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# The influence of molar incisor hypomineralization-related enamel defects in anterior teeth on peer perception of smile esthetics in children and adolescents

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ABSTRACT

*Objective:* This study aimed to evaluate the influence of enamel defects in anterior teeth associated with molar incisor hypomineralization (MIH) on peer perception of smile esthetics in children and adolescents.
*Methods:* A total of 288 children and adolescents aged 10–14 years from both public and private schools participated. Each participant evaluated standardized photographs of peers' smiles, either showing MIH-related anterior enamel opacities or digitally altered to appear defect-free. Participants rated each image across four psychosocial domains: athletic ability, social competence, leadership potential, and academic performance. Independent-sample t-tests were used to compare ratings between smile types, and General Linear Models (GLMs) were applied to analyze the influence of evaluator-related variables such as age and gender.
*Results:* Digitally modified smiles received significantly higher ratings than unedited images for athletic ability ($59.72 \pm 0.86$ vs. $50.94 \pm 0.89$; mean difference = 8.78, $p < 0.001$), social competence ($52.62 \pm 0.80$ vs. $43.78 \pm 0.81$; difference = 8.84, $p < 0.001$), leadership potential ($64.15 \pm 0.84$ vs. $56.44 \pm 0.86$; difference = 7.71, $p < 0.001$), and academic performance ($62.52 \pm 0.79$ vs. $58.36 \pm 0.83$; difference = 4.16, $p < 0.001$). GLM analysis indicated that evaluator age and gender were stronger predictors than smile type, with older children and female evaluators demonstrating greater esthetic sensitivity ($p < 0.05$).
*Conclusion:* MIH-related enamel defects in anterior teeth negatively affect peer perception, but evaluator-related factors such as age and gender play an important role in shaping social judgments.
*Clinical significance:* This study demonstrates that enamel defects in anterior teeth caused by MIH not only present a clinical challenge but also influence how children are perceived by their peers in terms of social attributes.

## 1. Introduction

Molar incisor hypomineralization (MIH) is a qualitative enamel mineralization defect, affecting at least one first permanent molar and often accompanied by similar defects in incisors [1]. The most recent systematic review, incorporating data from 135 studies across 53 countries, reported a global prevalence of 15.5% (95% Confidence Interval [CI]: 14.4–16.6%), with individual studies reporting prevalence rates ranging from 0.6% to 46.6% [2]. Its etiology remains unclear but is considered multifactorial, with prenatal, perinatal, and postnatal influences—as well as genetic, epigenetic, and environmental factors—proposed as potential contributors [3,4].

Clinically, MIH manifests as demarcated opacities—typically on the occlusal and buccal surfaces of permanent first molars, and on the buccal surfaces of incisors—with colors ranging from white or creamy to yellow or brown, with darker lesions generally indicating greater mineral loss and porosity [5,6]. These defects may cause hypersensitivity and increase restorative complexity, leading to both functional and esthetic concerns—particularly when anterior teeth are involved—potentially resulting in psychosocial consequences for affected children [7,8].

The optical effects of MIH-related enamel changes can create visible patches, especially on anterior teeth, directly affecting the appearance of the smile [9,10]. Because facial appearance—particularly the smile— is a key factor in social perception, even minor deviations in tooth color,

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shape, or alignment often dominate esthetic evaluations and may be interpreted as indicators of poor health or hygiene, potentially leading to peer rejection or bullying [11–14]. Consequently, children with enamel defects in anterior teeth may experience teasing, social withdrawal, and reduced self-esteem [15–17], particularly during developmental stages when peer approval and self-image are critical. Minimally invasive esthetic management of enamel defects in anterior teeth has been shown to improve patient satisfaction, emotional well-being, and self-confidence [15,18,19].

In the context of MIH, even mild enamel defects in anterior teeth may be perceived as problematic by children and parents, influencing self-image and social judgments [20]. Understanding peer perception of visible enamel defects in anterior teeth is therefore crucial for informing clinical decisions, particularly regarding the psychological and social outcomes of esthetic dental care [21]. Accordingly, the aim of this study was to evaluate the impact of enamel defects in anterior teeth of children and adolescents with MIH on peer perception across four domains: athletic ability, social competence, leadership potential, and academic performance. The null hypothesis was that the presence of these opacities would have no significant effect on peer perception.

## 2. Materials and methods

### 2.1. Ethical considerations

This cross-sectional cohort study was approved by the Non-Interventional Clinical Research Ethics Committee of Çanakkale Onsekiz Mart University (Decision No. 2024/06-05). All procedures were conducted in accordance with the ethical principles and guidelines of the Declaration of Helsinki. Since children and adolescents are considered a vulnerable population, particular care was taken to ensure strict adherence to all relevant provisions of the Declaration. Detailed information about the study was provided to the children and adolescents whose photographs were used, as well as to the children and adolescents serving as evaluators, along with their parents. Written informed consent was obtained from all participants and their legal guardians. In addition, written permission was obtained from the teachers and administrative staff of the schools where the assessments were carried out. Participation was entirely voluntary.

### 2.2. Sample size calculation

Sample size estimation was performed using G*Power version 3.1 (Faul, Erdfelder, Lang, & Buchner; Heinrich Heine University, Düsseldorf, Germany). One study that examined how orthodontically compromised dental esthetics influenced adolescents' peer perceptions across the domains of athletic ability, social competence, leadership potential, and academic performance was used as a reference [14]. In that study, a mean difference of 3.42 and a standard error of 1.39 were reported for peer perception of athletic ability between the ideal and non-ideal smile groups ($p = 0.00141$). Based on these values—with an effect size of 2.46, an alpha error probability of 0.05, and a power level of 0.99—the minimum required sample size was calculated to be 65 evaluators per group, yielding a total of 130 participants.

### 2.3. Patient selection and diagnostic procedures

Between October 2024 and February 2025, eight patients diagnosed with MIH at the Department of Pediatric Dentistry, School of Dentistry, Çanakkale Onsekiz Mart University, were included in the photographic documentation phase of the study. All clinical evaluations were performed under standardized conditions using the same dental unit, with consistent reflector-based illumination. A flat-surfaced No. 4 mouth mirror was used for intraoral inspection. Hard and soft tissues were initially examined in their natural moist state, and, when necessary, cotton rolls and compressed air were used to dry specific areas to improve the accuracy of visual assessments.

#### 2.3.1. Diagnostic criteria for molar incisor hypomineralization

The diagnostic criteria for MIH in this study were based on the guidelines provided by the European Academy of Paediatric Dentistry (EAPD) [22]. According to these standards, a lesion must have a minimum diameter of 1 mm to be classified as MIH. Any enamel changes smaller than this threshold were excluded. As outlined in the EAPD criteria, MIH may manifest as distinct white, creamy, yellow, or brown demarcated enamel opacities; post-eruptive enamel breakdown; atypical carious lesions; atypical restorations; or tooth loss attributed to MIH [22]. For a confirmed diagnosis, at least one permanent first molar must present with one or more of these features. Although incisor involvement is not a diagnostic requirement, this study included only patients who exhibited clearly visible enamel defects in anterior teeth, in alignment with the primary objective. MIH diagnoses were made by a single pediatric dentist (B.S.) with substantial expertise and academic background in the field. The examiner possesses an established research track record on MIH, including multiple peer-reviewed publications and extensive clinical experience, which ensured consistency and diagnostic reliability throughout the study.

#### 2.3.2. Inclusion and exclusion criteria

Inclusion criteria were as follows: willingness to participate with signed informed consent from both the child/adolescent and their parent; age between 10 and 14 years; a confirmed diagnosis of MIH; the presence of at least one incisor with a demarcated opacity of $\geq$1 mm in diameter; and sufficient cooperation for examination and photography. Exclusion criteria included: insufficient cooperation; ongoing orthodontic treatment or the use of intraoral or extraoral appliances; visible maxillomandibular developmental deformities; a diagnosis of intellectual disability; and the presence of other developmental enamel defects, including fluorosis, amelogenesis imperfecta, enamel hypoplasia, or dental caries.

### 2.4. Image acquisition and editing

Following intraoral examinations of the eight eligible patients, standardized photographic documentation was performed. A frontal smiling photograph was captured using a DSLR full-frame camera (EOS 6D Mark II; Canon, Japan) equipped with a 100 mm macro lens (EF 100mm f/2.8L Macro IS USM; Canon, Japan) and illuminated with dual softbox lighting units (VL400; Visico, China). The original image resolution was set in RAW format at 300 pixels per inch. To reduce the influence of non-dental facial features—such as gender, skin tone, or other individual characteristics—on esthetic judgments, all photographs were cropped to display only the smile region, defined as the area between the tip of the nose and the chin. In the digitally altered versions, the enamel defects in anterior teeth were corrected using Adobe Photoshop CC (Version 25.12.0 for Mac; Adobe Inc., San Jose, CA, USA). The color of the retouched areas was carefully adjusted to match the adjacent unaffected enamel, thereby simulating a naturally healthy appearance.

### 2.5. Survey design and distribution

Two parallel surveys were created using Qualtrics survey software (Qualtrics, Provo, UT, USA). Each survey contained one frontal smiling photograph of each subject—either the original image displaying visible enamel defects in anterior teeth or the digitally modified version in which the enamel defects had been corrected. If a subject's modified smile was included in Survey 1, the corresponding unedited image was included in Survey 2. Subject 5 served as a control and was shown with an unaltered smile in both surveys. The characteristics of the photographs included in each survey are summarized in Table 1, and the original and modified smile images are shown in Fig. 1.

**Table 1**
Image smile characteristics.

| | Survey group | |
|---|---|---|
| Subject | 1 | 2 |
| **1** | with MIH (original) | without MIH (modified) |
| **2** | with MIH (original) | without MIH (modified) |
| **3** | without MIH (modified) | with MIH (original) |
| **4** | without MIH (modified) | with MIH (original) |
| **5*** | with MIH (original) | with MIH (original) |
| **6** | with MIH (original) | without MIH (modified) |
| **7** | without MIH (modified) | with MIH (original) |
| **8** | without MIH (modified) | with MIH (original) |

* Subject 5 with a original smile image with MIH was shown to both groups of evaluators.

MIH: Molar incisor hypomineralization.

### 2.6. Evaluator recruitment, rating procedure and evaluation conditions

A total of 288 evaluators aged between 10 and 14 years participated in the study. They were recruited from two schools located in the city of Çanakkale, Türkiye—one public and one private institution. Each evaluator completed either Survey 1 or Survey 2, which was randomly assigned. Participants were asked to rate the photographs by indicating their agreement or disagreement with the following statements: (1) This person performs well in sports. (2) This person is socially well-liked. (3) This person has leadership qualities. (4) This person is academically successful. All evaluators belonged to the same peer age group as the children depicted in the photographs, and no additional inclusion or exclusion criteria were applied. To avoid potential bias, evaluators were not informed that the study was related to dental appearance.

The images were presented in a randomized sequence and viewed on digital screens from a distance of approximately 60 cm, reflecting a typical face-to-face interaction distance. Evaluators were unaware of any digital modifications and were not permitted to enlarge or zoom in on the images. All assessments were conducted under standardized indoor lighting conditions at midday (12:00 PM), with monitors positioned to prevent direct sunlight exposure. In addition to selecting their level of agreement with the four social domain statements, evaluators also rated each photograph using a visual analog scale (VAS) ranging from 0 (“not at all”) to 100 (“very much”) for each domain, based on their subjective perception. Furthermore, after completing the survey, approximately 20% of participants were asked to provide reasons for the score they assigned to one unedited photograph. Their responses were recorded in full sentences for qualitative analysis. Finally, each evaluator’s age and gender were documented upon survey completion.

### 2.7. Statistical analysis

All statistical analyses were performed using IBM SPSS Statistics (version 29.0, IBM Corp., Armonk, NY, USA). Descriptive statistics, including means and standard deviations, were calculated for each evaluated domain: athletic ability, social competence, leadership potential, and academic performance. Data normality was assessed using skewness and kurtosis values, all of which fell within the acceptable range (−1 to +1), thereby supporting the use of parametric tests. To compare ratings assigned to photographs with versus without MIH-related enamel opacities, independent-sample t-tests were conducted for each of the four social perception domains. A between-subject design was applied by assigning each evaluator to view either the unedited or digitally modified version of each subject’s photograph, depending on the survey they received. Additionally, one identical control photograph was included in both surveys to assess intra-study consistency. To examine the potential influence of evaluator characteristics (age and gender) on rating outcomes, univariate General Linear Models (GLMs) were constructed for each dependent variable. These models included Smile Type (presence vs. absence of MIH-related opacities) and Evaluator Gender as fixed factors, while Evaluator Age was entered as a covariate. Interaction effects between Smile Type × Evaluator Gender and Smile Type × Evaluator Age were also analyzed. GLMs were selected for their flexibility as an extension of traditional analysis of variance (ANOVA), allowing the inclusion of both covariates and interaction terms within a single model. All statistical tests were two-tailed, and statistical significance was set at $p < 0.05$.

## 3. Results

A total of 288 children and adolescents participated in the study, comprising 140 boys and 148 girls, with a mean age of 12.13 ± 0.98 years. The age distribution approximated normality and was evenly balanced between the two survey groups ($p > 0.05$). Although the a priori sample size calculation indicated that a minimum of 130 participants (65 per group) was sufficient, a larger sample was intentionally recruited to improve the precision of estimates, allow subgroup and covariate analyses, and ensure adequate balance across survey versions. All participants evaluated the displayed smile photographs across four psychosocial domains: athletic ability, social competence, leadership potential, and academic performance.

Independent-sample t-tests demonstrated that the digitally altered photographs—where enamel defects in anterior teeth had been corrected—received significantly higher scores across all four evaluated domains compared to the original, unedited versions. Summary statistics for each domain are provided in Table 2. For athletic ability, modified images scored higher ($M = 59.72$, $SE = 0.86$) than unedited ones ($M = 50.94$, $SE = 0.89$), yielding a mean difference of 8.78 (95% CI: 6.37–11.20, $p < 0.001$). Similarly, in the domain of social competence, modified images were rated at 52.62 ($SE = 0.80$) versus 43.78 ($SE = 0.81$) for unedited ones—a difference of 8.84 points (95% CI: 6.61–11.07, $p < 0.001$). Leadership potential was also rated higher for modified images ($M = 64.15$, $SE = 0.84$) than for originals ($M = 56.44$, $SE = 0.86$), with a 7.71-point difference (95% CI: 5.36–10.05, $p < 0.001$). Finally, academic performance scores were significantly greater for edited images ($M = 62.52$, $SE = 0.79$) than for unedited ones ($M = 58.36$, $SE = 0.83$), showing a mean increase of 4.16 (95% CI: 1.90–6.41, $p < 0.001$).

To further explore the influence of evaluator-related variables, univariate GLMs were conducted for each domain. Smile type (presence vs. absence of enamel opacities) and evaluator gender were entered as fixed factors, while evaluator age was included as a covariate. The effects of these subject and evaluator characteristics on image ratings are summarized in Table 3. In the domain of athletic ability, there was no significant main effect of smile type, $F(1, 2010) = 0.046$, $p = 0.830$, nor was there a significant effect of evaluator gender ($p = 0.176$). However, evaluator age had a significant effect, $F(1, 2010) = 15.97$, $p < 0.001$, indicating that perception of athletic ability varied significantly with age. The interaction between smile type and evaluator gender approached statistical significance, $p = 0.069$. In the domain of social competence, smile type did not exert a significant main effect on the ratings ($p = 0.747$), nor did evaluator gender ($p = 0.249$). However, evaluator age continued to significantly influence outcomes, $F(1, 2010) = 12.10$, $p = 0.001$. No significant interaction effects were observed for smile type × gender ($p = 0.301$) or smile type × age ($p = 0.764$). For leadership potential, smile type again showed no significant main effect ($p = 0.624$). In contrast, both evaluator gender and evaluator age significantly affected ratings: $F(1, 2010) = 24.22$, $p < 0.001$ and $F(1, 2010) = 6.46$, $p = 0.011$, respectively. None of the interaction effects reached statistical significance. In the case of academic success, smile type was not a significant predictor ($p = 0.840$). However, both evaluator gender ($F(1, 2010) = 5.87$, $p = 0.016$) and age ($F(1, 2010) = 5.88$, $p = 0.015$) significantly influenced evaluations. The interaction between smile type and evaluator gender approached significance ($p = 0.059$).

In summary, although digitally modified photographs—where enamel opacities were removed—initially received significantly higher

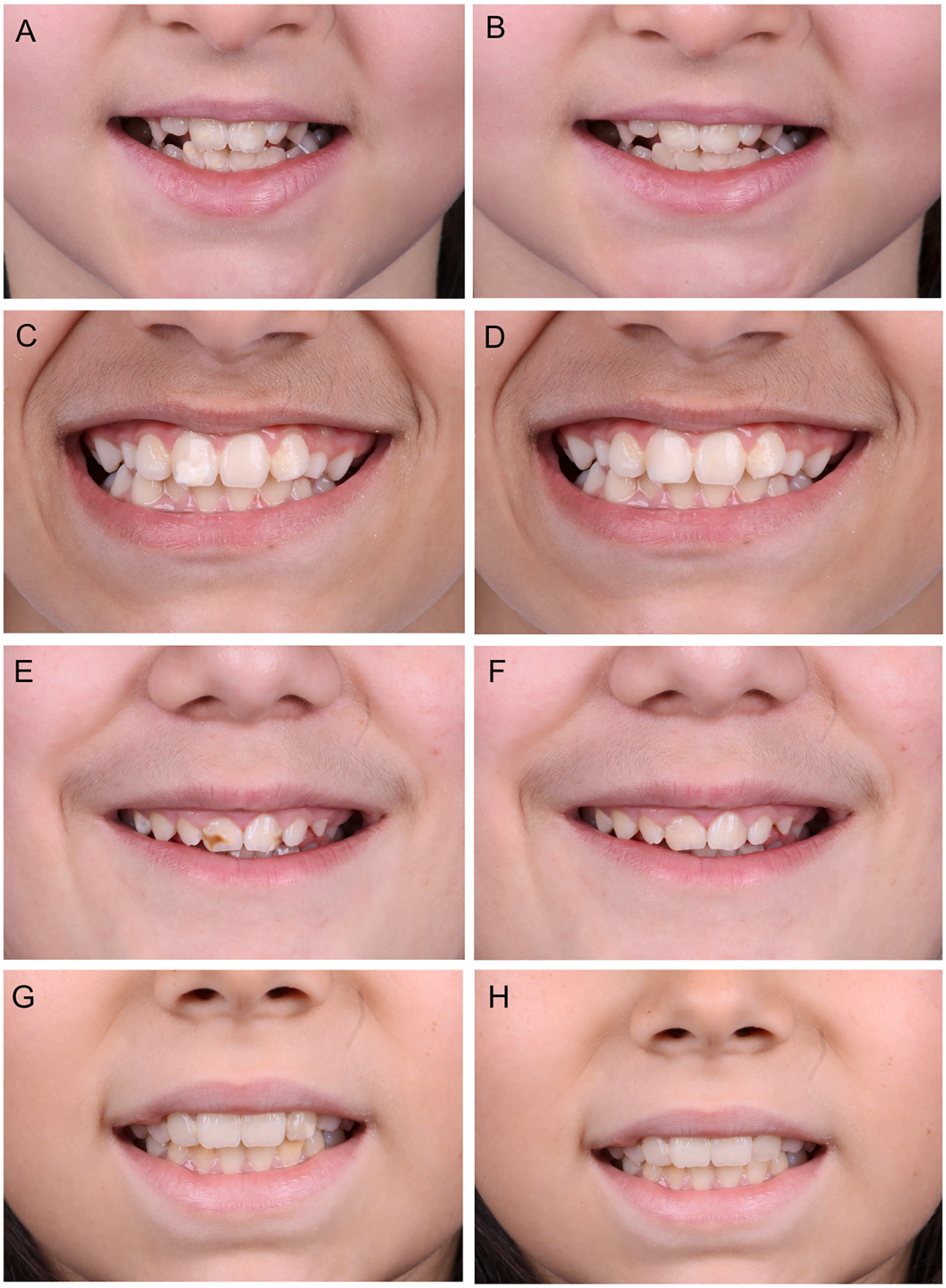



**Fig. 1.** Smile photographs used in the surveys. (A) A 10-year-old female with creamy demarcated opacity on the right maxillary permanent central incisor, white opacity on the left central incisor, and yellow opacities on the right mandibular central and lateral incisors. (B) Digitally edited version of image A with opacities removed. (C) A 13-year-old male with white and yellow opacities on the right maxillary central incisor. (D) Digitally edited version of image C. (E) An 11-year-old male with brown demarcated opacities on both maxillary central incisors. (F) Digitally edited version of image E. (G) A 12-year-old female with creamy demarcated opacity on the left maxillary lateral incisor and brown demarcated opacity on the left mandibular lateral incisor. (H) Digitally edited version of image G. (I, J) Subject 5 was used in both survey forms as an unmodified control. A 13-year-old female with creamy and yellow demarcated opacities on the right and left maxillary central incisors and the right mandibular lateral incisor, and a brown demarcated opacity on the left mandibular central incisor. (K) An 11-year-old female with white demarcated opacities on the maxillary central incisors and a brown demarcated opacity on the right maxillary lateral incisor. (L) Digitally edited version of image K. (M) A 10-year-old male with creamy demarcated opacity accompanied by post-eruptive enamel breakdown on the right maxillary central incisor, white opacity on the left mandibular central incisor, and brown demarcated opacity on the left mandibular lateral incisor. (N) Digitally edited version of image M. (O) A 12-year-old male with white demarcated opacity on the left maxillary central incisor and the right mandibular lateral incisor. (P) Digitally edited version of image O. *(Note: Only one image from each pair was shown to each participant.)*.

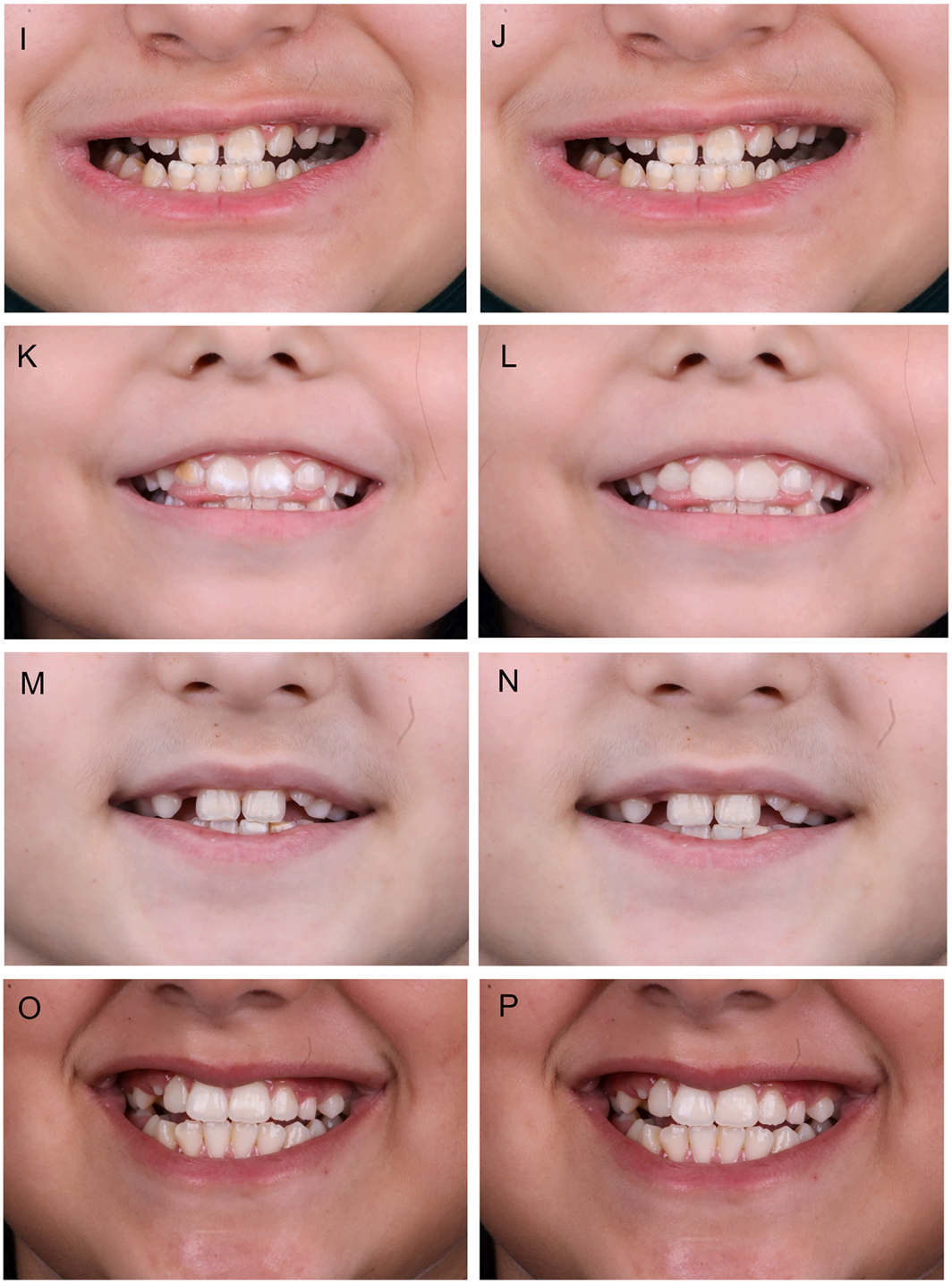



**Fig. 1.** (*continued*).

ratings across all psychosocial domains, these differences were substantially reduced once evaluator age and gender were accounted for in the GLMs. Evaluator age emerged as the most consistent predictor across all four domains, while evaluator gender significantly influenced perceptions of leadership and academic performance. These findings suggest that peer evaluations of dental appearance may be shaped more by the individual characteristics of the observer than by the enamel opacities themselves.

In addition to the quantitative findings, qualitative data were obtained from a randomly selected subset comprising approximately 20% of the evaluators ($n \approx 58$), who were asked to explain the rationale behind their ratings of one of the unedited photographs. Among these respondents, 91% explicitly cited tooth stains or discoloration as the primary reason for their scores. Another 4% mentioned tooth size or shape, while 5% did not provide any specific justification for their evaluations.

## 4. Discussion

This study investigated the impact of demarcated enamel opacities on the anterior teeth of children and adolescents with MIH on peer perceptions across four psychosocial domains: athletic ability, social

**Table 2**
Differences in peer perception scores across four domains between original (with molar incisor hypomineralization) and modified (without molar incisor hypomineralization) images.

| Characteristic | Smile Type | Mean | SE | 95% CI | *p*-value * |
|---|---|---|---|---|---|
| **Athletic Ability** | *with MIH* | 50.94 | 0.886 | | |
| | *without MIH* | 59.72 | 0.857 | | |
| | Difference | 8.78 | 1.23 | [6.37, 11.20] | < **0.001** |
| **Social Competence** | *with MIH* | 43.78 | 0.812 | | |
| | *without MIH* | 52.62 | 0.799 | | |
| | Difference | 8.84 | 1.14 | [6.61, 11.07] | < **0.001** |
| **Leadership Potential** | *with MIH* | 56.44 | 0.856 | | |
| | *without MIH* | 64.15 | 0.835 | | |
| | Difference | 7.71 | 1.20 | [5.36, 10.05] | < **0.001** |
| **Academic Performance** | *with MIH* | 58.36 | 0.830 | | |
| | *without MIH* | 62.52 | 0.793 | | |
| | Difference | 4.16 | 1.15 | [1.90, 6.41] | < **0.001** |

* Independent samples t-test. Bold values mean statistically significant
SE: Standard error; CI: Confidence interval; MIH: Molar incisor hypomineralization.

competence, leadership potential, and academic performance. Digitally modified photographs—where visible enamel defects had been corrected—were consistently rated more favorably than unedited images, indicating that such defects may negatively influence peer perceptions. The null hypothesis—that enamel opacities have no effect on peer perceptions—was therefore rejected.

Previous research has consistently demonstrated that MIH, particularly when it affects anterior teeth, can have a substantial impact on children's self-perception, psychosocial well-being, and overall quality of life. Affected children often experience embarrassment, reluctance to smile, and even social withdrawal due to the visibility of enamel defects [20,21,23]. These concerns extend beyond mere esthetic dissatisfaction, reflecting deeper anxieties about social acceptance and belonging. Evidence indicates that esthetic treatments—such as resin infiltration and minimally invasive restorations—can improve self-image and oral health-related quality of life, underscoring the emotional burden of enamel opacities [15,21,24,25]. However, much of the literature relies on self-reports or parental perspectives, leaving a critical gap in understanding how peers perceive children with MIH. Addressing this gap, our study found that digitally altered images without enamel defects were rated more favorably across multiple social domains, highlighting the external dimension of MIH's psychosocial impact. This shift from the "self" to the "social mirror" invites broader reflection on how visible oral conditions may reinforce implicit social hierarchies among children and adolescents. A smile—commonly viewed as a symbol of innocence and connection—can paradoxically become a source of exclusion when marked by visible irregularities. Accordingly, our findings not only align with previous work on self-perception but also expand the discussion by showing that esthetic dental conditions such as MIH influence peer evaluations of competence, likability, and even leadership potential. This perspective adds an ethical dimension to clinical decision-making, emphasizing that managing esthetic concerns in pediatric dentistry is not merely a cosmetic intervention but a psychosocial necessity.

Beyond MIH, multiple studies have shown that visible dental anomalies—such as malocclusion, anterior tooth fractures, discoloration, and avulsion—can significantly influence how children and adolescents are perceived by their peers. Those with dental esthetic impairments are often rated less favorably in intelligence, sociability, leadership, and athletic potential [14,26–28]. For instance, digitally modified images have demonstrated that dental misalignment consistently leads to negative social judgments among adolescents, setting a methodological precedent for the present study [14]. Similarly, avulsed or fractured anterior teeth have been linked to especially negative peer evaluations—particularly from older children and females—underscoring the role of both the type and the visibility of trauma [27]. Adolescents have also been found to be more self-critical and socially aware of anterior esthetic defects than their parents [28]. Such perceptions can have tangible consequences: over half of surveyed children in one study reported reduced popularity due to dental esthetics, with many also facing ridicule or bullying—especially girls and those from families with lower paternal education levels [29]. Additional evidence confirms that visible dental irregularities often lead to social stigma, exclusion from peer groups, and diminished confidence in leadership or academic settings [30–32]. Our findings align with this broader literature, indicating that even enamel-based anomalies such as MIH-related opacities can elicit measurable differences in peer evaluations. Viewed through the lens of developmental psychology and social cognition theories, these results suggest that children rely heavily on visible facial cues—especially smiles—when forming social hierarchies. Thus, the social burden of dental anomalies encompasses both self- and peer perception, reinforcing the ethical imperative to consider esthetic interventions as a core component of pediatric dental care.

Among the four evaluated domains—athletic ability, social competence, leadership potential, and academic performance—the most pronounced differences were in social acceptance and leadership. These results indicate that even minor enamel defects can influence perceptions of likability and leadership, traits closely tied to confidence and social integration. While differences appeared across all domains, the smaller variation in academic scores suggests a stronger link between dental appearance and social traits rather than cognitive ability. Higher ratings for digitally modified images without opacities highlight the role of esthetic harmony in peer judgments, particularly during developmental stages where appearance strongly shapes social impressions. Supporting this, over 90% of negative comments cited tooth color,

**Table 3**
Effects of subject and evaluator characteristics on image rating scores.

| | Characteristic | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Athletic Ability | | Social Competence | | Leadership Potential | | Academic Performance | |
| Predictor Variable | F (df1, df2) | *p*-value * | F (df1, df2) | *p*-value * | F (df1, df2) | *p*-value * | F (df1, df2) | *p*-value * |
| **Smile Type** | F(1, 2010) = 0.046 | 0.830 | F(1, 2010) = 0.104 | 0.747 | F(1, 2010) = 0.241 | 0.624 | F(1, 2010) = 0.041 | 0.840 |
| **Evaluator Gender** | F(1, 2010) = 1.834 | 0.176 | F(1, 2010) = 1.331 | 0.249 | F(1, 2010) = 24.222 | **< 0.001** | F(1, 2010) = 5.868 | **0.016** |
| **Evaluator Age** | F(1, 2010) = 15.967 | **< 0.001** | F(1, 2010) = 12.101 | **0.001** | F(1, 2010) = 06.463 | **0.011** | F(1, 2010) = 5.882 | **0.015** |
| **Smile Type × Evaluator Gender** | F(1, 2010) = 3.316 | 0.069 | F(1, 2010) = 1.069 | 0.301 | F(1, 2010) = 0.059 | 0.809 | F(1, 2010) = 3.565 | 0.059 |
| **Smile Type × Evaluator Age** | F(1, 2010) = 0.127 | 0.722 | F(1, 2010) = 0.090 | 0.764 | F(1, 2010) = 0.000 | 0.984 | F(1, 2010) = 0.240 | 0.624 |

* General Linear Model (GLM). All models were statistically significant at the $p < 0.001$ level. Bold values mean statistically significant.
F: Fisher's F-statistic; df: degrees of freedom.

underscoring children's awareness of dental esthetics and its impact on peer evaluations. Overall, these findings reveal how even subtle enamel alterations can affect social perception, peer relationships, and self-worth.

A novel aspect of this study is the finding that peer perception of MIH-related enamel defects is shaped not only by the presence of the anomaly but also by evaluator characteristics, particularly age and gender. GLM analysis showed that female participants consistently rated images with enamel opacities lower than males, reflecting greater esthetic sensitivity. This aligns with studies reporting that girls are more likely to experience appearance-related teasing [29] and to be more critical of anterior dental trauma [27]. Age also moderated perceptions, with older children showing greater differentiation between MIH and non-MIH images, consistent with evidence that appearance-based judgments become more pronounced with age due to cognitive and social development [26]. These findings indicate that peer perception is dynamic, influenced by developmental and sociocultural factors, and that managing esthetic concerns requires addressing both the physical anomaly and its potential social impact.

MIH-related enamel opacities may appear clinically mild, yet their psychosocial impact can be profound, especially in contexts where appearance is decisive. During childhood and adolescence—when identity is still forming and peer acceptance is critical—even minor esthetic deviations can lead to social exclusion or reduced self-esteem. While a smile is often idealized as a symbol of joy, deviations from socially accepted norms can turn it into a source of anxiety. Our findings emphasize dentists' ethical responsibility to recognize the psychosocial burden of esthetic irregularities that might appear clinically insignificant. Correcting—or even acknowledging—visible anomalies can be a crucial step toward social acceptance, self-confidence, and emotional resilience in children. This calls for a shift from treating teeth in isolation to addressing the child holistically, within the context of social and emotional development. Ultimately, this study challenges us to rethink how we define dental "need"—not solely in terms of decay or pain, but in terms of dignity, participation, and the silent currency of peer acceptance.

This study has several limitations that warrant consideration. First, although the facial images were digitally standardized to isolate the smile and minimize the influence of other facial features, this methodological simplification may have compromised ecological validity by eliminating the contextual richness of real-life social interactions. Furthermore, while enamel opacities were the primary variable, coexisting orthodontic anomalies—such as malalignment or spacing—were not fully controlled for, which could have influenced peer evaluations. Additionally, the study relied on still photographs rather than videos or face-to-face interactions, thereby limiting the generalizability of the findings to dynamic and authentic social settings. Despite these limitations, the study exhibits several noteworthy strengths. The evaluator sample included children aged 10 to 14 years—a developmental period characterized by heightened sensitivity to appearance—and was drawn from both public and private schools, thereby enhancing the demographic and socioeconomic diversity of the sample. To our knowledge, this is the first study to investigate the social perception of MIH-related enamel defects through peer evaluation using a controlled image-based design. The methodological decision to isolate only the smiling region of the face helped reduce confounding visual cues, ensuring that evaluators' attention was focused specifically on dental appearance. Future research should aim to control for coexisting dental features such as malocclusion more rigorously, explore real-time peer interactions through video-based or in-person simulations, and investigate longitudinal changes in perception following esthetic dental treatment. Expanding the cultural and socioeconomic diversity of participants would also help determine whether the observed patterns of dental esthetic evaluation are universal or culturally dependent in childhood peer dynamics.

## 5. Conclusions

This study demonstrated that the presence of enamel defects in anterior teeth, characteristic of molar incisor hypomineralization, significantly influences peer perceptions of children across psychosocial domains such as athletic ability, social competence, leadership potential, and academic performance. While digitally modified images received more favorable ratings in all domains, deeper analysis revealed that these judgments were not solely driven by dental appearance but were also significantly moderated by the evaluators' age and gender. Older children and female participants displayed greater sensitivity to esthetic differences. These findings highlight the importance of addressing both the clinical appearance and the associated psychosocial consequences of molar incisor hypomineralization within pediatric dental care.

## Data availability statement

The data that support the findings of this study are available from the corresponding author (B.S.) upon reasonable request.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

## Ethics approval statement

This cross-sectional cohort study was ethically approved by the Non-Interventional Clinical Research Ethics Committee of Çanakkale Onsekiz Mart University (Decision No. 2024/06-05). All procedures were conducted in accordance with the ethical principles and obligations outlined in the Declaration of Helsinki.

## Informed consent

Detailed information about the study was provided to the children and adolescents whose photographs were used, as well as to the children and adolescents serving as evaluators, along with their parents. Written informed consent was obtained from all participants and their legal guardians. Participation was entirely voluntary.

## CRediT authorship contribution statement

**Berkant Sezer:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Zeynep Sude Akbaş:** Software, Methodology, Investigation, Data curation, Conceptualization. **Asena Tuğçe Kara:** Software, Methodology, Investigation, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare that they have no conflict of interest related to this study.

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