

Knowledge and Diagnostic Confidence in Molar Incisor Hypomineralization Among Dental Students: A Cross-Sectional Study

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ABSTRACT

Aim: This study aimed to assess dental students' awareness, clinical knowledge, diagnostic confidence, and treatment preferences regarding molar incisor hypomineralization (MIH).

Material and Methods: A descriptive cross-sectional study was conducted between June and July 2025 among third-, fourth-, and fifth-year dental students. A total of 297 students participated. The questionnaire included 17 multiple-choice questions on demographic characteristics, awareness of MIH, knowledge of its etiology and clinical features, diagnostic confidence, and preferred treatment options. Data were analyzed using the chi-square test, with a significance level of $p < 0.05$.

Results: Overall, 94.6% of participants were aware of MIH, with a statistically significant difference across academic years ($p = 0.005$). Correct identification of affected teeth was highest among fourth-year students (91.2%) and lowest among third-year students (59.2%) ($p < 0.001$). Diagnostic confidence was notably low; 18.4% of third-year students, 1.0% of fourth-year students, and none of the fifth-year students reported feeling confident in diagnosing MIH ($p < 0.001$). Several operative treatment preferences for teeth with enamel breakdown differed by academic year; fourth-year students reported extraction more frequently, whereas fifth-year students more commonly selected composite restorations and preformed stainless steel crowns. Over 90% of students reported the need for further education on MIH.

Conclusion: Despite high levels of awareness, dental students demonstrate insufficient diagnostic confidence and inconsistent treatment approaches, which vary by academic level. Integrating more comprehensive, clinically oriented MIH training into undergraduate dental curricula could enhance diagnostic accuracy and clinical decision-making.

Diş Hekimliği Öğrencilerinde Molar İnsizör Hipomineralizasyonu Bilgisi ve Tanısal Güven: Kesitsel Bir Çalışma

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ÖZET

Amaç: Bu çalışma, diş hekimliği öğrencilerinin molar insizör hipomineralizasyonu (MIH) konusundaki farkındalıklarını, klinik bilgi düzeylerini, tanısal güvenlerini ve tedavi tercihlerini değerlendirmeyi amaçlamıştır.

Gereç ve Yöntemler: Tanımlayıcı kesitsel çalışma, Haziran–Temmuz 2025 döneminde üçüncü, dördüncü ve beşinci sınıf diş hekimliği öğrencileri arasında gerçekleştirilmiştir. Toplam 297 öğrenci çalışmaya dahil edilmiştir. Anket; demografik veriler, MIH farkındalığı, etiyoloji ve klinik bulgulara ilişkin bilgi, tanısal güven ve tercih edilen tedavilere yönelik 17 çoktan seçmeli sorudan oluşmuştur. Veriler ki-kare testi ile değerlendirilmiş, $p < 0.05$ anlamlı kabul edilmiştir.

Bulgular: Öğrencilerin %94,6'sı MIH hakkında bilgi sahibi olduğunu belirtmiştir ve sınıf düzeyleri arasında anlamlı fark vardır ($p = 0.005$). Etkilenen dişleri doğru tanımlama oranı dördüncü sınıflarda en yüksek (%91,2), üçüncü sınıflarda en düşüktür (%59,2) ($p < 0.001$). Tanısal güven belirgin derecede düşüktür; üçüncü sınıfların %18,4'ü, dördüncü sınıfların %1,0'ı, beşinci sınıfların ise hiçbiri MIH tanısında güvenli hissettiğini belirtmiştir ($p < 0.001$). Mine kırığı görülen dişlerde bazı operatif tedavi tercihleri sınıf düzeyine göre farklılık göstermiş; dördüncü sınıf öğrencileri çekimi daha sık bildirirken, beşinci sınıf öğrencileri kompozit restorasyonları ve prefabrike paslanmaz çelik kuronları daha sık tercih etmiştir. Katılımcıların %90'ından fazlası MIH konusunda ek eğitime ihtiyaç duyduğunu belirtmiştir.

Sonuç: MIH farkındalığı yüksek olmasına rağmen, öğrencilerin tanısal güveni düşüktür ve tedavi yaklaşımları sınıf düzeyine göre değişmektedir. Lisans eğitiminde MIH'ye yönelik daha kapsamlı ve klinik uygulamaya dayalı içeriklerin artırılması, tanı doğruluğunu ve klinik karar verme süreçlerini iyileştirebilir.

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INTRODUCTION

Molar incisor hypomineralization (MIH) represents a developmental disturbance of enamel formation that arises when systemic influences interfere with normal amelogenesis. The condition typically involves at least one permanent first molar and, in many cases, also affects the incisors.¹ Clinically, MIH presents with sharply delineated opacities, post-eruptive enamel loss, and increased dentin hypersensitivity—features that can complicate restorative management and adversely influence a child's esthetic perception and overall oral-health-related quality of life.² Although the precise etiology of MIH has not been fully clarified, multiple systemic influences across the prenatal, perinatal, and postnatal periods have been implicated, including prematurity, low birth weight, febrile illnesses, antibiotic exposure, and vitamin D deficiency.^{3,4}

Early epidemiologic studies from European cohorts reported MIH prevalence rates ranging from 3.6% to 25%.¹ Later global investigations demonstrated an even broader range, with estimates between 2.9% and 44%.⁵ Over the past decade, both national and regional research efforts examining MIH prevalence have increased substantially, with most studies adopting the standardized diagnostic criteria recommended by the European Academy of Paediatric Dentistry (EAPD).⁶ Epidemiologic studies conducted in Türkiye have reported prevalence rates between 7.7% and 24%.⁷

MIH is estimated to affect more than 800 million individuals worldwide, and its management poses substantial economic burdens, positioning it as a significant public health concern.⁸ The EAPD emphasizes that early diagnosis is a fundamental and critical step in managing the clinical and therapeutic challenges associated with MIH.⁹ Management of MIH is complex due to the heterogeneity of its clinical presentation and variability in individual treatment needs. Fragile enamel, hypersensitivity and pain control, restorative interventions, and orthodontic considerations

require multidisciplinary and well-informed clinical decision-making.^{5,10} Therefore, adequate knowledge of MIH diagnosis, treatment, and management among clinicians is crucial to ensure effective and standardized patient care.¹¹ This expectation applies not only to current practitioners but also to dental students who will become future clinicians.¹²

There is a growing consensus that MIH should be included as a fundamental topic within undergraduate dental curricula.¹³ Since MIH has only recently been incorporated into dental education programs, it is assumed that newly graduated dentists possess greater knowledge compared to those who completed their studies a decade or more ago.¹² However, current educational content is still considered insufficient.^{12,14} Previous studies consistently indicate that dental students' knowledge of MIH remains inadequate, highlighting potential deficiencies in learning and assessment within existing curricula. Unlike previous studies that have predominantly focused on senior dental students or newly graduated dentists, the present study provides an original contribution by simultaneously including third-, fourth-, and fifth-year dental students within the same institutional curriculum. Beyond assessing factual knowledge, this design integrates students' self-perceived diagnostic confidence and clinical attitudes, offering insight into their perceived clinical readiness for managing MIH. In this context, the study also examines how increasing theoretical knowledge and clinical exposure influence students' professional self-assessment and awareness of diagnostic complexity across different stages of undergraduate dental training. Therefore, the aim of this study was to evaluate the knowledge and awareness of MIH—specifically regarding its etiology, clinical features, and treatment approaches—among third-, fourth-, and fifth-year dental students undergoing theoretical and clinical pediatric dentistry training. The null hypothesis (H_0) states that there is no statistically significant difference across academic years in students' knowledge, awareness, or clinical attitudes toward MIH.

The alternative hypothesis (H_1) assumes that such differences do exist based on academic level.

MATERIALS AND METHODS

Study Design and Sample Size

This descriptive cross-sectional study was approved by the Van Yüzüncü Yıl University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (Decision No: 2025/05-02; Date: 16/05/2025). All procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki, and the reporting followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.¹⁵

The study population consisted of third-, fourth-, and fifth-year students enrolled in the faculty of dentistry. These academic years were selected because they represent the theoretical (3rd and 4th year) and clinical (4th and 5th year) phases of pediatric dentistry education.

The sample size was determined using G*Power 3.1 based on data from a similar study in the literature. Assuming an effect size of $w = 0.22$, an alpha level of 0.05, and a statistical power of 0.80, the minimum required sample size was calculated to be 163 participants.^{16,17} In the present study, 297 students were successfully reached, indicating that the sample size was statistically sufficient.

Participation was voluntary, and informed consent was obtained electronically from all participants. Responses were screened for completeness, and any questionnaires containing missing, erroneous, or inconsistent data were excluded prior to analysis.

Questionnaire and Data Collection

Data were collected using an online questionnaire consisting of 17 closed-ended questions. Some were dichotomous, while others were multiple-choice. At the beginning of the questionnaire, the aim of the study was explained, brief information about MIH was provided, and clinical images of hypomineralized permanent first molars,

incisors, and primary second molars were displayed.

The questionnaire consisted of three main sections: demographic information (age, sex, academic year); knowledge and attitudes regarding MIH, including etiology, diagnosis, and clinical characteristics; and questions concerning perceived prevalence, treatment preferences, and educational needs. The survey items were prepared based on the most frequently used and validated questionnaires in previous studies.^{12,14,18-20} The original questionnaire was translated from English to Turkish by a native Turkish-speaking researcher and then back-translated into English by a native English-speaking expert to ensure linguistic equivalence. In addition, the content validity of the questionnaire was reviewed by experienced pediatric dentistry academics to ensure consistency with current MIH literature.

A pilot study was conducted among fifth-year dental students ($n = 50$) to assess the clarity and comprehensibility of the questionnaire items. To assess test–retest reliability, the same students were asked to complete the questionnaire again after a one-month interval. Test–retest reliability was assessed using Cohen’s kappa coefficients, with all item-level kappa values exceeding 0.83, indicating high agreement over time.

Data were collected between June and July 2025 through the online survey. The questionnaire link was sent via email to students who agreed to participate. The email explained the aim and nature of the study, emphasized voluntary participation, and ensured that responses would remain anonymous. Before starting the questionnaire, participants reviewed an online information sheet and provided electronic informed consent. Completed responses were checked for completeness and accuracy; questionnaires containing missing, erroneous, or inconsistent data were excluded.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics (Version 31, Armonk, NY, USA). Categorical variables were presented as frequencies (n) and percentages

(%). Differences in responses by academic year and sex were analyzed using the Pearson chi-square (χ^2) test, and the Yates-corrected chi-square test was applied when necessary. In multi-categorical questions yielding statistically significant results, post-hoc Z-tests with Bonferroni correction were used to determine which groups differed. A p -value of <0.05 was considered statistically significant.

RESULTS

A total of 297 dental students participated in the study. Of these, 50.8% were female ($n = 151$) and 49.2% were male ($n = 146$). The distribution by academic year was as follows: 33.0% third-year ($n = 98$), 34.3% fourth-year ($n = 102$), and 32.7% fifth-year students ($n = 97$). The mean age of participants was 23.48 years, with mean ages of 22.51, 23.73, and 24.21 years

in the third-, fourth-, and fifth-year groups, respectively.

Overall awareness of MIH was high; however, significant differences were observed across academic years, with lower awareness among third-year students compared with senior students ($p = 0.005$). Lectures and formal coursework constituted the primary source of MIH-related knowledge across all grades, whereas reliance on clinical experience increased significantly with academic progression and was most frequently reported by fifth-year students ($p < 0.001$). Familiarity with the clinical features of MIH also differed significantly by academic level, with lower familiarity among third-year students ($p < 0.001$) (Table 1).

Table 1: Awareness, knowledge, and perception of MIH among dental students

Question / Response	3rd Year n(%)	4th Year n(%)	5th Year n(%)	P^*
Q4. Have you heard of Molar Incisor Hypomineralization (MIH)?				
– Yes	87 (88.8) ^a	98 (96.1) ^b	96 (99.0) ^b	0.005
– No	11 (11.2) ^a	4 (3.9) ^b	1 (1.0) ^b	
Q5. How did you find out about it? (Multiple answers possible)				
–Scientific publications	5 (5.1) ^a	9 (8.8) ^a	16 (16.5) ^b	0.026
– Lectures/Courses	89 (90.8)	91 (89.2)	88 (90.7)	0.912
– Congresses/Conferences	4 (4.1) ^a	2 (2) ^b	14 (14.4) ^b	<0.001
– Information brochures	1 (1)	2 (2)	7 (7.2)	0.054
– Clinical practice	15 (15.3) ^a	25 (24.5) ^b	54 (55.7) ^c	<0.001
– Internet	19 (19.4) ^a	35 (34.3) ^b	38 (39.2) ^c	0.007
– Textbooks	32 (32.7) ^a	52 (51) ^b	65 (67) ^c	<0.001
– Artificial intelligence	0	0	1 (1)	0.353
– Other	1 (1)	0	1 (1)	0.590
Q6. Do you know the clinical features of MIH?				
– Yes	62 (63.3) ^a	94 (92.2) ^b	91 (93.8) ^b	<0.001
– No	36 (36.7) ^a	8 (7.8) ^b	6 (6.2) ^b	

* Chi-square test; n: number of participants in each grade; a, b, c: different superscript letters indicate statistically significant differences between groups based on post-hoc analysis ($p < 0.05$).

Students' clinical perception and diagnostic confidence regarding MIH varied significantly according to academic year. Third-year students reported greater difficulty in distinguishing MIH from other enamel defects, while fourth-year students showed the highest accuracy in identifying teeth most commonly affected by MIH ($p < 0.001$). Perceived prevalence of MIH in Türkiye also differed significantly among groups, with uncertainty

more common among third-year students ($p < 0.001$). Despite these differences, overall diagnostic confidence remained low; while a small proportion of third-year students reported confidence, confidence levels were 1% or lower among fourth- and fifth-year students ($p < 0.001$). The majority of participants indicated a need for additional education on MIH, with no significant differences between academic years ($p > 0.05$) (Table 2).

Table 2: Clinical perception and self-perceived diagnostic confidence related to MIH among dental students

Question / Response	3rd Year n(%)	4th Year n(%)	5th Year n(%)	P*
Q7. Which teeth do you think are most frequently affected?				
– Permanent first molars and permanent incisors	58 (59.2) ^a	93 (91.2) ^b	75 (77.3) ^c	<0.001
– Permanent first molars and incisors and temporary second molars	24 (24.5) ^b	6 (5.9) ^c	19 (19.6) ^{ab}	
– I do not know/not sure	16 (16.3) ^a	3 (2.9) ^{bc}	3 (3.1) ^b	
Q8. Do you have difficulty distinguishing the MIH lesion from other lesions or malformations of dental tissues?				
– Yes	85 (86.7) ^a	66 (64.7) ^b	67 (69.1) ^b	0.001
– No	13 (13.3) ^b	36 (35.3) ^a	30 (30.9) ^a	
Q9. With which ones do you have difficulty distinguishing MIH? (Multiple answers possible)				
– Dental fluorosis	13 (13.3) ^a	32 (31.4) ^b	39 (40.2) ^b	<0.001
– Enamel hypoplasia	68 (69.4)	63 (61.8)	72 (74.2)	0.131
– Amelogenesis imperfecta	33 (33.7) ^a	56 (54.9) ^b	55 (56.7) ^b	0.002
– Dentinogenesis imperfecta	20 (20.4)	16 (15.7)	18 (18.6)	0.662
– Caries	17 (17.3)	19 (18.6)	16 (16.5)	0.931
– Other	1 (1)	0	0	0.350
Q10. What factors do you think are involved in the etiology of MIH? (Multiple answers possible)				
– Genetic factors	77 (78.6)	72 (70.6)	78 (80.4)	0.219
– Chronic diseases of the mother during pregnancy	55 (56.1) ^a	73 (71.6) ^a	77 (79.4) ^b	0.002
– Chronic diseases in the child	8 (8.2) ^a	47 (46.1) ^b	51 (52.6) ^b	<0.001
– Antibiotics/drugs taken by the mother during pregnancy	59 (60.2) ^a	80 (78.4) ^b	75 (77.3) ^b	0.006
– Antibiotics/drugs taken by the child	45 (45.9)	49 (48)	57 (58.8)	0.157
– Environmental pollutants	22 (22.4)	27 (26.5)	34 (35.1)	0.144
– Acute illnesses affecting the mother during pregnancy	38 (38.8) ^a	63 (61.8) ^b	66 (68) ^b	<0.001
– Acute illnesses affecting the child	29 (29.6)	46 (45.1)	44 (45.4)	0.055
– Exposure to fluoride	14 (14.3)	24 (23.5)	23 (23.7)	0.145
– None	1 (1)	1 (1)	0(0)	0.613
– Other	1	0	0	0.361
Q11. What do you think is the prevalence of MIH in Türkiye				
– < 5%	4 (4.1) ^b	9 (8.8) ^{ab}	14 (14.4) ^a	<0.001
– 5–10%	37 (37.8) ^a	26 (25.5) ^b	33 (34.0) ^c	
– 10–20%	17 (17.3) ^c	53 (52.0) ^a	44 (45.4) ^b	
– > 20%	3 (3.1) ^c	14 (13.7) ^a	6 (6.2) ^{bc}	
– Not sure	37 (37.8) ^a	0 (0) ^b	0 (0) ^b	
Q12. Do you think the pattern of caries in teeth with MIH is different from the pattern of normal caries?				
– Yes	91 (92.9)	90 (88.2)	90 (92.8)	0.414
– No	7 (7.1)	12 (11.8)	7 (7.2)	
Q13. How confident do you feel about diagnosing a tooth with MIH?				<0.001
– I feel confident	18 (18.4) ^a	1 (1.0) ^b	0 (0.0) ^b	
– I do not feel sufficiently confident	80 (81.6) ^b	101 (99.0) ^a	97 (100) ^a	
Q14. Would you like to receive more training on MIH in your career/training content?				
– Yes	93 (94.9)	95 (93.1)	90 (92.8)	0.811
– No	5 (5.1)	7 (6.9)	7 (7.2)	
Q15. On what aspects of MIH do you think you need to complete your training? (Multiple answers possible)				
– Diagnosis	74 (75.5)	85 (83.3)	85 (87.6)	0.081
– Etiology	65 (66.3)	64 (62.7)	59 (60.8)	0.720
– Treatment	74 (75.5)	86 (84.3)	80 (82.5)	0.252
– Others: prevention, long-term prognosis, etc.	79 (80.6) ^a	2 (2) ^b	0 (0.0) ^b	<0.001

* Chi-square test; n: number of participants in each grade; a, b, c: different superscript letters indicate statistically significant differences between groups based on post-hoc analysis ($p < 0.05$).

Several operative treatment preferences for MIH-affected teeth with enamel breakdown differed significantly across academic years ($p < 0.05$). Third-year students tended to favor more conservative restorative approaches, whereas fourth-year students reported

extraction more frequently ($p < 0.05$). Preferences for preformed crowns also varied significantly among academic levels, while no significant differences were observed for resin infiltration or glass ionomer-based restorative options (Table 3)

Table 3: Treatment options for MIH

Question / Response	3rd Year n(%)	4th Year n(%)	5th Year n(%)	<i>p</i>
Q16. What preventive (nonoperative) treatment would you apply to MIH lesions without enamel fracture? (Multiple answers possible)				
– Dental mousse with Recaldent	51 (52)	61 (59.8)	57 (58.8)	0.589
– Dental mousse with Recaldent and fluoride	72 (73.5)	85 (83.3)	84 (86.6)	0.051
– Professional application of high concentration fluoride varnish (22,600 ppm)	32 (32.7)	36 (35.3)	41 (42.3)	0.355
– Professional application of chlorhexidine varnish	18 (18.4)	16 (15.7)	16 (16.5)	0.874
– Sealing of pits and fissures.	33 (33.7)	43 (42.2)	44 (45.4)	0.227
– Application of silver diamine fluoride.	9 (9.2) ^b	41 (40.2) ^a	17 (17.5) ^b	<0.001
– Others	1(1)	1 (1)	0	0.613
Q17. What operative treatment would you apply to teeth affected by MIH with enamel fracture? (Multiple answers possible)				
– Microabrasion	22 (22.4) ^a	10 (9.8) ^b	26 (26.8) ^a	0.007
– Resin infiltration	34 (34.7)	30 (29.4)	34 (35.1)	0.636
– Conventional glass ionomer	37 (37.8)	39 (38.2)	35 (36.1)	0.948
– Resin-modified glass ionomer	60 (61.2)	61 (59.8)	61 (62.9)	0.905
– Composite filling	22 (22.4) ^a	30 (29.4) ^a	48 (49.5) ^b	<0.001
– Silver amalgam filling	6 (6.1)	14 (13.7)	12 (12.4)	0.184
– Preformed crowns	24 (24.5) ^a	30 (29.4) ^{ab}	42 (43.3) ^b	0.014
– Extraction	1 (1.0) ^a	12 (11.8) ^b	5 (5.2) ^{ab}	0.006

* Chi-square test; n: number of participants in each grade; a, b, c: different superscript letters indicate statistically significant differences between groups based on post-hoc analysis ($p < 0.05$).

DISCUSSION

MIH remains a challenging condition for dental professionals due to the limited data available on its epidemiology, etiology, and treatment.⁹ Given its high prevalence, it is likely that dentists will encounter MIH-affected teeth at some point during their clinical careers. Since undergraduate education plays a critical role in shaping future dentists' professional competencies, it is essential to investigate dental students' levels of awareness, attitudes, and knowledge regarding MIH. The present study demonstrated significant differences in students' knowledge, awareness, and clinical approaches toward MIH depending on their academic year. These findings demonstrated statistically significant differences across

academic years in several domains—including awareness, knowledge of clinical features, diagnostic confidence, and context-specific treatment preferences, particularly in cases involving enamel breakdown—thereby leading to the rejection of the null hypothesis and the acceptance of the alternative hypothesis. Although overall awareness of MIH was high among students, clinical knowledge and diagnostic confidence varied substantially across academic levels.

Several previous studies have assessed only senior dental students or graduates in their final year of education.^{3,12,14,17,20-25} In contrast, the present study also included third-year students in the sample. In dental curricula, fundamental theoretical information about MIH

is first introduced in the third year, and at this stage, students also begin to reinforce these concepts through clinical observation. Therefore, including third-year students enabled the assessment not only of those with clinical experience but also of students in the most theory-intensive phase of their training. This approach provided insight into whether educational deficiencies related to MIH originate during the preclinical phase or emerge during clinical practice. However, contrary to expectations, clinical experience was most frequently reported by fifth-year students (55.7%), while a substantially smaller proportion of third- and fourth-year students cited clinical observation as a source of MIH knowledge. Therefore, including third-year students offered a meaningful advantage, as it allowed the identification of when gaps in MIH-related knowledge and awareness first appear within the early phase of dental training.

Awareness of MIH has been increasing over the past two decades, particularly with the growing number of studies in recent years. In the present study, 94.6% of the participants reported having heard of MIH, and awareness was significantly higher among fourth- and fifth-year students compared to those in the third year. In Germany, 97% of students and in Switzerland, 99% reported being familiar with MIH.^{12,21} In contrast, awareness levels were lower in other countries, such as Spain (75.2%), Saudi Arabia (36%), and Syria (19%).^{18,20,25} These findings suggest that while overall awareness of MIH is generally high, it varies considerably between countries. In the current study, the most frequently reported sources of MIH-related knowledge were lectures and lecture notes, whereas clinical experience was predominantly reported by fifth-year students rather than by third- and fourth-year students. Similarly, in a German study, almost all students reported obtaining their information from university courses (99%) and clinical experience (98%).²¹ In Egypt, lectures (36.7%),

the internet (27.3%), and clinical settings (21.2%) were the most commonly cited sources.²⁴ Collectively, these data indicate that the primary channels of acquiring knowledge about MIH are largely similar across different countries, with formal education and clinical exposure consistently playing a central role.

Difficulty in distinguishing MIH from other enamel defects was most frequently reported by third-year students (86.7%). Participants indicated that MIH was commonly confused with certain conditions, particularly dental fluorosis and amelogenesis imperfecta, as well as enamel hypoplasia. Similar results were reported in another study conducted in Türkiye, where students had difficulty differentiating MIH from other enamel defects.¹⁷ Studies involving practicing dentists have also shown that this diagnostic confusion persists even after graduation, with MIH most frequently misdiagnosed as dental fluorosis or enamel hypoplasia.²⁶ A study from Spain similarly reported that MIH was most often mistaken for amelogenesis imperfecta and enamel hypoplasia, and some participants even misidentified carious lesions as MIH.²⁰ In line with these findings, several students in our study also reported confusing MIH with caries, suggesting that MIH may not only be mistaken for other enamel defects but even for common dental pathologies such as dental caries.

Recent systematic reviews emphasize that the etiology of MIH is not attributed to a single cause; rather, it is a multifactorial process shaped by the interaction of systemic, medical, and genetic factors occurring during the prenatal, perinatal, and postnatal periods.^{9,27} In the present study, genetic factors were among the most frequently reported etiological factors across academic years. Maternal medication exposure and chronic diseases during pregnancy were also frequently reported, whereas environmental pollutants and exposure to fluoride were less frequently selected. These findings align with the multifactorial etiological

model described in the literature. In a study from Poland, fifth-year students most frequently attributed MIH to postnatal infections and high fever during early childhood.²³ In contrast, the students in our study placed greater emphasis on prenatal and genetic factors. This suggests that differences in etiological perceptions across academic years may be more pronounced for specific systemic and maternal factors, rather than uniformly across all proposed causes, potentially reflecting variations in educational level, clinical exposure, and curriculum focus between institutions.

Navarro and Buldur reported that the global prevalence of MIH ranges between 0.5% and 40%, attributing this wide variation to methodological differences and environmental influences.²⁸ Regional studies conducted in Türkiye have similarly reported inconsistent prevalence rates: 9.1% in Bozcaada, 9.2% in Kocaeli, 7.7% in Ankara, 14.2% in İstanbul, and 11.5% in İzmir.²⁹⁻³² Surveys conducted among dental students in Türkiye have also demonstrated inconsistencies in awareness and prevalence estimates.^{17,33} Likewise, several international studies have shown that many students are unaware of MIH prevalence in their own countries and believe that further epidemiological research is needed.^{12,14,21,34} These findings suggest that awareness of MIH tends to increase with clinical exposure and highlight the need for standardized national epidemiological data.

In the present study, students' confidence in diagnosing MIH was generally low and differed significantly across academic years ($p < 0.001$). Diagnostic confidence was defined as a self-perceived construct encompassing the ability to recognize MIH-related enamel defects, perform differential diagnosis, and make an initial clinical judgment, rather than as an objective measure of diagnostic competence. The lower level of diagnostic confidence observed among senior students is more likely

to reflect increased clinical awareness rather than a reduction in actual diagnostic ability, as advancing clinical training exposes students to the diagnostic complexity of MIH, including the need for differential diagnosis, prognosis evaluation, and appropriate treatment planning. In contrast, earlier-stage students, whose exposure is predominantly theoretical, may perceive diagnosing MIH primarily as visual identification of characteristic enamel defects, which may contribute to higher self-reported confidence despite limited clinical certainty.

Similar patterns have been reported in the literature. In Austria, only 5% of students expressed full confidence in diagnosing MIH, while the majority reported being only partly confident.¹⁴ and a study conducted in Wuhan demonstrated limited mastery of diagnostic principles among students.²² Despite methodological differences across studies, the available evidence consistently indicates insufficient diagnostic confidence in MIH, a finding that has also been reported among practicing dentists.^{18,26} Given that diagnostic confidence in the present study was interpreted as a multidimensional construct, the observed decline across academic years appears to reflect a shift toward more realistic self-assessment associated with increasing clinical responsibility.³⁵ Notably, students' self-reported diagnostic confidence closely aligned with their perceived difficulty in differential diagnosis: although third-year students reported higher confidence, they simultaneously indicated the greatest difficulty in distinguishing MIH from other enamel defects, whereas senior students demonstrated broader awareness of overlapping conditions and greater diagnostic caution. Taken together, these findings suggest that students interpreted the act of diagnosing MIH as a composite process involving lesion recognition, differential diagnosis, and initial clinical decision-making rather than as a purely visual identification task.

One of the most noteworthy findings of our study is that the vast majority of students expressed a desire for additional education on MIH. Participants particularly prioritized hands-on training focused on diagnosis and treatment, while their interest in etiology was relatively lower—consistent with findings reported in studies published in 2024.²³ Additionally, the higher rate of “other” educational needs expressed by third-year students may be associated with uncertainty and perceived knowledge gaps during the early clinical exposure phase. In a study conducted in Romania, 64.8% of participants reported that they had not received any education on MIH, suggesting that this deficiency is not limited to undergraduate students but also persists after graduation.¹⁹ Therefore, there is a clear need to develop clinically oriented, practical, and continuous educational programs on MIH for both students and practicing dentists.

The available evidence on non-operative (preventive) and operative (restorative) treatment modalities for MIH—particularly for first permanent molars—is well documented, with treatment decisions primarily determined by the severity of the defect and the patient’s age.⁹ However, published evidence regarding treatment approaches for anterior teeth remains limited. In the present study, one of the most commonly preferred non-operative treatments was the application of biomimetic remineralizing agents such as Recaldent, whereas high-concentration fluoride varnish (22,600 ppm) was selected less frequently. This finding differs from previous studies reporting fluoride varnish as the most frequently selected first-line preventive therapy.^{22,36} In contrast, Tarazona-Valero et al. reported resin-based fissure sealants as the second most preferred option, differing from our results.²⁰ This discrepancy may be attributed to variations in educational content, clinical exposure, or access to specific dental materials.

Operative treatment options for MIH vary depending on the tooth group involved. In molars, reported treatment strategies include resin infiltration, glass ionomer or resin-modified glass ionomer restorations, preformed stainless steel crowns, and in severe cases—particularly between 8 and 10 years of age—planned extraction followed by orthodontic management. For anterior teeth in patients older than 18 years, recommended treatment options include enamel microabrasion, bleaching, Wright’s etch-bleach-seal technique, resin infiltration, composite restorations, and composite or porcelain veneers.⁵

In the present study, for MIH-affected teeth with enamel breakdown, resin-modified glass ionomer cement, composite resin restorations, and preformed stainless steel crowns were among the most frequently selected operative treatment options across all academic levels. Microabrasion was selected less frequently by fourth-year students than by third- and fifth-year students. Among third-year students, resin-modified glass ionomer cement was the most frequently selected option, whereas conventional glass ionomer cement, resin infiltration, preformed stainless steel crowns, and composite resin restorations were selected at lower rates. Fourth-year students showed a similar pattern, with composite restorations, resin infiltration, and preformed crowns being selected at similar rates. In contrast, extraction was reported more frequently by fourth-year students. Preferences for preformed stainless steel crowns were highest among fifth-year students. These findings suggest that treatment preferences may shift with increasing clinical exposure, particularly in cases where prognosis is compromised, rather than indicating a strict conservative-versus-radical distinction between academic years. The literature also indicates that operative treatment preferences for MIH are influenced by the patient’s age, lesion severity, and the expected durability of the

restoration. Serna-Muñoz et al.³⁷ reported that resin-modified glass ionomers, composite restorations, and preformed crowns were the most frequently used treatments, which is consistent with our findings. Similarly, Lygidakis et al.⁹ proposed composite restorations for mild cases, stainless steel crowns for moderate lesions, and extraction with orthodontic guidance for severe cases—an approach that is consistent with the variability in extraction preferences observed across academic years in our study. Conversely, some studies have reported composite resin as the most preferred treatment modality. For example, in studies by Tarazona-Valero et al.²⁰ and Skaare et al.²⁶, students predominantly selected composite restorations, followed by resin-modified glass ionomer restorations and preformed crowns. These differences may reflect variations in educational curricula, clinical experience, and access to dental materials.

This study has certain limitations. It was conducted at a single faculty of dentistry; therefore, generalization of the findings is limited, as curricula, clinical facilities, and student profiles may vary across institutions. Data were collected via an online self-reported questionnaire, and thus the possibility that students referred to external resources or provided socially desirable responses cannot be entirely excluded. Nevertheless, the relatively balanced number of participants across the 3rd, 4th, and 5th years supports the representativeness of the sample distribution. Additionally, the study primarily evaluated theoretical knowledge, awareness, and perceptions; actual clinical diagnostic skills or treatment competence were not objectively measured. For this reason, future research should include multicenter studies incorporating clinical observation and practical skill assessment to validate and expand upon these findings.

CONCLUSION

This study demonstrated that although dental students exhibit high awareness of MIH, they show notable deficiencies in diagnostic confidence, clinical management, and treatment planning—factors that are significantly influenced by academic year. These results indicate that theoretical knowledge alone is insufficient; MIH education should be reinforced through case-based, clinically oriented, and structured training programs. Incorporating standardized and evidence-based MIH modules into dental curricula may strengthen students' abilities in accurate diagnosis, treatment planning, and clinical decision-making. Furthermore, conducting large-scale, multicenter studies on the prevalence and management of MIH would contribute to increased national awareness and support the standardization of clinical practices.

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Ethical Approval

Ethical approval for this study was obtained from the Van Yüzüncü Yıl University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (Decision No: 2025/05-02; Date: 16/05/2025).

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Conflict of Interest

The authors deny any conflicts of interest related to this study.

Author Contributions

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