

Prevalence of the molar incisor hypomineralization in seven to twelve-year-old students of Kerman, Iran, in 2015-2016

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Original Article

Abstract

BACKGROUND AND AIM: Regarding the prevalence of molar incisor hypomineralization (MIH) among students and different populations and continuation of related problems, it seems necessary to assess the prevalence among students in Kerman, Iran. The aim of this study was to review the prevalence of MIH and its relation to the sex of 7-12-year-old students in Kerman during 2015-2016.

METHODS: In this cross-sectional study, 779 students from different schools of Kerman were studied after examination. We used a checklist to keep the record of MIH cases, which was filled by an inspector. Discolored (milky white or yellow and brown) teeth were counted as defective. Diagnosis of the MIH was done on basis of similar studies. After extracting the results, the data were analyzed by SPSS software, considering the sex of participants. The confidence interval (CI) of 95% was considered.

RESULTS: The prevalence of MIH was 6.5% among the studied students (51 students were diagnosed). There was no significant relationship between MIH and the students' sex. Among the 169 obviously defective teeth, the most prevalence was for lower right molar (54.9%), upper right central (52.9%), and lower left molar (49.0%).

CONCLUSION: Although the prevalence of MIH among the students was relatively low, it seems that awareness among the students and their parents' needs to be enhanced so that they can take better actions for the treatment of the defective teeth.

KEYWORDS: Molar-Incisor; Hypomineralization; Molar Incisor Hypomineralization; Prevalence; Enamel Defects

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Molar Incisor hypomineralization (MIH) is a term used for the first time in 2007 to describe enamel defects in one or more than one molar with or without the involvement of incisors.¹ Another definition describes MIH as a situation in which one or more than one first permanent molar, and in the majority of cases, at least one incisor tooth is hypomineralized. The condition is an entity different from other disorders. This defect

has 3 grades of mild (white to yellow opacity), moderate (yellow to brown opacity), sever (fully hypomineralized enamel).^{1,2}

It should be pointed out that a disturbance in the enamel matrix secretion phase of the tooth results in quantitative or morphological defects, i.e. hypoplasia. While a disturbance in the calcification process or maturation of enamel prisms leads to morphologically normal enamel with structural or qualitative defects, which is referred to as

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hypomineralization.³ Such defects initiate at birth by affecting the enamel structure or when the enamel of the first permanent molars or incisors is forming. This condition might affect the quality of mineralization of one of the four permanent molars with or without the involvement of incisors. Although the mechanism of this disorder is not fully known, some of the factors involved might be asthma, pneumonia, respiratory infections, middle ear infections, tonsillitis, tonsillectomy and use of antibiotics.⁴

Prevalence rate of MIH in Iran as well as in other countries (India, Jordan, Lithuania, Spain, France, Germany, Australia, Hong Kong, Netherlands, Turkey, Bosnia, and Brazil) have been reported to vary from 3.6% to 52%.⁵⁻⁸ Children who are at a risk of MIH lesions due to possible reasons and frequent medical conditions during the early years of life should be carefully evaluated and monitored regularly by a dentist. Several factors have been reported as etiologic factors for MIH that can be classified into 3 main categories of medical problems (before and after birth), environmental contaminants and genetic factors. Prenatal problems such as mother's frequent fever, problems during birth, such as cesarean sections, postnatal problems such as respiratory disturbances, convulsions, medications and immature infants could be the potential etiologic factors.^{6,7}

In terms of fluoride, although further studies are necessary for this respect, studies carried out to date have shown no relationship between the prevalence of MIH and exposure to fluoride. Therefore, it is improbable that fluoride is a risk factor for MIH.⁹ In addition, it has been suggested that in addition to exposure to environmental factors, predisposing genetic factors are also effective in the induction of MIH.^{3,6}

Regarding MIH treatment, fluoridated children toothpaste and other local fluoride agents, such as fluoride varnishes, are useful.¹⁰ Another product that might be useful for patients with MIH is casein phosphopeptide-

amorphous calcium phosphate (CPP-ACP); however, but further studies are necessary for this respect.^{9,11} Composite resins and glass-ionomers can be used for one-surface and multi-surface restorations of molars affected by MIH.¹¹

Considering the nature of MIH and since early diagnosis of MIH helps prevent destruction of tooth structures and also by considering the fact that MIH is relatively prevalent and no studies to date have evaluated the prevalence of MIH in Kerman, Iran, the present study was undertaken and aimed to determine the prevalence of MIH and its relation to sex in this area and provide recommendations for affected students. There is a paucity of research into MIH in Iran. Based on best of our knowledge, only two studies have been done in Shiraz and Zahedan, Iran, with MIH prevalence of 20.2% and 7.1% respectively.⁹

Methods

In this cross-sectional study, the community consisted of selected schools in Kerman. A total of 779 students were examined in these schools.

Kerman is situated in the south-east of Iran, with a population of 800000. This city is divided into two educational districts. In early 2015, approximately 68000 were studying in 396 elementary schools of Kerman, with an age range of 7-12 years. The sample size was estimated similar to other studies^{9,12,13} and by considering the number of students in elementary schools of Kerman. In this context, first, the student lists of all the elementary schools and consent forms were obtained from the Education Administration Organization of Kerman to include students in the present study. Then a multi-step random cluster sampling technique was used by tossing a dice. First 8 schools (4 for boys and 4 for girls) were randomly selected from each educational district (1 and 2). From each school, one class was randomly selected from the relevant educational level and half of the students in each class were randomly selected to be included in the study. An

informed consent form along with information about this study and its aims were provided for the parents.

The inclusion criteria⁹ consisted of an age range of 7-12 years, with at least one-third of the occlusal surface of all the four first permanent molars visible, and with the partial or complete eruption of at least one permanent first molar.

The following cases were not evaluated in the present study:⁹

1- Amelogenesis imperfecta (affliction of the enamel of all the permanent teeth while MIH affects only the enamel of permanent incisors and first molars). 2- Children with a history of orthodontic treatment because orthodontic treatment might result in enamel discoloration and lesion that resemble hypomineralization on tooth surfaces. And 3- children who had permanent first molars with completely carious crowns because severe caries and loss of the crown of permanent first molars cannot certainly be attributed to MIH and it might be due to lack of oral hygiene.

The protocol of the study was approved by the Ethics Committee of Kerman University of Medical Sciences, Iran, under the code IR.KMU.REC.1394.582.

Before the study, the students were asked to brush their teeth or at least rinse and clean their teeth with water. Then, the students were examined clinically by one of the authors who was trained according to some patients as well as the pictures. The incisors and permanent first molars visualized with the use of an electric torch and a dental mirror. Then, the teeth that exhibited milky white, brown or yellow discolorations were considered defective.¹⁴ A more accurate diagnosis of MIH lesions was reached based on the criteria of the European Academy of Pediatric Dentistry^{10,15} and the checklist which had already been prepared for each child was completed. The checklist contained demographic data. Finally, a pamphlet on MIH was provided for the parents.

Descriptive data were used for qualitative

data at a confidence interval (CI) of 95% in order to estimate the prevalence of hypomineralization. In addition, chi-square test was used to evaluate the relationship between hypomineralization and the variable evaluated. SPSS software (version 21, IBM Corporation, Armonk, NY, USA) was used for statistical analyses. No important ethical considerations were involved because no therapeutic intervention was involved and no medications were used. However, a verbal informed consent was taken from the parents as well as the demographic data of the children were kept confidential and they will not be published anywhere.

Results

In the present study, 779 elementary school students were evaluated in Kerman. Of all these, 51 (6.5%) were affected by hypomineralization. Table 1 presents hypomineralization of first permanent molars and incisors separately for each tooth. Of 51 affected children, 47.1% and 52.9% were girls and boys, respectively.

Table 1. Distribution of the teeth according to the jaw and the quadrant

Teeth	Teeth with MIH [n (%)]
Mandibular right permanent first molars	28 (16.5)
Maxillary right permanent central incisors	27 (15.9)
Mandibular left permanent first molars	25 (14.7)
Maxillary left permanent central incisors	23 (13.6)
Maxillary left permanent first molars	18 (10.6)
Maxillary right permanent lateral incisors	10 (5.9)
Maxillary right permanent first molars	10 (5.9)
Maxillary left permanent lateral incisors	10 (5.9)
Mandibular right permanent central incisors	6 (3.5)
Mandibular left permanent lateral incisors	5 (2.9)
Mandibular left permanent central incisors	5 (2.9)
Mandibular right permanent lateral incisors	2 (1.1)

MIH: Molar incisor hypomineralization

Table 2. Frequency of the affected first permanent molars according to sex

Sex (tooth)	Teeth with MIH [n (%)]	Total [n (%)]	P*
Boy (16 ^{**})	7 (25.9)	27 (100)	0.56
Girl (16 ^{**})	8 (3.3)	24 (100)	
Total	15 (29.4)	51 (100)	
Boy (26 ^{***})	12 (44.4)	27 (100)	0.15
Girl (26 ^{***})	6 (25.0)	24 (100)	
Total	18 (35.3)	51 (100)	
Boy (36 [#])	13 (48.1)	27 (100)	0.90
Girl (36 [#])	12 (50.0)	24 (100)	
Total	25(49.0)	51 (100)	
Boy (46 ^{##})	15 (55.6)	27 (100)	0.92
Girl (46 ^{##})	13 (54.2)	24 (100)	
Total	28 (54.9)	51 (100)	

*Chi-square test, **16, right upper first permanent molar; ***26, left upper first permanent molar; #36, left lower first permanent molar; ##46, right lower first permanent molar
MIH: Molar incisor hypomineralization

Tables 2 to 4 present the frequencies of hypomineralization separately for each tooth and in both sexes. In addition, overall 36 subjects exhibited affliction of lower molars (left and right) (70.6%) and 31 subjects exhibited affliction of upper molars (left and right) (60.8%), with a significant difference, i.e. the rate of affliction was significantly higher in lower molars compared to upper molars.

Discussion

In the present study, the prevalence of this lesion was estimated at 6.5%. Knowledge about the prevalence of MIH in each geographical location is a prerequisite for the diagnosis and preventive treatment planning.

The present study was carried out on 7-12-year-old children. This age range is ideal for the evaluation of MIH because in the

majority of children from 7 years onward all the permanent first molars and incisors have already erupted and some of these teeth will be treated after 12 years of age. As a result, this age range was selected in the present study. The results showed that 6.5% of students were affected by hypomineralization. Studies have reported very different prevalence rates for hypomineralization, which might be explained by differences in geographical location (different regions and countries), sample sizes, parameters, diagnostic criteria and opinions of observers.^{3,15} In many cases, the presence of carious lesions might mask these lesions, making it difficult to determine the true prevalence of MIH. In older children, occlusal attrition and restorations, too, might mask these developmental defects as well.^{3,15}

Table 3. Frequency of the affected lateral Incisors according to sex

Sex (tooth)	Teeth with MIH [n (%)]	Total [n (%)]	P*
Boy (12 ^{**})	6 (22.2)	27 (100)	0.62
Girl (12 ^{**})	4 (16.7)	24 (100)	
Total	10 (19.6)	51 (100)	
Boy (22 ^{***})	6 (22.2)	27 (100)	0.62
Girl (22 ^{***})	4 (16.7)	24 (100)	
Total	10 (19.6)	51 (100)	
Boy (32 [#])	2 (7.4)	27 (100)	0.65
Girl (32 [#])	3 (12.5)	24 (100)	
Total	5 (9.8)	51 (100)	
Boy (42 ^{##})	1 (3.7)	27 (100)	> 0.99
Girl (42 ^{##})	2 (3.9)	25 (100)	
Total	2 (3.9)	51 (100)	

*Chi-square test, **12, right upper lateral Incisor; ***22, left upper lateral incisor; #32, left lower lateral incisor; ##42, right lower lateral Incisor
MIH: Molar incisor hypomineralization

Table 4. Frequency of the affected central incisors according to sex

Sex (tooth)	Teeth with MIH [n (%)]	Total [n (%)]	P*
Boy (11 ^{**})	14 (51.9)	27 (100)	0.87
Girl (11 ^{**})	13 (54.2)	24 (100)	
Total	27 (52.9)	51 (100)	
Boy (21 ^{***})	10 (37.0)	27 (100)	0.22
Girl (21 ^{***})	13 (54.2)	24 (100)	
Total	23 (54.1)	51 (100)	
Boy (31 [#])	3 (11.1)	27 (100)	> 0.99
Girl (31 [#])	2 (8.3)	24 (100)	
Total	5 (9.8)	51 (100)	
Boy (41 ^{##})	3 (11.1)	27 (100)	> 0.99
Girl (41 ^{##})	3 (12.5)	24 (100)	
Total	6 (11.8)	51 (100)	

*Chi-square test, **11, right upper central incisor; ***21, left upper central incisor; #31, left lower central incisor; ##41, right lower central incisor
MIH: Molar incisor hypomineralization

As discussed above, the prevalence of MIH in the present study was 6.5%, which is similar to the results of a study by Mittal et al. in India (6.13%).¹⁶ However, other studies in India by Bhaskar and Hegde¹⁵ and Mittal et al.¹⁶ have shown a prevalence rate of 9.5% and 9.2%, respectively, for MIH. Other studies in other countries in Asia have reported the prevalence rates of 2.8% in Hong Kong,¹⁷ 17.6% in Jordan,¹⁸ 18.6% in Iraq,⁴ 20.2% in Iran⁹ and 12.5% in Singapore.¹⁹ In addition, the prevalence rates have been reported in non-Asian countries including 10.2% in Greece, 9.7% in Lithuania, 9.2% in Turkey and 12.3% in Bosnia and Herzegovina.^{20,21} Therefore, there is a wide range of prevalence rate for hypomineralization in different countries and regions, with wide variations in the prevalence rates of MIH among different ethnic groups.

In the present study, the highest relative frequency was detected in mandibular right first molars (54.9%), with the lowest prevalence rate in the right (3.9%) and left (9.8%) mandibular lateral incisors.

Affliction of permanent molars in all the cases in the present study was associated with the affliction of incisors. A study in India showed that 50% of the subjects had concomitant involvement of molars and incisors and 50% had involvement of molars alone.¹⁶ However, studies all over the world^{16,20,21} have shown a lower prevalence

rate for molars only and in the majority of cases molars and incisors were affected simultaneously. In the present study, mandibular molars were affected at a significantly higher rate compared to maxillary molars. In a study in India¹⁶, too, mandible molars were affected at a higher rate.

In addition, studies in western India,¹⁶ Jordan¹⁸ and Lithuania,²⁰ also have shown a higher prevalence rate of MIH in mandibular molars; however, in studies in Spain,²² France,²³ Germany²⁴ and Australia²⁵ maxillary molars were affected at a higher rate.

Studies in Hong Kong¹⁷ and the Netherlands²⁶ have shown that maxillary and mandibular molars were equally affected. The discrepancies in the results of studies in different communities might be explained by geographical locations and genetic and ethnic differences.

In the present study, girls were affected by MIH at a higher rate compared to boys; however, the difference was not significant. Results of a similar study in India showed MIH was more prevalent in boys, but the difference was not significant. In a different study in India,⁸ there were no significant differences in the prevalence of MIH between the two sexes.

However, in a study in Shiraz,⁹ contrary to the results of the present study, the prevalence of MIH was significantly higher in girls, which might be explained by the age

range of the subjects, which was more limited (9-11 years) compared to that in the present study (7-12 years). A lack of significant difference between boy and girl subjects in the present study might be explained by the etiology of MIH, which is not related to sex. In addition, in a study in Jordan, the prevalence of MIH was significantly higher in girl subjects compared to boys. In that study, similar to the study in Shiraz, the age range was more limited (7-9 years).¹⁸

A large number of studies have evaluated the role of early onset diseases and pre- and post-natal factors in the initiation of MIH as well as the prevalence of it. The results have shown a significant relationship between early-onset diseases and the infants' medical problems during birth and MIH.⁷ However, in the present study, the prevalence of MIH was evaluated in addition to its relationship with sex only. Therefore, it is suggested that further studies should be carried out to evaluate the role of these factors and socioeconomic factors and other factors affecting MIH.

Suga et al. carried out a study to evaluate the prevalence of MIH in elementary schoolchildren in Lithuania. The results showed a higher prevalence rate of MIH in 7-9-year-old children; in addition, the prevalence of MIH was higher in mandible molars,²⁰ consistent with the results of the present study. In addition, in a study by Ahmadi et al, the prevalence of hypomineralization of molars and incisors was evaluated in elementary schoolchildren in Zahedan. The results showed a prevalence rate of 7.1% for MIH.²⁷ The consistency

between the results of these two studies might be explained by the socioeconomic and culturally similarities. In a study by Garcia-Margarit et al, the epidemiology of MIH was evaluated in 840 children aged 8 years. The results showed a 9.7% prevalence rate for MIH. In addition, inconsistent with our outcomes, the results indicated that the prevalence of MIH was higher in maxillary molars compared to incisors.²² In the present study, the prevalence of MIH in mandibular molars was higher than that in other teeth. The differences in the results of these two studies might be explained by differences in geographical location and the effect of personal opinions on diagnosis.

Conclusion

In the present study, the prevalence of MIH was estimated at 6.5% in a group of students aged 7-12 years. Mandibular molars were affected at a higher rate than other teeth. In all the cases, the affliction of mandibular molars was associated with the affliction of incisors. There was no relationship between sex and MIH. Further studies are recommended in other regions of Iran to further evaluate the prevalence of MIH.

Conflict of Interests

Authors have no conflict of interest.

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