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**ORIGINAL ARTICLE**

# Impact of Molar Incisor Hypomineralization on Oral Health-Related Quality of Life in Brazilian Schoolchildren Aged 8 to 10 Years

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**ABSTRACT**

**Objective:** To assess the impact of Molar Incisor Hypomineralization (MIH) and confounding factors on oral health-related quality of life (OHRQoL) according to the perception of 8 to 10-year-old children and their parents/caregivers. **Material and Methods:** A cross-sectional study including 403 students aged 8-10 years was carried out, in which OHRQoL was measured using the Child Perceptions Questionnaire administered to both children and parents/caregivers. The diagnosis of MIH was performed according to the previously proposed index. Dental caries experience, malocclusion, and sociodemographic factors were evaluated as confounders. Cluster analysis and Poisson regression with robust variance ($p<0.05$) were performed. **Results:** The prevalence of MIH was 13.4%. Parents/caregivers of children with MIH in incisors showed a higher impact prevalence in the emotional well-being domain (PR=1.92; 95%CI=1.16-3.19). Children with hypoplasia had a higher prevalence of negative impact on OHRQoL in the oral symptoms domain (PR=1.51; 95%CI=1.03-2.23). According to the perception of parents/caregivers, dental caries experience had a negative impact on the quality of life of students in the emotional well-being domain (PR=4.19; 95%CI=1.06-16.49) and in the total questionnaire score (PR=3.21; 95%CI=1.06-9.71). **Conclusion:** According to the perception of parents/caregivers, children with MIH in incisors showed a greater impact on OHRQoL. Additionally, the presence of hypoplasia affected the self-perception of OHRQoL in children, and caries experience influenced the OHRQoL of children, as perceived by parents/caregivers.

**Keywords:** Dental Enamel Hypoplasia; Tooth Demineralization; Quality of Life; Child; Oral Health.

## Introduction

It is known that different oral diseases can affect the health and general quality of life of individuals [1,2]. For a considerable period, most research linking oral diseases to quality of life focused on dental caries, but enamel development defects (EDD), such as molar incisor hypomineralization (MIH), can also impact oral health-related quality of life (OHRQoL), as it affects both dental aesthetics and chewing function [2].

MIH defects are demarcated opacities, with borders of apparently healthy enamel asymmetrically distributed, affecting at least one permanent molar, with or without the involvement of incisors [3,4]. Despite being a relatively common condition in the population, MIH still remains unknown to many people, including dental professionals [5].

The literature has shown that MIH is associated with oral problems, such as pain, chewing discomfort, difficulties in sleeping and brushing, hypersensitivity, pigmentation, and dental changes of difficult clinical management [2,5].

Such clinical consequences of MIH can affect the physical, emotional and social well-being of individuals [6]; therefore, the impact of different MIH degrees on child OHRQoL is an aspect that deserves further investigation [7]. However, to date, studies evaluating the impact of MIH on the quality of life of schoolchildren are still limited [2,7-10].

Furthermore, there are particularities in the occurrence and comorbidities associated with MIH [3,5,11], and investigations in different geographic regions can contribute to a better understanding of the problem. In this sense, this study aimed to evaluate the impact of the presence of MIH and confounding factors (caries and malocclusion experience and other enamel defects) on the OHRQoL of schoolchildren aged 8-10 years, according to the perception of children and their parents/caregivers.

## Material and Methods

### Study Design and Location

This is an observational, cross-sectional, population-based study carried out in the municipality of Campina Grande, Paraíba, Northeastern Brazil. The study followed recommendations established by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) [12]. The municipality has an estimated population of 407,472 inhabitants, a human development index (HDI) of 0.72, and a Gini coefficient of 0.58 [13]. Regarding the education network, the municipality has 286 elementary schools, of which 74 are urban public schools [13].

For sample distribution, the division by Health Districts (HD) established by the Municipal Health Department was considered, as until the research, there was no administrative division of schools according to the northern, southern, eastern, western and central regions of the city. When the study was carried out (2019), the municipality had eight health districts (HD I to HD VIII), six of which were located in urban areas. Of the 74 urban public elementary schools, two were selected from each HD, totaling 12 institutions, and the simple random draws of schools were carried out using the Microsoft Excel 2016 software (Microsoft Press, Redmond, WA, USA).

### Population and Sample Calculation

Participants were selected from a total population of 53,596 schoolchildren [13], regularly enrolled in elementary schools in the municipality of Campina Grande.

Sampling was of the probabilistic type by clusters, and for the sample calculation, the Open Epi software (http://www.openepi.com/Menu/OE_Menu.htm), version 3.01, was used, using the formula for sample

calculation of infinite population: $n = z^2 \times P (1-P) / FE^2$. Where: n = sample size; z = chosen confidence level (95%), standard deviation (1.96); P = expected prevalence of the phenomenon to be investigated of 15.5% [6]; FE = predicted sampling error factor (5%).

The prevalence of MIH obtained by Dantas-Neta [6] was selected because it was the study on MIH carried out closest to Campina Grande-PB, in addition to having students of the same age group. The result corresponded to 201 children. A correction factor of 1.8 was used, totaling 362 students. An additional 10% was added to this value to compensate for possible losses, with the final sample estimated at 403 children.

Children were selected proportionally, stratified by regions of the city. Schools and classes were selected through a simple random draw. If children did not meet the inclusion criteria, presented any exclusion criteria or did not agree to participate in the research, a new class was selected.

Inclusion and Exclusion Criteria

All children aged 8-10 years of both sexes, who had all first permanent molars fully erupted in the oral cavity [2,6,7], and were present at school on the day of the clinical examination were included [8].

The exclusion criteria were children wearing fixed orthodontic appliances at the time of the assessment [2,7,8] and children with special needs (according to parents' report), who did not cooperate with the clinical examination or were unable to respond to questionnaires.

Calibration Procedures

Calibration was carried out in two stages, theoretical and practical, by three researchers considered the gold standard, PhD in Dentistry, trained in Pediatric Dentistry, with previous experience in epidemiological investigations for the diagnosis of MIH, dental caries, and malocclusion.

For MIH, the criteria established by Ghanim et al. [4] were adopted. Theoretical training involved the clinical presentation of hypomineralized lesions and the differential diagnosis with other EDD and white spot lesions from dental caries [4,14]. The *in-lux* calibration, with image projections, was carried out using the exercise forum proposed by Ghanim et al. [14]. Cohen's Kappa coefficient was from 0.61 to 0.72 for inter-examiner calibration and from 0.67 to 0.83 for intra-examiner calibration.

For dental caries, the International Caries Detection & Assessment System (ICDAS II) index was used and examiners completed online theoretical training (https://www.iccms-web.com). The face-to-face theoretical stage included a discussion about the clinical diagnosis, using criteria based on the study by Pitts [15], and the practical stage was carried out in a public school, where 640 dental faces were examined. The agreement found was that inter-examiner Kappa values were from 0.80 to 0.90 and intra-examiner Kappa values from 0.71 to 0.75.

For malocclusion, theoretical training was carried out through a discussion of criteria established by Jenny and Cons [16] between examiners and the gold standard examiner, in addition to the study of the Field Team Manual, made available by the Ministry of Health and used in the last Brazilian epidemiological survey [17]. The practical stage was carried out at the Dental School Clinic of the State University of Paraíba. The agreement found was inter-examiner Kappa values were from 0.76 to 0.89 and intra-examiner Kappa values were from 0.82 to 0.94.

Pilot Study and Data Collection

A pilot study was carried out to evaluate the proposed methodology, the logistics of the dental examination and the applicability of questionnaires used. Twenty-two children aged 8-10 years from two public elementary schools were selected by convenience and were not included in the main sample.

Data collection was carried out from March to May 2019 and occurred in two stages. The first stage was aimed at parents/caregivers, by signing the Free and Informed Consent Form (FICF), filling out a sociodemographic questionnaire (with questions relating to parents/caregivers and the child, such as gender, age, family income in minimum wages, schooling level of parents / guardians, family structure, in addition to data on their oral health condition such as use of dental services; recent pain complaint; recent tooth sensitivity complaint) and an instrument validated for the Brazilian population on the perception of parents / caregivers about their children's OHRQoL: short version of the Parental-Caregiver Perceptions Questionnaire (B-P-CPQ) [18].

The short form of the B-P-CPQ questionnaire presents 13 questions divided into three domains: oral symptoms, functional limitations and well-being. All questions refer to the last 3 months prior to the application of the instrument. Response options range from zero to four points (between never and every day or almost every day). "I don't know" answers are allowed and scored 0. The total score is obtained by adding the scores of all questions, which can range from 0 to 52. The higher the score, the greater the negative impact of oral diseases on quality of life [18].

In the second stage, students signed the consent form agreeing to participate in the research and answered a questionnaire on self-perception of OHRQoL validated for the Brazilian population in this age group, the Child Perceptions Questionnaire ($B\text{-}CPQ_{8\text{-}10}$) [19].

This instrument presents 25 questions distributed into four domains: oral symptoms, functional limitation, emotional well-being and social well-being. Response options range from zero and four points, indicating the frequency of the occurrence (between "never" and "every day or almost every day"), and questions refer to the last four weeks. The total score varies between 0 and 100 and higher scores denote a greater negative impact of oral conditions on OHRQoL [19].

Before the clinical examination, each child received toothpaste and toothbrush (Colgate-Palmolive Indústria e Comércio, São Paulo, SP, Brazil), oral hygiene guidance and supervised brushing. Clinical examinations took place in a private area of the school, with the child sitting in front of the examiner, under natural lighting, with the aid of head lamps (JWS Lanternas, São Paulo, SP, Brazil). Researchers used all personal protective equipment, mouth mirrors (Golgran Indústria e Comércio de Instrumental Odontológico, São Caetano do Sul, SP, Brazil) and WHO probes (Trinity Indústria e Comércio Ltda., São Paulo, SP, Brazil), both packaged and sterilized in autoclave (Gnatus Equipamentos Médico-Odontológicas Ltda., Barretos, SP, Brazil), in addition to sterile gauze pads to dry the teeth, in accordance with current infection control standards [20].

The presence of MIH was established according to criteria proposed by Ghanim et al. [4]. Children were diagnosed with MIH when at least one permanent first molar was affected by demarcated opacities with color ranging from white, cream, yellow to brown by post-eruptive enamel fractures, by atypical restorations/atypical carious lesions, or when there was absence of permanent molars due to MIH – all these clinical features with or without involvement of incisors [4]. MIH severity was classified as: mild, with only color changes – cream, white, yellow, orange or brown – and severe – fracture and/or atypical restoration/atypical caries/lost due to MIH [14]. The MIH severity of each child was defined by the most severe defect observed in the first permanent molars and/or permanent incisors [21].

Children were also evaluated to determine their dental caries and malocclusion experience and the presence of other enamel defects, as these are considered confounding variables. To determine their dental caries experience, the International Caries Detection and Assessment System II (ICDAS II) index was used [22]. ICDAS II is a standardized two-digit visual detection system to evaluate dental caries, in which the first refers to the dental condition (healthy, presence and condition of restorations, prosthetic crowns, among others), and

the second refers to the status of carious lesions [22]. The child was considered to have experienced caries when presenting at least one dental element with an ICDAS code >0.

Malocclusion assessment was performed using the Dental Aesthetic Index (DAI). This index is composed of ten occlusal characteristics related to dentofacial anomalies according to three components: dentition (number of missing incisors, canines and premolars); crowding and/or spacing (crowding in incisal segments, spacing in incisal segments, midline diastema, greater anterior irregularity in the maxilla and greater anterior irregularity in the mandible); and occlusion (maxillary overjet, mandibular overjet, anterior open bite and anteroposterior molar relationship). Then, DAI components are distributed into three groups: tooth, space and occlusion and placed in an equation through which it is classified as: absence/mild malocclusion, no need for treatment (DAI≤25) or presence of malocclusion, with elective treatment (26 to 30), severe malocclusion, with highly recommended treatment (31 to 35) and very severe malocclusion, with treatment considered mandatory (36 or more) [16]. For this study, malocclusion was classified as absence (DAI≤25) and presence (DAI>25) [16].

The differential diagnosis of MIH was performed with diffuse opacities (dental fluorosis), white spots of dental caries, amelogenesis imperfecta, enamel hypoplasia and other hypomineralization defects other than MIH [4]. After clinical examination, examiners informed children about their oral health conditions and instructed them to inform their parents/caregivers to take them to visit a dentist, if necessary.

Statistical Analysis

Data were analyzed using the SPSS® software (version 22.0 for Windows, SPSS Inc., Armonk, NY, USA). The reliability of quality of life questionnaires was measured using the Cronbach's alpha coefficient test, with results above 0.60 in both questionnaires, being considered substantial consistency [23]. This result ensures that the quality of life instruments are safe and consistent for the population under study.

To dichotomize the total score and the domains of B-CPQ$_{8-10}$ and B-P-CPQ instruments into a greater and lesser negative impact on OHRQoL, k-means cluster analysis was performed. Cluster analysis evaluates the pattern of responses for each item separately and for the formation of clusters. It considers the correlation between responses to the instrument and may be valid because there is no cutoff standard for the sum of questions of B-CPQ$_{8-10}$ and B-P-CPQ instruments for the total score and their domains.

To assess the quality of cluster formation, the t-test for independent samples was performed, resulting in statistically significant differences between clusters for all responses to both questionnaires. In the bivariate analysis, the chi-square test was used to verify the association between the negative impact on OHRQoL with MIH and independent variables. In the multivariate analysis, Poisson regression with robust variance was performed, which was presented in the form of prevalence ratio (PR) and its confidence intervals (95% CI) between the greatest negative impact on OHRQoL and independent variables, and among these, those considered confounding variables. To enter the final analysis model, all variables with p≤0.20 were used in the bivariate analysis, thus performing the adjusted analysis. Furthermore, it is noteworthy that variables presenting collinearity were excluded. The significance level was set at 5%.

Ethical Clearance

This study was approved by the local institutional ethics committee, with protocol No. 3.155.847. All procedures in this study were conducted in accordance with Resolution 466/2012 of the National Health Council of the Brazilian Ministry of Health [24] and the Declaration of Helsinki.

## Results

Data regarding the sociodemographic condition of children are described in Table 1. A total of 403 children were examined. The prevalence of MIH was 13.4% (n=54). Regarding severity degree, 34 (63.0%) students had mild degree and 20 (37.0%) had severe degree. A total of 90.1% of students had dental caries experience, 70.7% had malocclusion and in relation to other enamel defects, 12.2% of children were diagnosed with dental fluorosis, 6% with hypoplasia and 0.7% were diagnosed with other types of hypomineralization (Table 1).

**Table 1. Sample characterization regarding sociodemographic, economic and clinical factors.**

| Variables | N (%) |
|---|---|
| Gender | |
| Female | 165 (40.9) |
| Male | 238 (59.1) |
| Age | |
| 8 Years | 141 (35.0) |
| 9 Years | 145 (36.0) |
| 10 Years | 117 (29.0) |
| Family Income in minimum wages (MW)[+] | |
| ≤1 MW | 306 (82.9) |
| > 1 MW | 63 (17.1) |
| Schooling Level of Parents/Caregivers | |
| ≤ 8 years of study | 168 (42.3) |
| > 8 years of study | 229 (57.7) |
| Family structure | |
| No-Nuclear | 177 (43.9) |
| Nuclear | 226 (56.1) |
| Have you ever Visited the Dentist in your Life? | |
| Yes | 249 (62.3) |
| No | 151 (37.8) |
| MIH | |
| Present | 54 (13.4) |
| Absent | 349 (86.6) |
| MIH Severity | |
| Mild | 34 (63.0) |
| Severe | 20 (37.0) |
| Dental Caries Experience | |
| Yes | 363 (90.1) |
| No | 40 (9.9) |
| Malocclusion | |
| Present | 285 (70.7) |
| Absent | 118 (29.3) |
| Dental Fluorosis | |
| Present | 49 (12.2) |
| Absent | 354 (87.8) |
| Hypoplasia | |
| Present | 24 (6.0) |
| Absent | 379 (94.0) |
| Hypomineralization other than MIH | |
| Present | 3 (0.7) |
| Absent | 400 (99.3) |

[+]Brazilian minimum wage value in force at the time of the research was equivalent to R$ 998.00 (US$ 264.00).

Tables 2 and 3 show the bivariate analysis between the negative impact of domains and the total score of instruments on OHRQoL and independent variables.

**Table 2. Association between the negative impacts of domains and the total $CPQ_{8-10}$ score with MIH and confounding factors.**

| Variables | Negative Impact | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oral Symptoms | | | Functional Limitation | | | Emotional Well-being | | | Social Well-being | | | Total Score | | |
| | Greater N (%) | Smaller N (%) | p-value* | Greater N (%) | Smaller N (%) | p-value* | Greater N (%) | Smaller N (%) | p-value* | Greater N (%) | Smaller N (%) | p-value* | Greater N (%) | Smaller N (%) | p-value* |
| MIH | | | | | | | | | | | | | | | |
| Present | 19 (35.2) | 35 (64.8) | 0.335 | 13 (24.1) | 41 (75.9) | 0.433 | 10 (18.5) | 44 (81.5) | 0.470 | 49 (90.7) | 5 (9.3) | 0.484 | 10 (18.5) | 44 (81.5) | 0.587 |
| Absent | 147 (42.1) | 202 (57.9) | | 68 (19.5) | 281 (80.5) | | 80 (22.9) | 269 (77.1) | | 305 (87.4) | 44 (12.6) | | 76 (21.8) | 273 (78.2) | |
| MIH Severity | | | | | | | | | | | | | | | |
| Mild | 11 (32.4) | 23 (67.6) | 0.570 | 8 (23.5) | 26 (76.5) | 0.903 | 4 (11.8) | 30 (88.2) | 0.096+ | 33 (97.1) | 1 (2.9) | 0.037+ | 5 (14.7) | 29 (85.3) | 0.347 |
| Severe | 8 (40.0) | 12 (60.0) | | 5 (25.0) | 15 (75.0) | | 6 (30.0) | 14 (70.0) | | 16 (80.0) | 4 (20.0) | | 5 (25.0) | 15 (75.0) | |
| MIH on Incisors | | | | | | | | | | | | | | | |
| Yes | 10 (33.3) | 20 (66.7) | 0.363 | 6 (20.0) | 24 (80.0) | 0.989 | 7 (23.3) | 23 (76.7) | 0.891 | 27 (90.0) | 3 (10.0) | 0.707 | 6 (20.0) | 24 (80.0) | 0.852 |
| No | 156 (41.8) | 217 (58.2) | | 75 (20.1) | 298 (79.9) | | 83 (22.3) | 290 (77.7) | | 327 (87.7) | 46 (12.3) | | 80 (21.4) | 293 (78.6) | |
| MIH on Molars | | | | | | | | | | | | | | | |
| Yes | 19 (35.2) | 35 (64.8) | 0.335 | 13 (24.1) | 41 (75.9) | 0.433 | 10 (18.5) | 44 (81.5) | 0.470 | 49 (90.7) | 5 (9.3) | 0.484 | 10 (18.5) | 44 (81.5) | 0.587 |
| No | 147 (42.1) | 202 (57.9) | | 68 (19.5) | 281 (80.5) | | 80 (22.9) | 269 (77.1) | | 305 (87.4) | 44 (12.6) | | 76 (21.8) | 273 (78.2) | |
| Dental Caries Experience | | | | | | | | | | | | | | | |
| Yes | 154 (42.4) | 209 (57.6) | 0.130+ | 75 (20.7) | 288 (79.3) | 0.396 | 84 (23.1) | 279 (76.9) | 0.241 | 317 (87.3) | 46 (12.7) | 0.342 | 82 (22.6) | 281 (77.4) | 0.065+ |
| No | 12 (30.0) | 28 (70.0) | | 6 (15.0) | 34 (85.0) | | 6 (15.0) | 34 (85.0) | | 37 (92.5) | 3 (7.5) | | 4 (10.0) | 36 (90.0) | |
| Malocclusion | | | | | | | | | | | | | | | |
| Present | 123 (43.2) | 162 (56.8) | 0.212 | 63 (22.1) | 222 (77.9) | 0.118+ | 68 (23.9) | 217 (76.1) | 0.253 | 247 (86.7) | 38 (13.3) | 0.262 | 67 (23.5) | 218 (76.5) | 0.099+ |
| Absent | 43 (36.4) | 75 (63.6) | | 18 (15.3) | 100 (84.7) | | 22 (18.6) | 96 (81.4) | | 107 (90.7) | 11 (9.3) | | 19 (16.1) | 99 (83.9) | |
| Dental Fluorosis | | | | | | | | | | | | | | | |
| Present | 16 (32.7) | 33 (67.3) | 0.195+ | 12 (24.5) | 37 (75.5) | 0.413 | 8 (16.3) | 41 (83.7) | 0.281 | 44 (89.8) | 5 (10.2) | 0.655 | 10 (20.4) | 39 (79.6) | 0.865 |
| Absent | 150 (42.4) | 204 (57.6) | | 69 (19.5) | 285 (80.5) | | 82 (23.2) | 272 (76.8) | | 310 (87.6) | 44 (12.4) | | 76 (21.5) | 278 (78.5) | |
| Hypoplasia | | | | | | | | | | | | | | | |
| Present | 14 (58.3) | 10 (41.7) | 0.078+ | 5 (20.8) | 19 (79.2) | 0.926 | 8 (33.3) | 16 (66.7) | 0.182+ | 22 (91.7) | 2 (8.3) | 0.554 | 5 (20.8) | 19 (79.2) | 0.950 |
| Absent | 152 (40.1) | 227 (59.9) | | 76 (20.1) | 303 (79.9) | | 82 (21.6) | 297 (78.4) | | 332 (87.6) | 47 (12.4) | | 81 (21.4) | 298 (78.6) | |
| Hypomineralization other than MIH | | | | | | | | | | | | | | | |
| Present | 2 (66.7) | 1 (33.3) | 0.368 | 0 (0.0) | 3 (100.0) | 0.383 | 1 (33.3) | 2 (66.7) | 0.646 | 3 (100.0) | 0 (0.0) | 0.518 | 1 (33.3) | 2 (66.7) | 0.611 |
| Absent | 164 (41.0) | 236 (59.0) | | 81 (20.2) | 319 (79.8) | | 89 (22.2) | 311 (77.8) | | 351 (87.8) | 49 (12.2) | | 85 (21.2) | 315 (78.8) | |
| Gender | | | | | | | | | | | | | | | |
| Female | 94 (39.5) | 144 (60.5) | 0.406 | 48 (20.2) | 190 (79.8) | 0.967 | 48 (20.2) | 190 (79.8) | 0.210 | 210 (88.2) | 28 (11.8) | 0.771 | 49 (20.6) | 189 (79.4) | 0.658 |
| Male | 72 (43.6) | 93 (56.4) | | 33 (20.0) | 132 (80.0) | | 42 (25.5) | 123 (74.5) | | 144 (87.3) | 21 (12.7) | | 37 (22.4) | 128 (77.6) | |
| Age | | | | | | | | | | | | | | | |
| 8 | 66 (46.8) | 75 (53.2) | 0.068+ | 38 (27.0) | 103 (73.0) | 0.039+ | 38 (27.0) | 103 (73.0) | 0.187+ | 120 (85.1) | 21 (14.9) | 0.193+ | 41 (29.1) | 100 (70.9) | 0.020+ |
| 9 | 49 (33.8) | 96 (66.2) | | 25 (17.2) | 120 (82.8) | | 26 (17.9) | 119 (82.1) | | 12 (8.3) | 133 (91.7) | | 24 (16.6) | 121 (83.4) | |
| 10 | 51 (43.6) | 66 (56.4) | | 18 (15.4) | 99 (84.6) | | 26 (22.2) | 91 (77.8) | | 16 (13.7) | 101 (86.3) | | 21 (17.9) | 96 (82.1) | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Family Income in MW | | | | | | | | | | | | | | | |
| ≤1 MW | 127 (41.5) | 179 (58.5) | 0.462 | 61 (19.9) | 245 (80.1) | 0.652 | 70 (22.9) | 236 (77.1) | 0.506 | 274 (89.5) | 32 (10.5) | 0.878 | 64 (20.9) | 242 (79.1) | 0.363 |
| > 1 MW | 23 (36.5) | 40 (63.5) | | 11 (17.5) | 52 (82.5) | | 12 (19.0) | 51 (81.0) | | 56 (88.9) | 7 (11.1) | | 10 (15.9) | 53 (84.1) | |
| Schooling Level of Parents/Caregivers | | | | | | | | | | | | | | | |
| ≤ 8 years of study | 63 (37.5) | 105 (62.5) | 0.251 | 32 (19.0) | 136 (81.0) | 0.716 | 33 (19.6) | 135 (80.4) | 0.349 | 150 (89.3) | 18 (10.7) | 0.552 | 31 (18.5) | 137 (81.5) | 0.258 |
| > 8 years of study | 99 (43.2) | 130 (56.8) | | 47 (20.5) | 182 (79.5) | | 54 (23.6) | 175 (76.4) | | 200 (87.3) | 29 (12.7) | | 53 (23.1) | 176 (76.9) | |
| Family Structure | | | | | | | | | | | | | | | |
| Nuclear | 94 (41.6) | 132 (58.4) | 0.853 | 46 (20.4) | 180 (79.6) | 0.885 | 46 (20.4) | 180 (79.6) | 0.281 | 198 (87.6) | 28 (12.4) | 0.873 | 47 (20.8) | 179 (79.2) | 0.763 |
| No-nuclear | 72 (40.7) | 105 (59.3) | | 35 (19.8) | 142 (80.2) | | 44 (24.9) | 133 (75.1) | | 156 (88.1) | 21 (11.9) | | 39 (22.0) | 138 (78.0) | |
| Visited the Dentist | | | | | | | | | | | | | | | |
| Yes | 113 (45.4) | 136 (54.6) | 0.022+ | 60 (24.1) | 189 (75.9) | 0.005+ | 60 (24.1) | 189 (75.9) | 0.194+ | 215 (86.3) | 34 (13.7) | 0.083+ | 62 (24.9) | 187 (75.1) | 0.009+ |
| No | 51 (33.8) | 100 (66.2) | | 19 (12.6) | 132 (87.4) | | 28 (18.5) | 123 (81.5) | | 139 (92.1) | 12 (7.9) | | 21 (13.9) | 130 (86.1) | |

MW: Minimum Wages; *Chi-square test; +Variables with p<0.20 used for the adjusted multivariate model.

**Table 3. Association between the negative impacts of domains and total B-P-CPQ score with MIH and confounding factors.**

| Variables | Negative Impact | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oral Symptoms | | | Functional Limitation | | | Emotional Well-being | | | Social Well-being | | | Total Score | | |
| | Greater N (%) | Smaller N (%) | p-value* | Greater N (%) | Smaller N (%) | p-value* | Greater N (%) | Smaller N (%) | p-value* | Greater N (%) | Smaller N (%) | p-value* | Greater N (%) | Smaller N (%) | p-value* |
| MIH | | | | | | | | | | | | | | | |
| Present | 8 (14.8) | 46 (85.2) | 0.319 | 15 (27.8) | 39 (72.2) | 0.861 | 14 (25.9) | 40 (74.1) | 0.229 | 11 (20.4) | 43 (79.6) | 0.760 | 14 (25.9) | 40 (74.1) | 0.560 |
| Absent | 72 (20.6) | 277 (79.4) | | 93 (26.6) | 256 (73.4) | | 66 (18.9) | 283 (81.1) | | 65 (18.6) | 284 (81.4) | | 78 (22.3) | 271 (77.7) | |
| MIH Severity | | | | | | | | | | | | | | | |
| Mild | 5 (14.7) | 29 (85.3) | 0.977 | 9 (26.5) | 25 (73.5) | 0.780 | 7 (20.6) | 27 (79.4) | 0.243 | 9 (26.5) | 25 (75.5) | 0.147+ | 7 (20.6) | 27 (79.4) | 0.243 |
| Severe | 3 (15.0) | 17 (85.9) | | 6 (30.0) | 14 (70.0) | | 7 (35.0) | 13 (65.0) | | 2 (10.0) | 18 (90.0) | | 7 (35.0) | 13 (65.0) | |
| MIH on Incisors | | | | | | | | | | | | | | | |
| Yes | 4 (13.3) | 26 (86.7) | 0.352 | 9 (30.0) | 21 (70.0) | 0.681 | 11 (36.7) | 19 (63.3) | 0.016+ | 6 (20.0) | 24 (80.0) | 0.868 | 11 (36.7) | 19 (63.3) | 0.061+ |
| No | 76 (20.4) | 297 (79.6) | | 99 (26.5) | 274 (73.5) | | 69 (18.5) | 304 (81.5) | | 70 (18.8) | 303 (81.2) | | 81 (21.7) | 292 (78.3) | |
| MIH on Molars | | | | | | | | | | | | | | | |
| Yes | 8 (14.8) | 46 (85.2) | 0.319 | 15 (27.8) | 39 (72.2) | 0.861 | 14 (25.9) | 40 (74.1) | 0.229 | 11 (20.4) | 43 (79.6) | 0.760 | 14 (25.9) | 40 (74.1) | 0.560 |
| No | 72 (20.6) | 277 (79.4) | | 93 (26.6) | 256 (73.4) | | 66 (18.9) | 283 (81.1) | | 65 (18,6) | 284 (81.4) | | 78 (22.3) | 271 (77.7) | |
| Dental Caries Experience | | | | | | | | | | | | | | | |
| Yes | 75 (20.7) | 288 (79.3) | 0.219 | 102 (28.1) | 261 (71.9) | 0.076+ | 78 (21.5) | 285 (78.5) | 0.013+ | 71 (19.6) | 292 (80.4) | 0.279 | 89 (24.5) | 274 (75.5) | 0.015+ |
| No | 5 (12.5) | 35 (87.5) | | 6 (15.0) | 34 (85.0) | | 2 (5.0) | 38 (95.0) | | 5 (12.5) | 35 (87.5) | | 3 (7.5) | 37 (92.5) | |
| Malocclusion | | | | | | | | | | | | | | | |
| Present | 60 (21.1) | 225 (78.9) | 0.347 | 75 (26.3) | 210 (73.7) | 0.734 | 62 (21.8) | 223 (78.24 | 0.137+ | 59 (20.7) | 226 (79.3) | 0.142+ | 69 (24.2) | 216 (76.8) | 0.304 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absent | 20 (16.9) | 98 (83.1) | | 33 (28.0) | 85 (72.0) | | 18 (15.3) | 100 (84.7) | | 17 (14.4) | 101 (85.6) | | 23 (19.5) | 95 (80.5) | |
| Dental fluorosis | | | | | | | | | | | | | | | |
| Present | 8 (16.3) | 41 (83.7) | 0.509 | 8 (16.3) | 41 (83.7) | 0.077+ | 7 (14.3) | 42 (85.7) | 0.297 | 6 (12.2) | 43 (87.8) | 0.207 | 6 (12.2) | 43 (87.8) | 0.060+ |
| Absent | 72 (20.3) | 282 (79.7) | | 100 (28.2) | 254 (71.8) | | 73 (20.6) | 281 (79.4) | | 70 (19.8) | 284 (80.2) | | 86 (24.3) | 268 (75.7) | |
| Hypoplasia | | | | | | | | | | | | | | | |
| Present | 5 (20.8) | 19 (79.2) | 0.901 | 6 (25.0) | 18 (75.0) | 0837 | 4 (16.7) | 20 (83.3) | 0.687 | 4 (16.7) | 20 (83.3) | 0.777 | 4 (16.7) | 20 (83.3) | 0.458 |
| Absent | 75 (19.8) | 304 (80.2) | | 102 (26.9) | 277 (73.1) | | 76 (20.1) | 302 (79.9) | | 72 (19.0) | 307 (81.0) | | 88 (23.2) | 291 (76.8) | |
| Hypomineralization other than MIH | | | | | | | | | | | | | | | |
| Present | 0 (0.0) | 3 (100,0) | 0.387 | 1 (33.3) | 2 (66.7) | 0.798 | 3 (100.0) | 0 (0.0) | 0.387 | 1 (33.3) | 2 (66.7) | 0.520 | 1 (33.3) | 2 (66.7) | 0.663 |
| Absent | 80 (20.0) | 320 (80.0) | | 107 (26.8) | 293 (73.2) | | 320 (80.0) | 80 (20.0) | | 75 (18.8) | 325 (81.2) | | 91 (22.8) | 309 (77.2) | |
| Gender | | | | | | | | | | | | | | | |
| Female | 54 (22.7) | 184 (77.3) | 0.086+ | 72 (30.3) | 166 (69.7) | 0.060+ | 53 (22.3) | 185 (77.7) | 0.144+ | 48 (20.2) | 190 (79.8) | 0.420 | 60 (25.2) | 178 (74.8) | 0.171+ |
| Male | 26 (15.8) | 139 (84.2) | | 36 (21.8) | 129 (78.2) | | 27 (16.4) | 138 (83.6) | | 28 (17.0) | 137 (83.0) | | 32 (19.4) | 133 (80.6) | |
| Age | | | | | | | | | | | | | | | |
| 8 | 28 (19.9) | 113 (80.1) | 0.998 | 37 (26.2) | 104 (73.8) | 0.799 | 30 (21.3) | 111 (78.7) | 0.183+ | 23 (16.2) | 119 (83.8) | 0.361 | 28 (19.9) | 113 (80.1) | 0.160+ |
| 9 | 29 (20.0) | 116 (80.0) | | 37 (25.5) | 108 (74.5) | | 22 (15.2) | 123 (84.8) | | 26 (17.9) | 119 (82.1) | | 30 (20.7) | 115 (79.3) | |
| 10 | 23 (19.7) | 94 (80.3) | | 34 (29.1) | 83 (70.9) | | 28 (23.9) | 89 (76.1) | | 27 (23.1) | 90 (76.9) | | 34 (29.1) | 83 (70.9) | |
| Family Income in MW | | | | | | | | | | | | | | | |
| ≤1 MW | 66 (21.6) | 240 (78.4) | 0.109+ | 89 (29.1) | 217 (70.9) | 0.031+ | 63 (20.6) | 243 (79.4) | 0.572 | 64 (20.9) | 242 (79.1) | 0.134+ | 73 (23.9) | 233 (76.1) | 0.270 |
| > 1 MW | 8 (12.7) | 55 (87.3) | | 10 (15.9) | 53 (84.1) | | 11 (17.5) | 52 (82.5) | | 8 (12.7) | 55 (87.3) | | 11 (17.5) | 52 (82.5) | |
| Schooling Level of Parents/Caregivers | | | | | | | | | | | | | | | |
| ≤ 8 years of study | 29 (17.3) | 139 (82.7) | 0.219 | 41 (24.4) | 127 (75.6) | 0.429 | 29 (17.3) | 139 (82.7) | 0.306 | 29 (17.3) | 139 (82.7) | 0.546 | 34 (20.2) | 134 (79.8) | 0.322 |
| > 8 years of study | 51 (22.3) | 178 (77.7) | | 64 (27.9) | 165 (72.1) | | 49 (21.4) | 180 (78.6) | | 45 (19.7) | 184 (80.3) | | 56 (24.5) | 173 (75.5) | |
| Family Structure | | | | | | | | | | | | | | | |
| Nuclear | 48 (21.2) | 178 (78.8) | 0.430 | 62 (27.4) | 164 (72.6) | 0.745 | 47 (20.8) | 179 (79.2) | 0.591 | 44 (19.5) | 182 (80.5) | 0.723 | 51 (22.6) | 175 (77.4) | 0.887 |
| No-nuclear | 32 (18.0) | 145 (81.9) | | 46 (26.0) | 131 (74.0) | | 33 (18.6) | 144 (81.4) | | 32 (18.1) | 145 (81.9) | | 41 (23.2) | 136 (76.8) | |
| Visited the Dentist | | | | | | | | | | | | | | | |
| Yes | 53 (21.3) | 196 (78.7) | 0.322 | 69 (27.7) | 180 (72.3) | 0.577 | 55 (22.1) | 194 (77.9) | 0.180+ | 49 (19.7) | 200 (80.3) | 0.657 | 58 (23.3) | 191 (76.7) | 0.858 |
| No | 26 (17.2) | 125 (82.8) | | 38 (25.2) | 113 (74.8) | | 25 (16.6) | 126 (83.4) | | 27 (17.9) | 124 (82.1) | | 34 (22.5) | 117 (77.5) | |

MW: Minimum Wages; *Chi-square test; +Variables with p<0.20 used for the adjusted multivariate model.

Tables 4 and 5 show the crude multivariate models and tables 6 and 7 show the final multivariate models of negative impacts of independent variables on OHRQoL self-perceived by children and perceived by parents /caregivers, distributed across the domains and total scores of B-CPQ$_{8-10}$ and B-P-CPQ instruments.

**Table 4. Crude multivariate model of the association between the negative impacts of domains and the total B-CPQ$_{8-10}$ score with MIH and confounding factors.**

| Variables | Negative Impact | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oral Symptoms | | Functional Limitation | | Emotional Well-being | | Social Well-being | | Total Score | |
| | Crude PR (CI95%) | p-value* | Crude PR (CI95%) | p-value* | Crude PR (CI95%) | p-value* | Crude PR (CI95%) | p-value* | Crude PR (CI95%) | p-value* |
| MIH Severity | | | | | | | | | | |
| Severe | | | | | 2.550 (0.817-7.959) | 0.107 | 0.824 (0.657-1.034) | 0.095 | | |
| Mild | | | | | 1 | | 1 | | | |
| Dental Caries Experience | | | | | | | | | | |
| Yes | 1.414 (0.868-2.304) | 0.164 | | | | | | | 2.259 (0.875-6.835) | 0.092 |
| No | 1 | | | | | | | | 1 | |
| Malocclusion | | | | | | | | | | |
| Present | | | 1.449 (0.899-2.337) | 0.128 | | | | | 1.460 (0.920-2.318) | 0.108 |
| Absent | | | 1 | | | | | | 1 | |
| Dental Fluorosis | | | | | | | | | | |
| Present | 0.771 (0.506-1.173) | 0.224 | | | | | | | | |
| Absent | 1 | | | | | | | | | |
| Hypoplasia | | | | | | | | | | |
| Present | **1.454 (1.015-2.084)** | **0.041** | | | 1.541 (0.848-2.800) | 0.156 | | | | |
| Absent | 1 | | | | 1 | | | | | |
| Age | | | | | | | | | | |
| 10 | 0.931 (0.710-1.221) | 0.606 | **0.571 (0.345-0.945)** | **0.029** | 0.825 (0.534-1.273) | 0.384 | 1.014 (0.918-1.121) | 0.780 | **0.617 (0.388-0.983)** | **0.042** |
| 9 | **0.722 (0.541-0.963)** | **0.027** | 0.640 (0.409-1.002) | 0.051 | 0.665 (0.428-1.035) | 0.071 | 1.078 (0.990-1.173) | 0.083 | **0.569 (0.364-0.890)** | **0.014** |
| 8 | 1 | | 1 | | 1 | | 1 | | 1 | |
| Visited the Dentist | | | | | | | | | | |
| No | **0.744 (0.573-0.967)** | **0.027** | **0.522 (0.325-0.839)** | **0.007** | 0.770 (0.516-1.149) | 0.200 | 1.066 (0.996-1.141) | 0.065 | **0.559 (0.356-0.877)** | **0.011** |
| Yes | 1 | | 1 | | 1 | | 1 | | 1 | |

Variables in bold correspond to those with p-values <0.05 in the final model; Crude PR. (95%CI): Crude Prevalence Ratio; 95% CI: 95% Confidence Interval.

**Table 5. Crude multivariate model of the association between the negative impacts of domains and the total B-P-CPQ score with MIH and confounding factors.**

| Variables | Negative Impact | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oral Symptoms | | Functional Limitation | | Emotional Well-being | | Social Well-being | | Total Score | |
| | Crude PR (CI95%) | p-value* | Crude PR (CI95%) | p-value* | Crude PR (CI95%) | p-value* | Crude PR (CI95%) | p-value* | Crude PR (CI95%) | p-value* |
| MIH Severity | | | | | | | | | | |
| Severe | | | | | | | 0.378 (0.090-1.577) | 0.182 | | |
| Mild | | | | | | | 1 | | | |
| MIH on Incisors | | | | | | | | | | |
| Yes | | | | | **1.982 (1.183-3.322)** | **0.009** | | | **1.688 (1.016-2.807)** | **0.043** |
| No | | | | | 1 | | | | 1 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Dental Caries Experience | | | | | | | | | | |
| Present | | | 1.873 (0.880-3.989) | 0.104 | **4.298 (1.097-16.829)** | **0.036** | | | **3.269 (1.085-9.852)** | **0.035** |
| Absent | | | 1 | | 1 | | | | 1 | |
| Malocclusion | | | | | | | | | | |
| Present | | | | | 1.426 (0.883-2.302) | 0.146 | 1.437 (0.876-2.357) | 0.151 | | |
| Absent | | | | | 1 | | 1 | | | |
| Dental Fluorosis | | | | | | | | | | |
| Present | | | 0.578 (0.300-1.113) | 0.101 | | | | | 0.504 (0.233-1.091) | 0.082 |
| Absent | | | 1 | | | | | | 1 | |
| Gender | | | | | | | | | | |
| Female | 1.440 (0.943-2.199) | 0.092 | 1.387 (0.980-1.962) | 0.065 | 1.361 (0.895-2.069) | 0.149 | | | 1.300 (0.889-1.901) | 0.176 |
| Male | 1 | | 1 | | 1 | | | | 1 | |
| Age | | | | | | | | | | |
| 10 | | | | | 1.125 (0.715-1.769) | 0.611 | | | 1.463 (0.946-2.263) | 0.087 |
| 9 | | | | | 0.713 (0.433-1.174) | 0.184 | | | 1.042 (0.658-1.650) | 0.861 |
| 8 | | | | | 1 | | | | 1 | |
| Family Income in MW | | | | | | | | | | |
| ≤1 MW | 1.699 (0.859-3.357) | 0.128 | **1.832 (1.011-3.321)** | **0.046** | | | 1.647 (0.832-3.261) | 0.152 | | |
| > 1 MW | 1 | | 1 | | | | 1 | | | |
| Visited the Dentist | | | | | | | | | | |
| No | | | | | 0.750 (0.489-1.149) | 0.186 | | | | |
| Yes | | | | | 1 | | | | | |

B-P-CPQ = Parental-Caregiver Perceptions Questionnaire short Brazilian version; Variables in bold correspond to those with p-values <0.05 in the final model. Crude PR. (95%CI): Crude Prevalence Ratio. 95% CI: 95% Confidence Interval; MW: Minimum Wages.

According to the self-perception of children, dental enamel hypoplasia had a 51.8% higher impact rate in the oral symptoms domain of the B-CPQ8-10 questionnaire (RP=1.51; 95%CI=1.03-2.23). Furthermore, older age and lack of use of dental services were also associated with greater impact on the quality of life of students (Table 6).

**Table 6. Final multivariate model of the association between the negative impacts of domains and the total B-CPQ$_{8-10}$ score with MIH and confounding factors.**

| **Variables** | **Negative Impact** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oral Symptoms | | Functional Limitation | | Emotional Well-being | | Social Well-being | | Total Score | |
| | PRa (CI95%) | p-value* | PRa (CI95%) | p-value* | PRa (CI95%) | p-value* | PRa (CI95%) | p-value* | PRa (CI95%) | p-value* |
| Hypoplasia | | | | | | | | | | |
| Present | **1.518 (1.031-2.234)** | **0.034** | | | | | | | | |
| Absent | 1 | | | | | | | | | |
| Age | | | | | | | | | | |
| 10 | 0.928 (0.705-1.221) | 0.592 | **0.536 (0.316-0.909)** | **0.021** | | | | | **0.602 (0.369-0.980)** | **0.041** |
| 9 | 0.710 (0.532-0.947) | **0.020** | 0.661 (0.422-1.035) | 0.070 | | | | | **0.600 (0.383-0.941)** | **0.026** |
| 8 | 1 | | 1 | | | | | | 1 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Visited the Dentist | | | | | | | | | | |
| No | 0.766 (0.592-0.993) | **0.044** | **0.543 (0.338-0.873)** | **0.012** | | | | | **0.581 (0.370-0.912)** | **0.018** |
| Yes | 1 | | 1 | | | | | | 1 | |

B-CPQ$_{8-10}$= Child Perceptions Questionnaire Brazilian version; Variables in bold correspond to those with p-values <0.05 in the final model; PRa.: Adjusted Prevalence Ratio; 95% CI: 95% Confidence Interval.

In the perception of parents/caregivers, students with MIH in incisor teeth had a 92.6% higher impact rate in the emotional well-being domain of the B-P-CPQ questionnaire (RP=1.92; 95%CI=1.16-3.19). Furthermore, dental caries experience and family income less than or equal to 1 minimum wage also had a negative impact on the quality of life of students (Table 7).

**Table 7. Final multivariate model of the association between the negative impacts of domains and the total B-P-CPQ score with MIH and confounding factors.**

| **Variables** | **Negative Impact** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oral Symptoms | | Functional Limitation | | Emotional Well-being | | Social Well-being | | Total Score | |
| | PRa (CI95%) | p-value* | PRa (CI95%) | p-value* | PRa (CI95%) | p-value* | PRa (CI95%) | p-value* | PRa (CI95%) | p-value* |
| MIH on Incisors | | | | | | | | | | |
| Yes | | | | | **1.926 (1.160-3.198)** | **0.011** | | | 1.646 (0.999-2.711) | 0,051 |
| No | | | | | 1 | | | | 1 | |
| Dental Caries Experience | | | | | | | | | | |
| Present | | | | | **4.197 (1.068-16.493)** | **0.040** | | | **3.215 (1.064-9.715)** | **0.039** |
| Absent | | | | | **1** | | | | 1 | |
| Family Income in MW | | | | | | | | | | |
| ≤1 MW | | | **1.832 (1.011-3.321)** | **0.046** | | | | | | |
| > 1 MW | | | 1 | | | | | | | |

B-P-CPQ = Parental-Caregiver Perceptions Questionnaire short Brazilian version; Variables in bold correspond to those with p-values <0.05 in the final model; PRa.: Adjusted Prevalence Ratio; 95% CI: 95% Confidence Interval; MW: Minimum Wages.

## Discussion

The objective of this study was to identify whether MIH and sociodemographic factors are associated with negative perception of OHRQoL according to children and their parents/caregivers. The B-CPQ quality of life instrument for the age group of 8-10 years was chosen, as the European Academy of Pediatric Dentistry (EAPD) recommends the age of 8 years as an index to evaluate MIH since at this age, all first permanent molars and most incisors are already erupted, facilitating early diagnosis [25].

The B-CPQ$_{8-10}$ and B-P-CPQ questionnaires do not have cutoff points, so the cluster analysis was carried out to dichotomize the sample into greater and lesser impact on OHRQoL, as through this categorization, it is possible to define and evaluate a better grouping for children based on similarity of responses [6]. This form of categorization has been widely used in literature [6,26,27].

Dental caries, malocclusion, other enamel defects and socioeconomic factors were included as confounding variables for the impact on OHRQoL, as some studies have shown that these conditions can influence quality of life [1,2,7-10,28-30]. Furthermore, the use of dental services was also included as a confounding factor [31].

Although the literature has pointed to a negative impact of MIH on OHRQoL in children [2,7,8,10], in the present study, it was observed that the presence of MIH, regardless of severity degree, had no impact on the self-perception of quality of life in children. Based on the premise that complaints about pain and difficulty eating are the most perceived by parents/caregivers [1] and that children with enamel defects and opacities with low severity degree rarely presented symptoms or any discomfort [28], it is possible to understand the lack of influence of MIH on OHRQoL in children in this study, since the majority of students had MIH lesions of mild severity (63.0%).

However, from the perspective of parents/caregivers, the presence of MIH in incisor teeth was associated with a greater impact on the emotional well-being domain of the children's quality of life (92.6%). Problems with anterior teeth can be seen as a problem to good reception by other people [32]. In addition, children's dental appearance outside of established beauty standards is of great concern for parents [33], which may explain the impact of MIH present only in incisor teeth on OHRQoL, under the perception of parents/caregivers.

Although children's reports are important, perceptions of parents/caregivers of children's OHRQoL should also be considered, as they are the main informants of their children's oral health [18] and their perceptions often play an important role in the decision-making in relation to oral health, having a great influence on treatment options [34]. Therefore, investigating the perception of parents/caregivers allows a more complete assessment of children's OHRQoL and should be considered together with the children's version [35].

It is essential to also consider other aspects, mainly due to the emotional insecurity of children in this age group [2]. Therefore, the aesthetic impact of different MIH degrees on children's quality of life is a subject that deserves further investigation [7]. Furthermore, strategies are needed to prevent the clinical worsening of teeth that are affected by MIH, reducing the impact of this change on the OHRQoL of children [7,8].

Dental enamel hypoplasia had a significant impact on the self-perception of children on their quality of life, revealing a greater negative impact (51%) on the oral symptoms domain of the B-CPQ8-10 questionnaire. Hypoplasia is an enamel defect associated with reduced and localized enamel thickness [3]. An impact of this defect on the quality of life of children was also observed in the study by Andrade et al. [30]. Furthermore, according to Vargas-Ferreira and Ardenghi [28], hypoplasia was the only enamel defect that had a negative impact on the quality of life in the functional limitation domain. The authors attributed this finding to the greater severity of this type of enamel defect.

Children with enamel defects may experience anxiety and social embarrassment regarding their appearance [30]. Furthermore, signs, symptoms and clinical consequences caused by enamel hypoplasia [30] may justify the worse quality of life reported by children in the areas of oral symptoms, represented by questions about pain in teeth or mouth.

It is known that dental caries can cause changes in the functions of teeth, including chewing and phonetics difficulties and can also interfere with school attendance, resulting in absenteeism [1]. Furthermore, children with caries lesions may also experience psychological impairment, sleeping difficulty and irritability [1].

In this study, dental caries had no impact on quality of life according to the self-perception of students, different from results reported by Mexican [2], Brazilian [29] and Indian [36] studies. This impact was only observed when the children's quality of life was assessed from the perception of parents/caregivers, having a greater impact on both the total questionnaire score (21.5%) and the emotional well-being domain (19.7%).

OHRQoL is a dynamic construct, which is likely to change over time [37,38]. It is important to understand that the factors associated with OHRQOL can take into account sociocultural, socioeconomic and biological contexts in which the individual is inserted, in addition to personal psychosocial factors [39]. The subjective nature of OHRQL allows for variations and differences according to people's culture [39] and even changes over time in relation to individual standards related to quality of life [37]. Thus, some other striking factor related to the reality of children under study may have made the dental caries experience irrelevant at the time data were collected.

Oral diseases are cumulative and tend to worsen with increasing age [1]. Furthermore, health self-concept is linked to age [37], since individuals from different age groups may have different perceptions of the same condition [38]. Therefore, understanding the health problem is possibly more present in more mature individuals, explaining why older children had their OHRQoL more impacted (40.0%) than younger children.

Identifying the occurrence of oral problems as early as possible helps reduce their impact on children's quality of life [1]. Therefore, it is a challenge for dentists not only to early diagnose and adequately manage enamel defects in pediatric patients, but also to become aware of the impacts of this type of enamel defect on their quality of life [8,40], avoiding the perpetuation and worsening of its symptoms and consequences with advancing age.

According to Andrade et al. [30], social inequalities can have a negative impact on quality of life, also affecting children's general and oral health. In this study, low family income had a greater negative impact on the functional limitation domain (83.2%) of the quality of life perceived by parents/caregivers. Similar findings have been reported in other studies [7-9,30].

Families with low economic levels tend to have less access to oral health services and, in addition, are more exposed to complications during pregnancy, birth and childhood [1], being more likely to develop oral problems, such as enamel defects and dental caries. Thus, the importance of considering socioeconomic and demographic factors in public oral health strategies is emphasized [8].

Regarding dental care, despite its importance for the health of individuals, there is still a significant portion of the Brazilian population that does not have access to it [31]. In this study, 37.8% of students had never been to the dentist and the lack of this assistance revealed a greater impact on quality of life according to their self-perception, both in the general questionnaire score (41.9%) and in the oral symptom (22.4%) and functional limitation domains (45.7%).

According to Goettems et al. [41], dental care helps in the development of good oral health habits in schoolchildren, improving oral hygiene, correcting inadequate eating habits and improving parental knowledge [41], therefore contributing to improve oral health. Therefore, aware of the impact on the OHRQoL of populations that have never had access to dental care and that the pattern of maternal care is a predictor of the use of dental services by children [41], regular visits to the dentist should be strongly encouraged, both in the school community and to parents/caregivers.

This study has some limitations. Firstly, the cross-sectional design, since the perception of children and parents/caregivers about oral health was obtained at a certain point in their lives [2,8]. Furthermore, memory bias may have occurred, as the information depended on participants' recall. However, the sample calculation,

the use of widely-used OHRQoL assessment instruments validated for the Brazilian population in the age group under study and the good inter and intra-examiner reliability are highlighted.

Both MIH and hypoplasia are conditions that can cause a series of aesthetic and emotional discomforts. Thus, individual preventive programs can postpone the onset of restorative treatment, reduce patient discomfort in the long term and, thus, minimize the negative impact on OHRQoL that these changes can cause with increasing severity.

Further studies should be carried out to confirm these findings, especially in populations with low caries experience, as well as longitudinal studies to obtain a better understanding of factors that influence the perceptions of children and parents/caregivers regarding oral health, such as MIH [8,29,42,43].

## Conclusion

MIH had no negative impact on OHRQoL for the sample of schoolchildren evaluated in this study, but dental enamel hypoplasia negatively influenced OHRQoL oral symptoms, according to the self-perception of children. According to the perception of parents/caregivers, the presence of MIH in the incisor teeth has a greater negative impact on the emotional well-being domain. Furthermore, the dental caries experience influenced the children's OHRQoL in the emotional well-being domains and the total questionnaire score.

## Authors' Contributions

| | | |
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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.

## Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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