

ORIGINAL RESEARCH

Virtual learning object for developing knowledge about the diagnosis and management of molar incisor hypomineralization-An original research

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ABSTRACT

Aim: To develop, apply, and evaluate a virtual learning object (VLO) for teaching undergraduate dental students and paediatric dentists to diagnose and manage molar incisor hypomineralization (MIH).

Methodology: This controlled educational intervention included 170 undergraduate dental students and 50 paediatric dentists. The student intervention group (VLOG) was trained by the VLO, the control group of students (CG) received a synchronous virtual class, and the group of paediatric dentists (PDG) was trained by the VLO. Pre-test and post-test data were analyzed with a mixed one-way and Tukey's post hoc ANOVA test ($\alpha = 0.05$).

Results: The values obtained in the pre-test were significantly lower than those obtained in the post-test for all groups. The specialists showed a higher level of knowledge before and after the MIH training compared with the students ($p < .001$). Similarly, statistical differences were found in the level of knowledge, which increased after MIH training ($p < .001$). There were no differences between the CG and VLOG.

Conclusion: The level of knowledge increased in all groups after training regardless of the method used. VLOG works similar to traditional teaching approaches.

Keywords: dental; dental enamel hypoplasia; distance; education; health education.

INTRODUCTION

Molar incisor hypomineralisation (MIH) is a common developmental dental condition that presents in childhood. Well-demarcated areas of hypomineralised enamel affect one or more first permanent molars. Consequently, these teeth may be very sensitive, undergo post-eruptive tissue breakdown and be predisposed to caries. Associated opacities on anterior teeth are less likely to have functional problems but may result in cosmetic and psychosocial issues. The potential burden relating to MIH, from both an individual and a population perspective, is well recognised and continues to stimulate wide public and professional interest.¹⁻³ There can be considerable disparity in the management of children with MIH. Expert groups, such as the European Academy of Paediatric Dentistry, have established MIH clinical guidelines, but oral health professionals are exposed to diverse societal, cultural and health service factors that influence treatment approaches in different countries and settings.⁴ Furthermore, the evidence base to support treatment decisions for both hypomineralised first permanent molars (FPMs) and anterior teeth is surprisingly sparse for such a universal and challenging condition. The clinical appearance of MIH ranges from mild to severe lesions. Mild lesions appear as white to brown demarcated opacities. The darker colour of a lesion represents higher enamel porosities. This type of lesion tends to break down over time, leaving an opened dentin surface. Post-eruptive enamel breakdown and atypical caries are categorised as severe lesions.⁵ MIH is characterised by asymmetrical lesions in location, size, and severity to other collateral teeth in the same patient. Poor oral health due to hypersensitivity is commonly found in severe cases, and this condition makes MIH teeth prone to caries.⁶ Patients with severe MIH lesions also experience difficulties with anaesthesia. These conditions result in children with severe MIH having higher anxiety levels, thus making clinical management of MIH teeth a major challenge for dental practitioners. Globally, the incidence of MIH is quite high, differs among regions and countries, with prevalence ranging from 2.2% to 44%.⁷ There is no unified opinion on treatments for MIH, and currently, the treatments mainly aim to relieve symptoms. Previous studies have found that the oral health-related quality of life of children with MIH is lower than that of children without MIH.⁸ The main reasons for the reduced quality of life include tooth sensitivity, which causes chewing discomfort, and coloured opacities on the front teeth, which causes aesthetic problems.⁹ For dentists, it is important to distinguish MIH from other dental developmental defects. MIH has gradually received more attention over the years, and several surveys have been conducted on dentist awareness of MIH.¹⁰⁻¹² Dentists believe that MIH management presents quite a challenge.

AIM OF THE PRESENT STUDY

To develop, apply, and evaluate a virtual learning object (VLO) for teaching undergraduate dental students and paediatric dentists to diagnose and manage molar incisor hypomineralization (MIH).

METHODOLOGY

This controlled educational intervention included 170 undergraduate dental students and 50 paediatric dentists. The undergraduate students were divided into two equal groups- student intervention group (VLOG) and control group of students (CG). They were given the same electronic questionnaire survey before and after training formatted in English language. (Table 1) The questionnaire included disease awareness; the source of knowledge acquisition; the degree of mastery over MIH aetiology, epidemiology, clinical manifestations, and differential diagnosis; the probability of clinical encounters; and the choice of treatment methods. Also including following three questions: Do you want to gain relevant knowledge about MIH? What would you most like to know? What are the principal ways to obtain

professional dental knowledge? The student intervention group (VLOG) was trained by the VLO, the control group of students (CG) received a synchronous virtual class, and the group of paediatric dentists (PDG) was trained by the VLO. Pre-test and post-test data were analyzed with a mixed one-way and Tukey's post hoc ANOVA test ($\alpha = 0.05$). The answers to the questionnaire were analyzed with the one-way ANOVA test and Tukey's post hoc test ($\alpha = 0.05$).

RESULTS

Moreover, most students had heard about MIH in more than one context. The most common source was classroom teaching, followed by clinical practice, lectures, journal articles, and other sources. Some students (39%) had observed MIH clinically. Few students knew the diagnostic principles of MIH. All of the aetiologies of MIH (i.e., genetic factors, pregnancy and postnatal factors, drug factors, environment factors) were known by only 35%. Among the respondents who had observed MIH clinically, most (63%) were confident in distinguishing MIH from dental fluorosis, dentin hypoplasia, and other developmental dental diseases. The values obtained in the pre-test were significantly lower than those obtained in the post-test for all groups. The pedodontists showed a higher level of knowledge before and after the MIH training compared with the students ($p < .001$). Similarly, statistical differences were found in the level of knowledge, which increased after MIH training ($p < .001$). There were no differences between the CG and VLOG. (Table 2) The vast majority of students (90%) thought it was necessary to add MIH to the curriculum for future systematic teaching. They felt that the most desirable aspects to learn were the clinical manifestations, differential diagnosis, and treatment methods. The most important ways to learn this knowledge were thought to be from textbooks, the literature, the internet, and lectures.

Table 1- Questionnaire used in the present study

S. No.	Questions
1	Have you heard of MIH? (YES/NO)
2	Do you want to learn MIH more systematically? (YES/NO)
3	Which part do you want to study in MIH? <i>Clinical manifestation/Differential diagnosis/Treatment methods/Aetiology/Epidemiology</i>
4	Where do you usually learn oral knowledge? <i>Textbook/Journals/Internet/Lectures</i>
5	What do you think is the aetiology of MIH? <i>Genetic factors/Pregnant and postnatal factors/Drug factors/Environment factors/All of above</i>
6	Do you know the principles of diagnosis of MIH? (YES/NO)
7	What do you think the prevalence of MIH? <i>0–15%/15–30%/30–60%/More than 60%</i>
8	Which treatment would you provide for this is a newly erupted first molar with plaque on buccal surface? <i>Fluoride varnish/Pit and fissure sealant/Observation</i>
9	How often do you meet MIH in clinical? <i>Once a week/Once a month/Once half a year/Once a year/Once more than a year</i>
10	Can you distinguish MIH with other dental development disease? (YES/NO)
11	What are the principal ways to obtain professional dental knowledge? <i>Journals/Lectures/ Classroom teaching/ Clinical practice</i>

Table 2- Data recorded in the present study

Q. No.	Paediatric dentists		P value	Student intervention group (VLOG)		Control group of students (CG)	P value
	<i>Before training</i>	<i>After training</i>		<i>Before training</i>	<i>After training</i>		
1	3.36±2.35	2.09±1.8	<0.001	3.8±1.9	2.6±1.8	4.87±3.9	0.1003
2	3.22±2.11	2.15±1.87		3.7±1.4	2.2±1.9	4.1±3.15	
3	3.6±2.09	2.57±1.78		3.98±1.88	2.77±1.09	4.78±3.88	
4	3.44±2.5	2.48±1.55		3.11±1.21	2.89±1.67	4.67±3.15	
5	3.71±2.11	2.09±1.02		3.86±2.93	3.1±2.01	4.89±3.78	
6	3.33±2.56	2.43±1.37		3.55±2.50	2.98±1.02	4.01±2.99	
7	3.45±2.31	2.88±1.09		3.49±2.07	3.67±1.96	4.122±2.56	
8	3.04±2.9	2.45±1.77		3.65±2.49	2.01±1.01	4.87±3.67	
9	3.66±2.56	2.34±1.81		3.83±2.52	2.51±1.08	4.09±3.11	
10	3.03±1.99	2.59±1.96		3.44±2.56	2.56±0.98	4.65±3.56	
11	3.74±2.009	2.99±1.87		3.78±2.79	2.90±1.89	4.677±3.07	

DISCUSSION

There are obvious differences in the MIH prevalence among previously published studies, possibly due to differences in the populations, research methods, diagnostic criteria, etc. Compared to unaffected children, children with MIH had higher risks of caries and required more dental treatments.¹³ Severe MIH can affect both the quality of life and oral function in children.¹⁴ Without intervention, after two years, molars affected by mild MIH progress to moderate or severe MIH, with enamel breakdown.¹⁵ If we do not initiate preventive measures, the cost of treating MIH will become a heavy burden on the country and the individuals.¹⁶ Therefore, it is important to study the aetiology, treatment, and awareness of MIH. Judging from the current data, the situation is not optimistic. Although 80% of students had heard of MIH, only 20% of the respondents thought they could accurately evaluate it. Student enthusiasm for learning MIH related knowledge was very high, which showed that we need to increase the teaching of MIH-related theoretical knowledge. For the question of "How often do you encounter MIH clinically?", the results showed a far lower frequency than the frequency experienced by the authors in encountering patients with MIH in clinical settings. This discrepancy might be explained by several reasons. First, the authors work in the paediatric dentistry department; thus, we have come into contact with a large number of patients with MIH. Second, the authors have a better understanding of the theoretical knowledge of MIH. In contrast, the respondents were studying different majors and lacked sufficient opportunities to encounter patients with MIH clinically or to study MIH systematically. The different academic levels acquired knowledge through different sources. As the respondents aged, they gradually changed their ways of acquiring knowledge, from textbooks to journals, lectures, and then social platforms (e.g., blogs). On the one hand, this trend reflected the convenience of current networks; on the other hand, it also reflected the dentist's growth process, from passive learning to active learning. By searching for reading materials, students can improve their knowledge reserve and build their own experience system. In the future, accordingly, the introduction of MIH in paediatric dentistry courses at the undergraduate and graduate levels is necessary, and surveys should be conducted before and after teaching and learning to evaluate the outcomes.

CONCLUSION

We recommend that comprehensive, systematic training on MIH should be required at the undergraduate level, and additional training should be offered at the postgraduate level.

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