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RESEARCH ARTICLE / *ARAŞTIRMA MAKALESİ*

Association of Dental Anxiety with Color Preferences in Pediatric Dental Patients

Pediatrik Diş Hekimliği Pratiğinde Anksiyete'nin Luscher Renk Testi ile Değerlendirilmesi

Banu Çiçek Tez[1], Başak Kızıltan Eliaçık[1], Fırat Erdoğan[2]

[1]Health Sciences University, Hamidiye Faculty of Dentistry, Department of Pedodontics, Istanbul, Turkiye
[2]Istanbul Medeniyet University, Faculty of Medicine, Department of Pediatrics, Istanbul, Turkiye

ORCID ID: B.Ç.T. 0000-0002-6053-5547; B.K.E. 0000-0003-1848-3007; F.E. 0000-0002-6299-7067

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ABSTRACT

Objective: People's color preferences have been a subject of research and curiosity for many years. Among the methods aimed at minimizing such fears in children is the careful selection of colors in the environment in order to prevent individuals from developing negative feelings. The present study evaluates the association between colors and anxiety in a pediatric dental patient population aged 7–14 through a quantitative test.
Material and Methods: The State-Trait Anxiety Inventory for Children (STAIC), the faces version of Modified Child Dental Anxiety Scale (MCDAS-f) and the quick version of the Lüscher Color Test (LCT), respectively, were administered to 65 patients and 48 age and sex matched controls while in the waiting room before treatment.
Results: The MCDAS-f and STAIC state scale scores were significantly and moderately correlated with the LCT scores, while there was no statistically significant correlation between the STAIC trait and the LCT scores. The mean LCT score was 6.06±2.85 in the patient group and 3.22±2.21 in controls (p<0.001).
Conclusions: The results of this study support that the colors preferred by children during dental examination and treatment are in fact those that reflect their moods rather than those that should be used in dental surgery environments and medical attire, contrary to previous studies investigating the association between color preferences and anxiety in pediatric dentistry.

Keywords: Child, color, dental anxiety, dentistry, lüscher color test, personality inventory

ÖZ

Amaç: İnsanların renk tercihleri uzun yıllardır araştırma ve merak konusu olmuştur. Çocuklarda olumsuz duyguların gelişmesini önlemek ve bu tür korkuları en aza indirmek amacıyla kullanılan yöntemler arasında, ortamda kullanılan renklerin dikkatli seçilmesi yer almaktadır. Bu çalışmanın amacı, 7-14 yaş arası çocuk hasta grubunda, renklerin anksiyete üzerindeki etkisinin nicel bir test olan Luscher testi ile değerlendirilmesidir.
Gereç ve Yöntemler: Ağız ve diş muayenesi yapılacak olan 65 çocuk hastaya muayene öncesinde, Çocuklar için Durumluk-Sürekli Kaygı Envanteri (STAIC), Modifiye Çocuk Diş Anksiyete Yüz Skalası (MCDAS-f) ve Lüscher Renk Testi (LCT) yapılmıştır. Tedavi yapılmayacak 48 hasta da kontrol grubu olarak belirlenmiş ve aynı testler bu hastalara da uygulanmıştır.
Bulgular: MCDAS(f) ve STAIC testlerinin ölçüm değerleri, LCT değerleri ile anlamlı ve orta düzeyde korelasyon gösterirken, STAIC ile LCT verileri arasında istatistiksel olarak anlamlı bir korelasyon bulunamamıştır. Ortalama LCT skoru hasta grubunda 6.06±2.85 iken ve kontrol grubunda 3.22±2.21 olduğu kaydedilmiştir (p< 0.001).
Sonuç: Bu çalışmanın sonuçlarına göre, çocuk diş hekimliğinde anksiyete ile renk tercihleri arasındaki ilişkiyi araştıran önceki çalışmaların aksine, çocukların diş muayenesi ve tedavisi sırasında tercih ettikleri renklerin, diş kliniği ortamı ve tıbbi kıyafetlerde kullanılması gereken renklerden ziyade ruh hallerini yansıtan renkler olduğunu desteklemektedir.

Anahtar Kelimeler: Çocuk, dental anksiyete, diş hekimliği, renk, kişilik envanteri, lüscher renk testi

INTRODUCTION

The causes of childhood fear may vary depending on the children's needs in the developmental period (1). Fears about hospitals, healthcare professionals, and medical procedures are likely to reduce children's participation in healthcare practices and negatively affect their treatment processes. It is known that the dentist and the examining room environment are of great importance for children during their first visit to a dentist in their ability to relieve their anxieties and fears. It

Corresponding Author/Sorumlu Yazar: Banu Çiçek Tez **E-mail:** banucicektz@gmail.com

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was suggested that cooperation would be improved if children are not negatively affected by the dentist's appearance (2,5).

Pediatric medical and dental clinics perform not only examinations, but also bloodletting (venipuncture), injections, and a number of painful procedures for therapeutic purposes. This may increase the levels of fear and anxiety in children about being present and treated in such environments (6,7).

Dental fear and anxiety are related but not the same and may involve different physiological, cognitive, behavioral, and emotional states. Anxiety is not tied to an object, but rather a general response to the unknown or to internal conflict. Dental anxiety is defined as the response to a stressful stimulus specific to the dental context. The dentist, on the other hand, should distinguish the patient's dental anxiety from a psychiatric disorder (such as general anxiety or trait anxiety) (31). Fear is a response to a known, specific, and real threatening stimulus. Dental fear is a normal emotional response to threatening dental stimuli. It may occur due to past traumas during dental treatments (preliminary learning) or other medical procedures (fear generalization). The clinician should recognize that fear of potentially threatening practices and situations is a normal response for pediatric patients (32).

Despite the strong evidence indicating that fears are genetically determined, fears of medical procedures develop through traumatic experiences or through social learning (8).The importance of experience through social learning skills can be seen in the changes in the heartbeats of children who watch a movie about tooth extractions for the first time, and the reduced fear of children in the dental chair who have previously had a pre-operation-education about going to the dentist and having a tooth extracted (9).

Among the methods to minimize such fears in children is the careful selection of the colors in the environment in order to prevent individuals from developing negative feelings (10,11). There have been publications suggesting that an appropriate use of colors during the examination and treatment of pediatric patients in clinics and examination rooms is likely to motivate patients to freely enter such environments, and can be used as a factor for the relief of anxiety during interventions (3-5,12-15). It is known that the dentist and the examining room environment are of great importance for children in their first visit to a dentist in their ability to relieve their anxieties and fears. It was suggested that cooperation would be improved if children are not negatively affected by the dentist's appearance.

The aim of this study to evaluate the association between preferred colors and anxiety levels in a pediatric dental patient population aged 7–14 with a psychological instrument based on color preferences. We hypothesized that color preference could be affected by the presence of dental anxiety, and the anxiety level of children can be identified in relation to selected colors instead of different dental anxiety scales.

MATERIAL AND METHOD

Participants

The present cross-sectional study included 65 patients and 48 controls aged 7–14 who visited a dental clinic for the first time between April 2020 and November 2020, and who had no previous experience of dental treatment. The patients were administered the State-Trait Anxiety Inventory for Children (STAIC), the faces version of Modified Child Dental Anxiety Scale (MCDAS-f), and the quick version of the Lüscher Color Test (LCT), respectively, while in the waiting room before treatment. The control group consisted of children of dental staff who had visited the dental clinic and been in the waiting room before. In order to recruit controls, information leaflets about the study were distributed in dental clinic staff only areas, and interested parents were asked to contact the research team to participate in the study as control.

All participants who had completed both scales and LCT were included in the study. Patient exclusion criteria was history of color blindness or a history of acquired or congenital diseases with a significant impact on color vision (e.g., congenital glaucoma, progressive cone dystrophy, congenital cataract, or optic neuropathy). The study was approved by the Medipol University Ethics Committee (10840098-604.01.01-E.14294). All participants and their parents provided written informed consent, and the study followed the principles of the Declaration of Helsinki.

Instruments

State and Trait Anxiety Inventory-Children (STAIC)

Developed by Spielberger (1973), the STAIC consists of two subscales with 20 multiple-choice items for state and trait anxiety (27,29). State anxiety describes the anxiety experienced by a person at a particular time and under particular conditions, which may vary according to external factors. Trait anxiety, in turn, describes how a person generally feels, and reflects the overall anxiety level of a person. The Turkish reliability and validity study of the scale was conducted by Özusta (1995) (28,29)**.** Test–retest reliability of the state anxiety scale was 0.60, and that of the trait anxiety scale was 0.65. Internal consistency of the state anxiety scale was 0.82, and that of the trait anxiety scale was 0.81. The Turkish version of the measure successfully distinguished children with anxiety disorders from children without any disorders. Scores from the STAIC scale range from 20 to 60. Normative data from prior research indicates a STAIC state anxiety score of 30–37 in boys and 30–38 in girls.

Modified Version of the Dental Anxiety Scale for Children (MCDAS-f)

MCDAS is a modified, eight-item version of the Dental Anxiety Scale (DAS), which was originally a four-item scale, for children. The items added to the MCDAS-f relate to dental injections, extractions, general anesthesia, and sedation. The MCDAS-f scale includes 5 different face images (ranging from a very happy face to very sad face, rated 1–5) indicating different moods in order to improve the scale function, and is administered to young age groups with limited cognitive

function. Scores of the MCDAS-f scale range from 8–40, with scores below 19 indicating an absence of anxiety. Scores above 19 indicate the presence of anxiety, while scores above 31 suggest a severe phobic disorder.

Lüscher Color Test (LCT)

The short version LCT with eight different colored cards was developed by Lüscher in 1947 to measure one's anxiety based on color preferences (30). For this test, children were given eight cards of different colors, and asked to make their personal ranking from the most preferred to the least preferred. The eight-card ranking test consists of eight squares of different colors, four basic (blue, green, red, yellow) and four auxiliary (violet, brown, gray, black). Patients completed this exercise twice, two minutes apart. Results of the LCT (ranges 0-12) were analyzed using interpretation tables published in the LCT book, which accompanies the test cards (30).

Data analysis

The acquired data were analyzed using the SPSS 22.0 (Windows (SPSS) Inc., v22.0, Chicago, IL, USA) package. Descriptive statistics were expressed as mean, standard deviation (SD), counting, and frequency distribution. The data were tested for normality using a Kolmogorov-Smirnov test, followed by an Independent t-test to assess the age and scale scores and a Chi-square test to assess categorical variables. Pearson's correlation was used to analyze the correlations of STAIC and MCDAS-f with LCT, with a p value (<0.05) considered statistically significant.

RESULTS

The study included 65 patients (36 male; 29 female) with a mean age of 10.8±2.3 (7–14) years and 48 controls, matched for age and gender. From the patients, 53.8% (n=35) were aged between 7 and 10, whereas 46.2% (n=30) were aged between 11 and 14. Mean age, gender distribution, anxiety scales score, and LCT scores of each group are listed in Table 1.

When comparing the mean anxiety scale scores between genders, a statistically significant difference was noted only in the STAIC state scale between boys and girls (p=0.02). A statistical comparison for age groups revealed a significant difference both in the MCDAS-f and STAIC state anxiety scales (Table 2). The Cronbach's alpha coefficients for the internal

Table 1: Demographic and test scores of patients and controls

	Patients (n=65)	Controls (n=48)	p*
Age (years)	10.8±2.3	10.9±2.2	0.553
Gender (m/f)	36/29	28/20	0.757
STAIC-T†	30.46±3.26	18.22±2.24	0.001
STAIC-S‡	38.92±3.77	21.14±3.21	0.001
MCDAS-f§	29.36±2.89	14.12±2.74	0.001
LCT¶	6.06±2.85	3.22±2.21	0.001

*Statistically significant as p<0.05 with Chi square test, †State-Trait Anxiety Inventory for Children Trait subscale, ‡State-Trait Anxiety Inventory for Children State subscale, §the faces version of Modified Child Dental Anxiety Scale, ¶Lüscher Color Test (8-cards)

Table 2: Mean values of Modified Child Dental Anxiety Scale (MCDAS) and State and Trait Anxiety Inventory for Children (STAI-C) among 65 patients

	N	%	STAIC-T			STAIC-S			MCDAS-f		
			Mean	SD	p	Mean	SD	p	Mean	SD	p
Sex											
Boys	36	55.4	30.08	3.17	0.29	41.64	2.64	**0.02**	25.50	2.89	0.41
Girls	29	44.6	30.93	3.38		39.17	5.18		26.07	2.51	
Age (years)											
7-10	35	53.8	30.34	3.29	0.653	39.94	5.16	**0.033**	25.83	3.13	**0.02**
11-14	30	46.2	30.61	3.24		37.73	3.53		24.11	2.63	

Table 3: Preference and percentage of the 8 colors in order, basic and auxiliary, of Lüscher Color Test's short form, chosen by patients before dental examination.

Color Position	Basic (%)				Auxiliary (%)			
	Blue	Green	Red	Yellow	Violet	Brown	Black	Gray
I	15.4	23.1	12.3	23.1	13.9	0.00	1.5	0.00
II	18.5	21.5	12.3	20.0	12.3	7.7	1.5	4.6
III	23.1	15.4	18,5	18.5	18.5	12.3	3.1	3.1
IV	7.7	12.3	10.8	10.8	12.3	7.7	6.2	7.7
V	12.3	13.9	13.9	9.2	15.4	12.3	16.9	9.2
VI	12.3	7.7	12.3	10.8	12.3	15.4	18.5	16.9
VII	10.8	6.2	12.3	6.2	15.4	21.5	15.4	20.0
VIII	0.00	0.00	7.7	1.5	0.00	23.1	36.9	38.5

reliability of tests were 0.79, 0.83, and 0.81 for the MCDAS(f), STAIC state, and trait anxiety scales, respectively.

The mean LCT score was 6.06±2.85 in the patient group and 3.22±2.21 in controls (p<0.001). Preference and percentage of the eight colors (basic and auxiliary) chosen by children during LCT before dental examination is shown in Table 3. The most preferred colors, in first to second place, were yellow and green, and in third place was blue for basic color (23.08 % for all) and violet for auxiliary color (13.85%, 12.31% and 18.46%). The most preferred auxiliary colors in seventh to eighth place were brown and grey (21.54% and 38.46% respectively) and red as basic color (12.31% for both). When comparing the LCT scores in the study group by gender and age group, no statistically significant difference was established between the age (p= 0.277) and gender (p= 0.077) groups (Figures 1-2).

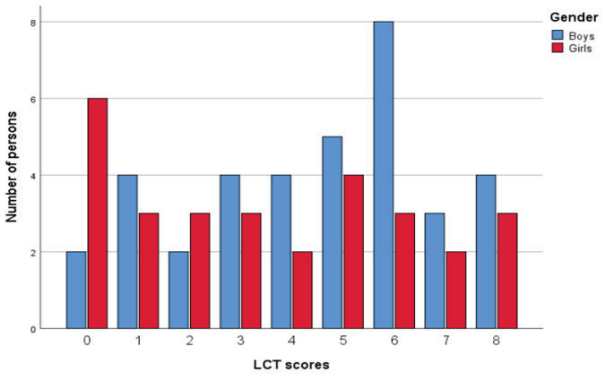

Figure 1. Distribution of LCT scores according to gender

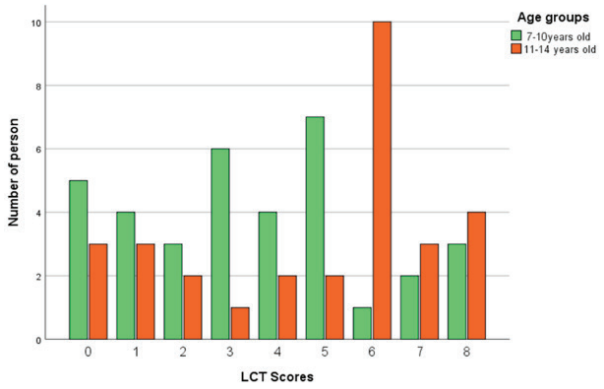

Figure 2: Distribution of LCT scores according to age

DISCUSSION

The aim of this current study was to evaluate the association between preferred colors and anxiety levels in a pediatric dental patient population aged 7–14. The STAI *state-anxiety* and MCDAS-f scales were found to be positively correlated with LCT, while no such correlation was observed with the STAIC *trait-anxiety scale*, suggesting that the acute anxiety experienced in the current environment may be more influential on children's color preferences than chronic anxiety. Although no statistical difference was found in the color preferences between genders and age groups, the LCT scores were higher in boys and in the 11–14 age group.

People's color preferences have been a subject of research and curiosity for many years. Several theories have been introduced in recent years suggesting the mechanisms that guide and manage such preferences. The ecological valence theory, one of the leading theories, stipulates that people select the colors they like or dislike based on their identification of the colors with examples in nature (16). A greenish yellow color has a triggering effect on people, bringing up subconscious images of dirty water or rotten food, while blue is believed to be associated generally with clear water. Another theory suggests that color preferences are likely to be associated with one's mood at that moment, regardless of the object (10). Despite publications claiming that color preference is a systemic response originating from a specific part of the brain, numerous studies revealed that people's preference for certain colors reflect their moods at the moment in question (2,17-21). This provided the foundation for subsequent studies investigating the effects of color preferences on cognitive and emotional judgments in humans, and the origins of such effects. When compared to adults, children demonstrate different attitudes and behaviors towards white coats (22-25). Studies showed that adult patients preferred physicians wearing white coats during their treatment (26); children, on the other hand, have been found in many studies to demonstrate an opposite attitude towards white coats (15,22-25).

A number of publications have suggested that wearing gowns in the clinic in the colors children prefer leads in part to reduced anxiety in pediatric patients in an environment they associate with painful procedures. Studies investigating the link between anxiety status and the color preferences of children in a pediatric dental clinic setting revealed that the color preferences of children may match their feelings, and so the treatment motivation of patients could be enhanced by using appropriate colors in pediatric dentistry Umamaheshwari et al. argued that the color preferences of children may match their feelings, and so the treatment motivation of patients could be enhanced by using appropriate colors in pediatric dentistry (3-5). Despite the findings of Umamaheshwari et al., Babaji et al reported that pediatric patients showed less anxiety about white coats with increasing age (4). A recent study by Annamary et al., thought that children's color preferences may be associated with their feelings, consistent with previous studies (2). Contrary to these studies, Bubna et al. administered the Corah's Dental Anxiety Scale-Revised to 6–12-year-old children for an anxiety status classification and reported that the color preferences of children are not associated with anxiety status (14). In our study, we found that state-anxiety level affects the color preferences rather than trait-anxiety level. The present study differs from prior research most significantly in its comparison of the correlated anxiety scores based on the personal color preferences of each patient rather than by dividing the children into subgroups in terms of anxiety status and then examining the association with their

color preferences. Our study findings demonstrate the effect of acute anxiety on color preferences rather than characterizing the color preferences of children with high anxiety scores directly as their favorite and non-favorite colors. We believe that the preliminary results of this study will be enhanced by further studies involving different anxiety scales.

This study was carried out in a single center and if it is done in more centers, demographic differences can be observed. Relatives of hospital staff were chosen as the control group. Children who have had dental treatment before can also be included in the study and a new group can be formed.

CONCLUSION

This study revealed that the colors preferred by children before dental visits were in fact those that reflect their anxiety level, contrary to previous studies investigating child-friendly colors and the association between color preferences and anxiety in pediatric dentistry.

Ethics Committee Approval: The study was approved by the Medipol University Ethics Committee (10840098-604.01.01-E.14294).

Informed Consent: All participants and their parents provided written informed consent, and the study followed the principles of the Declaration of Helsinki.

Author Contributions: Conception/Design of Study- B.Ç.T., B.K.E., F.E.; Data Acquisition- B.K.E., F.E.; Data Analysis/Interpretation- B.K.E., F.E.; Drafting Manuscript- B.Ç.T., B.K.E., F.E.; Critical Revision of Manuscript- B.Ç.T., B.K.E., F.E.; Final Approval and Accountability- B.Ç.T., B.K.E., F.E.

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