

Impact of molar-incisor hypomineralization on oral health-related quality of life in Vietnamese schoolchildren

Le Van Nhat Thang^{1*}, Nguyen Thi Thuy Uyen², Chau Ngoc Phuong Thanh¹, Lee Dae-Woo^{3,4,5}

(1) Faculty of Odonto-Stomatology, University of Medicine and Pharmacy, Hue University, Hue city, Vietnam

(2) Dept. of Histology - Embryology - Pathology & Forensic Medicine, University of Medicine and Pharmacy, Hue University, Hue city, Vietnam

(3) Dept. of Pediatric Dentistry & Institute of Oral Bioscience, School of Dentistry, Jeonbuk National University, Jeonju, Republic of Korea

(4) Research Institute of Clinical Medicine, Jeonbuk National University, Jeonju, Republic of Korea

(5) Biomedical Research Institute, Jeonbuk National University Hospital, Jeonju, Republic of Korea

Abstract

Background: Although molar-incisor hypomineralization (MIH) is prevalent in Asian countries, no studies have evaluated its impact on oral health-related quality of life (OHRQoL). The aim of this study was to determine the impact of MIH on OHRQoL in Vietnamese schoolchildren. **Materials and methods:** This cross-sectional study with 432 Vietnamese children aged 8-10 years was conducted in Hue city, Vietnam. OHRQoL was measured using the Child Perceptions Questionnaire for 8- to 10-year-olds (CPQ 8 - 10). The presence and severity of MIH was evaluated using the European Academy of Pediatric Dentistry (EAPD) criteria. A non-parametric Kruskal-Wallis test was applied for multiple intergroup comparisons, followed by Dunn's test. A p-value <0.05 was the threshold for statistical significance. Statistical analysis was performed using SPSS version 26.0 and GraphPad Prism software version 9.0.0. **Results:** Children with MIH had significantly higher CPQ 8 - 10 median scores than those without MIH, indicating that MIH negatively impacts OHRQoL. Similar trends were observed across all four domains: oral symptoms [3 (1 - 4) vs. 4 (3 - 7)]; functional limitations [1 (0 - 2) vs. 3 (1 - 6)]; emotional well-being [2 (0 - 4) vs. 4 (1 - 7)]; and social well-being [1 (0 - 3) vs. 2 (1 - 7)]. Regarding severity, CPQ 8 - 10 overall scores increased from mild [12 (7 - 19)] to severe [30 (23 - 33)] forms of MIH. **Conclusion:** MIH was associated with impaired OHRQoL. With increasing severity, this condition showed a more significant negative impact on OHRQoL. To confirm these findings, further studies should be performed with the Parental-Caregivers Perceptions Questionnaire.

Keywords: Molar-incisor hypomineralization, oral health-related quality of life, child perceptions questionnaire, Vietnam.

1. INTRODUCTION

Developmental defects of enamel are common in primary and permanent teeth and can be classified as either hypoplasia or hypomineralization. Hypoplasia is a quantitative defect resulting from an imbalance during enamel formation, whereas hypomineralization is a qualitative defect caused by an imbalance during enamel mineralization. According to the European Academy of Pediatric Dentistry (EAPD), Molar-incisor hypomineralization (MIH) is characterized by defective enamel development in at least one first molar, with or without associated defects in the incisors [1]. MIH occurs due to a dysfunction of ameloblasts during the later stages of mineralization in amelogenesis, leading to a qualitative defect in the enamel [2, 3].

Regarding MIH prevalence, a systematic review indicated that there is significant variation in the

prevalence of MIH between countries, with the highest rates in India, China, and the United States [4]. The global prevalence of MIH was estimated to range from 2 to 40% [4-6]. Specifically, the prevalence of MIH in Australia was 44% [7], 40.2% in Brazil [6], 3 to 22% in Europe [8, 9], and 13.7% in Africa [7]. In addition, a meta-analysis revealed that MIH is a common dental condition with a worldwide prevalence of 13% [10].

For clinical characteristics, the teeth affected by MIH generally present well-demarcated opacities of varying sizes that can change the color of teeth from white to yellow-brown with no thickness alteration [1]. This increased fragility makes it more susceptible to post-eruptive enamel breakdown, leading to several issues, such as dentine hypersensitivity, a higher risk of tooth decay, pain, and potential damage to the pulp, ultimately increasing the risk of

*Corresponding Author: Le Van Nhat Thang

E-mail: lvnthang@hueuni.edu.vn; lvnthang@huemed-univ.edu.vn

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tooth loss [4, 5, 11, 12]. Furthermore, some other psychological problems can be affected, such as dental anxiety and poor dental aesthetics [13-15].

Oral health is an essential aspect of overall health and can significantly influence a patient's quality of life (QoL) [16]. Oral health-related quality of life (OHRQoL) refers to an individual's self-assessment of their oral health status, including functional well-being, emotional well-being, expectations, and satisfaction with dental care, as well as its impact on their overall QoL [17]. MIH can notably impact OHRQoL through various physical, psychological, and social factors [18-21].

Recent systematic reviews have shown that MIH adversely affects OHRQoL [22, 23]. However, primary studies examining the relationship between MIH and OHRQoL have been conducted in some countries, including Germany, Australia, Belgium, Brazil, Colombia, Mexico, Iran, and Nigeria [22]. Although MIH is prevalent in Asian countries [4], no studies have evaluated its impact on OHRQoL. Therefore, this study aimed to evaluate the OHRQoL in children aged 8 - 10 with MIH in Hue city, Vietnam.

2. MATERIALS AND METHODS

Population and study sample

This study comprised a cross-sectional design carried out in 2023, of a representative sample of 8 to 10-year-old schoolchildren from Hue city, Vietnam. For convenience, two public primary schools in the study area were selected.

The sample size was determined to identify an odds ratio of 2.5 with 80% power, an alpha of 0.05, and a 0.30 probability for MIH. Considering the probability of those children with MIH having a negative impact on OHRQoL. The participants in the study included schoolchildren aged 8 to 10 who had at least one first permanent molar that had erupted. Those with orthodontic attachments that obstructed the examination of the tooth surface were excluded from the study. A total of 472 parents were asked to consent to their children participating in the study, with 446 agreeing and signing an informed consent form, resulting in a 94.5% response rate. Out of the 446 eligible subjects, two were eliminated due to the presence of an orthodontic appliance, and 12 were excluded for not attending school on the days the selection examinations took place. Consequently, the study was carried out on a group of 432 schoolchildren.

Calibration process

A dental clinical examination was conducted in the school nurse's office by three examiners who had been calibrated by an expert.

Before the study began, one of the examiners participated in a series of calibration exercises. The calibration process was divided into two phases. The initial phase involved a theoretical discussion regarding the clinical diagnosis and severity of MIH. In addition, training for oral clinical examinations was conducted using slides [24].

The second phase consisted of conducting clinical examinations. Fifteen schoolchildren who were not part of the main study were examined and re-evaluated after a 10-day interval. The conditions of all the schoolchildren were taken into account. Intra-examiner reliability was assessed on a tooth-by-tooth basis for each clinical condition. The Cohen's kappa coefficient for intra-examiner calibration for MIH was found to be 0.88.

Data collection

The children brushed their teeth prior to the examination, after which the presence or absence of MIH and its severity were assessed according to the criteria set by the EAPD [15]. MIH was identified if one or more first permanent molars revealed demarcated opacities, post-eruptive enamel breakdown, atypical restorations, or had been extracted due to MIH. Demarcated opacities with a diameter of less than 1 mm were not included in the analysis [1, 15, 25]. It is important to note that dental hypersensitivity was not evaluated during this examination. The inspection utilized a mouth mirror, gauze for drying, a tongue depressor, and good lighting. Children without MIH were selected as the control group.

Evaluation of Oral HealthRelated Quality of Life

The OHRQoL of children was evaluated using the version of the Child Perceptions Questionnaire (CPQ 8-10) created by Jokovic et al. [26] and translated and adapted to Vietnamese was used. The CPQ 8-10 includes 25 items across four domains: oral symptoms, functional limitations, emotional well-being, and social well-being. The items are rated using a Likert scale with options ranging from 0 to 4, reflecting the frequency of occurrences over the past four weeks. Higher scores indicate worse OHRQoL. In addition to the 25 items, two global questions assess the child's overall perception of their oral health and general well-being, with responses ranging from excellent to poor. The overall CPQ score ranges from 0 to 100, with higher scores reflecting greater

impairment in quality of life. The instrument has been validated for use with Vietnamese children.

Data analysis

Statistical analysis was performed using SPSS software version 26.0 and GraphPad Prism software version 9.0.0. Parametric data were expressed as mean \pm standard deviation (SD), while non-parametric data are presented as the median with interquartile range (IQR) (Q1-Q3). Mann-Whitney test was conducted for pairwise comparison. A non-parametric Kruskal-Wallis test was applied for multiple intergroup comparisons, followed by Dunn's test. A p-value <0.05 was the threshold for

statistical significance.

3. RESULTS

In this study, a total of 432 children were examined, of which 185 (42.82%) were female. The prevalence of MIH was found to be 29.86%, affecting 129 children. Among these, 105 children (24.31%) had mild MIH, while 24 children (5.55%) exhibited a severe form of the condition. The mean ages of the groups were as follows: 9.07 ± 0.83 years for the non-MIH group, 8.94 ± 0.78 years for the mild MIH group, and 8.83 ± 0.82 years for the severe MIH group (Table 1).

Table 1. Baseline characteristics of the participants

Characteristics	Non-MIH	Mild-MIH	Severe-MIH	Total
Gender (% within MIH)	303 (70.14)	105 (24.31)	24 (5.55)	432 (100)
Male (%)	174 (57.43)	57 (54.29)	16 (66.67)	247 (57.18)
Female (%)	129 (42.57)	48 (45.71)	8 (33.33)	185 (42.82)
Mean age (SD)	9.07 (0.83)	8.94 (0.78)	8.83 (0.82)	9.02 (0.82)

The scores of the domains for MIH-affected groups were significantly higher than the group without MIH (Oral symptoms [3 (1-4) vs. 4 (3-7)]; functional limitations [1 (0-2) vs. 3 (1-6)]; emotional well-being [2 (0-4) vs. 4 (1-7)]; and social well-being [1 (0-3) vs. 2 (1-7)]) ($p < 0.0001$, Mann-Whitney test). There was a common pattern of increase for all four domains when comparing the without MIH and with MIH groups (Figure 1).

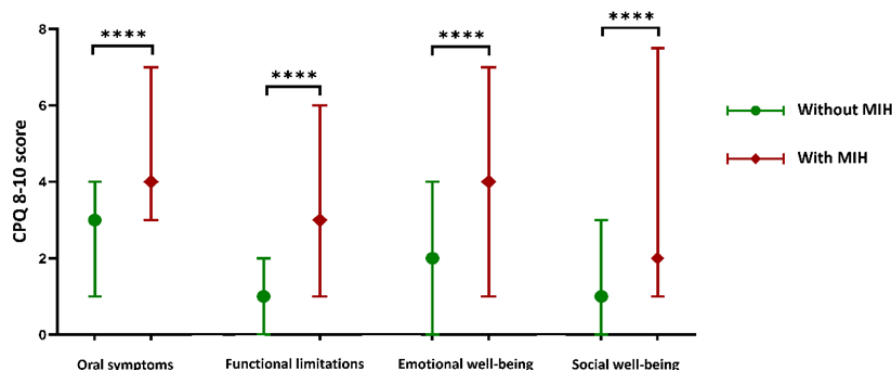


Figure 1. The median and interquartile range of CPQ 8-10 score for each domain based on MIH presence (**** $p < 0.0001$)

The median and IQR (Q1-Q3) for the scores in each domain were presented in Table 2. The median score was highest for all domains in the severe-MIH group. There were statistically significant differences in the scores among the three groups based on the presence and severity of MIH ($p < 0.0001$).

Table 2. CPQ 8-10 scores in participants with mild MIH, severe MIH, and without MIH

	Non-MIH	Mild-MIH	Severe-MIH	p
Oral symptoms	3 (1-4)	4 (2-6)	7 (5-10)	<0.0001
Functional limitations	1 (0-2)	3 (1-5)	5.5 (4-9)	<0.0001
Emotional well-being	2 (0-4)	3 (1-6)	7 (4-10)	<0.0001
Social well-being	1 (0-3)	2 (0-6)	8.5 (3.35-11.75)	<0.0001
Overall	6 (3-12)	12 (7-19)	30 (23-33)	<0.0001

Scores are shown as median with IQR (Q1-Q3).

Multiple intergroup comparisons indicated statistically significant differences between the non-MIH group, mild-MIH group, and severe-MIH group ($p < 0.0001$, Kruskal-Wallis test). Figure 2 showed that the group with more severe MIH had higher CPQ scores.

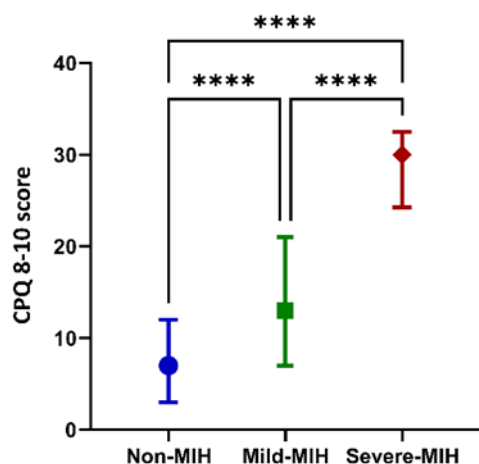


Figure 2. Overall CPQ 8-10 scores in non-MIH, mild-MIH, and severe-MIH participants.

Symbols and bars present median with IQR.

**** $p < 0.0001$.

4. DISCUSSION

This study examined the OHRQoL among Vietnamese children both with and without MIH attending public primary schools while also evaluating how the severity of MIH affects the OHRQoL. Although some authors have previously investigated the impact of MIH on OHRQoL [22]. This study is the first in Asia to concentrate on this topic. According to our study, children with MIH have impaired OHRQoL as their MIH severity increases.

Our study measured QHRQoL using the CPQ 8-10, a popular instrument translated and validated in several countries [18, 19, 21, 24, 27]. In this study, the Vietnamese version was applied. The CPQ 8-10 was designed for children aged 8 to 10. Therefore, the study focused on this specific age group. No younger patients were included in the study because the ideal age for examination of the condition is around 8 years. By this age, most children will have all four permanent molars and most of their incisors erupted, while signs of MIH will still be observable [1].

In this study, the presence of MIH significantly impacted OHRQoL compared to the control group. This finding aligns with the results of previous studies [18-21, 27, 28], which indicate that children with MIH often experience a range of related issues,

including dental caries, dentin hypersensitivity, and aesthetic concerns, all of which negatively affect their OHRQoL. Furthermore, regarding the severity of MIH, mean CPQ 8-10 scores rose with increasing severity, indicating a more impaired OHRQoL in severe cases. Children with mild MIH teeth had a median score of 12 (7-19), while this score increased to 30 (23-33) in patients with severe MIH; the difference was statistically significant.

It is essential to recognize that QoL extends beyond the impacts of MIH on oral health. It encompasses multiple dimensions, including psychological factors such as emotional and social well-being, physical symptoms, and functioning [19, 21]. Although all four domains, including oral symptoms, functional limitations, emotional well-being, and social well-being, were negatively affected by MIH, the highest scores were recorded in the oral symptoms domain. This finding is consistent with other studies that have reported the highest scores in this domain [27, 28]. Children with MIH were most commonly affected by pain.

To our knowledge, this is the first study in the Asian continent investigating the impact of MIH on OHRQoL. This suggests that early detection of MIH requires attention and timely intervention to avoid oral health problems and reduce its impact on Vietnamese schoolchildren's OHRQoL. Furthermore, similar to previous studies, the investigation of the impact of MIH on OHRQoL was conducted in schools, and the CPQ 8-10 was used for assessment. This demonstrates methodological consistency, further strengthening the evidence for the negative impact of MIH on OHRQoL. However, this study has some limitations. First, our design was a cross-sectional study, which only assesses the effect at a specific point in the participant's life. Second, the current findings should be generalized to other populations with caution because the participants in this study were from public schools and likely had less favorable socioeconomic conditions than children attending private schools. Furthermore, other factors that may influence the association between MIH and OHRQoL have not been assessed. Finally, the Parental-Caregivers Perceptions Questionnaire was not investigated to evaluate the parents' perception of the child's oral conditions impacting the OHRQoL. The combination of multidimensional questionnaires helps to more fully measure the impact of oral health on the functional, emotional, and social health of children and their families. Thus, further studies should be conducted using combined

questionnaires to determine this issue, especially in Asian countries.

5. CONCLUSION

This study found a significant association between MIH and OHRQoL. Children with MIH have a poorer OHRQoL as compared to children without MIH when applying the CPQ 8-10. Notably, schoolchildren with MIH experience a more significant impact across the four domains compared to children without MIH. The highest scores were observed among all domains in the oral symptoms domain. Further studies are necessary to confirm and extend these findings.

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