



Comparison of the prevalence of molar incisor hypomineralization among children with different health care coverage in the cities of Buenos Aires (Argentina) and Montevideo (Uruguay)

Comparación de la prevalencia de hipomineralización molar incisiva en niños con diferente cobertura asistencial en las ciudades de Buenos Aires (Argentina) y Montevideo (Uruguay)

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ABSTRACT The aim of this study was to compare the prevalence of molar incisor hypomineralization (MIH) among children with different health care coverage in Buenos Aires and Montevideo. An observational, cross-sectional and descriptive study was designed, considering children born from 1993-2003 who were seen in the Chairs of Comprehensive Children's Dentistry (Universidad de Buenos Aires) and of Pediatric Dentistry (Universidad de la República) and at five private dental offices between April and December 2010. Two groups were defined: A (Buenos Aires; n=1,090) and B (Montevideo; n=626). The clinical diagnosis was carried out with calibrated examiners (Kappa: 0.94) using the Mathu-Muju and Wright criteria. The prevalence of MIH was found to be 16.1% in A and 12.3% in B ($p=0.03$), with statistically significant differences between the public and private care sectors in both groups (A $p=0.0008$; B $p=0.0004$) and a positive correlation between MIH and year of birth (A $p=0.001$; B $p=0.005$). The results show that MIH is an emerging pathology and that MIH prevalence is related to year of birth and access to health care.

KEY WORDS Molar Incisor Hypomineralization; Enamel Dental; Prevalence; Argentina; Uruguay.

RESUMEN El objetivo fue comparar la frecuencia de la hipomineralización molar incisiva (HMI) entre niños con diferente cobertura de salud en Buenos Aires y Montevideo. Se diseñó un estudio transversal, observacional y descriptivo con los nacidos entre 1993-2003, asistidos en las Cátedras de Odontología Integral Niños (Universidad de Buenos Aires) y de Odontopediatría (Universidad de la República) y en cinco clínicas privadas, entre abril y diciembre 2010. Se conformaron dos grupos: A (Buenos Aires; n=1.090) y B (Montevideo; n=626). El diagnóstico clínico fue realizado por examinadores calibrados (Kappa: 0,94) con los criterios de Mathu-Muju y Wright. Los resultados mostraron una prevalencia de HMI en A del 16,1% y en B del 12,3% ($p=0,03$), con diferencias significativas entre los sectores público y privado en ambos grupos (A $p=0,0008$; B $p=0,0004$) y una correlación positiva entre la HMI y el año de nacimiento (A $p=0,001$; B $p=0,005$) Los resultados permiten concluir que la HMI es una patología emergente y su prevalencia se relaciona al año de nacimiento y al acceso al cuidado de salud.

PALABRAS CLAVES Hipomineralización Molar Incisiva; Esmalte Dental; Prevalencia; Argentina; Uruguay.

INTRODUCTION

Structural dental anomalies are related to alterations developed during the normal process of odontogenesis and their causes may be connected with hereditary, local or systemic factors. According to when these factors act, they may affect the primary dentition, the permanent dentition or both. In the period related to amelogenesis, if these factors act during the early stage of matrix secretion, quantitative structural defects or hypoplasia may be developed; if they act during the process of maturation or mineralization, qualitative defects or hypomineralization may be developed. In the late 1970s, the Public Dental Service in Sweden reported an increasing number of children suffering from severe hypomineralization in permanent molars and incisors. The results of the study published in 1987 by Koch *et al.* (1) showed a prevalence of 15.4% for a condition referred to as "idiopathic (enamel) hypomineralization" among children born in 1970. Subsequently, in 2001, as suggested by Weerheijm *et al.* (2), this condition was defined as "molar incisor hypomineralization." The etiology of this condition is still controversial and it seems to affect not only first permanent molars and incisors, but also other teeth. In the clinical examination, teeth present white, cream, yellow or brown demarcated asymmetric opacities which differ from the opacities caused by emerging caries lesion, amelogenesis imperfecta and endemic fluorosis. The enamel mineral concentration of the affected teeth decreases from the amelo-dentinal junction to the subsurface enamel, contrary to what happens in the case of normal enamel mineral concentration (3). Yellow-brown opacities are more porous and extend through the whole enamel thickness, whereas white-cream opacities are less porous and are situated in the inner parts of the enamel (4). The affected areas have well-defined borders between the normal and the hypomineralized enamel.

Histologically, the microstructure is preserved, indicating normal ameloblast function during secretory stage. However, the crystals seems to be looser and less organized in the porous parts, revealing a disruption of ameloblast

function at maturation stage and suggesting that the condition is developed during the last pre-natal period and the first years of life (5). Farah *et al.* (6) observed that enamel affected by MIH has a higher protein content than the normal enamel, with such proteins identified as serum proteins (serum albumin, type I collagen, antitrypsin and antithrombin). The protein content in enamel with brown lesions was 15-21 times higher than protein content in normal enamel, whereas it was 8 times higher in yellow lesions. Mangum *et al.* (7) compared the hypomineralized enamel affected by hypomaturation defects (amelogenesis imperfecta) and the enamel affected by MIH and found that the protein content in both conditions was 15 times higher than in the normal enamel. Regarding the level of residual amelogenins, it was closer to the normal level in MIH, distinguishing it from hypomaturation defects (amelogenesis imperfecta, fluorosis), in which the level of residual amelogenins was higher.

The severity of MIH varies among the different teeth of the same patient. Not all the first permanent molars and incisors are affected or are injured to the same extent, although the odontogenesis and calcification occur simultaneously or nearly at the same time (8). Many patients affected by MIH suffer from hypersensitivity, the etiology of which could be the bacterial invasion in the dentinal tubules beneath apparently intact but hypomineralized enamel, resulting in inflammatory reactions in the pulp (9). The microstructural characteristics of enamel increase the risk of rapid caries development which may even lead to tooth loss at an early age. The frequency of restorative interventions and the need for retreatment are significantly higher than in patient groups not affected by this condition, thus the early diagnosis of MIH is essential to prevent further consequences (10). MIH is considered a clinical problem by Latin American pediatric dentists. Although these professionals consider it a clinical problem in their place of residence, they also recognize the lack of information about this issue (11). In previous studies, Biondi *et al.* (12) found a 16.1% prevalence of MIH in the City of Buenos Aires (Argentina), and, in a similar study conducted by López *et al.* (13), this condition had a prevalence of 12.3% in the city of Montevideo (Uruguay).

The aim of this study is to compare the prevalence of MIH among children with different health care coverage (public and private sectors) in the city of Buenos Aires (Argentina) and Montevideo (Uruguay), and relate such prevalence to the children's sex and year of birth.

SUBJECTS AND METHODS

Ethical considerations

This study was approved by the Ethics Committee at the Faculty of Dentistry of the Universidad de Buenos Aires (UBA 20020090200068). The parents or guardians of the children gave their consent for this study and the children agreed to the clinical examination.

Experimental design

A cross-sectional, observational and descriptive study was designed and conducted with all the children born between 1993 and 2003 who sought health care with the physicians in charge of the Chairs of Comprehensive Children's Dentistry of the School of Dentistry at the Universidad de Buenos Aires (Argentina) between April and August 2010, and the Chairs of Pediatric Dentistry at the Universidad de la República between July and December in 2010, and at five private dental offices managed by dentists of the study team: three in Buenos Aires and two in Montevideo, during the same period of time respectively.

In this study, the following inclusion criteria were defined: children of both sexes born between 1993 and 2003, whose first four permanent molars and eight permanent incisors had erupted at the time of clinical examination. The following exclusion criteria were defined: children with amelogenesis imperfecta, hypoplasia, tetracycline staining, genetic or congenital disorders, caries, orthodontic braces or restorations preventing the clinical examination from being performed, and children from places with a high level of fluoride content in the drinking water.

Standardization of diagnostic criteria

White-cream and yellow-brown enamel defects and enamel loss were considered to be MIH, according to the severity criteria proposed by Mathu-Maju and Wright (14). Diagnosis of MIH was calibrated at three stages: homogenization of theoretical criteria, observation and discussion of criteria using digital photographs, and determination of concordance using files selected by a Gold standard composed of 30 images (106 teeth in different positions and forms) in order to assess the intra- and inter-examiner variability in visual diagnosis. The Kappa value coefficient was 0.94 (CI 0.92; 0.96).

Sample composition

Two groups were formed: A (Buenos Aires, $n=1,090$) and B (Montevideo, $n=626$), with an average age of 13.18 ± 2.55 and 12.53 ± 2.68 and proportion of males of 47.5% and for 47.6% in groups A and B respectively. Each of these groups was divided into subgroups in connection with the patient's dental care institution: A ($n=578$ private sector, $n=512$ public sector); and B ($n=163$ private sector, $n=463$ public sector).

DATA ANALYSIS

Data related to sex, year of birth, dental care institution and presence of MIH were recorded on charts specially designed for such purpose. The prevalence of MIH was defined as the percentage of children having at least one molar affected by this condition, regardless of whether the incisors were affected. Descriptive and inferential data analyses were carried out using percentages with their corresponding 95% confidence intervals. The association between the proportions was analyzed using Fisher's exact test. In addition, Pearson's correlation test was used to relate the number of MIH cases to the year of birth.

RESULTS

The results of MIH prevalence in groups A and B, divided into dental care sector (public or private), are shown in Table 1 and Figure 1.

There were no significant differences between Buenos Aires and Montevideo among patients with MIH in the private sector ($p=0.84$) or the public sector ($p=0.93$), nor among the groups of children without MIH ($p=0.77$).

There were significant differences in the prevalence of MIH between dental care sector in both groups (A $p=0.0008$; B $p=0.0004$).

Regarding sex, a greater prevalence of MIH was observed in male patients from both groups without statistical significance. Results of MIH prevalence in groups A and B, based on the year of birth, are shown in Table 2.

With regards to the presence of MIH and year of birth, results revealed a positive linear correlation in both groups with $r=0.78$ (Buenos Aires:

Table 1. Overall prevalence of molarincisor hypomineralization (MIH) based on dental care sector in groups A (Buenos Aires) and B (Montevideo), April-December, 2010.

Prevalence by sector	Group A (Buenos Aires)		Group B (Montevideo)	
	%	95% CI	%	95% CI
Total with MIH	16.15	14.00; 18.50	12.30	9.80; 15.14
Private sector	24.74	18.80; 32.00	26.99	17.70; 38.60
Public sector	6.45	3.15; 10.90	7.13	2.42; 15.20

Source: Own elaboration.

*Weighted average.

Note: 95% CI = 95% confidence interval.

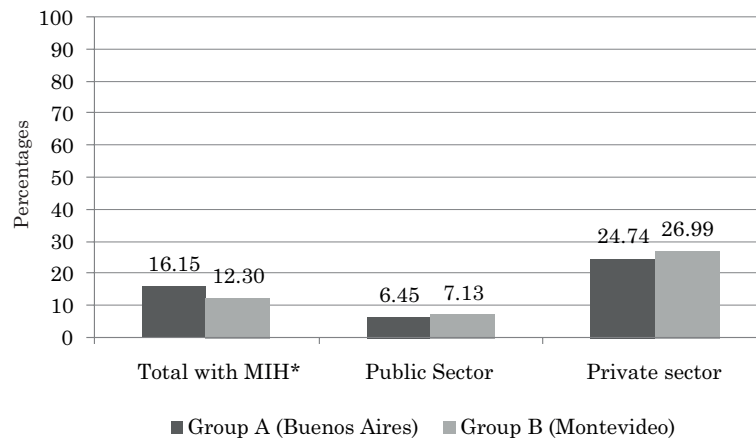


Figure 1. Prevalence of molarincisor hypomineralization (MIH) and distribution by dental care sector in groups A (Buenos Aires) and B (Montevideo), April-December, 2010.

Source: Own elaboration.

*Weighted average.

Table 2. Distribution of overall prevalence of molar-incisor hypomineralization (MIH) based on year of birth in groups A (Buenos Aires) and B (Montevideo), April-December, 2010.

Year of birth	Group A (Buenos Aires) %	Group B (Montevideo) %
1993	4.55	0.00
1994	3.39	5.26
1995	5.66	3.13
1996	4.65	12.90
1997	13.46	13.73
1998	8.76	7.69
1999	17.16	12.79
2000	22.75	14.61
2001	22.93	18.95
2002	21.31	8.14
2003	34.69	11.59

Source: Own elaboration.

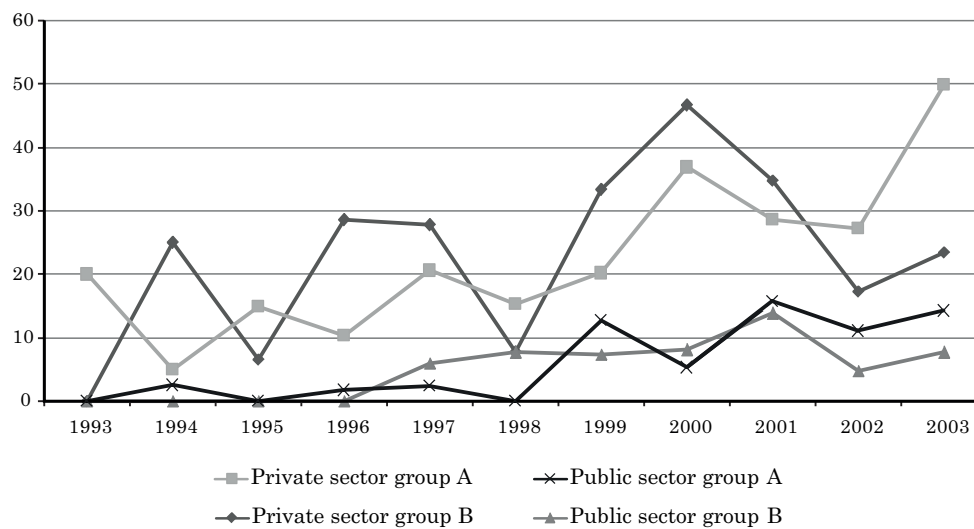


Figure 2. Distribution of molar-incisor hypomineralization (MIH) based on year of birth and dental care sector, in groups A (Buenos Aires) and B (Montevideo), April-December, 2010.

Source: Own elaboration.

0.79 and Montevideo: 0.73), with a statistical significance of $p=0.001$ and $p=0.005$ respectively.

For the variable “dental care institution,” there is a similar distribution of MIH according to year of birth in the cities of Buenos Aires and Montevideo (Figure 2).

DISCUSSION

Developmental enamel defects diagnosed as MIH are considered to be an emerging condition, which poses a challenge for Dentistry in relation to the condition’s diagnosis and difficult treatment as a consequence of its microstructural characteristics. The most severe injuries have a significant impact on treatment needs, frequently demanding complex restorative treatments (15,16). Prevalence values reported by several authors are heterogeneous and vary from 2.4% to 44% worldwide (17-26). The prevalence of MIH of 16.1% (12) reported in Buenos Aires and of 12.3% (13) in Montevideo, calculated using convenience sampling, showed lower values of prevalence than those reported by other researchers in Latin America, such as 16.8% in Chile by Jans *et al.* (6), and 19.8% by da Costa-Silva *et al.* (27) and 40.2% by Soviero *et al.* (28) in Brazil.

Jälevik *et al.* (17) warn about the increase in the prevalence of MIH in the last decade, (which was also observed in the results of the studies conducted in Buenos Aires and Montevideo), and recommend early diagnosis and encouraging researchers to study this clinical problem in depth. In a systematic review on prevalence and diagnosis of MIH published in 2010 by Jälevik (29), the methodological differences among the studies published by different authors are brought to light, such as diagnostic criteria, standardization of examiners, examination conditions, age groups, and social conditions of the groups included in the samples. In this study, data were collected at public universities located in the capital cities of countries within the same geographic region of South America (Argentina and Uruguay), where dental care is provided to children at social risk (30) and also at private dental offices where, generally, treatment is provided to children with a higher socioeconomic status. After a strict process

of calibration of examiners, samples meeting the same inclusion criteria were established. When analyzing these samples, it is observed that they were similar in terms of average age and gender proportion (Table 1). Although prevalence of MIH was lower in Montevideo, it is clear that the distribution of prevalence in terms of dental health care coverage (private or public sector) showed higher percentages in children treated in the private sector than in the public sector. It is necessary to highlight that the public sector was represented by the dental care services provided by two national schools of dentistry with appropriate equipment similar to the equipment at private offices, and with similar geographic locations. The difference between both sectors may be explained by the social condition of the population seeking dental care, considering that patients without health care coverage and with limited economic resources are the patients who receive public health care services. It is common for the population that attends private dental care institutions to do so for preventive purposes, without presenting clinical symptoms, and often for esthetic purposes as well. The results found in this study, regarding the socioeconomic status represented by the type of health care coverage, are similar to the results obtained by Balmer *et al.* (31) in the United Kingdom, which revealed that the prevalence of MIH was lower in children at higher social risk. The reasons presented by the authors, which may be applied to this study, would be related, on the one hand, to the fact that only children with four permanent molars were included in the study, recognizing that children of a lower socioeconomic status are exposed to a higher risk of having caries. Therefore, a greater amount of children treated in the public sector could have been excluded from the sample due to early tooth extractions. On the other hand, as Balmer suggests, a variable not considered was that of ethnic groups, given that in the public sector there is a larger number of immigrants. The etiopathogenesis of this condition still causes a great controversy among different authors worldwide; thus, it will be necessary to carry out studies considering these variables in the future.

Although the European Academy of Paediatric Dentistry (EAPD) (32) recommended the age of 8 years old for the evaluation of MIH in 2003, it is common that, at that age, all the incisors have not

erupted yet. Therefore, in this study, the inclusion criterion was not the age but the total number of permanent molars and incisors among children born during a period of time. In this study, the samples were analyzed according to the year of birth, considering the results obtained in different age groups and in agreement with the recommendations by Jälevik in 2010 about specifying the prevalence in each age group separately. Regarding the year of birth, results of MIH prevalence revealed a similar distribution in both cities and a higher prevalence of MIH in children born between 2000 and 2001 (2000 in the private sector and 2001 in the public sector), as clearly shown in Figure 2. It is possible that older children suffering from MIH were excluded from the sample for having lost their molars or having crowns as a consequence of this condition (33,34).

CONCLUSIONS

The results of this study showed that MIH is an emerging condition and that patients with access to private health care have a greater prevalence of MIH. No significant differences were found when comparing gender and age distribution, but there was a positive correlation regarding the year of birth. The relevance of MIH as an emerging condition makes it necessary to carry out studies with greater population representation in the sample and to design new research studies based on hypotheses that relates this condition to associated factors.

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