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RESEARCH ARTICLE

Molar Incisor Hipomineralization, prevalence and association to gender, presence of caries, MIH severity in incisors and the need for treatment

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Abstract

Introduction: Molar-Incisivor Hipomineralization is a defect of a systemic origin from first molars and permanent incisors, affecting children from the moment of their eruption, and may vary at socioeconomic, cultural, regional and ethnic levels.

Objective: This study aimed to investigate the prevalence of Molar-Incisivor Hipomineralization and its influence on the aesthetic perception of the students regarding the defects presented.

Material and Method: This cross-sectional observational study had a sample of 432 children aged 6-11 years old from the city of Mirante do Paranapanema -SP. Clinical examinations were performed by a single trained and calibrated examiner, using the criteria proposed by the European Academy of Paediatrics Dentistry (EAPD), classifying the anomaly as mild, moderate or severe. To evaluate the perception of aesthetics, the questionnaire Child's and Parent's Questionnaire about teeth appearance (CQATA) was used.

Results: A total of 35 (8.10%) of the children had MIH, and 28. presented severe symptoms. Previous abortion suffered by mothers was reported as the main etiology (11.42%). There was an aesthetic perception in relation to MIH present in the incisors and their dominance in relation to the position of the anomaly.

Conclusion: It is concluded that, there is no association of gender, presence of caries and the need for treatment in relation to MIH. However, there was an association between the severity of MIH and the presence of MIH in incisors with some domains of the CQATA questionnaire.

Keywords: Tooth demineralization; Quality of life; Children; Oral health; Dental enamel

Abbreviations

WHO: The World Health Organization; MIH: Molar Incisivor Hypo Mineralization; GIC: Glass Ionomer Cement

Introduction

Nowadays, oral health problems have drawn attention from managers to the public policies related to the human being quality, due to that they may cause a meaningful impact when it is about the physical, mental and social well-being from the person [1], as well as profess the World Health Organization (WHO), when it is about "Health as not being just the lack of a disease, but as a perfect well-being, physical, mental and social [2] Therefore, it is required the search for a good life quality from the population. The World Health Organization (WHO) defines the life quality as " the perception of a human being by their position in life, the cultural context and the values where they live in relation to their goals, expectations, patterns and worries", namely, it is given an overall perspective from the dimensions of a human being. [3] On the other hand, the child quality may be defined as multidimensional, because it includes social interaction, physical and emotional operation from the child and the teenagers as well as cultural aspects from a society, work relations, feeding, housing, basic sanitation, health environment, education access, leisure, as parameter throughout the person's development [4]. Permanent tooth formation, which is essential to the child and the adult teething, begins in the sixth week from the intrauterine life and its studies are extremely important. The process of this permanent teeth formation is described originated from the dental lamina where there are continuous and localized proliferative activities leading to a series of the epithelial invagination inside the ectomesenchyme, in local that corresponds to the future deciduous teeth position, thus, it is in this part which the teeth germs originate the permanent incisor, canines and premolars teeth, as a result of this proliferative activities. However, the molars of the permanent teething don't have a deciduous previous model, in the same way that their own germs are not originated from the same way as the others.

All the initial teething begins between the sixth and eighth

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weeks of the embryonic development and in the twentieth week of a intrauterine life and the tenth month after the birth the permanent teething happens [5]. The tooth enamel is a high mineralized tissue already known from the ectodermal, formed by the ameloblasts. Constituted by 96% of minerals and 4% of organic material and water. The organic content is consisted by hydroxyapatite, crystalline calcium phosphate, also found in the calcified cartilage, dentin, cementum and bone. When the dental germs are stimulated they may result defeats in the enamel, it may be local or systemic [6-9]. Throughout the years, there was a higher need directed to the developing defeats of the dental enamels [1, 7, 10], among them it can be mentioned the Molar-Incisivor Hypo mineralization (MIH) defined as a defeat of a systemic origin in the dental enamel of first molars and Incisivor permanents [1,7,10,11]. In that condition, the dental elements are fragile, highly affected [1,11,12], the enamel presents porosity, and it is being clinically characterized for being presented with the white opaque chlorination, yellow or brown vary from their degrees of severity, which enable the exposed dentine and allowing the development of carious lesions [1,10,18]. Different from the dental fluorosis, by the excessive hypo mineralization of the white spots fluorine in the moment of the eruption, this spots are more diffused while in the MIH the opacity is more demarcated [7, 11, 17, 19] The first testimony about this condition was identified in the end of the 70's, in the Sweden.

But only in 2001 was identified by Weerhejeim et al, as it was a systemic condition. [11, 13, 20] In relation to the prevalence, the MIH affects children from the dental eruption moment, first molar and incisive, and might vary from the social economic, cultural, region and also for ethnicity [1,13]. The factors may affect the people habits, resulting social embarrassment due to the aesthetic aspect and because the pain by the penetration from the bacteria's on dental tubes through the hypo mineralized enamel, still intact, which takes to inflammatory reactions from the pulp. [16]. Besides, people who are affected by the MIH rely on a dental treatment of their first affected molars among 4 and 10 times more than from people without this anomaly [1]. About the social facts, a study on Kenya developed by Kemoli, in 2008 confirmed that the results in children who were suffering from the MIH may be associated to the poverty level and to health problems in general. And also, affected more by the female gender than the male. In Botelho, Minas Gerais, Brazil, the prevalence of the MIH is of 17,6% in the urban area and 24,3% in the rural area. [14] As possible etiology from the MIH are mentioned systemic facts. [12] as prenatal, perinatal and postnatal complications quoted as respiratory diseases like asthma which makes the prevalence of the dental decay becomes higher and the salivary flow lower [17], low weight in the birth associated to the lack of oxygenation, metabolic disorders from calcium and phosphate and also the common known children diseases like high fever [10-12-19]. The permanent incisors are less affected due to not having masticatory forces acting in the hypo mineralized areas, for this reason incisive treatments have the aesthetic purpose with the composite resins, tooth whitening or micro abrasion. Related to the permanents molars is necessary a preventive treatment, interceptive, showing the use of varnish with fluorine, glass ionomer cement (GIC) which are the most used due the easiest adjust, liberation of fluorine helping the demineralization and a nice chemical adhesion to the dentine, as well as Jalevick et al. 2005 indicated the use of restoring materials that had a better adhesion to the dentine structure [14, 19], ionomer sealants [10, 11, 19], among others. Therefore, the treatment is since the prevention through the child monitoring until all the molars are completely erupted, restoration until the extraction according to the case severity. Not forgetting to mention that the decision of the treatment depend on many factors, the most identified are the dental age developing from the patient, expectation to the result, gravity of the problem, and also family social problems which determines a great role to the child life, providing that is extremely important the parents and children education [11] to the development of a good treatment. The tooth affected by the MIH may present variable porosity, white chlorination, yellow or brown, and when it breaks out lead to the dental exposition causing dental sensitivity and accumulation of niches to the tooth plaque, influencing the masticatory forces and taking to the development of carious lesions, and also causing social embarrassment. The aesthetic perception study of individuals with MIH is of an extreme importance because aesthetic in satisfaction may result in low self-esteem, damaging the physical, mental and emotional development of the child, consequently their quality of life and actions, so that relevant to a higher care and orientation to a posterior planning of health public policy. This study aims at investigating the prevalence of the Molar-Incisivor Hypo mineralization and factors associated to etiology.

Materials and Methods

Ethic Consideration

The research had its initials and execution after the approval of the Ethics Committee in a research performed in the University of the Oeste Paulista (protocol n°3595). Children just could participate after a sign of a consent form (attachment I) signed by parents or responsible of the kids and by the kids who signed the form (attachment IV). The questionnaires were applied after the admission of the Ethics Committee (attachment II, III).

Population and Study Sample

This observational cross-sectional study referred to a representative sample from students between 6 to 11 years old from the Municipal Prof. Zenóbia Campelo Cabral School, located in Mirante do Paranapanema city-São Paulo-Brazil. The population of the research was composed by 432 students from the age of 6 to 11 years old, enrolled in the municipal school previous mentioned. Students that presented their first molars and incisive with a complete erupted crown were included; the ones who accepted to participate in the research with the parents and/or responsible authorization and children with stains characterized of the Molar-Incisivor

Hypo mineralization. Children that had different defects in the enamel as hypoplasia or fluorosis were excluded from the research.

Clinical exam

Before the beginning of the exams, orientation was given about the health and sickness process, methods and controls of the oral condition induced by biofilm, as the dental caries, periodontal sickness and dental plaque. After that, the supervised dental brushing was performed. The exams in the students were performed inside the school in a dental office by a trained and calibrated examiner. Clinical plan oral mirror and periodontal probe were used (WHO), under artificial light (reflector), and wooden spatula. The criteria proposed by The European Academy of Paediatrics Dentistry (EAPD, 2009) were used to the MIH diagnosis, which has modification in at least one first permanent molar as: demarcated opacity bigger than 1mm; post eruptive enamel fracture; and/or atypical restorations that identifies opacity at its edges; lack of first permanent molars in dentition with low caries activity associated to other previous factors already mentioned. The severity of the MIH was ranged as: mild (demarcated opacity without treatment need), moderate (rough enamel or fractured) or severe (lack of dental structure affecting the enamel and the dentine, replacement of tissues with atypical restoration and extracted teeth due to Hypo mineralization) [3]. In order to determine the experience of the caries the index ICDAS was applied (ATTACHMENT II), in which was taken place in adequate conditions of illumination, clean surface, dry (air jets), so that some characteristics associated to the caries lesion became more evident . The index was proposed through scores: Score 0, free of caries; Scores 1-2, concern different lesion stages of white and brown stains; Score 3, lesion with micro cavities; Score 4, shaded lesions; Score 5-6, concern cavitated lesions (in dentin).

Questionnaire

Two questionnaires were applied: [1] Socioeconomic and Demographic (ATTACHMENT II), that was answered by the children parents or responsible and, the ones which had incomplete answers a phone contact was performed and a home visit; this questionnaire had information related to gender, age, parents or the responsible education, parents coexistence, family income (based on the Brazilian minimum wage-equivalent value of R$ 937,00) and the frequency of brushing; [2] Child's and Parent's Questionnaire about teeth appearance (CQATA) (ATTACHEMENT III), which evaluated the aesthetic perception of the child in relation to the defects diagnosed.

Statistical Analysis

The collected data in the study were statistically evaluated using the statistical package SPSS 16.0 (SPSS Inc., Chicago, IL, EUA), and the level of significance considered of α=0, 05. The normality of the data was verified by the Kolmogorov-Smirnov tests, and the scores of the CQATA did not present normal distribution. The Partitioning chi- square tests were used to check the distribution of the sample and from the etiological factors, dichotomized according to the severity of the MIH into mild and severe (including moderate and severe teeth). The statistical analyses were divided according to the gender and clinical characteristics. The clinical characteristics observed were the presence of dental caries, severity of the MIH, presence of the MIH in incisive teeth and the need for treatment. The distribution of the answers in each domain from the CQATA according to clinical features was verified by the Mann-Whitney tests. Scores from CQATA were counted to each domain of the instrument considering the options of the available answers.

Results

432 children were analyzed in the school; from this number 232 were boys (53, 5%) and 200 girls (46, 5%). The prevalence of the MIH was of 8, 10% totalizing a number of 35 children. The table 1 shows the distribution of the sample based on the severity of the Molar-Incisivor Hypo mineralization (MIH). In the total, 35 students from 6 to 11 years old were in the study, and 28, 5% presented severe MIH, 82, 8% lived in the urban area. From 280 dentin elements affected (molars and incisive), 61.0% presented some severity degree of MIH. Most of the affected teeth presented a mild defect (84.2%), followed by the moderate changes (10.0%) and severs (5.8%).

Molar-Incisivor Hypomineralization		
	Mild	**Serve**
Gender		
Male	12 (70.6)	5 (29.4)
Female	13 (72.2)	5 (27.8)
	p = 0.915 (X2)	
Age		
6	2 (100.0)	0 (0,0)
7	6 (50.0)	6 (50.0)
8	10 (100.0)	0 (0,0)
9	2 (50.0)	2 (50.0)
10	4 (66,7)	2 (33,3)
11	1 (100.0)	0 (0,0)
	p = 0,115 (X2 Division)	
Education of the country		
Illiterate to the complete elementary school	10 (71,4)	4 (28,6)
Incomplete high school to the higher education	15 (71,4)	6 (28,6)
	p = 1,000 (X2)	
Housing		
Urban Area	23 (79,3)	6 (20,7)
Rural Area	2 (33,3)	4 (66,7)
	p = 0,023* (X2)	
Income		
Less than 2 minimum wages	19 (76,0)	6 (24,0)
Equal or bigger than 2 minimum wages	6 (60,0)	4 (40,0)
	p = 0,344 (X2)	

Table1: Sample distribution [n(%)] according to gender, education of the country and housing, in accordance with the MIH severity.

The predominant chlorination was white (77.2%), followed by yellow chlorination (22.8%). The frequency of dental caries in the evaluated teeth was of 13.2%, determined by the presence of white stains, caries and restoration with association to caries, which all teeth were first permanent molars and presented MIH associated. In relation to the etiology, only previous abortions, in relation to the pregnancy from students were associated to the severe MIH (Table 2). In the investigation of the relation with the MIH and the physical, psychological and social domains from the CQATA questionnaire, it was not observed association to gender, presence of caries, MIH severity in incisors and the need for treatment (Table 3). In relation to other questions from the questionnaire, the association between the severity of the MIH and the presence in incisors with General Aesthetic Perception dominium was observed (Table 4). There was also an association between the perception of the position and the presence of the MIH in incisors (Table 4).

Molar-Incisivor Hypomineralization		
	Mild	**Severe**
Antibiotic use in pregnancy		
Yes	12 (85.7)	2 (14.3)
No	13 (61.9)	8 (38.1)
	p = 0.127 (X2)	
Anemia during pregnancy		
Yes	6 (75.0)	2 (25.0)
No	19 (70.4)	8 (29.6)
	p = 0.799 (X2)	
Diseases during pregnancy		
Yes	5 (100.0)	0 (0.0)
No	20 (66.7)	10 (33.3)
	p = 0.127 (X2)	
Previous abortions to the pregnancy		
Yes	1 (25.0)	3 (75.0)
No	24 (77.4)	7 (22.6)
	p = 0.029* (X2)	

Table 2: Frequency [n(%)] from the antibiotic use, presence of anemia and other diseases in the pregnancy and presence of previous abortion, according to maternal report, concerning the severity of the MIH.

Discussion

The prevalence of the MIH in individuals related in the literature shows the importance of a better comprehension from their oral health defects and characterization, therefore, the dentist surgeon must be able to recognize and treat the patients affected by the MIH. The prevalence of this study of MIH was higher in urban area, which from 35 children 29 (82, 8%) lived in the urban area, a different finding related to Costa Silva [24] study and Alves Filho [29], that relate higher prevalence in rural area. This paper presented analyzed possible etiologic factors of the MIH and its impact on the aesthetic perception of students from Mirante does Paranapanema city-São Paulo-Brazil. The sample included 432 children, in which 35 were affected by the MIH, a total of 8,10%, different results compared to previous studies by Jeremias [12], which is 12,3%, as well as also presented by Fragelli [35], which the result was 19, 7%, among other papers [24-36]. On the other hand, in relation to Alves Filho [24] studies, that presented 7, 44%, it showed higher; and Kairala [30], that presented a result of 5, 36%, consistent with studies realized in Asia (2, 8%) and Bulgaria (3, 58%) [30]. In this study children from 6 to 11 years old were evaluated, different from studies that presented ages ranging between [6 to 8, 6 to 9, 7] to [13, 8 to 12, 11 to 14], among others [24,29,32-36]. Those presented variations in the study to others, in relation to the prevalence of MIH, may be related to the non-standardization of the ages to be researched in general and also to ethnicities, which brings divergence in results. According to the European Academy of Pediatric Dentistry, the best age to evaluate the effects of the MIH is with 8 years old, when molars and incisors are related, decreasing the risks of defects in the tooth enamel [24, 27]. From the 280 studied teeth, 61, 0% presented some degree of MIH severity, in which a great number presented light severity (84, 2%) and affecting more the permanent first molars, similar data to the Dantas Neta et al. [33], resulting in 49, 5% to the

	Perception of the Oral Health [0-9]	**Physical Domain [0-3]**	**Psychological Domain [0-3]**	**Social Domain [0-3]**
Male	10.0 (2.23)	3.41 (1.00)	2.88 (1.31)	3.71 (0.68)
Female	10.2(2.96)	3.33 (1.02)	3.50 (1.15)	3.44 (1.09)
	p=0.636	p=0.832	p=0.163	p=0.708
Lack of caries	10.1 (2.83)	3.43 (1.03)	3.17 (1.40)	3.57 (0.99)
Presence of Caries	10.0 (2.19)	3.25 (0.96)	3.25 (0.96)	3.58 (0.79)
	p=0.851	p=0.595	p=0.932	p=0.851
Mild MIH	9.96 (2.58)	3.40 (0.91)	3.16 (1.28)	3.40 (1.00)
Severe MIH	10.6 (2.71)	3.30 (1.25)	3.30 (1.25)	4.00 (0.47)
	p=0.577	p=0.928	p=0.843	p=0.212
MIH absent in incisors	10.13 (2.47)	3.36 (0.90)	3.23 (1.23)	3.55 (0.91)
MIH Present in Incisors	10.15 (2.91)	3.38 (1.19)	3.15 (1.34)	3.62 (0.96)
	p=1.000	p=0.801	p=0.960	p=0.801
Absent Need for Treatment	10.08 (2.81)	3.43 (1.03)	3.09 (1.41)	3.57 (0.99)
Present Need for Treatment	10.25 (2.26)	3.25 (0.96)	3.42 (0.90)	3.58 (0.79)
	p=0.878	p=0.595	p=0.694	p=0.851

Table 3: Average (±DP) from CQATA domain: general perception of the oral health, Physical domain, psychological and social domain, is according to gender and clinical features.

	General Aesthetic Perception [0-20]	Appearance Perception [0-5]	Position Perception [0-5]	Coloring Perception [0-5]	Dental Health Perception [0-5]	Satisfaction with appearance [0-4]
Male	15.52 (2.71)	3.41 (1.12)	4.05 (0.89)	4.23 (0.90)	3.82 (0.95)	2.29 (0.92)
Female	16.22 (2.31)	3.50 (0.61)	4.55 (1.42)	4.22 (0.87)	3.94 (0.87)	2.44 (0.78)
	p=0.273	p=0.708	p=0.483	p=0.961	p=0.757	p=0.568
Lack of Caries	15.65 (2.69)	3.30 (0.97)	4.47 (1.12)	4.08 (0.94)	3.78 (0.90)	2.26 (0.61)
Presence of Caries	16.33 (2.14)	3.75 (0.62)	4.00 (1.34)	4.50 (0.67)	4.08 (0.90)	2.58(1.16)
	p=0.619	p=0.099	p=0.151	p=0.161	p=0.400	p=0.548
Mild MIH	15.36 (2.54)	3.32 (0.80)	4.12 (0.92)	4.16 (0.98)	3.76 (0.87)	2.36 (0.81)
Severe MIH	17.20 (1.93)	3.80 (1.03)	4.80 (1.68)	4.40 (0.51)	4.20 (0.91)	2.40 (0.96)
	p=0.041*	p=0.339	p=0.377	p=0.483	p=0.240	p=0.957
MIH in Absent Incisors	14.95 (1.98)	3.31 (0.71)	3.81 (0.85)	4.04 (0.84)	3.77 (0.86)	2.32 (0.83)
MIH in Present Incisors	17.46 (2.56)	3.69 (1.10)	5.15 (1.28)	4.53 (0.87)	4.07 (0.95)	2.46 (0.87)
	p=0.006*	p=0.287	p=0.002*	p=0.180	p=0.408	p=0.775
Present Need for Treatment	15.60 (2.72)	3.39 (0.98)	4.39 (1.19)	4.13 (0.96)	3.69 (0.92)	2.30 (0.76)
Absent Need for treatment	16.41 (2.02)	3.58 (0.66)	4.16 (1.26)	4.41 (0.66)	4.25 (0.75)	2.50 (1.00)
	p=0.548	p=0.503	p=0.503	p=0.327	p=0.099	p=0.668

Table 4: Average (±DP) from CQATA domains: general aesthetic perception, appearance, position, coloring, dental health and satisfaction, according to gender and clinical features.

same severity and molars being the most affected, as well as further studies 24-32. Different from Silva Junior studies (2015) 38, that shows that the most present degree in the MIH is the severe. In relation to the gender predilection, male and female, there was not a statistical significance, because the number of the difference is considered small, 17 boys and 18 girls. This data is in accordance with all analyzed studies which points out the same results. [24-31]. Studies as Andrade [27] and Tourino [30], shows that social economic factors is not related to the MIH, similar result to the present study, which 71, 42% of the families presented an income lower than two minimum wages. Socio economic problems must be taken into consideration when influencing children's health and families that presented different income levels may influence in dental caries, for instance. However, as well as in this paper and other presented, there is not this relation to the MIH [26, 27, 29-31]. The data as the level of education from parents was not mentioned as influence in the prevalence of the MIH in students evaluated, according to studies presented in this research [26, 29, 30]. The study revealed that the etiologic factor of significance was in relation to the abortion suffered from mothers previously to the pregnancy of their children who participated in the research, about [11], 42%. Data that differ from all papers studied in this research but also vary among them. [25-28, 30, 32]. Studies carried by Oliveira [25] and by Salem e et al. [26] pointed that diseases related to mothers during the pregnancy did not have significant relevance to children that participated in the research. But there was one which showed that mothers who underwent to cesarean delivery had relation to the prevalence of the MIH, another shows that the MIH was related to urinary disease, dermatitis from allergic origin, and exposure to pesticide (rural area), respectively. Beside this factor, other studies mention the relation of the prenatal, perinatal and postnatal problems that mothers had [27, 32, 35]. In addition, Salem and et al. [26] showed as MIH etiologic factor the duration of the breastfeeding. Other studies point out as MIH etiologic factor diseases in early childhood, as respiratory diseases. [32]. another one shows the frequency of bleeding during pregnancy of the mother as etiologic factor. [28]. the studies performed so far have shown many etiologic factors to the MIH, affirming that they are multifactorial and they may have a genetic and/or environmental origin. [9, 28]. The aesthetic perception from the child was observed with the presence of the MIH in incisors, as well as the position. Positive data to Fragelli study [35], which shows that the child had a perception in relation to their teeth aesthetic, and also more noticed by girls. The aesthetic perception may vary according to the child age, and over the time, so that it is considered subjective, therefore it is indicated by this study their longitudinal monitoring. The presence of caries was related in [13], 2% from the evaluated teeth, in which all the teeth were molars and had MIH associated. This may occur due to the post eruptive eruption of the tooth enamel, resulting in atypical cavities; and due to its presented characteristics as the lower mechanical resistance and a greater roughness in the teeth surface, beside the biofilm accumulation due to bad hygiene caused by the sensibility that the child presents [27, 29, 33, 34, 36-38]. The early diagnosis of the MIH is essential to adequate treatment varying with the severity of the anomaly, which may be preventive or curative [31, 37] .The treatments are since preventive measures, typical application of fluoride through gels or varnishes restorations with glass ionomer cement (GIC), modified GIC with resin and composed resin until the extraction of the dental element. When the teeth extraction happens, an orthodontic treatment is recommended or the naturally space closure is expected 37.

Conclusion

The conclusion is that, there is no association to gender, presence of caries and the need for treatment in relation to the MIH. However, there was an association between the severity of the MIH and the presence of the MIH in incisors with some domains from the CQATA questionnaire.

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