

Oral health-related quality of life in Colombian children with Molar-Incisor Hypomineralization

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ABSTRACT

The aim of this study was to assess the impact of Molar-Incisor Hypomineralization (MIH) on Oral Health-Related Quality of Life (OHRQoL) in schoolchildren from a public educational institution in Bucaramanga, Colombia. Eighty-eight 7- to 10-year-olds took part in the study; of whom half had MIH. The translated and adapted version of the Child Perceptions Questionnaire (CPQ 8-10) was applied by means of an interview. The dependent variable was OHRQoL and explanatory variables were presence and severity of MIH, sex, age, socioeconomic status and social security. Frequencies and proportions were calculated for qualitative variables, and measures of central tendency, dispersion and position were calculated for quantitative variables. Chi-square, Fisher's Exact Test, Mann-Whitney U Test and Kruskal-Wallis tests

were used, as appropriate. A p -value < 0.05 was considered statistically significant. Parents or caregivers of participating children signed informed consent, and children signed an assent. A statistically significant difference was found for age groups ($p < 0.001$), socioeconomic status ($p = 0.015$) and social security ($p = 0.045$) according to the presence of MIH. Likewise, statistically significant differences were found for each of the four domains of the questionnaire and for the overall CPQ 8-10 score ($p < 0.0001$) according to the presence of MIH. The presence of the Molar-Incisor Hypomineralization may have negative impact on the Oral Health-Related Quality of Life of the participating children.

Key words: Quality of Life, Dental enamel hypoplasia, Oral health, Tooth demineralization.

Calidad de vida relacionada con la salud oral en niños Colombianos con Hipomineralización Inciso- Molar

Resumen

El objetivo de este trabajo fue evaluar el impacto de la Hipomineralización Inciso Molar sobre la Calidad de Vida Relacionada con la Salud Oral (CVRSO) en escolares vinculados con una institución educativa pública de Bucaramanga, Colombia. Ochenta y ocho menores de 7 a 10 años hicieron parte del estudio, la mitad presentaba HIM; a todos se les aplicó la versión traducida y adaptada del Child Perceptions Questionnaire (CPQ 8-10) mediante entrevista. La variable de salida fue la CVRSO y las variables explicatorias, la presencia y severidad de HIM, el género, la edad, el estrato socioeconómico y la seguridad social. Se calcularon frecuencias y proporciones para las variables cualitativas, y medidas de tendencia central, dispersión y posición para las cuantitativas. Se utilizaron las pruebas χ^2 , Test Exacto de Fisher, U. de Mann Whitney y Kruskal-Wallis según fuera apropiado. Un valor de $p < 0,05$ fue considerado

estadísticamente significativo. Los padres o cuidadores de los menores participantes firmaron un consentimiento informado y los niños y niñas, un asentimiento. Se encontró una diferencia estadísticamente significativa en los grupos de edad ($p < 0,001$), el estrato socioeconómico ($p = 0,015$), y la seguridad social ($p = 0,045$) según la presencia de HIM. Así mismo, se obtuvo una diferencia estadísticamente significativa en cada uno de los cuatro dominios del cuestionario y en el puntaje global del CPQ 8-10 ($p < 0,0001$) de acuerdo con la presencia de HIM. Según las percepciones de los participantes al responder al CPQ 8-10, se podría sugerir la presencia de la Hipomineralización Inciso Molar influye de forma negativa sobre la Calidad de Vida Relacionada con la Salud Oral en los niños participantes.

Palabras clave: Calidad de vida, Hipoplasia del esmalte dental, Salud bucal, Desmineralización dental.

INTRODUCTION

Quality of Life (QoL) is defined as the perception of wellbeing and subjective, personal manifestation of feeling well within the cultural and social context in

which one lives. According to the World Health Organization (WHO) it is influenced in a complex way by physical health, psychological status, social relationships and relationship with essential elements

in the environment, among others¹. Oral health also affects QoL, with major impact on physical, psychological and social aspects. This is especially true for children, who are undergoing physical, mental and social growth, which is why some papers claim that oral diseases can have negative impact on children's QoL, in contrast to children who do not have any oral pathology^{2,3}.

Developmental Defects of Enamel (DDE) have been reported to impact QoL because they affect both aesthetics and function. These effects include Molar-Incisor Hypomineralization (MIH), defined as a hypomineralized lesion of the enamel as a result of different causes, mainly affecting permanent first molars and frequently associated to similar lesions on upper and/or lower permanent incisors, which causes deterioration and destruction of affected teeth because the enamel is fragile, and depending on the severity, may cause teeth to be lost^{4,5}. MIH on permanent incisors compromises aesthetics and MIH on first molars alters the eruption guide for other molars, and hence, occlusion^{4,6}.

Masticatory function is also altered, since depending on how severely the enamel is affected and the forces applied during mastication, dental wear and fractures may cause dentin to be exposed, with subsequent tooth sensitivity⁷. This leads to the child brushing their teeth less and thereby having inappropriate hygiene, leading to greater susceptibility to carious lesions and increasing deterioration of affected teeth^{8,9}. MIH also creates a dental clinical problem because it is difficult to eliminate dental sensitivity, and it causes marginal degradation of restorations due to lack of adequate

adhesion between tooth structure and restorative material^{4,10}.

In 2003, Weerheijm et al. proposed the criteria used by the European Academy of Paediatric Dentistry (EAPD), identifying lesions according to: presence or absence of demarcated opacity, posteruptive breakdown, atypical restoration, premature extraction of first molars due to MIH, failure of eruption of a molar or incisor¹¹. In 2006, Mathu-Mujuy and Wright¹² classified MIH as mild, moderate or severe. Many other classifications have been developed considering the severity, size, depth and extent of hypomineralization¹³. This lack of uniformity for diagnosing the lesion has meant that the results of studies are not consistent and not comparable epidemiologically⁶. Considering this situation, reports on prevalence of MIH differ widely among populations. Table 1 shows the values reported in some studies^{7,14-22}.

As mentioned above, MIH affects Oral Health-Related Quality of Life (OHRQoL). Dantas-Neta et al. (2016) evaluated perception of OHRQoL in 594 schoolchildren and their parents by applying the *Child Perceptions Questionnaire* (CPQ 11-14) and the *Parental-Caregiver Perceptions Questionnaire* (P-CPQ). They found that there was a negative impact in the domains of "oral symptoms" [RR 1.30 CI 95% 1.06 – 1.60] and "functional limitation" [RR 1.42 CI 95% 1.08 – 1.86] in schoolchildren with severe MIH compared to those without MIH²³. Arrow applied the *Parental Perceptions Questionnaire* (PPQ) to parents of 522 children and found no association between OHRQoL and Developmental Defects of Enamel (DDE) in first

Table 1: Evaluation criteria and prevalence of MIH.

Author, year	Country, city	Sample	Criterion	Prevalence
Murrieta-Pruneda et al., 2016 ¹⁴	Mexico, Mexico City	435	EAPD	13.9%
Escobar et al., 2015 ¹⁵	Colombia, Medellin	1075	EAPD	11.2%
Oyedele et al., 2015 ¹⁶	Nigeria, Ile Ife	469	EAPD	17.7%
Ng et al., 2015 ¹⁷	Singapore	1083	EAPD	12.5%
De Lima et al., 2015 ¹⁸	Brazil, Teresina	594	EAPD	18.4%
Bhaskar & Hedge, 2014 ¹⁹	India, Udaipur	1173	EAPD	9.5%
Garcia-Margarit et al., 2013 ²⁰	Spain, Valencia	840	EAPD	21.8%
Biondi et al., 2012 ²¹	Argentina, Buenos Aires	1098	DDE Index	15.8%
Da Costa-Silva et al, 2010 ⁷	Brazil, Botelhos	918	EAPD	19.8%
Calderara et al., 2005 ²²	Italy, Lissone	227	Weerheijm et al., 2001	13.7%

permanent molars²⁴. In this regard, it is important to mention that Arrow did not discriminate these defects in MIH and that it is not a good idea to use parents' answers as a proxy because their view may be based on external factors unrelated to what the child feels²⁵.

Since few studies have been published on the influence of Molar-Incisor Hypomineralization on Oral Health-Related Quality of Life in children, the aim of this study was to evaluate this relationship by applying the Colombian version of the *Child Perceptions Questionnaire* (CPQ 8-10) to children attending a public school in the city of Bucaramanga (Colombia).

MATERIALS AND METHODS

An analytical observational cross-sectional study was performed, with non-probability sampling of 88 7 to 10 year-old schoolchildren from a public educational institution in the city of Bucaramanga. Bucaramanga is the capital of the department of Santander, located in north-east Colombia, and considered in the July-September 2016 quarter to be the city with lowest unemployment in the country²⁶.

The sample was calculated using the OpenEpi software version 3.1 with 97% confidence and 5% type I error based on a population of 928 students, and expected prevalence of 5.4% according to a study performed in the city of Medellín (Colombia)^{27,28}. Participants were selected by convenience sampling to ensure equitable, proportional representation, with half the sample with MIH and the other half without MIH. Schoolchildren in this age range (7 to 10 years) were included because their permanent first molars and incisors have erupted. Children with systemic compromise, physical or mental disability, severe malocclusions, presence of fixed orthodontic appliances, teeth with cavities, fillings in first molars and incisors, and teeth with enamel developmental defects other than MIH (enamel fluorosis, amelogenesis imperfect) were excluded.

Output variable was Oral Health-Related Quality of Life evaluated by the CPQ 8-10. Explanatory variables were presence and severity of MIH, sex, socioeconomic level (tool to classify housing according to the National Statistics Administrative Department in Colombia) and type of social security.

Clinical examination

Dental clinical examination was performed at the school nurse's office by an examiner previously calibrated by an expert (Cohen's Kappa coefficient = 0.68). Children brushed their teeth, after which presence/absence (yes/no) of MIH and its severity were evaluated following the criteria of Mathu-Muju and Wright¹². MIH was considered present when at least one affected molar was found according to the guidelines proposed by the EAPD¹¹. It is important to note that dental hypersensitivity was not investigated. Inspection was performed using mouth mirror, gauze for drying, tongue depressor and very good lighting. Children without MIH were selected as controls.

Evaluation of Oral Health-Related Quality of Life

The version of the Child Perceptions Questionnaire (CPQ 8-10) created by Jokovic et al.^{29,30} and translated and adapted to Colombian Spanish was used. It consists of 25 questions divided into four domains: "oral symptoms" (five items), "functional limitation" (five items), "emotional wellbeing" (five items) and "social wellbeing" (10 items). Answer options are arranged on a Likert scale with five categories: 0 = never, 1 = once or twice, 2 = sometimes, 3 = often, and 4 = nearly every day. The CPQ 8-10 was applied in an interview. The closer the score was to zero, the better oral health-related quality of life was considered to exist.

In addition, socio-demographic information was collected by means of a questionnaire sent to children's parents or caregivers.

Statistical analysis

The information collected was entered in duplicate to an Excel database to be validated subsequently in EpiData 3.1. The fully refined database was exported to the Stata IC 12.0 statistical package³¹⁻³³. Univariate analysis was used to calculate central tendency values and dispersion for quantitative variables. Frequency tables were made for categorical variables. Bivariate analysis was used to analyze presence of MIH with relation to sex, age, socioeconomic status and social security by means of Chi-square or Fisher's exact test. The distribution of each domain in the questionnaire was reviewed and the mean score for each domain and total questionnaire score were calculated to be associated

with presence of MIH and sex using Mann-Whitney's test. The Kruskal-Wallis test was used to establish association between questionnaire domains and MIH degree of severity. A value of $p < 0.05$ was considered statistically significant.

Ethical considerations

This study was classified as “*research with minimum risk*” according to Resolution 8430 of October 1993 which establishes the scientific, technical and administrative standards for health research in Colombia³⁴. In addition, it was approved by the Research Ethics Committee of Universidad Santo Tomás. Authorization was requested from the school, and participants' parents signed an informed consent after receiving an explanation of the aim and procedure of the study. Children were asked for assent to participate. The principles of autonomy, beneficence, justice and non-maleficence were observed.

RESULTS

Half of the 88 children in the sample had MIH. Forty-seven (47; 53.4%) were female. Average age was 8.6 ± 1.2 years [CI 95% 8.4 – 8.9]. Average age was 8.8 ± 1.2 years for males and 8.5 ± 1.1 years for females; with no statistically significant difference for age according to sex ($p = 0.3167$). Table 2 shows the demographics of the study population according

to presence of MIH. A statistically significant difference ($p < 0.001$) was found according to age group, with a higher proportion of 7- to 8-year-olds having MIH.

Average CPQ 8-10 score for participants with MIH was 17.4 ± 14.1 [CI 95% 13.1-21.7] (Median = 12.5), ranging from 2 to 57. Average overall score for the questionnaire in children without MIH was 4.3 ± 4.1 [CI 95% 3.1 – 5.6] (Median = 4.0), ranging from 0 to 22. There was a statistically significant difference between groups ($p < 0.0001$).

Table 3 shows Median (Me) and Interquartile Range (IQR) for the scores in each dimension and for the overall questionnaire according to presence of MIH. Median score was 2.0 or higher for all domains when children had MIH.

Median score for the full questionnaire according to presence of MIH and sex was higher in females, regardless of presence of MIH. However, the difference was not statistically significant (Fig. 1). For MIH severity, 24 (54.6%) of the children had moderate severity (demarcated opacities on the occlusal/incisal third without breakdown, post-eruptive loss of enamel or carious lesions limited to one or two zones, without participation of cusps). There were 16 (33.4%) cases of isolated opacities without loss of dentin in these areas (mild). There was no statistically significant difference in CPQ 8-10 scores according to severity ($p = 0.4420$) (Table 4).

Table 2: Sample demographics according to presence of MIH (n=88).

Variables	With MIH n (%)	Without MIH n (%)	P
Sex			0.831 ^a
Female	23 (52.3)	24 (54.5)	
Male	21 (47.7)	20 (45.5)	
Age			<0.001 ^b
7	14 (31.8)	6 (13.6)	
8	14 (31.8)	5 (11.4)	
9	3 (6.8)	18 (40.9)	
10	13 (29.6)	15 (34.1)	
Socioeconomic status			0.015 ^b
1	4 (9.1)	13 (29.6)	
2	28 (63.6)	15 (34.1)	
3	11 (25.0)	13 (29.6)	
4	1 (2.3)	3 (6.8)	
Social security			0.045 ^b
Subsidiated	31 (70.5)	21 (47.7)	
Contributive	10 (22.7)	13 (29.6)	
Prepaid medical care	3 (6.8)	10 (22.7)	

a: Chi-square test. b: Fisher's exact test
Statistical significance $p < 0.05$

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a: Chi-square test. b: Fisher's exact test
Statistical significance p<0.05

Table 3: Median and interquartile range for scores in each domain and full questionnaire according to presence of MIH.

DOMAIN (items)	With MIH Me (IQR)	Without MIH Me (IQR)	P
Oral symptoms (5)	5.0 (3.0)	1.0 (1.0)	<0.0001
Functional limitation (5)	2.0 (4.5)	0.0 (1.0)	0.0003
Emotional wellbeing (5)	4.0 (6.5)	0.0 (1.0)	<0.0001
Social wellbeing (10)	2.0 (5.5)	0.0 (2.0)	0.0005
Total CPQ (25)	12.5 (17)	4.0 (3.5)	<0.0001

Me: Median. IQR: Interquartile range.
Wilcoxon Rank-sum (Mann-Whitney) Test.

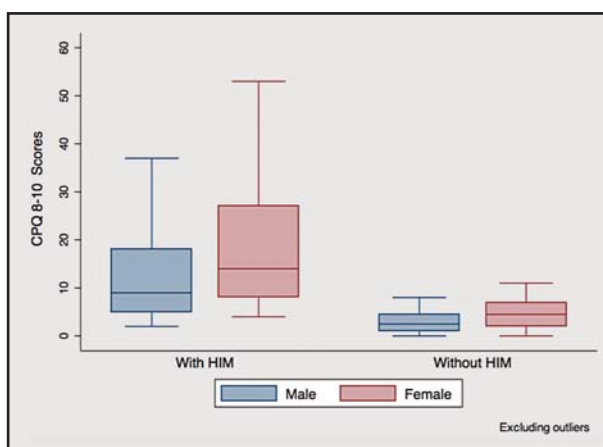


Fig. 1: Mean and interquartile range for CPQ 8-10 scores according to presence of MIH and sex.

DISCUSSION

Presence of Molar-Incisor Hypomineralization affected Oral Health-Related Quality of Life in the children who participated in the study. This is in agreement with Oyedele et al.⁸ who report that children with MIH presented a series of associated entities such as dental caries, dentin hypersensitivity and aesthetic compromise, which have a negative influence on OHRQoL.

Dantas-Neta et al. report that severe MIH was found to have a negative impact on OHRQoL when the *Child Perceptions Questionnaire* (CPQ 11-14) was applied to a population of 594 11- to 14-year-old schoolchildren; with Risk Ratio (RR) 1.30 [CI 95% 1.06 – 1.60] in the domain “oral symptoms” and RR

1.42 [CI 95% 1.08 – 1.86] in the domain “functional limitation”²³. It is important to note that participant age was higher in that study than in ours, considering that it has been suggested that untreated MIH worsens with age due to plaque accumulation, hypersensitivity, enamel breakdown and dental caries⁴. Vargas-Ferreira and Ardenghi³⁵ also found association between the dimension “functional limitation” in CPQ 11-14 and enamel defects. In contrast, Arrow³⁶ applied the CPQ 11-14 to children with enamel defects in first molars and found no effect on OHRQoL, although there was association with presence of dental caries. We found that MIH affected females more than males, considering that the CPQ 8-10 score were higher for females. This has also been reported by other authors^{23,37}. Girls are considered to be more concerned with their personal appearance and self-perception³⁶.

Socioeconomic status and type of social security revealed a statistically significant difference between participants with and without MIH. A higher proportion of children with MIH had low socioeconomic status and used the social security system subsidized by the Colombian State. Dantas-Neta et al²³ related low socioeconomic status with children’s difficulty to access to oral hygiene products and information, as well as timely dental care, with a negative impact on Oral Health-Related Quality of Life. These variables are therefore considered to be confounding because they are directly related to the OHRQoL, as reported. As mentioned above, one of the difficulties in comparing results is the variation in methods used

to identify hypomineralization, as it is included in the Defects in Development of Enamel (DDE) classification³⁸⁻⁴⁰. In addition, there is influence of age difference between populations evaluated, the ways in which clinical examination is performed, and recording methods⁶. It should be noted that the European Academy of Paediatric Dentistry suggests taking into account its recommendations to determine presence of MIH¹¹.

In participants with MIH, severity did not differ statistically between groups with relation to the four domains of the questionnaire and overall score, possibly because very few participants (less than 10%) presented degree of severity 3. Nevertheless, the median score for the whole questionnaire for this group was slightly lower than the score for the group with severity 2 (Me=14.0 vs. Me=15.5).

This study has some limitations. Participants were selected for convenience, so the results found cannot be generalized. In addition, the population study was from a public educational institution that did not include all socioeconomic levels, and participation of children with dental caries lesions was restricted. Among the strengths of the study, it is one of the few studies evaluating OHRQoL in children with MIH. Moreover, the clinical examination was performed carefully by a calibrated examiner, and children’s age was appropriate for evaluation of MIH⁶.

According to the results, it may be concluded that presence of MIH in 7- to 10-year-olds has negative impact on all dimensions of OHRQoL as reflected by the CPQ 8-10.

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