



The Prevalence and Association between MIH and HSPM in School Going Children of Goa state, India – A Cross-sectional Study

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KEYWORDS

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ABSTRACT:

Introduction: The prevalence of Molar Incisor Hypomineralization (MIH) and Hypomineralized Second Primary Molars (HSPM) varies globally and across different states of India. The aim of the study was to assess the prevalence of MIH and HSPM in 7–9-year-old school children in Goa, India.

Methods: Ethical clearance was obtained from the Institutional Ethics Committee and the study was carried out in primary schools across the talukas of Goa state. Molar Incisor Hypomineralization and HSPM were recorded in 7–9-year-old school children as per the data recording sheets suggested by Ghanim et al. The IBM SPSS version 26 software was used for the statistical analysis.

Results: A total of 503 children were examined, out of which 15.71% had MIH and 8.95% had HSPM. Almost half of the affected children showed the simultaneous occurrence of MIH and HSPM.

Conclusions: The prevalence of MIH and HSPM in Goa were found to be within global prevalence limits. Hypomineralized Second Primary Molars may be a warning sign for the occurrence of MIH.

1. Introduction

The term Molar Incisor Hypomineralization (MIH) was first introduced in 2001 by Weerheijm et al., and was defined as a hypomineralization of systemic origin, presenting as demarcated, qualitative defects of enamel of one to four permanent first molars (PFM), frequently associated with affected incisors [1]. Koch et al. later referred to these as “cheese molars.” This condition has also been described under various names, including hypomineralized permanent first molars, idiopathic enamel hypomineralization, non-fluoride hypomineralization and dysmineralized PFM [2].

The global prevalence of MIH has been estimated to vary widely, ranging from 2.9% to 44% [3]. The diagnostic criteria proposed by Weerheijm et al. are internationally recognized for identifying and classifying MIH, relying mainly on the clinical observation of clearly demarcated enamel opacities as the key feature for diagnosis [4].

Comparable enamel defects affecting the second primary molars (PSM) are termed Deciduous Molar Hypomineralization (DMH) or Hypomineralized Second Primary Molars (HSPM). This condition is also regarded as a potential predictor for the later development of MIH

[5]. The global prevalence of HSPM has been reported to range between 2.9% and 21.8% [6].

A consensus statement by the European Academy of Paediatric Dentistry (EAPD) established standardized criteria for the identification and scoring of teeth affected by MIH and HSPM [4,7]. Molar Incisor Hypomineralization is categorized according to severity as mild, moderate, or severe. Mild MIH presents with white or creamy opacities on the enamel surface. Moderate MIH is identified by yellow to brown discolorations. And, severe MIH involves post-eruptive enamel breakdown (PEB) in addition to discoloration, which can result in cavity formation and progressive enamel loss [4].

Only a limited number of studies in India have investigated the prevalence of HSPM and its possible association with MIH [8,9,10,11]. Hence, the present study was conducted to determine the prevalence of MIH and HSPM among 7–9-year-old school children in the state of Goa, India.



2. Methods

This cross-sectional survey was carried out in the primary schools of Goa, which were divided into 12 talukas. The minimum sample size was found to be 384 according to the formula:

$$N = Z^2PQ / d^2$$

Where, n = Minimum sample size

Z = Level of confidence (at 95% = 1.96)

p = Expected Prevalence (10% = 0.10)

q = 1 - p

d = Precision (3% = 0.03)

Ethical clearance was obtained from the Institutional Ethics Committee. Permission to conduct the study in primary schools across Goa was obtained from the Directorate of Education. Within each taluka, the simple random sampling method (Lottery method) was used to select the primary schools and the required number of children for the study. Permission was also obtained from the principals of the selected primary schools for conducting the examinations. A leaflet consisting of informed consent, assent, purpose and the nature of the study, was given to children aged 7-9 years. Only children who gave assent, and whose parents (or guardians) had consented for the study were considered. It was necessary that a minimum of one PFM and one PSM should have completed eruption.

An intraoral examination was performed by a single trained and calibrated examiner, who was assisted in data recording. The examiner underwent calibration using the EAPD training manual for MIH and HSPM to ensure accurate differentiation of MIH from other enamel defects and to minimize intra-examiner variability [12]. The agreement levels for all assessments ranged between 85% and 95% (kappa statistics), indicating a high level of consistency and reliability in the observations.

The examiner adhered to the standard infection control protocol. Each subject was asked to sit on a chair with The prevalence of both MIH and HSPM were found to be the highest and lowest in Tiswadi and Canacona, respectively (Tables 1 and 2). The total number of subjects with MIH, HSPM or both was found to be 82. However, the simultaneous occurrence of MIH and

their head resting at a 45° angle to the ground and was assessed as per the data recording sheets described by Ghanim et al. [7]. The teeth were examined without being air-dried using a sterile mouth mirror and artificial white light illumination. Sterile cotton rolls were used to remove debris if any. A sterile ball-ended probe (CPITN #3) was used to check for surface irregularities or cavitation. After evaluation, a talk on oral health was given to the students and teachers, and those who were found to require dental treatment were asked to visit the dental hospital for treatment.

The IBM SPSS version 26 software was used for statistical analysis. Descriptive statistics such as frequency, percentages, mean, and standard deviations were calculated. The associations between MIH and HSPM were made using the Chi-square test.

3. Results

A total of 800 parents (or guardians) and their children were requested to participate in the study. Out of these, only 503 parents and their children signed consent forms and provided assents, respectively. The subjects consisted of 228 males and 275 females. The percentage of children who were aged 7, 8 and 9 years were 28.8 %, 28.6 % and 42.5 % respectively. The prevalence of MIH was found to be 16.22 % (males) and 15.27% (females). MIH prevalence was the highest among 7-year-olds (17.25 %) followed by 9-year-olds (15.43 %) and 8-year-olds (14.59 %) with no statistical difference between the three age groups.

HSPM was found in males (10.52%) and females (7.63%), and its prevalence was the highest among 8-year-olds (10.41 %), followed by 9-year-olds (9.34 %) and 7-year-olds (6.89 %) with no statistical difference between the ages. MIH and HSPM were found to occur more commonly in the lower arch (MIH: 64.85 %; HSPM: 62.72 %) as compared with the upper arch (MIH: 35.14 %; HSPM: 37.27 %). The permanent incisors (PI) were affected in 26.58 % (21/79) of the cases with MIH, while they were affected in 33.33 % (15/45) of the cases with HSPM.

HSPM was found to be highly significant 51.21% (42 children; Table 3). The most common type of defect (Table 4) was 'demarcated opacities', for both MIH and HSPM and its occurrence was found to be statistically significant.

**Table 1. Distribution of the prevalence of MIH in the talukas of Goa**

Taluka	MIH absent		MIH present		Chi2 (p value)
	N	%	N	%	
Bardez	29	85.30	5	14.70	6.43 (0.843)
Bicholim	42	85.72	7	14.28	
Canacona	47	88.68	6	11.32	
Dharbandora	35	81.40	8	18.60	
Murmagoa	31	83.79	6	16.21	
Pernem	29	82.86	6	17.14	
Ponda	37	88.10	5	11.90	
Quepem	38	84.45	7	15.55	
Salcete	44	84.62	8	15.38	
Sanguem	25	83.34	5	16.66	
Sattari	38	88.38	5	11.62	
Tiswadi	29	72.50	11	27.50	
Total	424	84.29	79	15.71	

(MIH= Molar Incisor Hypomineralization; N= frequency; %= percentage)

Table 2. Distribution of the prevalence of HSPM in the talukas of Goa

Taluka	HSPM absent		HSPM present		Chi2 (p value)
	N	%	N	%	
Bardez	32	94.12	2	5.88	12.176 (0.351)
Bicholim	42	85.72	7	14.28	
Canacona	50	94.34	3	5.66	
Dharbandora	40	93.04	3	6.96	
Murmagoa	33	89.19	4	10.81	
Pernem	33	94.29	2	5.71	
Ponda	40	95.24	2	4.76	
Quepem	40	88.89	5	11.11	
Salcete	47	90.39	5	9.61	
Sanguem	29	96.67	1	3.33	
Sattari	40	93.03	3	6.97	



Tiswadi	32	80	8	20	
Total	458	91.05	45	8.95	

(HSPM: Hypomineralized Second Primary Molars; N= frequency; %= percentage)

Table 3. Association between MIH and HSPM

HSPM	MIH				Total	Chi2 Test
	Absent		Present			
	N	%	N	%		
Absent	421	91.9	37	8.1	458	p=0.000<0.001
Present	3	6.7	42	93.3	45	
Total	424	84.3	79	15.7	503	

(MIH= Molar Incisor Hypomineralization; HSPM: Hypomineralized Second Primary Molars; N= frequency; %= percentage)

Table 4. Distribution of the type of defects in MIH and HSPM

Type of defect	MIH		HSPM		Chi2 (p value)
	N	%	N	%	
Demarcated opacities	172	85.14	49	44.54	62.52 (<0.001)
Post-eruptive enamel breakdown	14	6.93	14	12.72	
Atypical restoration	3	1.48	6	5.45	
Atypical caries	13	6.43	40	36.36	
Extraction due to MIH/HSPM	0	0	1	0.9	
Total	202	100	110	100	

(MIH= Molar Incisor Hypomineralization; HSPM: Hypomineralized Second Primary Molars; N= frequency; %= percentage)

4. Discussion

The prevalence of MIH in Goa was found to be 15.71%. Similar prevalences such as 15.2% and 12.9% were observed in Riyadh (Saudi Arabia) and Chennai (Tamil Nadu), respectively [13,2]. A lower prevalence of 2.1% was reported in Krishna district (Andhra Pradesh) [14]. Higher prevalence rates of 27.2% and 21.4% were observed in Dubai (UAE) and Muradnagar (Uttar Pradesh), respectively [15,16]. The prevalence of HSPM in Goa was found to be 8.95 %, similar to prevalences such as 6.6% and 7.9%, in Iraq and Chandigarh (Punjab), respectively [17,8]. A higher prevalence of 14.1 % was

reported in Greater Melbourne (Australia) [18]. Lower prevalences of 5 % and 5.6 % were seen in Delhi NCR region and Uttar Pradesh, respectively [9,10]. The wide range of prevalences could be attributed to variations in sample size, diagnostic criteria, age groups, ethnic or racial factors and indices used in these studies.

In this study, the concomitant presence of MIH and HSPM was seen in 51.21% of the children, and the presence of MIH with HSPM was found to be highly significant (Table 3). The simultaneous presence of both MIH and HSPM were found to be 55.9 % and 32.73 % in two previous studies [13,10]. However, Sidhu et al.,



found that HSPM is not predictive of MIH [23]. The simultaneous presence of both the defects can be attributed to similar mineralization timings of FPM and HSPM [10].

Demarcated lesions were the most common defects observed in HSPM (44.54 %; Table 4). This result is in agreement to that obtained by Ghanim et al., who reported 44 % demarcated opacities in HSPM [17].

Mandibular teeth showed a significantly greater number of MIH and HSPM lesions. This is in accordance with a study done by Bhaskar et al., while Ghanim et al., reported greater number of MIH defects in the maxilla [20,21]. Two studies had observed a greater number of HSPM lesions in the mandible, while Goyal et al., reported more HSPM lesions in the maxilla [8,9,10]. Difficulties in viewing maxillary molars and the susceptibility of mandibular molars to caries due to earlier eruption, might have been the reason for variation in results [20].

Permanent incisors were found to be affected in 26.58% cases of MIH and 33.33% cases of HSPM. Similarly, Ghanim et al., and Elzein et al., reported hypomineralized FPM with affected incisors in 28.8 % and 45.1 % of the cases, respectively, however, Barber et al., reported affected incisors in 60 % of such children [21,22,23]. This could be because almost all the permanent incisors erupt by 8 years of age, and the inclusion of the 7-year-old age group in this study could have led to underreporting of affected incisors in MIH affected FPM.

Children aged 7-9 years were selected for the study, consistent with the recommended age group [24]. The modified EAPD diagnostic criteria by Ghanim et al., was used for assessing MIH and HSPM lesions, and the short charting method was employed which provides sufficient data about the demarcated enamel defects [7]. In many instances, the PSM had suffered complete crown destruction due to caries, creating difficulty in the assessment of HSPM. To prevent this limitation, we recommend future studies that would assess HSPM and MIH in 5- and 8-year-old children, respectively.

5. Conclusion

The prevalence of MIH and HSPM in Goa were found to be within global prevalence limits. HSPM may be a

warning sign for the occurrence of MIH. The prevalence of both MIH and HSPM were found to be the highest and lowest in Tiswadi and Canacona, respectively.

6. References

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