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KNOWLEDGE AND TREATMENT APPROACHES TO MOLAR INCISOR HYPOMINERALIZATION (MIH) AMONG DENTISTS IN BELARUS AND IRAN: A CROSS-SECTIONAL QUESTIONNAIRE BASED STUDY

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Introduction. The prevalence of molar incisor hypomineralization has been steadily increasing over the past decade. The variety of clinical manifestations, the rapid destruction of hypomineralized enamel accompanied by high sensitivity of the affected teeth, and children's fear of treatment often put dentists in a difficult position when choosing a treatment strategy.
The aim of the study was to assess and compare the knowledge and treatment approaches to MIH among dentists in Belarus and Iran.
Methods: An online questionnaire using Google Forms was sent to the dentists who were registered with the Belarus and Iran Dental Association and worked in Belarus and Iran through social media groups. The questionnaire consisted of three sections: 1) sociodemographic characteristics, 2) the knowledge of dentists about the etiology, diagnosis, and prevalence of MIH, and 3) treatment options and barriers for treating MIH.
Results: In total, 111 dentists participated in the questionnaire, comprising 87 Belarusian dentists and 24 Iranian dentists. This response represents a response rate of (37%) from the overall pool of 300 dentists, which includes 200 Belarusian dentists and 100 Iranian dentists, (98.3%) reported that they have come across MIH cases during their practice. All pediatric dentists from Iran were 24 (100%) confident in diagnosing MIH, this was statistically higher than pediatric dentist from Belarus 84 (96.6%). The majority of Iranian pediatric dentist think that significant percentage of caries caused by MIH 19 (79.2%) and Belarusian pediatric dentist 66 (75.9%). However, nearly half of the pediatric dentists 53 (51.55%) never noticed hypomineralised lesions in second primary molar compare to first permanent molar (39 (44.8%) Belarusian pediatric dentists and 14 (58.3%) Iranian pediatric dentists).
Conclusion: A majority of pediatric dentists in Iran and Belarus are familiar with the diagnosis and clinical presentation of Molar Incisor Hypomineralisation (MIH) affecting permanent first molars and incisors.
Keyword: Hypomineralisation, MIH, Questionnaire, Dentists, Iran, Belarus

ЗНАНИЯ И ПОДХОДЫ К ЛЕЧЕНИЮ МОЛЯРНО-РЕЗЦОВОЙ ГИПОМИНЕРАЛИЗАЦИИ (MIH) СРЕДИ СТОМАТОЛОГОВ БЕЛАРУСИ И ИРАНА: ПОПЕРЕЧНОЕ ИССЛЕДОВАНИЕ НА ОСНОВЕ АНКЕТИРОВАНИЯ

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Введение. Распространенность молярно-резцовой гипоминерализации (MIH) в последние годы неуклонно возрастает. Полиморфизм клинических проявлений, быстрое разрушение гипоминерализованной эмали, сопровождающееся выраженной чувствительностью пораженных зубов, а также тревожность детей перед стоматологическим вмешательством создают значительные трудности при выборе оптимальной тактики лечения.
Цель исследования - оценить и сопоставить уровень знаний и подходы к лечению MIH среди стоматологов Беларуси и Ирана.

Материалы и методы. Онлайн-опрос проводился с использованием Google Forms среди стоматологов, зарегистрированных в стоматологических ассоциациях Беларуси и Ирана и осуществляющих профессиональную деятельность в указанных странах. Распространение анкеты осуществлялось через группы в социальных сетях. Анкета включала три раздела: 1) социально-демографические характеристики респондентов, 2) знания стоматологов об этиологии, диагностике и распространенности МІН, 3) терапевтические подходы и основные барьеры при лечении данной патологии.
Результаты. В исследовании приняли участие 111 стоматологов, в том числе 87 из Беларуси и 24 из Ирана, что составило 37% от общей выборки из 300 специалистов. Большинство респондентов (98,3%) сообщили, что сталкивались со случаями МІН в своей клинической практике. Все детские стоматологи из Ирана (24; 100%) продемонстрировали уверенность в диагностике МІН, что статистически превышало аналогичный показатель среди детских стоматологов Беларуси (84; 96,6%). Значительная часть детских стоматологов Ирана (19; 79,2%) и Беларуси (66; 75,9%) считали, что существенная доля кариозных поражений связана с МІН. Вместе с тем почти половина респондентов (53; 51,55%) никогда не наблюдала гипоминерализованные поражения вторых временных моляров по сравнению с первыми постоянными молярами, включая 39 (44,8%) стоматологов Беларуси и 14 (58,3%) стоматологов Ирана.
Заключение. Большинство детских стоматологов Беларуси и Ирана обладают достаточным уровнем знаний о диагностике и клинических проявлениях молярно-резцовой гипоминерализации, поражающей первые постоянные моляры и резцы. Полученные данные свидетельствуют о необходимости дальнейшего совершенствования настороженности врачей в отношении поражения вторых временных моляров и стандартизации подходов к лечению МІН.
Ключевые слова: гипоминерализация, молярно-резцовая гипоминерализация, МІН, анкетирование, стоматологи, Беларусь, Иран.

БЕЛАРУСЬ ПЕН ИРАН СТОМАТОЛОГТАРЫ АРАСЫНДАҒЫ МОЛЯР-КҮРЕК ТІСТЕР ГИПОМИНЕРАЛИЗАЦИЯСЫНА (МІН) ҚАТЫСТЫ БІЛІМ ДЕҢГЕЙІ МЕН ЕМДЕУ ТӘСІЛДЕРІ: САУАЛНАМАҒА НЕГІЗДЕЛГЕН КӨЛДЕНЕҢ ЗЕРТТЕУ

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Кіріспе. Соңғы жылдары моляр-күрек тістер гипоминерализациясының (МІН) таралуы тұрақты түрде артып келеді. Клиникалық көріністерінің алуан түрлілігі, зақымданған тістердің айқын сезімталдығымен қатар жүретін гипоминерализацияланған кіреукенің жылдам бұзылуы, сондай-ақ балалардың стоматологиялық емнен қорқуы емдеу тактикасын таңдауда елеулі қиындықтар туғызады.
Зерттеудің мақсаты - Беларусь пен Иран стоматологтары арасындағы МІН бойынша білім деңгейі мен емдеу тәсілдерін бағалау және салыстыру.
Материалдар мен әдістері. Зерттеу Google Forms платформасы арқылы жүргізілген онлайн-сауалнама негізінде орындалды. Сауалнама Беларусь және Иран стоматологиялық қауымдастықтарында тіркелген және осы елдерде жұмыс істейтін стоматологтар арасында әлеуметтік желілердегі топтар арқылы таратылды. Сауалнама үш бөлімнен тұрды: 1) респонденттердің әлеуметтік-демографиялық сипаттамалары, 2) стоматологтардың МІН этиологиясы, диагностикасы және таралуы жөніндегі білімдері, 3) аталған патологияны емдеу тәсілдері мен емдеудегі негізгі кедергілер.
Нәтижелері. Зерттеуге жалпы саны 111 стоматолог қатысты, оның ішінде 87-сі Беларусьтен және 24-і Ираннан болды. Бұл 300 маманнан тұратын жалпы іріктеменің 37%-ын құрады. Респонденттердің басым бөлігі (98,3%) өздерінің клиникалық тәжірибесінде МІН жағдайларымен кездескенін көрсетті. Ирандық балалар стоматологтарының барлығы (24; 100%) МІН диагнозын қоюда өздеріне сенімді екенін білдірді, бұл Беларусь балалар стоматологтарымен салыстырғанда статистикалық тұрғыдан жоғары болды (84; 96,6%). Ирандағы балалар стоматологтарының елеулі бөлігі (19; 79,2%) және Беларусьтегі стоматологтар (66; 75,9%) кариозды зақымданулардың айтарлықтай үлесі МІН-пен байланысты деп есептеді. Сонымен қатар респонденттердің жартысына жуығы (53; 51,55%) бірінші тұрақты молярлармен салыстырғанда екінші сүт молярларындағы гипоминерализацияланған зақымдануларды ешқашан байқамағанын көрсетті, оның ішінде Беларусьтен 39 (44,8%) және Ираннан 14 (58,3%) стоматолог бар.
Қорытынды. Беларусь пен Ирандағы балалар стоматологтарының басым бөлігі бірінші тұрақты молярлар мен күрек тістерді зақымдайтын моляр-күрек тістер гипоминерализациясының диагностикасы мен клиникалық көріністері

жөнінде жеткілікті білім деңгейіне ие. Алынған нәтижелер екінші сүт молярларының зақымдануын анықтауға қатысты дәрігерлердің қырағылығын арттыру және МІН емдеудің стандартталған тәсілдерін жетілдіру қажеттігін көрсетеді.
Түйінді сөздер: гипоминерализация, моляр-күрек тістер гипоминерализациясы, МІН, сауалнама, стоматологтар, Беларусь, Иран.

Introduction

The term Molar Incisor Hypomineralization (MIH) was first introduced in 2001 by Weerheijm et al. Molar incisor hypomineralization (MIH) is defined as a developmental disorder that is observed when a patient has hypomineralized enamel lesions on the first permanent molars, and sometimes the incisors [1]. Reports exist on prevalence of MIH lesions in all teeth, and have shown that the second primary molars (SPMs), which form at a similar time as the FPM, can also be affected, with the condition defined as Hypomineralized second primary molar (HSPM) [2].

The etiology of MIH has not been clearly established, it is thought to be caused by factors such as genetic and epigenetic factors, environmental factors, drug use/smoking/diseases experienced by the mother during pregnancy, and vitamin D deficiency/being born with low birth weight/birth complications/diseases experienced by the child in the first 3 years after birth [3,4].

Clinically, hypomineralized lesions present weakened enamel delimited by well-defined opacities of different sizes and opaque white, cream, yellow-brown, or brown colors. There is often a distinct line between the lesion and healthy enamel. Depending on the severity of MIH, affected teeth may exhibit rapid wear, disintegration and rapid enamel loss after eruption, restoration loss, tooth loss and severe sensitivity. These opacities fracture easily, exposing the dentin tissue and making it susceptible to rapid carious lesion development [5-8]. That is among the main reasons that compromise pulp vitality and tooth permanence in the oral cavity [9]. Sometimes, even without an associated caries lesion, patients report a marked degree of hypersensitivity, affecting tooth integrity and overall patient conditions [10].

All children under the age of 18 years are provided with free dental care at public clinics and the dental hygienists are often the first to identify children with MIH. Patients requiring restorative treatment are referred to the dentist. Treatment of MIH often requires both the child and parents to attend several dental appointments, thus the disease carries a heavy financial burden for both the individuals' families and the state [11].

It is challenging for clinicians to make the best treatment decision in both a short and long term perspective. MIH-affected teeth are considered demanding to treat, due to difficulties in achieving adequate pain control, dental fear and behavioural management problems, determining the optimal preparation border and selecting an appropriate restorative material [5–7]. At present, there is no standard treatment which can be recommended for all MIH-affected teeth and the severity of the defects on MIH-affected teeth increases with patient's age. According to best clinical practice guidance and evaluation of relevant literature, resin composite is the recommended restorative material in the long run for fully erupted MIH-affected teeth [8,12-15].

Materials and Methods

The study population consisted of pediatric dentists of Iran and Belarus who were working either in private clinics, hospitals, or health centers during the period of the study. An online questionnaire using Google Forms was sent to the dentists through social media groups. By answering the online questionnaire, the participants gave their consent to participate in the study. The questionnaires were anonymous to maintain the privacy and confidentiality of all information collected in the study. The questions

were developed after reviewing pertinent lit erasure and the international guidelines. The questionnaire was designed in Persian and Russian and comprised of three sections: first, sociodemographic characteristics, including age, gender, and years of practice. The second section included questions regarding the knowledge of dentists about the etiology, diagnosis, and prevalence of MIH. The third section asked about treatment options and barriers for treating MIH patients.

Results

Among the 300 dentists who received the questionnaire, 111 provided responses, resulting in a response rate of 37%. Of which, 96 (86.5%) (12 (50%) in Iran and 84 (96.6%) in Belarus) were females and 15 (13.5%) (12 (50%) in Iran and 3 (3.4%) in Belarus) were males. Almost half of the respondents 16 (66.6%) had less than 10 years of practice in Iranian pediatric dentists and in Belarusian pediatric dentists this rate of less than 10 years' practice is around 39 (44.8%). The most popular source for Belarusian pediatric dentists to regarding MIH was internet 68 (78.2%) and for Iranian pediatric dentists was Books (printed or electronic) 17 (70.8%). The demographics of participants are shown in Table 1.

Table 1 - Demographic and work-related characteristics of the study participants

Characteristics	**Belarusian № (%)**	**Iranian № (%)**	**Total № (%)**	***p* value**
Gender				0.001
Female	84 (96.6%)	12 (50%)	96 (86.5%)	
Male	3 (3.4%)	12 (50%)	15 (13.5%)	
Years of dental experience				0.70
<5 years	30 (34.5%)	8 (33.3%)	38 (33.9%)	
6-10 years	9 (10.3%)	8 (33.3%)	17 (21.8%)	
11-20 years	14 (16.1%)	1 (4.2%)	15 (10.15%)	
21-30 years	20 (23%)	3 (12.5%)	23 (17.75%)	
>31 years	14 (16.1%)	4 (16.7%)	18 (16.4%)	

Table 2 shows the participants' knowledge regarding MIH diagnosis and prevalence. The majority of the respondents 108 (98.45%) reported about their knowledge of the clinical features to diagnose MIH (84 (96.6%) of Belarusian pediatric dentists and 24 (100%) of Iranian pediatric dentists).

Table 2 - Knowledge regarding MIH diagnosis and prevalence

	Belarusian PD	Iranian PD	All	*p* value
Do you know the clinical characteristics of MIH				
Yes	84 (96.6%)	24 (100%)	98.3%	0.81
No	3 (3.4%)	0%	1.7%	
source of information regarding MIH				

Lecture/Lecture notes	39 (44.8%)	7 (29.2%)	46 (37%)	0.43
Dental clinic	32 (36.8%)	5 (20.8%)	37 (28.8%)	
Dental journals (printed or electronic)	46 (52.9%)	5 (20.8%)	51 (36.85%)	
Books (printed or electronic)	41 (47.1%)	17 (70.8%)	58 (58.95%)	
Brochures	6 (6.9%)	0 (0%)	6 (3.45%)	
Internet	68 (78.2%)	10 (41.7%)	78 (59.95%)	
Other	5 (5.7%)	3 (12.5%)	8 (9.1%)	

With regards to the etiology of MIH, the respondents most often indicated Chronic medical condition during pregnancy - 66 (54.5%) (55 (63.2%) of Belarusian pediatric dentists and 11 (45.8%) of Iranian pediatric dentists), genetics - 64 (63.95%) (46 (52.9%) of Belarusian pediatric dentists and 18 (75%) of Iranian pediatric dentists) and Antibiotics/medication taken by the mother during pregnancy - 62 (49.2%) (53 (60.9%) of Belarusian pediatric dentists and 9 (37.5%) of Iranian pediatric dentists). Table 3 shows the Knowledge about etiology of MIH.

Table 3 - Etiology knowledge of participants

	Belarusian PD	**Iranian PD**	**All**	***p* value**
Etiological factors				0.15
Genetics	46 (52.9%)	18 (75%)	64 (63.95%)	
Environmental contaminants	23 (26.4%)	7 (29.2%)	30 (27.8%)	
Chronic medical condition during pregnancy	55 (63.2%)	11 (45.8%)	66 (54.5%)	
Chronic medical condition of child	33 (37.9%)	5 (20.8%)	38 (29.35%)	
Acute medical condition during pregnancy	57 (65.5%)	4 (16.7%)	61 (41.1%)	
Acute medical condition of child	38 (43.7%)	5 (20.8%)	43 (32.25%)	
Antibiotics/medication taken by the mother during pregnancy	53 (60.9%)	9 (37.5%)	62 (49.2%)	
Antibiotics/medication taken by the child	48 (55.2%)	5 (20.8%)	53 (38%)	
Fluoride exposure or consumption	2 (2.3%)	2 (8.3%)	4 (6.45%)	
None of the above	0 (0%)	1 (4.2%)	1 (4.2%)	
Not sure	5 (5.7%)	5 (20.8%)	10 (13.25%)	
Other	3 (3.4%)	1 (4.2%)	4 (3.8%)	

A significant challenge in diagnosing Minimal Intervention Needs (MIN) defects is differentiating them from enamel hypoplasia (Figure 1). This diagnostic difficulty is observed in 44 (50.6%) of Belarusian dentists and 10 (41.7%) of Iranian dentists.

a b

Figure 1 - MIH including a) incisors and b) molar with mild severity in 7 years old patient

Based on our questionnaire responses regarding the timing of the insult leading to Molar Incisor Hypomineralization (MIH), there is a divergence of opinions among dentists. This statement acknowledges the presence of different answers without specifying what those answers are (Table 4).

Table 4 - Regarding the timing of the insult leading to MIH

	Belarusian PD	Iranian PD	All	*p* value
Periods				0.001
First trimester	15 (17.2%)	2 (8.3%)	17 (12.75%)	
Second trimester	27 (31%)	3 (12.5%)	30 (21.75%)	
Third trimester	11 (12.6%)	7 (29.2%)	18 (20.9%)	
First year of life	30 (34.5%)	1 (4.2%)	31 (19.35%)	
Second year of life	2 (2.3%)	0 (0%)	2 (1.15%)	
Third year of life	0 (0%)	3 (12.5%)	3 (6.25%)	
Not sure	2 (2.3%)	8 (33.3%)	10 (17.8%)	

Treatment options for incisors:

Respondents reported that the first treatment options for treating teeth with mild MIH incisors in Belarus is Prophylaxis / regeneration - 72 (82.8%) and in Iran is Non-invasive therapy (infiltration/microabrason) - 12 (50%). Second treatment option in Belarus is Non-invasive therapy (infiltration/microabrason) - 11 (12.6%) and in Iran is Prophylaxis / regeneration - 10 (41.7%).

The best treatment option for treating teeth with severe MIH incisors in Belarus and Iran is Permanent therapy with restorations - 65 (67.5%) (Belarus 45 (51.7%) and Iran 20 (83.3%)).

The most frequent restoration material chosen by Iranian pediatric dentists is composite - 16 (66.7%) and for Belarusian pediatric dentists is glass ionomer cement (GIC) - 35 (40.2%). The second option of restoration material was resin modified glass ionomer cement - 6 (25%) and veneers - 6 (25%) for Iranian pediatric dentists and composite for Belarusian pediatric dentists - 25 (28.7%).

Treatment options for molars:

In Belarus, the primary approach for managing mild MIH molars is Prophylaxis /regeneration 48 (55.2%), while in Iran, the preferred method is Prophylaxis /regeneration 9 (37.5%) and permanent restoration 9 (37.5%).

The most effective treatment option for managing severe molar incisor hypomineralization (MIH) in Belarus and Iran is permanent therapy, which is utilized by 70 (71.9%) of practitioners (49 (56.3%) in Belarus and 21 (87.5%) in Iran). Additionally, in Belarus, primary restoration is employed by 36 (41.4%) of practitioners.

Iranian pediatric dentists most frequently select amalgam 10 (41.7%) and composite 13 (54.2%) as restorative materials, while their Belarusian counterparts primarily use glass ionomer cement (GIC) 36 (41.4%) and resin-modified GIC 49 (56.3%). The stainless-steel crowns were chosen by dentists in both countries in the lowest percentage of cases - 3 (12.5%) in Iran and 1 (1.1%) in Belarus.

Discussion:

This cross-sectional questionnaire-based study assessed the knowledge and treatment practices regarding Molar Incisor Hypomineralization (MIH) among pediatric dentists in Belarus and Iran.

The findings indicate that a majority of dentists in both countries are familiar with MIH and its clinical presentation, with nearly all respondents 108 (98.3%) having encountered MIH cases in their practice. Iranian pediatric dentists showed slightly higher confidence in diagnosing MIH 24 (100%) compared to their Belarusian counterparts 84 (96.6%).

In cases of severe molar incisor hypomineralization (MIH), nearly all dentists recommend tooth extraction. However, in general circumstances, 54 (62.1%) of dentists in Belarus and 13 (54.2%) of dentists in Iran do not prefer tooth extraction for MIH. This is attributed to the fact that 74 (87.4%) of dentists in Belarus and 19 (79.2%) of dentists in Iran consider early diagnosis of MIH to be crucial and effective for treatment.

In Belarus, 68 (78.2%) of pediatric dentists refer patients to orthodontic specialists before considering tooth extraction, while this figure stands at 14 (58.3%) among pediatric dentists in Iran.

In Belarus, 37 (42.5%) of pediatric dentists believe that the number of patients with molar incisor hypomineralization (MIH) is increasing, whereas only 6 (25%) of pediatric dentists in Iran share this belief.

Barriers to the treatment of teeth affected by molar incisor hypomineralization (MIH) include dental treatment that requires a long time to be accomplished, patient's behavior, difficulty in achieving local anesthesia, insufficient training to treat patients with MIH and Other factors. In Belarus, 23 (26.4%) of dentists cite patient behavior as a barrier to treatment, while 8 (33.3%) of dentists in Iran hold the same view. Additionally, insufficient professional training for treating MIH patients is considered one of the most significant barriers, with 13 (14.9%) of Belarusian dentists and 8 (33.3%) of Iranian dentists agreeing on this issue.

Conclusion:

The understanding of the clinical characteristics of Molar Incisor Hypomineralization (MIH) is largely uniform among pediatric dentists due to the reliance on similar sources of information, including books and internet. This shared foundation influences their diagnostic approaches within dental clinics.

Belarusian pediatric dentists prefer a more conservative approach to incisor treatment than Iranian dentists. However, almost half of the doctors choose the wrong filling material for

incisor restoration (GIC). On the other hand, Belarusian dentists more often prefer to consult an orthodontist when deciding on molar extraction. An unacceptably small number of dentists use stainless-steel crowns for severe MIH molars.

Dentists in both countries identified the same etiological factors for MIH. However, their answers regarding the timeframe of these factors' influence on the development of MIH were significantly different. Pediatric dentists in both countries are not confident in the differential diagnosis of MIH. The majority of dentists indicated their need to improve their approach regarding MIH diagnosis and treatment.

Conflict of Interest
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