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REVIEW ARTICLE

Molar Incisor Hypomineralization

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ABSTRACT

Developmental defects of tooth enamel are not uncommon, both in the primary and permanent dentition. An example of idiopathic enamel defect is molar incisor hypomineralization (MIH). The condition is defined as a hypomineralization of systemic origin of one to four permanent first molars frequently associated with affected incisors. The prevalence of MIH is reported to vary between 2.4 and 40.2% in normal child populations. Management consists of early diagnosis, prevention of caries or posteruptive breakdown and interception if caries or breakdown has already ensued. Management challenges include difficulty in obtaining adequate anesthesia, increased incidence of caries, early pulpal involvement and gross destruction of clinical crown of affected teeth. In young permanent teeth, semipermanent crowns like stainless steel crowns for posterior teeth and direct composite veneering for anterior teeth are the recommended solutions.

Keywords: Molar incisor hypomineralization, Dioxins, Cheesy molars.

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INTRODUCTION

Developmental defects of tooth enamel are not uncommon, both in the primary and permanent dentition.[1] An example of idiopathic enamel defect is molar incisor hypomineralization (MIH). Various terms have been used in literature for this entity, the most commonly used being cheesy molars due to soft and porous discolored chalk-like appearance[2] (Table 1). Weerheijm et al (2001) defined the condition as a hypomineralization of systemic origin of one to four permanent first molars frequently associated with affected incisors and suggested the name MIH for it.[1] The prevalence of MIH is reported to vary between 2.4 and 40.2% in normal child population.

CLINICAL PRESENTATION

Weerheijm et al described a criterion for diagnosis of MIH. After thorough cleaning, the four permanent first molars and the maxillary and mandibular incisors are inspected wet for demarcated opacities with a diameter exceeding 2 mm, post-eruptive breakdown and atypical restorations (Table 2).

The opacities are usually limited to the incisal or cuspal one-third of the crown, rarely involving the cervical one-third. The surface enamel is intact and typically hard as it is hypermineralized because of the posteruptive maturation whereas the subsurface enamel is soft and porous leading to breakdown and chipping off of the fragile enamel and exposure of the underlying dentin (Fig. 1). Caries develops relatively fast in such cases where one or more primary first molars have been extracted, teeth in an otherwise sound dentition should be examined for possible causes (e.g. opacities) and the child's history should be assessed for presence of possible etiological factors.[3]

The clinical severity of the hypomineralization varies and is not symmetrical in the same arch also. Difference between MIH and hypoplasia is clinically difficult to discern; hence, to differentiate the two, clinical and histological picture should be compared. In cases of hypoplasia, the borders of the normal enamel are mostly smooth, while in MIH molars, where the enamel matrix is initially formed to its normal shape, the borders of the normal enamel are irregular after

Table 1: Terms used for MIH in literature

1.	Nonfluoride enamel opacities
2.	Internal enamel hypoplasia
3.	Nonendemic mottling of enamel
4.	Opaque spots
5.	Idiopathic enamel opacities
6.	Enamel opacities
7.	Cheesy molars

Table 2: Weeirheijm's clinical criteria for diagnosis of MIH

1.	Demarcated opacities with a diameter exceeding 2 mm
2.	Posteruptive breakdown as a result of masticatory forces on fragile enamel
3.	Atypical restorations involving the cuspal or incisal third of the crowns
4.	Extraction of one or more young permanent first molars due to nonrestorable breakdown of the teeth

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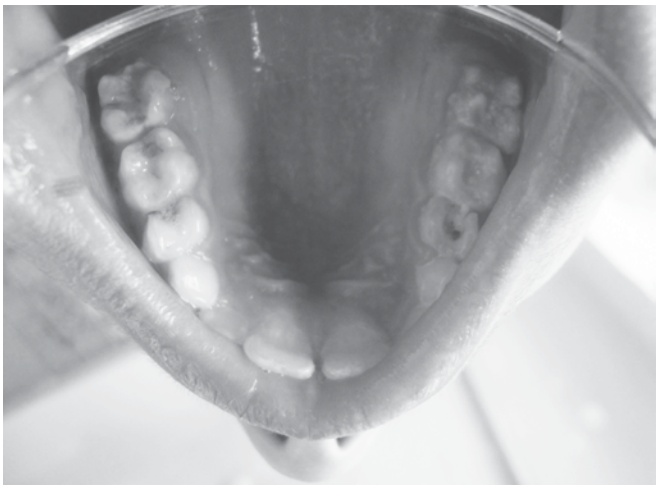

Fig. 1: Intraoral view showing a mixed dentition with affected maxillary first permanent molars having a mottled cheese appearance

Fig. 2: Intraoral view showing a mixed dentition with affected permanent left maxillary central incisor showing a well demarcated marked opacity

posteruptive enamel loss. Histologically also, the appearance of posteruptive enamel loss differs from that of hypoplasia.

In MIH, the lesions in the first permanent molars are often seen together with those in the maxillary and more rarely, the mandibular incisors. Not all patients with MIH exhibit enamel opacities on their permanent incisors (Fig. 2), but the prevalence of this feature may exceed 30% in some populations. As masticatory forces on the opacities in incisors are absent, the enamel substance does not disintegrate as easily as on the molars.

CLINICAL IMPLICATIONS

Clinically, the affected teeth can be very sensitive to stimuli like a current of cold or warm air and mechanical provocations. Unexpectedly, fast caries development may occur in the erupting first permanent molar. This may be partly due to high fragility of MIH molars and the condition is aggravated because the children tend to avoid the sensitive molars when brushing their teeth. Clinical implications for the dentist include increased treatment time and difficulty in obtaining effective anesthesia, limited cooperation of the child and repeated marginal breakdown of the restorations. Jälevik and Klingberg (2002) found that compared to normal molars, MIH molars need ten times more treatment time.[4] The children with MIH molars or opacities on the incisors should be monitored carefully until all four permanent first molars have erupted. If molars show signs of opacities and/or posteruptive breakdown, a child should be seen every three months until the time when the permanent first molars have completely erupted.

ETIOPATHOGENESIS

Molar incisor hypomineralization can be a result of a systemic upset during the first years of a child's life when the crowns of permanent first molars and incisors are in the process of mineralization. The transitional ameloblast is considered as the most vulnerable stage to systemic disturbances.

RISK FACTORS ASSOCIATED WITH DEVELOPMENT OF MIH

Lygidakis NA et al[4] conducted a study on 151 children with MIH. It was reported that 78% had experienced medical problems: prenatally (19%); perinatally (44%) and neonatally (22%). Only 15% of the children did not appear to have any medical problem in the first years of their life. Brogårdh-Roth S et al[5] also suggested that MIH is more common in preterm children than in full term children (38 *vs* 16%) and also that low gestational age and low birth weight increase the risk of MIH. As the permanent first molar commences mineralization soon after birth, a persistent systemic derangement postnatally may affect enamel mineralization. Preterm birth can be associated with respiratory difficulties, hyperbilirubinemia, metabolic disturbances including hypocalcemia and hypoglycemia, hematological disorders, patent ductus arteriosus and intracranial hemorrhage. Enamel hypomineralization has also been associated with the presence of polychlorinated dibenzo-p-dioxins (PCDDs) in breast milk in both clinical and laboratory studies. The PCDDs belong to a class of environmental pollutants known as polyhalogenated aromatic hydrocarbons. Persistence and accumulation of PCDDs in tissue lipids and in the food chain may result in chronic low-level exposure in humans.[6]

Other probable causative factors are oxygen starvation of the child combined with a low-birth weight and environmental conditions. Oxygen depletion may result from perinatal complications or from diseases that affect the oxygen balance in the head and neck area, such as respiratory tract infections, asthma, pneumonia, bronchitis and otitis media.

MANAGEMENT

Management consists of early diagnosis, prevention of caries or posteruptive breakdown and interception, if caries or breakdown has already ensued. Treatment options include symptomatic treatment for the increased sensitivity, sealing the caries prone pits and fissures in a noncarious freshly erupted MIH molar, restoration of the carious molars and in a badly broken down molar, stainless steel crowns provide a very successful option in children.[7]

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Brushing with a fluoridated, desensitizing toothpaste and at home application of remineralizing agents like casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) helps to consolidate oral health care.

1. *Desensitizing agents*: Molar incisor hypomineralization molars exhibit significant sensitivity, especially in the early posteruptive period. Five percent sodium fluoride varnish (Duraphat) is well tolerated by young children and can be applied sparingly directly to first permanent molars. Repeated application has been shown to reduce dentine sensitivity. Some of the standard commercially available 'sensitive tooth' toothpastes may also help in some instances.
2. *Remineralizing agents*: Remineralizing agents like topical fluoride, CPP-ACP may also be used to enhance the mineralization of affected teeth. Fluoride may be applied topically as varnishes (5% NaF varnish), gels (1.23% APF gel), or solutions (2% NaF, 8% SnF_2 and 1.23% APF solution). Casein phosphopeptide-amorphous calcium phosphate is available as tooth crèmes, mousses and lozenges.

   Remineralization of the defects also has an added advantage of desensitization. Remineralization must be started as soon as possible after the eruption so as to enhance mineralization in the superficial layer of enamel and prevent development of caries. Ozone treatment has been presented and discussed in literature as one of the 'new' ways of enhancing remineralization.
3. *Fissure sealants*: For mildly affected teeth where the enamel is intact clinically and radiographically, fissure sealants may be the treatment of choice. On a partially erupted molar, glass ionomer based sealants may be used due to lack of proper saliva control and later the same may be replaced by resin sealants.
4. *Intracoronal restorations*: Amalgam is of limited value as a restorative material for affected molars in MIH. Restorative glass ionomer cements are better in terms of their adhesive, insulating and fluoride releasing properties but their poor wear resistance precludes their use in stress bearing areas of affected permanent molars. Composites and poly acid modified resin composites can provide a definitive restorative solution in cases where defective enamel is well demarcated, confined to one or two surfaces with no cusp involvement and the preparation has supragingival margins. These materials are adhesive, provide support to the surrounding tooth structure and exhibit good wear resistance.
5. *Preformed stainless steel crowns*: For molars with extensive defects especially where there is significant cuspal involvement, preformed metal/SSCs often provide an expedient and effective medium term solution.[8]

   Advantages:

   i. These crowns are highly effective at stopping sensitivity and protecting the remaining tooth tissue from further mechanical or carious breakdown.
   ii. Establish correct interproximal contacts and proper occlusal relationships.
   iii. Stainless steel crowns are not as technique sensitive or costly as cast restorations and require little time to prepare and insert.
6. *Adhesively retained onlays or cuspal overlays have been advocated by a number of authors (Crawford and Aboush, 1993; Harley and Ibbetson, 1993; Hunter and Stone, 1997):* Partial and full coverage indirect adhesive or cast crowns and onlays may be considered for MIH in the late mixed and permanent dentitions. Such restorations are rarely indicated in young children due to placement difficulties associated with: short crowns, large pulps, long treatment time, high cost and the child's limited cooperation.

MANAGEMENT OF ENAMEL OPACITIES ON ANTERIOR TEETH

Ultrastructurally, opaque defects on anterior teeth usually extend through the full thickness of enamel, from the surface or subsurface down to the dentinoenamel junction (DEJ).

For this reason, acid/pumice microabrasion techniques tend to produce little improvement when used alone. Direct composite veneering with or without preparation offers the most reliable medium term way of improving esthetics of these teeth.

CONCLUSION

Molar incisor hypomineralization is an inherited disorder of mineralization of enamel. Management challenges include difficulty in obtaining adequate anesthesia, increased incidence of caries, early pulpal involvement and gross

destruction of clinical crown of affected teeth. Management primarily depends on the age of the patient at the time of intervention. In a young permanent tooth, semipermanent crowns like SSCs for posterior teeth and direct composite veneering for anterior teeth are the recommended solutions.

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