

**Research Article**

**A study on Molar Incisor Hypomineralization: An overview**

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**ABSTRACT**

Molar-incisor hypomineralization is a congenital defect characterized by well demarcated enamel defects in first permanent molars and incisors presenting at the eruption of these teeth. One to all first permanent molars, and also often the permanent incisors can be affected. Diagnosis and management of this disease at an earlier stage is important because the affected teeth are prone to rapid breakdown soon after their eruption making the treatment more complicated and less successful. **Aims and objectives:** To review the clinical features of molar-incisor hypomineralization and to highlight its diagnostic features and clinical management in young patients.

**Keywords:** Molar incisor Hypo mineralization, First Permanent Molars[FPMs], Post-eruption Breakdown[PEB], Glass Ionomer Cement[GIC]

**INTRODUCTION:**

Certain complex interactions between genetic and environmental factors during tooth development are responsible for producing developmental defects in teeth. Enamel of tooth does not undergo remodelling once it is formed, and if amelogenesis is disturbed at any of its stage, the enamel component being formed at that time will be affected permanently. Hence the changes produced during enamel formation have direct relationship with the timing and nature of adverse biological events occurring in a specific time period<sup>1</sup>. One such developmental defect is Molar-Incisor Hypo mineralization. In

2001, Weerheijm et al<sup>2-4</sup> defined MIH as 'The clinical appearance of morphological enamel defects involving the occlusal and/or incisal third of one or more permanent molars and/or incisors as a result of hypomineralization of systemic origin'. The enamel mineralization in MIH seems to be an anomaly of tissue translucency. However, it is a qualitative enamel defect<sup>5</sup> characterized by reduced levels of mineralization due to markedly low concentration of inorganic enamel components leading to enamel discoloration and fracture of affected teeth<sup>6</sup>. Normally, there is no alteration in enamel

thickness and any reduction in enamel thickness shows its breakdown soon after tooth erupts.<sup>-1</sup>

**Nomenclature:** Different names were given to MIH before 2001, when Weerheijm coined the term Molar-Incisor Hypomineralization. Some other terms given are as follow<sup>7-8</sup>

- .Internal enamel hypoplasia
- .Non-endemic mottling of enamel
- .Idiopathic enamel opacities
- .Non-Fluoride enamel opacities
- .Cheese molars
- .Opaque spots

**Etiological Factors:**

The etiology of MIH is quite complex and is considered to be a combination of some undetermined systemic and genetic factors disturbing the amelogenesis in early maturation stage or even at late secretory phase in affected teeth.<sup>-9</sup>

The mineralization of FPMs begins before birth, at 32 week of intrauterine life, and is completed at 4 year of life whereas their eruption takes place at the age of 6-8 years. The development of permanent incisors closely follows FPMs.<sup>10</sup> Hence, hypomineralization found in MIH must have occurred in this specific time period. The MIH involves permanent incisors and molars and the risk of permanent incisors to be involved increases with increasing number of affected FPMs.

**Classification of etiological factors of MIH:**

While keeping in mind the time period during which mineralization of FPMs and incisors takes place, certain factors thought to be responsible for hypomineralization in MIH are classified into prenatal, perinatal and postnatal groups as follow.<sup>11-13</sup>

**Prenatal medical conditions:**

- .High grade fever or common cold frequently encountered by expecting mother
- .Maternal nausea and vomiting leading to fluid and electrolyte imbalance particularly in third trimester

- .Prolonged use of certain medicines particularly myometrium spasmolytics
- .Maternal malnutrition
- .Diabetic or Hypertensive mother

**Perinatal Factors:**

- .Baby delivered via c-section<sup>14</sup>
- .Prolonged or complicated delivery resulting in respiratory distress or birth asphyxia.<sup>15-16</sup>
- .pre mature birth [most of calcium is taken from mother via placental barrier. In last trimester, in case of pre mature birth, baby has less time to take calcium from mother resulting in lower levels of calcium and consequently hypomineralization]-<sup>15</sup>
- baby having low birth weight-<sup>15</sup>
- Twins [calcium taken from mother is distributed between two resulting in comparatively lower levels than required resulting in hypocalcaemia]
- Haemorrhage [due to detachment during delivery]

**Postnatal Factors:**

The post natal factors which are considered to cause MIH are thought to play their important role primarily in first eight years of life. Some of them are as follow:

- .Frequent episodes of high grade fever in neonates
- .Respiratory tract infections i.e. laryngitis, bronchitis, pneumonia, asthmatic attacks occurring frequently in first 5 years of life.<sup>17-18</sup>
- Prolonged Breast feeding [Dioxin present in mother's milk]-<sup>19</sup>
- Chicken Pox
- Otitis media
- Gastroenteritis
- Urinary tract infections
- Encephalitis
- Exanthematous diseases associated with incubator
- calcium and phosphate metabolic disorders

Initially it was considered that antibiotic use for extended time period can cause hypomineralization but infact it is the underlying compromised medical condition which is responsible for enamel hypomineralization. All disorders producing hypoxia and hypocalcaemia have detrimental effect on amelogenesis resulting in enamel defects which may range from ameloblastic dysfunction to complete cellular degeneration.

### CLINICAL FEATURES:

The clinical features of MIH can be summarized as follow.

Large demarcated opacities characterized by abnormal enamel translucency with a clear demarcation between sound and affected enamel of tooth. The diseased enamel may be white, yellow or even brown in colour. The hypomineralized enamel porous and soft<sup>20-21</sup>, due to porosity it can chip off easily leading to exposure of underlying dentin and the patient complains of hypersensitivity to cold and hot foods and even to current of air. Patient may experience sudden onset of toothache on a mild Mechanical stimuli i.e tooth brushing.<sup>21</sup> Sometimes, due to heavy masticatory forces FPMS lose affected enamel soon after their eruption and it is misinterpreted that no enamel was formed during tooth development [enamel Hypoplasia]. However, MIH can be differentiated from enamel hypoplasia as in MIH the borders between sound and affected enamel are irregular<sup>22</sup>, enamel translucency is abnormal and there is no alteration in enamel thickness.<sup>23</sup> MIH may or may not involve permanent incisors, the risk of permanent incisors to be involved increases with increasing number of affected FPMs. The affected incisors are comparatively less prone to enamel loss and dentinal hypersensitivity because of lesser masticatory forces being applied in them than FPMs. However, the incisor involvement adversely affects aesthetics of patients. The affected teeth are at higher risk of plaque

deposition and caries than normal teeth and require dental treatment frequently.



Hypomineralised FPM with demarcated opacities.



FPM with post-eruptive enamel breakdown at the MIH lesion.

### DIAGNOSIS OF MIH

MIH should be diagnosed in young patients of 8 to 9 years age group on clean and wet teeth using a mirror probe and dental light because at this age group all FPMs and most of permanent incisors have erupted and are usually in good condition without PEB. The lesion should be greater than 1mm to be diagnosed as MIH.

### DIAGNOSTIC CRITERIA FOR MIH

In 2001, Weerheijm-et-al gave a diagnostic criteria for MIH, according to which following

features must be present FPMs and /or permanent incisors of a young patient while declaring it to have MIH.<sup>-23</sup>

**OPACITY:** A defect showing abnormally translucent enamel, translucency is variable in degree. The diseased enamel has normal thickness with a smooth surface can be white, yellow, or even brown in colour with irregular borders of lesion separating it from normal enamel of affected tooth.

**PEB:** It is characterised by attrition or trauma associated deficiency of affected tooth[enamel] surface.

**ATYPICAL RESTORATION:** The affected teeth are frequently restored and the size and shape of restoration do not have typical restorative features, restoration is usually extended to buccal or palatal smooth surface of affected teeth. Usually opacity is seen at the margin of restoration. **EXTRACTED MOLAR:** One or more FPMs in an otherwise sound permanent dentition are absent in combination with demarcated opacities in permanent incisors and/or other molars.

#### **CLASSIFICATION OF MIH ON THE BASIS OF SEVERITY:**

MIH is classified into mild, moderate and severe MIH based on the certain features seen in young affected patients.

**MILD MIH:** It is characterized by demarcated opacities in non-stress bearing areas of affected

FPMs. However, there is no carious lesion, nor does enamel loss is seen due to chipping off enamel. Patient gives no history of dental hyper sensitivity. Permanent incisors may or may not be involved.

**MODERATE MIH:** It is characterized by demarcated opacities on occlusal 3<sup>rd</sup> and/or incisal third of affected teeth with or without PEB of enamel. Affected teeth may or may not have carious lesion. If present, PEB of enamel and/or caries are limited to just one or two surfaces of teeth without involvement of cusp. The affected teeth may have been restored for recurrent caries and show atypical restoration. Patient gives no history of dental hypersensitivity.

**SEVERE MIH:** Both FPMs and incisors are involved. The affected teeth show marked yellowish brown discoloration due to severe mineral deficiency the crown morphology is distorted due to extensive PEB of enamel. The affected tooth is highly sensitive to mechanical stimuli even tooth brushing can trigger tooth ache. In most of cases due to rapid PEB, pulp involvement and dentinal hyper sensitivity is reported. The affected teeth are frequently restored and show atypical restorative margins. Due to incisor's involvement, aesthetic concerns are expressed by patient or parents of young patients.



**Severe MIH Showing PEB of tooth soon after eruption  
MIH Treatment Need Index:**

Steffen et al has given [MIH-TNI] to classify the MIH Patients according to specific features and treatment prescribed for them as follow.<sup>-24</sup>

Index	Definition
0	Clinically the patient has no sign and symptom of MIH
1	Patient is having MIH but no complain of hypersensitivity and no enamel defect is seen
2	Patient is having MIH with a defective lesion without dental hypersensitivity
2a	The defective lesion is covering less than 1/3 area of affected tooth surface
2b	Defective lesion is covering more than 1/3 but less than 2/3 affected tooth surface
2c	The lesion is covering more than 2/3 of tooth surface and or it is close to pulp or the affected tooth is having atypical restoration or affected tooth has been extracted.
3	Patient is having dental hypersensitivity without any visible defective lesion
4	Patient is having dental hypersensitivity as well as lesion
4a	Defect is extended to less than 1/3 of occlusal surface
4b	The lesion is covering more than 1/3 but less than 2/3 occlusal surface
4c	The defect is extended to more than 2/3 of tooth surface and or lesion is close to pulp or affected tooth is having a typical restoration or it has been extracted

#### **A CLINICAL MANAGEMENT APPROACH FOR FPMS AFFECTED BY MIH.**

A six step management approach has been proposed by William et al for patients having MIH affected FPMS<sup>-25</sup>

**RISK IDENTIFICATION:** By assessing the medical history for etiological factors.

**EARLY DIAGNOSIS:** Patients having strong evidence of frequent episodes of illness in first four years of life are at higher risk of MIH so at risk FPMS should be examined at regular interval on radio graphs during eruption phase.

**REMINERALIZATION AND DESENSITIZATION:** Topical fluorides are applied on localized affected areas of FPMS to reduce surface porosity and hence permeability.

**PREVENTION OF DENTAL CARIES AND PEB:** Glass ionomer is applied to cover the affected surfaces of a partially erupted molar to reduce caries susceptibility and preserve tooth structure.

**RESTORATION AND EXTRACTIONS:** Place intracoronal restoration i.e composite resin with self-etching primer adhesive or extra coronal restoration i.e stainless steel crowns. If affected FPM is not in a condition to be restored, extract it and consider orthodontic treatment.

**MAINTENANCE:** After restoring FPMS, regular checkup is advised to monitor the margins of restoration for PEB. The choice of an appropriate treatment modality is different for every patient. It depends on number of factors i.e Severity of condition, Patient's dental age, The child's social background and expectation as well as cooperation of young patient's.

#### **TREATMENT OPTIONS FOR MIH DEPENDING ON ITS SEVERITY**

Depending on severity of MIH, certain treatment options have been established as guidelines.

**MILD MIH:**

In case of mild MIH, primarily preventive measures are employed to maintain the permanent dentition. [1]. Fluoride varnish is applied to affected teeth.

[2]. Pit and fissure are placed on occlusal surfaces of affected FPMS, primarily when enamel of tooth does not show any PEB and patient gives no history of dental hypersensitivity before placing fissure sealant, the yellowish fissure should be pre-treated with 5% NaOCl for 1 minute to remove intrinsic enamel proteins. The affected FPMS should be regularly monitored and fissure sealants should be replaced when lost.

For partially erupted FPMs with MIH, GIC is a best fissure sealant as it provides temporary protection against caries and hypersensitivity. However, retention of GIC as a sealant is quite poor thus once FPMs have attained fully erupted position in dental arch, GIC must be replaced by resin bonded sealants.

#### **MODERATE MIH:**

For moderate MIH cases, preventive measures i.e fluoride varnish and fissure sealants placement are same as those for mild MIH. The enamel of affected FPM shows PEB frequently even after being restored with a filling material and hence shows atypical restoration. Because of hypomineralization and porous nature of enamel, retention of filling material is quite difficult. Among filling materials compomers and self-etching enamel etchant based composite resins have shown reliable results as compared to RMGIC or amalgam. When permanent incisors are also affected, isolated demarcated opacities causing unaesthetic appearance of patient should be treated with NaOCl other bleaching techniques, microabrasion or composite resin restoration.

#### **SEVERE MIH:**

Treatment of patients with severe MIH presents many problems because of severe mineral deficiency. Patients report severe dental hypersensitivity, recurrent caries and PEB of enamel thus there is a need for restoration repeatedly resulting in atypical restorative features of affected teeth. In many cases, it is difficult to anesthetize the teeth for dental procedures.

Certain treatment guidelines are proposed for patients with severe MIH.

[1]. Early interventional measures must be employed to prevent PEB i.e fluoride varnish or GIC as a fissure sealant in partially erupted FPMs.

[2]. If it is difficult to achieve local anaesthetic effect, the use of nitrous oxide in conjunction with local anaesthetic agent is beneficial.

[3]. Once molar has erupted completely, preformed stainless steel crowns are treatment of choice for

severely hypoplastic molars to protect them from heavy masticatory load and to increase patient's compliance for maintaining proper oral hygiene.

[4]. Once all permanent teeth have erupted and a more stable gingival to clinical crown height of teeth is attained, the interim stainless steel crown should be replaced by full coverage cast restoration.

[5]. Porcelain veneers should be considered for affected permanent incisors to manage the compromised aesthetic appearance of patient.

[6]. Extraction of FPM should be considered if it shows excessive PEB, recurrent failure in retention of filling or if management of patient is difficult due to his violent behaviour.

#### **CONCLUSION:**

High risk identification, early diagnosis and preventive measures are essential for increasing the success rate of subsequently employed measures for managing a patient with MIH.

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