MANAGING MOLAR INCISOR HYPOMINERALIZATION WITH CLASS III MALOCCLUSION: A MULTIDISCIPLINARY APPROACH IN A 7-YEAR-OLD PATIENT: A CASE REPORT.

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ABSTRACT

Molar-Incisor-Hypomineralization (MIH) is a condition affecting dental enamel development, primarily impacting permanent first molars and incisors. It results from disturbances during the maturation phase of enamel formation. Clinically, MIH manifests as demarcated discolored hypomineralized areas on affected teeth, which can lead to post-eruptive breakdown (PEB), dentin exposure, hypersensitivity, increased susceptibility to cavities, and behavioral challenges in children due to dental anxiety and esthetic concerns. Managing MIH involves addressing both the dental defects and associated challenges. In a recent case report involving a 7-year-old female pediatric patient, comprehensive dental management was detailed. The report focuses on treating MIH-affected teeth, particularly the first molars with immature apexes, alongside managing hypomineralization defects and posteruptive breakdown. Additionally, the case highlights the early orthodontic intervention for a Class III malocclusion, which is a condition where the lower jaw protrudes forward relative to the upper jaw. The decision on whether to initiate orthodontic treatment early or to await skeletal growth completion remains a debated topic among orthodontists. In summary, the case report underscores the multifaceted approach required in managing MIH in pediatric patients, addressing both dental health issues and associated orthodontic concerns early in the patient's developmental stage.

KEYWORDS: Case report, MIH, minimal invasive dentistry, Class III, Early Mixed Dentition.

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INTRODUCTION

Molar Incisor Hypomineralization (MIH) is a notable issue in pediatric dentistry, marked by a developmental anomaly impacting the enamel of permanent molars and incisors. Its incidence has risen worldwide, presenting complexities for dental professionals in terms of identifying, treating, and managing the condition. Coined in 2001, the term "molar incisor hypomineralization" specifically denotes the clinical manifestation of enamel hypomineralization of systemic origin, affecting one or more permanent first molars (PFMs) and permanent maxillary incisors (1). The likelihood of MIH affecting the permanent maxillary incisors rises as the number of affected PFMs increases (2).

MIH is a prevalent dental condition affecting up to 25% of children globally (3). Its exact cause remains uncertain (1, 3). Generally, enamel hypomineralization occurs due to disruptions in the function of ameloblast cells at various stages of enamel formation. However, MIH is believed to result from multifactorial systemic factors contributing to enamel hypomineralization (4). Research indicates that children born prematurely or with poor general health early in life face a higher risk of developing MIH (3, 4). Furthermore, antibiotic use during early childhood has been associated with MIH, although distinguishing whether the condition arose from the disease itself or the antibiotic treatment presents challenges due to their concurrent occurrence (5).

The primary cause of Class III malocclusion is believed to be hereditary, although environmental factors such as habits and mouth breathing may also contribute. Individuals with Class III malocclusion often exhibit a combination of skeletal and dentoalveolar issues. Skeletally, this can involve an underdeveloped maxilla, an overdeveloped mandible, or a combination of both. Dentoalveolar components include maxillary incisors that are protruded and mandibular incisors that are retruded, which represent a compensatory mechanism. Research by Ellis and McNamara indicated that 65-67% of Class III malocclusions are characterized by maxillary retrognathism (6). Early orthodontic treatment aims to create conditions that facilitate more favorable dentofacial development (7). The manuscript of this case report adheres to the CARE checklist for case reporting guidelines (8).

Case Report:

A 7-year-old girl visited the Department of Pediatric Dentistry and Dental Public Health at Alexandria University, Egypt, accompanied by her father. Her primary concern was multiple cavities in both upper and lower teeth, along with a desire to improve the appearance of her smile. The family belongs to a moderate socioeconomic status. There were no complications during her birth, and her father noted similar dental conditions in other family members. The girl complained of tooth sensitivity and difficulty with biting and chewing. Her medical history indicated no systemic health issues or medications affecting dental health, although her father mentioned she had received antibiotics frequently during her early years. Additionally, she had a history of teeth extraction.

Upon examination, the patient exhibited severe hypomineralization affecting the permanent first molars and incisors. She had premature extraction of teeth #75, #74, #85, #84 [figure 2]. The differential diagnosis considered for the patient included MIH, enamel hypoplasia, Turner's hypoplasia, dental fluorosis, and amelogenesis imperfecta. Following a comprehensive evaluation of the patient's medical and dental history, along with oral examination and radiographic findings, a clinical diagnosis of MIH was established. This diagnosis was made in accordance with the diagnostic criteria outlined by the European Academy of Pediatric Dentistry (EAPD) in 2021 (9). The severity of MIH affecting the molars and central incisors was classified as severe based on the EAPD criteria (9).

The patient's parents were informed about the diagnosis of MIH, including its treatment options and prognosis. They received counseling and education regarding the nature of MIH, its implications for dental health, and the recommended treatment approach. Both the patient and her parents were motivated to pursue appropriate treatment and committed to regular follow-up appointments. This comprehensive approach aimed to ensure understanding and active participation in managing the patient's dental condition effectively.

The molars exhibited post-eruptive breakdown and noticeable creamy-yellowish demarcated opacities, while the incisors displayed enamel defects characterized by discolorations ranging from white to brown. During examination, the patient presented with a straight profile and competent lips [figure 1]. Intra oral examination revealed zero overjet and zero overbite during centric occlusion [figure 2]. Additionally, panoramic x-ray was taken [figure 3]. Cephalometric Xray [figure 4] also was requested and its analysis showed the patient displayed developing Class III malocclusion with a deficient maxilla and normal mandible.

Given the patient's age, compliance, cooperation level, and the stage of early mixed dentition, coupled with the clinical presentation of MIH affecting newly erupted young permanent first molars and partially erupted incisors, a treatment plan was devised following a minimally invasive and preventive dentistry approach, incorporating nonpharmacological behavior management techniques (BMT).

Before proceeding with any dental procedures, informed consent was obtained from the parents, ensuring they were fully informed about the proposed treatment plan, its objectives, potential risks, and expected outcomes. Nonpharmacological behavior management techniques (BMT) were employed to enhance the patient's cooperation and overall experience during treatment sessions. The treatment planning process involved a multidisciplinary approach, incorporating expertise from pediatric dentistry, endodontics, and orthodontics departments. The initial priority was addressing the patient's dental pain and restoring functional capabilities. This included the application of desensitizing agents, fluoride varnish, and resin infiltration on affected teeth to enhance their structural integrity. Orthodontic assessment revealed the need to correct growth of the maxillary arch and facilitate proper alignment of the teeth. A combination of facemask and extra oral elastics was planned to address the malocclusion and improve occlusal relationships [figure 5].

Regular follow-up appointments were scheduled to monitor the ongoing progress of dental treatments, evaluate oral hygiene practices, and offer supportive care and education to both the patient and their caregivers. These appointments were crucial for assessing the effectiveness of the implemented treatments, ensuring proper maintenance of oral health, and addressing any emerging concerns promptly. By maintaining consistent follow-up, the dental team aimed to optimize treatment outcomes, promote patient comfort, and empower the caregivers with the knowledge needed to support the patient's dental care at home.

Figure 1: Extraoral examination of the patient

Figure 2: Intraoral photograph

Figure 3: Pre-operative Panoramic radiograph

The treatment plan proceeded through the regular sequence of preventive, restorative, orthodontic, rehabilitation and maintenance phases accompanied by basic behavior management techniques. The treatment included oral hygiene instructions (OHI), dietary analysis, prophylaxis, topical fluoride varnish application, scaling and polishing. For tooth #26 consultation was sought from the endodontic department, and treatment options were discussed with parents. It was planned to perform caries excavation then vital pulp therapy by MTA partial or full pulpotomy, and after removing the pulp chamber tissue, full pulpotomy was done as bleeding was controlled after 2 minutes of application of cotton pellets immersed in 5.25% of sodium hypochlorite [figure 7, A].

Tooth #36 partial pulpotomy with MTA was done as inflamed pulp tissue beneath the exposure was removed to a depth of two millimeters and a healthy pulp tissue was reached [figure 7, B]. Pulp bleeding was controlled by irrigation with 5.25% sodium hypochlorite. For tooth #46 indirect pulp capping was performed to achieve apexogenesis as no pulp exposure happened after caries removal [figure 7, C]. Teeth #16, #26, #36, #46 were covered with a prefabricated stainless-steel crowns SSC (3M ESPE, SSC, Germany) and cemented with glass ionomer cement (3M-ESPE, Ketac Cem, Seefeld, Germany).

For primary teeth #65, #64 pulpotomy and SSC, for teeth #73, #83 pulpotomy and strip crowns were performed, and for teeth #55 #54 #53 #52 #63 #62 composite restoration was done. Tooth #21 has deep brown opacities and veneer composite was done to achieve better esthetics. For teeth #11, #32, #31, #41 resin infiltration was treatment of choice to eliminate the white opacities. Then, remaining root #74 was extracted.

For the orthodontic phase, in the lower arch lingual arch space maintainer was inserted. In the maxillary arch Nance appliance with hooks for facemask was fabricated and roundation to lower canines' cusps was done [Figure 5]. The patient and parents were satisfied with the favorable outcomes of dental treatment provided [figure 6, 8].

A long-term treatment plan was established to schedule follow-up appointments with the patient every 3 months. These appointments aimed to provide anticipatory guidance, including advice on anticipated dental developments and potential challenges. Fluoride application would be regularly administered to strengthen teeth and prevent cavities. During these visits, the dental team would also assess the condition of existing restorations, examine for any new lesions or changes in dental health, and reinforce oral hygiene instructions. Additionally, dietary guidance would be reviewed to promote dental health and prevent further enamel deterioration. Monitoring the normal eruption sequence of teeth was also part of the long-term plan to ensure proper growth and alignment of the dentition. By maintaining this structured follow-up schedule, the dental team aimed to support ongoing dental health, address emerging issues promptly, and empower both the patient and caregivers with effective strategies for maintaining oral hygiene and overall dental wellness.

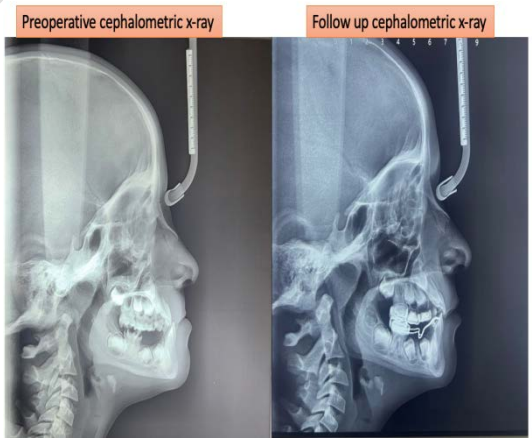

Figure 4: Cephalometric X-rays (preoperative and post-treatment)

Figure 5: Facemask insertion

Figure 6: Postoperative photographs

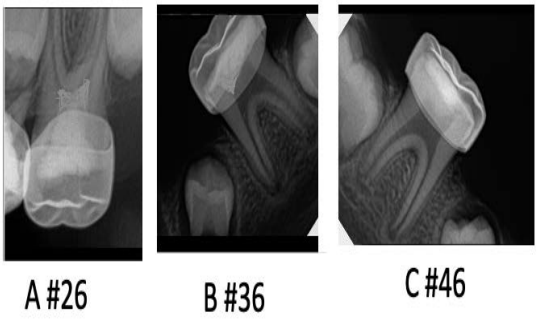

Figure 7 Immediate post operative periapical radiographs.

Figure 8: enhancement of the patient profile following the treatment.

DISCUSSION

The clinical presentation of MIH is characterized by distinct discolorations and opacities in affected teeth, ranging from creamy/white to yellow/brown, often accompanied by posteruptive enamel breakdown (10, 11). Histologically, these defects associated with MIH are highly porous, primarily located in the deeper layers of the enamel tissue (10, 12). Research into the histopathology of MIH indicates that hypomineralization begins at the amelodentinal junction rather than on the enamel surface during amelogenesis, which distinguishes it from other types of enamel structural defects (13). Studies have shown that MIH-affected enamel exhibits a 20% decrease in mineral concentration compared to healthy enamel (13). Additionally, the protein concentration in MIH-affected enamel is reported to be 3-15 times higher than in sound enamel (13). These findings underscore the unique nature of MIH-related enamel defects and highlight the biochemical changes that contribute to its clinical manifestations.

In this particular case, the molars severely affected by MIH exhibited brownish discoloration and signs of wear, along with post-eruptive breakdown (PEB) of the enamel on their occlusal surfaces. The permanent incisors also displayed severe manifestations of MIH. These clinical observations highlight the extensive impact of MIH on both molars and incisors, underscoring the challenges posed by this condition in terms of aesthetics, function, and ongoing dental care needs.

Managing MIH poses several challenges for clinicians, including difficulties in achieving sufficient anesthesia in affected teeth, dentinal hypersensitivity, and the rapid onset or progression of cavities on hypomineralized enamel surfaces. Additionally, there is a high incidence of marginal breakdown of dental restorations, compounded by the challenge of securing cooperative behavior from pediatric patients during treatment (14). Studies indicate that children with MIH often exhibit greater dental anxiety and behavior management issues compared to those without

MIH, often necessitating treatment under sedation or general anesthesia (15, 16).

In this particular case, the patient demonstrated positive behavior during dental treatment, achieving a Frankl scale rating of 1, which reflects effective management through nonpharmacological behavior management techniques (BMT) such as modeling, the Tell-Show-Do (TSD) method for desensitization, parental presence, and distraction techniques. These approaches were pivotal in ensuring the successful and efficient delivery of dental care, effectively addressing challenges associated with MIH while promoting a comfortable and cooperative experience for the young patient. Remineralization therapy, initiated promptly upon accessible enamel surfaces, aimed to restore a mineralized surface layer. Topical fluoride applications, in forms like varnishes or gels, were integral to this therapy, facilitating enamel remineralization, reducing sensitivity, and enhancing resistance against demineralization. These interventions were crucial for supporting the long-term health and stability of the affected teeth (18).

Various esthetic treatments for affected incisors include microabrasion, resin infiltration, resin composite restorations, and options ranging from composite or porcelain veneers to full veneer crowns during childhood. In adulthood, metal or metal-ceramic full veneer crowns may be considered. The clinical appearance of white spots, whether carious, hypoplastic, or fluorotic, can be attributed to a physical phenomenon related to the refractive index (RI) of enamel. The RI in these porous areas differs from that of healthy enamel, contributing to the whitish appearance of the lesion. The increased porosity and crystalline spaces in affected enamel allow the infiltration of substances like adamantine fluid, which has an RI similar to water (1.33), into spaces that would normally be occupied by enamel hydroxyapatite (RI of 1.62). This difference in RI helps explain the visual characteristics of these lesions (19).

Resin infiltrates are photopolymerizable resins characterized by low viscosity and a high-penetration coefficient. This allows the material to penetrate deeply into the porous spaces of hypoplastic enamel through capillary action (19). The application of resin infiltration, which has a refractive index (RI) of 1.46, alters the optical properties of teeth affected by enamel hypoplasia. This treatment effectively masks white spots by filling and reinforcing the porous enamel structure (20).

Although initially developed for use in early-stage caries lesions, clinical trials conducted by Tirlet et al. have demonstrated the efficacy of resin infiltration for treating white spot lesions stemming from various etiologies, including hypoplastic spots as observed in the present study (20). The authors reported successful outcomes, utilizing resin infiltration to mask these lesions by altering their optical properties effectively. This approach underscores the versatility of resin infiltration beyond its original scope, providing a valuable treatment option for enhancing the esthetics of enamel affected by different types of defects.

When managing first molars severely affected by MIH, particularly those with pulpal involvement, the initial clinical decision revolves around whether to restore the tooth or consider extraction. Options for restoration include composite fillings, indirect restorations, or stainless-steel crowns, all of which are viable choices (21). In pediatric patients, vital pulp therapy is typically preferred due to its minimally invasive nature and high success rate. Techniques such as MTA pulp capping, partial pulpotomy, or full pulpotomy are suitable for treating immature permanent teeth with inflamed pulps (21, 22). If achieving pulpal homeostasis proves challenging, root apexification may be considered. This procedure involves creating a barrier of hard tissue at the root end to promote healing. In a retrospective study by Jeeruphan et al., MTA apexification demonstrated success and survival rates of 95%, while calcium hydroxide apexification had rates of 77% in treating immature teeth (23).

Stainless steel crowns represent a reliable treatment option for severely damaged first molars affected by MIH, offering high long-term survival rates and durable coverage until the final restoration can be implemented. This approach effectively restores function and preserves tooth integrity, particularly in cases involving extensive damage or pulpal involvement.

Class III malocclusions often involve maxillary retrognathia, mandibular prognathia, or a combination of both. Cases characterized by skeletal maxillary retrognathism with a low MP angle are typically candidates for treatment with a facemask (24). Facemask therapy is ideally initiated between ages 6-8 years, provided the patient can manage the appliance and maintain good compliance. The treatment works by stimulating maxillary growth while restraining mandibular growth. Challenges associated with facemask therapy include patient compliance and the risk of relapse due to continued mandibular growth occurring later (24). Therefore, early interception of Class III malocclusion is crucial to redirect growth, particularly when maxillary deficiency is a primary factor or dental and functional issues are involved.

A limitation of this case report is the absence of long-term follow-up to assess the survival rate of endodontically treated molars in pediatric patients. This area presents an opportunity

for future research to evaluate treatment outcomes over time and enhance understanding of the effectiveness of various dental interventions in managing MIH-related dental issues in young patients.

CONCLUSION

This case underscores the complexities involved in managing molar incisor hypomineralization (MIH) alongside Class III malocclusion in pediatric patients. A comprehensive interdisciplinary approach, integrating pediatric dentistry and orthodontics, is pivotal for achieving successful outcomes in these cases. Key findings included forward displacement of the maxilla, proclination of maxillary incisors, positive overjet, a more convex profile, and improvements in smile aesthetics.

Early diagnosis and intervention play critical roles in minimizing the detrimental effects of MIH and addressing associated malocclusions. By initiating timely treatment, clinicians can optimize oral health and function, thereby enhancing the overall well-being of the patient. This approach emphasizes the importance of proactive management strategies tailored to the specific needs of young patients affected by these challenging dental conditions.

DECLARATION OF PATIENT CONSENT

These authors confirm that they have obtained informed consent from the legal guardian of the patient. The consent form includes permission for images and other clinical information to be reported in the journal. The guardian understands that personal identifiers such as names and initials will not be published to maintain confidentiality, although complete anonymity cannot be guaranteed.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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