# New Approaches to Diagnosis and Management of Molar Incisor Hypomineralization. A Literature Review

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## Abstract

Introduction: Molar Incisor Hypomineralisation (MIH) is a developmental disorder of dental enamel with a systemic origin that affects one to four permanent first molars associated with incisors involvement. The aim of this study is to bring to the attention of professionals this pathology, emphasizing at the same time the importance of early diagnosis and frequency of controls of the affected individuals, including updates on diagnosis criteria. Methodology: This a literature review helping the professionals with new research in this field. Results: The European Academy of Pediatric Dentistry has established the criteria for the evaluation of MIH updated in 2022, mostly involved in diagnosis and management. Many studies have shown that prevalence varies in different populations meanwhile have advanced in identifying possible etiological factors. Conclusions: This literature review related to MIH brings to the attention of professionals this pathology that requires a multidisciplinary intervention. Early diagnosis, identification, and awareness of dentists, and parents can influence its appearance and treatment options. Preventive therapy through remineralization can prevent massive post-eruptive enamel breakdown as well as other serious complications, with an important psycho-social impact on the child's life.

**Keywords:** molar incisor hypomineralisation, prevalence, etiology, diagnosis, clinical manifestation

## Introduction

Structural disorders of dental enamel are frequent pathologies encountered in permanent teeth. They can appear because of interference of external factors in the process of secretion or mineralization of enamel, during embryogenesis. In some cases, the causes are known, as in others, the factors that can cause such pathologies to have not yet been fully discovered. These disorders can vary in their appearance in

terms of the extent and number of affected teeth, the demarcation, and the color of the lesions. In the framework of structural lesions, hypomineralization of systemic origin of one to four first permanent molars, often associated with the affection of permanent incisors, has been defined as a special form, called Molar and Incisor Hypomineralization (MIH) (1), to increase attention to this pathology.

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**Methodology:** This a literature review helping the professionals with new research in this field.

**Discussions: Clinical appearance of MIH**

In the literature, there are described two forms of MIH: mild and severe form. In Table 1, are presented the clinical characteristics (signs and symptoms) of each severity level according to the criteria of EAPD 2010, updated in 2022 (20).

Table 1. Description of severity level according to the EAPD criteria.

| Severity Level | Sign and Symptoms |
|---|---|
| Mild | Demarcated enamel opacities, without enamel breakdown. Induced sensitivity to external stimuli (e.g., air/water) but not brushing.<br>Mild aesthetic concerns from incisor discoloration. |
| Severe | Demarcated opacities of the enamel with breakdowns and dental caries,<br>Spontaneous and persistent hypersensitivity that affects the functioning, (e.g., from brushing, mastication),<br>Strong aesthetic concerns with socio-psychological impact. |

MIH is characterized by clearly demarcated opaque lesions, with shades ranging from white, to yellow and brown, mostly localized in the occlusal/incisal third, in mild forms of the pathology. Hypomineralized enamel is soft and porous. In severe forms, hypomineralization is followed by a rapid breakdown of the post-eruptive enamel, which leads to the exposure of the dentin and the subsequent creation of cavities with irregular margins. Dentin exposure leads to increased sensitivity (hypersensitivity) of MIH-affected teeth and at the same time makes them more prone to caries. Negre-Barber et al. (3) evidenced that MIH is considered a risk factor for dental caries, in populations with low levels of caries. Kosma et al. (4) studied the relationship between MIH and dental caries and showed that children with MIH have a higher DMFS index compared to children who are not affected by MIH. At the same time,

caries progression is much faster in first permanent molars with MIH due to more porous and less mineralized enamel (17), leading frequently to pulpal affection.

Another aspect that is pointed out by the literature is the asymmetry of the lesions as well as the degree of MIH involvement, which varies from one patient to another, but also in the same patient. The number of molars affected by MIH can vary from one to four, but if one of the molars is heavily affected by MIH then most likely the antagonist of the same arch is also affected. It seems that the greater the number of first molars affected by MIH, the higher the risk of affecting the superior incisors. Defects in the incisors are usually not associated with loss of tooth substance due to the absent masticatory forces. (5). However, not all patients show these types of disorders (opacities) in the permanent incisors. Koch et al, (6), report a prevalence of them of over 30% in some populations. He defects of the incisors are milder than those of the molars. Since masticatory forces on the opacities in incisors are absent, the enamel substance does not disintegrate after eruption.

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**Diagnosis of MIH**

For the clinical evaluation of susceptible teeth, it has been recommended to examine the 4 first permanent molars and the 8 permanent incisors, wet, after they have been cleaned. The indicated age for their examination is 8 years old because all first molars have erupted and so have most of the incisors (1). The evaluation criteria of these teeth for MIH are presence/absence of limited opacities, post-eruptive enamel fracture PEB, atypical fillings/restorations, and extractions as a result of MIH (7), updated by EAPD 2022 with the recommendation of adding the use of intraoral X-Rays (20) (Table 2):

**Table 2.** Criteria used for diagnosing MIH (Weerheijm et al 2001a) updated by EAPD 2022

| Diagnostic feature | Description of the defect |
|---|---|
| Teeth involved | One to all four permanent first molars (FPM) with enamel hypomineralisation<br>Simultaneously, the permanent incisors can be affected.<br>At least one FPM has to be affected for a diagnosis of MIH.<br>The more affected the molars, the more incisors involved and the more severe the defects.<br>The defects may also be seen at the second primary molars, premolars, second permanent molars, and the tip of the canines |

| | |
|---|---|
| Demarcated opacities | Clearly demarcated opacities presented with an alteration in the translucency of the enamel.<br>Variability in color, size, and shape<br>White, creamy, or yellow to brownish color<br>Only defects greater than 1 mm should be considered |
| Post-eruptive enamel breakdown | Severely affected enamel breaks down following tooth eruption, due to masticatory forces.<br>Loss of the initially formed surface and variable degree of porosity of the remaining hypomineralised areas.<br>The loss is often associated with a pre-existing demarcated opacity.<br>Areas of exposed dentine and subsequent caries development |
| Sensitivity | Affected teeth frequently reveal sensitivity, ranging from mild response to external stimuli to spontaneous hypersensitivity.<br>MIH molars may be difficult to anesthetize |
| Atypical restorations | The size and shape of restorations do not conform to the typical caries picture.<br>In molars, the restorations are extended to the buccal or palatal/lingual smooth surface.<br>Opacity can be frequently noticed at the margins of the restorations.<br>First permanent molars and incisors with restorations having similar extensions as MIH opacities are recommended to be judged as that |
| Extraction of molars due to MIH | Extracted teeth can be defined as having MIH when there are:<br>- Relevant notes in the records<br>- Demarcated opacities or atypical restorations on the other first molars<br>- Typical demarcated opacities in the incisors |

**Prevalence and management of MIH**

The results from the literature review show studies that focus on different directions. Some studies focus on determining the prevalence of MIH in different countries as well as identifying possible etiological factors. These studies show that the prevalence of MIH varies from 2.4 - 44% in different countries (3,8,9,10,11,12). In Albania, the prevalence reported by Hysi et al. (2016), is 14% (13). Currently, the etiological factors are better understood. MIH is a multi-factorial condition that in some cases may result from environmental-gene interactions. The risk of MIH appears to be

increased by systemic medical conditions such as perinatal hypoxia, preterm, and other hypoxia-related perinatal issues, including cesarean delivery. Infant and childhood illnesses are also associated with MIH, and symptoms of illnesses such as fever and antibiotic use have also been connected to MIH (20). Low birth weight or disorders in the metabolism of calcium and phosphates are also among possible factors (8,12,14).

Other studies focus on the management and treatment of MIH. The management of MIH presents a series of difficulties related to the sensitivity and rapid evolution of caries attached to teeth affected by MIH, the difficult cooperation with the child patient, difficulties in achieving anesthesia as well as the continuous breakdown of the enamel from the margins of the cavities (11).

Regarding the treatment of MIH, data coming from the literature, suggest that it depends on the eruption phase of the affected tooth as well as the degree of hypomineralization. In newly erupted teeth affected by MIH, preventive therapy is indicated aiming to prevent post-eruptive enamel breakdown. In mild cases of MIH, when a minor loss of substance is detected, restoration with glass ionomer cement is recommended (11,14, 15, 16). This is considered a temporary intervention until the tooth fully erupts, and the possibility of cooperation with the patient increases. The fluoride released by the glass ionomer cement can affect the prevention of the evolution of caries or the appearance of secondary caries. In cases with greater loss of dental substance, composite restoration or complete tooth coverage with stainless steel crowns should be considered (17). Studies show that if two or three-fifths of the tooth surfaces are affected, composite fillings have satisfactory long-term performance and can be an alternative to stainless steel crowns (15). The reported longevity of composite fillings averages up to 5.2 years (14,15). The longevity of stainless-steel crowns is less reported in the literature.

In cases of severe forms of MIH, extraction may be considered. If the extraction of the first permanent molars is done before the eruption of the second molars (more precisely, at the beginning of the calcification of the bifurcation of the second permanent mandibular molar), then the occupation of the space of the first may occur spontaneously, with favorable results for the patient. This period corresponds to the age of 8.5-9.5 years (5). In some cases, orthodontic intervention is necessary to improve the function of the dental-maxillary apparatus.

In Table 3, the recommended steps to be followed in the management of teeth with HMI are summarized (11).

**Table 3**. Clinical management of first permanent molars with MIH

| Steps | Recommended procedures |
|---|---|
| Risk identification | Asses medical history for putative etiological factors |

| | |
|---|---|
| Early diagnosis | Examine at-risk molars on radiographs if available |
| Remineralization and desensitization | Apply localized topical fluoride |
| Prevention of dental caries and post-eruption breakdown (PEB) | Institute thorough oral hygiene home care program<br>Reduce cariogenicity and erosivity of diet.<br>Place pit and fissure sealants |
| Restorations or extractions | Place intracoronal (resin composite) bonded with a self-etching primer adhesive or extracoronal restorations (stainless steel crowns)<br>Consider orthodontic outcomes post-extraction |
| Maintenance | Monitor margins of restorations for PBE<br>Consider full coronal coverage restorations in the long term. |

## Conclusions

This literature review related to MIH aims to bring to the attention of professionals this form of pathology, which is encountered relatively frequently and may require a multidisciplinary intervention. A very important factor is the early diagnosis form, the recognition and awareness of parents regarding the factors that influence its appearance as well as the treatment options. Remineralization and early preventive therapy can prevent massive post-eruptive enamel breakdown as well as other serious complications, with an important psycho-social impact on the child's life.

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