

## Assessing the prevalence of molar-incisor hypomineralization and its effects on oral health-related quality of life in children aged 8-12 years in the city of Kerman, Iran

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Molar-incisor hypomineralization (MIH) is known as a developmental defect in enamel structure and shape seen in one to four permanent first molar teeth, usually affecting incisors. MIH can also influence children's self-confidence and oral health-related quality of life (OHRQoL), as an index to assess the effect of oral and orofacial diseases on individuals' health status, mood, and sense quality which are specifically measured in children and teenagers through the Child Perceptions Questionnaire (CPQ<sub>8-10</sub> or CPQ<sub>11-14</sub>). Accordingly, this study aimed to examine the prevalence of MIH and the effects of MIH on OHRQoL during mixed dentition period in Kerman, Iran.

**METHODS:** This descriptive-analytical cross-sectional study was performed on a total number of 2507 children aged 8-12 years in public schools selected using cluster random sampling method. Clinical examination was correspondingly done under daylight with a dental probe and a disposable dental mirror by a calibrated dental student. The data were coded and imported into the SPSS software wherein chi-square test, independent t-test, and one-way analysis of variance (ANOVA) were employed for analyses. The significance level was also set at 0.05.

**RESULTS:** A total of 129 (5.14%) students were diagnosed with MIH. The mean score of OHRQoL according to the standard CPQ<sub>8-10</sub> or CPQ<sub>11-14</sub> in children with MIH in this study was  $19.9 \pm 15.1$ , ranged from 0 to 82. Moreover, girls suffering from MIH had lower OHRQoL compared with boys ( $P = 0.006$ ).

**CONCLUSION:** MIH had a negative impact on OHRQoL in children.

**KEYWORDS:** Quality of Life; Molar-Incisor Hypomineralization; Oral Health; Child

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Enamel opacities in white to brown yellow in the first permanent molars (FPMs) were primarily introduced in Sweden in the late 1970s and they were consequently named as molar-incisor hypomineralization (MIH) by Weerheijm in 2004.<sup>1</sup>

According to the definition provided by the European Association of Pediatric Dentistry (EAPD), clinical diagnosis of MIH includes white, brown, and yellow opacities, fracture of erupted teeth, along with unusual restorations and extractions that can be attributed to MIH (Figure 1).

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**Figure 1.** Molar-incisor hypomineralization (MIH) in first permanent molar (FPM) and incisors

It is also estimated that the global prevalence rate of MIH varies between 2.4% in China and 40.0% in Brazil.<sup>2,3</sup> Prevalence rate of MIH in Iran has been reported to vary from 3.6% to 52.0%.<sup>4</sup>

Besides, oral and dental problems can have an effect on children's psychological and socioeconomic status and accordingly cause uncomfortable feelings, unseemly appearances, pains, and in total problems in quality of life (QoL) although understanding the impact of health status on children's QoL is complicated.<sup>5-7</sup>

Oral health can even influence QoL and different life aspects such as smiling, speaking, and eating that mitigate self-confidence.<sup>8-10</sup>

MIH usually has dental complications such as quick development of dental caries, hypersensitivity, and frequent dental treatment needs. These factors can affect the daily lives of persons, leading to negative esthetic and social effects as well as pain.<sup>11</sup>

The concept of oral health-related QoL (OHRQoL) points to the effect of oral conditions on daily activities as well as emotional and physical health status with reference to an individual's attitudes because QoL is a very personal concept. OHRQoL assessment also tries to meet actual needs based on a person's viewpoints. It similarly

pays attention to technical needs that are evaluated by dentists.<sup>12</sup>

The previous studies have only evaluated the prevalence of MIH in Kerman, Iran, and there is not any research available on the relationship between MIH and OHRQoL. Therefore, this study assessed the prevalence of MIH and the effects of MIH on OHRQoL during mixed dentition period in order to plan for health programs, promote self-confidence in children, and enhance efficacy at primary and junior high schools.

### Methods

This study was performed on a total number of 2507 primary school students in the city of Kerman, considering the history of 6.5%<sup>4</sup> prevalence rate of the MIH. They were selected using cluster random sampling method and the schools were chosen randomly from every educational district.

The inclusion criteria were students with age of 8 to 12 years and eruption of all four FPMs, as second to sixth grades of primary school.

The exclusion criteria were students with developmental defects of enamel (DDE), e.g., fluorosis, amelogenesis imperfecta (AI), students with chronic systemic disease, those affected undergoing orthodontic treatments or using orthodontic appliances at present time or before the study, and students that consumed medicine for a long time.<sup>13</sup>

Children's oral examinations were performed with the informed consent of the parents and obtaining the necessary permits from the relevant organizations.

Clinical examination was additionally carried out under daylight using a dental probe and a disposable dental mirror by a dental student that had been 97% calibrated with the supervision of a pediatric dental specialist.

The clinical diagnosis of MIH was done using the criteria developed by EAPD in which at least one FPM should have signs such as significant opacity as well as unusual restoration or extraction due to MIH. Opacities are also classified into three categories according to their color (namely,

white, yellow, and brown). In order to evaluate MIH severity, two separate conditions were further considered: mild injury (opacity) and severe injury (fracture after eruption along with unusual restoration and extraction due to MIH). The only recorded defects were the ones which were more than one millimeter in dimension.<sup>1</sup>

In order to determine the relationship between MIH and OHRQoL, after diagnosis of children infected with MIH, the Child Perceptions Questionnaire (CPQ<sub>8-10</sub> or CPQ<sub>11-14</sub>) was completed in face-to-face interviews.

It should be noted that the translated CPQ whose validity had been confirmed was applied in this study to assess the effects of MIH on OHRQoL.<sup>14,15</sup> This questionnaire was composed of 25 items classified into four domains: oral symptoms (5 items about pain/discomfort), functional limitations (5 items about mastication/speech), emotional-affective well-being (5 items about appearance/self-esteem), and social well-being (10 items about intimacy/communication), which could determine how many times these occasions had happened in the last 30 days. The answers were also based on a five-point Likert-type scale (1 time = 0, 1 time or 2 times = 1, sometimes = 2, often = 3, every day and almost every day = 4) ranged from 0 (no effect on OHRQoL) to 100 (full effect on OHRQoL). The higher the score was, the higher the impact of oral health on QoL of the children was. The study was approved by the Ethical Committee of Kerman University of Medical Sciences, Kerman (code: IR.KMU.REC.1398.504).

After collecting the completed questionnaires, the data were coded and imported into the SPSS software (version 20, IBM Corporation, Armonk, NY, USA) and the mean score of QoL in children infected with MIH was separately assessed in four domains. Finally, the total mean score of QoL was determined and presented in tables. Moreover, chi-square test, independent t-test, and one-way analysis of variance (ANOVA) were used to analyze the data. The significance level was also set at 0.05.

## Results

In this study, a total number of 2507 students aged 8-12 years (the mean age:  $10.5 \pm 1.0$ ) consisting of 1795 boys (71.6%) and 712 girls (28.4%) were examined and 129 (5.1%) of these students were ultimately diagnosed with MIH. Table 1 shows MIH prevalence rate and demographic characteristics information about children recruited in this study.

**Table 1.** Molar-incisor hypomineralization (MIH) prevalence rate and demographic characteristics information of children aged 8-12 years examined in the city of Kerman, Iran

Variable	Levels	Value
Gender	Men	53 (58.89)
	Women	37 (41.11)
Age (year)	8	147 (5.9)
	9	175 (7.0)
	10	853 (34.0)
	11	796 (31.8)
	12	536 (21.4)
MIH	Yes	129 (5.1)
	No	2378 (94.9)

MIH: Molar-incisor hypomineralization

Of 129 children affected with MIH, all had at least one infected FPM and the anterior teeth had been also infected in 37 of them. As well, 82 children had severe MIH and it was of mild type in 47 cases. Table 2 outlines the prevalence rate of the variables related to MIH including type of infected teeth, infection severity, color of infected teeth, and history of restoration and extraction of affected teeth in children with MIH in study population.

**Table 2.** Prevalence rate of variables in children with molar-incisor hypomineralization (MIH) in study population

Variables	Levels	n (%)
Type of teeth affected with MIH	FPM	129 (100)
	Anterior	37 (28.6)
MIH severity	Severe	82 (63.6)
	Mild	47 (36.4)
Color of teeth infected with MIH	White	41 (31.8)
	Yellow	15 (11.6)
	Brown	73 (56.6)
History of restoration in teeth affected with MIH	Yes	10 (7.8)
	No	119 (92.2)
History of extraction in teeth infected with MIH	Yes	4 (3.1)
	No	125 (96.9)

FPM: First permanent molar; MIH: Molar-incisor hypomineralization

Table 3 presents the total mean score of OHRQoL according to the results of CPQ in children affected with MIH that was equal to  $19.9 \pm 15.1$ , ranged from 0 to 80. The mean score of QoL in the domain of oral symptoms ( $6.5 \pm 3.8$ ) was also higher than those of other domains and it was concluded that oral symptoms had more effects on children's QoL.

**Table 3.** Total mean score of quality of life (QoL) in children infected with molar-incisor hypomineralization (MIH)

Variable (domain)	Mean $\pm$ SD	Min	Max
Oral symptoms	$6.51 \pm 3.89$	0	16
Functional limitations	$4.18 \pm 4.18$	0	20
Emotional-affective well-being	$4.19 \pm 4.31$	0	20
Social well-being	$5.02 \pm 5.93$	0	30
QoL total mean score	$19.90 \pm 15.11$	0	82

QoL: Quality of life; SD: Standard deviation

The difference of QoL score in both genders was significant and girls affected with MIH had a lower QoL than boys ( $P = 0.001$ ). However, the mean difference of QoL score at different ages was not significant ( $P = 0.506$ ). Regression analysis also confirmed age and gender outcomes (Table 4).

**Table 4.** Mean score of quality of life (QoL) in children infected with molar-incisor hypomineralization (MIH)

Variables	Levels	N	Mean $\pm$ SD	P
Gender	Male	90	$17.04 \pm 12.02$	0.001
	Female	39	$26.78 \pm 19.25$	
Age (year)	8	5	$24.60 \pm 12.70$	0.506
	9	9	$16.44 \pm 9.38$	
	10	46	$18.80 \pm 14.90$	
	11	29	$23.82 \pm 16.10$	
	12	40	$18.56 \pm 15.93$	

SD: Standard deviation

## Discussion

In this study, the prevalence rate of MIH in children aged 8-12 years in the city of Kerman was reported 5.14%. Such a value had been also reported as 12.5% in the study by Ahmadi et al. conducted on children of 7 to 9 years of age in the city of Zahedan, Iran,<sup>16</sup> 20.2% in the investigation by Ghanim et al. on 9- to 11-year-old children in the city of Shiraz, Iran,<sup>17</sup> and 6.5% in the survey by

Poureslami et al. in the same setting, i.e., the city of Kerman.<sup>4</sup> Souza et al. found this number for Brazilian 7- to 12-year-old children as 12.3%.<sup>18</sup> Schwendicke et al. additionally reported that this value was 1%-13% in children all over the world.<sup>19</sup> The prevalence rate described in this study was similar to the number from a previous one in the city of Kerman<sup>4</sup> which was lower than other cities in Iran and other nations in the world. The reason for this discrepancy could be due to different etiologies and factors related to MIH that could be very diverse and sometimes idiopathic.

In the present study, OHRQoL according to the results of the standard CPQ in children affected with MIH was  $19.9 \pm 15.1$  and the mean score of QoL in the domain of oral symptoms ( $6.5 \pm 3.8$ ) was also higher than those of other domains. The oral symptoms domain consists of items that address the history of pain in the last 30 days (including pain that was stimulated by cold), bad breath, and food impaction.<sup>3</sup> Also, in the study by Oyedele et al., children affected with MIH had more oral pathology than their healthy peers. The related side effects such as dentin sensitivity, dental caries, and esthetic concerns also had negative effects on children's QoL.<sup>20</sup> In the survey by Hasmun et al., it was correspondingly demonstrated that opacity removal treatment further enhanced their QoL and had a positive impact on children's psychological health status.<sup>21</sup> In the study by Arrow, MIH in the FPM teeth affected children's QoL.<sup>22</sup> In the study by Soviero et al. using the CPQ and the Parental-Caregiver Perceptions Questionnaire (P-CPQ), it was concluded that MIH could have more effects on oral symptoms such as pain induction, spontaneous pain, halitosis, chewing dysfunction, and sleeping habits in children. These results were mostly observed in older children because they had experienced more severe injuries like fracture after eruption. Children with MIH were also unsatisfied with the color of their tooth, so they avoided smiling and had a lower social

health status.<sup>23</sup> Moreover, in the study by Portella et al., it was reported that MIH was associated with dental caries and it could affect OHRQoL.<sup>24</sup> In Kalkani et al.'s study, it was also revealed that MIH could lead to several clinical challenges and have negative effects on QoL in infected children and their families.<sup>25</sup>

In the present study, girls with MIH had a lower QoL compared with boys who had a similar condition ( $P = 0.001$ ). In the study by Portella et al., female children presented a higher prevalence of an impact on OHRQoL in the oral symptoms domain of the CPQ.<sup>24</sup> Other studies reported similar results, indicating that girls presented a greater impact of oral conditions on OHRQoL compared with boys.<sup>25</sup> In the investigation by Velandia et al., the results similarly showed that MIH had negative impacts on QoL in children.<sup>26</sup> Therefore, studies like the present one showed the negative side effects of MIH on OHRQoL in children and teenagers, indicating the importance of well-timed diagnosis and treatment of MIH so that

children with MIH can be gifted with a healthy and happy life and beautiful smiles.

This study has some limitations that are inherent to its cross-sectional design. The data reflect the individual's perception at the moment of evaluation. Thus, a longitudinal design is needed to analyze the impact of MIH on OHRQoL.

### Conclusion

MIH had a negative impact on OHRQoL in children. In this regard, health programs should plan for promoting self-confidence in children. The side effects of MIH including esthetic and appearance disturbances as well as decrease in daily activities in girls were also more than those observed in boys.

### Conflict of Interests

Authors have no conflict of interest.

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