LOMA LINDA UNIVERSITY
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Managing Molar-Incisor Malformation (MIM): A Case Report

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Introduction

Molar incisor malformation (MIM) is a relatively uncommon dental defect that has been documented in the literature. It mainly affects permanent maxillary and mandibular first molars, but it has also been found to affect permanent maxillary incisors, primary second molars, and canines in some cases.[1] The cause of MIM is unknown, but it has been linked to the use of certain drugs, premature delivery, and neonatal infections.

MIM was formerly confused with molar-incisor hypomineralization (MIH), which affects the same teeth and has a similar etiology. However, enamel is frequently involved in MIH, while dentin and cementum are affected in MIM. Underdeveloped roots in affected teeth, crowns with cervical constriction, and calcified pulp chambers are common symptoms of MIM. It may also be associated by a severe periodontal infection, which can result in tooth loss, space loss, spontaneous discomfort, impaction, and poor esthetics.[2] It differs from MIH in that the crowns appear to be entirely intact and unaffected clinically, and radiographic evaluation is required for accurate diagnosis. (See table 1)

In this case report, we will describe the management of a 15-year-old African American female who has idiopathic root deformity affecting her permanent first molars, maxillary incisors, and primary canines, suggestive of MIM.

Table 1

Summary of Radiographic features.

	Incisors	Permanent or deciduous canines	Deciduous molars	Permanent first molars
Radiographic features	Wedge-shaped crown defect (17/17) Cervical constriction (11/17) Split root (5/17) Calcified canal or pulp stone (3/17) Slender root (2/17) Dilacerated root (2/17)	Cervical constriction (5/5) Wedge-shaped crown defect (2/5) Slender root (2/5) Dilacerated root (1/5)	Pulp obstruction (18/20) Cervical constriction (15/20) Short root (14/20) Slender/spiky root (8/20) Undeveloped root (4/20)	Cervical constriction (38/38) Pulp obstruction (37/38) Slender/spiky root (35/38) Short root (34/38)

Table 2

Summary of comparison between MIH and MIM.

	Molar-incisor hypoplasia (MIH)	Molar-incisor malformation (MIM)
Affected tooth	Permanent first molars, incisors	Permanent and deciduous molars, incisors, and canines
Diagnosis using visual inspection	Can be detected Different enamel opacity (creamy-white to yellow-brown) due to hypomineralized enamel	Molars - Not easily detected Incisors – Can be detected when malformation is shown in the crown
Diagnosis using radiographic examination	Not easily detected	Easily detected and essential - through typical morphologic change of malformed tooth (slender root, cervical constriction of crown, pulp obstruction)

Case Report

15-year-old African American female with controlled Asthma was referred to LLU pediatric dentistry clinic for management of her malformed teeth. Mother's main concern was the need for orthodontic treatment to fix her front teeth and that none of the orthodontists that she saw agreed to work on her. Patient has spaced dentition and open bite, teeth #8 and #9 were previously treated with RCT followed by composite build up. No family history of malformation or root resorption. However, patient's mom reported that patient had premature delivery.

Clinical Findings: Mixed dentition, spacing between her teeth, missing maxillary permanent canines, over retained maxillary primary canines, previously RCT treated and restored #8 and #9. (See fig 1) Patient did not report any signs of pain or discomfort and no active caries was noted.

Radiographic Findings: Revealed an unusual presentation and malformed roots on mandibular and maxillary first molars, and cervical constrictions on maxillary incisors and deciduous canines. Mandibular molars had an associated dento-alveolar infection and maxillary permanent canines were congenitally missing. (See fig 5 & 6)

The quality of the RCT on teeth #8 and #9 is questionable and Endodontic consultation recommended to continue monitoring the teeth since there are no associated signs of pain, discomfort, and infection. Prognosis of the teeth is poor and redoing RCT might weaken the tooth or lead to root fracture.

The marked severity of this condition provided a poor long-term prognosis of the affected teeth, and it was deemed that any attempt of active orthodontic movement could risk further exacerbation and their imminent loss. Therefore, we decided to delay the orthodontic treatment until she has stable teeth. Extraction was choice of treatment for mandibular first molars followed by removable prosthesis, and we decided to monitor maxillary first molars, maxillary central incisors. (See table 3)

Figure 1. Intra-oral photos
Affected teeth appear to be intact clinically

Before **After**

Figure 2. Strip crowns #C, H, 8, 9

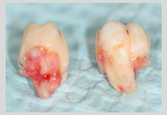

Figure 3. MIM molars
Note: malformed roots after extraction

Figure 4. Removable prosthesis delivered after extractions of #19,30

Table 3

	Treatment plan summary
1.	**Resin Strip crowns on #8, #9, #C and #H to address patient's need for better esthetics.**
2.	**Extraction of #19, 30 – followed by removable prosthesis**
3.	**Continue to monitor #3, 14, 8, 9, C, H**
4.	**Periodic monitoring**
5.	**Future orthodontic consultation**

Figure 5. Radiographs
Questionable RCT with PARL #8, #9
Cervical constrictions on #3, #14, #C, #H, #8, #9
Malformed roots on #19, #30 with associated dento-alveolar infection around #19

Figure 6. Panoramic radiograph

Discussion

Molar-incisor malformation (MIM) is a rare new defect that has substantial clinical and radiographic findings, and pediatric dentists are frequently the first ones to notice it. There does not appear to be any gender predilection associated with this condition. The cause of MIM is unknown, although most studies in the literature show that it is linked to preterm birth, infant hospitalizations, and early exposure to drugs such as antibiotics, which may impact the development of affected teeth.[3] In addition, MIM individuals had meningitis, spina bifida, brain cysts, convulsions, hydrocephalus, and other disorders that could have influenced the development of the affected teeth. Another theory was that the cells of Hertwig's epithelial root sheath (HERS) were destroyed much earlier, disrupting the regulation of the starting process of odontoblast differentiation, which is important for root development but happens later.[4]

MIM radiographic findings are comparable to those of dentinal dysplasia type 1-b, but unlike dentinal dysplasia, it is a limited to a few teeth only. The permanent mandibular first molars were affected in all documented cases in the literature, and in the majority had all four of their first permanent molars were affected. Pulp obstruction and cervical constriction in molars, crown deformity and cervical constriction in incisors and canine were the most common radiologic findings associated with this disorder. The enamel of clinical crowns is usually unaffected, and the condition is usually diagnosed after radiographic examination.[3] The condition can be initially confused for molar-incisor hypomineralization (MIH), a developmental dental abnormality that occurs in permanent first molars and incisors. There are, however, distinctions between these two abnormalities. (See table 2) MIM's most prevalent consequence is dentoalveolar infection. Another interesting discovery is that pulp necrosis occurs in all MIM-affected teeth, independent of caries or periodontitis severity.

Because of the rarity of documented cases, no standardized treatment for MIM patients exists; instead, treatment has been patient-specific and dependent on the degree of the root deformity to date. MIM children must be closely monitored over time.[5] MIM teeth have typically required extraction in treated situations. There have been occasions where an endodontic operation was performed to stabilize the tooth, but the teeth's long-term prognosis was still poor. Patients with MIM may require orthodontic treatment, but the condition complicates the use of orthodontic mechanics. If orthodontic therapy is necessary, certain precautions must be taken, including the use of light, continuous forces to the affected molar, periodic clinical and radiographic monitoring, and robust treatment consent is essential. For significantly impacted teeth, extraction is usually unavoidable option, followed by prosthetics for young patients who aren't suitable candidates for implants. If patient is diagnosed early and extraction of affected permanent first molars was done between the age of 9-11 years, second molar substitution might occur.

Conclusion

The key to managing MIM patients for a good long-term prognosis is early diagnosis. This condition might lead to challenges in restorative, prosthetic, and endodontic management as well as orthodontic treatment. Even though pediatric dentists are generally the first to notice this problem and plays a significant role in management of these patients, comprehensive management of such individuals requires a multidisciplinary approach.

References

1. Witt CV, Hirt T, Rutz G, Luder HU. Root malformation associated with a cervical mineralized diaphragm—a distinct form of tooth abnormality? Oral Surg Oral Med Oral Pathol Oral Radiol. Apr 2014;117(4):e311-9. doi:10.1016/j.oooo.2013.06.030
2. Lee H-S, Kim HJ, Lee K, Kim MS, Nam OH, Choi S-C. Complications of Teeth Affected by Molar-Incisor Malformation and Pathogenesis According to Microbiome Analysis. Applied Sciences. 2021;11(1):4.
3. Kim JE, Hong JK, Yi WJ, et al. Clinico-radiologic features of molar-incisor malformation in a case series of 38 patients: A retrospective observational study. Medicine (Baltimore). Oct 2019;98(40):e17356. doi:10.1097/md.0000000000017356
4. Neo HL, Watt EN, Acharya P. Molar-incisor malformation: A case report and clinical considerations. J Orthod. Dec 2019;46(4):343-348. doi:10.1177/1465312519875973
5. Vargo RJ, Reddy R, Da Costa WB, Mugayar LRF, Islam MN, Potluri A. Molar-incisor malformation: Eight new cases and a review of the literature. Int J Paediatr Dent. Mar 2020;30(2):216-224. doi:10.1111/ipd.12592