Prevalence of Molar Incisor Hypomineralization in Mexican Children

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Objective: *To determine the prevalence of and factors associated with molar incisor hypomineralization (MIH) in schoolchildren aged 6–12 years. Study design**:** This study included 1156 schoolchildren aged 6–12 years, living in Mexico City. A previously standardised examiner (k = 0.79) applied the diagnostic criteria for MIH from the European Academy of Paediatric Dentistry. Children's parents completed a questionnaire about medical conditions in the perinatal period and the first 3 years of their children's lives. Descriptive measures were examined, multivariate logistic regression analysis was performed, and odds ratios (ORs) were calculated.* ***Results:*** *The subjects were 582 (50.4%) females and 574 (49.6%) males, with an average age of 8.4 ± 1.6 years. The prevalence of MIH was 15.8%, and this condition was more prevalent in children aged 9–12 years than in those aged 6–8 years (18% vs. 13.7%, p < 0.05). Risk factors for MIH were low birth weight (OR = 1.905, 95% confidence interval [CI] 1.130–3.211, p = 0.014), urinary tract infection (OR = 4.841, 95% CI 2.863–8.186, p = 0.001), chickenpox (OR = 1.826, 95% CI 1.196–2.786, p = 0.005), and history of allergies (OR = 4.370, 95% CI 2.538–7.523, p < 0.001).* ***Conclusions:*** *The prevalence of MIH in a group of Mexican schoolchildren was 15.8%. Medical conditions in the first years of life were more prevalent in children affected by MIH.*

Key words: *Molar incisor hypomineralization, children, Mexican, etiological factors*

INTRODUCTION

Molar incisor hypomineralization (MIH) is characterised by asymmetrical white, cream, yellow, and/or brown opacities of the tooth enamel caused by changes in the calcification or maturation of the first permanent molars and/or incisors.[1] MIH is considered to have a multifactorial aetiology, having been linked to systemic problems that alter odontogenesis around birth, as well as the administration of some drugs; however, further evidence is needed to specify the predisposing factors.[2]

MIH affects mainly the first permanent molars, which begin to develop during the fourth month of gestation and begin to calcify around the time of birth. In these stages, growth and developmental processes are extremely sensitive to environmental disturbances.[3]

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MIH causes sensitivity and pain during chewing, makes tooth brushing difficult, and predisposes individuals to dental caries. The increased susceptibility to caries is explained by the fragility and porosity of the affected enamel, which causes greater retention of dental biofilm.[4] Data on the worldwide prevalence of this altered enamel development are variable: reported prevalence are 8.9% in India,[5] 10% in Greece,[6] 12.6% in Brazil,[7] 16% in Argentina,[8] and 16.9% in Malaysia.[9] Little information on the prevalence and causes of MIH in the Mexican population is available. Evidence suggests that the aetiology of this condition is not unifactorial, and that the combined effects of different factors can increase its severity.[10] This study was conducted in Mexico City, to determine the prevalence and determinants of MIH in a population of schoolchildren.

MATERIALS AND METHOD

This cross-sectional study involved 1156 schoolchildren aged 6–12 years who were enrolled in two public primary schools in the Santa Cruz area of the Delegation of Iztapalapa. The bioethics committee of the Zaragoza School of Higher Studies approved the study protocol. Only children with the first four erupted permanent molars, whose parents had provided written consent and completed the medical history questionnaire, were included. One paediatric dentist

who had been standardised previously in MIH diagnosis (k = 0.79) performed the dental examinations. The examinations were conducted after toothbrushing, under artificial light, using a mirror and blunt probe. The teeth were not dried.

A child was classified as having MIH when at least one molar or incisor displayed any of the following characteristics, as indicated by the European Academy of Paediatric Dentistry: opacity, post-eruptive fracture, and atypical restoration or extraction due to MIH. The severity of MIH was classified based on the molar or incisor with greatest involvement in each child using criteria described by Mathu-Muju *et al*.[11] (Table 1).

To investigate predisposing systemic medical conditions during the perinatal period and the first 3 years of life, a detailed questionnaire was designed to obtain the following information from subjects' medical histories: complications during birth, premature birth, type of delivery, and illnesses and conditions during the 3 first years of life (respiratory and urinary tract infections, chickenpox, allergies, and antibiotic treatment). The questionnaire was supplemented with interviews and with medical histories provided by the schools. The data were analysed using chi-squared tests and logistic regression, with calculation of odds ratios (ORs). Values were considered statistically significant at $p < 0.05$.

RESULTS

A total of 1156 schoolchildren (582 [50.4%] females and 574 [49.6% male]) with a mean age of 8.4 ±1.6 years participated in the study. The prevalence of MIH was 15.8%, and this condition was more prevalent in children aged 9–12 years than in those aged 6–8 years (18% vs. 13.7%, $p < 0.05$). No significant differences were observed between boys and girls. With respect to severity, 56.6% of cases were classified as mild, 31.7% as moderate, and 12% as severe.

Of the factors significantly associated with the presence of MIH, urinary tract infection was the most prevalent (44.4%, $p < 0.05$). Univariate analysis identified the following conditions as risk factors for MIH: low birth weight (OR = 1.905, 95% confidence interval [CI] 1.130–3.211, $p = 0.014$), urinary tract infection (OR = 4.841, 95% CI 2.863–8.186, $p = 0.0001$), chickenpox (OR = 1.826, 95% CI 1.196–2.786, $p = 0.005$), and history of allergies (OR = 4.370, 95% CI 2.538–7.523, $p = 0.0001$). Factors remaining significant in multivariate analysis were urinary tract infection (OR = 4.948, 95% CI 2.864–8.548, $p = 0.0001$), history of allergies (OR = 4.911, 95% CI 2.777–8.685, $p = 0.0001$), low birth weight (OR = 2.575, 95% CI 1.502–4.414, $p = 0.001$), and chickenpox (OR = 2.171, 95% CI 1.394–3.380, $p = 0.001$; Table 2).

DISCUSSION

The prevalence of MIH in this study (15.8%) is similar to those reported in Chilean (16.8%),[12] Spanish (17.8%),[13] and Jordanian (17.6%)[14] children. MIH prevalence of <2–8% have also been reported.[15–17] Thus, similarities are seen among schoolchildren with different lifestyles and populations with different genetic characteristics, which indicates that the presentation of MIH is influenced mainly by constitutional factors inherent to development.

MIH has been linked to medical complications during labour and to systemic diseases and related factors, such as asthma, pneumonia, upper respiratory tract infection, otitis media, tonsillitis, recurrent febrile rash illness, antibiotic intake, and exposure to dioxins, in the first years of life. Susceptibility varies among individuals; the pattern of involvement is different in homologous teeth, even when the causal factors are the same.[18–20]

Table 1 Characteristics for evaluating the severity of MIH, as described by Mathu-Muju and Wright[11].

Mild
▪ **Opacities delimited in areas free of occlusal forces** ▪ **Isolated opacities** ▪ **No enamel loss in opaque areas** ▪ **No history of dental hypersensitivity** ▪ **No activities related to caries of affected enamel** ▪ **Alterations of incisors are mild, if present**
Moderate
▪ **Atypical and intact restorations may be present** ▪ **Opacities delimited in the occlusal/incisal third of the tooth, without loss of the structure after eruption** ▪ **Loss of posteruptive enamel and carious lesions that are limited to 1 or 2 areas, without participation of cusps** ▪ **Tooth sensitivity** ▪ **Often, aesthetic complaints are expressed by the patient or parents**
Severe
▪ **Posteruptive losses are present and usually occur when the tooth erupts** ▪ **History of tooth sensitivity** ▪ **Often, extensive carious lesions are associated with the affected enamel** ▪ **Coronary destruction can advance quickly and involve the dental pulp** ▪ **The presence of defects in atypical restorations** ▪ **Aesthetic complaints are expressed by the patient or parents**

Table 2. Multivariate analysis of risk factors associated with MIH in schoolchildren from Iztapalapa

Risk factors	OR	95% CI	P value
Low birth weight	2.575	1.502 - 4.414	0.001
Urinary tract infections	4.948	2.864 - 8.548	0.0001
Chickenpox	2.171	1.394 - 3.380	0.001
Allergies	4.911	2.777 - 8.685	0.0001

OR: odds ratio

95% CI: 95% confidence interval

This study showed that various medical factors may be associated with MIH development. The observed association with low birth weight is consistent with the findings of Aine *et al* [21] who reported a higher prevalence of enamel defects in preterm and low-birth-weight children. Children with birth weights < 1500 g were found to have more dental opacities.[20] Ghanim *et al* [22] and Brogårdh-Roth *et al* [23] noted that the risk of MIH decreases with increasing gestational time and birth weight. However, other clinicians have argued that odontogenesis is affected by complications during birth and health status during the first days of life, rather than by low birth weight.[24]

The results of this study are in agreement with those of Ahmadi *et al* [25] who found that postnatal conditions such as kidney disease, chickenpox, asthma, and allergic reactions were more common in children with MIH than in those without this condition. Some viruses infect epithelial surfaces; thus, the chickenpox virus likely affects the epithelial precursors of enamel and changes ameloblastic activity during mineralization.[26]

Regarding allergic history, respiratory disorders such as asthma and rhinitis have been reported to generate systemic metabolic stress linked to defects in the dental structure.[21] Experimental studies have shown that changes in the pH of the enamel matrix caused by metabolic acidosis and lower oxygenation levels from hypoventilation inhibit the action of proteolytic enzymes and the development of hydroxyapatite crystals, leading to hypomineralisation.[27]

The lack of a relationship between MIH and antibiotic use in the present study may reflect the difficulty determining whether enamel defects are caused by medications or disease.[4,24]

One limitation of this study was that information was obtained from parents' questionnaire responses. To minimise bias, the children's medical certificates were reviewed, and care was taken to not influence responses in any way. However, to obtain more accurate results, the performance of prospective studies with control groups is essential. Discrepancies among studies regarding the possible aetiological factors of MIH highlight the importance of conducting further research on this pathology. Moreover, the early diagnosis of MIH is extremely important to enable the provision of specific, minimally invasive protective treatment to prevent the post-eruptive loss of enamel and associated repercussions on oral health and quality of life in schoolchildren.

CONCLUSION

In this study, 15.8% of Mexican schoolchildren presented with MIH, and medical conditions in the first years of life were more prevalent in children affected by MIH. The primary aetiological factors were urinary tract infection, allergic history, and chickenpox. However, more research involving larger populations of Mexican children is needed.

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