

# Molar Incisor Hypomineralization Prevalence in the Schoolchildren of Gannavaram Mandal, Krishna District, Andhra Pradesh, India: A Cross-sectional Study

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## ABSTRACT

**Aim and objectives:** To evaluate the prevalence of molar incisor hypomineralization (MIH) in schoolchildren of the ages between 8 and 14 years of Gannavaram Mandal, Krishna district, Andhra Pradesh, India.

**Materials and methods:** A total of 2,250 children of ages between 8 and 14 years were selected randomly from different schools. After obtaining requisite permissions from Mandal Educational Officer (MEO), children was screened for the prevalence of MIH according to European Academy of Paediatric Dentistry (EAPD) 2003 diagnostic criteria and severity for MIH was examined using Wetzel and Reckel scale.

**Results:** Prevalence of MIH was observed to be 2.1% with higher cases of mild severity and with no sex predilection ( $p > 0.05$ ).

**Conclusion:** Early diagnosis and treatment can significantly reduce complications associated with MIH. Very few studies have been conducted in India and studies encompassing extensive population are warranted to better understand its etiology.

**Clinical significance:** MIH lesions lead to carious development. Hence there is need to identify MIH in children as early as possible to reduce the clinical complications.

**Keywords:** Cross-sectional study, Dental caries, Developmental defects, Molar incisor hypomineralization, Prevalence, Severity.

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## INTRODUCTION

Developmental defects of teeth are attributed to a complex interplay between genetic and environmental factors during formative years of tooth development. Any developmental defect affecting the enamel will cause irreversible damage since it is an exceptional hard tissue that does not remodel during life.<sup>1</sup> Qualitative defects of enamel occur when there is an insult to the tooth during secretory phase while quantitative defects are a result of injury during maturation phase.<sup>2,3</sup>

Developmental enamel hypoplasia of first permanent molars with unknown etiology was first described by Swedish dentists in 1970s and a variety of terminologies have been used to describe the condition since then.<sup>4,5</sup> The term Molar Incisor Hypomineralization (MIH) was first coined by Weerheijm et al. in 2001 to describe a specific pattern of enamel defects affecting molars and incisors and molarhypomineralization (MH) is one more variant where only four permanent first molars (FPMs) are affected without involving permanent incisors.<sup>4,6</sup> They defined MIH as "hypomineralization of systemic origin of one to four permanent first molars (FPMs), frequently associated with affected incisors."<sup>5,7</sup> Several etiological factors have been suggested like environmental changes, hypoxia affecting ameloblasts, respiratory diseases, frequent childhood diseases with high fever, low birth weight, disturbances in calcium/phosphate metabolism, antibiotic usage, and prolonged exposure to dioxine by breast feeding.<sup>8</sup>

Globally, studies have mentioned the prevalence of MIH ranging from 2.4 to 40.2%.<sup>9</sup> Prevalence studies in India regarding MIH are sparse and they have quoted MIH prevalence as low as 0.48% to as high as 27%.<sup>9-19</sup> This study is undertaken since no such prior studies are available with respect to MIH prevalence in this region.

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## MATERIALS AND METHODS

The present study was carried out on schoolchildren of Gannavaram Mandal, Krishna district, Andhra Pradesh. The study was approved by the college ethical committee and permission was attained from the MEO and respective school principals prior to the study. The schools included both government and private aided schools and were randomly selected. The sample comprised of 2,250 children. Children of ages 8-14 years from this region only were selected for the study and there were no gender, ethnic, or race restrictions. Children with defective or discolored teeth, having extracted first permanent molars and incisors or wearing fixed orthodontic appliances were excluded from the study.

Oral examination for MIH was carried out in broad day light by a single calibrated examiner using disposable mouth mirror and

sterile blunt probe (WHO 1962, Type 3 Examination). Before the examination, all the teeth were dried by means of sterile cotton and each surface of permanent first molars and incisors were screened for MIH. The diagnostic norms for MIH were based on the criteria given by Weerheijm et al.<sup>10,12,13</sup> The severity of MIH was recorded by using Wetzel and Reckel scale.<sup>20</sup> The prevalence and severity of MIH were thus noted. Also, the decayed, missing due to decay, filled due to decay tooth (DMFT index) of permanent teeth was recorded.

### Statistical Analysis

The data obtained was entered in MS Excel and analyzed through SPSS V22 software. Descriptive statistics were represented in the form of percentages and Chi square test was applied to find statistical significance ( $p < 0.05$ ).

### RESULTS

The study comprised of 2,250 children out of which 1,051 are females (46.7%) and 1199 (53.3%) are males. The overall prevalence of MIH is 2.1% children. Thirty-one children (1.4%) had mild MIH and 16 children (0.7%) had moderate MIH (Table 1). Twenty-three children of females (2.2%) and 24 of males (2.0%) are affected with MIH that shows no sex predilection ( $p' = 0.77$ ) (Table 2). Thirty three of MIH-affected children (70.2%) and 1,192 of MIH-free children (54.1%) have some degree of dental caries though not significant statistically ( $p' = 0.06$ ).

### DISCUSSION

MIH has drawn widespread attention over the past decade and has been realized that it is a distinct entity. It is believed to be an acquired defect with a tendency toward genetic predisposition with a variety of etiological factors implicated.<sup>21-24</sup> Molar incisor hypomineralization is a hypo calcific defect due to altered ameloblast function during the transitional and maturational phases of enamel. Hypomineralized enamel has higher protein content than normal but what distinguishes MIH from other hypomaturation defects is that it typically has near normal levels of residual amelogenins implicating it as a hypo calcific defect. Also, since the MIH enamel is porous, it tends to acquire various proteins from saliva and blood that vary according to the integrity of enamel surface.<sup>25-27</sup>

Clinically, MIH can be differentiated from hypoplastic defects by means of its irregular borders of normal enamel following

posteruptive break down. It is distinguished from fluorosis by its demarcated lesions with asymmetric distribution. These lesions are well-demarcated opacities that vary in color from white, cream yellow to brownish. Since the enamel is porous, it can chip off easily exposing the dentin and leading carious development. MIH-affected teeth cause particular problems since the inflamed pulp triggers sensitivity even with day-to-day activities like tooth brushing thereby precipitating fear and anxiety in the child. Restorative failures occur due to poor bonding to the teeth and these need more treatment time than normal teeth. These implications validate the need to identify MIH in children as early as possible.<sup>28,29</sup>

Wide variations in MIH prevalence have been reported by studies across globe ranging from as low as 2.4% to as high as 40.2%.<sup>9</sup> Similar divergence has been reported by Indian studies with prevalence ranging from 0.48 to 27%.<sup>9-19</sup> In India, studies related to MIH are few and results varied according to region. No studies related to MIH have been conducted in this region and hence the need of this study.

Studies reported either no differences in prevalence of MIH between fluoridated and nonfluorinated areas or decrease in prevalence. Thus, it can be concluded that fluoride is not implicated in MIH etiology and in fact it might be a possibility that fluoride is protective against MIH. Very few studies have been conducted regarding the prevalence of MIH in fluoride belts.<sup>2,30</sup> This region falls under endemic fluorosis and hence it is interesting to see the prevalence of MIH.

The best time to assess MIH is that the child must have all first permanent molars and incisors erupted. Besides, more than half of the crown must be visible. Eight years is the ideal age when all the molars and most of the incisors must have erupted into the oral cavity.<sup>30</sup> Studies also reported delayed eruption time in the Indian population. To mitigate the risk of under assessment of MIH, a large sample of 2,250 children between 8 and 14 years of age was chosen for this study.

In the past several different criteria have been used for the diagnosis of MIH that resulted in wide variation in prevalence. Since 2003, majority of the studies used EAPD criteria for diagnosis of MIH because it is considered to be standard, validated, and the best consensus-based criterion for diagnosing and recording MIH. Hence, EAPD 2003 criterion was chosen for this study.<sup>10,12,13</sup> To avoid the interexaminer variability, all the children were examined by a single trained examiner. All the children were examined under broad day light in their respective schools using a mouth mirror and probe following WHO type III criteria.

This study diagnosed 47 out of 2,250 to be having MIH, a prevalence rate of 2.1%. Prevalence rates in this range are reported by 3 non-Indian studies conducted in Brazil (2.5%), Hong Kong (2.8%), and Libya (2.9%).<sup>5</sup> All other non-Indian studies reported higher prevalence rates than this study with the highest being a Brazilian study (40.2%).<sup>9</sup> Only one Indian study conducted in South Bangalore reported prevalence rate (2.9%) which is near to this study.<sup>16</sup> All other Indian studies reported higher prevalence rates

**Table 1:** Severity of MIH

Severity of MIH	Frequency	Percent
1	31	1.4
2	16	0.7
Nil	2,203	97.9
Total	2,250	100.0

**Table 2:** MIH in relation to sex predilection

Gender	MIH				p-value
	Absent		Present		
	Count	%	Count	%	
Female	1,028	46.7%	23	48.9%	0.77
Male	1,175	53.3%	24	51.1%	
Total	2,203	100.0%	47	100.0%	

than this study except one study that was conducted in Bengaluru city that reported a very low prevalence rate of 0.48%.<sup>9</sup> The highest prevalence rate of MIH in India was reported in Udipi, Karnataka (27%).<sup>19</sup>

Low prevalence rate in this study can be attributed to this region being an endemic fluorosis zone. Studies conducted regarding the prevalence of MIH in fluoridated areas are very few. One Swedish study surveyed in 1981 showed no difference in MIH prevalence between fluoridated and nonfluoridated areas.<sup>31</sup> However, this was a retrospective study carried out to look for fluoride defects that also extrapolated specific patterns for MIH diagnosis. One British study conducted in Northern England by Richard Balmer et al. in 2012 actually showed decrease in demarcated opacities in fluoridated areas than nonfluoridated suggesting that fluoride in fact can be protective against MIH.<sup>32</sup> However, the only other study conducted in India with respect to endemic fluorosis was in Salem, Tamilnadu by Krishnan et al. that reported a prevalence rate of 7.3%.<sup>2</sup>

These wide variations in the studies are attributed to sample size differences, age groups involved in the study, method of recording MIH, racial and ethnic factors, and water fluoride content of the region. Otherwise, from all the studies it can be assumed that MIH is quite prevalent in most of the communities and can be considered as an important health issue that warrants early intervention considering its sequelae.

Gender predilection of MIH was recorded in this study and no significant difference was observed. Several non-Indian studies studied gender prevalence of MIH and results concurrent with this study were shown in studies conducted in Jordan (2011), Iraq (2011), and Spain (2014). However, one study conducted in Egypt (2017) had shown female predilection.<sup>33</sup> Indian studies conducted in Gujarat (2012), Rajasthan (2014), South Bangalore (2016), Uttar Pradesh (2016), and Mumbai (2017) have also shown no gender predilection for MIH prevalence.<sup>13,15-17</sup> However, only one study conducted in South Bangalore (2014) reported male predilection for MIH.<sup>10</sup> From the above, it can be inferred that most of the studies leaned toward no gender bias toward MIH predilection.

The severity of the MIH was also determined in this study wherein 66% children had mild and 34% children had moderate MIH. None of the children showed severe MIH. Similar results were shown in all non-Indian studies conducted in Germany (2007), Jordan (2011), Turkey (2012), and Brazil (2010 and 2015) where the majority of the children are shown to have mild MIH.<sup>3,20,23</sup> These results concur with all the Indian studies conducted in Gujarat (2012), Udaipur (2014), Karnataka (2015), and Tamil Nadu (2016).<sup>13,14,16,19</sup> From the above results, it can be deduced that all the studies agreed mild form of MIH as the predominant one.

The relation between MIH and dental caries prevalence in permanent teeth (DMFT) was studied and 70.2% of MIH-affected children had dental caries while only 54.2% of MIH free children had caries. Similar results were reported in several non-Indian studies conducted in Hong Kong (2008), Germany (2013), Slovenia (2013), Brazil (2012 and 2015), and Pakistan (2016) where MIH-affected children had higher caries.<sup>5,34-36</sup> Indian studies conducted in Rajasthan (2014), Tamil Nadu (2015), and Karnataka (2015 and 2016) also concurred the same.<sup>2,15,16,19</sup> The above findings suggest that MIH children are prone to dental caries. This might be due to the gradual break down of inherently porous MIH enamel thereby making the tooth susceptible to dental caries. This highlights the importance of early diagnosis and intervention of MIH.

The ideal stage to study MIH is at 8 years of age according to EAPD because at this age, the diagnosis becomes easy

since the first molars and incisors have only erupted recently and not affected by deterioration or other pathological conditions.<sup>5,21</sup> Authors studying MIH also reported that older children have hypomineralized enamel breakdown owing to chewing forces and possible caries development.<sup>9</sup> The possible treatment outcomes may mar the diagnosis of MIH that might lead to underreporting. Further studies including the sample size of near 8-year age group might give an accurate forecast of MIH prevalence in this region.

This study did not investigate the etiological factors pertaining to MIH to establish further insights in understanding MIH. Though the area is an endemic fluorosis belt, school water fluoride level has not been taken into consideration to draw any association between MIH and fluorosis. Further studies by taking the above drawbacks into consideration and encompassing a larger sample size might help in understanding the etiology of MIH.

## CONCLUSION

The overall prevalence of MIH was 2.1% with no gender predilection. With respect to severity of MIH, mild form of MIH dominates the prevalence and affected individuals had higher dental caries rate of permanent teeth than non-MIH individuals.

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