Effect of chromotherapy on the anxiety level in the patients undergoing endodontic treatment: A randomized clinical study

Purnima Saklecha, Karkala Venkappa Kishan, Krushn Savaliya
Department of Conservative Dentistry and Endodontics, K. M. Shah Dental College and Hospital, Sumandeep Vidyapeeth, Vadodara, Gujarat, India

Abstract

Background: Incorporation of chromotherapy is an established modality in medical science. However, its use in adult dentistry is an unexplored area.

Aim: This study aimed to clinically evaluate and compare the effect of chromotherapy on anxiety levels in patients undergoing endodontic treatment.

Materials and Methods: Using computer randomization, the included 90 patients were divided into three groups: Group – 1: Blue, Group – 2: Pink, and Group – 3: Control. Patients were given a preoperative Modified Dental Anxiety Scale questionnaire. Preoperative assessment of heart rate, systolic blood pressure (BP), and diastolic BP was followed by color therapy. Assessment of all the parameters was done at three levels, i.e., preoperative, post chromotherapy session, and after endodontic treatment.

Statistical Analysis: Obtained data were tabulated and subjected to ANOVA and post hoc Tukey’s test, with P < 0.05 considered statistically significant.

Results: The present study demonstrated that patients subjected to blue and pink color therapy had a statistically significant reduction in anxiety as compared to the control group after chromotherapy and post endodontic treatment (P < 0.05). However, between the pink- and blue-colored groups, no statistically significant difference was found (P > 0.05).

Conclusions: Chromotherapy plays a pivotal role in anxiety reduction before and during the dental treatment procedure and can be effectively incorporated during routine practice.

Keywords: Anxiety; color; endodontic

INTRODUCTION

When people visit the dentist, one of the most prevalent feelings they encounter is dental anxiety. Dental treatment has been ranked fifth among the commonly feared situations. One of the dental procedures which is feared by many people is endodontic treatment.[1] Threatening stimuli set it off, causing the person to behave in specific ways. Many people avoid or postpone dental care due to apprehension over the procedure.[2] Dental anxiety is caused by a mix of biochemical changes in the body, as well as the patient’s personal past experience.[3]

Chromotherapy, colorology, or color therapy, is an old alternative medicine practice that employs the energy of the visible spectrum of electromagnetic radiations (i.e., colored light) to bring about changes in human
Goldstein asserted in 1939 that certain colors trigger certain emotional reactions. It has the potential to be a stress-relieving factor for everyone. Color is physically and emotionally perceptible and hence has the potential to elicit psychological responses.

Using colored lighting to influence people’s emotional states, a few authors have successfully treated individuals with behavioral disorders. Pink light, for example, has been shown to lower the aggressiveness of inmates in prison. Furthermore, in the School for Special Education San Rafael, Granada (Spain), another color-based technique with blue light was employed for disruptive behavior problems with significant gains. Under some circumstances, the heart rate (HR) is widely acknowledged as a stress indicator.

Schauss studied color’s calming influence and discovered that it lessens violent behavior and aggression. Cool colors had the reverse effect on worried people, functioning as a relaxant and sedative, reducing the raised blood pressure (BP), relieving tension, reducing muscle spasms, and lessening eye blink frequency. Since the color of the dental setting has been shown to have a positive effect on reducing dental anxiety, adding bright colors to the clinical setup and introducing colorful equipment would make patients feel better and more at ease in the dental environment. Blue color with a shorter wavelength is effective in reducing HR and BP. Further, pink color helps in calming the patient. As a result, the current study incorporates the application of these colors.

To evaluate the anxiety status of the patient, various scales have been developed. Humphris, Morrison, and Lindsay (1995) updated the original Corah Dental scale. Modified Dental Anxiety Scale (MDAS) consists of an additional question regarding local anesthesia which is one of the main reasons of anxiety in the dental clinic, which was incorporated in the present study.

On searching the literature, limited data were found regarding the effect of chromotherapy on anxiety level in patients undergoing endodontic treatment. Hence, the purpose of this study was to clinically evaluate and compare the effect of chromotherapy on anxiety levels in patients undergoing endodontic treatment. The null hypothesis was that chromotherapy would have no effect on anxiety levels in patients receiving endodontic treatment.

**MATERIALS AND METHODS**

Institutional Ethical Committee approved the study protocol (SVIEC/ON/Dent/SRP/19134). The current randomized clinical study was registered with Clinical Trial Registry of India (CTRI/2020/09/027571). A sample size of 90 was required to achieve 90% power 2° of freedom Chi-square test with a significance level (alpha) of 0.05. Hence, the final size came to be 90, with 30 samples being allocated to three groups each. The groups were as follows: Group – 1: Blue color, Group – 2: Pink color, and Group – 3: Control group.

Patients who were 18–60 years old, with normal vision, and required the use of local anesthesia during the endodontic treatment were included in the study. Pregnant women and individuals with physical or mental problems were not included.

Randomization of groups was done based on computer randomization. Each patient was given a code produced by www.randomiser.com and then told to pick a sealed envelope containing a piece of paper with their group number inscribed on it.

The principal investigator treated all of the teeth. Patients were given a preoperative MDAS questionnaire, which consisted of five questions. The MDAS is a five-item survey with a standardized response system that ranges from “not anxious” to “extremely anxious.” It is added together to make a Likert scale with a minimum of 5 and a maximum of 25 points. A cutoff value of 19 and above has been empirically proven to signify excessive dental anxiety, which may necessitate extra attention from dental professionals. Preoperative assessment of HR, systolic BP, and diastolic BP was done. This was followed by color therapy. Blue and pink colors were used as interventional groups.

Chromotherapy room was created with the use of long drapes of blue- and pink-colored cloth for blue and pink groups, respectively, covering the walls and ceiling of the room. Patients were given blue- and pink-colored goggles according to the group allotment. Patients were told to breathe deeply and relax while looking at the colorful wall in the room before the therapy. The color therapy was conducted for 20 min, and it was made sure that respondents were awake throughout the session. Patients in the control group were asked to wait in the waiting area for 20 min, and no special color therapy was provided.

Patient’s HR and BP were assessed in all the three groups. BP was measured thrice and their mean was taken into account. Participants were instructed for filling of the MDAS questionnaire.

Following this, patient’s treatment commenced. Blue- and pink-colored dental armamentaria such as suction tips, gloves, instrument tray, and instruments as far as possible were used during the endodontic treatment. After completion of the treatment, the patient had to fill posttreatment MDAS questionnaire and posttreatment assessment of HR, systolic BP, and diastolic BP was carried out. The collected data were tabulated, and statistical tests such as one-way ANOVA, post hoc Tukey’s test, and Paired t-test were used to analyze the results.

Journal of Conservative Dentistry  |  Volume 25 | Issue 4 | July-August 2022
RESULTS

The present study demonstrated that patients subjected to blue and pink color therapy had a statistically significant reduction in anxiety as compared to the control group after chromotherapy and post endodontic treatment ($P < 0.05$). However, between the pink- and blue-colored groups, no statistically significant difference was found ($P > 0.05$).

Demographic details and baseline values of all the 90 patients regarding their anxiety level and other vital parameters such as HR and BP did not differ significantly among the groups.

Individuals with anxiety score $<11$ were considered not anxious, score $11–14$ were considered moderately anxious, score with $15–18$ were considered highly anxious, and score with $≥19$ were considered extremely anxious.

DISCUSSION

Most people have a preconceived fear and anxiety regarding the endodontic treatment or dental treatment in general. This anxiety might hinder the treatment process, may give an unpleasant experience to the patient, or might even result in incomplete procedure.$^{[2]}$ Further, the individual might be even reluctant to future treatments. Reasons for anxiety may be several. Local anesthetic injection, sound from the dental equipment, and use of a mask are a few of them.$^{[10]}$

The incorporation of colors in various ways to enhance health and healing is known as chromotherapy. Color is a component of light, which is made up of a variety of electromagnetic waves. When light strikes the retina’s photoreceptor cells, it is turned into electric impulses, which travel to the brain and cause hormones to be released.$^{[4]}$ The lack of sunlight in northern countries during the winter months is well known to cause depression in many people, a disease known as seasonal affective disorder has been proven to be improved by constant exposure to full-spectrum light from a specific bright-light box, which suppresses daytime spike of the hormone melatonin (a molecule that promotes sleep) and increases the quantity of the mood-elevating brain chemical serotonin.$^{[4]}$ Color therapy proponents argue that since light, as well as its absence, has such tremendous impacts on humans, then the specific hues that make up light must as well. However, no clear confirmation of this has ever been discovered.$^{[4]}$

Several researchers have explored the impact of light on human physiology using biochemical markers such as cortisol and melatonin levels, as well as biosignals such as electrocardiographic and electroencephalographic (EEG) signals. In addition, the HR is widely used as a stress indicator under specific circumstances.$^{[15]}$

In the present study, the parameters that had been included to assess anxiety were an anxiety questionnaire, i.e., MDAS, and measurement of HR, diastolic BP, and systolic BP. Patients can express their anxiety through the use of a questionnaire, which helps practitioners to tailor their treatment accordingly. Individuals with anxiety score $<11$ were considered not anxious, score $≥11$ were considered dentally anxious, score $11–14$ were considered moderately anxious, score with $15–18$ were considered highly anxious, and score with $≥19$ were considered extremely anxious.$^{[14]}$

A lot of research has been carried out on the pediatric population.$^{[2,3]}$ However, the role of color for adult population in dental treatment remains unveiled. The process of chromotherapy helps in relaxing the individuals, thus enabling a smooth and peaceful treatment process.$^{[6,7]}$ Present study demonstrated that the use of chromotherapy is a significant tool in attaining anxiety reduction in anxious patients.

The parameters were assessed at three different intervals, i.e., before chromotherapy, after chromotherapy, and after completion of the treatment, which was also carried out in chromotherapy room. When the anxiety score before chromotherapy was compared with postchromotherapy and postendodontic treatment, results showed a statistically significant difference within both the color groups as compared to the control group ($P = 0.00$). There was a significant difference in HR and diastolic BP following pink chromotherapy. This is probably because when people are surrounded by pink, they are unable to be violent since the hue depletes their energy. Following minutes of exposure, pink has been discovered to have a relaxing and tranquilizing impact. It reduces aggressive, angry, and nervous behavior. When a person is anxious, the sympathetic nervous system is stimulated, causing their BP and HR to rise.$^{[16]}$ A study of the effect of wall color on learning environments found that light colors generated more relaxation than vibrant colors, and that short-wavelength colors (e.g., violet, blue, and green) reduced HR more than longer-wavelength colors (e.g., yellow and red).$^{[2]}$ Furthermore, a few authors have had success treating persons with behavior disorders by employing color illumination to influence their emotional states (e.g., producing mental quiet). Pink light, for example, has been shown to lower the aggression of individuals in prison.$^{[17]}$

A statistically significant difference was also found in the diastolic and systolic BP before and after chromotherapy in blue chromotherapy group. This could be because longer exposures to blue light (over several hours) produce melatonin suppression and phase alteration in the circadian clock, resulting in reduced tiredness and increased alertness. Light can stimulate cortical activity that is not involved in visual cognitive processes through
modulating alertness-related subcortical activity. Early EEG responses are influenced by light color adaptation.\(^{[18]}\) Another study found that a woman’s cortisol levels were reduced after a brief (20-min) stay in a blue room.\(^{[15]}\) Cortisol shows a regulating effect on salt and water balance, which aids in BP control. Goethe created a color wheel in 1840 to demonstrate the psychological influence of various colors. He discovered that blue creates a feeling of cold, whereas yellow creates a feeling of warmth. In various researches, the color blue was proven to have effects such as muscular relaxation, BP reduction, and calming restless youngsters. The findings were comparable to those of another study, which found that children chose pink and blue to express cheerful feelings.\(^{[19]}\) According to Lubos L’s\(^{[16]}\) research, exposure to blue colour therapy resulted in a considerable reduction in stress levels. Blue, has shown to induce emotions of tranquility and well-being while also having a soothing impact. He highlighted that blue activates the parasympathetic function in humans. The exposure to blue reduced sympathetic nervous system activity, making the participants calmer and more relaxed.\(^{[16]}\)

Patients subjected to blue and pink color therapy showed a statistically significant anxiety reduction as compared to the control group after chromotherapy and post endodontic treatment [Tables 1 and 2]. Furthermore, both the color groups and the conventional group had statistically significant differences in systolic BP and HR. The usage of a dedicated chromotherapy room gives sufficient separation to conduct stress-related investigations in a controlled environment.\(^{[15]}\)

Although there are other ways for determining anxiety levels, we employed the MDAS in our research. This scale has low instrumental effects and good psychometric qualities, making it a useful clinical tool for evaluating dental anxiety.

Certain color and shape combinations have either destructive or generative impacts on living creatures, according to Rudolph Steiner’s research.\(^{[20]}\) It is difficult to fully comprehend the psychological state of anxious patient because there are so many etiological elements that cause worry about dental treatment.\(^{[20]}\) However, color therapy was found to have a generative influence on the subjects in this investigation.

The possible limitations of the current study may arise from the fact that individuals from various regions and religions might have different perceptions regarding particular colors. In addition, exposing the patients to their color of choice might have a variable impact, though it is not convenient in a clinical setup.

### Table 1: Displaying the results of chromotherapy between the groups

| ANOVA                      | Sum of squares | df | Mean square | F      | P     |
|---------------------------|----------------|----|-------------|--------|-------|
| Anxiety before chromotherapy |                |    |             |        |       |
| Between groups            | 34.200         | 2  | 17.100      | 1.133  | 0.327 |
| Within groups             | 1312.700       | 87 | 15.089      |        |       |
| Total                     | 1346.900       | 89 |             |        |       |
| Anxiety after chromotherapy |                |    |             |        |       |
| Between groups            | 242.600        | 2  | 121.300     | 10.192 | 0.000 |
| Within groups             | 1035.400       | 87 | 11.901      |        |       |
| Total                     | 1278.000       | 89 |             |        |       |
| Anxiety after endodontic treatment |             |    |             |        |       |
| Between groups            | 375.200        | 2  | 187.600     | 19.040 | 0.000 |
| Within groups             | 857.200        | 87 | 9.853       |        |       |
| Total                     | 1232.400       | 89 |             |        |       |
| Anxiety pre-post chromotherapy |             |    |             |        |       |
| Between groups            | 106.400        | 2  | 53.200      | 8.996  | 0.000 |
| Within groups             | 514.500        | 87 | 5.914       |        |       |
| Total                     | 620.900        | 89 |             |        |       |
| Anxiety before chromotherapy-after endodontic treatment |       |    |             |        |       |
| Between groups            | 212.600        | 2  | 106.300     | 15.677 | 0.000 |
| Within groups             | 589.900        | 87 | 6.780       |        |       |
| Total                     | 802.500        | 89 |             |        |       |

DF: Degrees of freedom

### Table 2: Difference between all the parameters at all three assessment levels between the groups

| Dependent variable                  | Group | Mean difference | SE  | P     |
|-------------------------------------|-------|-----------------|-----|-------|
| Anxiety after chromotherapy         | Pink  | 1.100           | 0.891 | 0.436 |
|                                     | Blue  | −2.800          | 0.891 | 0.006 |
|                                     | Control | −1.100        | 0.891 | 0.436 |
|                                     | Blue  | −3.900          | 0.891 | 0.000 |
|                                     | Control | −2.400         | 0.891 | 0.000 |
|                                     | Pink  | 2.800           | 0.891 | 0.006 |
|                                     | Blue  | 3.900           | 0.891 | 0.000 |
| Anxiety after endodontic treatment  | Pink  | 0.600           | 0.810 | 0.740 |
|                                     | Blue  | −4.000          | 0.810 | 0.000 |
|                                     | Control | −0.600         | 0.810 | 0.740 |
|                                     | Blue  | −4.600          | 0.810 | 0.000 |
|                                     | Control | −4.000         | 0.810 | 0.000 |
|                                     | Pink  | 4.000           | 0.810 | 0.000 |
|                                     | Blue  | 4.600           | 0.810 | 0.000 |
| Anxiety pre-post chromotherapy      | Pink  | −0.200000       | 0.62790 | 0.946 |
|                                     | Blue  | 2.200000        | 0.62790 | 0.002 |
|                                     | Control | 0.200000      | 0.62790 | 0.946 |
|                                     | Control | 2.400000       | 0.62790 | 0.001 |
|                                     | Pink  | −2.200000       | 0.62790 | 0.002 |
|                                     | Blue  | −2.400000       | 0.62790 | 0.001 |
| Anxiety before chromotherapy-after endodontic treatment | Pink  | 0.300000       | 0.67233 | 0.896 |
|                                     | Blue  | 3.400000        | 0.67233 | 0.000 |
|                                     | Control | −0.300000     | 0.67233 | 0.896 |
|                                     | Control | 3.100000       | 0.67233 | 0.000 |
|                                     | Pink  | −3.400000       | 0.67233 | 0.000 |
|                                     | Blue  | −3.100000       | 0.67233 | 0.000 |

SE: Standard error
CONCLUSIONS

The current study demonstrated that chromotherapy plays a pivotal role in anxiety reduction before and during the dental treatment procedure and can be effectively incorporated during routine practice.

Further studies with a larger sample size are required to substantiate the results of the present study so as to have a significant impact when setting a clinical work area.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Gupta PD, Mahajan P, Monga P, Thaman D, Khinda VIS, Gupta A. Evaluation of the efficacy of nitrous oxide inhalation sedation on anxiety and pain levels of patients undergoing endodontic treatment in a vital tooth: A prospective randomized controlled trial. J Conserv Dent 2019;22:356-61.
2. Kothari S, Gurunathan D. Factors influencing anxiety levels in children undergoing dental treatment in an undergraduate clinic. J Family Med Prim Care 2019;8:2036-41.
3. Amir A, Kamate S, Gupta P, Gupta A, Singh J, Singh S. Assessment of dental anxiety using MDAS (Modified Dental Anxiety Scale) among students in Bareilly city-A cross sectional study. Int J Contemp Med Res 2018;5:1-3.
4. Azeemi ST, Raza SM. A critical analysis of chromotherapy and its scientific evolution. Evid Based Complement Alternat Med 2005;2:481-8.
5. Boyatzis CJ, Varghese R. Children’s emotional associations with colors. J Genet Psychol 1994;155:77-85.
6. Yatishkumar S, Sudhanshu S, Jain SR, Asapaliya P, Choudhary G, Sharma N. Importance of chroma therapy in dentistry. Indian J Dent Adv 2013;5:1252-6.
7. Alexander S. Tranquilizing effect of color reduces aggressive behavior and potential violence. Int J Biosoc Med Res 1985;8:218-21.
8. Reinhardt T, Schmahl C, Wüst S, Bohus M. Salivary cortisol, heart rate, electrodermal activity and subjective stress responses to the Mannheim Multicomponent Stress Test (MMST). Psychiatry Res 2012;198:106-11.
9. Azeemi SY. A quantitative study on chromotherapy. Chemistry 2007. Available from: http://prr.hec.gov.pk/jspui/bitstream/123456789/3637/2/373S.pdf.
10. Umamaheshwari N, Asokan S, Kumaran TS. Child friendly colors in a pediatric dental practice. J Indian Soc Pedod Prev Dent 2013;31:225-8.
11. Al-Ayash A, Kane RT, Smith D, Green-Armytage P. The influence of color on student emotion, heart rate, and performance in learning environments. Color Res Appl 2016;41:196-205.
12. Schauss AG. Tranquilizing effect of color reduces aggressive behavior and potential violence. Int J Biosoc Med Res 1985;8:218-21.
13. Humphris G, Morrison T, Lindsay SJ. The Modified Dental Anxiety Scale: UK norms and evidence for validity. Community Dental Health. 1995;12:143-150.
14. Humphris GM, Dyer TA, Robinson PG. The modified dental anxiety scale: UK general public population norms in 2008 with further psychometrics and effects of age. BMC Oral Health 2009;9:20.
15. Minguillon J, Lopez-Gordo MA, Renedo-Criado DA, Sanchez-Carrion MJ, Pelayo F. Blue lighting accelerates post-stress relaxation: Results of a preliminary study. PLoS One 2017;12:e0186399.
16. Lesley L. The role of colors in stress reduction. Liceo J High Educ Res 2008;5:95-103.
17. Hotwani K, Sharma K. Assessment of the impact of colors on child’s anxiety and treatment preference for local anesthesia injections. J Adv Oral Res 2017;8:42-46.
18. Eyseck HJ. A critical and experimental study of color preferences. Am J Psychol 1941;54:383-94.
19. Annamary K, Prathima GS, Sajeev R, Kayalvizhi G, Ramesh V, Ezhimalai G. Colour preference to emotions in relation to the anxiety level among school children in Puducherry-A cross-sectional study. J Clin Diagn Res 2016;10:C26-30.
20. Singh H, Meshram G, Warhadpande M, Kapoor P. Effect of ‘Perceived control’ in management of anxious patients undergoing endodontic therapy by use of an electronic communication system. J Conserv Dent 2012;15:51-5.