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Molar Incisor Hypomineralisation (MIH): Estimating prevalence and characteristics among children of Pune, Maharashtra

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ABSTRACT

Background: Molar Incisor Hypomineralisation (MIH) is a qualitative defect of enamel mineralisation with worldwide presence. In India, most data has been have been published from North and South India and not much data has been published from West and East India. **Aim:** To estimate the prevalence, defect characteristics and severity of MIH among children of Pune, Maharashtra. **Method:** This cross-sectional study included 1080 children in the age range of 8-12 years, studying in Zila Parishad Primary Schools from Pune, Maharashtra, India. The dental examination was conducted for the diagnosis of MIH by a single well-trained and calibrated pedodontist in day light conditions using the EAPD 2003 criteria. The teeth were examined in wet condition. The data was collected and recorded in MS excel sheets and subjected to statistical analysis.**Statistical Analysis:** All the analyses were carried out using Statistical Package for the Social Sciences (SPSS) 22.0 version (Chicago, Inc., USA). To compare the dichotomous variables Chi-square/Fisher exact test was used. P-value of <0.05 was considered statistically significant. **Results:** Prevalence of MIH in Pune population was found to be 8.3% without any gender difference. Mandibular molars were more frequently affected as compared to maxillary molars. The most commonly affected tooth was mandibular right first permanent molar. Mild defects were seen in 79.8% and severe defects in 20.2 % out of all the MIH affected teeth. **Conclusions:** MIH is an important topic for public health relevance; because of its progressive deterioration, it can cause significant morbidity in the affected teeth. Knowledge about its prevalence, characteristics and treatment needs is highly imperative for an early diagnosis and management. Prevalence of MIH in Maharashtra population was found to be similar to most of the studies evaluating children in India.

Keywords: Enamel opacities, Molar incisal hypomineralization, MIH, MIH Severity, Clinical characteristics.

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INTRODUCTION

Enamel hypomineralization is a qualitative defect of enamel caused by poor mineralization of developing enamel[1]. This condition has been previously described as idiopathic enamel hypomineralisation[2], non-fluoride hypomineralisation[3] and cheese molars[4]. Molar Incisor Hypomineralization (MIH) is a type of hypomineralization defect of enamel defined by Weerheigm[1] as hypomineralization of one or more first permanent molars (FPMs) which presents asymmetrically with frequent involvement of permanent incisors (PIs) as well. Clinically it can presents as a creamy-white/yellowish/yellowish-brown opacity with/without Post-Eruptive Breakdown (PEB)[5]. PEB is more common in molars when compared to anterior teeth[5]. MIH though common but still it is a relatively unknown entity to many[6]. MIH has an incompletely defined aetiology, as the lack of evidence in the literature does not allow establishing the factors of this disease clearly. Prenatal complications in the last gestational trimester and respiratory illness during the first three years of life are considered possible causes[7,8].

It is a globally prevalent condition with an average prevalence of 14 %[9]. A wide disparity has been noted in the reported prevalence rate ranging from as low as 2.8 % in Hong Kong[10] to as high as 40.2 % amongst Brazilian subjects[11].

The European Academy of Paediatric Dentistry (EAPD 2003) criterion is currently an accepted and standard diagnostic clinical criterion for recording and reporting MIH[12].

According to EAPD 2003 diagnostic criteria[12], MIH is diagnosed if either demarcated opacity, enamel breakdown or atypical restoration can be identified on any of the FPMs and/or Permanent Incisors (PIs).

A recent systematic review has highlighted that individuals with MIH are 2.1 to 4.6 times more likely to have caries in permanent dentition than those without MIH[13]. Other common clinical problems reported in patients with MIH are Post-eruptive enamel breakdown, teeth sensitivity, anxiety and fear, aesthetic problem in anterior teeth and early loss of affected teeth due to poor prognosis[14-16].Early diagnosis and management of MIH is thus important to control the symptoms and morbidity produced by it.

With all these facts, the present study was planned to study the prevalence of MIH, its clinical presentation and severity in 8-12 years old children residing in Pune, Maharashtra.

MATERIAL AND METHODS

This school based cross sectional study was conducted at Zila Parishad Primary Schools from Pune, Maharashtra. The study sample was selected from the school-based dental health care programmes in the age range of 8 to 12 years. Students having all index teeth present (4 FPM and 8 incisors) with written parental informed consent were included in the study. Study sample finally examined included 1080 children without any history of medical and systemic illnesses affecting bone metabolism.

Children whose all index teeth present did not erupt were not included in the study. Children with teeth having dental enamel changes such amelogenesis imperfecta, dentinogenesis imperfecta, hypoplasia, diffuse opacities, white spot lesions, tetracycline staining, dental erosion and fluorosis were also excluded.

A single well trained and calibrated Pedodontist examined the entire study sample and recorded MIH, its pattern and clinical presentation. The clinical examination was carried out in the classroom under natural light using a dental mirror and a blunt ended probe with the teeth in wet condition. To diagnose MIH, at least one FPM had to be affected. The findings were recorded as per the European Academy of Paediatric Dentistry (EAPD 2003) criterion[12].

The severity of MIH was also recorded as per the EAPD policy document[17]. Defects less than 1 mm were not reported. Demarcated enamel opacities on incisors and molars without enamel breakdown with only mild aesthetic concerns of discolouration of the incisors and occasional

sensitivity to external stimuli e.g. air/water but not brushing were recorded as mild cases. Cases were classified as severe if there were demarcated enamel opacities with breakdown, caries, persistent/spontaneous hypersensitivity affecting function with strong aesthetic concerns.

Statistical Analysis

The collected data was recorded in MS excel sheets and subjected to statistical analysis. All the analyses were carried out using Statistical Package for the Social Sciences (SPSS) 22.0 version (Chicago, Inc., USA). To compare the dichotomous variables Chi-square/Fisher exact test was used. P-value of <0.05 was considered statistically significant.

Results

Distribution of the subjects

The age range of the children examined having all index teeth present (4 FPM and 8 incisors) was 8-12 yrs. In total, 1080 of 8-12 year old children were examined following the selection criteria described above. Seventy percent children were in the age group of 8-10 years. Gender distribution of sample population revealed 518 (48%) females and 562 (52%) males (Table 1).

Table 1: Distribution of study population according to age and gender.

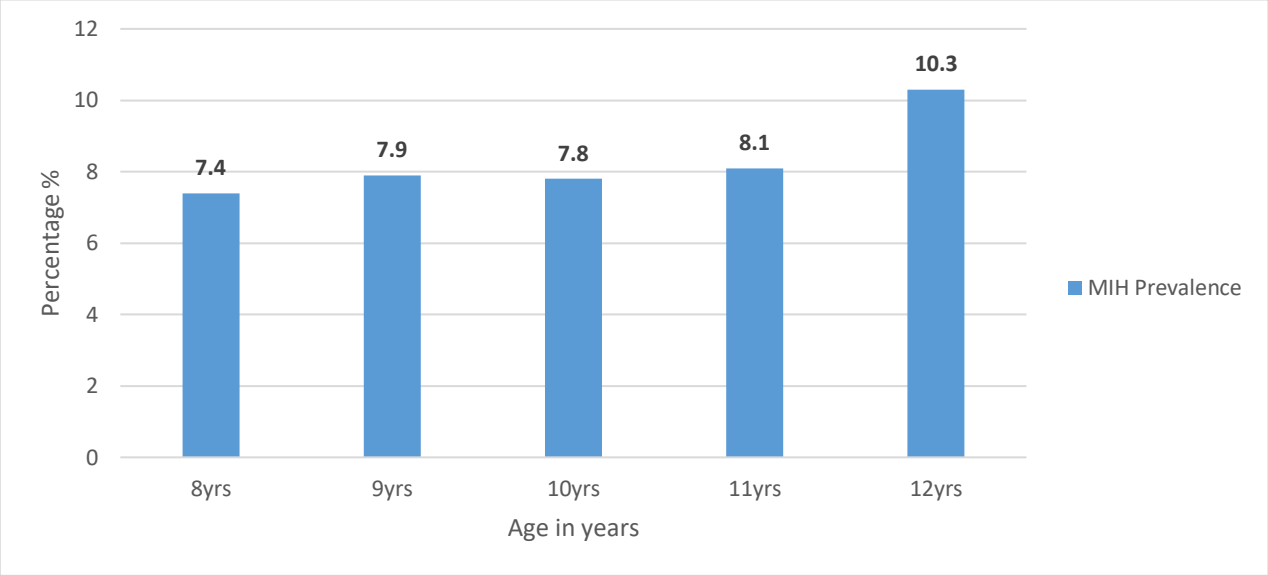
Age (years)	No. of subjects (%)	Male	Female
8	243 (22.5%)	123 (21.9%)	120 (23.1%)
9	216 (20.0%)	111 (19.8%)	105 (20.3%)
10	306 (28.3%)	163 (29.0%)	143 (27.6%)
11	207 (19.2%)	106 (18.8%)	101 (19.5%)
12	108 (10.0%)	59 (10.5%)	49 (9.5%)
Total	1080 (100%)	562 (52%)	518 (48%)

MIH Prevalence: From the total 1,080 children examined, MIH was noted in 90 children depicting a prevalence of 8.3 %. Regarding the gender males had a prevalence of 8.7% and females had 7.9 % with the difference being not significant (p=0.63) (Table 2).

Table 2. Prevalence of MIH in school children of Pune

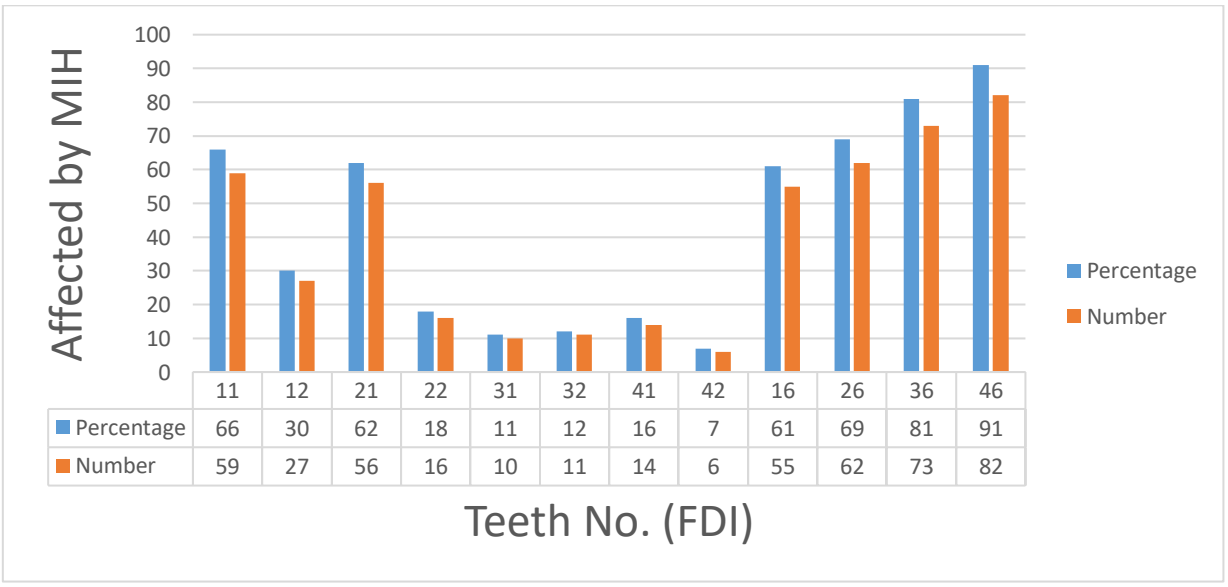
Male	Female	Overall	*p*- value
8.7 % (49/562)	7.9% (41/518)	8.3 (90/1080)	0.63

On comparison of MIH as per the age (Graph 1), 12-year-old age group children had higher MIH prevalence (10.3 %), as compared to other age groups where the prevalence ranged in between 7-8 %. This difference was statistically significantly (p=0.02).



Graph 1. Percentage of Pune children affected by MIH by age group.

MIH distribution as per the affected teeth: Only molars affected without incisor involvement was noted in 19 (21.1%) of the children had while 71 (78.9 %) of them had both incisors and molars affected (MIH). Graph 2 shows number & percentage of affected teeth in Pune children affected by MIH. Ninety children diagnosed with MIH had 471 affected teeth this included 272 molars and 199 incisors. The most commonly involved molar tooth was the mandibular right first permanent molar (91.1 %), followed by the mandibular left first permanent molar (81.1%), the maxillary left (68.8%) and right first permanent molars (61.1%). On comparison of overall teeth affected by MIH more maxillary teeth (58.4 %) were involved as compared to the mandible (41.6 %) with the difference being statistically significant (p=0.041). When molars involved in the two arches were compared mandibular molars were more frequently affected than maxillary molars and the difference was statistically significantly ($p<0.05$). On comparison of MIH affected incisor teeth the most commonly affected tooth was the maxillary right permanent central incisor (65.6 %) followed by the left permanent central incisor (62.2%).



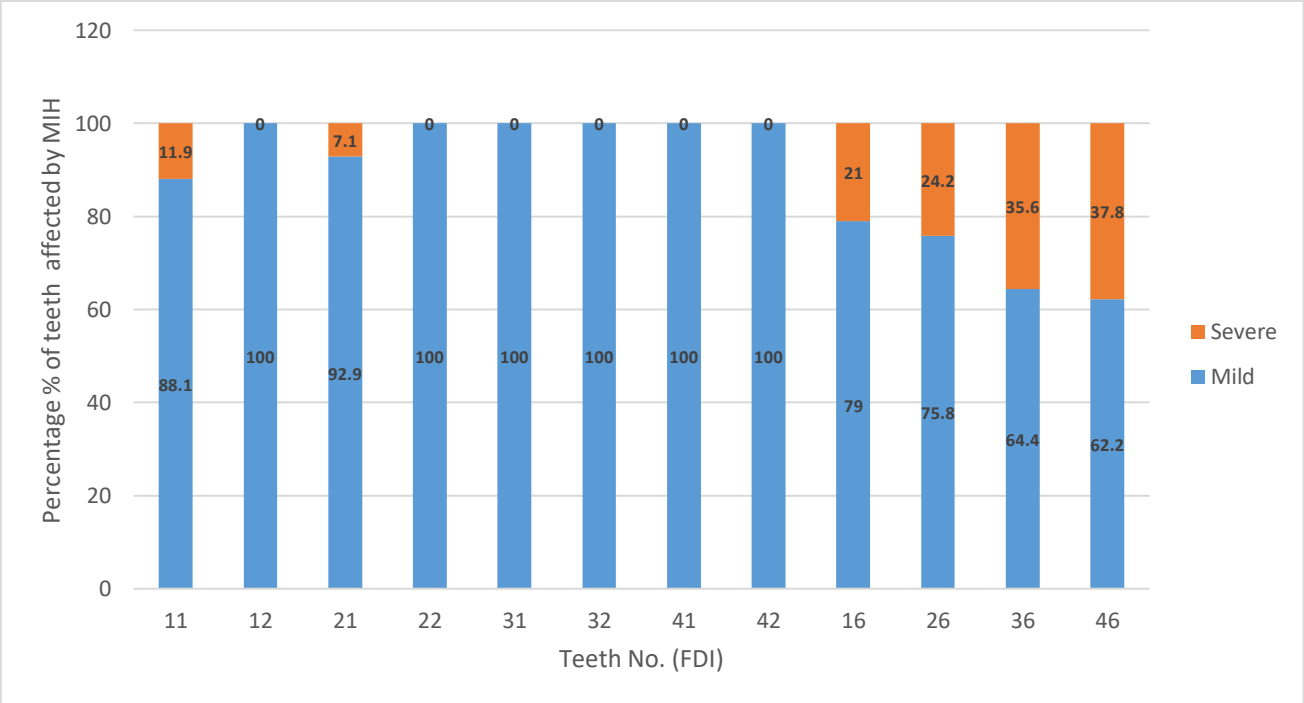
	11	12	21	22	31	32	41	42	16	26	36	46
Percentage	66	30	62	18	11	12	16	7	61	69	81	91
Number	59	27	56	16	10	11	14	6	55	62	73	82

Graph 2. Distribution of MIH affected teeth (Number & Percentage)

Distribution of affected teeth as per the severity of involvement: Out of all affected teeth mild defects were seen in 376/471 (79.8%) of affected teeth and severe defects in 95/471 (20.1%) Table 3 and Graph 3. When molars were compared 188 (69.1%) of the molars were found to be mildly affected, with the remaining 84 (30.9%) had severe defects. On comparison, among the molars the most frequently severely affected tooth was the mandibular right first permanent molar (37.8 %), followed by the mandibular left (35.6%) first permanent molar. Out of 199 affected incisors, 188/199 (94.5%) had mild defects while 11 (5.5%) had severe defects. Severe defects were more commonly noted in maxillary right central incisor (11.9%) followed by maxillary left central incisor (7.1%) with the difference being statistically not significant (p=0.12).

Table 3. Severity of affected teeth distribution

Tooth No.	Mild Defects	Severe Defects	Total
11	52	7	59
12	27	0	27
21	52	4	56
22	16	0	16
31	10	0	10
32	11	0	11
41	14	0	14
42	06	0	06
16	43	12	55
26	47	15	62
36	47	26	73
46	51	31	82
Total	376 (79.8%)	95 (20.2%)	471



Graph 3. Severity of affected teeth with MIH (Percentage%)

Discussion:

MIH has a global presence[18]. Pune is the second largest city in the Indian state of Maharashtra, after Mumbai. As per the Census of India (2011), Pune has a population of approximately 3,124,458. Mumbai being a cosmopolitan city does not truly represent a true Maharashtrian population. Choosing the Zila Parishad Primary Schools from Pune that mainly enrols the residents of Pune is therefore a good representative of the child population of Pune as well as Maharashtra. Considering the inclusion criteria and the different age groups examined in the present study, the study design followed to much extent the EAPD guidelines regarding MIH prevalence studies[17].

Age group of 8-12 years was chosen as by this age all four first permanent molars and most of the incisors would have erupted into the oral cavity allowing thorough examination of the MIH spectrum.

A wide disparity has been noted in the reported prevalence of MIH worldwide[10,11]. Difficulty in cross comparison of these studies arise because of different age groups selected, the use of different indices and criteria, examination variability and methods of recording[17]. In the present study, the EAPD (2003) was criteria used for the assessment of MIH. Uniformity in examination was ensured as a single trained pedodontist carried out the examination of the entire sample.

The prevalence of MIH in the present study was 8.3 %. On comparison with other Indian studies, similar prevalence rates have been reported by Mittal[19] from Gautam Buddha Nagar-7.4 %, Parikh[20] from Ahmedabad-9.2 %, Yannam[21] from Chennai-9.46% and Bhaskar[22] from Udaipur-9.46 %. Countries like Greece-10.2%, Lithuania 9.7%, Bosnia and Herzegovina-12.3% and Turkey-9.2% have also reported similar results[23-25]. From India higher prevalence has been reported by Mishra[26] from Lucknow-13.9%, Rai[27] from Muradnagar 21.4%. A much lower prevalence rate of 0.48% has been reported by Subramaniam[28] from Chennai. Zhao[9] et al. has reported a pooled prevalence of MIH was 14.2% globally.

Of all the affected children with MIH 21.1% had Molar Hypomineralization only, while 78.9% suffered full MIH spectrum. This percentage is similar to previous reports, where 17.4–35 % of MIH affected children having only molars involved[20,23,24,29,30]. Mittal has reported almost equal distribution of both[33]. In the present study more maxillary teeth in total were affected compared to the mandibular, among molars, mandibular molars and among incisors, maxillary incisors were the most commonly involved teeth which is in agreement with previous studies[20,24,30,31,33,35]. Few studies have also reported contradicting results[3,23,24]. Negligible differences between the MIH involvement of upper and lower teeth have been reported in literature[10,29,32]. MIH is characterised by dynamicity of its lesions, as severity of defects tends to increase after eruption post eruptive breakdown due to masticatory forces [33]. Of all affected teeth majority (79.8%) had mild defects, using the classification adopted by the EAPD in 2010 that defines only mild and severe defects which is in agreement with previous studies [17,24,31]. More severe defects have also been reported in literature[33]. Insult/s acting for a longer time during prenatal/perinatal/postnatal periods may lead to a greater number and more severely affected teeth[26].

In the present study, 1 out of 12 children were suffering from MIH and it appears that this condition is a concerning developmental dental disturbance in Pune and Maharashtra region. Following the results of the present study, there is definitely a need to determine the occurrence of MIH from other regions of Maharashtra and also from Eastern India from where less studies have been reported. Until the exact causes are known and prevention of the defect could be an option, children with MIH frequently require extensive treatment soon after tooth eruption[36]. Considering the high population of India, the costs involved and the demanding nature of the dental treatment in MIH teeth clearly warrants an

urgent need for further investigations. For better preventive and therapeutic measures for dealing with MIH a carefully managed recall program for children who are affected is essential. MIH is also an extremely important topic for public health authorities because of the need of early diagnosis and the necessary dissemination of information.

Conclusions:

The prevalence of MIH is approximately 8.3 % in the 8-12 years old child population residing in Pune, Maharashtra. Males and females were equally affected. Prevalence of MIH in Maharashtra population was found to be similar to most of the studies evaluating children in India. Mandibular right first permanent molar was the most severely affected teeth. MIH is an important topic for public health because of its early progressive deterioration. Knowledge about its prevalence, characteristics and treatment needs is highly imperative for an early diagnosis and management.

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