common type (74.4%). The study also found that there was an association of MIH with dental caries, oral hygiene status, and BMI of the child.

Clinical significance: The MIH is a global dental issue that needs to be addressed at an early stage in order to prevent its rapid progression. This study helps in identifying the prevalence of this condition among the particular population, thereby stressing the importance of early identification and prevention. Further studies are required to find the strong etiology of this global disease.

Keywords: Body mass index, Dental caries, Molar incisor hypomineralization, Oral hygiene status, Prevalence.

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Introduction

Molar incisor hypomineralization (MIH), an enamel defect is characterized by hypomineralization, discolored opacities, or total absence of enamel structure in the first permanent molars (FPMs), whether or not the permanent incisors are involved.[1] In 1987, a thorough investigation into the prevalence of particular opacities in FPMs and incisors was conducted.[1] However, Weerheijm et al. provided the initial definition of it in 2001.[2] The terms "idiopathic enamel hypomineralization," "cheese molars," and "demineralized permanent first molars (PFMs)" are also used to describe it.[3,4] It is crucial to understand MIH because it can have negative effects including rapid spread and early enamel loss that leads to sensitivity.[5] Up to this point, all observable cases of definable opacities, hypoplasia and posteruptive enamel deterioration in permanent and primary teeth were well described in the literature. However, research states that the exact etiology of the cause of MIH is not yet found.[5]

Due to the global decline in dental caries, researchers and physicians have been motivated to look into and find additional issues that were previously routinely ignored. MIH is prevalent in many populations all over the world having a prevalence ranging from 2.4 to 40.2%.[6–8] Values between 3.6 and 25% were recorded in Northern Europe, where the majority of prevalence examinations were carried out. According to observations, the MIH prevalence varies in each country like 2.4, 40, and 44% in Germany, Leeds and Sydney, respectively. Very limited information regarding MIH has been published in India.[6–8] As a result, in order to enhance epidemiological assessments, the European Academy of Pediatric Dentistry (EAPD) created a diagnostic and categorization system for MIH.[4] The Indian community may find this information helpful as a proving ground in determining the causative cause and course of treatment for this condition, which is currently under study.

The acknowledgment of nonfluoride-associated developmental dental abnormalities as an expanding clinical issue dates back a few decades. Since the affected teeth typically show posteruptive enamel loss, early detection of MIH is crucial to preventing the rapid spread of caries. The purpose of treatment for hypomineralized

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molars is to stop dental caries from initiating, which helps to stop or slow down enamel loss, restore shape and function, and address esthetic concerns. The majority of prevalence research pertaining to MIH has been conducted in various countries in European and information on people in Asia, particularly South Asia, is scarce. Children are not frequently screened for MIH in national epidemiological surveys used to evaluate dental caries in India. Hence the goal of this study is to determine the prevalence of MIH in children aged 8–12 years belonging to Chengalpattu, Tamil Nadu, India. This study also attempts to find the association of MIH with body mass index (BMI), dental caries, and oral hygiene status.

Materials and Methods

Middle school children from the Chengalpattu district, Tamil Nadu, India, between the ages 8 and 12 participated in this prevalence study, after proper approval for the study. The study was conducted according to the ethical principles for medical research involving human subjects, including research on identifiable human material and data. A Sample size was 430 children, calculated by G*Power software. Children from a total of three private and three government schools from different parts of Chengalpattu district were included in the study. The study was conducted with proper approval from the institutional heads of all private and government schools included in the study. Prior to the start of the study, informed consent was obtained from the parents of all the children involved. The study was done between the period of October–December 2022. Children with special needs, dentofacial and craniofacial abnormalities, and teeth with any other defects other than enamel opacities were excluded from this study.

Calibration of Examiners

The examiner was trained with the help of classes by calibrator about the examination of MIH based on EAPD classification.[9] Intraexaminer reliability was calculated by examining 20 children with MIH and grading them. Again, the reexamination of the same children was done after 2 weeks. The κ statistics were found to be 0.9 which reflects good reliability.

Screening

Parents and concerned school officials provided their informed consent prior to the start of the study. First, demographic details (name, age, gender, and communication details) of the child were obtained. The physical parameters recorded were height (cm) and weight (kg). The height was recorded by making the child stand straight and measured using a wall-mounted stature meter and the weight was measured by making the child over the weight weighing machine (Omron). Pertaining to the oral examination, a sterile mouth mirror and explorer were used and performed under good illumination. The decayed, missing or filled teeth (DMFT) index was used to record the caries state (DMFT). Initial caries lesions, teeth removed due to orthodontic purposes, and naturally absent teeth were not taken into account when calculating the DMFT value. The diagnostic standards by World Health Organization (WHO) for dental caries were followed.[10] The teeth were assessed to record the calculus index (CI) and debris index (DI) to calculate OHI-S (CI+DI). Following this, the permanent incisors and FPMs were cleaned with wet cotton and examined for MIH. The MIH was recorded criteria set by the EAPD. This criteria ranges from 0 to 10 grading the clinical status of MIH and its extent on the involved tooth surface as well as other enamel defects.

Statistical Analysis

The data were exported to a Microsoft Excel file 2007 (version 12.0) (version 12.0). Statistical was done using Statistical Package for the Social Sciences software (version 26). Descriptive summary statistics were obtained. The Chi-square test was used to compare the categorical data. Pearson correlation has been used to determine the relationship between MIH and other parameters.

Results

Molar Incisal Hypomineralization

A total of 430 people (100%) participated. Among them, males and females were 234 (54.4%) and 196 (45.6%), respectively. The unaffected males were 209 (54.5%) and the unaffected females were 174 (45.5%). The affected males were 25 (53.2%) and the affected females were 22 (46.8%). The prevalence based on EAPD was found to be 10.9%. The data is given in Table 1. A total of 430 children were screened, 200 children were screened from three government schools, and 230 children were screened from four private schools. The MIH was graded according to the EAPD classification, as given in Table 2. The maximum of the children having MIH had yellow or brown opacities with demarcation, with posteruptive breakdown (74.4%).

Age

According to age, the study was conducted among 8–12-years-old, out of which the absence and presence of MIH in each group are mentioned in Table 3. Among the presence of MIH, children belonging to age 10 showed a higher prevalence (48.9%) compared to other ages considered. Descriptive statistics of age-groups with presence and absence of MIH are given in Table 4. A statistically significant difference ($p = 0.000$) is found among the age-groups.

Table 1: Percentage of MIH-affected males and females

		Gender			
MIH (EAPD)		*Male*	*Female*	*Total*	*p-value*
Absence	*n*	209	174	383	0.495
	%	54.5%	45.5%	100.0%	
Presence	*n*	25	22	47	
	%	53.2%	46.8%	100.0%	
Total	*n*	234	196	430	
	%	54.4%	45.6%	100.0%	

EAPD, European Academy of Pediatric Dentistry; N, number of samples; * $p < 0.05$, statistical significance; %, percentage

Table 2: MIH prevalence as determined by EAPD diagnostic standards

MIH type	*N (%)*
White/creamy demarcated opacities, no PEB (1)	0 (0)
White/creamy demarcated opacities, with PEB (1a)	10 (21.3)
Yellow/brown demarcated opacities, no PEB (2)	2 (4.3)
Yellow/brown demarcated opacities, with PEB (2a)	35 (74.4)
Atypical restoration	0 (0)
Missing because of MIH	0 (0)

N, number of samples; %, percentage; PEB, post-eruptive breakdown

Table 3: Distribution of MIH according to age

		Age					
MIH (EAPD)		*8*	*9*	*10*	*11*	*12*	*Total*
Absence	*n*	166	67	70	40	40	383
	%	43.2%	17.5%	18.3%	10.5%	10.5%	100.0%
Presence	*n*	3	4	23	5	12	47
	%	6.4%	8.6%	48.9%	10.6%	25.5%	100.0%
Total	*n*	169	71	93	45	52	430
	%	39.3%	16.5%	21.6%	10.5%	12.1%	100.0%

EAPD, European Academy of Pediatric Dentistry; N, number of samples; %, percentage

Table 4: Descriptive data of all the other parameters recorded

MIH (EAPD)		*N*	*Mean*	*Standard deviation*	*p-value*
Age	Absence	383	9.2749	1.38053	0.000*
	Presence	47	10.8511	1.33480	
Height (cm)	Absence	383	132.5340	5.68948	0.000*
	Presence	47	137.7872	5.23341	
Weight	Absence	383	31.6911	4.85419	0.000*
	Presence	47	36.1489	4.87219	
BMI	Absence	383	16.94103	1.553447	0.000*
	Presence	47	19.97101	1.53402	
Dental caries	Absence	383	2.3037	1.42233	0.021*
	Presence	47	2.2553	1.39012	
DI	Absence	383	0.1586	0.12967	0.000*
	Presence	47	0.2532	0.12828	
CI	Absence	383	0.1772	0.12115	0.068
	Presence	47	0.2128	0.15827	
OHI-S score	Absence	383	0.3359	0.20935	0.000*
	Presence	47	0.4468	0.18040	

EAPD, European Academy of Pediatric Dentistry; *n*, number of samples; * $p < 0.05$, statistical significance; cm, centimeter

Table 5: Correlation based on presence of MIH

Variables	*Pearson correlation*	*p-value*
Height	0.341	0.0003*
Weight	0.866	0.051
BMI	0.202	0.0002*
Debris score	0.341	0.001*
Calculus score	0.03	0.539
OHI-S score	0.159	0.0002*
Dental caries	0.137	0.0005*

*Strong correlation found $p \leq 0.001$

Dental Caries

The caries status of the tooth was recorded using the DMFT index. The mean and standard deviation in the presence (2.255 ± 1.39) and absence (2.3 ± 1.42) of MIH are given in Table 4. A statistically significant difference ($p = 0.021$) is found among the presence and absence of MIH.

Body Mass Index

For calculating the BMI, height, and weight were used. The mean and standard deviation in presence (19.97 ± 1.53) and absence (16.94 ± 1.55) of MIH are given in Table 4. A statistically significant difference was found among BMI ($p = 0.00$), height ($p = 0.00$), and weight ($p = 0.00$) in the presence and absence of MIH.

Oral Hygiene Status

The oral hygiene index-simplified (OHI-S) index was calculated using debris score and a calculus score. The mean and standard deviation of all the parameters are mentioned in Table 4 with statistical significance seen in DI ($p = 0.00$) and OHI-S score ($p = 0.00$).

Correlation

The correlations of all the parameters were obtained based on the presence of MIH using Pearson correlation as mentioned in Table 5. Correlation is significant at the 0.001 level and is mentioned in Table 5.

Overall results show that among 430 children screened, the prevalence of MIH was found to be 10.9% with yellow or brown opacities with demarcation, with posteruptive breakdown being the most common type and children belonging to age 10 had the highest prevalence. On comparing between the presence and absence of MIH among all the parameters, statistically significant differences were found among age, dental caries, BMI, height, weight, DI, and OHI-S score. In association with the presence of MIH, a positive correlation was found in dental caries, height, BMI, DI, and OHI-S score.

Discussion

It is important to have an early warning of MIH since specific teeth typically show posteruptive enamel loss, which can cause rampant advancement of caries resulting in pain. Hence, this study assessed the prevalence of MIH in Chengalpattu children because to the best of our knowledge there is not any data on the prevalence from this part of the world, despite the necessity of early diagnosis. The prevalence of MIH was 10.9% in the population of Chengalpattu children aged 8–12 years. This study also attempted to find the association of MIH with BMI, dental caries, and oral hygiene status. The prevalence of MIH in this study, was well within the range seen in other investigations carried out in other regions of the world. According to estimates, Hong Kong in 2008 had the lowest prevalence percentage in Asia (2.8%) while Iraq in 2012 had the highest prevalence rate, using the developmental enamel defects (DDE) index for classifying MIH (18.6%).[9,11,12] Between the years 1996 and 2008, research on the prevalence of MIH in European nations found that it varied from 2.9% in Germany to 25% in Finland.[13] Among Brazilian children, a 2009 study found an extremely high prevalence of 40.2%.[14] which is the highest incidence rate to date. Due to the variability of the age and ethnic groups being researched as well as the retrospective character of the study, there may be a difference in MIH prevalence seen around the globe.[5] The different diagnostic criteria, such as the exclusion of genetically based hypomineralization and hypomineralization with uncertain origin, may also help to explain it.[1]

In the current study, participants aged 10 exhibited a considerably greater incidence of MIH (48.9%) than those in other age-groups, whereas children aged 9 showed the lowest prevalence (6.4%). Similar results were seen from a study conducted in Chennai, Tamil Nadu, India in 2016 that included children between the ages of 8 and 12 and the 10-year-old children had the highest prevalence (12.9%).[15] According to da Costa-Silva in 2011,[16] children aged 10 or older (16.6%) had a greater prevalence.

The majority of the affected teeth in the current study (77.3%) had minor defects. This conclusion is in line with the findings of the earlier study conducted in Greece in 2008 and Sweden in 2001.[17,18] The varying intercontinental cultural variations and the difference in methodologies used, there may be differences in these prevalence rates and type of MIH.

A total of 430 people (100%) made up the study's distribution of participants. A total of 234 (53.4%) were males and 196 (45.7%) were females. Males who were unaffected made up 209 (54.5%) while females who were unaffected made up 174 (45.5%). Males were impacted in 25 cases (53.2%), whereas females were afflicted in 22 cases (46.8%). Although there was no statistically significant gender-based variation in prevalence, there was in terms of age.

The other parameters recorded during this study were height and weight and dental caries were recorded with DI and CI and OHI-S (DI+CI). The mean and standard deviation of all the parameters were significant.

Dental caries were assessed in these children by the DMFT index. A statistically significant difference was assessed in children with and without MIH. A strong positive correlation was seen between MIH children and dental caries. Most of the children who had MIH, seemed to show a high DMFT index, thus signifying its association in the presence of MIH. The presence of enamel flaws would be an obvious reason for this, as they raise the possibility of dental caries in the teeth.[13]

Body mass index (BMI) was calculated using the height and weight of the children. Statistically significant differences were found pertaining to BMI and Height. A strong positive correlation was seen between MIH children and height and BMI. These results contradict a previous study that found no significant correlation or link between stunted schoolchildren's height and MIH.[19] This discrepancy may be attributed to the high prevalence of short stature amongst Egyptian youngsters.

Oral hygiene status was assessed using the OHI-S index. It was found that the debris score and OHI-S score were statistically significant among children with and without MIH. A strong positive correlation was seen between MIH children and debris score and OHI-S score. This is explained by the fact that patients with defective enamel result in extreme sensitivity while brushing, thereby compromising the brushing efficiency and leading to a high amount of plaque buildup in the MIH group.[20]

The study's findings further imply that MIH may be affected by ethnicity, the number of teeth affected per kid, the total number of MIH patients' teeth with enamel opacity, and the degree of MIH. As of yet, MIH's precise cause is unknown.[21] The nonspecific nature of enamel abnormalities, the lack of known threshold levels for the etiological agents, and the difficulty in predicting the timing of events pose the main challenges in identifying any one specific etiological component.[21] Dioxin in breast milk, infections like chicken pox or respiratory illnesses in children, environmental changes that took place during a specific time period, and others are some of the possible causes.[21] All of these pieces of the MIH puzzle are vital to understanding because they give clinicians insight when establishing treatment plans for patients who suffer from MIH.

The strength of this study is that the prevalence of MIH in Chengalpattu district has been evaluated, which is not done previously. MIH is associated with many parameters like BMI, dental caries, and oral hygiene status. The limitations of this study are that the gender predilection and the clear etiology behind MIH were not assessed. The future scope is to conduct a nationwide survey to determine the prevalence of MIH, in order to assess the severity of the condition and create public awareness. In addition to this, it is important to have careful recall and follow-up appointments for the affected children, in order to prevent its full-blown effects on the teeth.

Conclusion

The MIH prevalence in Chengalpattu district was 10.9% without gender preference. Children aged 10 displayed the highest prevalence of any age-group and posteruptive breakdown with yellow or brown opacities being the most common defect type. The study also found that there was an association of MIH with Dental caries, BMI, and oral hygiene status of the child. This study helps in identifying the prevalence of this condition among the particular population, thereby stressing the importance of early identification and prevention of its rapid progression. Further, longitudinal studies are required to find the strong etiology of this global disease.

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