International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

2734 17 Avenue SW,
Calgary, Alberta, T3E0A7,
Canada
+15878858911
editorial-office@sciformat.ca

ARTICLE TITLE	THE IMPACT OF DEVELOPMENTAL ENAMEL DEFECTS ON QUALITY OF LIFE AND PSYCHOSOCIAL ASPECTS IN MINOR PATIENTS WITH MIH, AMELOGENESIS IMPERFECTA, AND DENTAL FLUOROSIS
DOI	https://doi.org/10.31435/ijitss.3(51).2026.5850
RECEIVED	14 April 2026
ACCEPTED	22 July 2026
PUBLISHED	07 August 2026
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

THE IMPACT OF DEVELOPMENTAL ENAMEL DEFECTS ON QUALITY OF LIFE AND PSYCHOSOCIAL ASPECTS IN MINOR PATIENTS WITH MIH, AMELOGENESIS IMPERFECTA, AND DENTAL FLUOROSIS

Monika Maria Szerszeń *(Corresponding Author, Email: monikamszerszen@gmail.com)*
Independent Researcher, Warsaw, Poland
ORCID ID: 0009-0005-3145-8326

Maria Torchalska
Medical Center of Medical University of Warsaw, Warsaw, Poland
ORCID ID: 0009-0006-5175-6053

Martyna Smogór
Independent Researcher, Warsaw, Poland
ORCID ID: 0009-0002-6473-9472

ABSTRACT

Developmental enamel defects (DEDs) constitute a clinically significant group of conditions with multifactorial etiology. Beyond their structural and functional consequences — including dentinal hypersensitivity, increased susceptibility to caries, and mechanical fragility — developmental enamel defects significantly reduce oral health-related quality of life (OHRQoL) in the pediatric population.

The aim of this literature review was to characterize three distinct developmental enamel defects — molar-incisor hypomineralization (MIH), dental fluorosis, and amelogenesis imperfecta (AI) — and to evaluate their impact on OHRQoL in minor patients.

Between March and May 2026, the PubMed and Google Scholar databases were searched, with inclusion limited to English-language publications.

All three conditions were associated with reduced OHRQoL through aesthetic compromise, diminished self-esteem, and social avoidance. In MIH, patients face difficulties achieving effective anesthesia and demonstrate a pronounced tendency toward carious lesions. Fluorosis negatively affects self-perception among those affected. AI is associated with psychological distress and social withdrawal. Prosthetic rehabilitation and aesthetic treatment improve OHRQoL in patients with developmental enamel defects. Aesthetic dental treatment in this group should be regarded as a preventive intervention against depression and social exclusion, rather than merely a cosmetic procedure.

KEYWORDS

Developmental Enamel Defects, MIH, Fluorosis, Amelogenesis Imperfecta, OHRQoL, Pediatric Dentistry

CITATION

Monika Maria Szerszeń, Maria Torchalska, Martyna Smogór. (2026) The Impact of Developmental Enamel Defects on Quality of Life and Psychosocial Aspects in Minor Patients with MIH, Amelogenesis Imperfecta, and Dental Fluorosis. *International Journal of Innovative Technologies in Social Science*. 3(51). doi: 10.31435/ijitss.3(51).2026.5850

Introduction

Developmental enamel defects represent a serious health concern that reduces quality of life. The prevalence of defects among children varies by region; in the case of molar-incisor hypomineralization (MIH) it may reach 15.6%, enamel hypoplasia 4.5%, and fluorosis 18.5% [1]. Enamel abnormalities may be caused by multiple interacting factors, ranging from environmental influences to systemic diseases and genetic disorders. Developmental enamel changes may present as hypoplasia or foci of disrupted mineralization, manifesting as alterations in crown morphology, tissue discoloration, and compromised aesthetics. These visible changes co-occur with hypersensitivity, increased susceptibility to dental caries, erosive lesions, and pathological tooth wear [2]. Enamel defects may also affect the psychological well-being of those afflicted.

Research indicates that dentition and its aesthetics influence not only facial attractiveness but also a person's perceived social and intellectual appeal [3]. With advances in dentistry and treatment quality, an important aspect of oral health is not merely the condition of the dentition per se, but also dental aesthetics [4]. It appears that in contemporary practice, the appearance of teeth is a matter of considerable importance to both patients and dental clinicians. Oral health-related quality of life is multidimensional; the four most important aspects currently identified as defining orofacial appearance are orofacial pain, oral function, psychosocial impact, and appearance [5].

The aim of this study is to characterize three types of developmental enamel defects (molar-incisor hypomineralization, fluorosis, and amelogenesis imperfecta) and to present their psychosocial effects and impact on quality of life in minor patients.

Materials and Methods

Relevant scientific publications were identified and retrieved from the PubMed and Google Scholar databases. The literature review was conducted using the following search terms: oral health-related quality of life (OHRQoL), developmental enamel defects, MIH, fluorosis, and amelogenesis imperfecta. Articles in languages other than English were excluded, with the exception of selected excerpts from the chapter "Developmental Abnormalities of Enamel and Dentin" from the textbook edited by Dorota Olczak-Kowalczyk „Kompendium stomatologii wieku rozwojowego” Otwock 2023. Searching and review were conducted between March and May 2026.

Results

MIH

The term "molar-incisor hypomineralization" was first introduced in 2001. It describes a condition of systemic origin that manifests as a developmental enamel disturbance affecting one to four permanent first molars, frequently associated with the incisors [6]. The causative factors are highly diverse; some studies indicate that they may act during the perinatal or postnatal period, and include infections, childhood illnesses, febrile episodes, and antibiotic use at a young age [7]. The enamel of affected teeth exhibits quantitative or qualitative defects, or a combination thereof. The color of lesions may range from creamy-white defects with diffuse margins to yellow-brown defects with sharply demarcated borders [6]. Over the past decade, the number of studies on MIH has increased substantially, enabling more refined prevalence estimates [9]. In 2003, Weerheim and Mejare reported MIH prevalence ranging from 3% to 25% [10]. According to the 2018 systematic review by Dave and Taylor, the overall global prevalence of MIH is 14.2% [11]. Schwendicke et al., in their 2018 review, demonstrated that the global burden of MIH is 13.1%, affecting approximately 878 million people, with 17.5 million new cases recorded annually, of which 27.4% require treatment for pain and hypersensitivity [12]. Teeth with hypomineralized tissues are susceptible to atypical carious lesions, post-eruptive enamel breakdown, reduced resin bond strength in restorations, and aesthetic problems [13]. Studies also report difficulties including pulp inflammation and the necessity for premature tooth extraction [14]. All of these complications may necessitate repeated dental treatment. Furthermore, there is a well-documented problem with achieving effective anesthesia in MIH-affected teeth [15], which considerably increases the burden of dental treatment and reduces quality of life.

İpek and Bolanka, in a 2025 study [16], reported a correlation between MIH and dental treatment-related fear and anxiety. A statistically significant association was also observed between MIH and a higher prevalence of dental caries, corroborating the problem of frequent dental treatment in MIH patients.

Dentas-Neta, Moura et al. [17] emphasized that school-age children with severe MIH demonstrated lower oral health-related quality of life and greater functional limitations than children without MIH. This is consistent with the fact that MIH can cause aesthetic alterations in the oral cavity, dental pain, and halitosis,

and may impair food intake (due to hypersensitivity, mastication difficulties, and problems with biting) as well as the consumption of hot and cold beverages.

Children with MIH may present with malocclusion, which produces aesthetic disturbances in the oral cavity and negatively affects patients' self-esteem, as such conditions provoke adverse social reactions among adolescents [18].

Michealis et al. [19] conducted a study comparing the impact of dental caries and MIH on children's oral health and quality of life. They examined 528 children aged 7–10 years and concluded that both conditions exert a serious impact on patients' health and well-being, with symptom severity and discomfort increasing with disease progression in both groups. The authors noted that it cannot be unequivocally stated that MIH represents a more serious problem than caries. However, they clearly observed that MIH patients had three times more affected anterior teeth than caries patients, and that children in the MIH group more frequently demonstrated poorer emotional and social well-being indices — suggesting that the unaesthetic appearance of anterior teeth may lead to deterioration of mood, particularly when it attracts the attention of others.

Fluorosis

Dental fluorosis is a developmental enamel defect caused by excessive fluoride exposure during tooth development. The most commonly cited threshold dose is 0.1 mg/kg body weight per day, although the precise toxic dose remains unknown, as the condition may occur at lower intake levels [20]. This disorder affects both the aesthetics and function of teeth, and is most prevalent among individuals who reside in areas with elevated fluoride concentrations in drinking water during early childhood [21]. Additional predisposing factors include high altitude of the area in which fluoridated water is consumed [22] and renal disease leading to a reduced glomerular filtration rate [23].

Aesthetic changes in the permanent dentition most commonly appear in children who experienced excessive fluoride exposure between 20 and 30 months of age. It should be noted that the period of greatest susceptibility to fluoride excess occurs between 1 and 4 years of age, whereas risk is no longer present by the age of 8 years [24].

Fluorosis manifests as white or yellow changes on the tooth surface [25], which may take various forms: mottled enamel, brown or yellow discoloration, surface pitting, and thin horizontal striations that may involve all tooth surfaces and extend into dentin [26]. The severity of fluorosis depends on the duration and timing of excessive fluoride exposure, the patient's body weight, physical activity during the exposure period, nutritional factors, and bone growth rate — suggesting that the same fluoride dose may produce varying degrees of fluorosis in different patients [27].

The smile is recognized as an important element of facial and dental aesthetics. Among adolescents, the smile exerts a significant influence on self-esteem and well-being [28].

Marhman et al. [29] reported that enamel defects per se do not cause diminished self-esteem. However, they emphasize that these changes substantially affect individuals whose self-evaluation is primarily appearance-based and who depend on external acceptance.

Molina-Frechero et al., in a 2017 article [30], concluded that fluorosis-induced enamel changes affect adolescents and their interpersonal relationships, owing to the unaesthetic appearance of the teeth — particularly during smiling. The authors also highlighted the issue of health inequity, as individuals with limited financial resources do not consider aesthetic treatment, thereby remaining unable to alleviate the anxiety associated with unattractive dental appearance.

García-Pérez et al., in a 2017 study [31], observed a negative impact of both dental caries and fluorosis on quality of life in children aged 8–12 years. They further emphasized that in order to develop effective prevention and health promotion programs, the impaired quality of life of children affected by caries and fluorosis must be acknowledged, and timely dental treatment must be incorporated into official guidelines.

Dental appearance can influence how individuals are perceived by others. Siddiq et al., in a 2020 study [32], examined the perceptions of children with visible fluorosis held by their peers in a group aged 12–15 years. The study's conclusions highlighted that children themselves believed fluorosis could negatively affect their appearance, and that peers without fluorosis evaluated those with the condition unfavorably on the basis of appearance.

Amelogenesis Imperfecta

Amelogenesis imperfecta (AI), also known as hereditary enamel fragility, is a group of heterogeneous developmental disorders affecting amelogenesis (the process of enamel formation) in both primary and permanent dentitions. It is inherited in an X-linked manner or as an autosomal dominant or recessive trait, and may co-occur with changes in other tissues of ectodermal origin. The clinical presentation is heterogeneous and depends on the phenotype of the observed enamel defect [20]. Prevalence ranges from 1:14,000 [33] to 1:700 [34].

According to Witkop (1988), four main types of amelogenesis imperfecta are distinguished: Type I hypoplastic, Type II hypomaturation, Type III hypocalcification, and Type IV hypomaturation combined with hypoplasia and taurodontism [20], [35], [36].

Each type has characteristic features. Type I: crowns may be reduced in size, enamel is thin, smooth or pitted, with chalky, yellow, or brown discoloration, and a tendency toward open bite. Type II presents with enamel of normal thickness but rough, "bleached" chalky surfaces and minor yellow discoloration; hypersensitivity to stimuli and susceptibility to mechanical damage are observed, with frequent open bite. Type III is characterized by rough, soft enamel with discoloration and a predisposition to calculus deposition. Type IV combines features of Types I and II along with taurodontism. Different types of amelogenesis imperfecta may occur in the same patient on different teeth [20], [37].

Table 1. Comparison of the main features of the four types of amelogenesis imperfecta

	I hipoplastic form	**II hypomaturation form**	**III hypocalcificativon form**	**IV hypomaturation and hypo plastic form with taurodontism**
Shape of tooth crowns	Smaller than normal	Correct size	Correct size	As in I or II
Enamel thickness	Thinner	Correct thickness	Correct thickness	As in I or II
Color of discoloration	Chalk wite, yellow, brown	„Bleached” surfaces	Yellow, brown	As in I or II
Enamel structure	Smooth or with recesses	Rough	Rough, smooth	As in I or II
Additional characteristics	Open bite	Open bite	Increased calculus deposition	Taurodontism

Cases of co-occurring systemic disorders have been reported, including delayed skeletal and dental maturation [38]; one study even described a correlation between the hypoplastic form of amelogenesis imperfecta and nephrocalcinosis [39].

The appearance of AI-affected teeth deviates markedly from accepted norms. Individuals with this disorder may face difficulties not only with dental appearance — owing to enamel chipping, crown discoloration, and the tendency toward tooth breakdown and attrition — but also with orthodontic anomalies, impaired masticatory function, gingivitis, hypersensitivity, and pain. This ultimately leads to social withdrawal and reduced quality of life.

It should be noted that the condition of such teeth is sufficiently severe that full-ceramic crowns, rather than composite restorations alone, represent the most durable long-term solution [40]. AI has been shown to lead to greater social avoidance and anxiety in affected patients compared to unaffected individuals [41].

Lundgren et al. [42] analyzed oral health-related quality of life in adolescents and young adults before and two years after early prosthetic treatment with full-ceramic crowns. Patients with amelogenesis imperfecta completed quality of life questionnaires; the OHIP-14 instrument was used to assess the impact of oral health

on quality of life. Results demonstrated that young people with AI had markedly reduced quality of life prior to treatment, which improved substantially two years after therapy.

Coffield et al. in 2005 [43] tested the hypothesis that AI is associated with negative psychosocial outcomes. Using a questionnaire addressing demographic data, dental treatment history, and psychometric scales, they compared two patient groups: one with AI and one without. The AI group demonstrated higher rates of social avoidance and psychological tension, as well as greater levels of oral health-related discomfort, dysfunction, and handicap. Additionally, a correlation was observed between age and the impact of negative evaluation on self-esteem: younger patients with AI tended to exhibit lower self-esteem than older patients.

Discussion

Oral health-related quality of life is of considerable importance in clinical practice. It encompasses subjective assessment of oral health, functional and emotional well-being, treatment expectations and satisfaction, and overall sense of well-being [44]. For each of the developmental enamel defects discussed above, the conditions were found to impair quality of life due to the visibly atypical dental appearance and associated aesthetic concerns — in MIH [18], fluorosis [28], and amelogenesis imperfecta [42].

In individuals with enamel defects, difficulties with self-esteem and social acceptance are frequently highlighted as components of reduced quality of life. Physical appearance exerts a significant psychological and social influence on a substantial proportion of the population. The oral cavity and teeth are recognized as playing an essential role in both verbal and non-verbal communication, constituting an important element of social interaction [30]. In MIH, this was particularly relevant in the context of peer group belonging among adolescents [19]. Opacities and enamel staining, by producing aesthetic abnormalities, negatively affected self-esteem and social interaction [45]. In the case of fluorosis, the unaesthetic appearance of the teeth — from the patients' own perspective — had an adverse effect on interpersonal relationships [30]. Furthermore, individuals without fluorosis themselves rated peers with fluorosis more negatively on the basis of appearance [32].

Regarding amelogenesis imperfecta, affected individuals demonstrated greater social avoidance than healthy counterparts and suffered from diminished self-esteem due to the unaesthetic appearance of their teeth [43].

Discomfort arising from factors other than aesthetics was particularly evident in MIH, where pronounced daily hypersensitivity and difficulties in achieving adequate anesthesia during dental treatment represent major concerns in the majority of cases [6], [15]. In AI-affected teeth, hypersensitivity may or may not be present [37], whereas in fluorosis, hypersensitivity is common among those affected, though its intensity does not correlate with fluorosis severity [46].

In scientific studies and systematic reviews, authors have drawn attention to the correlation between enamel defects and caries prevalence in MIH patients [16]. Regarding AI, studies do not clearly establish a relationship between this condition and caries prevalence; instead, they highlight susceptibility to mechanical crown damage, which may subsequently necessitate reconstructive treatment analogous to that required for caries [40]. In the case of fluorosis, the relationship is the inverse of that observed in MIH: excess fluoride disrupts enamel mineralization, yet studies do not demonstrate that higher fluoride intake is associated with reduced caries risk [47].

An important factor with secondary implications for quality of life is dental treatment-related fear. Jälevik et al. [48], in a 2022 systematic review, noted that while studies on the impact of MIH on quality of life are relatively abundant, only a single study unequivocally addressed dental treatment fear specifically. The authors highlighted that the majority of research on this topic has been conducted from the clinician's rather than the patient's perspective, and that further patient-centered research involving individuals with enamel defects is warranted. In AI patients, the prosthetic treatment process involving ceramic crowns did not result in increased dental anxiety [42].

Appelstrand et al., in a 2022 review [49], reported that dental fear was addressed in only one study included in the review, and its findings did not indicate a significant correlation between dental treatment fear and the presence of AI. Reviews addressing fluorosis lack information on dental fear directly attributable to this specific enamel defect in the studied patients.

Conclusions

Dental and oral health is an aspect that profoundly influences quality of life. This review identified that smile aesthetics decisively impacts life comfort. For each developmental enamel defect examined, the distinctive appearance of the teeth had a negative effect on self-esteem and concerns about peer group belonging, resulting in the social marginalization of affected individuals due to their differentiated appearance.

Quality of life was also affected by symptoms accompanying the defects: hypersensitivity and difficulties in achieving adequate anesthesia, which were associated with daily discomfort and pain during dental treatment. The tendency toward carious lesions and susceptibility to mechanical tooth damage — necessitating restorative dental treatment — were responsible for frequent dental visits and the requirement for invasive intervention.

The cases cited provide evidence that aesthetic dental treatment in MIH, fluorosis, and amelogenesis imperfecta may serve as a significant element in preventing diminished self-esteem. The importance of such treatment among young patients deserves emphasis. It should be underscored that the goal of aesthetic treatment is not merely to improve the appearance of the smile per se, but primarily to prevent poor psychological well-being, depressive states, feelings of alienation, and lack of peer acceptance within the pediatric population.

REFERENCES

1. Lopes, C. M. M. T., Falcão, L. J. S., Lemos, L. M., Costa, L. L., & Santos, P. B. (2026). Prevalence of developmental defects of enamel in Brazil: A systematic review and meta-analysis. *European Archives of Paediatric Dentistry*. Advance online publication. https://doi.org/10.1007/s40368-026-01193-z
2. Seow, W. K. (2014). Developmental defects of enamel and dentine: Challenges for basic science research and clinical management. *Australian Dental Journal, 59*(Suppl. 1), 143–154. https://doi.org/10.1111/adj.12104
3. Papio, M. A., Fields, H. W., Jr., Beck, F. M., Firestone, A. R., & Rosenstiel, S. F. (2019). The effect of dental and background facial attractiveness on facial attractiveness and perceived integrity and social and intellectual qualities. *American Journal of Orthodontics and Dentofacial Orthopedics, 156*(4), 464–474.e1. https://doi.org/10.1016/j.ajodo.2018.10.021
4. Larsson, P., Bondemark, L., & Häggman-Henrikson, B. (2021). The impact of oro-facial appearance on oral health-related quality of life: A systematic review. *Journal of Oral Rehabilitation, 48*(3), 271–281. https://doi.org/10.1111/joor.12965
5. John, M. T., Hujoel, P., Miglioretti, D. L., LeResche, L., Koepsell, T. D., & Micheelis, W. (2004). Dimensions of oral-health-related quality of life. *Journal of Dental Research, 83*(12), 956–960. https://doi.org/10.1177/154405910408301213
6. Inchingolo, A. M., Inchingolo, A. D., Viapiano, F., Ciocia, A. M., Ferrara, I., Netti, A., Dipalma, G., Palermo, A., & Inchingolo, F. (2023). Treatment approaches to molar incisor hypomineralization: A systematic review. *Journal of Clinical Medicine, 12*(22), 7194. https://doi.org/10.3390/jcm12227194
7. Dulla, J. A., & Meyer-Lueckel, H. (2021). Molar-incisor hypomineralisation: Narrative review on etiology, epidemiology, diagnostics and treatment decision. *Swiss Dental Journal, 131*(11), 886–895. https://doi.org/10.61872/sdj-2021-11-763
8. Guerra, F., Mazur, M., Corridore, D., Pasqualotto, D., Nardi, G. M., & Ottolenghi, L. (2015). Evaluation of the esthetic properties of developmental defects of enamel: A spectrophotometric clinical study. *The Scientific World Journal, 2015*, 878235. https://doi.org/10.1155/2015/878235
9. Lygidakis, N. A., Garot, E., Somani, C., Taylor, G. D., Rouas, P., & Wong, F. S. L. (2022). Best clinical practice guidance for clinicians dealing with children presenting with molar-incisor-hypomineralisation (MIH): An updated European Academy of Paediatric Dentistry policy document. *European Archives of Paediatric Dentistry, 23*(1), 3–21. https://doi.org/10.1007/s40368-021-00668-5
10. Weerheijm, K. L., & Mejàre, I. (2003). Molar incisor hypomineralization: A questionnaire inventory of its occurrence in member countries of the European Academy of Paediatric Dentistry (EAPD). *International Journal of Paediatric Dentistry, 13*(6), 411–416. https://doi.org/10.1046/j.1365-263x.2003.00498.x
11. Dave, M., & Taylor, G. (2018). Global prevalence of molar incisor hypomineralisation. *Evidence-Based Dentistry, 19*(3), 78–79. https://doi.org/10.1038/sj.ebd.6401324
12. Schwendicke, F., Elhennawy, K., Reda, S., Bekes, K., Manton, D. J., & Krois, J. (2018). Global burden of molar incisor hypomineralization. *Journal of Dentistry, 68*, 10–18. https://doi.org/10.1016/j.jdent.2017.12.002
13. Garot, E., Denis, A., Delbos, Y., Manton, D., Silva, M., & Rouas, P. (2018). Are hypomineralised lesions on second primary molars (HSPM) a predictive sign of molar incisor hypomineralisation (MIH)? A systematic review and a meta-analysis. *Journal of Dentistry, 72*, 8–13. https://doi.org/10.1016/j.jdent.2018.03.005
14. Altan, H., & Yilmaz, R. E. (2023). Clinical evaluation of resin infiltration treatment masking effect on hypomineralised enamel surfaces. *BMC Oral Health, 23*(1), 444. https://doi.org/10.1186/s12903-023-03140-6
15. Somani, C., Taylor, G. D., Garot, E., Rouas, P., Lygidakis, N. A., & Wong, F. S. L. (2022). An update of treatment modalities in children and adolescents with teeth affected by molar incisor hypomineralisation (MIH): A systematic review. *European Archives of Paediatric Dentistry, 23*(1), 39–64. https://doi.org/10.1007/s40368-021-00635-0

16. Özbey İpek, H., & Bolaca, A. (2025). Evaluation of dental fear and dental caries in pediatric patients with molar incisor hypomineralization. *Oral Health & Preventive Dentistry, 23*, 629–634. https://doi.org/10.3290/j.ohpd.c_2316
17. Dantas-Neta, N. B., Moura, L. F., Cruz, P. F., Moura, M. S., Paiva, S. M., Martins, C. C., & Lima, M. D. (2016). Impact of molar-incisor hypomineralization on oral health-related quality of life in schoolchildren. *Brazilian Oral Research, 30*(1), e117. https://doi.org/10.1590/1807-3107BOR-2016.vol30.0117
18. Sardenberg, F., Martins, M. T., Bendo, C. B., Pordeus, I. A., Paiva, S. M., Auad, S. M., & Vale, M. P. (2013). Malocclusion and oral health-related quality of life in Brazilian school children. *The Angle Orthodontist, 83*(1), 83–89. https://doi.org/10.2319/010912-20.1
19. Michaelis, L., Ebel, M., Bekes, K., Klode, C., & Hirsch, C. (2021). Influence of caries and molar incisor hypomineralization on oral health-related quality of life in children. *Clinical Oral Investigations, 25*(9), 5205–5216. https://doi.org/10.1007/s00784-021-03828-5
20. Olczak-Kowalczyk, D., et al. (2023). *Kompendium stomatologii wieku rozwojowego* (pp. 112–115). Med Tour Press.
21. DenBesten, P. K. (1999). Biological mechanisms of dental fluorosis relevant to the use of fluoride supplements. *Community Dentistry and Oral Epidemiology, 27*(1), 41–47. https://doi.org/10.1111/j.1600-0528.1999.tb01990.x
22. Akosu, T. J., & Zoakah, A. I. (2008). Risk factors associated with dental fluorosis in Central Plateau State, Nigeria. *Community Dentistry and Oral Epidemiology, 36*(2), 144–148. https://doi.org/10.1111/j.1600-0528.2007.00387.x
23. Khan, D., Mattia, A., Wang, Z., & Malin, A. J. (2025). Urinary fluoride and dental fluorosis in relation to kidney and liver function in adolescents and young adults in the United States. *Environmental Health, 24*(1), 85. https://doi.org/10.1186/s12940-025-01235-x
24. Abanto Alvarez, J., Rezende, K. M., Marocho, S. M., Alves, F. B., Celiberti, P., & Ciamponi, A. L. (2009). Dental fluorosis: Exposure, prevention and management. *Medicina Oral, Patología Oral y Cirugía Bucal, 14*(2), E103–E107. http://www.medicinaoral.com/pubmed/medoralv14_i2_pE103.pdf
25. Aoba, T., & Fejerskov, O. (2002). Dental fluorosis: Chemistry and biology. *Critical Reviews in Oral Biology and Medicine, 13*(2), 155–170. https://doi.org/10.1177/154411130201300206
26. Zotti, F., Albertini, L., Tomizioli, N., Capocasale, G., & Albanese, M. (2020). Resin infiltration in dental fluorosis treatment—1-year follow-up. *Medicina, 57*(1), 22. https://doi.org/10.3390/medicina57010022
27. Den Besten, P. K. (1994). Dental fluorosis: Its use as a biomarker. *Advances in Dental Research, 8*(1), 105–110. https://doi.org/10.1177/08959374940080010201
28. Hassebrauck, M. (1998). The visual process method: A new method to study physical attractiveness. *Evolution and Human Behavior, 19*(2), 111–123. https://doi.org/10.1016/S1090-5138(98)00002-6
29. Marshman, Z., Gibson, B., & Robinson, P. G. (2009). The impact of developmental defects of enamel on young people in the UK. *Community Dentistry and Oral Epidemiology, 37*(1), 45–57. https://doi.org/10.1111/j.1600-0528.2008.00453.x
30. Molina-Frechero, N., Nevarez-Rascón, M., Nevarez-Rascón, A., González-González, R., Irigoyen-Camacho, M. E., Sánchez-Pérez, L., López-Verdin, S., & Bologna-Molina, R. (2017). Impact of dental fluorosis, socioeconomic status and self-perception in adolescents exposed to a high level of fluoride in water. *International Journal of Environmental Research and Public Health, 14*(1), 73. https://doi.org/10.3390/ijerph14010073
31. García-Pérez, Á., Irigoyen-Camacho, M. E., Borges-Yáñez, S. A., Zepeda-Zepeda, M. A., Bolona-Gallardo, I., & Maupomé, G. (2017). Impact of caries and dental fluorosis on oral health-related quality of life: A cross-sectional study in schoolchildren receiving water naturally fluoridated at above-optimal levels. *Clinical Oral Investigations, 21*(9), 2771–2780. https://doi.org/10.1007/s00784-017-2079-1
32. Siddiq, H., Pentapati, K. C., & Acharya, S. (2020). Children's perception of other children with dental fluorosis—A cross-sectional study. *Journal of Oral Biology and Craniofacial Research, 10*(2), 72–77. https://doi.org/10.1016/j.jobcr.2020.02.005
33. Witkop, C. J. (1957). Hereditary defects in enamel and dentin. *Acta Genetica et Statistica Medica, 7*(1), 236–239. https://doi.org/10.1159/000150974
34. Bäckman, B., & Holm, A. K. (1986). Amelogenesis imperfecta: Prevalence and incidence in a northern Swedish county. *Community Dentistry and Oral Epidemiology, 14*(1), 43–47. https://doi.org/10.1111/j.1600-0528.1986.tb01493.x
35. Bloch-Zupan, A., Rey, T., Jimenez-Armijo, A., Kawczynski, M., Kharouf, N., O-Rare Consortium, Dure-Molla, M., Noirrit, E., Hernandez, M., Joseph-Beaudin, C., Lopez, S., Tardieu, C., Thivichon-Prince, B., ERN Cranio Consortium, Dostalova, T., Macek, M., Jr., International Consortium, Alloussi, M. E., Qebibo, L., Morkmued, S., … Laugel-Haushalter, V. (2023). Amelogenesis imperfecta: Next-generation sequencing sheds light on Witkop's classification. *Frontiers in Physiology, 14*, 1130175. https://doi.org/10.3389/fphys.2023.1130175
36. Witkop, C. J., Jr. (1988). Amelogenesis imperfecta, dentinogenesis imperfecta and dentin dysplasia revisited: Problems in classification. *Journal of Oral Pathology, 17*(9–10), 547–553. https://doi.org/10.1111/j.1600-0714.1988.tb01332.x
37. Crawford, P. J., Aldred, M., & Bloch-Zupan, A. (2007). Amelogenesis imperfecta. *Orphanet Journal of Rare Diseases, 2*, 17. https://doi.org/10.1186/1750-1172-2-17

38. Aren, G., Ozdemir, D., Firatli, S., Uygur, C., Sepet, E., & Firatli, E. (2003). Evaluation of oral and systemic manifestations in an amelogenesis imperfecta population. *Journal of Dentistry, 31*(8), 585–591. https://doi.org/10.1016/S0300-5712(03)00116-7
39. Hunter, L., Addy, L. D., Knox, J., & Drage, N. (2007). Is amelogenesis imperfecta an indication for renal examination? *International Journal of Paediatric Dentistry, 17*(1), 62–65. https://doi.org/10.1111/j.1365-263X.2006.00782.x
40. Pousette Lundgren, G., & Dahllöf, G. (2024). Advances in clinical diagnosis and management of amelogenesis imperfecta in children and adolescents. *Journal of Dentistry, 147*, 105149. https://doi.org/10.1016/j.jdent.2024.105149
41. Aldred, M., Crawford, P. J., Savarirayan, R., & Savulescu, J. (2003). It's only teeth—Are there limits to genetic testing? *Clinical Genetics, 63*(5), 333–339. https://doi.org/10.1034/j.1399-0004.2003.00045.x
42. Pousette Lundgren, G., Karsten, A., & Dahllöf, G. (2015). Oral health-related quality of life before and after crown therapy in young patients with amelogenesis imperfecta. *Health and Quality of Life Outcomes, 13*, 197. https://doi.org/10.1186/s12955-015-0393-3
43. Coffield, K. D., Phillips, C., Brady, M., Roberts, M. W., Strauss, R. P., & Wright, J. T. (2005). The psychosocial impact of developmental dental defects in people with hereditary amelogenesis imperfecta. *Journal of the American Dental Association, 136*(5), 620–630. https://doi.org/10.14219/jada.archive.2005.0233
44. Sischo, L., & Broder, H. L. (2011). Oral health-related quality of life: What, why, how, and future implications. *Journal of Dental Research, 90*(11), 1264–1270. https://doi.org/10.1177/0022034511399918
45. Lferde, M., & Ramdi, H. (2025). Aesthetic management of molar-incisor hypomineralization with deep resin infiltration: A case report. *Cureus, 17*(6), e85800. https://doi.org/10.7759/cureus.85800
46. Idon, P. I., Ikusika, O. F., Sotunde, O. A., & Ogundare, T. O. (2022). Are there associations between the occurrence of dental fluorosis and the experience of dentine hypersensitivity? A cross-sectional study. *The Nigerian Postgraduate Medical Journal, 29*(2), 161–166. https://doi.org/10.4103/npmj.npmj_7_22
47. Heller, K. E., Eklund, S. A., & Burt, B. A. (1997). Dental caries and dental fluorosis at varying water fluoride concentrations. *Journal of Public Health Dentistry, 57*(3), 136–143. https://doi.org/10.1111/j.1752-7325.1997.tb02964.x
48. Jälevik, B., Sabel, N., & Robertson, A. (2022). Can molar incisor hypomineralization cause dental fear and anxiety or influence the oral health-related quality of life in children and adolescents? A systematic review. *European Archives of Paediatric Dentistry, 23*(1), 65–78. https://doi.org/10.1007/s40368-021-00631-4
49. Appelstrand, S. B., Robertson, A., & Sabel, N. (2022). Patient-reported outcome measures in individuals with amelogenesis imperfecta: A systematic review. *European Archives of Paediatric Dentistry, 23*(6), 885–895. https://doi.org/10.1007/s40368-022-00737-3