Prevalence and Severity of Molar Incisor Hypomineralization in a Region of Germany – A Brief Communication

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Abstract

Objectives: *Molar incisor hypomineralization (MIH) is a developmental disturbance concerning permanent incisors and first permanent molars. The aim of this study was to ascertain the frequency of MIH in the region of central Hesse, Germany.* ***Methods:*** *1,022 children aged 6 to 12 years were surveyed during routine school-based dental examinations, which were conducted by the regional public health department. Symptoms of MIH were recorded and a DMF-T evaluation was carried out.* ***Results:*** *Approximately 6 percent (5.9 percent) of all examined children showed at least one ill-structured first permanent molar in terms of MIH. Furthermore, 57.9 percent of these children with hypomineralized first molars also showed changes in the enamel structure of the permanent incisors. Altogether, children with MIH showed a significantly higher DMF-T value for permanent teeth than children without MIH.* ***Conclusions:*** *A carefully managed recall program for children affected by MIH is essential with regard to the increasing importance of preventive and restorative measures.*

Key Words: enamel defects, MIH, children, permanent molar, permanent incisor

Introduction

The term "molar incisor hypomineralization" (MIH) was first used by Weerheijm et al. (1) in 2001. It denotes enamel defects in first permanent molars and permanent incisors, ranging from distinct, isolated, white, and cream-colored markings to large-scale ill structuring. As a rule, the defects cannot be related to well-known causes such as rickets, tetracycline-based discoloring, dental fluorosis, or amelogenesis imperfecta. Surveys on the etiology of MIH have not produced clear results. It has not been possible to name one singular influence or even a combination of multiple influences working together as being responsible for the disease. Posited causes include frequent administration of drugs in early childhood, exposure to dioxins resulting from prolonged breastfeeding, polychlorinated biphenyls, and harmful toxins released from plastic nursing bottles and/or comforters (2-5).

In Germany, prevalence studies have so far only been conducted with older children (6) or with outpatients being attended at the Department of Paediatric Dentistry in Giessen (5). The aim of the present study was to determine the prevalence of this type of enamel defect in Germany as well as to analyze its severity and localization.

Methods

Probands. A total of 1,022 children were examined as part of the scientific research program of the Department of Pediatric Dentistry in Giessen in close cooperation with the regional service for Public Dental Care of the Lahn-Dill district (a rural area located in the middle of Germany). Collecting data from the patients was linked to fixed dates arranged by the respective public health authorities with the participating primary schools. There was no special preselection of primary school children, as it was important to have a cross-section of children between 6 and 12 years old. After examining the 1,022 schoolchildren, we had to exclude 20 of them who were older than 12 years or who had no permanent molars because of belated toothing. Thus, 1,002 clinical findings could be evaluated – 506 boys (50.5 percent) and 496 girls (49.5 percent).

Clinical Examination. The examinations took place in a suitable room at the individual school. In order to guarantee favorable light conditions, all dental examinations were performed with the help of a forehead lamp (Relags Corp., Tuntenhausen, Germany). A full-mouth inspection of wet teeth was conducted. Caries and developmental defects were diagnosed using two calibrated examiners fitted with mirrors and dental probes. First, the official dentist from the respective public health authority examined the children and recorded cases of

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caries, fillings, missing teeth, and all types of developmental defects concerning dental hard tissue. Diagnosis of caries was based on the general principles of Baume (7) in line with the international standardization of caries statistics; in this way, DMF-T values could be determined. A second, identical examination of the children was conducted by a second investigator.

Degrees of Severity. MIH-related enamel changes were classified on a scale according to Wetzel and Reckel (5,8).

- Degree 1: Isolated white and cream to yellowish-brown discolorations on the chewing surface and upper part of the crown.
- Degree 2: Hypomineralized yellowish-brown enamel affecting more or less all the humps on the top of the crown, but with only a slight loss of substance.
- Degree 3: Large-scale mineral deficiency with distinct yellowish-brown discolorations and defects in crown morphology resulting from extensive loss of enamel.

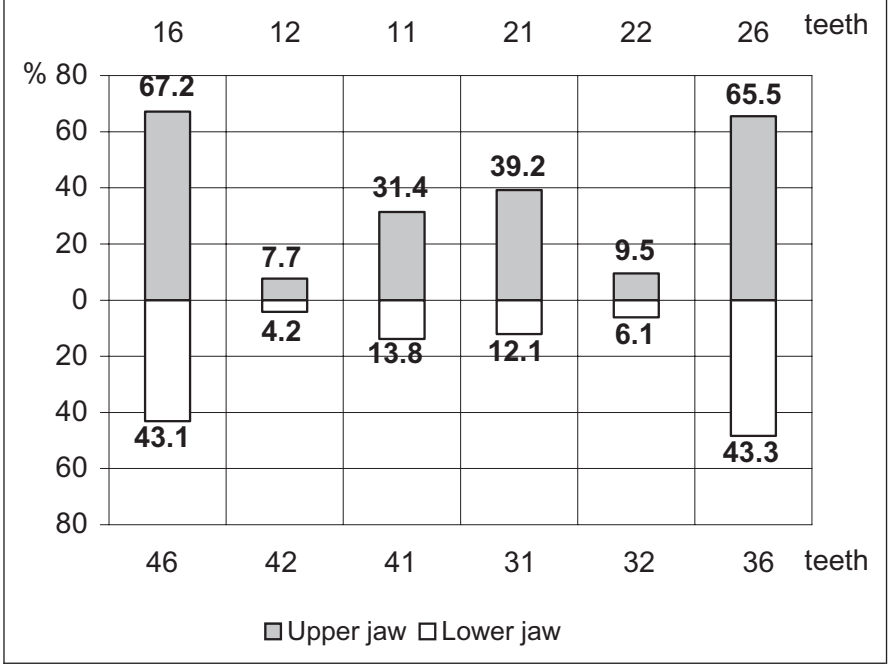
In a second step, classification was carried out according to Koch et al. (9). Structural defects in the various tooth surfaces were recorded, and the crown was evaluated in vertical sections: incisal/occlusal, intermediate, and gingival. Accordingly, there were 13 evaluation units per tooth.

Statistics. Chi-square test, Kruskal–Wallis *H* test, Spearman rank correlation, Mann–Whitney *U* test, Friedman test, and *T* test for coupled samples were used. Statistical analysis was carried out in cooperation with the Institute of Medical Informatics of the University of Giessen.

Results

Altogether, 5.9 percent (59 of 1,002 children) showed signs of MIH in permanent teeth. One child had only three out of four first permanent molars in the oral cavity. The other 58 boys and girls had a total of 130 ill-structured (hypomineralized) first permanent molars (mean = 2.24). The number of affected molars per child was determined: 19 with one, 17 with two, 11 with three, and 11 with four. Most (57.9 percent) of the MIH children who had all their permanent incisors showed defects in the enamel development of these teeth. With an increasing number of hypomineralized first permanent molars, more incisors were also affected. Both molars and incisors were affected to a significantly greater extent in the upper than in the lower jaw ($P < 0.001$). The difference between the central and the lateral incisors also proved to be significant ($P < 0.001$), whereas there was no significant difference between the right and the left half of the jaw (Figure 1).

Figure 1
Distribution of enamel defects (hypomineralizations) in first permanent molars and permanent incisors



Using the degrees of severity according to Wetzel and Reckel (8), 122 of the 133 ill-structured first permanent molars could be assigned definitely to one of the three groups: 67.7 percent belonged to degree 1, 25.4 percent to degree 2, and 7.4 percent to degree 3. Using changes in color and surface according to Koch et al. (9), the highest incidence of hypomineralization was found in connection with the occlusal surface of first permanent molars. Then followed, in descending order, the buccal, palatinal/lingual, distal, and mesial surfaces. In the case of incisors, such enamel changes were mainly localized labially. Their frequency and severity likewise decreased from incisal to gingival.

MIH was found in equal parts among boys and girls. The frequency of MIH did not differ significantly among the three age groups, the percentages being 5.8 for age group I (6 to 8 years), 6.2 for age group II (8 to 10 years), and 5.4 for age group III (10 to 12 years) ($P = 0.935$). The difference between children born in Germany and those born in other countries was clearly below the level of significance ($P = 0.5$).

Children with MIH showed a greater DMF-T value (0.79) than the controls (0.51). The difference was highly significant ($P = 0.009$). An explanation for this was found when the individual values for decayed, missing, and filled permanent teeth were taken into consideration. It became clear that much more restorative treatment (F-T) had already been carried out in the case of children with disturbed amelogenesis (Table 1).

Table 1
Comparison of Average DMF-T Values for Children Concerned and Unconcerned with Molar Incisor Hypermineralization (MIH)

	MIH (mean)		
	Yes	No	*P*
D-T	0.08	0.22	0.069
M-T	0.00	0.01	0.539
F-T	0.71	0.28	<0.001*
DMF-T	0.79	0.51	0.009*

* Significant.
DMF-T, decayed, missed, or filled permanent teeth; D-T, decayed permanent teeth; M-T, missed permanent teeth; F-T, filled permanent teeth.

Discussion

In the present study, the prevalence of MIH was 5.9 percent, which is lower than in other areas, where rates between 6.3 and 19.3 percent have been found (1,6,9). The wide range of results may well be because of the differences in examination conditions (10). In some cases, wet teeth were examined, while in others, the teeth were dried before inspection. Another important point was whether full mouth inspection was carried out or whether individual teeth were inspected separately. As previously mentioned, we carried out full mouth inspection without drying the teeth.

In general, the frequency and severity of the ill structuring decreased from occlusal/incisal to gingival. This may be connected with the onset and duration of the influence of the causative agent on the mineralizing dental tissue. It has to be considered that the occlusal third of the crown is exposed to the influences of the oral cavity earlier and more intensively than the intermediate and gingival sections. Such influences include mastication, bacterial plaque, or acidic beverages.

In the present study, the higher DMF-T value of the MIH children in comparison with the controls is closely related to the extent of restorative therapy already performed. With a value of 0.71, the affected children had an F-T that was at least 2.5 times higher than in the control group.

Our recent research supports the assumption that MIH is a widespread problem in Western Europe. Previous studies from Germany, Finland, Sweden, and the Netherlands (1,6,9) underline this. There is definitely a need to determine the occurrence of enamel defects of unknown origin in the first permanent molars as assessment that should be completed in dental offices or clinics. This is not a new concern, but a point which our study group at the University of Giessen emphasized in 1991, when we started a survey in the medical journal *Zahnärztliche Mitteilungen* (8).

MIH is induced during the first 3 years of life in the course of crown mineralization and its etiology is unknown. Until exact causes are known and prevention is an option, children with MIH require therapy soon after tooth eruption. The ensuing costs and somewhat stressful nature of the respective dental treatment clearly indicate the urgent need for further intensive investigations. A carefully managed recall program for those children who are affected is essential. This would certainly help in the development of preventive and therapeutic measures for combatting this threatening developmental disturbance of permanent teeth. MIH is also an extremely relevant topic for public health authorities because of the importance of early diagnosis and the necessary dissemination of information.

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