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SHORT COMMUNICATION

Defining the Prevalence of Molar Incisor Hypomineralization in Brazil

Fernanda Mafei Félix da Silva[1], Yuqiao Zhou[2], Fernanda Gabriela de Fátima Vieira[1], Flávia Martinez de Carvalho[3,4], Marcelo de Castro Costa[1], Alexandre Rezende Vieira[2]

[1]Department of Paediatric Dentistry and Orthodontics, School of Dentistry, Federal University of Rio de Janeiro, Rio de Janeiro, RJ, Brazil.
[2]Department of Oral Biology, School of Dental Medicine, University of Pittsburgh, Pittsburgh, USA.
[3]Laboratory of Congenital Malformation Epidemiology, Oswaldo Cruz Institute, Rio de Janeiro, RJ, Brazil.
[4]Latin American Collaborative Study of Congenital Malformations, National Institute of Population Medical Genetics, Rio de Janeiro, RJ, Brazil.

Author to whom correspondence should be addressed: Alexandre Rezende Vieira, University of Pittsburgh, 335 Sutherland Dr. Pittsburgh, PA, USA. 15261. Phone: +1 412 383-8972. E-mail: alexandre_vieira@pitt.edu.

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Abstract

Objective: To define the prevalence of Molar Incisor Hypomineralization (MIH) in Brazil since the reports ranged from 2.5% to 40.2%. **Material and Methods:** We studied 407 children from 7 to 14 years of age. MIH was measured using the European Academy of Paediatric Dentistry criteria of 2003. Clinical data were collected by a calibrated dentist (Kappa=0.88) and included affected teeth and degree of MIH severity (mild/severe). Mild MIH cases were considered when the tooth presented demarcated opacity ≥ 1.0mm, without any loss of structure. While severe cases were defined by teeth in which loss of structure was present, or past or current lesion that required treatment, or presence of atypical restorations. In addition, published data (nine studies) reporting MIH in Brazilians were identified, and the heterogeneity of these studies was tested (I2 index/ p≤0.01). **Results:** In the original sample studied, the majority of patients were males (55.3%; n = 225), with an average age of 10.1 years (± 2.1 years). The prevalence of MIH in this group was 14.5% (59 affected in 407), and most of the affected teeth had a mild degree of alteration (77.4% or 202 in 261 teeth). **Conclusion:** A meta-analysis including nine published reports, and our original data showed that MIH prevalence in Brazil is 13.48 (95% CI, 8.66% -18.31%).

Keywords: Dental Enamel Hypoplasia; Molar; Prevalence; Cross-Sectional Studies.

Introduction

Molar Incisor Hypomineralization (MIH) is defined as a qualitative enamel defect that occurs during different stages of amelogenesis [1]. This condition usually affects at least one of the first permanent molars and may be associated with permanent incisors [2]. However, some studies report the association of MIH with permanent canines and primary second molars [3,4].

Disturbances during pregnancy, severe infections, the frequent use of antibiotics in childhood [5], and other exposures [6] have been investigated as etiologic factors and the genetics play role [7]. One of the main characteristics of MIH is enamel porosity and opacity, which may vary from white/yellowish to brown [2]. In some cases, MIH may cause the loss of tooth structure, resulting in functional (pain, tooth sensitivity and dental caries), and aesthetic problems for the individual [8].

It is suggested that the diagnosis of MIH should be performed on clean and wet teeth, and epidemiological studies of MIH should be based on 8-year-olds since, at this age, all permanent molars and incisors have erupted [2,9]. Likely due to different criteria of diagnosis, the prevalence of MIH varies considerably in different parts of the world ranging from 2.4 to 37% in European countries [10-12], 2.5% in China [13], and 2.5% to 40% [14-17] across Brazil. Due to these facts, the present study aimed to define the prevalence of MIH in Brazilians, which shows the widest range reported in the literature.

Material and Methods

Sample and Calibration

A sample consisting of 407 individuals of both sexes from 7 to 14 years of age treated at the Paediatric Dentistry. The inclusion criteria for this study was the patients having all first permanent molars erupted. Children with syndromes known to affect the enamel development were not included in the study.

To assess the intra-examiner reliability, an exercise was first applied to the examiner (F.M.F.S) and the gold standard evaluator (M.C.C.). Twenty clinical pictures of dental enamel defects (eight with MIH) were shown to the two individuals. Two weeks after the first assessment, a new assessment was carried out with the examiner, and the resulting Kappa was 0.88.

Clinical Examination

The clinical examination was performed by the calibrated dentist (F.M.F.S) carried out with a mirror and a probe in the dental chair using artificial light. MIH was evaluated using the European Academy of Paediatric Dentistry (EAPD) [2,9]. Mild MIH cases were considered when the tooth presented demarcated opacity ≥ 1.0mm, without any loss of structure. While severe cases were defined by teeth in which loss of structure was present, or past or current lesion that required treatment, or presence of atypical restorations [2]. The study included 225 males (55.3%) and 182 (44.7%) females, with an average age of 10 years.

Bibliographic Sources

A database search was performed in PubMed, Lilacs (Latin American and Caribbean Health Sciences Literature) and BBO (Brazilian Bibliography of Dentistry) using the following terms: "Dental Enamel Hypoplasia", "Molar Incisor Hypomineralization", "MIH", Hypomineralization Molar Incisor", "First permanent molars and incisors", "Prevalence", "Epidemiology", "Epidemiol" and "Brazil". A total of 383 references were identified and after excluding the publications that did not report denominators to allow calculation of frequencies, case reports, and studies that included the same sample of other publications, nine articles were selected (Table 1).

Table 1. Characteristics of the articles (MIH study location, prevalence, and diagnostic criteria).

Author and Year	City (State)	Type of Study	Sample	Age/Years	Calibration/Kappa	Prevalence MIH%	Diagnostic Criteria
Soviero et al., 2009 [17]	Rio de Janeiro (RJ)	Cross-Sectional	249	7-13	0.80/0.90/0.96 Theoretical + Clinical Examination	40.2	EAPD (2003) Koch (2001) Opacity (-----)
Costa Silva et al., 2010 [8]	Botelhos (MG)	Cross-Sectional	918	6-12	0.91 Photographs	19.8	EAPD (2003) Opacity >1.0mm
Jeremias et al., 2013 [7]	Araraquara (SP)	Cross-Sectional	1.157	6-12	0.91	12.3	EAPD (2003) Opacity >2.0mm
Hanan et al., 2015 [18]	Manus (AM)	Cross-Sectional	2.062	6-10	0.87 Clinical Examination	9.12	EAPD (2003) Opacity >2.0mm
Rodrigues et al., 2015 [19]	São Luis (MA)	Cross-Sectional	1.179	7-14	0.91 Photographs	2.5	EAPD (2003) Opacity >2.0mm
Silva Junior et al., 2015 [14]	Belém (PA)	Cross-Sectional	260	5-17	0.7 Clinical Examination	8.84	EAPD (2003) Opacity >2.0mm
Lima et al., 2016 [20]	Teresina (PI)	Cross-Sectional	594	11-14	0.91 Theoretical + Clinical Examination	18.4	EADP (2003) Opacity >1.0mm
Tourino et al., 2016 [21]	Lavras (MG)	Cross-Sectional	1.181	8-9	0.96 Theoretical + Photographs + Clinical examination	20.4	EADP (2003) Opacity >1.0mm
Costa Silva et al., 2017 [16]	Botelhos (MG)	Prospective Cohort	142	5-6	0.93 Theoretical + Photographs	16.1	EADP (2003) Opacity >1.0mm

Statistical Analysis

Data were analyzed using SPSS version 20.0 (Statistical Package for Social Sciences, SPSS Inc., Chicago, III). Chi-square, with a significance level set at 5%, was used to compare the MIH distribution by sex. The prevalence estimates from the literature were pooled together using random-effects meta-analysis that accounted for between-study heterogeneity. Statistical heterogeneity (RevMan) was assessed by the chi-square test on Q statistic, which was quantified by the I-square values. I-square values of 25, 50, and 75% were nominally assigned as low, moderate, and high estimates, respectively.

Ethical Aspects

This study was performed after approval from the local Ethics Committee for Research Hospital Universitário Clementino Fraga Filho (Protocol No. 44598514.7.00005257). All subjects/guardians read and signed a written informed consent before their participation in the study.

Results

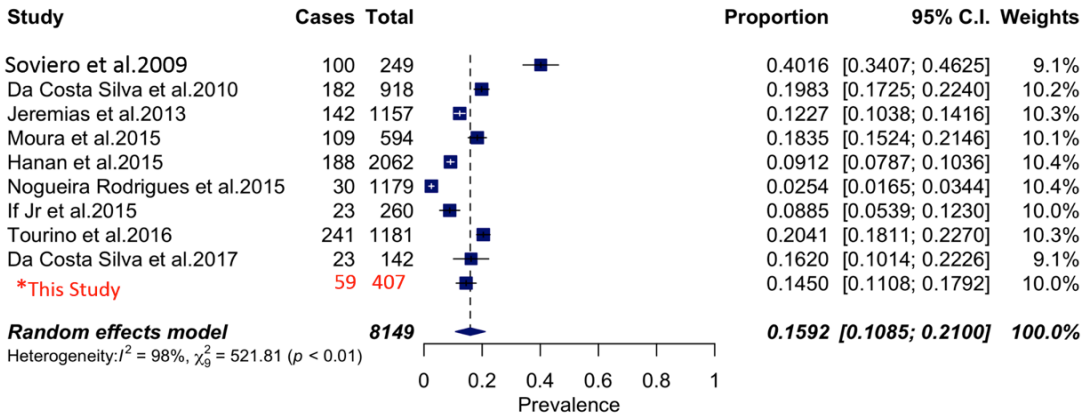
The prevalence of MIH in the studied sample was 14.5 % (59 affected in 407 individuals studied), and there was no statistically significant difference in MIH affection by sex (p=0.914).

A total of 261 teeth were affected by MIH, 33% of them (n=86) were first permanent maxillary molars, 28.3% (n= 74) first permanent mandibular molars, 22.2% (n=58) permanent maxillary incisors, and 16.5% (n=43) permanent mandibular incisors. According to the degree of severity, it was observed that most teeth were mildly affected by MIH (77.4%; 202 in 261 affected teeth). Among the most severely affected teeth, most of them were first permanent molars (84.7%; 50 in 160 affected molars) (Table 2).

Table 2. Characteristics of the MIH group.

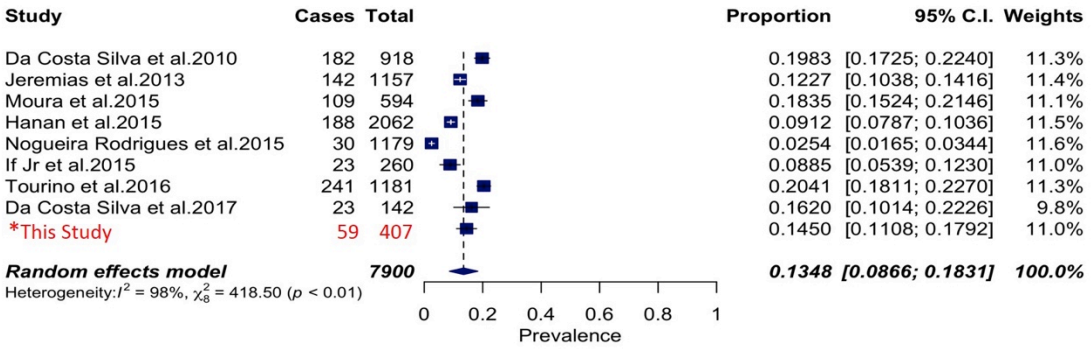
Variables	MIH Group (n=59)	
Mean Age (SD)	10.15 (±1.5)	
Sex	N (%)	
Male	33 (55.9)	
Female	26 (41.1)	
Teeth Affected by MIH	Mild	Severe
	N (%)	N (%)
Permanent Maxillary Central Incisors	38 (18.1)	6 (10.2)
Permanent Maxillary Lateral Incisors	13 (6.4)	1 (1.6)
Permanent Mandibular Central Incisors	26 (13)	1 (1.6)
Permanent Mandibular Lateral Incisors	15 (7.5)	1 (1.6)
Firs Permanent Maxillary Molars	64 (32.)	22 (37.4)
First Permanent Mandibular Molars	46 (23.)	28 (47.6)
Total	202 (77.4)	59 (22.6)

Meta-analysis was performed on data from nine articles results in addition to our original data. Figure 1 shows the estimates of MIH reported by the ten studies, which yielded a summary prevalence of 15.92 (95% CI, 10.85%–21.00%) with significant evidence of between study heterogeneity ($Q = 521.81$, $p<0.01$, $I2 = 98$) (Figure 1). In an attempt to reduce heterogeneity, the sensitivity analysis was performed by removing the study that reported a different clinical diagnostic (the size of the lesions was not taken into consideration and used two methods for diagnostics). The new estimate was 13.48 (95% CI, 8.66% -18.31%) (Figure 2).



*The new prevalence study of MIH.

Figure 1. Plot MIH of prevalence with a new result.



*The new prevalence study of MIH.

Figure 2. Plot MIH of prevalence without Soviero et al. [17].

Discussion

There is great interest in understanding why MIH occurs, but this is a difficult task if we do not have even a decent estimate of the prevalence of the condition. However, it is notable that over the years, prevalence studies of MIH have been increasing mainly in Brazil.

The prevalence of MIH in the present study was 14.5%, which was consistent with most of the literature [22,23]. Not surprising, the prevalence estimate in our sample is close to the one found in the city of São Paulo (12.3%) [15], which is just 400 kilometers from downtown Rio de Janeiro. This may also be due to the diagnostic criteria that was similar among these studies. The frequency in the north-eastern region of Brazil appears to be lower [18,14]. This may be due to the inclusion of opacities greater than 2 mm in studies conducted in the region, which makes it more a strict criterion.

The meta-analysis showed high heterogeneity among the studies included. This is probably related to the use of different indexes, diagnostic criteria, and age groups. All selected articles had their examiners calibrated, but in different types of photographic training, clinical examination, or both. Eight studies, included our original data, used the same diagnostic criteria. Some studies included in the meta-analysis [14,19,20],

except for one [16], reported lower prevalence compared to our study, probably because they considered only opacities that were larger than 2 millimeters of diameter.

In our sample, most cases had mild MIH, although more than 50% of affected teeth were first permanent molars with some degree of loss of structure. Such cases can have discomfort, caries lesion development, and esthetic concerns [14]. Prevalence studies are important to help formulate strategies to prevent or reduce the possibility of the consequences of MIH.

Conclusion

The prevalence of MIH in Brazilians is 13.48 (95% CI, 8.66% -18.31%).

Authors' Contributions

FMFS	0000-0003-3247-7746	Conceptualization, Methodology, Investigation, Writing – Original Draft Preparation and Writing – Review and Editing.
YZ	0000-0001-9450-4055	Validation, Formal Analysis and Writing – Review and Editing.
FGFV	0000-0001-9437-1715	Investigation and Writing – Review and Editing.
FMC	0000-0003-2617-9689	Formal Analysis and Writing – Review and Editing.
MCC	0000-0003-2192-1960	Formal Analysis and Writing – Review and Editing.
ARV	0000-0003-3392-6881	Conceptualization, Methodology, Formal Analysis, Writing – Original Draft Preparation and Writing – Review and Editing.

All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

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