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Short Communication

The responsiveness of the health system to MIH in children aged 6–8 years: The case of Ardabil Province (A short communication)

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Abstract

Background: Molar-incisor hypomineralization (MIH) is common in regions where dental caries is controlled but requires specialized care. Therefore, a specific structure must be defined for the maintenance and care of affected teeth within health systems.

Methods: The following steps were undertaken to investigate MIH: (*i*) launching an MIH registry and care system in the Ardabil University of Medical Science, (*ii*) making an agreement with the Department of Education to provide screening and health education services, as well as preventive services, to children with MIH and their parents, (*iii*) training people involved in providing education, care, and prevention services for MIH teeth and treating them (during the screening examinations by the trained personnel; the screening assessments were based on a modified table, which was developed at the start of the practical training program for health personnel), (*iv*) launching a province-wide campaign of "Do I have chalky teeth?" to raise the community's awareness to pursue the care required by the children with MIH, (*v*) equipping healthcare centers to provide services required for the treatment of teeth with MIH; (*vi*) providing services to all children diagnosed with MIH, registering the services in an electronic system, and proposing the initial treatment plan by the MIH Lesion Treatment Commission to the healthcare networks based on the images sent for each child, and (*vii*) monitoring and evaluating the program.

Results: A total of 38,000 children aged 6–8 years in the first and second grades were screened for MIH lesions. Subsequently, they received treatment and preventive services, and the results were registered in an electronic system. The prevalence of lesions was 2.3%, and 52% of affected children were referred to state-run centers for services.

Conclusion: The registry system with predefined services proved to be an effective solution for the healthcare system to preserve teeth affected by MIH.

Keywords: Oral health, Molar hypomineralization, Dental enamel hypomineralization, Dental enamel hypoplasia

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Introduction

Dental caries is a common disease controlled at varying levels worldwide.[1] Specific actions have been taken for dental control in Iran over the last thirty years with notable success.[2] Molar-incisor hypomineralization (MIH) progresses rapidly to caries in regions with a high rate of caries and is diagnosed as caries. As the condition takes longer to turn into dental caries in communities in which it is controlled more strictly, it is extensively diagnosed in children with a low rate of dental caries.[3] MIH, introduced by Weerheijm,[4] is a risk factor for dental caries. If there is no specific program to take care of the teeth with MIH, they will undergo early and advanced caries, complicating their treatment and often leading to the extraction and permanent elimination of the teeth. The rate of MIH incidence varies from 2.4% to 40.2%. Different studies in Iran have estimated it to be 5.1%–25.6%.[5,6] Poureslami et al[7] estimated MIH prevalence in Kerman city to be 6.5%. According to Bagheri et al,[8] academics in Iran have differing views and opinions regarding the clinical pattern of MIH lesions. On the other hand, MIS lesions can negatively impact children's quality of life, with a more pronounced effect in female children than in males.[9] According to Saitoh et al,[10] MIH prevalence was 19.8% in

children aged 7–9 years in Japan. It was estimated at 13.5% among children aged 6–12 years in Germany[11] and 14.2% among children aged 8–11 years in Istanbul, Turkey.[12] Saitoh et al[3] reported its prevalence in the 2.8–21% range in different countries.

Given the need to deal with MIH as the silent epidemic of oral and dental health,[7] the present program serves as a pilot study to explore the feasibility of the system's readiness to manage MIH in the healthcare system.

Methods

After acquiring the ethics code from the university Ethics Committee (IR.ARUMS.REC.1402.089), it was registered as a study of MIH and caring for teeth with MIH, emphasizing preserving and saving the permanent molar teeth with MIH. It was conducted through the following steps:

1. Launching an MIH registry and care system at the Medical University of Ardabil, with its headquarters in the Department of Dentistry
2. Launching an electronic MIH care system
3. Entering into an agreement with the Department of Education for the dentists to visit the schools to examine the students
4. Developing an organizational chart, including job descriptions at different levels of service provision in the system (Figure 1).

The first-level services included:

a. Assessing caries level and enamel defects on the tooth surface (Figure 2).
b. Screening and determining treatment needs (Figure 3)
c. Training and improving the health literacy of parents, children, teachers, and community by preparing educational materials and defining the

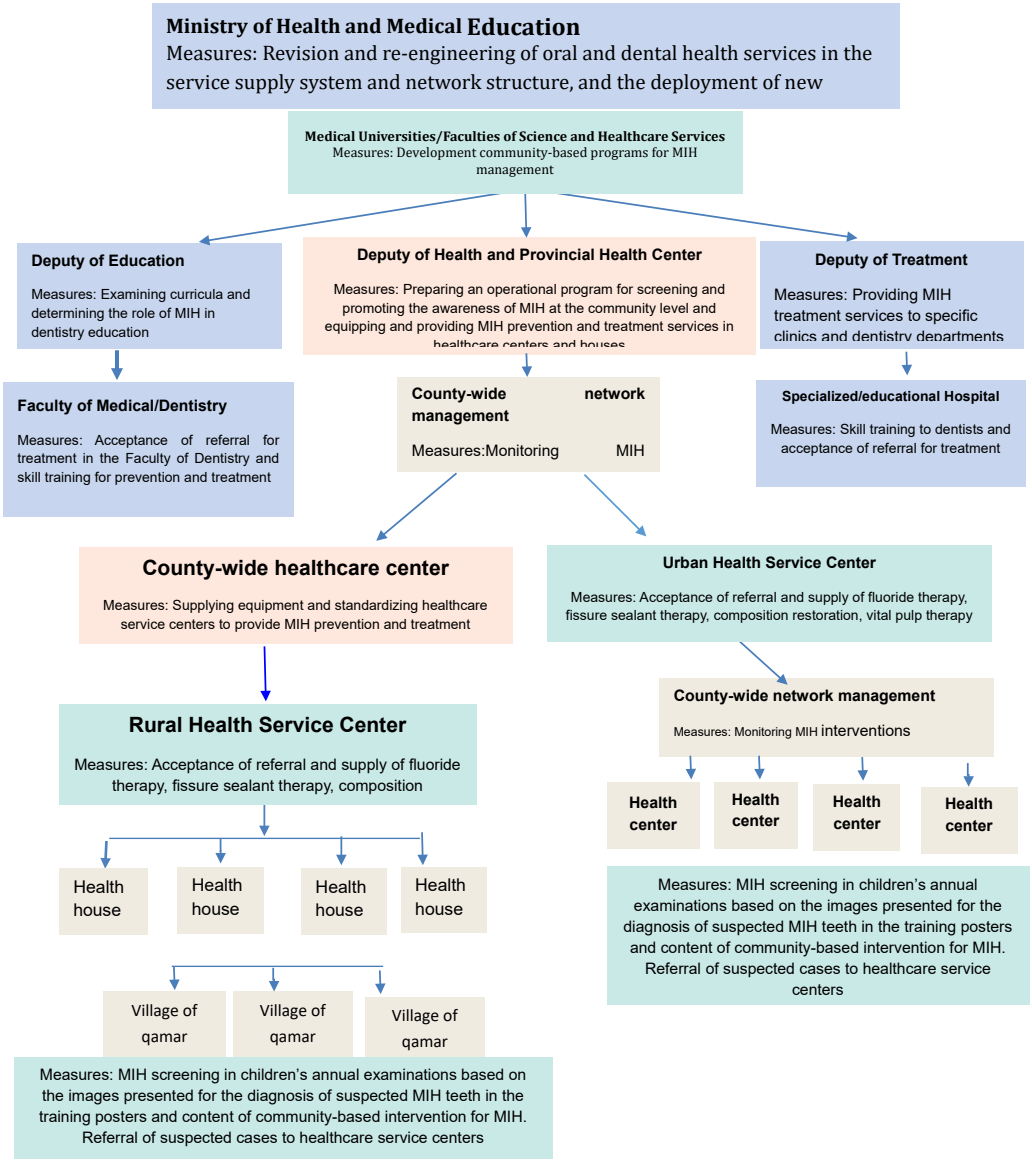

Figure 1. The healthcare network organization of Iran and measures at each level of the community-based MIH screening, prevention, and treatment program

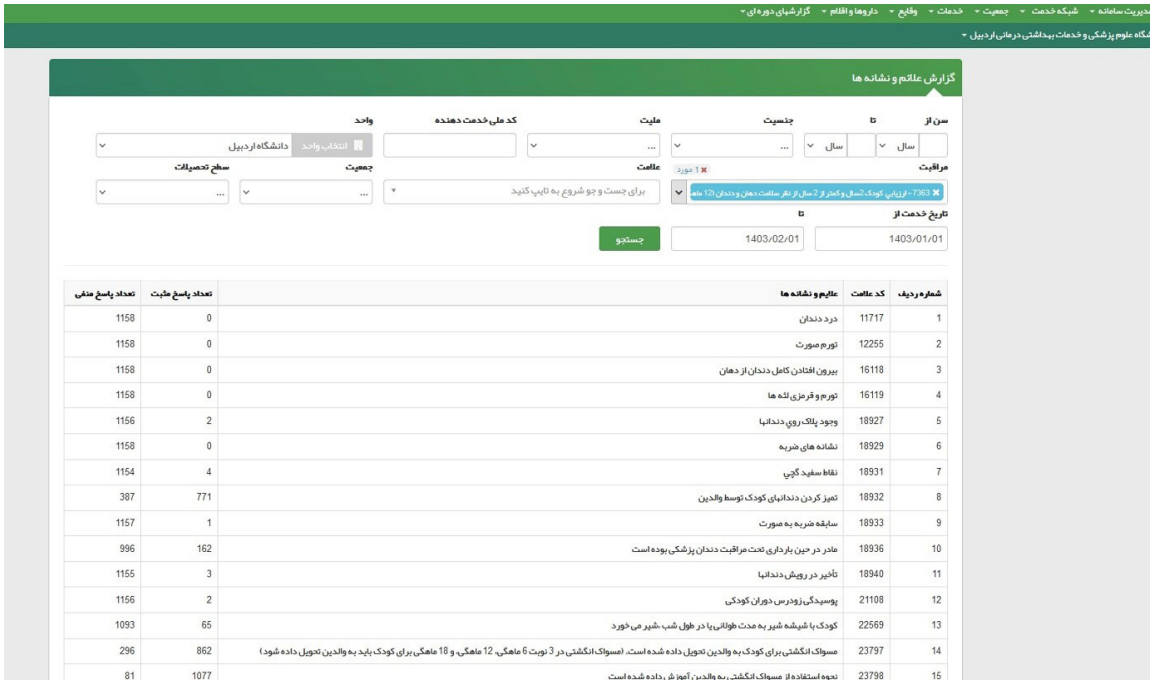

Figure 2. Completing the electronic questionnaire to identify chalky white spots

Figure 3. Registration of examination results

educational process (Figure 4, Supplementary file 1, Figure S1–S2), including determining the stages of change based on motivational interviews, providing education through illustrated educational materials, and finally, doing the teach-back process to ensure the understanding of the materials, and all these services were recorded in the patients electronic file.

Providing preventive services such as fluoride varnish therapy and finally referring suspected MIH cases to the second-level services to receive treatment measures (as shown in (Supplementary file 1, Figure S3) where they were provided by the following services: accepting referrals from the level-one service centers, performing a complete dental examination and registering it in an electronic system, providing specified services such as fissure sealant therapy, fluoride therapy, and other measures and documenting it (as shown in Supplementary file 1, Figure S4–S8). Finally, the third-level health services included complex treatments such as apexogenesis, apexification, resin infiltration, and other specialized procedures performed in the dental school (as shown in Supplementary file 1, Figure S9) and at the dental hospital (Figure 5).

5. Training those involved in the program for the

Figure 4. Special educational materials for informing the community

first-level services, including dental assistants and oral health providers, and the second-level services, including dentists, to provide healthcare and preventive services for teeth with MIH and treating them. A special form was used to record enamel defects (Figure 6).

The codes used to register the lesion intensity were as follows:

- 0 = No MIH
- 1 = Presence of MIH without sensitivity or enamel fracture or destruction
- 2a = Presence of MIH with enamel destruction, extending to less than one-third of the crown surface, but without tooth sensitivity
- 2b = Presence of MIH with enamel destruction, extending between one-third and two-thirds of the tooth crown, but without tooth sensitivity
- 2c = Presence of MIH with enamel destruction, reaching more than two-thirds of the tooth crown and close to the pulp, but without tooth sensitivity
- 3 = Presence of MIH without destruction but with tooth sensitivity
- 4a = Presence of MIH with tooth sensitivity and enamel destruction, reaching one-third of the tooth crown
- 4b = Presence of MIH with tooth sensitivity and enamel destruction, reaching from one-third to two-thirds of the tooth crown
- 4c = Presence of MIH with tooth sensitivity and enamel destruction, reaching more than two-thirds of the tooth crown, or destruction reaching the vicinity

Figure 5. Complex MIH services delivery at the third level of health services (Dental Faculty, Specialized Dental Hospital)

Teeth status in suffering from MIH, its intensity, and its medical needs

	16	15	14	13	12	11	21	22	23	24	25	26	
10						2a							21
22													33

	46	45	44	43	42	41	31	32	33	34	35	36	
34													45
46													47

Figure 6. A special form for MIH registration

of the dental pulp

The codes used to record the need for treatment related to the severity of the lesion were as follows:

- For Index 0: A_1 = Prevention based on risk level (low risk, medium risk, high risk)
- For Index 1: B_1 = Bleaching, B_2 = Resin infiltration, B_3 = Microabrasion, B_4 = Combination of microabrasion and bleaching, B_5 = Combination of microabrasion and resin infiltration, and A_1
- For Index 2: C_1 = Short-term temporary restoration (glass ionomer), C_2 = Long-term temporary restoration (glass ionomer with orthoband), D = Long-term temporary restoration (SSC), E_1 = Direct permanent restoration (composite), E_2 = Indirect permanent restoration, F = Tooth extraction, H_1 = Indirect pulp cap, H_2 = Direct pulp cap, H_3 = Partial pulpotomy, H_4 = Complete pulpotomy, H_5 = Pulpectomy, and A_1
- For Index 3: G_1 = Adhesive flowable resin treatments, G_2 = Glass ionomer with low viscosity, E_1 = Direct permanent restoration (composite), E_2 = Indirect permanent restoration, and A_1
- For Index 4: G_1 = Adhesive flowable resin treatments, G_2 = Glass ionomer with low viscosity, C_1 = Short-term temporary restoration (glass ionomer), C_2 = Long-term temporary restoration (glass ionomer with orthoband), D = Long-term temporary restoration (SSC), F = Tooth extraction, E_1 = Direct permanent

restoration (composite), H_1 = Indirect pulp cap, H_2 = Direct pulp cap, H_3 = Partial pulpotomy, H_4 = Complete pulpotomy, H_5 = Pulpectomy, and A1

6. Launching a province-wide campaign, "Do I have chalky teeth?", to prepare the community, raise their awareness, and follow up on the care needed by children with MIH
7. Equipping the centers so that they can provide optimal services required for the treatment of MIH cases
8. Dental personnel visit schools to examine first- and second-grade students.
9. Caregivers taking photographs of the teeth with MIH at schools after obtaining parental consent.
10. Forming an MIH Teeth Treatment Commission to manage the scientific focal point of the program and prepare the required treatment plan
11. Referring the students in need of medical services to health centers to receive the preventive, therapeutic, and care services they need based on the treatment plan specified by the Commission
12. Providing care and treatment services to children with MIH defects and registering them in the electronic system
13. Monitoring the program with a checklist to achieve the maximum results
14. Reporting the feedback of the monitoring results to healthcare networks to meet service standards
15. Following up on the measures taken to ensure the durability of the provided treatments
16. Evaluating the program based on the results considered in the chain model of the program

In the first-level healthcare (examining and recording the results in the e-file), the healthcare providers conducted oral and dental examinations on children aged 6–8, screened them based on the MIH diagnosis criteria, classified them, and referred the suspected children to dentists in the healthcare service centers for the final diagnosis of MIH. The caries risk level was assessed, training was provided on self-care, and first-level services were provided based on the risk assessment.

Results

A total of 37 423 first and second-grade students aged 6–8 years were screened at their schools, and MIH was detected in 898 students based on the diagnostic criteria. Then, they were invited to healthcare centers and the Department of Dentistry to receive the treatments required. After the training provided to the first-level service staff, their skills in (a) identifying and determining the treatment needed and (b) providing care to the target group as per a checklist (the checklist's Cronbach's alpha was 84%) increased from 25% before training to 95% after training and from 14% before training to 93% after training, respectively. Regarding the dentists, their skill in providing vital pulp therapy was promoted from 35% to 95% (Table 1).

The prevalence of MIH in the studied children in the 6–8 age group was 2.3, and there was no significant difference between boys and girls (Table 2).

Discussion

It is recommended to perform needs assessments and select care and treatments based on lesion severity [2]. Such an approach was adopted in the registry system in the current study.[13] The results showed that establishing the MIH registry system created an optimal capacity in the healthcare system for caring for and treating MIH-affected teeth. However, to keep the treatment protocols updated, research must be conducted on the permanence of the teeth and the treatments performed on them in the registry system in the future.[14] The application of a registry system has been reported to be successful.[15] Lynch9 took a similar measure in assessing the caries risk level based on a registry.

Likewise, Herndon et al[16] reported risk factor management based on a registry. Registering dental caries in children 6–12 years old in their dentistry e-file was a successful experience in oral and dental health, and diagnoses were made using an ICDAS II system.[15] In

Table 1. The significance of the difference in enhancing the knowledge and skill of first-level and second-level personnel providing MIH-lesion-related services

Title	Pre-training	Post-training	Difference	Confidence interval 95%	*P* value
Percent of first-level personnel with knowledge of determining MIH diagnosis and treatment requirement	25%	94.9%	69.9%	-0.729399, -0.667432	0.000
Percent of first-level personnel with skill in providing MIH care services	13.9%	92.9%	78.9%	-0.816918, -.761918	0.000
Percent of dentists with MIH treatment skills, including vital pulp therapy	35%	95%	59.7%	-0.708909, -.486493	0.000

Table 2. Frequency of MIH defects and their distribution across the genders

Gender	Number of screened children	Number of children with MIH	Percent of children with MIH	Differences	Confidence interval	*P* value
Female	19,231	463	1.23	0.7	-0.000812, 0.002308	0.34
Male	18,192	435	1.16			
Total	37,423	898	2.3			

The chi-square test showed a significant difference between genders in having MIH.

another study on the registry of caries risk assessment, the registry promoted caries risk assessment from 57% to 92% and had positive feedback regarding the potential of improving the patient's cooperation and training and the quality of care. This research revealed how the registry of dental risk assessment could improve service quality, promote the shared cooperation of the patient and service provider, reinforce shared decision-making, and systematically collect information on the patient to produce timely and practical data for improving care quality and positive consequences for the patient at the personal and population level.[15] Another study on using a registry for managing dental caries risk factors and receiving preventive services based on the risk level showed that such a system could reduce the need for dental restoration. Enamel failures and other evolutionary failures in teeth structure are among the risk factors for dental caries.[16]

Conclusion

The registry system with predefined services was a good solution for the healthcare system to respond to and preserve teeth with MIH.

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Authors' Contribution

Conceptualization: All authors.
Data curation: All authors.
Investigation: All authors.
Formal analysis: All authors.
Methodology: All authors.
Writing-original draft: All authors.
Writing-review & editing: All authors.

Competing Interests

The authors declare there is no conflict of interest.

Data Availability Statement

Data will be available upon request to the corresponding author.

Ethical Approval

The study proposal was confirmed by the Human Research Ethics Committee at Ardabil University of Medical Sciences, Ardabil (IR.ARUMS.REC.1402.089).

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Supplementary File

Supplementary file contains Figures S1-S9.

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