Judgement criteria for Molar Incisor Hypomineralisation (MIH) in epidemiologic studies: a summary of the European meeting on MIH held in Athens, 2003

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ABSTRACT. Aim This paper reviews the proceedings and conclusions of a meeting of experts concerned with the problem of hypomineralised incisors and molars (MIH). The aims of this meeting were to establish criteria for the judgement of MIH, to select representative cases and to discuss how the name of the condition was best described as hypomineralised, or hypomaturated, first permanent molars. Conclusion There was not complete agreement as to the correct diagnosis and aetiology of the condition. A suggested list of definitions of the judgement criteria to be used in diagnosing Molar Incisor Hypomineralisation (MIH) for prevalence studies was agreed upon. KEYWORDS: Hypomineralisation, Molars, Incisors.

Introduction

At the 6th Congress of the European Academy of Paediatric Dentistry (EAPD) attention was focussed on the question of mineralisation defects involving first permanent molars. One of the conclusions was that only a limited number of studies concerning prevalence data of Molar Incisor Hypomineralisation (MIH) were available. In previous studies different criteria had been used, which has made it difficult to compare any prevalence figures [Weerheijm, 2003]. On the other hand suggestions were made by dental scientists that the prevalence of MIH is increasing and it would be beneficial to collect more information on the distribution of MIH in child populations of Europe. To this end comparable and representative prevalence studies are urgently needed.

Such data would be of considerable use to show that MIH continues to be a problem in our child populations. Strategies for diagnosis, treatment and possible prevention are needed.

In Denmark, at the present time, for example, hypomineralised defects are found more frequently in first permanent molars than occlusal caries [Brook et al., ]. Valid prevalence data for MIH can also justify prospective studies on the aetiology of the defect that is, in spite of many different suggestions as to cause, still unknown.

After the discussions on MIH at the EAPD Dublin Congress, the authors of the present document met in Athens, March 2003, and discussed the lack of valid prevalence data on this important problem in paediatric dentistry. The aims of this meeting were to establish criteria for the judgement of MIH, to select representative cases for general identification in clinical surveys and to discuss how the name of the condition was best described as hypomineralised, or hypomaturated, first permanent molars. All these subjects discussed were of interest for EAPD members and for general identification in clinical surveys especially for those who are interested in performing similar studies in their own countries. In this short communication the agreed criteria, together with examples, are presented for epidemiological surveys.

Nomenclature. The name of the condition is still debated. Therefore, the authors suggested that members of the EAPD should think about an accurate description of the condition based on scientific criteria. A discussion on this and related issues needs to occur within the remit of this Journal or with the authors.
**Diagnostic criteria**

For accurate diagnosis of the condition of MIH, a simple, reproducible scoring index is needed. The FDI DDE Index [1992] was considered to be not adequate and too time consuming for use in MIH prevalence studies. In this latter index a score for Posteruptive Enamel Breakdown (PEB), a sign which is often seen in MIH, is missing. Although such a score can be found presented in the Enamel Defect Index (EDI), as suggested by Brook et al. [2001], overall this index was not considered useful in case of MIH. This is because the first level of the EDI included one score for opacities to indicate demarcated as well as diffuse opacities. Because of this, the demarcated opacities related to MIH are put together with the diffuse opacities, which may be caused by high fluoride intake. As the appearance of fluorosis differs from that of MIH, while at the same time the occurrence of MIH is not influenced by fluoride [Koch, 2003], it was concluded that diffuse opacities should not be incorporated in a MIH index. In addition, in the EDI index any tooth surfaces affected by caries and large restorations are excluded. While caries can develop very rapidly in MIH molars, at young age, consequently resulting in a typical restorations, this does not seem appropriate when making a diagnosis of the condition.

An examination for MIH should be performed on wet teeth after cleaning. Eight years of age was considered as the best time for any examination for the condition. At this age, in most children, all 4 permanent molars will be erupted, as will be the majority of the incisors, while signs of MIH will still be present in its best performance for diagnosis. The most appropriate teeth to be examined are the 4 first permanent molars and 8 permanent incisors. Judgements related to individual teeth should be recorded for:

- absence or presence of demarcated opacities;
- posteruptive enamel breakdown;
- atypical restorations;
- extraction of molars due to MIH;
- failure of eruption of a molar or an incisor.

Table 1 shows the definitions of the criteria just mentioned. To illustrate the definitions of the criteria given in Table 1 and to facilitate calibration between the examiners, an example of these criteria is shown in Figure 1. The figure also includes some differentiating features of other enamel defects in order to help the examiner to avoid the inclusion of other enamel disturbances.

**Nomenclature for the condition**

Weerheijm et al. [2001] suggested the terminology of MIH to describe the clinical picture of a hypomineralisation of systemic origin of one or more of the four permanent first molars, as well as any associated

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**Table 1 - Definitions of the judgement criteria to be used in diagnosing MIH for prevalence studies.**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Definition</th>
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<tbody>
<tr>
<td><strong>Demarcated opacity</strong></td>
<td>A demarcated defect involving an alteration in the translucency of the enamel, variable in degree. The defective enamel is of normal thickness with a smooth surface and can be white, yellow or brown in colour.</td>
</tr>
<tr>
<td><strong>Posteruptive enamel breakdown (PEB)</strong></td>
<td>A defect that indicates deficiency of the surface after eruption of the tooth. Loss of initially formed surface enamel after tooth eruption. The loss is often associated with a pre-existing demarcated opacity.</td>
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<tr>
<td><strong>Atypical restoration</strong></td>
<td>The size and shape of restorations are not conforming to the temporary caries picture. In most cases in molars there will be restorations extended to the buccal or palatal smooth surface. At the border of the restorations frequently an opacity can be noticed. In incisors a buccal restoration can be noticed not related to trauma.</td>
</tr>
<tr>
<td><strong>Extracted molar due to MIH</strong></td>
<td>Absence of a first permanent molar should be related to the other teeth of the dentition. Suspected for extraction due to MIH are: opacities or atypical restorations in the other first permanent molars combined with absence of a first permanent molar. Also the absence of first permanent molars in a sound dentition in combination with demarcated opacities on the incisors is suspected for MIH. It is not likely that incisors will be extracted due to MIH.</td>
</tr>
<tr>
<td><strong>Unerupted</strong></td>
<td>The first permanent molar or the incisor to be examined are not yet erupted.</td>
</tr>
</tbody>
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Notes: in cases of a large caries lesion with demarcated opacities at the border of the cavity or on the non caries surfaces, these teeth should be judged as MIH. Other changes in dental enamel such amelogenesis imperfecta, hypoplasia, diffuse opacities, white spot lesions, tetracycline staining, erosion, fluorosis, white cuspal and marginal ridges should be excluded from the types of enamel defects outlined as above.

and affected incisors. This description was chosen to put emphasis on the fact that molars are always involved in the phenomenon and often there is a combination of molars with demarcated opacities of the incisors. On the other hand opacities only on the incisors may indicate another origin of the defect and should not be referred to as MIH. Although the defects described as MIH can sometimes also be noticed on second primary molars, second permanent molars and tips of the permanent canines the most frequent occurrence in children is that of first permanent molars.

Clinically the first permanent molars are those that create discomfort to the child and of considerable concern to a child’s parents. If the demarcated opacities are combined with opacities on the incisors this sometimes results in aesthetic problems.
**Fig. 1 - Intraoral photographs illustrating the condition of Molar Incisor Hypomineralisation (MIH) for prevalence studies.**

Demarcated opacities in enamel of molars and incisors

Disintegrated enamel of molars and incisors

Atypical restorations

Asymmetric appearance in molars. The 4 molars are from the same child (a and b: upper molars; c and d: lower molars)

Asymmetric appearance in incisors
To indicate the phenomenon clinically the combination of the molars with the incisors, as suggested by Weerheijm et al. [2001], seems logical and results in the term Molar Incisor Hypomineralisation. However, there are arguments as to whether the term hypomineralisation is the correct one. It was questioned whether it was hypomineralisation or hypomaturation. These questions are very relevant if all clinicians and researchers are to have the same idea of what is meant by the nomenclature for clinical practice and research. During the discussions on the best term to be used, it was suggested that maybe one of the former, more colloquial, names such as ‘cheese molar’ was not so unfavourable after all [van Amerongen and Kreulen, 1995]. The authors of this document reached agreement that we are dealing with asymetric demarcated opacities for which, at the moment, the aetiology is not at all clear. For the time being the name MIH will be used, but more discussion is needed to reach agreement on a definitive name to indicate the phenomenon in future.

**References**