

Distribution of Molar Incisor Hypomineralization in Malaysian Children Attending University Dental Clinic

Hussein AS*/ Faisal M**/ Haron M***/ Ghanim AM****/ Abu-Hassan MI*****

Objectives: Molar-Incisor Hypomineralization (MIH) is a condition of hypomineralized enamel of systemic origin affecting first permanent molars and frequently permanent incisors. It is considered a global problem and data from South-East Asian countries, including Malaysia are lacking. Hence the aim of this study were to investigate the distribution and severity of MIH in a group of children aged 7-12 year olds attending pediatric dental clinic at Faculty of Dentistry, Universiti Teknologi MARA (UiTM), Malaysia. **Study design:** Hundred and fifty four children age 7-12 year-old with mean age of 9.14 ± 1.682 had their first permanent molars and permanent incisors were examined at Faculty of Dentistry, UiTM using European Academy of Paediatric Dentistry 2003 (EAPD) criteria for diagnosis of MIH. Children at least one first permanent molar affected were considered as having MIH. Data were recorded and statistically analysed using descriptive analysis and Chi square test. **Results:** Twenty six of the total examined children ($n=154$) had MIH (16.9%). There was no statistical difference between males and females in the prevalence of MIH. However, a statistical significant difference was found by age groups. The first permanent molars were more frequently affected (58%) as compared to permanent incisors. Mandibular molars were to have the highest rate of MIH (15.5%). The right and left sides were equally affected. Mild defects were the most frequent lesion type (96.6%). **Conclusions:** This study revealed that MIH is a common condition (16.9%). Molars were more frequently affected than incisors with mild defects were the most common lesion status. Further studies on this defect amongst Malaysian children are worthwhile.

Key words: Molar incisor hypomineralization, children, distribution, severity, Malaysia

*AS Hussein, MSc, Department of Pediatric Dentistry, Faculty of Dentistry, Universiti Teknologi MARA (UiTM), Malaysia

**M Faisal, BDS, Faculty of Dentistry, Universiti Teknologi MARA (UiTM), Malaysia

*** M Haron, BDS, Faculty of Dentistry, Universiti Teknologi MARA (UiTM), Malaysia

****AM Ghanim, PhD, Department of Oral Anatomy, Medicine & Surgery, Melbourne Dental School, Cooperative Research Centre for Oral Health Science, The University of Melbourne, Australia.

*****MI Abu-Hassan, PhD, Department of Restorative Dentistry, Faculty of Dentistry, Universiti Teknologi MARA (UiTM), Malaysia

Send all correspondence to:

Alaa S. Hussein
Department of Pediatric Dentistry
Faculty of Dentistry
Level 19, Tower 2
Science & Technology Complex
Universiti Teknologi MARA, UiTM
40450 SHAH ALAM
Selangor, Malaysia
Phone: 603-55435828
Fax: 603-55435803
Email: dr_alaaabah@yahoo.com

INTRODUCTION

Non-fluoride-associated developmental defects of tooth enamel are recognized as an increasing clinical problem.^{1,2} The term molar-incisor hypomineralization (MIH) was introduced in 2001 which is defined as a developmentally derived enamel defect that involves hypomineralization of one to four first permanent molars (FPMs) that is frequently associated with similarly affected permanent incisors.³

Clinical examination shows that affected tooth has demarcated white, creamy, yellow or brown asymmetrical opacities, which differ from those due to incipient caries lesions, amelogenesis imperfecta and endemic fluorosis.⁴ Some studies suggested that yellow/brown enamel defects are more severe than white/opaque defects,⁵ and it may be used clinically to reflect the severity of the defect.⁶ In severe cases, the defective enamel is lost shortly after molar eruption, exposing underlying dentine favoring the tooth sensitivity and the dental carious lesion.⁷ The affected tooth may result in atypical cavities or even complete coronal distortion, requiring extensive restorative treatment.³

MIH can create serious problems for clinician in terms of management as well as for children due to sensitivity of mainly the affected molars. Children often report shooting pain when they are brushing their teeth, shortly after the eruption of the affected teeth.⁸ Additionally, it has been shown that children with MIH receive much more dental treatment than those unaffected children, thus treatment planning should also consider the long term prognosis of teeth with

MIH.^{9,10} Recently, there has been increasing attention regarding the fact that MIH can be a sign of interruption in a child's growth caused by early childhood illnesses.^{11,12} However, the etiological factors of MIH remain unclear yet.^{13,14}

Among all reported international studies, most prevalence studies have been conducted in Europe with range from very low (2.4%) to very high (40.2%).¹⁵ There are few reports available from Asia and data from Malaysia is lacking. Therefore, the aims of the present study were to investigate the distribution of MIH among 7 to 12 year-old children attending pediatric dental clinic at Faculty of Dentistry, Universiti Teknologi MARA (UiTM), Shah Alam and to determine its severity.

MATERIALS AND METHOD

Ethical approval was obtained from Human Ethics Committee at Universiti Teknologi MARA (UiTM) to conduct this study. Written informed consent asking children's guardians to give their permission for their children to participate in this study was obtained. Data collection occurred in 2012 over a period of 3 months. The participants comprised of children (n=154) with an age range of 7-12 year-old attending pediatric dental clinic of faculty of dentistry at UiTM for check-up or seeking dental treatment.

Before performing the study, a calibration exercise was carried out for the examiner (MF) with the help of a trained examiner in the dental clinic using a series of photographs for MIH and other enamel defects. Kappa statistics revealed inter-examiner and intra-examiner agreements as good (0.75) and very good (0.80), respectively.¹⁶

Children with age range 7-12 year-old, residents in Shah Alam, having at least one FPM erupted or partially erupted and with guardian's informed consent.

Children having amelogenesis imperfecta, fluorosis, tetracycline staining, hypoplasia or undergoing orthodontic treatment at the time of examination and those who have the crowns of FPMs were completely broken down where the potential cause of breakdown was difficult to determine.

Clinical examination and assessment criteria

Index teeth [4 FPMs and 8 permanent incisors (PIs)] were examined wet with no brushing was performed at the time of examination. The coronal part (buccal/labial, lingual/palatal and occlusal/incisal surfaces) of the index tooth was examined for evidence of MIH using European Academy of Pediatric Dentistry 2003 (EAPD) evaluation criteria in the dental clinic under standard dental lighting (Table 1).³ The term molar hypomineralization (MH) was used when referring to demarcated hypomineralization defects affecting first molars only whereas the term MIH was used to refer to at least one affected first molar or a combination of affected first molars and incisors. Teeth that were erupted less than one-third of the crown height were recorded as unerupted.²

The severity of the hypomineralized defect was considered in terms of the clinical status.^{17,18} A tooth diagnosed with color changes only (i.e. creamy/white or yellow/brown) was considered as mildly affected, moderate lesions had loss in enamel substance, whereas loss of enamel associated with affected dentine and/or atypical restoration was considered as severely affected. When uncertainty existed regarding rating the lesion severity, the less severe rating was recorded. The child's identification number, age, gender, race, date of birth, number of permanent teeth, and the number and the

location of the teeth affected were recorded on a sheet created for data collection.

The collected data were entered and analyzed using Statistical Package for the Social Sciences version 20.0 (SPSS Inc., Chicago, IL, USA). A descriptive analysis of the prevalence, distribution and severity of MIH defects was performed. Chi square was used for nominal or ordinal variable. The p value of less 0.05 was considered statistically significant.

Table 1 Criteria adapted from EAPD recommendations for scoring of MIH

Criteria	Clinical description
Demarcated opacity	An abnormality in the translucency of the enamel identified as demarcated white creamy or yellow brown opacities with clear and distinct borders to the adjacent unaffected enamel.
Post-eruptive enamel breakdown	Disintegration of the enamel following tooth eruption potentially resulting from masticatory forces on the fragile enamel.
Atypical restoration	The size and shape of the restoration is not conforming to the temporary caries picture. In most cases, it often extends to the buccal or palatal smooth surface. At the border of the restoration frequently opacity can be noticed.
Extracted molar due to demarcated lesions	A missing first permanent molar may be considered as extracted due to demarcated lesions if accompanied by other first permanent molar/molars diagnosed with opacities or atypical restorations.

Modified from Weerheijm *et al* (2003).

RESULTS

The mean age of the children examined was 9.14 (SD±1.68) and the sample was distributed slightly more girls than boys (56.5 %) (Table 2). The majority of the children (90%) had their 12 index teeth fully erupted.

Table 2: Distribution of the participants

Variables	Number	Percentage (%)
Gender		
males	67	43.5
females	87	56.5
Age (Yrs)		
7	37	24.02
8	19	12.33
9	45	29.22
10	6	3.89
11	32	20.77
12	15	9.74
Mean age (Yr)	9.14 (SD±1.68)	

Out of the total number of the children examined 26/154 were diagnosed with MIH, indicating a frequency of occurrence of 16.9%. Of those 13/26 (50%) were diagnosed with affected molars (MH) only whilst the remaining have both affected molars and incisors (MIH). There was no statistical significant difference between boys and girls in MIH occurrence. On comparing MIH distribution by age groups, seven years-old group reported the highest frequency of occurrence (7.1%) while the ten years-old group reported the lowest frequency of occurrence (0.6%). A statistical significant difference was found in the MIH distribution by age groups ($\chi^2=7.026$, $df=5$, $p=0.008$) (Figure 1).

Distribution of MIH defect by tooth type, dental arch and jaw side

Of the total examined permanent index teeth, there were 148 teeth affected by MIH, including 87 (58.8%) first molars and 61 (41.2%) incisors. Among molars, mandibular molars were the teeth most commonly affected (26.4%) followed by maxillary molars (23.5%). In the incisors group, mandibular central incisors were the teeth most frequently affected (16.4%) while maxillary lateral incisors were the least affected teeth (8.2%). Overall the

most frequently affected tooth was mandibular right and left molars (15.5%) (Figure 2).

Overall mandibular index teeth were statistically more affected than maxillary teeth (54% vs 46%, respectively) ($\chi^2=81.4$, $df=1$, $p=0.001$) with no significant difference was found in defect distribution by jaw side. Furthermore, over half of the affected children presented with MIH lesions in the four first molars; they comprised 18/87 (69.2%) of the total cases, with the remaining 30.8% having 1-3 molars affected.

Distribution of MIH defect by severity level of the affected teeth

The severity of the defect in this study varied from mild defects (i.e. color changes only; creamy/ white or yellow/brown) to moderate defects (i.e. loss in enamel substance). Mild defects were the most prevalent clinical presentation for MIH in this study. All of the affected incisors revealed mild defects, as compared to 81 (95.3%) of the molars, 6 molars (6.9%) were moderately affected. Overall, mild defects comprised (96.6%) of the total affected teeth, with the moderate defects constitute (3.4%). No cases with severe defects including atypical restoration or missing due to MIH were reported (Figure 3).

Figure 1 MIH% according to age groups

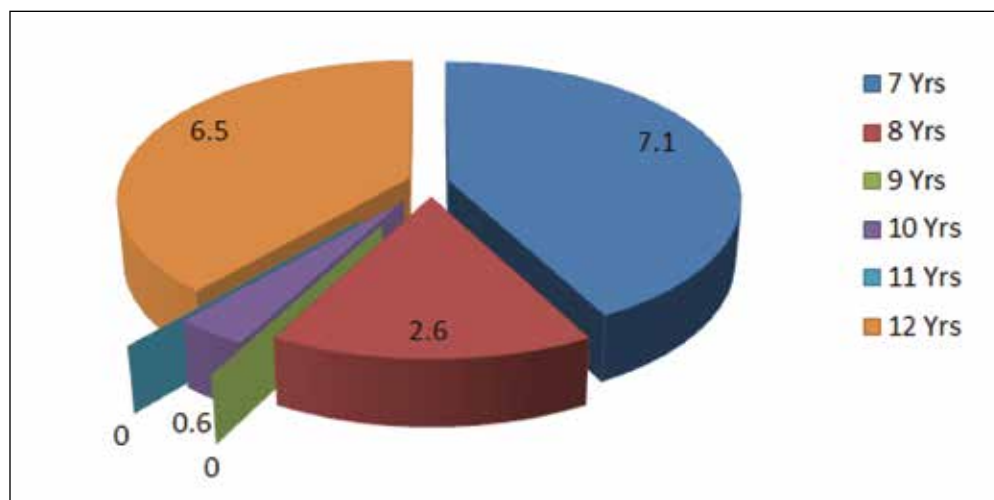
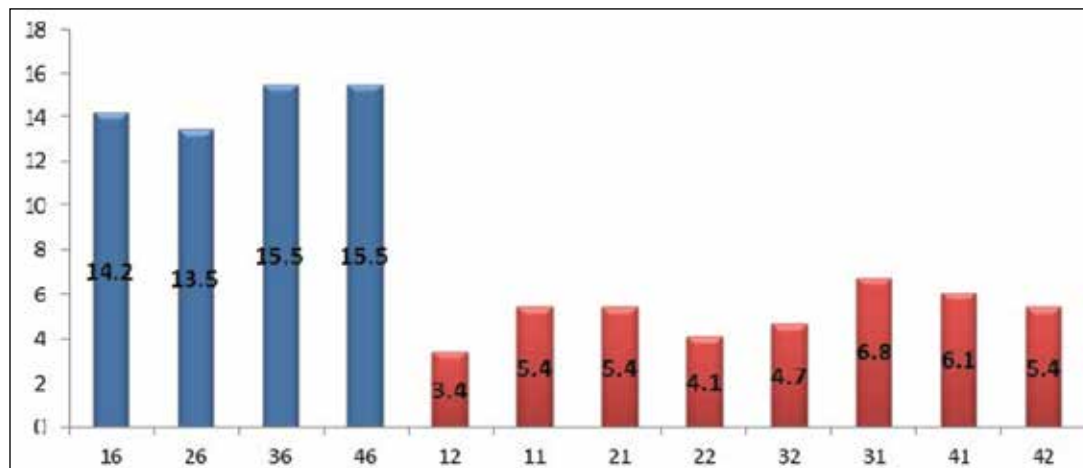


Figure 2 MIH % of individual tooth



DISCUSSION

The present study is the first published report investigating the distribution of MIH in a group of children in Malaysia and one of a few relating to South East Asia. Based on the reports following the 6th Interim seminar and workshop of the EAPD on MIH,^{16,17} the large variations in prevalence and severity data appearing in the various studies worldwide was partly attributed to the different criteria used in the past for diagnosis of MIH. Therefore in our study, the criteria used for the assessment of MIH were the ones recommended by the EAPD. Also in order to have the best possible consistency for the dental examination in this study, a single trained investigator was involved in the data collection.

The overall distribution of MIH was 16.9% among 7-12 year-old attending pediatric dental clinic of faculty of dentistry at UiTM, Malaysia. It is supporting the assumption that MIH is a global problem¹⁹⁻²² and shows that MIH is a common condition amongst a group of Malaysian children. The reported prevalence appears to be close to that reported in Jordan (17.6%) and Iraq (18.6%) who almost examined similar age groups, but higher than that reported in Hong Kong (2.8%) and India (9.2%).^{23,24,8} These differences may be attributed to variations in sample size, age cohorts, or could be an actual difference secondary to environmental and genetic factors of the studied populations.

In the present study, there was no significant difference in MIH distribution by gender which is in agreement with the findings of other studies.^{2,8} Similar to previous findings, a significant difference in MIH distribution between different age categories was revealed in the present study.^{8,24}

The present finding revealed that over half of the affected children had, on average, nearly four first molars affected by MIH confirmed the finding of others.^{25,26} It highlighted the potential adverse impact of MIH on the oral health of children. In addition to the well-known complications of sensitivity, and tooth structure loss, MIH is increasingly recognized as a significant risk factor for increased severity of caries.^{27,28}

Significant variation in the involvement of maxillary and

mandibular molars with MIH was observed in the present study. Mandibular molars were more frequently affected than maxillary molars. This finding is in line with previous reports.^{8,23,24} The majority of the affected teeth in the present study demonstrated mild defects, in agreement with most of the earlier literature.^{2,8,23,24} Undoubtedly, teeth diagnosed with the moderate defects required more treatment than those in the mild categories. It should be remembered that defect progression in teeth diagnosed with opacities is likely to become more severe after a period of oral function (29).²⁹

In the present study, the distribution of MIH is 16.9% and it appears that this condition is becoming a dental problem in Malaysia. Following the findings of this study, there is certainly a need to determine the occurrence of MIH in Malaysia using representative population and valid and reliable assessment criteria.

Our study is not without limitations. The sample is considered relatively small and may not represent the population. Furthermore the reported prevalence is derived from a clinical-based study; therefore a community-based survey in the future will be required to provide the true prevalence value of MIH in the Malaysian community. Nonetheless, this work provides database for future research on MIH in Malaysia.

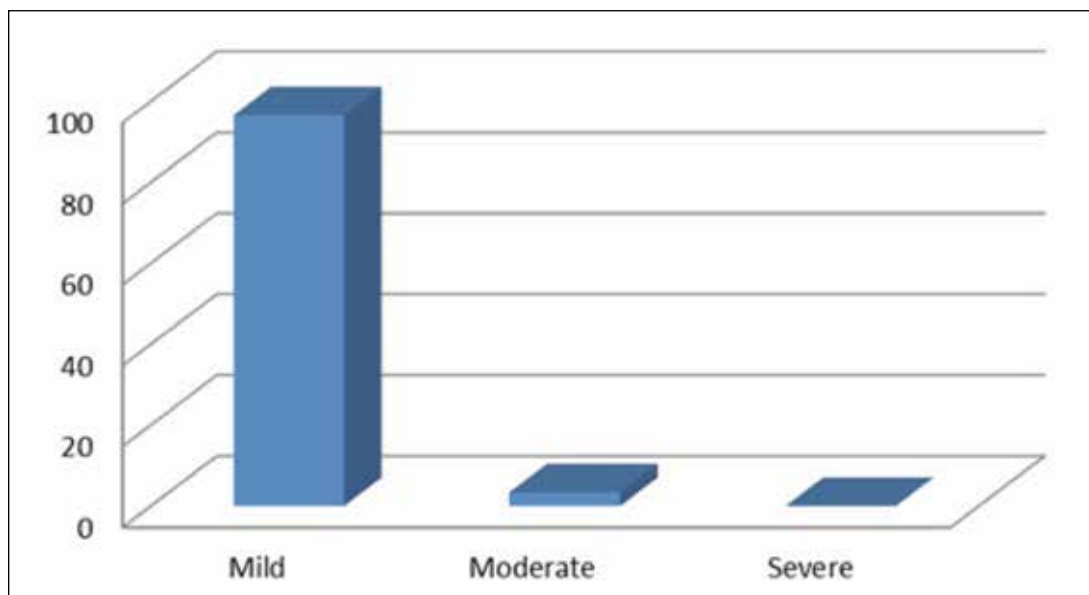
CONCLUSIONS

The distribution of MIH was found to be about 16.9% in 7-12 year-old children attending pediatric dental clinic at Faculty of Dentistry, UiTM, Malaysia. A statistical significant difference was found by age groups. Mandibular index teeth were significantly more affected than maxillary index teeth. The majority of the examined children (96.4%) were diagnosed with mild defects.

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Figure 3 Severity of MIH %



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