ORIGINAL RESEARCH

Evaluation of the Efficacy of Aromatherapy on Anxiety Level among Pediatric Patients in a Dental Setting: A Randomized Control Trial

Sheena Soni[1], **Rupinder Bhatia**[2], **Jyoti Oberoi**[3]

ABSTRACT

Aim: The aim of the study was to evaluate the anxiety level in children under aromatherapy using orange essential oil.

Materials and Methods: A total of 30 children aged between 6 and 9 years were selected for the study. In the control group, 15 patients were treated without aroma, and in the experimental group, 15 patients were treated with orange essential oil. Before starting the procedure and after the procedure, blood pressure, pulse rate, oxygen saturation level, and anxiety level of the patient were checked. The choice of treatment was class 1 glass ionomer cement restoration (GC type IX) which was done for all the subjects in the study.

Results: The mean ± standard deviation of blood pressure, oxygen saturation, and pulse rate were calculated in each group before and after completion of treatment using paired *t*-test. The difference in means of blood pressure, oxygen saturation, and pulse rate treatment under orange essential oil and treatment without aroma was significant; however, statistically, it came out to be non-significant. The difference between both the groups for Venham's picture test was calculated using Mann–Whitney *U*-test and was found to be highly significant but on intergroup comparison results came statistically non-significant.

Conclusion: This randomized control trial provides significant evidence that the use of orange essential oil in dental settings reduces anxiety, blood pressure, oxygen saturation, and pulse rate during the child's first dental visit.

Keywords: Aromatherapy, Anxiety level, Essential oil, Pediatric patients

[1]Final year Postgraduate, [2]Professor, [3]Lecturer

[1-3]Department of Pedodontics and Preventive Dentistry, D.Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India

Corresponding Author: Dr Rupinder Bhatia, Professor, Department of Pedodontics and Preventive Dentistry, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India. Phone: +91-9869362766. e-mail: bhatia.rupinder@gmail.com

How to cite this article: Soni S, Bhatia R, Oberoi J. Evaluation of the Efficacy of Aromatherapy on Anxiety Level among Pediatric Patients in a Dental Setting: A Randomized Control Trial. Int J Oral Care Res 2018;6(2):44-49.

Source of support: Nil

Conflicts of interest: None

INTRODUCTION

Fear and anxiety toward visiting dentists are major problems for a sizeable proportion of children and adolescents. The prevalence of dental fear and anxiety (DFA), i.e., dental fear and anxiety in children and adolescents range from 5% to 20% in various countries, with some cases being considered to be a dental phobia, severe DFA.[1,2] Children and adolescents with DFA are often uncooperative during dental visits, thus rendering treatment difficult or impossible.[3]

Dental stimuli have the potential of inducing anxiety.[4] There are various anxiety-provoking factors in a dental setting such as the sights, needles, sounds, drilling, smells of cut dentine, medicaments, and sensation of high-frequency vibration. Aromatherapy is commonly used as one of the non-pharmacological methods that have long been regarded as a popular means of treatment for anxiety.[5]

Aromatherapy is the use of essential oils to alleviate emotional or physical discomfort.[6] It is a type of complementary medicine in which the volatile oil of plants is used to promote the level of physical, spiritual, psychological, and physiological health. Aromatherapy is used in several forms including massage, inhalation, compresses, baths, or topical application. Inhalation and massage are the most widely used forms, especially in medical practices.[7,8]

It involves the inhalation of scented oils, volatile molecules of the oil, which reach the lungs and rapidly diffuse into the blood, causing brain activation through systemic circulation.[9] However, these molecules also bind to olfactory receptors, creating an electrophysiological response, which reaches the brain. Neocortex activation is expected to occur by this response, which has an effect on perception of odors and reaches the limbic system regions including amygdale and hypothalamus,

the areas where the levels of hormone and emotions are controlled[10] [Figure 1].

There are various essential oils that have been used in dentistry such as lavender oil, eucalyptus oil, apple oil, and bergamot oil.

Animals studies found evidence that citrus fragrance can relieve stress-induced immunosuppression[11] and may have potential antidepressant effects in rats.[12] This result was followed up in a clinical study in patients with depression. A mixture of citrus oils was capable of reducing the necessary treatment doses of antidepressants, normalizing neuroendocrine hormone levels, and immune function in depressive patients.[13]

Orange essential oil (*Citrus sinensis*), commonly named as sweet orange, is a member of the Rutaceae family.[14] Studies have shown that orange scent is a suitable aroma to decrease anxiety. It increases the activity of the parasympathetic nervous system by 12% and decreases the activity of the sympathetic nervous system by 16%.[15]

Hence, the aim of the study was to evaluate the anxiety level in children under aromatherapy using orange essential oil.

MATERIALS AND METHODS

It is a randomized clinical trial evaluating the effect of orange essential oil on child anxiety during dental procedure.

A total of 30 children (15 boys and 15 girls), aged between 6 and 9 years, were selected who attended the OPD of pedodontics and preventive dentistry. The inclusion criteria used for selecting the patients were as follows: Children aged 6–9 years, who had class 1 cavity and were Frankl rating 3 in cooperation (children who accept treatment with cautious behavior at times; willing to comply with the dentist, at times with reservation, but follow the dentist's direction cooperatively), with the absence of any systemic problems, physical and mental disabilities, and those whom it was the first dental visit. Children with common cold and allergy were excluded from this study. Before the session, an informed consent was obtained from parents or legal guardians, and they completed a form containing children's medical information. The study protocol was approved from the institutes ethical committee.

Participants were randomly divided into two groups: In the control group, half of the participants (15 patients) were treated without aroma and in the experimental group where the other half participants (15 patients) were treated with orange essential oil. In the experimental group, 10 minutes prior, before starting the treatment, the room was exposed to orange aroma.

The main components of orange essential oil are determined by gas chromatography, which are found to be limonene 92%, myrcene 3%, and other components 5%, and most of them were α-pinene, β-pinene, *p*-cymene, linalool, and geraniol.

In a ceramic diffuser, four drops of orange aroma oil were poured on the upper plate and a candle was lit below the plate to allow the aroma to diffuse in the room [Figure 2].

During each visit, the patient was separated from the parent. Before starting the procedure and after the procedure, sphygmomanometer was used to measure the blood pressure, pulse rate and oxygen saturation level were measured with pulse oximeter, and anxiety level of the patient was checked with Venham's picture scale [Figure 3]. The choice of treatment was class 1 glass ionomer cement (GIC) restoration (GC type IX) which was done for all the subjects in the study.

RESULTS

A total of 30 children with the mean age of 7.60 ± 1.1 years participated in the study. They were assigned randomly in two groups according to the study. The first group consisted of 15 children (7 girls and 8 boys) with the mean age of 7.60 ± 1.1 years, who were treated in the absence of orange aroma (control). The second group consisted of 8 girls and 7 boys, with the mean age of 7.27 ± 1.2 years, who were treated under orange aroma in the experimental group.

Anxiety level of children was assessed with Venham picture scale, blood pressure level, oxygen saturation, and pulse rate before and on completion of each dental appointment.

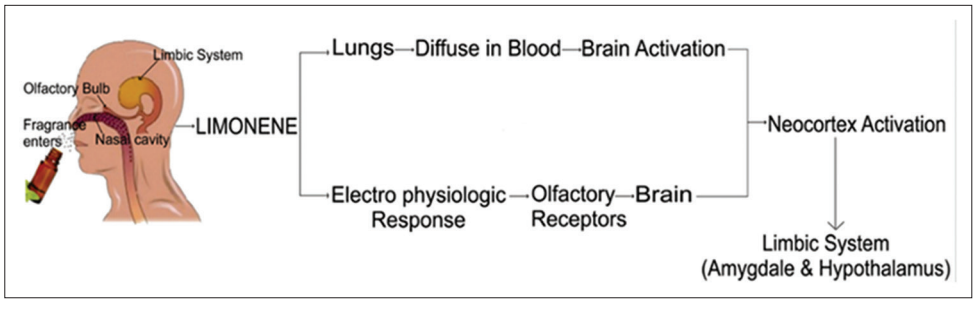

Figure 1: Represents the effect of orange essential oil on the limbic system

Figure 2: Orange essential oil and diffuser used.

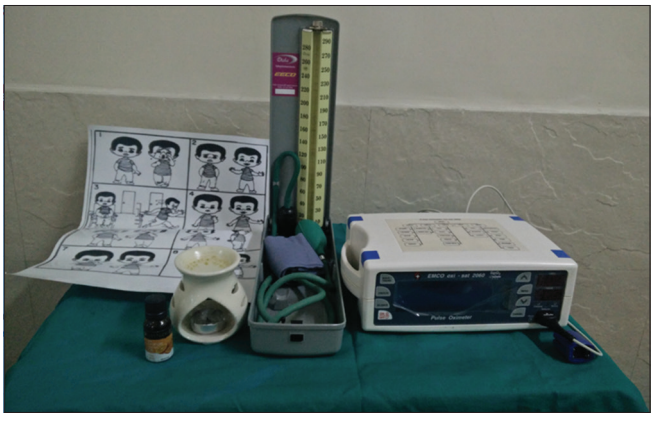

Figure 3: Armamentarium used in the present study.

The mean ± standard deviation (SD) of all the parameters were calculated in the control group before and on completion of the treatment, which is presented in Table 1.

Table 1 summarizes that using paired *t*-test, at baseline, i.e., pre-operative, the mean (SD) value of systolic blood pressure, diastolic blood pressure, and pulse rate was 102.40 (6.2), 72.80 (15.4), and 100.87 (5.8), respectively, and after the completion of the procedure, the mean (SD) value of systolic blood pressure, diastolic blood pressure, and pulse rate was 98.93 (7.5), 67.73 (14.5), and 97.67 (5.8), respectively. Since *P* value for systolic pressure ($P < 0.001$) and pulse ($P < 0.001$) was <0.001 and for diastolic pressure ($P = 0.036$), it indicates that there is statistical significance observed between the pre-operative and post-operative values. However, the oxygen saturation level in the control group did not show any statistical significance.

Table 2 summarizes the mean ± SD of all the parameters in the experimental group. Using paired *t*-test, at baseline, i.e., pre-operative, the mean (SD) value of systolic blood pressure, diastolic blood pressure, and pulse rate was 102.27 (12.4), 68.40 (13.3), and 103.33 (12.8), respectively, and after the completion procedure, the mean (SD) value of systolic blood pressure, diastolic blood pressure, and pulse rate was 96.13 (11.7), 63.47 (14.5), and 92.33 (9.8), respectively. Since *P* value for pulse ($P < 0.001$) is <0.001 and for systolic blood pressure ($P = 0.002$) and diastolic pressure ($P = 0.012$), it indicates that there is statistical significance observed between the pre-operative and post-operative values. However, the oxygen saturation level in the experimental group did not show any statistical significance.

Table 3 summarizes pre and post values of Venham's picture test in the control and experimental group. As the data were not equally distributed, Wilcoxon signed-rank test was applied. At baseline, i.e. pre-operative, the mean (SD) of the control and experimental group was 3.27 (1.751) and 3.60 (1.957), respectively, and after completion of the procedure, the post-operative value was 0.87 (1.807) and 0.60 (1.121), respectively. Since $P < 0.001$, there is high statistical significance seen.

Table 4 summarizes the difference between the experimental group and control group. Since *P* value of all the parameters compared was more than 0.05, there was no statistical significance observed.

Table 5 summarizes the difference in experimental and control group of Venham's picture test. As the data were not equally distributed, Mann–Whitney *U*-test was used. Since *P* is more than 0.05 in both the groups, there was no statistical significance observed.

DISCUSSION

It is widely believed that fragrances have the power to influence emotional states in humans.[5] Recently, contemporary and alternative medicine approaches such as aromatherapy (use of essential oils, scented, and volatile liquid substances for therapeutic purposes) have been considered in dental[15-18] settings. This method supports the concept that common oils can produce positive pharmacological, psychological, and physiological effect on humans by its aroma.

Only 6–9-year-old children who are nearly in concrete operation of Piaget's stage were taken as subjects in this study,[19] as the child is mature enough to use logical thoughts or operations which was also similar to a study conducted by Jafarzadeh *et al*.[10]

Anxiety in a child alters the levels of pulse rate, blood pressure, and oxygen saturation. Pulse rate in the present study was recorded, as was also recorded by previous studies conducted by Westra *et al*.[20] who evaluated discomfort in children who underwent unsedated magnetic resonance imaging (MRI) and by Chang and Shen[21] who assessed aromatherapy on elementary school teachers. In the present study, there was a statistically significant decrease in the pulse rate in both the groups. However, it was more in the experimental group. High blood pressure was also evaluated as episodes of anxiety can cause rise in blood pressure. In

Table 1: Comparison of pre- and post-operative values using paired *t*-test in control group

Questions	Mean (SD)	Mean difference	*t* value	*P* value
Systolic blood pressure				
Pre-operative	102.40 (6.2)	3.467	4.026	<0.001**
Post-operative	98.93 (7.5)			
Diastolic blood pressure				
Pre-operative	72.80 (15.4)	5.067	2.314	0.036*
Post-operative	67.73 (14.5)			
Oxygen saturation				
Pre-operative	98.27 (0.8)	-0.067	-1.000	0.334
Post-operative	98.33 (0.8)			
Pulse (beats/min)				
Pre-operative	100.87 (5.8)	3.200	5.870	<0.001**
Post-operative	97.67 (5.8)			

SD: Standard deviation

Table 2: Comparison of pre- and post-operative values using paired *t*-test in experimental group

Questions	Mean (SD)	Mean difference	*t*-value	*P* value
Systolic blood pressure				
Pre-operative	102.27 (12.4)	6.133	3.743	0.002*
Post-operative	96.13 (11.7)			
Diastolic blood pressure				
Pre-operative	68.40 (13.3)	4.933	2.864	0.012*
Post-operative	63.47 (14.5)			
Oxygen saturation				
Pre-operative	98.07 (0.8)	-	NA	NA
Post-operative	98.07 (0.8)			
Pulse (beats/min)				
Pre-operative	103.33 (12.8)	11.000	9.203	<0.001**
Post-operative	92.33 (9.8)			

SD: Standard deviation

Table 3: Comparison of pre- and post-operative Venham's picture test values using Wilcoxon signed-rank test

Test groups	*N*	Mean±SD	*Z* value	*P* value
Control				
Pre-operative	15	3.27±1.751	3.219	<0.001**
Post-operative	15	0.87±1.807		
Experimental				
Pre-operative	15	3.60±1.957	3.432	<0.001**
Post-operative	15	0.60±1.121		

SD: Standard deviation

the present study, there was no significant rise in the blood pressure when both the groups were compared; however, both the methods were significantly effective in reducing the blood pressure. Oxygen saturation level was evaluated as anxiety in children can alter respiratory rate and thus alter the oxygen saturation rate. In our study, there was no alteration in the oxygen saturation level in both the groups.

Venham's picture test was used to assess the anxiety in the present study due to its ease of use, attractiveness of the scale and was well comprehended by the children. In the present study, Venham's picture test, there was high statistical difference in anxiety in both the control and experimental group. However, it was not statistically significant when the two groups were compared.

However, the effect of aromatherapy on dental anxiety has been assessed in a few studies. In a cluster randomized controlled trial, Kritsidima *et al*. explained reduced state of anxiety with lavender scent in dental patients.[17] Muzzarelli *et al*. recommended that aromatherapy can be more useful at a moderate level of anxiety.[22] In a study performed by Maura *et al*., the effect of gender and ethnicity on preferences and attitudes in children was investigated. They reported that children are very different from adults in their odors and taste preferences, and they are likely to use essential oils, which they find pleasant. They found aromatherapy appealing and acceptable for school-age children and concluded that specific essential oils are accepted by children such as sweet orange or lemon.[19]

Lehrner *et al*. studied the effect of orange odor and reported improved mood and less anxiety only in females.[15] 5 years later, in another study, they compared the effect of orange and lavender odor with a

Table 4: Comparison of mean (SD) scores of both the groups (***N***=15 in each group)

Variable	Experimental Mean (SD)	ControlMean (SD)	*t* value	*P* value
Systolic blood pressure				
Pre-operative	102.27 (12.4)	102.40 (6.2)	0.037	0.971
Post-operative	96.13 (11.7)	98.93 (7.6)	0.778	0.443
Diastolic blood pressure				
Pre-operative	68.40 (13.3)	72.80 (15.4)	0.838	0.409
Post-operative	63.47 (14.5)	67.73 (14.6)	0.804	0.428
Oxygen saturation				
Pre-operative	98.07 (0.8)	98.27 (0.8)	0.686	0.499
Post-operative	98.07 (0.8)	98.33 (0.8)	0.904	0.374
Pulse (beats/min)				
Pre-operative	103.33 (12.8)	100.87 (5.9)	0.677	0.504
Post-operative	92.33 (9.8)	97.67 (5.9)	1.816	0.080

SD: Standard deviation

Table 5: Comparison of pre- and post-operative Venham's picture test values using Mann–Whitney ***U***-test

Test groups	*N*	Mean±SD	*Z* value	*P* value
Pre-operative				
Control	15	3.27±1.751	0.486	0.653
Experimental	15	3.60±1.957		
Post-operative				
Control	15	0.87±1.807	0.339	0.775
Experimental	15	0.60±1.121		

SD: Standard deviation

music condition and a control condition, demonstrated that odors are capable of reducing anxiety and altering emotional states in dental patients.[18]

It has been proven that limonene was the main component of this natural essential oil of orange. The limonene concentration in orange essential oil used was similar to studies by Lehrer *et al*.,[15,18] and the animal study by Future *et al*., essential oil of orange has been shown to reduce salivary cortisol and pulse rate due to child anxiety state in a study by Jafarzadeh *et al.*[10] Hence, orange essential oil *was chosen* for the current study.

The present study, when we compared the anxiety level in our subjects in experimental and control group, significant difference was seen which was similar to a study by Peng *et al*.,[23] but statistically it was non-significant. The current study was in accordance to a study done by Ndao *et al*.[24] who studied the effect of inhalation aromatherapy and stated that respiratory administration of bergamot essential oil did not decrease anxiety, nausea and pain when added to standard supportive care.

While choosing a treatment, class 1 GIC restoration was selected because of convenience, non-invasiveness, and ethical nature, as this procedure is painless, and we wanted to assess any changes in blood pressure and pulse rate due to stress and not because of pain.

CONCLUSION

This randomized control trial provides significant evidence that the use of orange essential oil in dental settings reduces blood pressure, pulse rate, and anxiety due to child's anxious state though it was statistically non-significant. Hence, further studies should be taken up with larger sample size and are also recommended to evaluate the influence of aromatherapy on more complex and invasive dental procedures which can induce more anxiety and fear in child patients.

REFERENCES

1. Chhabra N, Chhabra A, Walia G. Prevalence of dental anxiety and fear among five to ten year old children: A behaviour based cross sectional study. Minerva Stomatol 2012;61:83-9.
2. Lee CY, Chang YY, Huang ST. Prevalence of dental anxiety among 5-to 8-year-old Taiwanese children. J Public Health Dent 2007;67:36-41.
3. 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 2007;17:391-406.
4. King SL, Hegadoren KM. Stress hormones: How do they measure up? Biol Res Nurs 2002;4:92-103.
5. Venkataramana M, Pratap K, Padma M, Kalyan S, Reddy AA, Sandhya P. Effect of aromatherapy on dental patient anxiety: A randomized controlled trial. J Indian Assoc Public Health Dent 2016;14:131-4.
6. Kiberd MB, Clarke SK, Chorney J, d'Eon B, Wright S. Aromatherapy for the treatment of PONV in children: A pilot RCT. BMC Complement Altern Med 2016;16:450.
7. Kim M, Kwon YJ. Effects of aroma inhalation on blood pressure, pulse, visual analog scale, and McNair scale in nursing students practicing intravenous injection at the first time. Int J Adv Sci Technol 2010;23:61-8.
8. Kutlu AK, Yılmaz E, Çeçen D. Effects of aroma inhalation on examination anxiety. TLN 2008;3:125-30.
9. Maddocks-Jennings W, Wilkinson JM. Aromatherapy practice in nursing: Literature review. J Adv Nurs 2004;48:93-103.
10. Jafarzadeh M, Arman S, Pour FF. Effect of aromatherapy with orange essential oil on salivary cortisol and pulse rate in children during dental treatment: A randomized controlled

clinical trial. Adv Biomed Res 2013;2:10.
11. Shibata H, Fujiwara R, Iwamoto M, Matsuoka H, Yokoyama MM. Recovery of PFC in mice exposed to high pressure stress by olfactory stimulation with fragrance. Int J Neurosci 1990;51:245-7.
12. Komori T, Fujiwara R, Tanida M, Nomura J. Potential antidepressant effects of lemon odor in rats. Eur Neuropsychopharmacol 1995;5:477-80.
13. Komori T, Fujiwara R, Tanida M, Nomura J, Yokoyama MM. Effects of citrus fragrance on immune function and depressive states. Neuroimmunomodulation 1995;2:174-80.
14. Mohamadi B. Herbal Essential Oil. 2nd ed. Tehran: Nooerdanrsh; 2002. p. 62, 57.
15. Lehrner J, Eckersberger C, Walla P, Pötsch G, Deecke L. Ambient odor of orange in a dental office reduces anxiety and improves mood in female patients. Physiol Behav 2000;71:83-6.
16. Hainsworth J, Moss H, Fairbrother K. Relaxation and complementary therapies: An alternative approach to managing dental anxiety in clinical practice. Dent Update 2005;32:90.
17. Kritsidima M, Newton T, Asimakopoulou K. The effects of lavender scent on dental patient anxiety levels: A cluster randomised-controlled trial. Commun Dent Oral Epidemiol 2010;38:83-7.
18. Lehrner J, Marwinski G, Lehr S, Johren P, Deecke L. Ambient odors of orange and lavender reduce anxiety and improve mood in a dental office. Physiol Behav 2005;86:92-5.
19. Fitzgerald M, Culbert T, Finkelstein M, Green M, Johnson A, Chen S. The effect of gender and ethnicity on children's attitudes and preferences for essential oils: A pilot study. Explore 2007;3:378-85.
20. Westra AE, Zegers MP, Sukhai RN, Kaptein AA, Holscher HC, Ballieux BE, *et al*. Discomfort in children undergoing unsedated MRI. Eur J Pediatr 2011;170:771-7.
21. Chang KM, Shen CW. Aromatherapy benefits autonomic nervous system regulation for elementary school faculty in Taiwan. Evid Based Complement Alternat Med 2011;2011:946537.
22. Muzzarelli L, Force M, Sebold M. Aromatherapy and reducing preprocedural anxiety: A controlled prospective study. Gastroenterol Nurs 2006;29:466.
23. Peng SM, Koo M, Yu ZR. Effects of music and essential oil inhalation on cardiac autonomic balance in healthy individuals. J Altern Complement Med 2009;15:53-7.
24. Ndao DH, Ladas EJ, Cheng B, Sands SA, Snyder KT, Garvin JH Jr., *et al*. Inhalation aromatherapy in children and adolescents undergoing stem cell infusion: Results of a placebo-controlled double-blind trial. Psychooncology 2012;21:247-54.