

# Prevalence and Treatment Need of Molar Incisor Hypomineralisation in 8-12 Year Old School Going Children of Cuttack, Odisha

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## ABSTRACT

**Introduction:** Molar Incisor Hypomineralisation (MIH) is a condition where one or more first permanent molars with or without permanent incisors are hypomineralised due to disturbances during the maturation phase.

**Aim:** To determine the prevalence, severity and treatment need of MIH among 8-12-year-old school going children in Cuttack, Odisha.

**Materials and Methods:** A cross-sectional epidemiological survey was conducted, including 1525 students, using diagnostic criteria established by the European Academy of Paediatric Dentistry (EAPD) 2003. Two calibrated examiners examined the children using artificial light. A descriptive analysis of the prevalence and distribution of the clinical recordings was performed using the Statistical Package for Social Sciences, version 17.0 (SPSS Inc., Chicago, IL, USA).

**Results:** A total of 87 children (5.7%) were found to have MIH. Boys showed higher prevalence (57.4%) compared to girls (42.4%). Mandibular molars and maxillary incisors were found to be affected more frequently compared to other teeth.

**Conclusion:** MIH is more prevalent in boys than girls and mandibular molars are affected more frequently than maxillary molars. Hypomineralised molars are more susceptible towards developing dental caries than molars which are not affected by the condition. Molars affected by this condition need wide spectrum of treatment ranging from preventive care, pit and fissure sealant application, restoration, pulp therapy and extraction. Early intervention of these teeth can reduce the complications and expenses incurred towards dental treatment.

**Keywords:** Dental caries, Dental enamel hypoplasia, Incisors

## INTRODUCTION

Molars and sometimes permanent incisors are hypomineralised due to disturbances in maturation phase of tooth development leading to a condition known as MIH [1]. The condition is also known as non-fluoride enamel opacities, internal enamel hypoplasia, non-endemic mottling of enamel, opaque spots, idiopathic enamel opacities, enamel opacities, cheese molars and idiopathic enamel hypomineralisation [2]. The term MIH was first introduced by Weerheijm KL, [3] as hypomineralisation of systemic origin of one to four permanent first molars frequently associated with affected incisors.

Clinical appearance of the affected teeth may vary from white to brown with well demarcated line between the healthy and affected portion of the enamel. The affected enamel can be porous and chip off easily under masticatory force. The tooth may appear as hypoplastic due to enamel break down but can be differentiated from hypoplasia based on irregular margins of the lesion in MIH cases [4]. The affected incisors show only discolouration of varying degrees with minimal or no loss of enamel due to less force exerted on the incisors [5].

MIH increases risk for enamel breakdown which leads to increased plaque accumulation and subsequently increased risk of developing dental caries. This condition often inflicts significant long-term costs to the affected individuals. At population level, MIH implicitly poses a substantial socioeconomic burden and overlaps with conventional risk factors for childhood caries [6].

The treatment options of MIH depend upon severity of conditions. Early identification of children at risk of MIH and prompt diagnosis at initial stage of involvement can lead to more effective and conservative

management. It is always prudent to commence prevention measures such as remineralising agents and fluoride application as soon as MIH teeth erupt as they are prone to post-eruptive enamel breakdown and caries due to the greater porosity of enamel and its lower mechanical resistance especially in severe MIH lesions [7]. The treatment decision for MIH affected tooth depends upon child's age, severity of MIH, pulp involvement, presence of third molar germ, restorability of the tooth, expected long-term prognosis and long-term treatment cost [8]. The treatment options for MIH affected molar and incisors ranges from minimal invasive approach like resin infiltration technique, light cure composite restorations/veneers or laminates and glass ionomer, full or partial coverage restoration to extraction of severely affected teeth.

The prevalence of MIH varies across the world between 2.4% to 40.2% [2,7]. Studies from different parts of India like Gujarat, Chandigarh and Mumbai reported prevalence of MIH to be 9.2%, 7.9% and 9.7% respectively [9-11]. The highest prevalence is reported among children of Rio de Janeiro, Brazil [8]. Zhao D et al., conducted a review of 70 studies across the globe and reported a pooled prevalence of MIH among the children as 14.2% [12].

There exists paucity of scientific evidences pertaining to MIH especially in the Eastern part of India mainly from Odisha. Hence, the present study was executed in an attempt to determine the prevalence and treatment need of MIH among the 8-12 year school going children population of Cuttack, Odisha.

## MATERIALS AND METHODS

A list of Government schools was obtained from District Education office, Cuttack. Out of the existing 18 educational clusters of Cuttack,

six clusters were selected one each from north, south, east, west and two from central. Six Government schools were selected one from each selected cluster by simple random sampling through assigning numbers generated from table of random numbers. All the children aged between 8-12 years in the selected schools were included for this cross-sectional survey, which involved 1525 children excluding the absentees. This age group was selected to have best probability of having first permanent molars and incisors erupted into the oral cavity.

Due approval for the study was obtained from the Institutional Ethics Committee of S.C.B Dental College and Hospital, Cuttack (Letter No. SCBDCH/IEC/05/18). The data was collected between December 2017 and May 2018. Before commencement of the study, prior permission was obtained from the District Education Officer (DEO), Cuttack and respective school authorities. Informed consent forms were distributed to all students and parental approval was ascertained.

Students present on the day of examination, with approved informed consent forms, were included in the study. Two well-trained calibrated examiners performed the dental examinations using artificial light and mouth mirror. In order to avoid variation in the observations, the examiners were calibrated before conducting the survey. Inter and intra examiner agreement was standardised by Cohen's Kappa >0.8. A full mouth visual inspection of wet teeth was performed for all students included in the study by using the European Academy of Pediatric Dentistry (EAPD) 2003 criteria for recording MIH [13], and WHO 1997 criteria were used for recording caries status and treatment need of the affected teeth.

### STATISTICAL ANALYSIS

Statistical Package for Social Sciences (SPSS) 17.0 was used for data analysis. A descriptive analysis of the distribution of the clinical recordings and prevalence was performed.

### RESULTS

Amongst 1525 examined children, examined 52.5% (800) were boys and 47.5% (725) were girls [Table/Fig-1]. Out of 1525 children, 87 (5.7%) were diagnosed to have teeth affected by MIH. The occurrence of MIH was observed more frequently in boys, 50 (3.27%) than in girls, 37 (2.43%) [Table/Fig-2]. Age wise distribution of the condition revealed higher prevalence; 22 (1.45%) among the 10-year age group compared to other age groups of the study population [Table/Fig-3]. Among the affected children, 33 (37.9%) had hypo-mineralised molars (MH) and 38 (43.7%) had hypo mineralised incisors (IH) while 16 (18.4%) had both molars and incisors affected with MIH [Table/Fig-4]. Among the 87 children, a total of 253 First Permanent Molars

Age	Gender		χ <sup>2</sup>	p-value
	Boys	Girls		
8 years	149 (9.8%)	118 (7.73%)	2.3	0.66
9 years	171 (11.2%)	147 (9.63%)		
10 years	155 (10.16%)	152 (9.96%)		
11 years	149 (9.77%)	146 (9.57%)		
12 years	176 (11.54%)	162 (10.62%)		
Total	800 (52.45%)	725 (47.54%)		

[Table/Fig-1]: Gender and Age wise distribution of the children.

Gender	MIH Status		χ <sup>2</sup>	p-value
	MIH present	MIH absent		
Boys	50 (3.27%)	750 (49.18%)	0.92	0.33
Girls	37 (2.42%)	688 (45.1%)		
Total	87 (5.7%)	1438 (94.3%)		

[Table/Fig-2]: Gender wise distribution of MIH affected children.

(FPM) and permanent incisors were found to be affected by MIH, out of which 178 (70.4%) were FPM and 75 (29.6%) were permanent incisors. Among the affected 1<sup>st</sup> molars 112 (63%) were mildly affected, whereas 66 (37%) were severely affected. Mandibular 1<sup>st</sup> molars on right quadrant were found to be the most commonly affected followed by maxillary left, mandibular left and maxillary right 1<sup>st</sup> molars [Table/Fig-5]. It was found that mandibular left first molars affected by MIH, were most commonly involved by dental caries [Table/Fig-6]. About 75% of the teeth affected by MIH were sound and did not need any treatment, 20% were in need of preventive therapy, 13% needed application of pit and fissure sealant, and 19% required one or two surface restoration [Table/Fig-7].

Age	MIH status		χ <sup>2</sup>	p-value
	MIH present	MIH absent		
8 year	17 (1.1%)	250 (16.39%)	3.84	0.42
9 year	15 (0.9%)	303 (19.86%)		
10 year	22 (1.44%)	285 (18.68%)		
11 year	19 (1.24%)	276 (18.09%)		
12 year	14 (0.91%)	324 (21.24%)		
Total	87 (5.7%)	1438(94.3%)		

[Table/Fig-3]: Age wise Distribution of MIH affected children.

Phenotype	Frequency	Percentage
Molar alone (MH)	38	43.7
Incisor alone (IH)	33	37.9
MH+IH	16	18.4

[Table/Fig-4]: Distribution of MIH based on phenotype.

Arch	Tooth	Side	Mild n (%)	Severe n (%)
Maxillary	1 <sup>st</sup> molar	Right	22 (8.6%)	13 (5.1%)
		Left	27 (10.7%)	17 (6.7%)
Mandibular	1 <sup>st</sup> molar	Right	38 (15.0%)	21 (8.3%)
		Left	25 (9.9%)	15 (6.0%)
<b>Total molars</b>			112 (44.2%)	66 (26.0%)
Maxillary	Central incisor	Right	25 (9.8%)	5 (1.9%)
		Left	4 (1.5%)	1 (0.3%)
	Lateral incisor	Right	28 (11.0%)	4 (1.5%)
		Left	3 (1.1%)	1 (0.3%)
Mandibular	Central incisor	Right	1 (0.3%)	1 (0.3%)
		Left	2 (0.6%)	0 (0.0%)
	Lateral incisor	Right	0 (0.0%)	0 (0.0%)
		Left	0 (0.0%)	0 (0.0%)
<b>Total incisors</b>			63 (24.9%)	12 (4.7%)

[Table/Fig-5]: Distribution of MIH according to the type of teeth and severity (n=253).

Caries status	Maxillary		Mandibular	
	Right n (%)	Left n (%)	Right n (%)	Left n (%)
Sound	70 (27.6%)	67 (26.48%)	60 (17.6%)	56 (16.4%)
Decayed	11 (4.3%)	18 (5.2%)	22 (6.4%)	28 (8.2%)
Restoration with decay	1 (0.2%)	0 (0.0%)	1 (0.2%)	0 (0.0%)
Restoration without decay	2 (0.5%)	0 (0.0%)	1 (0.2%)	1 (0.2%)
Extracted	2 (0.5%)	0 (0.0%)	2 (0.5%)	1 (0.2%)
Missing due to other reasons	0	0	0	0
Sealant	0	0	0	0
Abutment	0	0	0	0
Unerrupted	1 (0.2%)	2 (0.5%)	1 (0.2%)	1 (0.2%)
Not recorded	0	0	0	0

[Table/Fig-6]: Caries Status of First Molars among children affected by MIH (n=343).

Variables	Maxillary		Mandibular	
	Right n (%)	Left n (%)	Right n (%)	Left n (%)
None	39 (11.6%)	48 (14.07%)	37 (11.01%)	36 (10.71%)
Preventive, caries arresting care	21 (6.1%)	15 (4.4%)	15 (4.4%)	18 (5.2%)
Fissure sealant	14 (4.1%)	11 (3.2%)	12 (3.5%)	8 (5.2%)
One surface filling	6 (1.1%)	10 (0.8%)	12 (1.1%)	14 (1.1%)
Two or more surface filling	2 (0.5%)	5 (0.2%)	7 (0.5%)	9 (1.7%)
Crown for any reason	1 (0.1%)	0	0	2 (0.2%)
Veneer or laminate	0	0	0	0
Pulp care	1 (0.1%)	2 (0.2%)	2 (0.2%)	3 (0.2%)
Extraction	1	1 (0.1%)	2 (0.2%)	0
Need for other care	0	0	0	0
Not recorded	0	0	0	0

**[Table/Fig-7]:** Treatment Need of the First Molars among the children affected by MIH (n=336). Five Molars were extracted and for two treatment need category could not be determined as per the criteria.

## DISCUSSION

The present study was conducted on a group of school going children aged 8-12 years to assess the prevalence and treatment need of teeth affected by MIH. Eight years and above age group were selected to have best probability of having first permanent molars and most of the incisors erupted into the oral cavity [9]. In the present study, EAPD 2003 criteria were used for diagnosing MIH [10]. Before EAPD criteria several other criteria have been used for the diagnosis of MIH e.g., idiopathic enamel defects by Koch G et al., [2], modified DDE index by FDI, diagnostic criteria by Alalauusa S et al., [2,14,15]. Variations in the findings of different studies on MIH may be partly due to use of different criteria.

Prevalence of MIH was found to be 5.7% among the population in the present study. Lower prevalence in this study may be due to omission of lesions smaller than 2 mm in the present study. A study conducted by Parikh DR et al., in Gujarat reported a prevalence of 9.2% [9], whereas Mittal NP et al., reported 7.9% prevalence in Chandigarh [10]. Similar studies conducted in Rajasthan, Karnataka and Chennai reported prevalence of 7.9% to 9.7% [16-18]. Studies conducted in different Asian countries revealed prevalence of 2.8% in Hong-Kong by Cho SY et al., 17.6% in Jordan by Zawaideh FI et al., and 18.6% in Iraq by Ghanim A et al., [19-21]. This variation in prevalence of MIH could be attributed to difference in methodology and the diagnostic criteria used for the evaluation of the lesion. In this study prevalence of MIH among boys was found to be higher compared to girls. The higher prevalence in boys may be attributed to high masticatory force and food preferences among boys compared to girls. In similar studies conducted by Bhaskar SA and Hegde S and Allazzam MS et al., higher prevalence of MIH has been reported among boys compared to girls [16,22]. Krishnan R et al., in a study conducted in Tamil Nadu reported higher prevalence of MIH among girls (8.9%) compared to boys (6.1%) which are contradictory to observation of the present study [23]. Prevalence of the condition was found to be higher in 10-year age group compared to other age group in the study. Similar studies conducted by Yannam SD et al., have reported 10-year age group [18], whereas Bhasker SA et al., have reported 13-year age group to be showing higher prevalence of MIH [16]. Higher prevalence in 10-years and above age group may be due to ease of diagnosis due to post-eruptive discolouration and breakdown is higher in these age groups compared to younger ones. The findings from different studies across the world are given in [Table/ Fig-8] [2,3,7,15-17,23-46].

Author	Population	Prevalence	Criteria
Koch G et al., 1987, Sweden [2]	2226	15.41	Custom
Jalevik B et al, 2001, Sweden [7]	516	18.41	FDI, 1992
Weerheijm KL et al., 2001, Netherlands [3]	497	9.66	DDE, 1992
Yannam SD et al., 2016, India [17]	2864	9.67	EAPD, 2003
Zagdwon AM et al., 2002, UK [25]	307	14.66	DDE, 1992
Dietrich G et al., 2003, Germany [26]	2408	5.61	mDDE
Jasulaityte L et al., 2007 Lithuania [24]	1277	9.71	EAPD, 2003
Preusser SE et al., 2007, Germany [27]	1022	5.77	Koch, 1987
Bhaskar SA and Hegde S 2014, India [16]	1173	9.46	EAPD, 2003
Petrou MA et al., 2014, Germany [28]	2395	10.10	EAPD, 2003
Kühnisch J et al., 2014 Germany [29]	693	9.38	EAPD, 2003
Temilola OD et al., 2015, Nigeria [30]	236	9.75	Kemoli AM, 2008
de Lima Mde MD et al., 2015, Brazil [31]	594	18.35	EAPD, 2003
Oyedele TA et al., 2015, Nigeria [32]	2107	12.67	Jalevik, 2010
Kühnisch J et al., 2015, Germany [33]	1048	13.65	EAPD, 2003
Kevrekidou A et al., 2015, Greece [34]	2335	21.33	EAPD, 2003
Ng JJ et al., 2015, Singapore [35]	1083	12.47	EAPD, 2003
Hanan SA et al., 2015, Brazil [36]	2062	9.12	EAPD, 2003
Nogueira Rodrigues SC et al., 2015, Brazil [37]	1179	2.54	DDE, 1992
Tadikonda AN et al., 2015, India [38]	352	26.99	EAPD, 2003
Mittal N and Sharma BB, 2015, India [39]	978	7.36	EAPD, 2003
Krishnan R et al., 2015, India [23]	4989	7.70	EAPD, 2003
Kirthiga M et al., 2015, India [17]	2000	8.95	Cho SY et al., 2003
Da Silva IF et al., 2015, Brazil [40]	300	7.67	EAPD, 2003
Negre-Barber A et al., 2016, Spain [41]	414	24.15	EAPD, 2003
Mittal NP et al., 2013, India [10]	886	7.11	EAPD, 2003
Opydo-Szymaczek J, Gerreth K, 2015, Poland [42]	470	8.09	mDDE
Tourino LF et al., 2016, Brazil [43]	1181	20.41	EAPD, 2003
Dantas-Neta NB et al., 2016, Brazil [44]	594	18.35	EAPD, 2003
Subramaniam P et al., 2016, India [45]	2500	0.48	EAPD, 2003
Wuollet E et al., 2016, Finland [46]	287	11.50	EAPD, 2003

**[Table/Fig-8]:** Epidemiological Studies on MIH across the world [2,3,7,15-17,23-46].

The common phenotypic expression of MIH among the affected children was found to be only molar involvement followed by only incisor involvement. This finding is similar to the results reported from studies in different regions like Lithuania, Greece and Jordan [20,24,47]. However, few studies have reported involvement of both molar and incisors to be more prevalent [9,48]. Mandibular right FPM was found to be most commonly involved in this study which is similar to the observations reported by studies on different population groups from Gujarat, Lithuania, Greece and Jordan [9,20,24,47]. In contrast to the current observation, studies from China, Australia have reported maxillary molars to be more frequently affected than mandibular molars [19,48]. Maxillary incisors were found to be more frequently affected than mandibular incisors in this study which is similar to the observation reported by studies from different parts of the world [9,12,19,21]. Mean DMFT for the first molars among the MIH affected children were found to be 1.03. Clinical presentation of carious lesions was found to be more in MIH affected molars in comparison to sound molars. This is in agreement with the observations reported by some of the studies across different regions in the world [19,49,50]. The treatment need for the affected molars was assessed in this study as per the WHO criteria [51]. It was found that majority of the molars required only personal oral hygiene care and need not receive any

treatment. Preventive and caries arresting care followed by Pit and fissure sealant application were the major treatment required for the FPM as per findings of the study. Prevention is required in early developmental age, because the MIH affected tooth is more likely to have caries and Post-Eruptive Breakdown (PEB) due to higher porosity [52]. Toothpaste with a fluoride level of at least 1,000 ppm [53], remineralising agents such as Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP) [54], fluoride varnish [55] is few of the recommended preventive agents in various studies for application on teeth affected by MIH. Though sealant application is a non invasive approach for these molars, poor retention rate has been reported by few of the studies for conventional resin based sealant application [56]. A study has reported that application of fifth generation bonding agent prior to application sealant can improve retention rate [57]. Among the FPM needing restorations one surface restoration was more than two surface restorations. Glass Ionomer Cement (GIC), composite resin restoration with non invasive conservative design can be done in the affected molars as recommended by few studies for teeth affected by MIH [36,58]. Treatment need for pulpal care and extraction were observed to be very low in this study.

### Limitation(s)

The study has taken into consideration only govt schools from few clusters due to constraint of time. More number of schools both from Government and private sectors and from all the cluster of Cuttack District can be included to have a homogenous study population in regards to socio economic status in future studies.

### CONCLUSION(S)

The MIH is one of the most commonly encountered clinical and public health problems which have a negative impact on oral health quality of life. A thorough knowledge regarding the aetiology, early diagnosis by differentiating from other enamel defects and appropriate treatment are essential for the management of MIH. There should be protocol for regular dental check-up among the school going children to detect these conditions early which can be managed by preventive therapy to reduce the frequent dental visits of the child in future. A prevalence rate of 7.4% was observed in the present study with higher predilection amongst male child and mandibular molars were predominantly affected. Further studies with larger sample size are required to ascertain the prevalence of MIH.

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