Comparative Assessment of Emotional Association with Color Preference and Anxiety Levels in Children - A Cross-Sectional Study

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ABSTRACT

Background. Most of the children are difficult to manage in a dental clinic as they do not cooperate during a dental procedure which may be due to emotional distress experienced by the child during the treatment. By knowing a child's color preference at a point of time, a dentist can evaluate the emotional state and identify fear hence, this study was conducted to assess and compare emotional association with color preference and anxiety levels in children.

Aim of The Study. To assess and compare emotional association with color preferences and anxiety levels in children.

Methodology. 600 children aged between 6-12 years, were randomly selected from the patients visiting the department of pediatrics and preventive dentistry in V.S dental college. A specially designed proforma was used to record the personal information consisting of, Humphris modified dental anxiety scale and face drawings sheet representing both emotions: Happiness and sadness. The children were provided with 8 crayons and were asked to color the emoticons with their preferred color of choice. Data collected was analyzed statistically by applying a chi-square test.

Results. 70.3% (190) children of the younger age group were graded as anxious, while 29% (80) children were found to be non-anxious. 41.2% (136) of the older age group were anxious, while 58.8% of children (194) were non-anxious. 45.9% (126) boys and 41.7% (136) girls preferred yellow to shade the positive emoticon. Black was the preferred color of choice for negative emotion by 41.2% girls (134) and girls (112).

Conclusion. From this study, we conclude that adding colors like yellow and pink to the dental environment could enhance a positive attitude and make the child at ease, while black, blue, red and green might impart a negative outlook in their mind.

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1. Introduction:

Children are the future of our civilization. The experience of a child during the formative years can go a long way in formulating the individual personality as an adult. Most of the children are difficult to manage in a dental clinic as they do not cooperate during a dental procedure. These difficulties in managing children are not only related to the mechanical procedure involved but also to the emotional distress experienced by the child during the treatment.

Dental anxiety is one of the most common problems affecting children and adolescents. Despite the advances in technology, dental materials, and increased oral health awareness, a significant percentage of people suffer from dental anxiety. It is ranked fourth among common fears and nine among intense fears. Around 5-20% of children in various countries show dental fear and anxiety among which, a few cases are considered as dental phobia (Kutchma, 2003). Anxiety can be developed either directly by conditioning through an unpleasant experience, indirectly by modeling or by acquired information from various sources. The effects of dental anxiety may lead the child to avoid the required treatment at the right time, thereby compromising the dental health which may, in turn, worsen their dental problems requiring more intensive treatments that reinforce their initial fear.

Color is an inseparable part of everyday life and it has been recognized that colors also have a strong impact on our emotions and feelings. The therapeutic effects of

colored minerals, stones, crystals, salves, and dyes were utilized by ancient Egyptians and Greeks as remedies. Recent research into color therapy has shown that color is becoming a widely accepted therapeutic tool with numerous medical applications. Color builds instant subconscious judgment during a consumer's decision to purchase. It was found that people make up their opinions within 90 seconds of their initial interactions with each other or with a product (Pope, Butler, & Qualter, 2012).

Colors are significant and act as a basic tool of communication in their use as a medium to reflect the emotions and thoughts of individuals. The effects of colors on human psychology can also influence individuals' color preferences. It has been observed that a child's behavior and cooperation with the treatment are influenced by the dental environment in which it is being carried out. Current research suggests that when the brain perceives color, a physiological reaction takes place. In this regard, the dental environmental elements that induce positive emotions can reduce dental anxiety and vice versa

By knowing a child's color preference at a point of time, dentist can evaluate the emotional state and identify fear, after which methods can be implemented to reduce their anxiety as it will improve patient management and the overall quality of dental treatment and hence, this study was conducted to assess and compare emotional association with color preference and anxiety levels in children.

2. Methodology:

This study was conducted amongst 600 children aged between 6-12years, who were randomly selected from the patients visiting the department of pediatrics and preventive dentistry in V.S dental college, for routine dental checkups. Signed written informed consent from parents of the children and institutional ethical committee clearance was obtained before the commencement of the study.

A specially designed proforma was used to record the personal information which contains, Humphris modified dental anxiety scale and face drawings sheet representing two emotions: Happiness (positive emotion) and sadness (negative emotion). A modified dental anxiety scale was used to record the anxiety level of each child before the dental examination. It contains five questions; each question is scored from one (not anxious) to five (extremely anxious) such that the total score ranges from 5 to 25. Children with a score equal to or more than 15 were considered as anxious and less than 15 were considered as non-anxious.

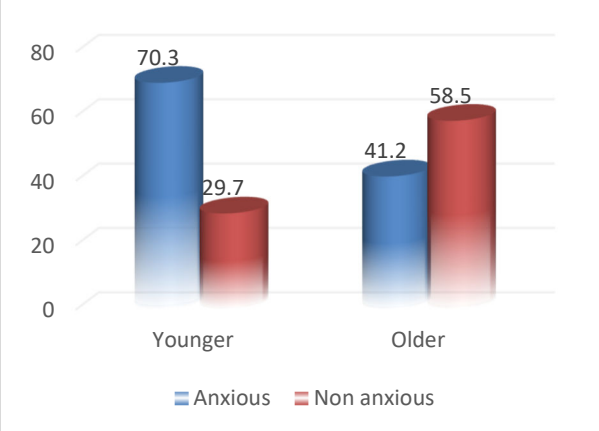
After the questionnaire section, the children were given 8 crayons (blue, green, yellow, red, pink, orange, black and white) and they were asked which crayon would they choose to color the happy face. They were then asked to color the happy emoticon with their color of choice.

Next, they were asked which color would they prefer to color the sad face and subsequently they were asked to color the sad cartoon face drawing with their most preferred color. Both boys and girls were divided into younger children (6-9 years) and older children (9-12 years), anxious and non-anxious. Data collected was analyzed statistically by presenting the qualitative and quantitative measure variables into different categories in the form of tables and graphs. Inferential statistical analysis was carried out by applying a chi-square test.

3. Results:

The present study was conducted to assess and compare the emotional association with color preference and anxiety levels in children. The children were randomly selected from the patients visiting the department, for routine dental checkups. 600 children aged between 6-12 were included in the study, in which 45.6% (274) were boys and 54.4% (326) were girls.

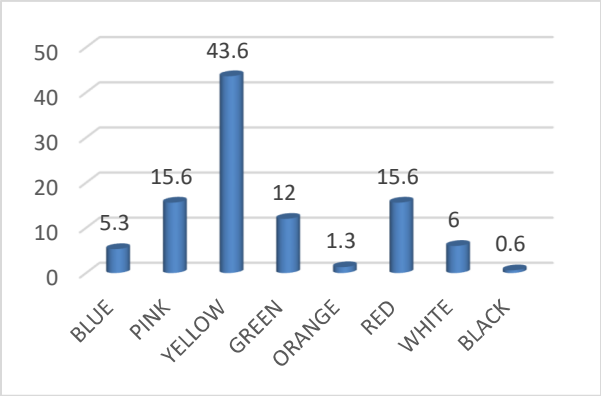
Children in the age group of 6-9 years were grouped as younger children 45% and 10-12 years were grouped as older children 55%. All the children were categorized into anxious and non-anxious based on the modified dental anxiety scale; the mean was taken as 15. Values < 15 were considered non-anxious 45.6% and those ≥ 15 were considered anxious 54.4%. 70.3% of children of the younger age group were graded as anxious, while 29% of children were found to be non-anxious. 41.2% of the older age group were anxious, while 58.8% of children were non-anxious. Younger children showed more anxiety compared to older children, and a statistically significant difference ($p<0.05$) was seen. There were no dropouts in the study [graph 1].



Graph 1. Anxiety Level & Age Group.

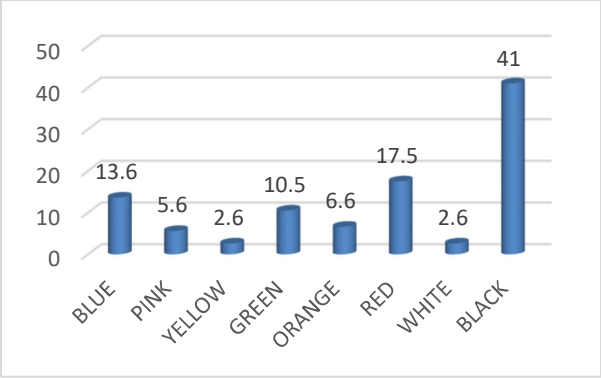
For the positive emotion, 43.6% of children preferred yellow followed by pink and red both -15.6%,

green 12%, white 6%, blue 5.3%, orange 1.3%, and black 0.6% respectively [graph 2].



Graph 2. Colour Preference for Happy Faces.

For the negative emotion, 41% of children preferred black followed by red 17.5%, blue 13.6%, green 10.5%, orange 6.6%, pink 5.6%, yellow and white 2.6% each [graph 3].



Graph 3. Colour Preference for Sad Face.

The difference between younger and older children in preferring different colors was assessed with the Chi-square test. Out of 274 boys, 45.9% (126) preferred yellow to color the happy face followed by red 18.6% (51), green 13.1% (36), white 8.7% (24), blue 8.1% (22), pink 3.6% (10), orange 1.4% (4) and black 0.6% (1). Among 326 girls, 41.7% (136) preferred yellow to shade the positive emoticon followed by pink 25.7% (84), red 13.1% (43), green 11.1% (36), white 3.6% (12), blue 3.1% (10) orange 1.2% (4) and black 0.5% (1) [Table 4]. The results of the Chi-square test revealed that there was a statistically significant difference between boys and girls in preferring pink (p = 0.002) when they are in positive emotion. Both younger 48.1% (130) and older 40% (132), anxious 39.3% (128) and non-anxious 48.9% (134) children preferred yellow color for happy face [table 5-6].

Table 4. *Colour Preference to Happy Face Based on Gender.*

	Boys	*Girls*	*Total*	*Chi-square test*	*P-Value*
Blue	22 (8.1%)	10 (3.1%)	32	1.02	0.310
Pink	10 (3.6%)	84 (25.7%)	94	9.32	**0.002***
Yellow	126 (45.9%)	136 (41)	262	0.762	0.09
Green	36 (13.1%)	36 (11.1%)	72	0.02	0.88
Orange	4 (1.4%)	4 (1.2%)	8	0.01	0.96
Red	51 (18.6%)	43 (13.1%)	94	0.65	0.42
White	24 (8.7%)	12 (3.6%)	36	0.65	0.42
Black	1 (0.6%)	1 (0.5%)	2	0.03	.93
Total	274	326	600		

*P<0.05 is statistically significant.

Table 5: *Colour Preference to Happy Face Based on Age Group.*

	Younger children	*Older children*	*TOTAL*	*Chi-square TEST*	*P VALUE*
Blue	12 (4.4%)	20 (6.1%)	32	0.12	0.87
Pink	46 (17.1%)	48 (14.5%)	94	0.80	0.06
Yellow	130 (48.1%)	132 (40%)	262	0.54	0.36
Green	28 (10.3%)	44 (13.3%)	72	0.33	0.56
Orange	2(0.7%)	6(1.8%)	8	0.14	0.79
Red	25 (9.3%)	69 (20.9%)	94	1.69	0.19
White	26 (9.6%)	10 (3.1%)	36	2.09	0.14
Black	1 (0.5%)	1 (0.3%)	2	0.17	0.89
Total	270	330	600		

*P<0.05 is statistically significant.

Table 6. *Colour Preference to Happy Face Based on Anxiety Level.*

	Anxious	*Non-anxious*	*TOTAL*	*Chi square TEST*	*P Value*
Blue	18 (5.5%)	14 (5.1%)	32	0.09	0.89
Pink	58 (17.8%)	36 (13.1%)	94	0.25	0.61
Yellow	128 (39.3%)	134 (48.9%)	262	0.56	0.45
Green	38 (11.7%)	34 (12.4%)	72	0.24	0.65
Orange	2 (0.6%)	6 (2.1%)	8	0.19	0.59
Red	64 (19.6%)	30 (10.9%)	94	1.60	0.20
White	18 (5.5%)	18 (6.6%)	36	0.67	0.78
Black	0 (0%)	2 (0.9%)	2	0.11	0.87
Total	326	274	600		

*P<0.05 is statistically significant.

When color preferences to negative emotions were compared based on gender, it was observed that boys and girls had preferred blue (p = 0.04) and red (p =0.03) which was statistically significant. Both boys and girls (41.2%) preferred black color for negative emotions. [Table 7].

Table 7. *Colour Preference to Sad Face Based on Gender*

	Male	*Female*	*TOTAL*	*Chi square TEST*	*P Value*
Blue	18 (6.5%)	64 (19.6%)	82	4.06	**0.04***
Pink	14 (5.1%)	20 (6.1%)	34	0.13	0.72
Yellow	10 (3.6%)	6 (1.8%)	16	0.45	0.78
Green	28 (10.2%)	34 (10.4%)	62	0.32	0.81
Orange	18 (6.5%)	22 (6.7%)	40	0.19	0.90
Red	67 (24.8%)	35 (11.1%)	102	4.69	**0.03***
White	6 (2.1%)	10 (3.1%)	16	0.54	0.51
Black	112 (41.2%)	134 (41.2%)	246	0	1
Total	274	326	600		

*P<0.05 is statistically significant.

Younger children 39.3% (106) and older children 42.7% (140), preferred black color for the negative emotion. [Table 8].

Table 8: *Colour Preference to Sad Face Based on Age Group.*

	Younger children	*Older children*	*TOTAL*	*Chi-square Test*	*P-Value*
Blue	18 (6.6%)	64 (19.4%)	82	2.85	0.09
Pink	12 (4.4%)	22 (6.6%)	34	0.23	0.72
Yellow	12 (4.4%)	4 (1.2%)	16	0.67	0.43
Green	44 (16.3%)	18 (5.4%)	62	3.53	0.06
Orange	18 (6.6%)	22 (6.6%)	40	0	1
Red	51 (19.6%)	51 (15.7%)	102	0.25	0.67
White	8 (2.8%)	8 (2.4%)	16	0.11	0.85
Black	106 (39.3%)	140 (42.7%)	246	0.67	0.43
Total	270	330	600		

*P<0.05 is statistically significant.

Anxious 43.5% (142) and non-anxious 39.2% (104) children also preferred black color for negative emotion [table 9].

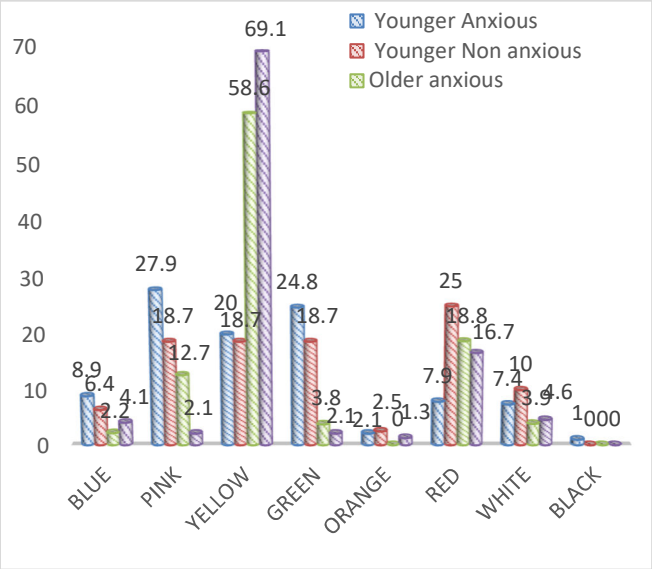
Table 9: *Colour Preference to Sad Face Based on Anxiety Level.*

	Anxious	*Non-anxious*	*Total*	*Chi square TEST*	*P Value*
Blue	56 (17.2%)	26 (9.5%)	82	1.167	0.28
Pink	22 (6.7%)	12 (4.8%)	34	0.67	0.43
Yellow	12 (3.7%)	4 (1.5%)	16	0.51	0.49
Green	12 (3.7%)	50 (18.2%)	62	6.705	**0.001***
Orange	14 (4.3%)	26 (25%)	40	8.056	**0.004***
Red	57 (17.8%)	45 (16.7%)	102	0.19	0.78
White	10 (3.1%)	6 (2.1%)	16	0.13	0.88
Black	142 (43.5%)	104 (39.2%)	246	0.26	0.75
Total	326	274	600		

*P<0.05 is statistically significant.

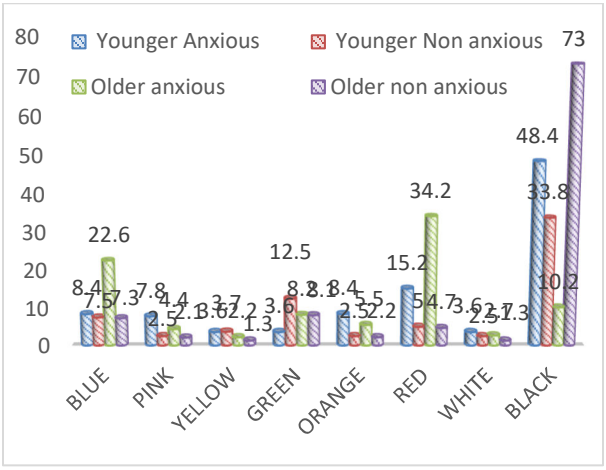
Green and orange color was preferred by anxious and non-anxious children for the sad face which was found to be statistically significant (p =0.004) [table 9].

Color preferences for both positive and negative emotions were compared with anxiety level and age group. 27.9% younger anxious children preferred pink whereas 18.7% younger non-anxious children preferred pink, yellow and green colors for a happy face. 58.6% Older anxious children and 69.1% older no anxious children preferred yellow for happy face [graph 10].



Graph 10. Colour Preference to Happy Face Based on Age and Anxiety Level.

For negative emotion, 48.4% younger anxious children and 33.8% younger non-anxious children preferred black color. 34.2% Older anxious children preferred red and 73% older non-anxious children preferred black for sad face [graph 11].



Graph 11. Colour Preference to Sad Face Based on Age and Anxiety Level

4. Discussions:

This study has included 600 children to assess and compare the emotional association with color preference and anxiety levels. It is to be highlighted that none of the previous similar studies have had such a broad sample set, this factor will increase the accuracy of the study. Color has come to play an important role in communication in recent days more than ever. Various psychological influences of color on human beings have been of significance for a long time. The emotional effect varies with the color of the object. It has been observed that warm colors in the color red system arouse genial, positive, active feelings, and neutral colors such as green promote moderate, calm, ordinary feelings, while the cool colors in the blue color system produce cold, passive, quiet feelings (Yoto, Katsuura, Iwanaga, & Shimomura, 2007).

Avicenna, an Arab physician mentioned in his Canon of Medicine (Avicenna, 980 AD) that he used various colors in treatment which details that red flowers cured blood disorders, yellow flowers, and morning sunlight cured disorders of the biliary system. Our perception is influenced by the wavelengths of light that strikes on the human eye. As the light hits the retina, it is converted to electrical impulses that are transmitted to the hypothalamus for interpretation. The hypothalamus is the part of the brain governing our hormones and our endocrine system and acts as the body's biological clock (Wright, 2008) through which it governs our body's temperature, our appetite, sexual functions, sleeping, and behavioral patterns (Wright, 2008). Due to the presence of energy, it has been proven that color has a physical effect on humans to demonstrate this, an experiment involving blind people was carried out which resulted in them identifying colors with ease.

Color has been observed to affect memory, attention, emotions, mood, and behavior; and motor functions as well (McKelvie, Sano, & Stout, 1994; Spence, Wong, Rusan, & Rastegar, 2006; Camgöz, Yener, & Güvenç, 2004; Bradley, Codispoti, Cuthbert, & Lang, 2001; Valdez, & Mehrabian, 1994; Zentner, 2001; Elliot, & Aarts, 2011; Babin, Hardesty, & Suter, 2003; Kwallek, Lewis, & Robbins, 1988; Rosenstein, 1985). Colors can have an amazing effect on every individual psychologically. According to Poore & Ragan (1997), clothing, interiors, landscape color can change our mood from sad to happy, from confusion to intelligence, from fear to confidence (Poore & Ragan, 1997). Color can affect a person's emotions, energy level, and sense of order, or disorder. Further, it can also influence the tone of interior and make it seem formal, or informal, masculine or feminine, coolly aloof or invitingly warm.

Although there are several similar studies in the literature none of them have evaluated the difference in color preferences in relation to gender except in a study

conducted by Annamary *et al*. (2016). Hence the importance of our study has shed some light on this relationship as well. Children are exposed to a considerable amount of vibrant color through toys and possessions, all of which can carry certain messages and associations in their minds. There is a stereotypical gender color association observed as the children were exposed to particular colors by parents and family: blue for boys and pink for girls. This study was conducted to evaluate the color preference to emotions (happiness and sadness) in relation to children's age, gender and anxiety level.

Modified Dental Anxiety Scale to assess the anxiety was used in this study as it is a reliable, uses simple language, has minimal instrumental effects and sound psychometric properties. Furthermore, it has a question regarding local anesthetic injection anxiety, which could be of great importance in pediatric patients.

In this study, eight easily identifiable colors – pink, blue, green, yellow, orange, white, red and black and two well-experienced emotions of children i.e. happiness and sadness have been included. Children of two age groups were included in this study i.e. 6-9 years and 10-12 years because studies among children can be more easily validated and less confounding than the studies done on adults since adults have more learned environmental responses than young children. On the other hand, children less than 6 years of age do not seem to have the required cognitive abilities developed for taking part in the study to produce meaningful observations**.** Some authors observed that the relationship between color and emotion preferences varies as age advances based on their experiences (Terwogt, & Hoeksma, 1995; Saunders, 1998).

The study done by Kattayam et al revealed that compared to older children, younger children showed more anxiety which is similar to our study results (Annamary *et al*., 2016). It was observed that children related the color yellow with happiness and the colors red and black with sadness. This is in agreement with the findings of Bubna, Hegde, & Rao, (2017). Further Boyatzis, & Varghese, (1994) also observed a similar trend wherein dark colors such as black and gray are associated with negative emotions and light colors such as yellow and blue are associated with positive emotions. Besides, prior research has noted that colors with shorter wavelengths tend to be more pleasant when compared with a longer wavelength (Gerard 1958). Terwogt, & Hoeksma, (1995) carried out a similar study in which children related sadness to yellow which is not in agreement with the current study. Psychologically, yellow is noticed to be the strongest color, it is about emotions, self-esteem, and creativity (Wright, 1998). In a study by Hemphill, it was found that bright colors induced positive emotions, while dark colors induced negative emotions (Hemphill, 1996).

Cimbalo *et al*. in his study found that children used yellow, blue, green and orange to color happy scenes and red, black and brown for sad scenes (Cimbalo, Beck, & Sendziak, 1978). Kasikci et al mentioned that black color is known as the color of sadness, death, burden, seriousness, and pessimism (Kaşıkçı, 2006). Malarcher mentioned in his study that the subjects involved stated that color black symbolizes mysteriousness (30%), power (27%), manhood (23%), depressiveness (20%) and conservatism (18%) (Malarcher P. (1995).

Frank and Gilovich found that black uniforms when compared with nonblack uniforms, led to higher levels of player aggressiveness during his investigation on the effects of black versus nonblack uniforms of professional football and hockey teams (Frank, & Gilovich, 1988). Terwogt & Hoeksma carried out a similar study in which children related surprise(emotion) to black color which is an additional relation revealed (Terwogt, & Hoeksma, 1995). Majority of boys and girls opted yellow color to shade happy face and further boys and girls preferring pink color were statistically significant, which is in agreement with the study done by Annamary *et al*. in which they observed that boys and girls preferred yellow, pink, green, orange and blue when they are in positive emotion on the other hand red and black were associated with negative emotions (Annamary *et al*., 2016).

It is to be noted that in this study that boys and girls preferring blue (boys- 6.5% & girls- 19.6%) and red (boys- 24% & girls-11.1%) were statistically significant for negative emotions, which is not in agreement with study conducted by Terwogt & Hoeksma, Cimbalo et al as well as Tamirat, which revealed blue is associated with positive emotions (Terwogt, & Hoeksma, 1995; Cimbalo, Beck, & Sendziak, 1978; Abegaz, Dillon, & Gilbert, 2015) . Ueda et al observed that blue has a more relaxing effect as was pointed out by Gerard in his study about the possible uses of blue as a tranquilizer and relaxant for anxious individuals, and as a way of reducing blood pressure in the treatment of hypertension (Ueda, 2004).

With respect to the color pink, Hamid and Newport, observed that the effect of pink room color on gross motor activity of children increased physical strength and positive mood in comparison to a blue room (Hamid, & Newport, (1989). Pink holding cells are now used extensively to reduce violent and aggressive behavior among inmates because the color saps their energy (Lubos, 2008). Pink has been found to have a certain tranquilizing and calming effect within minutes of exposure and it suppresses hostile, aggressive, and anxious behavior. Profusek and Rainey (1987) investigated the effects of rooms painted in red versus Baker-Miller pink on anxiety and as hypothesized, pink caused less anxiety than red[32]. Further research based on

Goldstein's theory of color perception has revealed that red has stimulating effects on human behavior including mental judgment, which have been found to show inaccurate performance under red room conditions (Nakshian, 1964).

In our study, anxious and non-anxious children preferred yellow for happy face and black for the sad face which was in agreement with the study conducted by Umamaheshwari *et al*. (2013). Anxious and non-anxious children preferring green and orange for negative emotion was statistically significant which is not in agreement with the study conducted by Cimbalo et al. which revealed that children used orange and green to color happy scenes (Cimbalo, Beck, & Sendziak, 1978). while Lang related colors like green to the perception of an increase in the size of rooms (Lang, 1987). Park investigated the color preference for pediatric patient rooms among the inpatients, outpatients, and healthy children (Park, 2009). Regardless of gender effects, healthy children and pediatric patients preferred green and blue.

Terwogt and Hoeksma, has related fear with green in his study (Terwogt, & Hoeksma, 1995). Walsh and colleagues investigated the effects of color on children's food preferences which revealed red, green, orange, and yellow were preferred by children in that order (Walsh, Toma, Tuveson, & Sondhi, 1990). Green is generally regarded as an emotionally calming color that gives a sense of refreshment, harmony, and equilibrium and symbolizes universal love, environmental awareness, and peace.

Younger anxious children preferred pink color for positive emotion in our study which is different from the results obtained by Umamaheshwari et al in which children preferred yellow for positive emotion (Umamaheshwari *et al*., 2013). Our study revealed that older anxious and non-anxious children preferred yellow for positive emotion whereas the findings by Umamaheshwari showed that blue is the preferred color for positive emotion (Umamaheshwari *et al*., 2013). Studies revealed that individuals with higher levels of anxiety preferred dull colors compared to individuals with lower levels of anxiety and the stimulating effects of the shiny colors are the reason for this preference.

A limitation of this study could have resulted from cultural or individual differences for color preference. For example, red is a favorable color in Japanese culture (Hatta, Yoshida, Kawakami, & Okamoto, 2002) and white in some Eastern cultures (Walsh, Toma, Tuveson, & Sondhi,1990). The findings by Ingman et al. on the importance of the effect of culture on dental anxiety in children revealed that in the same region Christian children showed more fears than Muslims (Ingman, Ollendick, & Akande, 1999). Cultural studies have found that culture influences color preference (Shin et al., 2012). Attributes of colors including hue, brightness, and saturation need to be considered in the study due to the variations in colors that convey several meanings, for instance, differences in brightness could be a confounding factor that could significantly affect results. A good example is a red color, which can simulate both positive (love) and negative (anger) emotions. Another limitation is the difficulty of distinguishing fear from anxiety in young children.

5. Conclusion:

Children develop color-emotional concepts and schemas during their early childhood. The anxiety level of children in relation to colors can be analyzed and child-friendly colors can be identified which could be incorporated into clinical set up to help reduce the overall anxiety of children during the dental procedure by reducing the stress level and further decreasing the time utilized for procedures as well. From this study, we conclude that adding low wavelength colors like yellow and pink to the dental environment could enhance a positive attitude and make the child at ease, while black, blue, red and green might impart a negative outlook in their mind.

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References:

1. Abegaz, T., Dillon, E., & Gilbert, J. E. (2015). Exploring affective reaction during user interaction with colors and shapes. *Procedia Manufacturing*, *3*, 5253-5260.
2. Annamary, K., Prathima, G. S., Sajeev, R., Kayalvizhi, G., Ramesh, V., & Ezhumalai, G. (2016). Colour preference to emotions in relation to the anxiety level among school children in Puducherry–A cross-sectional study. *Journal of clinical and diagnostic research: JCDR*, *10*(7), ZC26.
3. Babin, B. J., Hardesty, D. M., & Suter, T. A. (2003). Color and shopping intentions: The intervening effect of price fairness and perceived affect. *Journal of business research*, *56*(7), 541-551.
4. Boyatzis, C. J., & Varghese, R. (1994). Children's emotional associations with colors. *The Journal of genetic psychology*, *155*(1), 77-85.
5. Bradley, M. M., Codispoti, M., Cuthbert, B. N., & Lang, P. J. (2001). Emotion and motivation I: defensive and appetitive reactions in picture processing. *Emotion*, *1*(3), 276.
6. Bubna, K., Hegde, S., & Rao, D. (2017). Role of colors in pediatric dental practices. *Journal of Clinical Pediatric Dentistry*, *41*(3), 193-198.

7. Kutchma, T. M. (2003). The effects of room color on stress perception: red versus green environments. *Journal of Undergraduate Research at Minnesota State University, Mankato*, *3*(1), 3.
8. Camgöz, N., Yener, C., & Güvenç, D. (2004). Effects of hue, saturation, and brightness: Part 2: Attention. *Color Research & Application: Endorsed by Inter-Society Color Council, The Colour Group (Great Britain), Canadian Society for Color, Color Science Association of Japan, Dutch Society for the Study of Color, The Swedish Colour Centre Foundation, Colour Society of Australia, Centre Français de la Couleur*, *29*(1), 20-28.
9. Cimbalo, R. S., Beck, K. L., & Sendziak, D. S. (1978). Emotionally toned pictures and color selection for children and college students. The Journal of Genetic Psychology, 133(2), 303-304.
10. Elliot, A. J., & Aarts, H. (2011). Perception of the color red enhances the force and velocity of motor output. *Emotion*, *11*(2), 445.
11. Frank, M. G., & Gilovich, T. (1988). The dark side of self-and social perception: Black uniforms and aggression in professional sports. *Journal of personality and social psychology*, *54*(1), 74.
12. Gerard RM. (1958). Differential effects of colored lights on psychophysical functions.
13. Hamid, P. N., & Newport, A. G. (1989). Effect of colour on physical strength and mood in children. Perceptual and Motor skills, 69(1), 179-185.
14. Hatta, T., Yoshida, H., Kawakami, A., & Okamoto, M. (2002). Color of computer display frame in work performance, mood, and physiological response. *Perceptual and motor skills*, *94*(1), 39-46.
15. Hemphill, M. (1996). A note on adults' color–emotion associations. *The Journal of genetic psychology*, *157*(3), 275-280.
16. Ingman, K. A., Ollendick, T. H., & Akande, A. (1999). Cross-cultural aspects of fears in African children and adolescents. Behaviour Research and Therapy, 37(4), 337-345.
17. Kaşıkçı, E. (2006). *Yüreğini bedenine yansıt: imaj-iletişim beden dili*. Hayat Yayıncılık.
18. Kwallek, N., Lewis, C. M., & Robbins, A. S. (1988). Effects of office interior color on workers' mood and productivity. *Perceptual and Motor Skills*, *66*(1), 123-128.
19. Lang, J. (1987). Creating architectural theory. *The role of the behavioral sciences in environmental. design.*
20. Lubos, L. C. (2008). The role of colors in stress reduction. Liceo Journal of Higher Education Research, 5(2), 1-1.
21. Malarcher P. (1995). Coloring the Future. *Surface Design Journal*. 19:20-1.
22. McKelvie, S. J., Sano, E. K., & Stout, D. (1994). Effects of colored separate and interactive pictures on cued recall. *The Journal of general psychology*, *121*(3), 241-251.
23. Nakshian, J. S. (1964). The effects of red and green surroundings on behavior. *The Journal of General Psychology*, *70*(1), 143-161.Pope,
24. D. J., Butler, H., & Qualter, P. (2012). Emotional understanding and color-emotion associations in children aged 7-8 years. *Child Development Research*, *2012*.
25. Park, J. G. (2009). Color perception in pediatric patient room design: Healthy children vs. pediatric patients. *HERD: Health Environments Research & Design Journal*, *2*(3), 6-28.
26. Poore, J., & Ragan, S. L. (1994). *Interior color by design: A design tool for architects, interior designers, and homeowners*. Rockport Pub.
27. Profusek, P. J., & Rainey, D. W. (1987). Effects of baker-miller pink and red on state anxiety, grip strength, and motor precision. *Perceptual and motor skills*, *65*(3), 941-942.
28. Rosenstein, L. D. (1985). Effect of color of the environment on task performance and mood of males and females with high or low scores on the Scholastic Aptitude Test. *Perceptual and Motor Skills*.
29. Saunders, B. (1998). What is colour?. *British Journal of Psychology*, *89*, 697.
30. Shin, M. J., Westland, S., Moore, E. M., & Cheung, T. L. V. (2012). Colour preferences for traditional Korean colours. *Journal of the International Colour Association*, *9*, 48-59.
31. Spence, I., Wong, P., Rusan, M., & Rastegar, N. (2006). How color enhances visual memory for natural scenes. *Psychological Science*, *17*(1), 1-6.
32. Terwogt, M. M., & Hoeksma, J. B. (1995). Colors and emotions: Preferences and combinations. *The Journal of general psychology*, *122*(1), 5-17.
33. Ueda, Y. (2004). Consciousness and Recognition of Five Colors; Using Functional-MRI and Brain Wave Measurements. *J Intl Soc Life Info Sci*, *22*, 366-371.
34. Umamaheshwari, N., Asokan, S., & Kumaran, T. S. (2013). Child friendly colors in a pediatric dental practice. *Journal of Indian Society of Pedodontics and Preventive Dentistry*, *31*(4), 225.
35. Valdez, P., & Mehrabian, A. (1994). Effects of color on emotions. *Journal of experimental psychology: General*, *123*(4), 394.
36. Walsh, L. M., Toma, R. B., Tuveson, R. V., & Sondhi, L. (1990). Color preference and food choice among children. *The journal of psychology*, *124*(6), 645-653.
37. Wright, A. (2008). How it works. Retrieved from http://www. colour-affects.co.uk/how-it-works.
38. Wright, A. (1998). Beginner's guide to color psychology. London, England: *Color Affects.*
39. Yoto, A., Katsuura, T., Iwanaga, K., & Shimomura, Y. (2007). Effects of object color stimuli on human

brain activities in perception and attention referred to EEG alpha band response. *Journal of physiological anthropology*, *26*(3), 373-379.

40. Zentner, M. R. (2001). Preferences for colours and colour--emotion combinations in early childhood. *Developmental Science*, *4*(4), 389-398.

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