Role of Colors in Pediatric Dental Practices

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Objective: *This study evaluated the association between colors and emotions in a pediatric dental population.* ***Study design:*** *In this randomized cross-sectional study, 100 children aged 6-12 years were categorized as non-anxious and anxious using Corah's Dental Anxiety Scale–Revised. They were then instructed to color two cartoon faces, one depicting happiness emotion and the other, sadness, with any of six colors provided. Data obtained were statistically analyzed.* ***Results:*** *The mean Corah's Dental Anxiety scores were 11.7 and 4.97 for the anxious and non-anxious children, respectively. Both groups expressed the highest preference for the color yellow for happiness emotion. No significant differences were observed between color choices in either group ($p>0.05$), except for black which was not chosen by any child for happiness ($p<0.005$). Children in both groups significantly preferred red for sadness emotion. No significant differences were observed between color choices in the anxious group ($p>0.05$). In the non-anxious group, yellow assumed significant preference over green ($p<0.05$).* ***Conclusions:*** *Yellow was the most-preferred color and black, the least-preferred, for happiness emotion, whereas, for sadness emotion, red and green were the most- and least-preferred colors, respectively. Color preference was not affected by the presence of dental anxiety.*

Key words: child-friendly colors, dental environment, colors and dental attitude

INTRODUCTION

Dental anxiety and specific phobia of dental procedures are prevalent conditions that can cause substantial distress to the pediatric dental patient and often lead to dental neglect.[1] A review of studies in children and adolescents has revealed that the prevalence of dental fear and anxiety varies from 6% to 20% in 12 different populations, with a mean of 11%.[2] The perception of painful and unpleasant stimuli associated with the dental environment is often a precursor to the development of dental anxiety.[3] The changing expectations of children today encourages pediatric dentists to develop a more child-friendly atmosphere in dental clinics.[4]

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It is widely recognized that colors have a strong impact on our emotions and feelings.[5] Color has the ability to inspire, excite, soothe, heal and even agitate. This is particularly true for children, who can be extra sensitive to the impact of color.[6] Moreover, color stimulates and works synergistically with all the senses, symbolizes abstract concepts and thoughts, expresses fantasy or wish fulfillment, recalls another time or place and produces an emotional response.[7] Some colors may be associated with several different emotions and some emotions are associated with more than one color. The relationship between color and emotion is closely tied to color preferences, that is, color preferences are associated with whether a color elicits positive or negative feelings.[8]

If the colors of the dental environment can have a positive impact on the child's behavior, it is possible that those colors may add to the comfort of a child and reduce dental anxiety. Hence, the importance of picking out the right color for a pediatric dental clinic should not be underestimated. The use of child-friendly colors in the dental office could create a positive dental environment for children. The present study aimed to evaluate the association of colors with emotions in a pediatric dental population aged 6 to 12 years.

MATERIALS AND METHOD

The present cross-sectional study included 100 children aged 6 to 12 years, randomly selected from a children's home in Udaipur, Rajasthan state, India. Inclusion criteria were a history of previous dental experience and no physical, mental or emotional condition that could affect the child's ability to understand and

follow instructions. Ethical clearance from the institutional Ethical Committee was obtained, as also written, informed consent of the parents/guardians. All children assented to participate in the study.

The age distribution of the study sample is presented in Table 1. A majority (74%) of the children were 9-12 years of age.

The children and their parents/guardians were first given general instructions about the interview procedure in a common room by examiner A. The examiner then interviewed each child separately in the presence of the parent who was only allowed to observe silently so as to avoid any bias. The children were asked the four questions from Norman Corah's Dental Questionnaire[9] (Figure 1). The examiner provided five answers to each question from the questionnaire, translated to the local language in simple words, and the child was asked to select one. The answer to each question was allotted a score of 1 (not anxious) to 5 (extremely anxious) as described in Corah's Dental Anxiety Scale – Revised,[9] leading to a total score ranging from 5 to 20. Children obtaining a score of 9 or more were categorized as anxious and those who scored below 9 were considered as non-anxious as far as dental treatment was concerned.[9]

Next, the children were all made to sit in a large room, at distances from each other sufficient to eliminate any possibilities of copying or discussion. Parents were not present during this part of the study. Each child was given a happy, smiling, cartoon face printed on paper and 6 crayon pencils (blue, green, yellow, pink, red and black) by examiner B and instructed to fill in the cartoon face with a color that best suited a happy emotion. The same process was repeated with a cartoon face that depicted sadness (Figure 2).

Data collected was tabulated and subjected to statistical analysis using Statistical Package for Social Sciences software version 19 for Windows (SPSS Inc., Chicago, IL, USA). The probable association between emotions and preferred colors was evaluated using the chi-square test. For all tests, a P value ≤ 0.05 was considered to be statistically significant.

Figure 2: Cartoon faces depicting happiness and sadness emotions

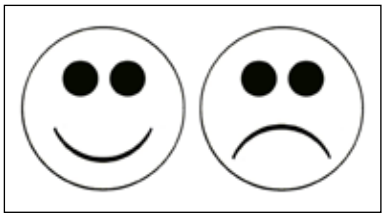

Figure 1: Corah's Dental Anxiety Scale, Revised (DAS-R)

Name _____ **Date** _____

1. If you had to go to the dentist tomorrow for a check-up, how would you feel about it?
a. I would look forward to it as a reasonably enjoyable experience
b. I wouldn't care one way or the other
c. I would be a little uneasy about it
d. I would be afraid that it would be unpleasant and painful
e. I would be very frightened of what the dentist would do

2. When you are waiting in the dentist's office for your turn in the chair, how do you feel?
a. Relaxed
b. A little uneasy
c. Tense
d. Anxious
e. So anxious that I sometimes break out in a sweat or almost feel physically sick

3. When you are in the dentist's chair waiting while the dentist gets the drill ready to begin working on your teeth, how do you feel?
a. Relaxed
b. A little uneasy
c. Tense
d. Anxious
e. So anxious that I sometimes break out in a sweat or almost feel physically sick

4. Imagine you are in the dentist's chair to have your teeth cleaned. While you are waiting and the dentist or hygienist is getting out the instruments which will be used to scrape your teeth around the gums, how do you feel?
a. Relaxed
b. A little uneasy
c. Tense
d. Anxious
e. So anxious that I sometimes break out in a sweat or almost feel physically sick

Scoring the Dental Anxiety Scale, Revised (DAS-R)
(This information is not printed on the form that patients see)
a = 1, b = 2, c = 3, d = 4, e = 5 Total possible = 20
Anxiety rating:
• 9 - 12 = moderate anxiety but have specific stressors that should be discussed and managed
• 13 - 14 = high anxiety
• 15 - 20 = severe anxiety (or phobia). May be manageable with the Dental Concerns Assessment but might require the help of a mental health therapist

RESULTS

Of the 100 children, 58 were categorized as anxious and 42 as non-anxious (Table 1). The mean Corah's Dental Anxiety Score was 11.60 for the anxious children and 4.92 for the non-anxious children. Table 1 presents the categorization of the study sample by age as anxious and non-anxious children with the mean Dental Anxiety Score (DAS) for each age group. The 11-year age group had the highest DAS, followed by the 12 year-olds.

Table 2 presents the color preference for happiness emotion. Both anxious and non-anxious groups expressed the highest preference for the color yellow (43% and 45%), followed by blue (22.4% and 23.8%), green (15.5% and 10.4%), pink (8.6% and 11.9%) and red (10.3% and 7.1%).

Table 3 presents a comparison of color preferences of anxious and non-anxious children for happiness emotion. No significant differences were observed between color choices in either group ($p > 0.05$), except for the color black which was not chosen by any child for depicting happiness ($p < 0.005$)

Table 4 presents the color preference for sadness emotion. Children in both the anxious and non-anxious groups preferred red (29.3% and 33.3%), followed by yellow (17.2% and 26.1%), black (15.5% and 21.4%), pink (15.5% and 9.5%), blue (8.6% and 9.5%) and green (13.7% and 0%). Table 5 presents a comparison of color preferences of anxious and non-anxious children for sadness emotion. No significant differences were observed between color choices in the anxious group ($p > 0.05$). In the non-anxious group, yellow assumed significant preference over the color green ($p < 0.05$).

No differences in color preference were observed between the anxious and non-anxious groups (Tables 2 and 4).

DISCUSSION

Color psychology is the study of color as a determinant of human behavior. Psychologically, colors can have an amazing effect on every individual. The appreciation for color does not develop in adulthood. Babies and children are also affected by it – both positively and negatively. Color therapist June McLeod,[10] who worked with a nursery childcare organization, reported that the proper use of color can have extremely positive effects on the children including improved emotional development, increase sharing and co-operation, decreased noise levels, easier organization of thoughts, reduced tension and aggression, easier and more peaceful sleep in babies, and the creation of a calmer, happier and more relaxed environment.

Table 2: Color preference of children for happiness emotion

Anxious		P value	Non-anxious		P value
Yellow vs	Blue	0.967	Yellow vs	Blue	0.961
	Green	0.755		Green	0.714
	Red	0.731		Red	0.686
	Pink	0.737		Pink	0.694
	Black	0.001		Black	0.001
Blue vs	Green	0.757	Blue vs	Green	0.716
	Red	0.732		Red	0.688
	Pink	0.739		Pink	0.696
	Black	0.002		Black	0.002
Green vs	Red	0.645	Green vs	Red	0.588
	Pink	0.650		Pink	0.594
	Black	0.004		Black	0.002
Red vs	Pink	0.633	Red vs	Pink	0.575
	Black	0.005		Black	0.004
Pink vs	Black	0.005	Pink vs	Black	0.005

Table 1: Distribution of study sample by age and Dental Anxiety Scores (DAS)

Age (years)	Number of children	Anxious children		Non-anxious children	
		n (%)	Mean DAS	n (%)	Mean DAS
6	10	6 (60%)	10.60	4 (40%)	5
7	9	5 (55.56%)	11.20	4 (44.44%)	5.50
8	8	6 (75%)	11	2 (25%)	4
9	13	9 (69.23%)	11.11	4 (30.77%)	5
10	13	6 (46.15%)	12	7 (53.85%)	4.28
11	11	6 (54.55%)	12.66	5 (45.45%)	6
12	37	21(56.76%)	12.61	16 (43.15%)	4.68
Total	100	58	11.6	42	4.92

Category	Yellow	Blue	Green	Red	Pink	Black
Anxious (n=58)	25 (43.10%)	13 (22.41%)	9 (15.51%)	6 (10.34%)	5 (8.62%)	0
Non-anxious (n=42)	19 (45.23%)	10 (23.80%)	5 (11.90%)	3 (7.14%)	5 (11.90%)	0
Total (n=100)	44 (44%)	23 (23%)	14 (14%)	9 (9%)	10 (10%)	0

Table 3: Comparison of color preferences for happiness emotion in anxious and non-anxious children

Anxious		P value	Non-anxious		P-value
Yellow vs	**Blue**	**0.967**	**Yellow vs**	**Blue**	**0.961**
	Green	0.755		Green	0.714
	Red	0.731		Red	0.686
	Pink	0.737		Pink	0.694
	Black	0.001		Black	0.001
Blue vs	Green	0.757	Blue vs	Green	0.716
	Red	0.732		Red	0.688
	Pink	0.739		Pink	0.696
	Black	0.002		Black	0.002
Green vs	Red	0.645	Green vs	Red	0.588
	Pink	0.650		Pink	0.594
	Black	0.004		Black	0.002
Red vs	Pink	0.633	Red vs	Pink	0.575
	Black	0.005		Black	0.004
Pink vs	Black	0.005	Pink vs	Black	0.005

Chi-square test; p≤0.05=significant

Table 4: Color preference of children for sadness emotion

Category	Red	Yellow	Black	Pink	Blue	Green
Anxious (n=58)	17 29.31%)	10 (17.24%)	9 (15.51%)	9 (15.51%)	5 (8.62%)	8 (13.79%)
Non anxious (n=42)	14 (33.33%)	11 (26.19%)	9 (21.42%)	4 (9.52%)	4 (9.52%)	0 (0%)
Total (n=100)	31 (31%)	21(21%)	18 (18%)	13 (13%)	9 (9%)	8 (8%)

Table 5: Comparison of color preferences for sadness emotion in anxious and non-anxious children

Anxious		P value	Non-anxious		P value
	Blue	0.527		Blue	0.457
	Green	0.092		Green	0.048
Yellow vs	Red	0.505	Yellow vs	Red	0.433
	Pink	0.412		Pink	0.335
	Black	0.442		Black	0.367
	Green	0.118		Green	0.066
	Red	0.802		Red	0.768
Blue vs	Pink	0.588	Blue vs	Pink	0.525
	Black	0.648		Black	0.592
	Red	0.114		Red	0.063
Green vs	Pink	0.099	Green vs	Pink	0.052
	Black	0.104		Black	0.056
	Pink	0.562		Pink	0.495
Red vs	Black	0.615	Red vs	Black	0.555
Pink vs	Black	0.487	Pink vs	Black	0.414

Chi-square test; p≤0.05=significant

In the present study, six easily identifiable color groups–blue, green, pink, yellow, red, and black – were used, four of which (blue, green, yellow, red) correspond to the four principal colors of the Munsell system.[11] Pink was included as it might be related to bodily tissues and black, as an achromatic color.[10]

Six emotions commonly reported as experienced by children include happiness, surprise, anger, sadness, aversion and fear.[12] In this study, two well-experienced emotions of children i.e. happiness and sadness, were taken into consideration and it was observed that children related the colors yellow and blue most with happiness and the colors red and black most with sadness. This is in agreement with the findings of Boyatzis and Varghese,[13] who observed that light colors (e.g., yellow, blue) are associated with positive emotions (e.g., happy, strong) and dark colors (e.g., black, gray) with negative emotions. Hemphill[5] also found that bright colors elicited positive emotions, while dark colors elicited negative emotions. Cimbalo *et al* [14] found that children used yellow, blue, green and orange to color happy scenes and red, black and brown for sad scenes. Ballast[15] observed that colors like blue, green and purple were considered restful and quiet, while Lang[16] related colors like blue and green to the perception of increase in size of rooms. Wexner[17] found that associations of some mood tones with particular colors are more apparent and precise than others.

Studies[18-20] have reported that the color yellow is associated with happiness, cheerfulness and a positive emotional state, blue is associated with security, calmness and comfort, green with quietness, red with anger, aggression and excitation, and black with depression or anxiety.[21-22] Kotler[23] opined that colors could help create attention, convey messages, and create feelings that might increase purchase probability. Gerard[24] reported that the color red increases blood pressure, respiratory rate, and eye blink frequency, while blue does not have such effects. Jacobs and Suers[25] observed that colors like red and yellow caused more anxiety than blue and green. Park[4] investigated the color preference for pediatric patient rooms among the inpatients, out patients and healthy children. Regardless of gender effects, healthy children and pediatric patients preferred blue and green the most and white the least. In the present study, color preference was not affected by the presence of dental anxiety.

Colors are rich with symbolism. This symbolism can be apparent in how an individual associates colors with things, objects or physical space.[26] In our study, one child said he used red as the color for positive emotion because his favorite dress was of a red color. Similarly the color yellow was selected by a child for happiness emotion because his school bus was the same color.

Moreover, color conventions differ from one society to another. In Western cultures, red is thought to be a fiery color, green is said to be soothing.[26] Black symbolizes mourning in some countries, and in others, marriage.[27] In the present study, both red and black were associated with sadness.

The results of the present study indicated that yellow is considered the color of happiness, followed by blue. The use of these colors in the dental operatory may contribute to providing a pleasant environment for child dental patients. Colors like red and black, which have been associated with dark emotions like anger and aggression, must be avoided.

Future research with a larger sample size and a larger range of color samples is recommended in order to establish the impact of color on behavior of children in the pediatric dental set-up.

CONCLUSION

Yellow was the most-preferred color and black, the least-preferred, for happiness emotion, whereas, for sadness emotion, red and green were the most- and least-preferred colors, respectively. Color preference was not affected by the presence of dental anxiety.

REFERENCES

1. Gordon D, Heimberg RG, Tellez M, Ismail AI. A critical review of approaches to the treatment of dental anxiety in adults. J Anxiety Disord; 27(4):365-78. 2013.
2. Klingberg G, Broberg AG. Dental fear/anxiety and dental behaviour management problems in children and adolescents: a review of prevalence and concomitant psychological factors. Int J Paediatr Dent; 17(6):391-406. 2007.
3. Krikken JB, Ten Cate JM, Veerkamp JS. Child dental fear and general emotional problems: a pilot study. Eur Arch Paediatr Dent; 11(6):283-6. 2010.
4. Park JG. Color perception in pediatric patient room design: Healthy children vs. pediatric patients. Higher Education Research and Development; 2:6-28. 2009.
5. Hemphill M. A note on adults color-emotion associations. J Gen Psychol; 157:275-81. 1996.
6. Abbasi MA, Talaei A, Talaei A, Rezaei A. The use of appropriate colors in the design of children's room: a short review. Int J of Pediatr; 10(2):1-4. 2014.
7. Ulrich RS. Nature verses urban scenes; some psycho-physiological effects. Environt Behavior; 13:523-56. 1981.
8. Saito M. Comparative studies on color preference in Japan and other Asian regions, with special emphasis on the preference for white. Color Research and Application; 21(1):35- 49. 1996.
9. Corah NL. Assessment of a dental anxiety scale. J Am Dent Assoc; 97(5):816-9. 1978.
10. Carruthers HR, Morris J, Tarrier N, Whorwell P. The Manchester color wheel: Development of a novel way of identifying color choice and its validation in healthy, anxious and depressed individuals. BMC Med Res Methodol; 10:1-16. 2010.
11. Munsell AH. A pigment color system and notation. Am J Psychol; 23(2):236-44. 1912.
12. Ekman P, Freisen WV. Facial signs of emotional experience. J Pers Soc Psychol; 39:1125-34. 1980.
13. Boyatzis, CJ, Varghese R. Children's emotional associations with colors. J Gen Psychol; 155:77-85. 1994.
14. Cimbalo RS, Beck KL, Sendziak DS. Emotional toned pictures and color selection for children and college students. J Gen Psychol; 133:303-4. 2014.
15. Ballast DK. Interior design reference manual. Belmont, CA: Professional Pub. Inc.; 2002.
16. Lang J. Creating architectural theory: The role of the behavioral sciences in environmental design. New York: Van Nostrand Reinhold; 1993.
17. Wexner LB. The degree to which colors (hues) are associated with mood-tones. J Appl Psychol; 6:432-6. 1954.
18. Schaie KW. Scaling the association between colors and mood tones. Am J Psychol; 74:266-73. 1961.
19. Schaie KW. A Q-sort study of color-mood association. J Proj Tech; 25:341-6. 1996.
20. Nolan RF, Dai Y, Stanley PD**.** An investigation of relationship between color choice and depression measured by the Beck Depression Inventory. Percep Mot Skills; 81:1195-200. 1995.
21. Birren F. Aspects of light and color bearing on the reactions of living things and the welfare of human beings. Chicago: Color and Human Response; 1978.
22. Sharpe DT. The psychology of color and design. Chicago: Nelson-Hall; 1974.
23. Kotler P. Atmospherics as a marketing tool. Journal of Retailing; 49(4):48-61. 1973.
24. Gerard RM. Differential effects of colored lights on psycho-physiological functions [unpublished doctoral dissertation], University of California; 1957.
25. Jacobs KW, Suess, JF. Effects of four psychological primary colors on anxiety state. Perceptual and Motor Skills; 41:207-10. 1975.
26. Naz Kaya. Relationship between color and emotion: a study of college students. USA: The University of Georgia; 2004.
27. Linton H. Color consulting: A Survey of International color design. New York: Van Nostrand Reinhold; 1991.