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Original Research Article

Prevalence of Molar Incisor Hypomineralisation in a city of Western Uttar Pradesh and its association with Hypomineralised Second Primary Molar

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Abstract

Background: Molar incisor hypomineralization (MIH) is a systemic enamel defect that affects one to four permanent first molars, sometimes involving associated incisors. It is marked by distinct enamel opacities, which can occasionally result in post eruptive breakdown. The defects are usually asymmetrical, with one molar or incisor potentially showing severe damage, while its corresponding contralateral tooth may appear clinically normal or display only slight imperfections. This cross- sectional study was conducted to analyze the prevalence of MIH and to assess its association with Hypomineralised Second Primary Molar (HSPM) among children of preadolescent age group (9-12 years) in a city in Western U.P.
Materials and Methods: Dental examination of children was done in schools using a mouth mirror and explorer under portable light. Occlusal, buccal and palatal surfaces of permanent first molars and second primary molars along with labial and lingual surfaces of maxillary and mandibular incisors were examined by a single examiner using European Archives of Pediatric Dentistry (EAPD) criteria for MIH diagnosis.
Results: The prevalence of MIH and HSPM in this cross-sectional study was found to be 19.5% (74/380) and 6.8% (26/380) respectively.
Conclusion: Only molars were affected in about 32.43% (24/74) of MIH cases and both molars and incisors were affected in 67.5% (50/74) of cases. There was no significant association of sex and age with MIH ($p<0.05$). However, a significant association was found between HSPM and MIH ($P=0.00$).

Keywords: Molar incisor Hypomineralisation, Hypomineralised second primary molar, Prevalence

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1. Introduction

Molar Incisor Hypomineralisation (MIH) is a prevalent developmental dental condition occurring in childhood. Well demarcated areas of hypomineralised enamel are found on one to upto all the first permanent molars, occasionally affecting the incisors too.[1] MIH was defined in 2001 as a qualitative enamel defect of systemic origin that affects at least one first permanent molar and can also be associated with permanent incisors.[2] In 2003, MIH has been further described as a developmental, qualitative enamel defect that is caused by reduction in mineralisation and more inorganic enamel components, leading to enamel discolouration and breakdown of the affected teeth.[3]

Exact cause of MIH remains uncertain, but the localized and asymmetrical nature of the lesions suggest a systemic origin. Disruption in the amelogenesis process occurs most likely during the early maturation stage or possibly, in the late secretory phase.[4] MIH has been found to be associated with a number of prenatal factors such as maternal smoking or various illness during pregnancy, perinatal factors that include premature or prolonged birth, low birth weight of the newborn, caesarean delivery, and postnatal factors such as early childhood respiratory illnesses, and a number of medications. Additionally, various environmental conditions, respiratory tract issues, and perinatal complications have also been proposed as potential causative factors.[5]

In some cases of MIH, these demarcated defects can be seen on the second primary molars and the tips of permanent canine cusps along with the permanent molars and incisors.[6] The second primary molars with such demarcated defects are known as Hypomineralised Second Primary Molars or

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HSPMs. Negre-Barber et al. (2016) concluded in his study that MIH can be predicted with the presence or absence of HSPM in early childhood emphasizing the significance of regular follow ups. However, the presence of HSPM is not a definitive indicator, as MIH can still develop in its absence.[7] The hypomineralized enamel in MIH is soft, porous, and resembles discolored chalk or aged Dutch cheese. A distinct boundary is observed between the MIH-affected enamel and healthy enamel. The clinical appearance of the enamel defects ranges from white to yellow or brownish shades. Due to its porous and brittle nature, the affected enamel is prone to chipping under masticatory forces, often resulting in posteruptive enamel breakdown (PEB). Aesthetic concerns are frequently observed in MIH patients with affected incisors. A conservative approach should be followed for the management of MIH-affected incisors in young patients, considering that their anterior teeth are immature and have large, sensitive pulps.[5]

Since 2001, when MIH was first defined as a distinct clinical condition, various studies have been conducted worldwide to report its prevalence in both general and clinical populations.[1] The reported prevalence varies widely, from 3% to 40%, depending on the country and population being studied.[8] Recent meta-analyses have provided evidence suggesting that MIH impacts approximately 13% to 14% of children across the globe.[9] The MIH prevalence was found to be higher among children aged ten years or less (15.1%) compared to those above ten years (12.1%). This may be due to the fact that MIH is more readily apparent at the onset of eruption of the first permanent molars and incisors, or teeth may have been extracted or restored previously by the time of evaluation.[10] It is important to know the magnitude of MIH because of its vulnerability for consequences if not treated early in children including rapid caries development, early enamel loss, sensitivity, post eruptive enamel breakdown and loss of function. indicator of MIH in the future.

On a regular day in our OPD, we receive a fairly high number of MIH cases affecting atleast 3-4 FPMs. These molars usually have varying grades of enamel breakdown and hypersensitivity to thermal and tactile stimulation compromising children's overall quality of life. Even treatment of such molars is highly painful to patients as it is difficult to anesthetize them. In a considerable number of cases of endodontic treatment of such teeth, the tooth could not be anesthetised properly even after we administered nerve blocks and intrapulpal anesthesia. This led to treatment difficulties in children as well as a negative psychological impact on children instilling more fear and anxiety regarding dental treatment. These experiences sparked the idea to conduct a study on the prevalence of MIH in this region in order to create awareness about it in the dental fraternity so that during examination and diagnosis, the dentist would be more cautious regarding this condition. Furthermore, it has been observed in various studies that presence of HSPM is a predictive indicator of MIH. From this perspective, if we can diagnose or predict future MIH cases, implementing preventive treatments could help reduce the severity of the condition and allow for less traumatic or invasive interventions. Therefore, prevalence of HSPM and its correlation with MIH was also assessed in this study. Hence, this observational study was conducted to assess the prevalence of Molar Incisor Hypomineralisation and its association with Hypomineralised Second primary molar in children of preadolescent age group in a city of Western U.P. The null hypothesis is that there is no association between HSPM and MIH.

2. Materials and Methods

The ethical clearance was obtained from the Institutional Ethics Committee, Faculty of Medicine, Aligarh Muslim University, Aligarh, India. The manuscript follows the STROBE guidelines. Multistage stratified sampling was adopted for selecting schools for this cross-sectional study. Four schools were selected from different zones of the city. Prior permission letter from school authorities were obtained. The informed consents were distributed to the parents of the children with the help of school authorities. The calculated sample size was 378. The children present in the school on the day of dental examination with informed consent from their parents/guardians under the age of 9–12 with the first permanent molars and or incisors erupted were included in the study. Children with generalized development defects such as, dentinogenesis imperfecta, fluorosis, amelogenesis imperfecta etc, children undergoing orthodontic treatment, or with any systemic diseases were excluded from the study. Thus, in total 380 children were enrolled in the study, matching the calculated sample size.

The oral examination of children was done in schools using a mouth mirror and explorer under portable light. Gauze was used to wipe out any plaque or the food accumulations on the teeth whenever necessary. Buccal, palatal and occlusal surfaces of permanent first molars and second primary molars along with labial and lingual surfaces of maxillary and mandibular incisors were examined by a single examiner. During examination in the schools, cross infection control measures were adopted by using sterilized diagnostic instruments, disposable face masks, disposable gloves and hand sanitizer for each subject. The criteria initially developed for the diagnosis of MIH by the European Academy of Pediatric Dentistry in 2003, and revised in 2010 was followed during examination. Frequency tables of each variable were calculated as a descriptive analysis. Chi square test of independence was implemented to analyze the association between the variables. All statistical analysis was performed using IBM SPSS version 20 software with level of significance set at 5%.

3. Results

Table 1 shows the demographic data of the study population as well as the distribution of MIH according to sex and age. **Table 2** shows the frequency of occurrence of MIH, MIH (only molars), MIH (molars & incisors) and HSPM in the sample. **Table 3** shows the association between HSPM and MIH. The prevalence of MIH and HSPM in present study was found to be 19.5% (74/380) and 6.8% (26/380) respectively. Only molars (**Figure 1**) were affected in about 32.43% of MIH cases (24/74) and both molars and incisors (**Figure 2**) were affected in 67.5% (50/74) of cases. As per the results shown in **Table 1**, there was no significant association of sex and age with MIH ($p<0.05$). Chi square test showed a significant association between HSPM (**Figure 3**) and MIH (P=0.00). **Table 4** shows there was a significant association between HSPM and MIH (only molars) and MIH (molars + incisors) ($p>0.05$).

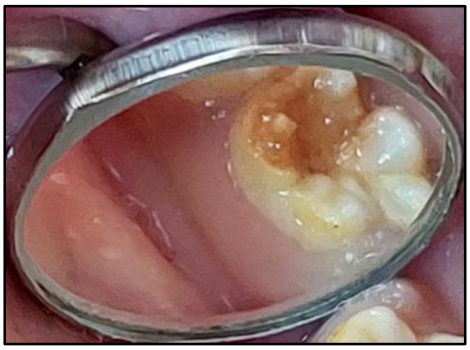

Figure 1: Clinical image of first permanent molar affected with Molar Incisor Hypomineralisation

Figure 2: Clinical image of permanent incisor affected with Molar Incisor Hypomineralisation

Figure 3: Clinical image of Hypomineralised Second Primary Molar wrt 75 along with Molar Incisor Hypomineralisation involving permanent molars and incisors; 3; **A**): Frontal view of the maxillary and mandibular arch (showing MIH affected incisors); **B**): Maxillary occlusal view (showing MIH affected maxillary first permanent molars); **C**): Mandibular occlusal view (showing MIH affected mandibular first permanent molars with hypomineralised second primary molar wrt 75)

Table 1: Demographic data of the study population

Variable		Frequency (%)	MIH	Significance level (p- value)
Gender	Male	202 (53.2)	32	0.069
	Female	178 (46.8)	42	
	Total	380	74	
Age	9	91 (23.9)	16	0.791
	10	82(21.6)	18	
	11	98(25.8)	21	
	12	109(28.7)	19	
	Total	380	74	

P<0.05 is significant

Table 2: Frequency distribution of population presenting with MIH involving only molars, MIH involving both molars and incisors, MIH (total diagnosed cases) and HSPM

Variable	Present/Absent	Frequency (%)	Total
MIH involving Molars only	Present	24 (6.3%)	380
	Absent	356(93.7%)	
MIH involving Molars & Incisors	Present	50 (13.1%)	380
	Absent	330 (86.9%)	

MIH (Total diagnosed cases)	Present	74(19.5%)	380
	Absent	306(80.5%)	
HSPM (Hypomineralised Second Primary Molar)	Present	26 (6.8)	380
	Absent	354(93.2)	

Table 3: Association of HSPM with MIH

		MIH		Total	Significance Level (p value)
		Absent	Present		
HSPM	Absent	306	74	380	**0.00***
	Present	0	26	26	
Total		306	74	380	

P<0.05 is significant

Table 4: Association of HSPM with MIH (involving only molars) and MIH (involving molars & incisors)

		MIH (Molars)	MIH (involving Molars & Incisors)	Total	Significance Level (p value)
HSPM	Absent	15	33	48	**0.00***
	Present	9	17	26	
Total		24	50	74	

P<0.05 is significant

4. Discussion

The findings of this study provide crucial insights into the prevalence of this condition in the target population, and the results are discussed in the context of existing literature from various regions of India and around the world.

The sample size in this study included children of age group 9-12 years of age as in this age group all the permanent molars along with the permanent incisors were likely to be present. The prevalence of MIH in this study which was conducted in a city of western U.P was found to be 19.4%. The pooled global prevalence of MIH has been found to be 14.2%.[10] A study conducted in city of Gandhinagar, Gujarat, found a 9.2% prevalence of MIH in the sample aged 8-12 years of age which is less as compared to this study.[11] Another study conducted in the city of Ghaziabad among 922 children aged 7-9 years found the prevalence of MIH to be 21.4%.Factors such as problems during pregnancy, normal delivery and childhood illness/ infections were found to have the highest strength of association.[12]

A study conducted in Bulandshahr, Uttar Pradesh, revealed an MIH prevalence of 23.5% among school children aged 8–12 years, with a higher occurrence in boys than girls and mandibular molars predominantly affected.[13] In Lucknow, MIH prevalence among children aged 8–16 years was reported at 7.6%, with significant associations to childhood infections and systemic factors.[14] Another study from Chandigarh reported a prevalence of 11.72%, identifying prenatal, perinatal, and postnatal factors like low birth weight and neonatal jaundice as significant risk factors.[15]

In broader Indian contexts, a systematic review encompassing 16 studies across seven states estimated the national prevalence of MIH at 10%, showing no significant variation by sex and equal impact on maxillary and mandibular arches.[16] A study involving 3,030 school-going children highlighted a prevalence of 7.9%, emphasizing mandibular molars as the most affected and pointing to the need for early intervention to mitigate caries risk.[17]

Globally, MIH prevalence varies widely. A systematic review identified an average global prevalence of 9.4%, with the highest rates reported in the Americas (17.7%) and the lowest in Africa (4.9%). Asian regions, including India, align closely with the global average at 10.7%.[18] Variability stems from differences in diagnostic criteria, environmental exposures, and systemic health factors during early childhood.[19]

Comparing Indian and global data highlights notable regional variations. While India exhibits moderately high prevalence rates, the variability within the country underscores the importance of localized studies. For example, the prevalence in Bulandshahr (23.5%)[13] is significantly higher than in Lucknow (7.6%)[14] or Chandigarh (11.72%),[15] suggesting possible differences in environmental factors, healthcare access, and genetic predispositions. The studies collectively emphasize early diagnosis and preventive strategies, particularly for high-risk groups, to address the aesthetic, functional, and psychosocial impacts of MIH.

Talking a bit about the systemic factors contributing to development of MIH in Indian population, a study in Chandigarh identified significant systemic factors, including low birth weight (odds ratio [OR] 2.37), preterm birth (OR 3.01), neonatal jaundice (29.8% prevalence in MIH cases vs. 14.2% in non-MIH cases), and maternal anemia during pregnancy (10.6% prevalence in MIH cases vs. 3.8% in controls). Frequent use of antibiotics, particularly

Amoxicillin Clavulanate, was also significantly associated with MIH development (OR 3.01).[15]

A systematic review of Indian MIH studies further highlighted infections and illnesses during childhood as crucial risk factors. The meta-analysis revealed that children with a history of high fevers or respiratory infections during their early years were more likely to develop MIH. The review also noted that systemic diseases affecting the enamel formation window, particularly from birth to 3 years, had a strong association with MIH prevalence.[16]

In Lucknow, systemic factors such as childhood illnesses, including measles and respiratory infections, showed a significant correlation with MIH ($p < 0.05$). The study also identified a higher prevalence of MIH in children who experienced complications during the perinatal period, such as low birth weight and neonatal distress.[17]

Managing molar incisor hypomineralisation (MIH) requires tailored approaches based on the severity of the defect and the affected teeth. Aesthetic concerns in incisors are frequently addressed with minimally invasive treatments like microabrasion and resin infiltration. For more severe cases, composite resin restorations or veneers may be employed. In one case series, composite restorations successfully improved both function and aesthetics for anterior teeth affected by MIH, providing long-lasting results.[20]

For MIH-affected molars, sealing techniques play a pivotal role in preventing hypersensitivity and posteruptive breakdowns. Fissure sealants made from resin are ideal for fully erupted teeth, while glass ionomer cement is recommended for partially erupted molars where isolation is challenging. These techniques not only reduce sensitivity but also protect against further enamel deterioration.[21] Severely compromised molars may require restorations using preformed crowns or extractions followed by orthodontic planning to manage space loss.[19]

Cost-effectiveness is a crucial consideration in treatment planning. A systematic review revealed that preventive and minimally invasive treatments for MIH are more economical than addressing severe complications like caries or extensive restorative needs. Early intervention significantly reduces the long-term financial burden on both patients and healthcare systems.[22]

5. Conclusion

In conclusion, systemic factors such as prenatal complications, early childhood illnesses, and nutritional deficiencies significantly influence the development of MIH in Indian children. Addressing these factors through maternal healthcare, early nutritional support, and timely medical interventions during critical enamel development periods is essential. By mitigating these risks, we can reduce MIH prevalence and improve oral health outcomes for affected children.

6. Source of Funding

None

7. Conflict of Interest

None

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