Molar Incisor Hypomineralization: prevalence and severity among children from Nothern Poland

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Abstract

Aim The aim of this study was to determine the prevalence and severity of molar incisor hypomineralisation in 6-12-year-old children living in Northern Poland.

Materials and Methods The study involved 1437 children aged 6 to 12 years. The dental examinations took place at the school and were performed in daytime classroom lighting conditions by a single paediatric dentist. The students were examined with headlamp, oral mirror and dental probe. Teeth were not cleaned or dried before examination. All surfaces of the index teeth were examined and diagnosed MIH according to Weerheijm et al. criteria. The severity was recorded as mild or severe according to EAPD criteria.

Results Of all children, 6.43% exhibited signs of MIH on first permanent molars (FPMs) and in 50% of them permanent incisors (PIs) were also affected. There were differences in the MIH prevalence between genders (5.79% female vs. 6.47% male) and place of living (6.4% rural vs. 5.96% urban), without statistical significance. Girls were more likely to have severe lesions, which was statistically significant. The highest incidence of MIH was found in the group of six-year-olds (11.5%), and the lowest in the group of ten- (2.7%) and twelve-year-old (2,65%). Also MIH occurred statistically more often in children up to 8 years of age, compared with children over 8 years of age (8.24% and 4.24%, respectively).

Conclusion In North Poland the prevalence of MIH is 6.43%.

KEYWORD Children, molar incisor hypomineralization, enamel defects, prevalence.

Introduction

Molar Incisor Hypomineralisation (MIH) is a qualitative, developmental defect of enamel that affects one to four first permanent molars (FPMs) with or without permanent incisors involvement (PIs). Clinically, MIH lesions appears as white, whitish-yellow or yellowish-brown opacities varied in size, that are well demarcated from healthy enamel [Weerheijm et al., 2001; Weerheijm, 2014]. Clinically the severity of enamel hypomineralisation may differ within one patient's FPMs. According to the European Academy of Pediatric Dentistry (EAPD) guidance FPMs and PIs are the index teeth to examine MIH so that two phenotypes of this conditions may be noticed:

- MH: hypomineralisation that affects only 1–4 FPMs without affecting any other teeth in the dentition
- M+IH: hypomineralisation that affects FPMs and PIs simultaneously, but not any other tooth in the dentition [Lygidakis et al., 2010; Mittal, 2016].

The hypomineralised enamel is porous and in severely affected teeth it weakens teeth, which can chip off easily. Histologically, yellowish and brownish lesions are more porous and more severe than the whitish ones. At the time of eruption the defective enamel has the proper thickness. However, posteruptive enamel breakdown can occur due to masticatory forces soon after tooth eruption. The presence of higher porosity of the enamel in MIH teeth favours the passage of the bacteria into the pulp, possibly causing subclinical pulpal inflammation. Therefore children with severe MIH complain of extreme sensitivity to external stimuli, even to tooth-brushing. The affected teeth, especially the ones with a severe type of defect, require intensive treatment not only because of enamel disintegration caused by posteruptive breakdowns, but also because of extensive dental caries which can develop rapidly [Jälevik and Klingberg, 2002].

The aetiology of the condition is still not clear. Assignation of one aetiologic factor is difficult already at the research stage. Medical interview with parents is often deficient, because they do not remember all medical

problems and medicines taken in early childhood.

Literature focuses on childhood illness as a potential aetiological factor, especially: recurrent high fever, upper respiratory infections, and otitis media occurring in the first 3 years of life. Their incidence is significantly correlated with the occurrence of MIH [Jälevik and Noren, 2000; Lygidakis et al., 2008]. It is also indicated that respiratory diseases (e.g. bronchitis, pneumonia) occurring during the first 4 years of a child's life are associated with hypomineralisation. However, there is still doubt, whether it is the disease that is mainly responsible for hypomineralisation, or is it the drugs (including antibiotics) used in its treatment [Kühnisch et al., 2014a]. The main antibiotic suspected of negatively affecting tooth mineralisation is amoxicillin [Laisi et al., 2009], which is very often used in children. Research in mice suggests that amoxicillin during the initial stages of enamel development may affect structural changes in ameloblasts to reduce the enamel matrix [De Souza et al., 2016]. Interestingly MIH was discovered in Sweden before 1975, and amoxicillin was not available at this time [Koch et al., 1987]. There is, however, a group of patients with MIH, with no reported illnesses during childhood [Lygidakis et al., 2008]. In a Swedish study of 17,000 children born between '97 and '99, there was no correlation between severe hypomineralisation of first permanent molars and childhood illness, drug intake, environmental or socioeconomic factors. There was no significant difference between maternal disease during pregnancy and medication. It has been shown that the risk of severe hypomineralisation lesions is up to five times higher in children with co-occurrence of two factors: breastfeeding over 6 months and late introduction of gruel and infant formula food (at 6 months of age) [Jälevik et al., 2001]. Genetic predispositions are not excluded. In some studies, genetic correlations with MIH have not been proven [Fagrell et al., 2011], but other researchers believe that this issue cannot be ruled out explicitly [Lygidakis et al., 2008a; Kühnisch et al., 2014b]. However, there is consensus that further studies with larger groups of patients are needed to confirm this [Kühnisch et al., 2014b].

Frequently an environmental pollution is considered to be an aetiological factor as well. Various researchers have attempted to identify the difference in the prevalence of MIH in urban and rural settings, but these differences were not significant [Kuscu et al., 2009]. This was also highlighted in the critical review, where no single factor responsible for development of MIH was found. Once again, attention was paid whether exposure to dioxins, pre-, peri- and neonatal problems as well as early childhood malnutrition were linked to MIH [Crombie et al., 2009]. However in the systemic review on the aetiology of MIH published in 2016, the authors observed a small association of MIH with pre – and perinatal factors. There are single reports about smoking, maternal stress and low birth weight, but more research is needed to consider these factors as related to MIH [Silva et al., 2016]. In a study published in 2018 the authors showed once again the correlation between MIH and childhood-related illnesses, such as varicella, otitis media, pneumonia, bronchitis/asthma, febrile syndrome. It was for the first time, in this study, that the authors drew the attention to the association of MIH and atopic dermatitis and food allergies [Hernandez et al., 2018]. Certainly future research will confirm whether this can be included among the potential causative factors of MIH.

Nowadays it is more commonly thought that aetiology is multifactorial and further studies will help to identify a group of risk factors for MIH.

The prevalence of MIH worldwide is reported between 2.4 and 40.2% [Jälevik, 2010]. Thus far, there have been two large meta-analyses evaluating the prevalence of MIH based on research from around the world. In a meta-analysis of 70 articles, Zhao et al. [2017] assess the pooled global prevalence at 14.2%. Most of the data came from Europe, although the highest prevalence was found in South Africa and Oceania. No gender correlation was found, but MIH was more often diagnosed in younger children (<10 years old). This data has some limitations caused by unified diagnostic criteria for MIH, sample sizes and age. In turn, in a 2018 meta-analysis including 99 studies from 43 countries the global burden was assessed. The authors showed the global average prevalence of MIH at 13.1% with statistically significant differences between super-regions, regions and countries. Undoubtedly it can be said that this disease affects children around the world and the number of diagnosed cases is still growing. The number of prevalent cases of MIH in 2016 was estimated at 878 (791-971) per million people and the incident cases at 17.5 (15,8-19,4) per million people. The highest number of prevalent cases were found in high-income countries, Southeast Asia, East Asia, and Oceania and South Asia. The highest number of incident cases has been found also in Sub-Saharan Africa. While the lowest numbers of prevalent and incident cases were found in Central and Eastern Europe and Central Asia [Schwendicke et al., 2018].

MIH studies and research have not yet been conducted in Poland. In a questionnaire survey, polish dentists rated prevalence at various levels. Over 90% of dentists observed MIH and more than 50% of them said that the number of hypomineralisation has recently increased in Poland [Głodkowska and Emerich, 2016].

The aim of this study was to evaluate the prevalence and severity of MIH among children living in northern Poland.

Materials and methods

Characteristics of the project location

The Pomeranian Voivodship is the northermost province in Poland, and it has over 2,300,000 inhabitants. The largest city is Gdansk. Groundwater in the Pomeranian Voivodship is the main source of water supply for both municipal and industrial purposes. The fluoride content varies from region to region, from <0.1 mg / l in the west to 0.7 mg / l in the south, while in the east of the province Malbork it is 1.12 mg / l F-. In Gdansk the level of fluoride is 0.2 mg / l. The permissible value in Poland is 1.5 mg / l.

Study design and sampling procedure

There are 719 primary schools in the Voivodship. Special schools, penal institutions and correctional schools as well as schools in hospital were excluded; 553 schools (336 in the rural area and 217 in the urban area) qualified for the study. In total, 142,653 children aged 6–12 years are taught in primary schools, so a significance level of 0.95 for the sample of 384 children was considered.

In 2016, 30 randomly selected primary schools, located in Pomorskie Voivodeship, were invited to participate in the study (15 in urban areas and 15 in rural areas). Twenty

Demarcated opacity	A demarcated defect involving an alteration in the translucency of the enamel, variable in degree. The defective enamel is of normal thickness with a smooth surface and can be white, yellow or brown in colour.
Posteruptive Enamel Breakdown (PEB)	A defect that indicates deficiency of the surface after eruption of the tooth. Loss of initially formed surface enamel after tooth eruption. The loss is often associated with a pre-existing demarcated opacity.
Atypical restoration	The size and shape of restoration are not conform the temporary caries picture. In most cases in molars it will handle about restorations extended to the buccal or palatal smooth surface. At the border of the restorations frequently an opacity can be noticed. In incisors a buccal restoration can be noticed not related to a trauma.
Extracted molar due to MIH	Absence of a first permanent molar should be related to the other teeth of the dentition. Suspected for extraction due to MIH are: opacities or atypical restorations in the other first permanent molars combined with absence of a first permanent molar. Also the absence of first permanent molars in a sound dentition in combination with demarcated opacities on the incisors is suspected for MIH. It is not likely that incisors will be extracted due to MIH.
Unerupted	The first permanent molar or the incisor to be examined are not yet erupted.

TABLE 1 MIH diagnostic criteria according to Weerheijm [Weerheijm et al., 2003].

Mild	There are demarcated enamel opacities without enamel breakdown, occasional sensitivity to external stimuli e.g. air/water but not brushing and only mild aesthetic concerns on discolouration of the incisors.
Severe	There are demarcated enamel opacities with breakdowns, caries, persistent/spontaneous hypersensitivity affecting function e.g. during brushing and finally strong aesthetic concerns that may have socio-psychological impact.

TABLE 2 Recording the severity of the defects according EAPD criteria [Lygidakis et al., 2010].

of them gave permission to conduct the study. Prior to examination parents of randomly selected children aged 6–12 years from each grade, were informed about the study and were asked for consent to participate. On the day of the study the children without parent's permission, or with general medical diseases, or uncooperative were excluded. The Research Ethics Committee of the Medical University in Gdansk gave approval to conduct the study. (NKBBN/182/2013).

Study setting

The dental examinations took place at the school and were performed in daytime classroom lighting conditions by a single paediatric dentist. Students were examined with headlamp, oral mirror and dental probe. Teeth were not cleaned or dried before examination. When necessary, cotton rolls have been used to remove food debris.

Survey instrument and examination criteria

All surfaces of the index teeth (FPMs and PIs) were examined and MIH was diagnosed according to Weerheijm et al. [2003] criteria, which are presented in Table 1. The severity was recorded as mild or severe according to the EAPD criteria (Table 2) [Lygidakis et al., 2010]. Teeth that were erupted less than one third of the crown height, were consider as unerupted. Only defects greater than 1 mm in diameter were reported.

Analysis

The data were analysed using Chi-square Test. The level of significance was set at $p<0.05$.

Results

Distribution of the sample by sociodemographic factors

Of the 2000 surveyed children aged 6–12 years, 1,437 children were examined (response rate of 71.85%).

The study involved 50.5% females and 49.5% males; 890 (61.9%) children lived in urban areas and 547 (38.1%) in rural areas. The largest groups consisted of children aged 7 and 8, 19.1% and 20.5%, respectively. Average age was 8.65 (SD=1.93). Of the children examined 1,369 (95,27%) had at least one FPM erupted, 89.49% had all 4 FPMs erupted, and 67.36% of children had their 12 index teeth erupted.

Distribution and prevalence of MIH by gender, place of living and age groups

Results based on gender and place of residence are shown in Table 3. Of the examined children, 88 (6,43%) showed signs of MIH on FPMs and 44 (50%) of them had also PIs affected. There were differences in the MIH prevalence between the genders (5.79% female vs. 6.47% male) and place of living (6.4% rural vs. 5.96% urban), but this was not statistically significant (Table 3).

Girls were more likely to have severe lesions, which was statistically significant. The highest incidence of MIH was found in the group of 6-year-olds (11.5%), and the lowest in the group of 10- (2.7%) and 12-year-olds (2.65%). MIH occurred statistically more often in children up to 8 years of age, compared with children over 8 years of age (8.24% and 4.24%, respectively). At 7 years of age, mild lesions

	Place of living				Sex				Total (n)	%
	Rural area (n)	%	Urban area (n)	%	Girls (n)	%	Boys (n)	%		
Number of children examined	547	38.07	890	61.93	726	50.52	711	49.48	1437	100.0
Number of children with at least 1 FPM erupted	515	37.62	854	62.38	698	50.99	671	49.01	1369	100.0
MIH diagnosed	35	6.80	53	6.21	42	6.02	46	6.86	88	6.4
Only FPMs affected	22	4.27	32	3.75	20	2.87	24	3.58	44	3.2
Number of children with 12 index teeth	358	36.98	610	63.02	522	53.93	446	46.07	968	100.0
MIH diagnosed	23	6.42	28	4.59	27	5.17	24	5.38	51	5.3
Number of affected teeth	1	4.35	1	3.57	1	3.70	1	4.17	2	3.9
	4	17.39	3	10.71	3	11.11	4	16.67	7	13.7
	1	4.35	3	10.71	3	11.11	1	4.17	4	7.8
	5	21.74	7	25.00	9	33.33	3	12.50	12	23.5
	1	4.35	7	25.00	5	18.52	3	12.50	8	15.7
	5	21.74	3	10.71	3	11.11	5	20.83	8	15.7
	0	0.00	0	0.00	0	0.00	0	0.00	0	0.0
	3	13.04	1	3.57	1	3.70	1	4.17	4	7.8
	0	0.00	0	0.00	0	0.00	0	0.00	0	0.0
	1	4.35	0	0.00	1	3.70	1	4.17	1	2.0
	1	4.35	0	0.00	0	0.00	1	4.17	1	2.0
	1	4.35	3	10.71	1	3.70	3	12.50	4	7.8
Number of children with 4 FPMs erupted	478	37.17	808	62.83	658	51.17	628	48.83	1286	100.0
MIH diagnosed	32	6.69	45	5.57	38	5.78	39	6.21	77	6.0
Number of affected molars	1	3.13	2	4.44	1	2.63	2	5.13	3	3.9
	6	18.75	7	15.56	6	15.79	7	17.95	13	16.9
	8	25.00	8	17.78	9	23.68	7	17.95	16	20.8
	17	53.13	28	62.22	22	57.89	23	58.97	45	58.4
Total MIH diagnosed teeth	179	43.13	236	56.87	201	48.43	214	51.57	415	100.0
Mild lesions	136	75.98	174	73.73	136	67.66	174	81.31	310	74.7
Severe lesions	43	24.02	62	26.27	65	32.34*	40	18.69	105	25.3
*Statistically significant $\chi^2(1. N = 415) = 10.21; p = 0.001$										

TABLE 3 Number of examined children and number of MIH diagnosed according to gender and place of living.

Age (years)	7		8		9		10		11		12		Total	
Mild lesions	72	85.7%*	61	58.7%	35	71.4%	35	85.4%	34	75.6%	11	73.3%	248	73.4%
Severe lesions	12	14.3%	43	41.3%*	14	28.6%	6	14.6%	11	24.4%	4	26.7%	90	26.6%
Total	84	24.9%	104	30.8%	49	14.5%	41	12.1%	45	13.3%	15	38.5%	338	100%
*Statistically significant: $\chi^2(6. N = 409) = 21.99; p = 0.001$														

TABLE 4 Percentage of children who presented MH or MIH depending on number of affected FPM.

Number of affected FPMs	1	2	3	4
Number of children presenting MH	5 (100%)	13 (76.5%)	8 (38.1%)	18 (40%)
Number of children presenting MIH	0 (0%)	4 (23.5%)	13 (61.9%)*	27 (60%)*
Total	5 (100%)	17 (100%)	21 (100%)	45 (100%)

* Analysis of the rho-Spearman rank correlation showed a statistically significant relationship between the variables studied (p <0.010).

TABLE 5 Percentage of children who presented MH or MIH depending on number of affected FPM.

were noted statistically more often, and at 8 years of age more severe lesions were diagnosed (Table 4).

Distribution of the demarcated hypomineralisation defect by type and tooth surface

The distribution of different types of lesions among the FPM is presented in Figure 2. The most common lesion was yellow demarcated opacity (51%). All four FPMs were equally affected. In Figure 3 the severity of lesions between FPMs is presented. Severe lesions was more often diagnosed on mandibular molars, which was statistically significant. Among PIs the maxillary central incisors were the most commonly affected. Over 96% of lesions were demarcated opacities: 70% of them were white in color and 30% were yellow. No post-eruptive enamel breakdown or extraction due to MIH among PIs have been reported. Statistically, more frequent severe lesions were observed on the molars than on the incisors. In total 5,363 FPMs and 9,759 PIs were examined: 5.25% FPMs and 1.36% PIs have been diagnosed with MIH.

Mean number of affected teeth with MIH in subgroups of children

Among the affected children, 77 had all FPMs erupted and 45 (58.4%) of them had all four FPMs affected (Fig. 1). In Table 5 the overall number of affected FPMs and percentage of children with affected PIs is presented. In the case of 3 or 4 FPMs affected, about 60% of children had also lesion on PIs (MIH), which was statistically significant. In the group of children with all 12 index teeth erupted, the average number of MIH teeth was 5.19. There was no difference attributable to place of living, while on average more teeth were diagnosed MIH in boys than in girls (5.58 vs 4.62, respectively).

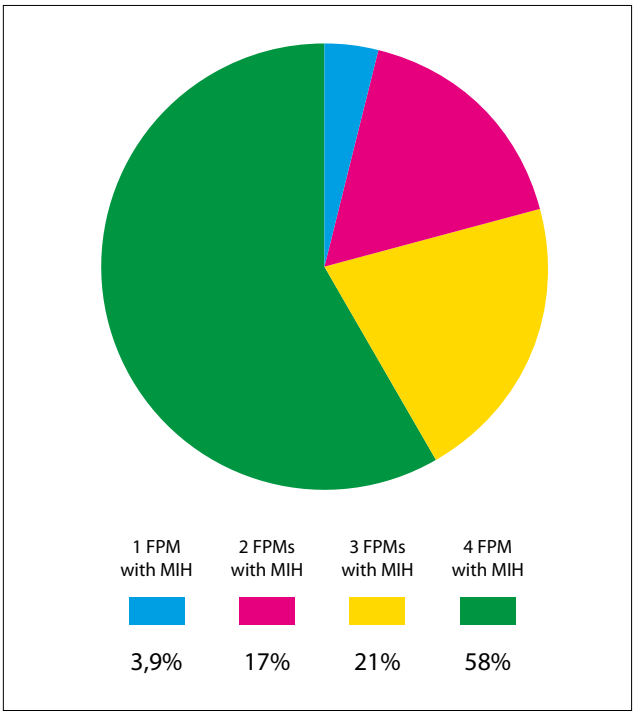

FIG. 1 Percentage of cases with 1-4 FPMs affected.

Discussion

In recent years many researchers have focused on the study of MIH. Hypomineralisation has been noticed for the first time in the 1970s.. Demarcated opacities have been observed, which could not be classified as fluorosis or other developmental disorders. The prevalence of these idiopathic hypomineralisation was investigated in Sweden and, depending on the year of birth, ranged between 4.4–15.4% [Koch et al., 1987].

Over the years, many authors have published studies on hypomineralisation, differently referring to these changes: cheese molar, non-fluoridated hypomineralisation, idiopathic hypomineralisation etc. [Jälevik et al., 2001]. Without any doubts this is an important problem in modern children's dentistry. This is a major clinical problem in European countries and around the world. In a study in Great Britain it has been found that this is the second cause of extraction of permanent teeth [Albadri et al., 2007].

In the literature children suffering MIH together with their mothers also perceived the condition as an oral health problem. More often they were dissatisfied with the color of their teeth, but children also complained about tooth alignment and in some cases they even avoided smiling because of the appearance of their teeth [Leal et al., 2017]. MIH is also associated with rapid caries progression. Indices of caries are higher especially in children with severe hypomineralisation. These children also require more frequent dental treatment [Negre-Barber et al., 2018]. Reconstruction of teeth affected by MIH is often difficult due the young age of patients and some authors claim that due to the subclinical inflammation of the pulp, it is difficult to get the full anesthesia of these teeth. Composite fillings are recommended for restoration although glass-ionomer fillings can be used temporarily. In more severe cases it is recommended to use stainless steel crown or inlay/onlay. In the absence of orthodontic contraindications, when the tooth does not promise a long-term survival, it is worth considering extraction [Fayle, 2003]. Paediatricians and general practitioners should also be involved because to

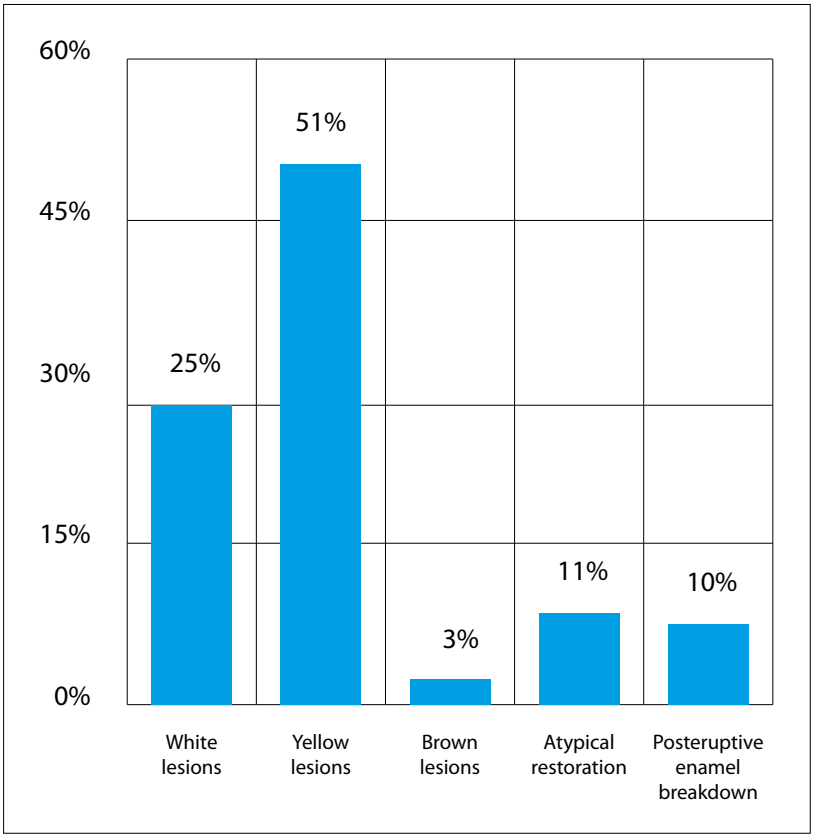

FIG. 2 Distribution of FPMs according to diagnostic criteria for MIH.

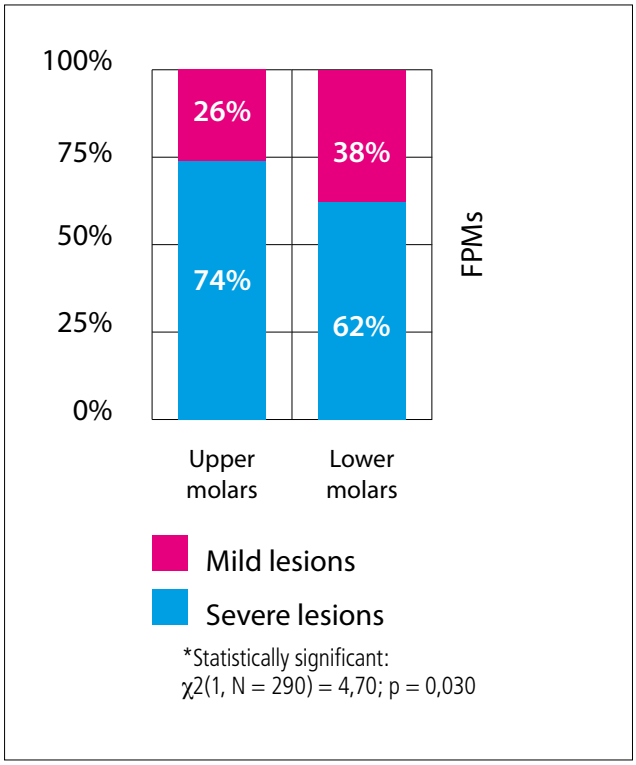

FIG. 3 Distribution of FPMs according to severity of MIH.

achieve satisfactory treatment results, early diagnosis and a multidisciplinary cooperation are important [Paglia, 2018].

Over the years different guidelines for MIH assessment have been proposed, in an attmpt to unify research and diagnostic criteria [Lygidakis et al., 2010; Weerheijm et al., 2003]. In this study we followed the criteria of Weerheijm et al., published in 2003. The authors of the present research are also trying to unify the criteria of severity. The EAPD guidelines published in 2010 recommend determining the severity as mild or severe [Lygidakis et al., 2010], which is easy to do, however this does not distinguish the color and extent of dental changes. Therefore, it is often difficult to clearly classify a lesion belonging to a particular group. In a study carried out in Brazil, a three-stage system has been used to determine the severity of lesions. Teeth with demarcated opacities with no need of treatment were considered to have mild MIH, while those with rough and broken enamel were considered to have moderate MIH. Severe defects included the presence of hypomineralised lesions associated with loss of dental structure affecting both enamel and dentin, atypical restorations replacing affected hard tissue and teeth extracted because of severe hypomineralisation [Da Costa-Silva et al., 2010]. The hypomineralisation severity index, which was published in Australia, allows to calculate the severity of MIH on a scale from 1.25–7. This index is time-consuming and quite difficult to use, which can be considered a disadvantage [Chawla et al., 2008]. Future research is needed to standardise test methods, especially since it has been reported that studies

using the EAPD case definitions found significantly higher prevalence than those using other case definitions. This may be due to the fact that MIH complications are also included in the EAPD criteria. Missing teeth and atypical restorations may also indicate the presence of MIH in the past. Thus, if not taken into account, prevalence may be underestimated [Schwendicke et al., 2018]. Unfortunately, the assessment often turns out to be difficult if there are no parents present at school during the examination and we do not have access to the dental history of the child. During examination, one should be careful and diagnose MIH only when it is certain that tooth loss or atypical restoration are not due to other reasons.

This study is the first of its kind in Poland.

The prevalence is rated at 6.43%,similar to that showed in the studies conducted in Germany in 2003 and 2007 – 5.6% and 5.9% respectively [Dietrich et al., 2003; Preusser et al., 2007] – while in a study conducted in 2014, in a larger area of the country, the prevalence was 10.1% [Petrou et al., 2014]. Similarly in Greece, in a 2008 study, prevalence was estimated at 10.2% [Lygidakis et al., 2008b], and in a study conducted in 2015 it increased to 21% [Kevrekidou et al., 2015]. This may also indicate an increase in the number of hypomineralisation cases in recent years. Studies from many regions of the world are needed to clearly identify changes in the number of hypomineralisation cases over the years.

Prevalence in Northern Poland is much lower than that found in other parts of Europe, such as in Italy - 13.7% [Calderara et al., 2005], Bosnia and Herzegovina - 12.3% [Muratbegovic et al., 2007], Netherland - 14.3% [Jasulaityte et al., 2008] and Slovenia – 21.4% [Grošelj and Jan, 2013], but it is similar to that in Graz (Austria), where the prevalence in 2018 was 7% [Buchgraber et al., 2018]. However, it should be remembered that despite the large group of children surveyed for this study, this is still a group from a single region of the country. As shown in a German study, in 4 cities the prevalence varied between 4.3 to even 14.6% [Petrou et al., 2014]. This may mean that the exact value of MIH in Poland will be more accurately estimated after conducting a larger number of tests in various provinces in Poland.

Differences in prevalence may be due to different diagnostic criteria, as well as location restrictions. Most studies are conducted in schools where there is no adequate lighting, and the surfaces of the teeth are not professionally cleaned or dried before testing. However, this method has its advantages because it makes easy to examine a large group of children.

As with other authors, no correlation was found between gender and MIH [Zhao et al., 2017; Lygidakis et al., 2008b; Muratbegovic et al., 2007]. In most cases there were 4 FPMs affected and 50% of participants had also PIs affected. This is consistent with the results of other researchers [Lygidakis et al., 2008b]. This should alert the clinician that if one of the erupted molars is affected, the remaining molars can also be affected, and if all four molars are involved, there is a greater risk of lesions on PIs. Studies have highlighted the increased severity of the lesions due to the increased number of affected molars [Jasulaityte et al., 2008]. In this study, no correlation was found.

The most commonly recognised lesions were yellow demarcated opacities on the FPMs and white lesions on PIs. Comparing the clinical and morphological picture, it can be seen that yellow-brown lesions are more porous than white lesions [Jälevik et al., 2005; Crombie et al., 2013]. Due to the greater porosity of the enamel in teeth with yellow-brown lesions, the carious process develops faster, and the teeth are more sensitive to external stimuli [Jälevik et al., 2005]. As a result, the lesions are more severe and the teeth are destroyed more quickly.

The study involved 6–12 year-old children; 67% of them had already 12 index teeth erupted. The average age at which all these teeth were present was 9.38 years.

One of the suspected factors of MIH is environmental pollutants such as polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans, synthetic chemicals widely used in industry. These pollutants are accumulated in the food chain and secreted with breast milk. Similarly, as in the Kuscu et al. study [2009], no link has been found between prevalence of MIH and region of residence. This may be due to the fact that even in rural areas there are some level of pollutants. The development of the tooth, although genetically controlled, is very sensitive to environmental factors, so this should be further investigated [Laisi et al., 2008].

Conclusion

Prevalence of Molar Incisor Hypomineralisation in Northern Poland is 6.43%. Hypothesis that environmental factors cause MIH was not supported. In 50% of patients with affected molars, changes on incisors were also observed. Over 50% of children with MIH have lesions on all 4 FPMs. Overall 74.7% of the examined teeth presented mild lesions. Further studies are needed to assess the prevalence and severity of MIH in Poland.

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