

# Knowledge of Dentists about Hypomineralization Enamel Defects: A Cross-Sectional Study

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**Academic Editor:** Ana Maria Gondim Valença

**Received:** 04 April 2022 / **Review:** 02 September 2022 / **Accepted:** 13 September 2022

**How to cite:** Costa AP, Silva FMF, Vieira FGF, Primo LG, Costa MC. Knowledge of dentists about hypomineralization enamel defects: a cross-sectional study. *Pesqui Bras Odontopediatria Clín Integr.* 2023; 23:e220059. <https://doi.org/10.1590/pboci.2023.047>

## ABSTRACT

**Objective:** To evaluate a group of Brazilian dentists on their knowledge of Molar Incisor Hypomineralization (MIH) and Hypomineralized Second Primary Molars (HSPM) related to clinical aspects, consequences, and diagnostic criteria. **Material and Methods:** In this cross-sectional, the participants were invited by e-mail and Whatsapp® to answer a questionnaire about their knowledge of hypomineralization enamel defects (MIH/HSPM) on the Google Forms® platform. The questionnaire comprised eight questions about personal data and multiple-choice questions about their knowledge concerning clinical aspects, diagnostic criteria of MIH/HSPM and differential diagnosis through clinical images. Chi-square test was applied with the significance level set at 5%. **Results:** Most participants (n = 492; 91.1%) reported having knowledge about MIH/HSPM. The general dentists gave more incorrect answers (n = 40; 65.6 %) about dental tissues affected by MIH/HSPM. Overall, 83.3% of the dentists gave the correct answer to which dentitions are associated with this condition. In addition, most dentists presented knowledge about the consequences related to possible fractures (n= 487; 90.2%) and about an increased risk of caries (n= 479; 88.9%) in the affected teeth. Regarding the differential diagnosis performed through clinical images, most participants gave incorrect answers (p≤0.001). **Conclusion:** The participants presented knowledge about the dentition associated with this condition and possible consequences related to the teeth affected by MIH/HSPM; however, they showed difficulties concerning clinical diagnostic criteria.

**Keywords:** Dentists; Dental Enamel; Dental Enamel Hypoplasia; Surveys and Questionnaires.

## Introduction

Molar Incisor Hypomineralization (MIH), is defined as a developmental defect of enamel (DDE) that affects at least one permanent molar [1]. In addition, similar hypomineralization lesions have been identified in primary teeth, most frequently on second primary second molars, known as Hypomineralization Second Primary Molars (HSPM) [2]. This condition has been described as one of the more common DDEs [3]. The global prevalence is estimated at 14.2% [4-6], while in Brazil, it varies from 2.5% to 40.2%, depending on the region [7,8].

These hypomineralization lesions are clinically characterized by demarcated opacities, which may vary from white/yellowish to brown and, in some cases, may be presented as post-eruptive fractures [1,8]. Another characteristic is hypersensitivity of the affected teeth, which may cause difficult oral hygiene, resulting in dental caries [9]. Also, aesthetic problems may be considered since this condition may affect anterior teeth [10,11]. In this sense, individuals with MIH\HSPM should be periodically monitored at dental appointments to help the management [12].

Due to the severity of these lesions, it is extremely important to assess the level of knowledge of dentists in relation to MIH/HSPM, allowing for future educational and informational projects about these conditions to minimize the consequences for individuals. Only a few studies have reported the lack of knowledge of MIH/HSPM by dentists, especially in relation to the clinical diagnosis and methods of treatment [13-15]. Difficulties in diagnosis can happen because these defects may have similar clinical presentations. Thus, this study aimed to evaluate the knowledge concerning clinical aspects, diagnosis criteria and consequences about MIH/HSPM among dental practitioners with different education degrees.

## Material and Methods

### Ethical Aspects

This study was approved by the local Ethics Committee (*Hospital Universitário Clementino Fraga Filho – HUCFF/UFRJ*) under protocol number 3.556.13. All subjects read and signed a written informed consent form before participating in the study.

### Study Design

This cross-sectional study was conducted with general dentists and postgraduates from Brazil. The individuals were invited to answer structured electronic questionnaires about their knowledge concerning clinical aspects, diagnostic criteria of MIH/HSPM and its consequences. The questionnaire was prepared on the Google Forms® platform (Google, San Francisco, USA) and the link with the instrument was sent by email and WhatsApp Messenger (WhatsApp Inc., Menlo Park, CA, USA) to registered dentists and research groups. Before proceeding with the answers, the participants had to agree to their participation in order to access the questionnaire. Incomplete questionnaires were excluded.

### Questionnaire Elaboration

The elaboration process of the questionnaire was carried out in three stages.

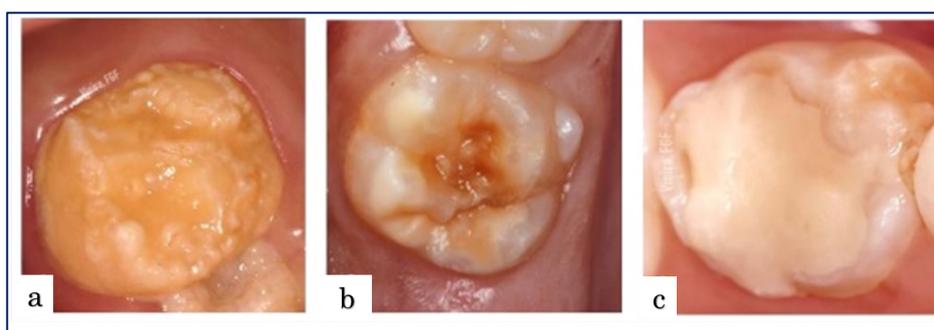
#### 1) Elaboration of the Questions

In this stage, there was the participation of one Pediatrics dentistry professor, one Ph.D. student and one Master student in Pediatric Dentistry, with experience in relation to enamel development defects. The questions were related to their education degree, knowledge about clinical aspects, diagnosis criteria, and

consequences of MIH/HSPM. In addition, the last question included clinical images with different aspects of the hypomineralization enamel defects (MIH/HSPM) [15] and one with amelogenesis imperfecta to perform the differential clinical diagnosis.

## 2) Selection of Clinical Images for the Clinical Diagnosis

Clinical images used in the questionnaire were obtained from files at Pediatric Dentistry Clinic of the Federal University of Rio de Janeiro. A pediatric dentist (Ph.D. student) previously calibrated for MIH/HSPM selected the images. The European Academy of Pediatric Dentistry [14] criterion was used for the selection of images. A total of three clinical images were selected: the first was amelogenesis imperfecta in a permanent first molar; the second was a demarcated opacity in a permanent first molar and the last one, a demarcated opacity with loss of structure in a primary second molar (Figure 1).



**Figure 1. Clinical images: (A) Amelogenesis imperfect in permanent first molar; (B) Demarcated opacity in a permanent first molar; (C) Demarcated opacity with loss of structure at a primary second molar.**

## 3) Evaluation of the Clarity and Appropriateness of the Questions

Five pediatric dentists assessed the understanding and clarity of the first version of questionnaire (consisting of nine questions). Each evaluator analyzed the questionnaire separately and they made suggestions such as to remove the questions about treatment since they presented more than one option and could generate doubts in the respondents. Another suggestion was to change the images to more representative ones. Then the questions were classified as “agree” or “disagree”. If the question had three or more disagree ratings, they would be removed. The final version has eight questions, as follows:

1. What is your educational qualification?
2. Do you know about the MIH/HSPM?
3. What dental tissues are affected by MIH/HSPM?
4. Which dentitions can be affected by MIH/HSPM?
5. What is the criterion used for the diagnosis of MIH/HSPM?
6. Do patients with MIH/HSPM have a greater chance to fracture the affected tooth?
7. Do patients with MIH/HSPM have a greater chance to present dental caries?
8. Which of these images do you diagnose as MIH/HSPM?

The response options for all questions were presented in the form of multiple-choice items and each question had just one correct answer. Questions 3 to 7 present three different options to choose, but question 8 presents six options to choose. These questions were rated as correct (1) or incorrect (0), according to the scientific evidence related to the topic.

## Statistical Analysis

The data were evaluated using SPSS® (Statistical Package for the Social Sciences®, version 21.0, Chicago, USA). Descriptive statistics were determined in questions 3 to 7. The Chi-square test was used just for question number 8 (diagnostic criteria) to analyze a significant difference between the correct and incorrect answers for all respondents.

## Results

A total of 540 individuals answered the questionnaires and most of them were composed of pediatric dentists (n=333 / 61.7%), 17.8% (n=96) had a master's degree, 9.2% (n=50) a Ph.D. degree and 11.3% (n=61) general dentists' degree. Most participants (n= 492; 91.1%) reported knowledge about MIH/HSPM. The general practitioners presented more incorrect answers regarding knowledge of the dental tissues that are affected by MIH/ HSPM (n = 40; 65.6 %), followed by the master's degree group (n = 51; 54.2%) (Table 1).

When asked what dentition could be affected by MIH/HSPM, 83.3% of the participants chose both (primary and permanent). The general dentist's group (60.7%) reported more incorrect answers in relation to the diagnostic criteria, followed by the specialists (53.2%) (Table 1).

**Table 1. Distribution of the answers to questions 3 to 7 chosen by the participants according to the education degree.**

Questions	Answers	Education Degree			
		General Dentist N (%)	Specialist N (%)	Master N (%)	Ph.D. N (%)
What dental tissues are affected by MIH/HSPM?	Enamel	31 (50.8)	134 (40.2)	44 (45.8)	23 (46)
	Dentine	1 (1.6)	2 (0.2)	2 (2.1)	0 (0.0)
	Enamel + Dentine	22 (36.1)	186 (55.9)	47 (49)	26 (52)
	Do not know	7 (11.5)	11 (3.3)	3 (3.1)	1 (2.0)
What dentition can be affected by MIH/HSPM?	Permanent	14 (23)	50 (15)	7 (7.3)	8 (16)
	Primary dentition	6 (9.8)	4 (1.2)	0 (0.0)	1 (2.0)
	Both dentition	41 (64.2)	279 (83.8)	89 (92.7)	41 (92.7)
What is the criterion used for the diagnosis of MIH/HSPM?	Presence of at least one affected permanent first molar	16 (26.2)	62 (19.2)	14 (14.6)	11 (22)
	Presence of at least one affected permanent incisor	5 (8.2)	3 (0.9)	4(4.2)	0 (0.0)
	Presence of at least one first permanent molar and/or one second primary molar	23 (37.7)	157 (47.1)	55 (57.3)	28 (56)
	None of the answers are right.	17 (27.9)	109 (32.7)	23 (24.0)	11 (22.0)
Patients with MIH/HSPM are more chance to fracture the affected tooth?	Yes	47 (77)	298 (90.0)	95 (96.6)	47 (94.0)
	No	14 (23)	33 (10.0)	3 (3.1)	3 (6.0)
Patients with MIH/HSPM have more chance to develop dental caries?	Yes	48 (78.7)	295 (88.6)	88 (91.7)	48 (96.0)
	No	13 (21.3)	38(11.4)	8(8.3)	2 (4.0)

In questions 6 and 7, 90.2% of the general dentists were aware about changes to the mechanical properties and 88.9% of them agreed that teeth affected by MIH/HSMD have a greater chance to develop dental caries (Table 1). Considering the differential diagnosis based on the clinical images (Figure 1), there were statistical differences between all the groups in relation to the incorrect answers ( $p \leq 0.001$ ) (Table 2).

**Table 2. Diagnosis of MIH\HSPM based on the clinical image.**

Question Number #8	Answer	Education Degree				Total N (%)	p-value*
		General Dentist N (%)	Specialist N (%)	Master's N (%)	Ph.D. N (%)		
Which of these images do you diagnose as MIH/HSPM?	Correct	6 (9.8)	119 (35.7)	32 (33.3)	19 (38.0)	176 (32.6)	0.001
	Incorrect	55 (90.2)	214 (64.3)	64 (66.4)	31 (62.0)		

\*Statistical differences between all the groups.

## Discussion

The data collected and the results of this study show that most participants, regardless of their degree, claimed to have knowledge of MIH/HSPM (91.1%); however, difficulty was observed in relation to the diagnosis. Similar results were found in a study in the city of Teresina, Brazil [13], carried out with 324 dental professionals, where although 93.9% of the interviewees claimed to know the condition, there was also difficulty in making an adequate diagnosis.

Also, the results showed that dentists know about the consequences for individuals with this condition. Teeth affected by HMI/HSPM are more vulnerable to post-eruptive fractures due to hypocalcified enamel [15], which reveals the great need for early diagnosis. When asked about this mechanical property, most respondents answered that teeth with MIH/HSPM are more likely to fracture, corroborating findings already present in the literature [13,16].

Regarding the greater chance of developing caries in the affected teeth, the largest number of participants were assertive in their answers, in agreement with the results of previous studies [16,17]. This was confirmed with a perception study, which reported that hypomineralization was an important risk factor for the presence of caries in permanent and deciduous dentition, with rapid progression in hypomineralized molars [18].

In addition, most interviewees reported correct answers about which dental tissue could be affected by MIH/HSPM, except the general dentists, who presented 49,1 % of incorrect answers. Another point observed was that the dentists demonstrated knowledge about which dentitions were affected by MIH/HSPM, though most of them presented difficulties in relation to the diagnostic criteria. The same information was observed in an Irish study where 42% of the dentists lacked confidence to diagnose this condition [7].

MIH/HSPM requires a differential diagnosis with fluorosis, amelogenesis imperfecta, and hypoplasia [1]. Regarding the diagnostic with clinical images, many participants (general dentists and postgraduates) were not able to perform it correctly. This fact might directly impact the clinical conduct since the correct diagnosis is essential to establish preventive measures and adequate treatments for patients with dental enamel defects.

Some studies, which focused on the dentist's perception of hypomineralization enamel defects, evaluated demographic characteristics, different professional groups, in addition to questions about treatment options and etiological factors [15-18]. Our study focused mainly on the clinical characteristics, consequences and diagnosis of MIH/HSPM. However, we believe that data on treatment options and knowledge about the possible etiological factors are important. We encourage future studies to include these points. It is worth mentioning that the sample of the present study was composed mostly by specialists, who may have received more information on the topic, and therefore, the results should not be generalized. However, this study should still be considered relevant as it provides a basis for future investigations on the topic, especially with general dentists, who were the minority in the study. In addition, the fact that the images of the questionnaire only showed one tooth with a development defect of enamel (DDE) made it more difficult for the participants to choose the correct answer, as it can be confused with other alterations such as amelogenesis imperfecta, which affects all groups of

teeth. Full mouth images would be more appropriate in Amelogenesis imperfecta (AL), although the clinical features of the teeth displayed in the questionnaire were quite representative.

The results from these studies are important since it is possible to understand the perception of dentists in relation to this condition. Development defects of enamel directly affect the quality of life of children worldwide. Therefore, it is important to organize educational strategies to prepare dentists to make the correct diagnosis and provide better management of individuals affected by MIH/HSPM.

## Conclusion

The general dentist and postgraduate presented knowledge about the clinical aspects and consequences of the teeth affected by MIH /HSPM. However, mostly the general dentist had difficulty establishing the affect MIH/HSPM has on dental tissues. Furthermore, most participants (dental surgeons or postgraduates) chose the incorrect answer when asked about the diagnosis through photography.

## Authors' Contributions

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FMFS		<a href="https://orcid.org/0000-0003-3247-7746">https://orcid.org/0000-0003-3247-7746</a>	Conceptualization, Methodology, Formal Analysis, Investigation, Writing - Review and Editing.
FGFV		<a href="https://orcid.org/0000-0001-9437-1715">https://orcid.org/0000-0001-9437-1715</a>	Methodology, Formal Analysis, Investigation and Writing - Original Draft.
LGP		<a href="https://orcid.org/0000-0003-3718-693X">https://orcid.org/0000-0003-3718-693X</a>	Methodology, Validation, Formal Analysis, Writing - Review and Editing, Supervision and Project Administration.
MCC		<a href="https://orcid.org/0000-0003-2192-1960">https://orcid.org/0000-0003-2192-1960</a>	Methodology, Writing - Review and Editing, Supervision and Project Administration.
All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.			

## Financial Support

None.

## 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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