Submitted: 30 April, 2023 Accepted: 12 June, 2023 Published: 03 September, 2023 DOI:10.22514/jocpd.2023.066

ORIGINAL RESEARCH

Journal of Clinical Pediatric Dentistry

Do hypomineralized teeth affect parents' emotional states and attitudes more than other discoloration conditions?

Didem Sakaryalı Uyar[1,*], Tansel Uyar[2]

[1]Pediatric Dentistry, Faculty of Dentistry, Başkent University, 06490 Ankara, Turkey
[2]Biomedical Engineering, Faculty of Engineering, Başkent University, 06790 Ankara, Turkey

***Correspondence**
dsakaryali@baskent.edu.tr
(Didem Sakaryalı Uyar)

Abstract

Discoloration poses a significant esthetic issue, and parents' opinions and emotional states may vary regarding different types of discoloration, such as molar incisor hypomineralization, caries or chromogenic bacteria. This study aimed to assess parent's emotional state and attitudes towards discoloration in primary and permanent teeth. A two-part questionnaire was designed, consisting of questions about demographic data and simulated visuals of different primary and permanent teeth discoloration conditions. The Visual Analog Scale (VAS) was used to determine the emotional state, while parents' attitudes towards dental consultation for each simulated visual were determined using statements such as "Absolutely yes"; "Yes"; "I don't have an idea"; "No"; "Absolutely no". The simulated visuals included cases of "caries with cavitation", "yellow-brown hypomineralized area", "white hypomineralized area" and "chromogenic bacteria". The questionnaire was distributed to 300 parents through online communication channels. Categorical variables were analyzed using Pearson chi-square, with statistical significance set as $p < 0.05$. A total of 230 parents completed the questionnaire. The highest VAS scores and the highest percentage of "Absolutely yes" responses were observed for "caries with cavitation" in both primary (77.8%, 81.7%) and permanent (60.4%, 94.3%) teeth. Additionally, statistically significant differences were found in the VAS scores for chromogenic bacteria ($p = 0.04$), caries with cavitation ($p = 0.005$), white hypomineralized area ($p = 0.01$) and yellow-brown hypomineralized area ($p = 0.02$). Comparatively, parental preferences showed statistically significant differences for chromogenic bacteria ($p = 0.01$), caries with cavitation ($p = 0.01$), yellow-brown hypomineralized area ($p = 0.01$) and white hypomineralized area ($p = 0.004$). Parents displayed stronger emotional responses towards "caries with cavitation" compared to hypomineralization and chromogenic bacteria discolorations and expressed a positive attitude towards seeking dental consultation.

Keywords

Caries; Chromogenic bacteria; Discoloration; Esthetics; Molar incisor hypomineralization; Parent's response; Seeking for dental therapy

1. Introduction

Discoloration is one of the most common reasons for seeking dental consultation, primarily due to the esthetic concerns. This issue is frequently observed in adults and is caused by staining or discoloration on the enamel surface resulting from the consumption of colored beverages such as coffee, tea, fruit juices, wine and cola, as well as artificial food colorants [1–3]. Comparatively, children and adolescents can also experience discoloration in their primary and permanent teeth, but unlike adults, internal factors rather than external factors are primarily responsible for such discoloration [4, 5]. Internal factors include structural disorders and discoloration from pharmaceutical use during pregnancy or early infancy [6, 7], while external factors contributing to discoloration include chromogenic bacteria, traumatic dental injuries, poor oral hygiene, caries and pulp necrosis [4, 5, 8–11].

The appearance of the colored area varies depending on the influencing factors [4]. For instance, Molar Incisor Hypomineralization (MIH), which is associated with structural-developmental disorders in permanent teeth, presents as a well-defined stain in opaque, yellow or brown colors, appearing anywhere on the crown [11, 12]. On the other hand, discoloration caused by chromogenic bacteria exhibits an indistinct dark brown appearance, often characterized by an incomplete line of dark dots primarily in the gingival region of the affected teeth, which in some cases can be observed throughout the lingual/palatal or buccal surfaces [8, 9].

Based on the evaluation of 70 epidemiological studies, the global prevalence of MIH is estimated to be approximately 14.2% [13]. MIH is a developmental disorder that presents with various significant clinical problems, including pain, post-eruptive breakdown, chewing and eating problems, esthetic concerns, treatment challenges and heightened sensitivity to heat and cold immediately after eruption [11–13]. Jawdekar *et al*. [14] conducted a systematic review and meta-analysis on the assessment of oral health-related quality of life (OHRQoL) in children with MIH and reported that the impact of MIH on OHRQoL was conflicting. However, further analysis revealed that five studies involving 2112 subjects and three studies involving 811 subjects reported a statistically significant impact of MIH on OHRQoL. Thus, based on their quantitative analyses, they concluded that children with MIH could be approximately 17–25 times more likely to experience an impact on their OHRQoL compared to children without MIH.

In a study conducted by Ghanim *et al*. [15], the time and reasons for dental visits in case of MIH were examined. The results of the study revealed that children affected by MIH reported a significantly higher frequency of seeking dental care compared to non-affected children, primarily due to tooth sensitivity and pain. Previous studies [9, 10, 16] have indicated that untreated caries or traumatic injuries leading to discoloration can be considered as primary factors that prompt parents or children to seek dental care, influenced by their emotional state. However, there is currently a lack of literature addressing parents' emotional status and attitudes regarding counseling for dental treatment specifically related to various discolorations caused by MIH, compared to tooth caries and chromogenic bacteria.

The aim of this study was to investigate parental attitudes and emotional states towards counseling for dental treatment in cases of common discoloration, including caries with cavitation, yellow-brown hypomineralized area, white hypomineralized area and discoloration caused by chromogenic bacteria in both primary and permanent teeth. The study's null hypothesis posited that all types of discoloration would yield similar results in terms of emotional states and attitudes towards dental counseling.

2. Materials and methods

2.1 Priori power analysis

The power analysis conducted for this research determined that a sample size of 216 participants was required to detect a significant difference, with a power of 90%, an effect size of 0.4, and a two-sided type I error at 0.05.

2.2 Study instrument development and validation

In this study, intraoral photographs were taken from two different children to simulate various discoloration cases. One child was 5 years old and had no tooth caries on primary anterior teeth, while the other child was 14 years old and had no tooth caries on the permanent anterior teeth. The intraoral photographs of both primary and permanent teeth were standardized to a size of 5184 × 3456 pixels. The simulations of four different discoloration cases were applied to these intraoral photographs of primary and permanent teeth at Başkent University, Department of Biomedical Engineering, using photo editing software (Photoshop CC 2015, Adobe, San Jose, CA, USA).

Four different discoloration conditions were applied to these intraoral photographs, namely caries with cavitation, yellow-brown hypomineralized area, white hypomineralized area and chromogenic bacteria. For each discoloration condition, one visual representation was prepared for both primary and permanent dentition, which were included in the questionnaire. The images of these discoloration conditions were cropped to display the area between the right and left canine teeth with a size of 2600 × 700 pixels using Matlab (2021b, The Mathworks, Natick, MA, USA) to standardize the visuals and reduce bias. All discoloration conditions were applied to the maxillary left primary central tooth and the maxillary left permanent central tooth. The location of the discoloration on the tooth surface was determined based on the most commonly observed regions. For example, chromogenic bacteria discoloration was applied as an indistinct dark brown appearance with an incomplete line of dark dots at the gingival region, while caries with cavitation was represented as a brown in color at the gingival region. However, hypomineralization cases with yellow-brown and white areas were applied to incisal region of both the primary and permanent maxillary left central tooth.

The questionnaire used in this study into two sections: (1) Questions regarding demographic information of the voluntarily participating parents, and (2) Questions regarding the images of different discoloration cases of both primary and permanent teeth. The first part included details such as the gender and age of the parents and their children, as well as information about the parents' socio-economic status, occupation and education level. The second section of the questionnaire contained two closed-ended questions aimed at evaluating the parents' attitudes and emotional states regarding their preference for counseling on dental treatment for discoloration cases in both primary and permanent teeth. The Visual Analog Scale (VAS) was used to assess the parents' emotional states. The question asked was, "How would you feel if your child's tooth looked like the one in the picture? Please indicate your feelings by scoring the face from 0 to 10, with different faces representing different emotions.". VAS was shown as different faces depicting various emotions, allowing parents to indicate their emotional status on a scale from very happy to sad, with scores ranging from 0–10 (Fig. 1). The second question in this section asked parents whether they would prefer to take their child to the dentist immediately if their child's teeth resembled the images shown. Parents could choose one of the following statements to indicate their preference for counseling on dental treatment: "Absolutely yes; Yes; I don't have an idea; No; Absolutely no".

Therefore, within the scope of this study, the first part of the questionnaire collected demographic information, while the second part consisted of two questions addressing the emotional status and parental preferences for counseling in the case of four different discoloration conditions for primary and

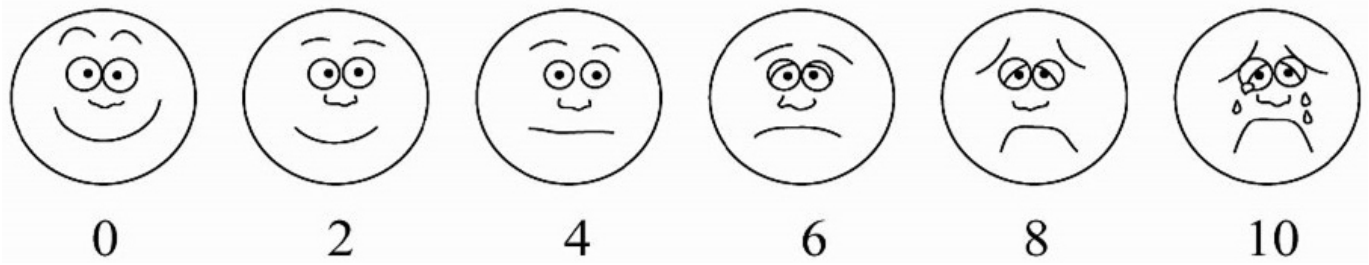

FIGURE 1. VAS for evaluating emotional status.

permanent teeth. The questionnaire demonstrated sufficient validity and reliability, with a reliability coefficient of 0.78 determined through a pilot study involving 30 parents.

2.3 Participants and data collection

The questionnaire was administered online using Google Forms (Google Inc., California, USA). It was distributed to a total of 300 parents who had previously visited the pediatric dentistry clinic and volunteered to participate in the research. Communication methods such as e-mail and WhatsApp (Meta Platforms Inc, California, USA) were used to send the questionnaire to the participants. Before distributing the questionnaire, an introduction explaining the purpose and significance of the study was provided, along with an assurance of confidentiality and the participants' right to withdraw at any time. They were required to indicate their consent by marking a checkbox before proceeding with the questionnaire. During the questionnaire filling process, parents were asked to provide an email address, and duplication was prevented by configuring the questionnaire to allow responses only once with "can be answered once" option. The inclusion criteria for these voluntary parents were having a child or children aged between 0–12 years old without any systemic disease, physical or psychological disorders. The exclusion criteria were having a child with a systemic disease or being over 12 years of age. Parents who agreed to receive the questionnaire, regardless of their own or their child's gender or place of residence, were eligible to participate in the study. After a waiting period of 1-month, the questionnaire was closed for responses.

2.4 Statistical analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) Statistics Version 22 (IBM Corporation, Armonk, NY, USA) software package. Descriptive statistics, including measures such as average, mean and standard deviation, were used to summarize the data. Data analysis and comparison of the relationships between categorical variables were assessed using the Pearson chi-square test. Statistical significance was set $p < 0.05$.

3. Results

Two hundred thirty out of 300 parents completed the questionnaire without any withdrawals or dropouts. The demographic information of these 230 participating parents and their children is presented in Table 1. The emotional states of the parents, represented by the distribution of VAS scores for different discoloration problems in primary and permanent teeth, are shown in Table 2. According to the analysis of the data in Table 2, it was found that a VAS score of 10 was the most commonly selected by parents for all types of discoloration in permanent teeth, and the corresponding percentages were white hypomineralized area (40.0%), chromogenic bacteria (50.9%), yellow-brown hypomineralized area (67.0%) and caries with cavitation (77.8%), respectively.

In terms of primary tooth discolorations, the highest emotional status was observed with a VAS score of 6 for teeth affected by chromogenic bacteria (34.3%) and white hypomineralized area (28.7%). A VAS score of 8 was reported for yellow-brown hypomineralized area (31.3%), and a VAS score of 10 was recorded for teeth with caries with cavitation (60.4%). Statistical analysis revealed a significant difference between the VAS scores for discolorations caused by chromogenic bacteria ($p = 0.04$), caries with cavitation ($p = 0.005$), white hypomineralized area ($p = 0.01$) and yellow-brown hypomineralized area ($p = 0.02$) in terms of both primary and permanent teeth discolorations.

The attitudes of parents towards counseling for treatment were assessed using the statements "Absolutely yes; Yes; I don't have an idea; No; Absolutely no". The distribution of these statements for each tooth discoloration is presented in Table 3. For both primary and permanent teeth discolorations, the statement "Absolutely yes" was the most frequently chosen by parents. The highest percentage for the "Absolutely yes" statement was reported for caries with cavitation, with 81.7% for primary teeth discolorations and 94.3% for permanent teeth discolorations. The results for "Absolutely yes" statement were white hypomineralized area (53.5%), chromogenic bacteria (56.5%), yellow-brown hypomineralized area (73.0%) and caries with cavitation (81.7%) for primary teeth discolorations, respectively. The higher percentages for "Absolutely yes" statement was reported for permanent teeth discolorations as white hypomineralized area (74.3%), chromogenic bacteria (84.3%), yellow-brown hypomineralized area (87.0%) and caries with cavitation (94.3%), respectively. Statistical analysis revealed a significant difference in the distribution of "Absolutely yes" statements for chromogenic bacteria ($p = 0.01$), caries with cavitation ($p = 0.01$), yellow-brown hypomineralized area ($p = 0.01$) and white hypomineralized area ($p = 0.004$) in terms of both primary and permanent teeth discolorations.

TABLE 1. Demographic data of the participating parents and their children.

Demographic data	Mean ± sd (yr)	Subgroups	Average value	
			n	%
Children's age	11.53 ± 5.01			
Parent's age	35.90 ± 6.34			
Children's gender				
		Female	130	56.5
		Male	100	43.5
Parent's gender				
		Female	189	82.2
		Male	41	17.8
Education level				
		University	148	64.3
		Master-doctorate	42	18.3
		High-school	34	14.8
		Elementary school	6	2.6
Socio-economic level				
		>2-minimum wage	66	28.7
		>1-minimum wage	116	50.4
		1-minimum wage	36	15.7
		<1-minimum wage	12	5.2

sd: standard deviation; mean ± sd used for age; n: number; %: percentage used for showing the distribution of gender, education level, and socio-economic level.

TABLE 2. VAS scores for different discolorations amongst primary and permanent teeth.

Tooth discolorations	VAS scores	Primary teeth		Permanent teeth		*p*-value
		n	%	n	%	
Chromogenic bacteria						
	0	3	1.3	0	0.0	0.04*
	2	8	3.5	3	1.3	
	4	36	15.7	12	5.2	
	6	79	34.3	27	11.7	
	8	63	27.4	71	30.9	
	10	41	17.8	117	50.9	
Caries with cavitation						
	0	1	0.4	1	0.4	0.005*
	2	1	0.4	1	0.4	
	4	8	3.5	2	0.9	
	6	24	10.4	13	5.7	
	8	57	24.8	34	14.8	
	10	139	60.4	179	77.8	
White hypomineralized area						
	0	3	1.3	1	0.4	0.01*
	2	7	3.0	4	1.7	
	4	56	24.3	12	5.2	
	6	66	28.7	37	16.7	
	8	63	27.4	84	36.5	
	10	35	15.2	92	40.0	
Yellow-brown hypomineralized area						
	0	4	1.7	1	0.4	0.02*
	2	9	3.9	2	0.9	
	4	37	16.1	5	2.2	
	6	45	19.6	13	5.7	
	8	72	31.3	55	23.9	
	10	63	27.4	154	67.0	
Total		230	100.0	230	100.0	

*VAS: Visual Analog Scale; Categorical variables were shown as number (n) and percentages (%) of chromogenic bacteria, caries with cavitation, white and yellow-brown hypomineralized area for primary and permanent teeth and analyzed with Pearson Chi-Square Test. *$p < 0.05$ indicates a statistically significant difference.*

TABLE 3. Parental preference statements for different discolorations amongst primary and permanent teeth.

Tooth discolorations	Parental preference statements	Primary teeth		Permanent teeth		*p*-value
		n	%	n	%	
Chromogenic bacteria						
	Absolutely no	2	0.9	2	0.9	0.01*
	No	18	7.8	0	0.0	
	I don't have an idea	6	2.6	1	0.4	
	Yes	74	32.2	33	14.3	
	Absolutely yes	130	56.5	194	84.3	
Caries with cavitation						
	Absolutely no	1	0.4	2	0.9	0.01*
	No	3	1.3	0	0.0	
	I don't have an idea	2	0.9	2	0.9	
	Yes	36	15.7	9	3.9	
	Absolutely yes	188	81.7	217	94.3	
White hypomineralized area						
	Absolutely no	1	0.4	2	0.9	0.004*
	No	16	7.0	1	0.4	
	I don't have an idea	9	3.9	2	0.9	
	Yes	81	35.2	54	23.5	
	Absolutely yes	123	53.5	171	74.3	
Yellow-brown hypomineralized area						
	Absolutely no	3	1.3	6	2.6	0.01*
	No	15	6.5	0	0.0	
	I don't have an idea	3	1.3	1	0.4	
	Yes	41	17.8	23	10.0	
	Absolutely yes	168	73.0	200	87.0	
Total		230	100.0	230	100.0	

*Categorical variables were shown as number (n) and percentages (%) of chromogenic bacteria, caries with cavitation, white and yellow-brown hypomineralized area for primary and permanent teeth and analyzed with Pearson Chi-Square Test. *$p < 0.05$ indicates a statistically significant difference.*

4. Discussion

Discoloration problems caused by chromogenic bacteria, hypomineralization and tooth caries can be confusing for parents due to their similar appearances, such as black staining in chromogenic bacteria, dark brown color in tooth caries and yellow-brown hypomineralization [9, 17]. However, the findings of this research demonstrated a statistically significant difference between the VAS scores and the preference for dental counseling for both primary and permanent teeth across all types of discoloration. Therefore, the hypothesis of this study was rejected based on the observed statistical difference between primary and permanent teeth concerning discoloration cases, including chromogenic bacteria, caries with cavitation, yellow-brown hypomineralized area and white hypomineralized area. These research results align with previous studies [16, 18, 19] that have assessed the emotional status of parents or children concerning various discoloration conditions in primary and permanent teeth. However, to the best of our knowledge, this study represents the first investigation specifically evaluating parental preferences and attitudes towards dental treatments for different discolorations caused by yellow-brown and white hypomineralization, as well as chromogenic bacteria.

The primary reasons for parents seeking dental care for their children are often related to pain and esthetic concerns [16, 20, 21]. Undesirable or unsatisfactory smile esthetics can lead to hesitance in speaking and smiling among children and adolescents, potentially resulting in psychosocial development issues. Parents who are aware of or have experienced this situation frequently seek dental intervention to address the impact on their children's personal and social development [11, 17, 21, 22]. Previous studies [10, 11] have highlighted that discoloration caused by untreated caries or traumatic injuries is considered one of the primary factors prompting parents to seek dental care due to the emotional state of the child or the parent. Additionally, Rodd *et al.* [23] conducted a survey study assessing esthetic concerns before and after

treatments for anterior teeth affected by MIH-affected using VAS. The results indicated that visible enamel defects had negative psychosocial impacts before treatment but led to positive self-assessment of confidence and happiness after treatment. Furthermore, Calheiros-Lobo *et al*. [20] conducted a systematic review and meta-analysis focusing esthetic perception of various clinical situations related to maxillary lateral incisor agenesis, employing the VAS as a measurement tool. Therefore, the VAS, functioning as a Likert scale, was used in this study to evaluate the emotional status associated with different discoloration conditions. Its simple structure, with scores ranging from 0 to 10 and representing emotions through facial expressions, made it easier for parents to understand and answer.

Based on the results concerning primary teeth, parents demonstrated stronger emotional responses towards caries with cavitation compared to yellow-brown hypomineralized area, chromogenic bacteria and white hypomineralized area. Additionally, parents expressed an "Absolutely yes" statement regarding counseling for dental treatments for all types of discolorations. However, the highest preference for receiving dental intervention was observed for caries with cavitation, surpassing yellow-brown hypomineralized area, chromogenic bacteria, and white hypomineralized area. These findings may be influenced by the level of discoloration, such as the presence of a darker color rather than a lighter one. Also, several studies have evaluated the esthetic concerns of children and their parents about the cases with or without tooth loss [20, 23–25]. In addition, some studies [16, 19] that evaluated traumatic injuries reported that injuries with more tissue loss had more emotional effects on parents and children than simple injuries. Similar to the present research results, the emotional response and attitude for dental consultancy were high for caries with cavitation more than the discolorations of white hypomineralization, yellow-brown hypomineralization and chromogenic bacteria.

The results of this study indicated that a VAS score of 10 was commonly reported for emotional status regarding primary teeth discoloration conditions. However, despite this high emotional response, the results showed a higher preference for receiving dental intervention in cases of permanent teeth discolorations compared to primary teeth, with a statistically significant difference. This discrepancy may be attributed to the clinical significance placed on permanent teeth, as emphasized in previous studies [2, 6, 10, 26]. Duruk *et al*. [26] conducted a study examining parental ability to distinguish between primary and permanent teeth, and the results indicated that some parents tend to overlook the health of permanent first molar teeth under the assumption that they are primary teeth that will eventually exfoliate. Furthermore, another study [16] assessing different traumatic dental injuries in primary and permanent teeth reported that parental emotional states and attitudes were higher for permanent teeth compared to primary teeth injuries, which align with the findings of the present study. Hence, it can be inferred that parents may tend to neglect discolorations and traumatic dental injuries in primary teeth more so than in permanent teeth.

Permanent teeth have a significant impact on esthetics and have been gaining increasing importance, particularly due to the rising prevalence of MIH has increased recently [11, 15]. Hypomineralization presenting as yellow-brown or white discoloration on permanent anterior teeth can cause significant esthetic problems, potentially affecting a child's desire to laugh or smile [14, 15, 17]. Silva *et al*. [24] conducted a study assessing esthetic perceptions of different enamel opacities, including white and yellow colors, with or without tooth loss, and reported that bilateral yellow opacity, with or without loss, had the greatest impact on enamel defects. Altogether, findings from previous literature [20, 23, 25] were consistent with those reported in our present study to a certain extent. In this current study, parents stated stronger emotional response towards yellow-brown hypomineralized anterior permanent teeth compared to white hypomineralized teeth. Additionally, parents exhibited stronger emotional response towards discoloration caused by chromogenic bacteria than white hypomineralized discoloration cases; thereby indicating that parents tend to place less importance on discolorations that do not present esthetic problems [18, 20].

According to the existing literature [7, 10, 17], discoloration significantly affects a child's desire to smile and laugh, thus influencing their social interactions. The results of this study indicate that most participating parents preferred to seek dental consultation for discolorations caused by chromogenic bacteria, hypomineralization, and tooth caries in both primary and permanent teeth, suggesting a high level of parental awareness and perception, which could be attributed to the fact that most participants had a high level of education, primarily at the university level. It is important to acknowledge that this high level of parental awareness may have influenced the high emotional response rates and the preference for dental intervention. These findings reflect parents' concern regarding the potential increase in social anxiety and their efforts to seek dental treatments for esthetic improvements, considering dental esthetics as an integral part of OHRQoL [14]. Also, the different prevalence of these discoloration conditions might be another limitation due to a higher response for discoloration caused by caries than hypomineralization or chromogenic bacteria. However, the strength of this study lies in its unique evaluation of both emotional response and parental attitudes towards dental counseling for treatment in the case of different discolorations caused by hypomineralization and chromogenic bacteria while also comparing them with tooth caries. The results obtained from this study provide a clearer understanding of the impact of discoloration on parents' perceptions for both primary and permanent teeth. Therefore, it is crucial to prevent or treat these discolorations before they leave a lasting impact on children's lives, which could be achieved through educational initiatives in schools to raise awareness about early referrals to dentists and involve pediatricians in providing guidance and consulting with pediatric dentists.

5. Conclusions

Based on the evaluation of different discoloration cases on parents' emotional states and attitudes, the following conclusions can be drawn:

- All discolorations have a similar impact on parents' emotional states.

- Parents exhibited stronger emotional responses for discolorations caused by “caries with cavitation” than those resulting from hypomineralization and chromogenic bacteria.
- Yellow-brown hypomineralization appears to have a greater emotional impact and elicits a more positive response for dental consultation than white hypomineralization cases.

AVAILABILITY OF DATA AND MATERIALS

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

AUTHOR CONTRIBUTIONS

DSU and TU—conceived the idea, collected the data, analysed the data. DSU—led the writing. TU—revised the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by Başkent University Institutional Review Board and Ethics Committee (Project no: KA21/490) and complied with the principles of the Declaration of Helsinki. Written consent forms were obtained from the parents indicating their permission to use photographs of their children for research purposes. Every participating parent provided an approved informed consent form by marking a checkbox indicating their agreement to participate before completing the questionnaire to ensure voluntary participation in the study. There were not any inducements for parents before the study to conduct or complete.

ACKNOWLEDGMENT

Not applicable.

FUNDING

This study was supported by Başkent University Research Fund (Project no: KA21/490).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Mahmood I, Pettinato M. Impact of intrinsic and extrinsic factors on the pharmacokinetics of peptides: when is the assessment of certain factors warranted? Antibodies. 2021; 11: 1.
[2] Chen Y, Dou G, Wang D, Yang J, Zhang Y, Garnett JA, *et al*. Comparative microbial profiles of caries and black extrinsic tooth stain in primary dentition. Caries Research. 2021; 55: 310–321.
[3] Joiner A, Luo W. Tooth colour and whiteness: a review. Journal of Dentistry. 2017; 67: S3–S10.
[4] Lygidakis NA, Garot E, Somani C, Taylor GD, Rouas P, Wong FSL. Best clinical practice guidance for clinicians dealing with children presenting with molar-incisor-hypomineralisation (MIH): an updated EAPD policy document. European Archives of Paediatric Dentistry. 2022; 23: 3–21.
[5] Blanchet I, Camoin A, Tardieu C, Jacquot B. Microabrasion in the management of enamel discolorations in paediatric dentistry: a systematic review. Journal of Clinical Pediatric Dentistry. 2023; 47: 17–26.
[6] Caeiro-Villasenín L, Serna-Muñoz C, Pérez-Silva A, Vicente-Hernández A, Poza-Pascual A, Ortiz-Ruiz AJ. Developmental dental defects in permanent teeth resulting from trauma in primary dentition: a systematic review. International Journal of Environmental Research and Public Health. 2022; 19: 754.
[7] Kotsanos N, Papagerakis P, Sarnat H, Bloch-Zupan A. Developmental defects of the teeth and their hard tissues. Pediatric Dentistry. 2022; 4: 415–463.
[8] James P, Worthington HV, Parnell C, Harding M, Lamont T, Cheung A, *et al*. Chlorhexidine mouthrinse as an adjunctive treatment for gingival health. Cochrane Database of Systematic Reviews. 2017; 3: CD008676.
[9] Janjua U, Bahia G, Barry S. Black staining: an overview for the general dental practitioner. British Dental Journal. 2022; 232: 857–860.
[10] Goettems ML, Thurow LB, Noronha TG, Silva Júnior IF, Kramer PF, Feldens CA, *et al*. Incidence and prognosis of crown discoloration in traumatized primary teeth: a retrospective cohort study. Dental Traumatology. 2020; 36: 393–399.
[11] Fragelli C, Barbosa TS, Bussaneli DG, Restrepo M, Cordeiro RCL, Santos-Pinto L. Aesthetic perception in children with molar incisor hypomineralization. European Archives of Paediatric Dentistry. 2021; 22: 227–234.
[12] Bekes K, Weerheijm KL. Diagnosis, classifications and treatment strategies of MIH-affected teeth. Molar Incisor Hypomineralization. 2020; 35: 47–58.
[13] Zhao D, Dong B, Yu D, Ren Q, Sun Y. The prevalence of molar incisor hypomineralization: evidence from 70 studies. International Journal of Paediatric Dentistry. 2018; 28: 170–179.
[14] Jawdekar AM, Kamath S, Kale S, Mistry L. Assessment of oral health-related quality of life (OHRQoL) in children with molar incisor hypomineralization (MIH)—a systematic review and meta-analysis of observational studies. Journal of Indian Society of Pedodontics and Preventive Dentistry. 2022; 40: 368–376.
[15] Ghanim AM, Manton DJ, Morgan MV, Mariño RJ, Bailey DL. Trends of oral health care and dental treatment needs in relation to molar incisor hypomineralisation defects: a study amongst a group of Iraqi schoolchildren. European Archives of Paediatric Dentistry. 2012; 13: 171–178.
[16] Sakaryalı Uyar D, Uyar T, Memiş Özgül B. Attitudes and emotional status of parents regarding traumatic dental injuries. Dental Traumatology. 2023; 39: 2–10.
[17] Salim NA, El-Smadi LA, Sawair FA, Satterthwaite JD. Parental perception and acceptance of silver diamine fluoride treatment among Syrian refugees. Community Dental Health Journal. 2021; 38: 251–255.
[18] Althagafi N. Esthetic smile perception among dental students at different educational levels. Clinical, Cosmetic and Investigational Dentistry. 2021; 13: 163–172.
[19] Loureiro JM, Jural LA, Soares TRC, Risso PA, Fonseca-Gonçalves A, Magno MB, *et al*. Critical appraisal of the information available on traumatic dental injuries found in applications. Dental Traumatology. 2022; 38: 77–87.
[20] Calheiros-Lobo MJ, Calheiros-Lobo M, Pinho T. Esthetic perception of different clinical situations of maxillary lateral incisor agenesis according to populations with dental and non-dental backgrounds: a systematic review and meta-analysis. Dentistry Journal. 2023; 11: 105.
[21] Firdous S, Berger A, Jehangir W, Fernandez C, Behm B, Mehta ZY, *et al*. How should we assess pain: do patients prefer a quantitative or qualitative scale? A study of patient preferences. American Journal of Hospice and Palliative Medicine®. 2021; 38: 383–390.
[22] Larsson P, Bondemark L, Häggman-Henrikson B. The impact of oro-facial appearance on oral health-related quality of life: a systematic review. Journal of Oral Rehabilitation. 2021; 48: 271–281.
[23] Rodd HD, Abdul-Karim A, Yesudian G, O’Mahony J, Marshman Z. Seeking children’s perspectives in the management of visible enamel defects. International Journal of Paediatric Dentistry. 2011; 21: 89–95.

[24] Silva FMFd, Magno MB, Neves AB, Coqueiro RDS, Costa MC, Maia LC, *et al*. Aesthetic perceptions and social judgments about different enamel opacities. Brazilian Oral Research. 2020; 34: e049.

[25] Militi A, Sicari F, Portelli M, Merlo EM, Terranova A, Frisone F, *et al*. Psychological and social effects of oral health and dental aesthetic in adolescence and early adulthood: an observational study. International Journal of Environmental Research and Public Health. 2021; 18: 9022.

[26] Duruk G, Gümüşboğa ZŞ. Parents' ability to distinguish between primary and permanent teeth. Journal of Dentistry for Children. 2020; 87: 159–165.

How to cite this article: Didem Sakaryalı Uyar, Tansel Uyar. Do hypomineralized teeth affect parents' emotional states and attitudes more than other discoloration conditions? Journal of Clinical Pediatric Dentistry. 2023; 47(5): 162-169. doi: 10.22514/jocpd.2023.066.