REVIEW OF MIH SYNDROME TREATMENT IN CHILDREN AND ADOLESCENTS

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ABSTRACT

Aim of the study Molar incisor hypomineralization syndrome (MIH) is considered to be a 21st century disease, but it was studied for a long time in dental medicine, as it poses clinical problems for dentists around the world, especially in children and adolescents. This study aims to evaluate treatment methods available in literature for teeth affected by MIH syndrome. **Materials and method** Information were obtained by evaluating electronic databases PubMed and Web of Science and performing a review of literature containing basic science and clinical studies regarding MIH syndrome in children and adolescents. In total, a number of 54 scientific articles were selected and evaluated, after applying the MeSH search terms: "MIH syndrome", "treatment", "children and adolescents". **Results** Preventive strategies, treatment options and management guidelines are available in literature, and each clinician should carefully evaluate their implementation depending on the severity of the syndrome and the age of the child. **Conclusions** Management of MIH syndrome is complex and difficult considering the morpho-functional, psycho-social and economic aspects of the disease, but possibilities are varied and dentists should always be up to date with treatment protocols. Some of the treatment methods available today are presented in this review.

Key words: MIH syndrome, treatment, children and adolescents

INTRODUCTION

Molar incisor hypomineralization syndrome (MIH) is a term introduced by Weerheijm, Jalevik and Alaluusua in 2001 (1), referring to hypomineralization defects on one or all four permanent first molars and permanent incisors.

Although the terminology is relatively recent, literature shows numerous observational and clinical studies which addressed the symptoms of this pathology and previously described it as: 'opaque spots', 'cheese teeth', 'idiopathic enamel hypomineralization of the first permanent molars', 'demarcated enamel opacities', 'mottled enamel' and others (2-4).

The etiology of the qualitative enamel deficiencies expressed by MIH syndrome is not yet fully understood, and a plethora of factors are supposedly incriminated (e.g. genetic factors, systemic disturbances, environmental factors) (5). Most risk factors described in the literature require an episode of hypoxia in a certain phase of the enamel mineralization (6).

MIH syndrome is a clinical problem with global impact, with a prevalence of about 13-14% of children all over the world (7).

The diagnosis of MIH syndrome can be difficult considering the age of the child and the symptomatology which can interpose with the clinical examination (high sensitivity, pain,

impairment of the oral hygiene which lead to rapidly progressive caries) (8).

Literature has reported the necessity of standardized evaluation and research protocols, in order to achieve a correct diagnosis. Some authors have suggested standardized diagnosis protocols, underlining the ideal age of around 8 years old to diagnose MIH, because all the first permanent molars and incisors are erupted (9).

The characteristic of MIH lesions include well demarcated white or brown opaque spots, with soft and porous enamel which can undergo post eruptive enamel breakdown (PEB) and expose the sensitive dentin (10).

Treatment of a child with MIH syndrome must have a holistic and multidisciplinary approach, with a long term management plan including the patient-parent duo and the medical team. The provocations faced when treating MIH lesions are the extreme sensitivity to physical and mechanical stimuli which can lead to higher anxiety levels and subsequently behavior challenges, and often the impossibility of reaching proper analgesia during the treatment (11). The psycho-social component of MIH syndrome is not to be ignored, children with this disorder often complaining of the aesthetics.

Teeth with MIH lesions are at a greater risk of developing caries due to their qualitative enamel defects and also have a post-eruptive breakdown susceptibility. In addition, restorative techniques are difficult to implement due to the low success rate of dental surface – material adhesion bond (11).

Treatment options suggested in literature vary, depending on the severity degree of the disease, child's age and cooperation, technique limitations and even economical means (12) and range from prophylactic strategies to complex restorative procedures (13).

MATERIALS AND METHOD

A review of the basic science and clinical literature was performed, using information obtained electronically from PubMed and Web of Science databases and also physically by reading printed articles. In total, a number of 54 scientific articles were selected and evaluated, after including key words like "MIH syndrome", "treatment", "children and adolescents", "management of MIH syndrome".

RESULTS AND DISCUSSION

The management of MIH syndrome starts with caries prevention, and the European Academy of Pediatric Dentistry (EAPD) has established a few guidelines in order to individualize the strategies for each case (14).

Preventive strategies address the early recognition of MIH syndrome and reducing the caries risk by correctly instructing the child and caregiver about oral hygiene and diet. Children with MIH syndrome tend to avoid oral hygiene procedures due to the hypersensitivity, therefore additional care must be taken regularly at home or in the dentist's office, through topical fluoride applications, fluoride mouthwashes, application of desensitizing pastes like casein phosphopeptide – amorphous calcium phosphate (15,16).

The use of sealants is very important in caries prevention and it plays a substantial role for protecting newly erupted MIH affected molars. Some studies have shown that glass ionomer sealants have higher success rates compared to conventional resin-based sealants, due to the bonding difficulties at the dental surface-material interface (15). Other authors suggest resin sealants should be the treatment of choice and the first option in preventing caries and post-eruptive breakdown in fully erupted MIH affected molars (17,18).

The decision-making which actually sets the restorative techniques used in the treatment of MIH syndrome must be taken in accordance to the severity of the disease, the compliance of the child and the economic implications. After the preventive measures applied, affected molars could be restored with different materials, taking into consideration the risk of repetitive restorations due to poor bonding to the dental surfaces, or extraction could be performed with or without orthodontic space closure (19).

Conservative approaches for MIH affected molars include atraumatic restorations, but conventional glass ionomer cements used in this technique have proven low rates of success in recent studies (20). Enhancing the properties of the material by using glass-ionomer hybrid restorations or high viscosity glass ionomer cements have shown promising results (21,22). Regardless of the material and its long term resistance, the atraumatic restorative technique (ART) remains an effective method for treating anxious, uncooperative small children, or as intermediate restoration until a proper restoration can be performed (14).

For moderate and severe cases, studies have suggested various treatment techniques and materials. Hybrid glass ionomer cements, resin composite restorations, CAD/CAM prepared ceramic inlays or onlays, preformed metal crowns are described in literature (15,23).

Resin restorations have proven high success rates if correct moisture control can be obtained by rubber dam isolation. (24,25,26). The main cause of failure and re-intervention is the low bond strength of the material to the MIH-affected enamel (27). Strategies to improve adhesion have been proposed, including the use of self-etch or total-etch techniques, deproteinisation with 5% sodium hypochlorite, or using a resin infiltrant (28,29,30).

Indirect restorations are prepared in the laboratory and require at least two treatment sessions. Materials which can be used for inlays/onlays vary from metal, resin composite and ceramics and have high success rates in cases of teeth with largely affected surfaces (31,32). Studies which compared the materials used for indirect restorations have found insignificant differences between the three, and authors recommend them all equally (33,34).

One recent study compared CAD/CAM (Computer-aided Design/Computer-aided Manufacturing) ceramic restorations with conventional resin composite restorations and found similar survival rates (moderate to high) after 36 months (20).

Considered the election treatment for severely affected molars, preformed metal crowns are a suitable solution for teeth with large structure loss, where multiple surfaces are involved. A relatively cheap option, metal crowns have shown high success rates (25,35,36).

Preformed metal crowns (PMC) have some important advantages, like maintaining the tooth's structural integrity, reducing the hypersensitivity by eliminating direct contact with stimuli and also, preserving the occlusal contact (14). PMCs are relatively easy to place, requiring minimal preparation of the tooth, and one study even suggested the use of Hall technique which eliminates all preparation prior to placement (37).

Extraction is an option to be considered for severely affected molars with poor restoration prognosis, with pulp involvement or periapical abscess. Another indication for extraction could be a poor long-term prognosis of the tooth, if likely repeated interventions and restorations are needed, and the psycho-social and economic implications on the child and caregiver are serious (38).

Scheduled extractions should be performed after a multidisciplinary consultation with an orthodontist, if the child is at an ideal stage of dental development, of around 8-10 years of age (39). Some authors believe that extraction at this ideal age is likely to resolve through a spontaneous space closure (40), while others state that complete space closure is not guaranteed (41).

Planning an extraction for MIH affected teeth must take into consideration the underlying malocclusions of the child, the presence or absence of crowding, the presence or absence of the third molar, and the dental developmental stage of the child (40).

Extraction is a radical approach and each clinician must take a decision based on his own cultural attitude and practices, in accordance to the patient and caregiver's choice. Long term extensive restorative treatment could pose a significant economic burden, as well as having a psycho-social component on the child (38).

Anterior teeth could be affected by MIH syndrome in different degrees, from no opacities at all to post-eruptive surface destruction in cases with severe molar implication as well (42). The psycho-social impact on the child is considerable, even in mild cases with small opacities or discoloration, as the altered aesthetics could impair the quality of life (43).

Management of incisor defects in MIH syndrome has to be planned according to the severity of the lesions but is largely dictated by patient's and parents aesthetic concerns (23).

In children with poor oral hygiene, multiple carried teeth and a cariogenic diet, EAPD recommends deferring the cosmetic treatment of anterior teeth until all molar caries are treated and an improvement of the oral hygiene status is seen (14).

A conservative approach and minimally invasive treatments are first recommended in order to improve the aesthetics and preserve sane teeth structures in moderate defects (23).

A variety of minimally invasive treatment options are available in literature, such as teeth whitening or external bleaching, microabrasion techniques, the etch-bleach-seal technique, resin infiltrations, direct or indirect resin composite restorations (16,44,45).

Recommended mainly to camouflage white opacities, external bleaching or tooth whitening can be made with hydrogen peroxide (in various concentrations, up to 6% concentration) and 10% or 16% carbamide peroxide. The bleaching gels can be applied at home or in the dental office, using custom whitening acrylic trays made in the laboratory (45,46). Many clinicians are still reluctant in using whitening techniques in children, due to its side effects like gingival inflammation and dental sensitivity, reluctance reinforced by the European Union's recent directives restricting tooth whitening agents in children to only 0,1% hydrogen peroxide, concentration proven to be clinically ineffective (47).

Microabrasion is another minimally invasive approach, which removes approximately 100μm of enamel surface by using a pumice slurry or an abrasive paste based on silicon carbide (48). Recent studies have shown efficacy of microabrasion with 18% hydrochloric acid or 37% phosphoric acid followed by remineralizing agents (casein phosphopeptide-amorphous calcium phosphate) (49).

Resin infiltration is a relatively recent microinvasive treatment, based on an acid etchant (15 to 20% hydrochloric acid), etanol and a monomer resin infiltrant (50). The resin is penetrating enamel porous subsurface and

masks the opacities, appearing to be the most efficient treatment in improving the aesthetics (51).

Another similar method is the etch-bleach-seal technique, which first uses 5% sodium hypochlorite to bleach the tooth for about 20 minutes and after that etches the tooth with 37% phosphoric acid, before applying the resin sealant (52).

When minimally invasive techniques cannot be applied, in cases of severe opacities or structural loss, conventional resin composite restorations are recommended. Considering the lower bond strength to the affected enamel, marginal staining, wear of the material and fractures could occur, which impose a long term maintenance of the restorations (53). Extra care should be taken while preparing a conservative cavity when restoring with conventional resins, due to specific morphological aspects of young permanent incisors, especially a large pulp anatomy (14).

Recent studies shown that combined treatment techniques have proven greater efficiency, with a higher chance of meeting individualized clinical requirement and restoration needs of each case (54).

CONCLUSIONS

Molar incisor hypomineralization syndrome is a complex condition, with a relatively high prevalence worldwide, becoming a public health issue because of the long term implications of its treatment. Management of MIH syndrome poses a unique problematic due to characteristics of affected enamel, low bonding strength of adhesive materials, psychological implications of the dental hypersensitivity and the age of the child.

Preventive measures have been studied and prophylactics has been proven effective, especially in reducing the risk caries of MIH affected molars, depending on the severity of the disease. Restorative techniques for molars use conventional glass ionomer cement, hybrid glass ionomer cement, resin composites or even ceramics. Preformed metal crowns were proven to be the treatment of choice for severely affected molars and temporization of treatment, when dealing with long term management of MIH teeth. Extraction is the radical option many dentists still avoid, but in some severe cases planned scheduled extractions have the best clinical outcome, after an orthodontic or spontaneous closing of the space, at an optimal age of the child.

In anterior teeth, minimally invasive procedures are recommended, like microabrasion or resin composite infiltration. In severe cases with profound opacities or even loss of dental substance, conventional resin restorations are the most frequent method of treatment. Clinicians should take into consideration a long-term monitoring and maintenance of these restorations, given the structural characteristics of the affected enamel.

The treatment options presented have shown better results when combined. Regardless of the chosen method, MIH management should always be carefully planned with a multidisciplinary team and the patient-caregiver duo, always having the child's well-being in mind. Individualized treatment plans for each case should have the best outcomes, considering the variety of treatment possibilities available.

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