Possible Risk factors in the occurrence of Molar-Incisor Hypomineralization among a group of Nigerian Monozygotic Twins

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Abstract

Objective

Molar Incisor Hypomineralisation (MIH) is systemic in origin, and affects one to four permanent first molars. It frequently affects the incisors also. Its aetiology remains unknown, with some evidence suggesting association with childhood diseases during the first four years of life, the use of antibiotics (amoxicillin, a macrolide), and exposure to dioxins. This report is documented to highlight the possible risk factors for MIH in four sets of monozygotic twins.

Methods

A case series consisting of four related case reports.

Results

In each of the four cases described, precipitating environmental factors could be identified. This ranged from prolonged use of antibiotics, to early childhood illnesses, prenatal maternal ill health, and long duration of breast feeding.

The possibility of genes in the aetiology of MIH is further strengthened by the observation in this study, that all the monozygotic twin pairs identified with MIH during public oral health screening exercises, had the lesion.

Conclusion

The aetiology of MIH may be due to early childhood illnesses and the use of amoxicillin. Also, the possible role of genetic disposition needs to be further investigated.

Keywords

hypomineralisation, monozygotic twins, hypoplasia, opacity.

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Introduction

Developmental abnormality of the enamel may be acquired or inherited and can be broadly categorised into enamel hypoplasia or enamel opacities. Disturbances in the initial matrix secretion phase of amelogenesis will most likely present as quantitative or morphologic defects of the enamel.\textsuperscript{1,2} Disruptions in the calcification or maturation processes may produce morphologically normal but structurally or qualitatively defective enamel known as hypomineralisation.\textsuperscript{3}

In this case, the matrix is secreted to normal thickness but areas within it fail to mature or mineralised properly, so there are regions where the mineral content is deficient and these present clinically as diffuse or demarcated opacities that may be yellow or brown in colour.\textsuperscript{1,2}

Molar incisor hypomineralisation (MIH) is a qualitative defect of the enamel affecting one to all of the permanent molars with or without involvement of the incisors.\textsuperscript{4} The occlusal surfaces of the molars are mostly affected with more lesions in the upper than in the lower jaw.\textsuperscript{5}

The developmental defect can create considerable discomfort to the child shortly after the eruption of the affected teeth has started. The lesion can also be a locus of lowered resistance to caries development.\textsuperscript{6}

Several factors have been implicated in the aetiology of MIH. The aetiological factors may be grouped by age periods of the insult on ameloblasts (prenatal, perinatal and postnatal); and by the putative factors likely to be present during those periods.\textsuperscript{7}

Possible genetic disposition for MIH, together with environmental and systemic insults act together to produce MIH defects.\textsuperscript{8}

Despite the implication for the potential link between genetics and the aetiology of MIH, research in this field has been very limited. In a study using dental casts of Australian twins, Taji et al\textsuperscript{5} examined twin concordance for hypoplastic lesions on the labial aspect of primary canine. Slightly higher concordance levels in monozygotic twin pairs, together with the presence of some mirror imaging in the size and location of lesions among twins led the researchers to suggest cautiously, an
underlying genetic predisposition to the development of localised enamel hypoplasia with the developmental environment being the main determinant of trait exposure.

Studies on monozygotic twins, with the same genetic composition may point help highlight the possible inherited genetic component to MIH since they share more of their genes. This study reports on the case of four sets of twins who had MIH. The twins were identified during a school visit screening programme.

CASE REPORT

Case 1

The nine-year old female twins were the fifth and sixth kids in a family of six children and were from the middle socio-economic strata.

They were born through unassisted spontaneous vagina delivery, and had both resided in Ile-Ife all through their lives. Their main source of water supply was well water. They both had severe diarrhoea when they were eight months old. Amoxicillin was used for about 14 days to manage the diarrhoea.

They were both breastfed for 18 months, five of which was exclusive. They were not on any routine medication. There was no reported maternal ill health during pregnancy, and they were not exposed to herbal remedies.

Case 2

The 16-year-old female twins were the fourth and fifth children in a family of five children and were from the middle socio-economic strata.

They were born prematurely at eight months of gestation through unassisted spontaneous vagina delivery. They both had measles and associated high fever at two years of age, and were placed on amoxicillin during the episode of measles infection. They were both breastfed for three years. Exclusive breastfeeding was done the first five months.

Case 3

The 10-year-old male twins were the only children of their family. The family was from the middle socio-economic strata. The boys were delivered through caesarean section at eight months of gestation. No medical history of importance was elicited from the mother.

They were both were breastfed for a duration of 12 months, and were exclusively breastfed for the first three months.

Case 4

The seven-year-old female twins were the fourth and fifth children in a family of five children from the middle socio-economic strata. Their mother took ill during the last four gestational months, and was hospitalised throughout the period until delivery. She also had urinary tract infection during the last trimester.

The twins were delivered through unassisted, spontaneous vaginal delivery. The twins had no contributory medical history. They were both breastfed for 12 months, and exclusively for five months.
Table 1: Other findings in the twins

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<th>Surfaces affected</th>
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<td>Severe</td>
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<td>*PEB</td>
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PEB – post eruptive breakdown

Discussion
In each of the four cases described, precipitating environmental factors could be identified as possible predisposing factors for MIH. This ranged from prolonged use of antibiotic, early childhood illnesses, prenatal maternal ill health and long duration of breast feeding. These findings had all been highlighted in prior studies. The role of genetics in the aetiology of MIH and how environment or lifestyle factors influence the expression of MIH.

The possibility of genes in the aetiology of MIH is further strengthened by the observation in this study that all the monozygotic twin pairs identified with MIH during the public oral health screening exercises had the lesion expressed in both twin pairs.

Pictures of MIH affected teeth

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The idea behind twin studies is that if there is a particular disease, identical twins will be more likely to develop the same disease than non-identical twins are and thus, help gain insight into the possibility of genetic links to disease processes. It has long been used as a means of evaluating the relative contribution of genetic and environmental factors in the development of specific traits. This model assumes that the co-twins within each twin pair have been subjected to the same common environmental factors. However, there is some dispute about whether it is possible to tell how much - if any - of this difference is really due to genes or due to the influence of environment or lifestyle factors.

If multiple genes and environmental factors interact together to cause the disease, it becomes more difficult to explain any observed differences less straightforward and the calculated 'heritability' could be exaggerated.

This study has its limitations. Like all retrospective studies, we had to depend on the ability of the mothers to recall the history of pre-, peri- and postnatal illnesses. The potential for recall bias is high thereby limiting the ability to truly reports on all possible illnesses that could be associated with MIH in the study participants.

Conclusion
Despite the limitations of the current case report, the recruitment process of the twins reported helps us to establish the possibility of a genetic link in the aetiology of MIH. Future prospective studies recruiting monozygotic and dizygotic twins may help identify further aetiological and predisposing factors for MIH.

Relevance to pediatric dentists
- This report will help clinician to pay a close attention to monozygotic twin presenting in the clinic with MIH
- Provide further information about the aetiology of MIH
- Point to the direction of genetic cause of MIH and promote genomic research in this area

Competing interest
The authors declare that there are no competing interests.

Authors' contributions
TAO conceived the ideal, carried out the oral examination and took part in the drafting of the manuscript. MOF took part in the design of the questionnaire and drafting of the final manuscript. EOO participated in the drafting of the questionnaire, oral examination and drafting of the manuscript.

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References