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

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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 others\(^1\). 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 sensitivity\(^7\). 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\(^10\).

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, post-eruptive breakdown, atypical restoration, premature extraction of first molars due to MIH, failure of eruption of a molar or incisor\(^11\). In 2006, Mathu-Mujuy and Wright\(^12\) classified MIH as mild, moderate or severe. Many other classifications have been developed considering the severity, size, depth and extent of hypomineralization\(^13\). This lack of uniformity for diagnosing the lesion has meant that the results of studies are not consistent and not comparable epidemiologically\(^6\). 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 MIH\(^23\). 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>
<thead>
<tr>
<th>Author, year</th>
<th>Country, city</th>
<th>Sample</th>
<th>Criterion</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murrieta-Pruneda et al., 2016(^14)</td>
<td>Mexico, Mexico City</td>
<td>435</td>
<td>EAPD</td>
<td>13.9%</td>
</tr>
<tr>
<td>Escobar et al., 2015(^15)</td>
<td>Colombia, Medellin</td>
<td>1075</td>
<td>EAPD</td>
<td>11.2%</td>
</tr>
<tr>
<td>Oyedele et al., 2015(^16)</td>
<td>Nigeria, Ile Ife</td>
<td>469</td>
<td>EAPD</td>
<td>17.7%</td>
</tr>
<tr>
<td>Ng et al., 2015(^17)</td>
<td>Singapore</td>
<td>1083</td>
<td>EAPD</td>
<td>12.5%</td>
</tr>
<tr>
<td>De Lima et al., 2015(^18)</td>
<td>Brazil, Teresina</td>
<td>594</td>
<td>EAPD</td>
<td>18.4%</td>
</tr>
<tr>
<td>Bhaskar &amp; Hedge, 2014(^19)</td>
<td>India, Udaipur</td>
<td>1173</td>
<td>EAPD</td>
<td>9.5%</td>
</tr>
<tr>
<td>Garcia-Margarit et al., 2013(^20)</td>
<td>Spain, Valencia</td>
<td>840</td>
<td>EAPD</td>
<td>21.8%</td>
</tr>
<tr>
<td>Biondi et al., 2012(^21)</td>
<td>Argentina, Buenos Aires</td>
<td>1098</td>
<td>DDE Index</td>
<td>15.8%</td>
</tr>
<tr>
<td>Da Costa-Silva et al, 2010(^22)</td>
<td>Brazil, Botelhos</td>
<td>918</td>
<td>EAPD</td>
<td>19.8%</td>
</tr>
<tr>
<td>Calderara et al., 2005(^22)</td>
<td>Italy, Lissone</td>
<td>227</td>
<td>Weerheijm et al., 2001</td>
<td>13.7%</td>
</tr>
</tbody>
</table>
permanent molars. 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 feels.

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 country.

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). 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 Wright. MIH was considered present when at least one affected molar was found according to the guidelines proposed by the EAPD. 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. 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 package. 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 Colombia. 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.

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).
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 caries\(^{4}\). Vargas-Ferreira and Ardenghi\(^{35}\) also found association between the dimension “functional limitation” in CPQ 11-14 and enamel defects. In contrast, Arrow\(^{36}\) 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-perception\(^{36}\).

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 al\(^{23}\) 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) classification\(^{38-40}\). In addition, there is influence of age difference between populations evaluated, the ways in which clinical examination is performed, and recording methods\(^{6}\). It should be noted that the European Academy of Paediatric Dentistry suggests taking into account its recommendations to determine presence of MIH\(^{11}\).

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 MIH\(^{6}\).

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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REFERENCES