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**Original Article**

# Comparative Efficacy of Aromatherapy and Conscious Sedation in Pediatric Dental Anxiety Management

**Dinesh Kumar[1], Deepa Gurunathan[1]*, Zohra Jabin[2], Suha Talal[3]**

[1]Department of Pediatric and Preventive Dentistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600077, India.
[2]Department of Health Sciences, Brunel University, Brunel, London, UK.
[3]Department of oral Physiology, College of Dentistry, University of Baghdad, Baghdad, Iraq.

***E-mail** ✉ deepag@saveetha.com

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## ABSTRACT

The best strategies for treating young children with caries in their primary dentition are being debated due to recent studies. It is necessary to ensure that children have a positive dental experience because they are usually afraid of needles and the dentist's setting. Therefore, the study aimed to differentiate between the effects of conscious sedation and aromatherapy in reducing dental anxiety in children having extractions. This randomized clinical trial was conducted at a private dental college for patients visiting the pediatric and preventive dentistry department in Chennai. 30 youngsters of the 6-9 years in the trial were randomly assigned to the aromatherapy and conscious sedation groups. Dental anxiety was measured using a Venham picture scale, and oxygen saturation and pulse were measured using a digital pulse oximeter. The bp was measured using a sphygmomanometer. Each parameter was assessed before and after extraction. The data were statistically analyzed using SPSS version 23.0, and the distribution of parameter differences was evaluated using both independent and paired t-tests. The mean ages of the aromatherapy and conscious sedation groups were 7.93 ± 1.033 years and 7.20 ± 1.612 years, respectively. After extraction, there was a significant decrease in pulse and anxiety levels was observed in both groups. Oxygen levels were also significantly higher in the conscious sedation groups after extraction. In youngsters having dental procedures, both aromatherapy and conscious sedation were successful in reducing heart rate and anxiety.

**Keywords:** Dental anxiety, Aromatherapy, Lavender oil, Nitrous oxide, Conscious sedation, Venham picture scale

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## Introduction

Aromatherapy is a rapidly growing alternative therapy worldwide. According to the National Institutes of Health's National Center for Complementary and Integrative Medicine, Americans spend over 300 crores on this treatment annually [1]. The global market is expected to have grown to 500 crores by 2050. Another name for integrative medicine [2].

For frontline nurses, knowing the difference between integrative therapy and alternative therapy is essential. Alternative medicine employs therapy to support standard medical treatment, whereas integrative therapy stands alone and replaces all traditional medical care [3]. According to the National Institutes of Health and the National Center for Complementary and Integrative Health, these therapies can be classified as hypnotic therapy, biologically based practices, spiritual and persuasive practices, biofeedback, and authentic medical systems like traditional Chinese medicine (TCM) and AYUSH [4]. Aromatherapy is a type of mind-body treatment used in dental care [5].

Essential oils are used in nursing care to enhance therapeutic interventions and lower anxiety. It is expected that applications of plant-based essential oils, such as essential oil interventions, post-anxiety symptoms, and pre-anxiety symptoms, will be quantifiable [6]. Anxiety levels before and following an essential oil administration might be used to assess the oil's effectiveness [7].

Aromatherapy has been used for many years; Hippocrates, the father of modern medicine, advocated it because believed that massages and scented baths were necessary for good health [8]. According to some investigators, aromatherapy is a long-term treatment for the body, mind, and soul [9].

Lavandula, a member of the Lamiaceae family, represents one of the plants that is often researched for its therapeutic and fragrant qualities. The shrub's purple-blue blossom has been used to treat a variety of illnesses since ancient times [10]. The four most commonly employed species of lavender are Lavandula angustifolia, Lavandula latifolia, Lavandula stoechas, and Lavandula intermedia. Around the globe, it is cultivated for commercial uses. It is cultivated in India's Kashmir Valley, Himachal Pradesh, and Uttar Pradesh. There are reports of its anxiolytic, anti-inflammatory, antinociceptive, antioxidant, and antibacterial qualities [11, 12]. Lavender oil, or Lavandula angustifolia, has been widely used as a cosmetic and medicinal ingredient since ancient times. Authorization as a natural drug has been given by the European Drug Authority. Lavender oil is said to have anti-infectious, relaxing, and calming properties. It has also been shown to improve sleep quality. Aromatherapy, a natural stress-reduction method, has recently focused a lot of emphasis on lavender oil inhalation. Research has demonstrated that the use of lavender aromatherapy lowers autonomic variables such as heart rate and blood pressure. Lavender oil inhalation has also been demonstrated to lessen postpartum sadness and anxiety during gynecological tests.

Lavender essential oils are one example of a herbal product that may help address antibiotic resistance, invasive procedures, side effects, or even medication addiction [13]. Today, these characteristics make lavender a very useful medicinal herb because of the rise in drug resistance. Numerous investigations on the application of herbal essential oils in dentistry and medicine have been carried out [14, 15]. Herbal remedies such as lavender essential oils can help address antibiotic resistance, invasive procedures, side effects, and even medication addiction [13, 16]. These characteristics make lavender an incredibly useful medicinal herb in today's world because of the rise in drug resistance. Numerous research investigations have been carried out on the application of herbal essential oils in medicine and dentistry. This study intends to distinguish between the effects of conscious sedation and aromatherapy in lowering dental anxiety in children having extractions.

## Materials and Methods

*Study design*

A randomized trial.

*Study setting*

The investigation was carried out at a private dental institution in Chennai's pediatric and preventive dentistry department.

*Study population*

The study population included patients visiting the outpatient department of pediatric dentistry aged 6-9 years. 30 children were allotted randomly into 2 groups namely the aromatherapy group and the conscious sedation group.

*Inclusion criteria*

- Children between the age group of 6 and 9 years who require treatments that are extraction of mandibular molar etc. and whose parents were willing to participate in the study were included.
- Children who fit within category three of Frankl's behavior rating scale, or (positive: patient cooperates with the dentist and accepts treatment; patient exhibits occasionally cautious behavior; patient is generally willing to comply with dentist's requests.)

*Exclusion criteria*

- Children whose parents were not willing to take part in the study were excluded.
- Children who were challenged systemically were excluded.
- Children getting the same treatments under GA were excluded.
- Children with short-term severe pain and/or rapid treatment intervention.
- Children who give the impression of having behavior problems (excessive attachment to parents, etc.).

*Ethical clearance*

- An institutional ethical committee's approval for the study's conduct was acquired before it began.

- The parents of the study subjects provided their written informed consent.
- The participants' identities were kept private.

*Sample size calculation*

G Power computed the sample size based on the Janthasila and Keeratisiroj [5] study with a P-value of 0.05 and 95 power and an effect size of 0.756. Thirty was the estimated sample size.

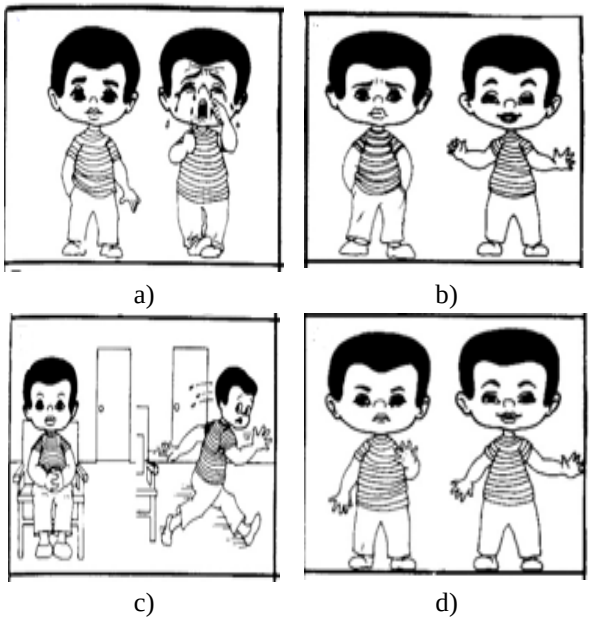
*Sampling*

The study participants were chosen using a simple random sampling procedure.

*Survey instrument*

The anxiety levels of the study subjects were assessed using the Venham picture scale. Eight cards—one labeled "anxious" and the other "non-anxious"—make up the Venham picture test. The children were asked to point to the figure that, at the time, most closely resembled them. The numbers were on top of the deck of cards while it was on display. If the child pointed at the "anxious" figure, a score of one was recorded; if the child pointed at the "non-anxious" figure, a score of zero was recorded. The total score was calculated by adding the number of times the "anxious" figure was chosen (minimum score: 0; maximum score: 8) **(Figure 1)** [17].

A digital pulse oximeter was employed to assess the pulse rate and oxygen saturation of the child during the appointment. A BP apparatus was used to measure the blood pressure of the children.



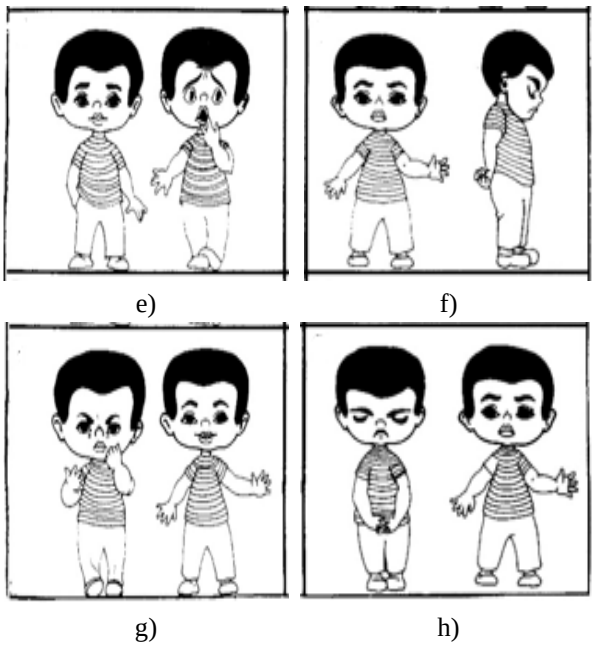




**Figure 1.** Venham picture scale

*Randomization and allocation concealment*

A statistics consultant created a random block design using a computer. Block randomization admitted for an equal distribution of the two groups mandibular quadrants (A: The aromatherapy side and B: Conscious sedation side) within each block, which represented two quadrants. To choose which side will be attended to during the visit, a simple random sequence was constructed. 30 sheets of standard size were inserted with the block randomized list sequence. Afterward, each sheet was covered with a piece of black paper, and the two papers were inserted into an envelope. The 30 blocks were all built in the same way.

The sleeves or covers were carefully combined in a plastic container before being sequentially labeled with the numbers 1 through 30. The next chain was written on 30 sheets in a similar manner. The 30 envelopes were numbered 1 through 30 and mixed in another plastic container. When patients were selected for the examination session, the envelopes were placed into each container in number order and the patients opened each one in turn.

*Blinding*

Due to the nature of the intervention, it was not possible to blind the researchers or the patients. The statistician who analyzed the data was blinded about the allocation of the groups.

*Data collection*

Thirty children were screened who came to the pedodontic department of a tertiary dental center. All study procedures were carried out by a single

investigator. According to Frankl's behavior rating scale, the patients were monitored and their behavior was documented. Once the patient's guardians had signed the informed consent form and the patient met the trial's inclusion specifications, they were given a thorough explanation of the study methodology. Only then was the patient allowed to participate in the experiment? Children were randomly divided into two groups.

Children who were allocated to the aromatherapy group were made to sit in a separate room for 30 minutes and aromatherapy was delivered through a humidifier. Lavender oil was infused in the humidifier. Extraction was done in the same room after 30 minutes the child was allowed to sit. The other 15 children underwent conscious sedation by intranasal administration of nitrous oxide with a nasal hood. After the child went to the stage of conscious sedation, extraction was done.

Blood pressure, pulse rate, oxygen saturation, and anxiety were assessed before and after the extraction in both groups.

*Statistical analysis*

Microsoft Excel spreadsheet was used to enter the data, and SPSS software was used to analyze it (version 23.0). Descriptive statistics, which included mean, standard deviation, frequency, and percentages were used to analyze the data. To determine if the distribution of all parameters was normally distributed, the Kolmogorov-Smirnov test was used. Paired t-tests for intragroup comparison and independent t-tests for used to assess the differences in the means of continuous variables for intergroup comparisons at $P < 0.05$.

**Results and Discussion**

The thirty study subjects were split into two groups with a 1:1 allocation ratio. The average age of the group receiving aromatherapy was 7.93 ± 1.033 years, while the group receiving conscious sedation had an average age of 7.20 ± 1.612 years **(Figure 2)**. There were 46.7% men and 53.3% women in the aromatherapy group and 60% men and 40% women in the conscious sedation group **(Table 1)**.

The pulse and anxiety levels in the aromatherapy and conscious sedation groups were considerably reduced after extraction, whereas the oxygen saturation levels in the conscious sedation group were substantially greater **(Table 2)**.

Before tooth removal, the groups did not differ significantly across any of the metrics, according to the independent t-test. However, after the removal, the conscious sedation group's oxygen saturation was statistically higher than the aromatherapy group's. Additionally, following extraction, the aromatherapy group's anxiety level was noticeably lower than that of the conscious sedation group **(Table 3)**.

This demonstrates that both aromatherapy and conscious sedation considerably lower patients' anxiety and heart rate throughout the extraction process.

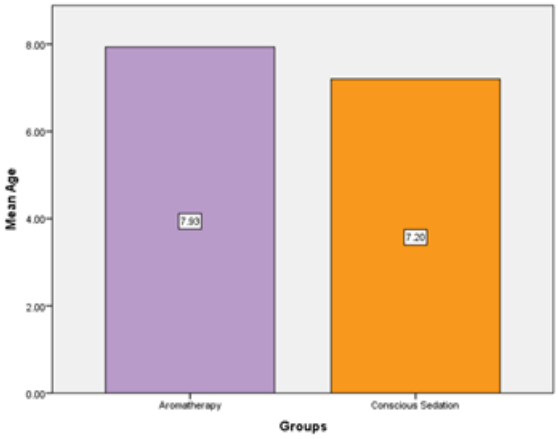



**Figure 2.** Distribution of age among the study groups

**Table 1.** Distribution of gender among the study groups

| Groups | Males | Females |
|---|---|---|
| Aromatherapy | 7 (46.7%) | 8 (53.3%) |
| Conscious sedation | 9 (60%) | 6 (40%) |

**Table 2.** Paired t-test showing mean differences between the pre-and post-extraction in various parameters among the study groups

| | | Paired t-test | | | |
|---|---|---|---|---|---|
| | | Mean | Std. deviation | Std. error mean | P-value |
| Pair 1 | Aromatherapy pre-oxygen saturation | 98.067 | .7988 | .2063 | .217 |
| | Aromatherapy post-oxygen saturation | 97.800 | .4140 | .1069 | |
| Pair 2 | Aromatherapy pre-pulse beats/minute | 82.600 | 5.3426 | 1.3794 | 0.000 |
| | Aromatherapy post-pulse beats/minute | 79.200 | 4.9886 | 1.2880 | |
| Pair 3 | Aromatherapy pre-anxiety level | 4.800 | .4140 | .1069 | 0.000 |
| | Aromatherapy post-anxiety level | .533 | .5164 | .1333 | |

| | | | | | |
|---|---|---|---|---|---|
| **Pair 4** | Conscious sedation spare-oxygen saturation | 98.200 | .6761 | .1746 | **0.000** |
| | Conscious sedation post-oxygen saturation | 99.667 | .4880 | .1260 | |
| **Pair 5** | Conscious sedation pre-pulse beats/minute | 84.333 | 5.9362 | 1.5327 | **0.000** |
| | Conscious sedation post-pulse beats/minute | 77.000 | 6.2106 | 1.6036 | |
| **Pair 6** | Conscious sedation pre-anxiety level | 4.867 | .3519 | .0909 | **0.003** |
| | Conscious sedation post-anxiety level | 3.533 | 1.4075 | .3634 | |
| **Pair 7** | Aromatherapy pre-blood pressure | 113.67 | 6.114 | 1.579 | 0.082 |
| | Aromatherapy post-blood pressure | 112.67 | 6.230 | 1.609 | |
| **Pair 8** | Conscious sedation pre-blood pressure | 111.33 | 2.968 | .766 | 0.751 |
| | Conscious sedation post-blood pressure | 111.00 | 3.381 | .873 | |

**Table 3.** Independent t-test showing mean differences between the study groups in various parameters

| **Independent t-test** | | | | |
|---|---|---|---|---|
| | **Groups** | **Mean** | **Std. deviation** | **P-value** |
| **Pre BP** | Aromatherapy | 113.6667 | 6.11400 | 0.198 |
| | Conscious sedation | 111.3333 | 2.96808 | |
| **Pre oxygen saturation** | Aromatherapy | 98.0667 | .79881 | 0.626 |
| | Conscious sedation | 98.2000 | .67612 | |
| **Pre pulse** | Aromatherapy | 82.6000 | 5.34255 | 0.408 |
| | Conscious sedation | 84.3333 | 5.93617 | |
| **Pre anxiety** | Aromatherapy | 4.8000 | .41404 | 0.638 |
| | Conscious sedation | 4.8667 | .35187 | |
| **Post BP** | Aromatherapy | 112.6667 | 6.22973 | 0.373 |
| | Conscious sedation | 111.0000 | 3.38062 | |
| **Post oxygen saturation** | Aromatherapy | 97.8000 | .41404 | **0.000** |
| | Conscious sedation | 99.6667 | .48795 | |
| **Post pulse** | Aromatherapy | 79.2000 | 4.98856 | 0.294 |
| | Conscious sedation | 77.0000 | 6.21059 | |
| **Post anxiety** | Aromatherapy | .5333 | .51640 | **0.000** |
| | Conscious sedation | 3.5333 | 1.40746 | |

Dental extractions are one of the dental procedures that might induce dental anxiety. This may be possible because a syringe was used to provide the local anesthetic. One major factor that can accelerate the development of dental anxiety is injection fear [18]. 35.2% of the 164 oral surgery patients at Pacific Dental College in India who participated in a recent study on dental anxiety before permanent tooth extraction exhibited this phobia. A tooth removal can become challenging and less likely to be accomplished if a patient develops tooth anxiety throughout the surgery [19]. The origin of dental anxiety may be related to dental trauma or unpleasant experiences, as well as fearful attitudes inherited from family members who are dentally anxious [20]. Based on the primary causes of their fear, dental anxiety patients can be categorized into four groups: those who feel uneasy because of a specific stimulus, individuals who lack confidence in dentists, those who aren't anxious about most things in general, and those who worry that they might have a medical emergency while getting dental care [21]. Anxious patients will show some refusal symptoms while obtaining care, regardless of how dental anxiety is classified. These physical, behavioral, cognitive, and emotional symptoms of anxiety-related refusal can all be classified as symptoms of anxiety [22]. The physiological symptoms that are most likely to show that the treatment has not worked are dyspnea, hyperventilation, tachycardia, hypertension, tachypnea, nausea, and vomiting [23]. With sedation, these physiological effects can be lessened. Sedatives reduce anxiety, irritability, and agitation, making planned dental procedures easier. The two main goals of sedation are to keep patients as relaxed and comfortable as possible and to enable dentists to work effectively [24].

To lessen dental anxiety in children having extractions, the present research employed aromatherapy with lavender oil and conscious sedation with nitrous oxide. Conscious sedation and cognitive behavior therapy significantly decreased dental fear and increased cooperation in 45 toddlers undergoing pulp therapy under LA in a related trial conducted in Iran [25]. Similarly, dental rehabilitation under conscious sedation enhanced dental behavior and quality of life in a Turkish trial [26]. Additionally, aromatherapy has seen some success. Lavender or sweet orange aromatherapy, when given via a nebulizer or inhaler, reduced dental anxiety in children receiving dental treatment under local anesthesia, according to a study conducted in Nellore. However, only sweet oranges were able to alleviate the discomfort that the children self-reported [27]. Additionally, as an intervention during their consultations, 72 orthodontic patients

received lavender and rose oils. During the aromatherapy, participants' blood pressure and heart rate—two objective measures of dental anxiety—as well as a subjective dental anxiety scale decreased [28]. When used sparingly, aromatherapy lowers blood pressure and anxiety during dental treatments, according to a systematic review and meta-analysis that included six clinical trials [29]. Additionally, another systematic review that evaluated 11 randomized controlled trials and 6 clinical trials found that aromatherapy decreased anxiety and its physiological symptoms, including pain, mood, alertness, and calmness, in patients receiving dental treatment when compared to negative control and music intervention [30].

Conversely, it has been demonstrated that music therapy dramatically lowers dental anxiety, blood pressure, and heart rate in dental patients [31, 32]. In addition to music, other therapies include exposure-based therapies such as modeling, cognitive therapy, systematic desensitization, hypnosis, acupuncture, distraction, encouragement of positive behavior, and stop signaling [33]. Our group's wealth of expertise and study experience has resulted in excellent [34-44]. There are drawbacks to this study as well. There are many other ways to measure dental anxiety, but this study only examined two therapies. The study may also be limited by the absence of a control group. The research could have evaluated any dental treatment performed under local anesthetic, however it only evaluated individuals who were having extractions. Thus, it is not possible to extrapolate the findings of this study.

## Conclusion

Both conscious sedation and aromatherapy successfully decreased dental anxiety and its objective physiological symptom pulse rate within the constraints of the current investigation. Future research involving a control group for patients receiving dental treatments under LA should evaluate different kinds of aromatic oils administered via a diffuser or nebulizer because there isn't one.

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**Conflict of Interest:** None

**Financial Support:** None

**Ethics Statement:** The study was performed after approval by the Institutional Human Ethical Committee (IHEC/SDC/PEDO-2005/22/127).

## References

1. Brignardello-Petersen R. Aromatherapy may be effective in reducing anxiety in patients undergoing dental treatment. J Am Dent Assoc. 2020;151(11):e109. doi:10.1016/j.adaj.2020.07.005
2. Price S, Price L. Aromatherapy for health professionals E-Book. Elsevier health sciences; 2011.
3. Pal SK, Shukla Y. Herbal medicine: current status and the future. Asian Pac J Cancer Prev. 2003;4(4):281-8.
4. Jamshidi N, Cohen MM. The clinical efficacy and safety of tulsi in humans: a systematic review of the literature. Evid Based Complement Alternat Med. 2017;2017(1):9217567. doi:10.1155/2017/9217567
5. Janthasila N, Keeratisiroj O. Music therapy and aromatherapy on dental anxiety and fear: a randomized controlled trial. J Dent Sci. 2023;18(1):203-10. doi:10.1016/j.jds.2022.06.008
6. Malcolm BJ, Tallian K. Essential oil of lavender in anxiety disorders: ready for prime time? Ment Health Clin. 2018;7(4):147-55.
7. Mojtehedi M, Salehi-Pourmehr H, Ostadrahimi A, Asnaashari S, Esmaeilpour K, Farshbaf-Khalili A. Effect of aromatherapy with essential oil of Lavandula angustifolia mill- citrus bergamia and mindfulness-based intervention on sexual function, anxiety, and depression in postmenopausal women: a randomized controlled trial with factorial design. Iran J Nurs Midwifery Res. 2022;27(5):392-405.
8. Sibbritt DW, Catling CJ, Adams J, Shaw AJ, Homer CS. The self-prescribed use of aromatherapy oils by pregnant women. Women Birth. 2014;27(1):41-5.
9. Shaaban HA, El-Ghorab AH, Shibamoto T. Bioactivity of essential oils and their volatile aroma components. J Essent Oil Res. 2012;24(2):203-12.
10. Sen I. Lavender essential oil: your complete guide to lavender essential oil uses, benefits, applications and natural remedies. CreateSpace independent publishing platform; 2016.
11. Nisa NT, Chisti H. Handbook of lavender as a medicinal plant. GRIN verlag; 2017.
12. Silva GL, Luft C, Lunardelli A, Amaral RH, Melo DA, Donadio MV, et al. Antioxidant, analgesic and anti-inflammatory effects of Lavender essential oil. An Acad Bras Cienc. 2015;87(2 Suppl):1397-408.

13. Erland LA, Mahmoud SS. Lavender (lavandula angustifolia) oils. Essential oils in food preservation, flavor and safety. 2016:501-8.
14. Kajjari S, Joshi RS, Hugar SM, Gokhale N, Meharwade P, Uppin C. The effects of Lavender essential oil and its clinical implications in dentistry: a review. Int J Clin Pediatr Dent. 2022;15(3):385-8.
15. Arslan I, Aydinoglu S, Karan NB. Can lavender oil inhalation help to overcome dental anxiety and pain in children? A randomized clinical trial. Eur J Pediatr. 2020;179(6):985-92.
16. Dagli N, Dagli R, Mahmoud RS, Baroudi K. Essential oils, their therapeutic properties, and implication in dentistry: a review. J Int Soc Prev Community Dent. 2015;5(5):335-40.
17. Buchanan H, Niven N. Validation of a facial image scale to assess child dental anxiety. Int J Paediatr Dent. 2002;12(1):47-52.
18. Maulina T, Djustiana N, Shahib MN. The effect of music intervention on dental anxiety during dental extraction procedure. Open Dent J. 2017;11(1):565-72.
19. Nair MA, Shankarapillai R, Chouhan V. The dental anxiety levels associated with surgical extraction of tooth. Int J Dent Clin. 2009;1(1):20-3.
20. Haliti F, Juric H. The relationship between dental trauma, anxiety and aggression behavior in 7 to 14 year old children in Kosovo. Acta Stomatol Croat. 2017;51(1):3-12.
21. Jeddy N, Nithya S, Radhika T, Jeddy N. Dental anxiety and influencing factors: a cross-sectional questionnaire-based survey. Indian J Dent Res. 2018;29(1):10-5.
22. Stenebrand A, Wide Boman U, Hakeberg M. Dental anxiety and symptoms of general anxiety and depression in 15-year-olds. Int J Dent Hyg. 2013;11(2):99-104.
23. Halonen H, Nissinen J, Lehtiniemi H, Salo T, Riipinen P, Miettunen J. The association between dental anxiety and psychiatric disorders and symptoms: a systematic review. Clin Pract Epidemiol Ment Health. 2018;14(1):207-22.
24. Dantas LP, de Oliveira-Ribeiro A, de Almeida-Souza LM, Groppo FC. Effects of Passiflora incarnata and Midazolam for control of anxiety in patients undergoing dental extraction. Med Oral Patol Oral Cir Bucal. 2017;22(1):e95-101.
25. Kebriaee F, Sarraf Shirazi A, Fani K, Moharreri F, Soltanifar A, Khaksar Y, et al. Comparison of the effects of cognitive behavioural therapy and inhalation sedation on child dental anxiety. Eur Arch Paediatr Dent. 2015;16(2):173-9.
26. Guney SE, Araz C, Tirali RE, Cehreli SB. Dental anxiety and oral health-related quality of life in children following dental rehabilitation under general anesthesia or intravenous sedation: a prospective cross-sectional study. Niger J Clin Pract. 2018;21(10):1304-10.
27. Nirmala K, Kamatham R. Effect of aromatherapy on dental anxiety and pain in children undergoing local anesthetic administrations: a randomized clinical trial. J Caring Sci. 2021;10(3):111-20.
28. Aafaque S, Sumalatha S, Narendran N. Effect of aromatherapy on dental anxiety among orthodontic patients: a randomized controlled trial. Cureus. 2019;11(8):e5306.
29. Purohit A, Singh A, Purohit B, Shakti P, Shah N. Is aromatherapy associated with patient's dental anxiety levels? A systematic review and meta-analysis. J Dent Anesth Pain Med. 2021;21(4):311-9.
30. Cai H, Xi P, Zhong L, Chen J, Liang X. Efficacy of aromatherapy on dental anxiety: a systematic review of randomised and quasi-randomised controlled trials. Oral Dis. 2021;27(4):829-47.
31. Packyanathan JS, Lakshmanan R, Jayashri P. Effect of music therapy on anxiety levels on patient undergoing dental extractions. J Family Med Prim Care. 2019;8(12):3854-60.
32. Bradt J, Teague A. Music interventions for dental anxiety. Oral Dis. 2018;24(3):300-6.
33. Appukuttan DP. Strategies to manage patients with dental anxiety and dental phobia: literature review. Clin Cosmet Investig Dent. 2016;8(1):35-50.
34. Priyadarshini P, Jeevanandan G, Govindaraju L, Subramanian EMG. Clinical evaluation of instrumentation time and quality of obturation using paediatric hand and rotary file systems with conventional hand K-files for pulpectomy in primary mandibular molars: a double-blinded randomized controlled trial. Eur Arch Paediatr Dent. 2020;21(6):693-701.
35. Juliet S, Jeevanandan G, Govindaraju L, Ravindran V, Subramanian EM. Comparison between three rotary files on quality of obturation and instrumentation time in primary teeth− a double blinded randomized controlled trial. J Orofac Sci. 2020;12(1):30-4.
36. Divya S, Jeevanandan G, Sujatha S, Subramanian EMG, Ravindran V. Comparison of quality of obturation and post-operative pain using manual vs rotary files in primary teeth - a randomised clinical trial. Indian J Dent Res. 2019;30(6):904-8.
37. Jeevanandan G, Govindaraju L, Subramanian EMG, Priyadarshini P. Comparative evaluation of

quality of obturation and its effect on postoperative pain between Pediatric hand and rotary files: a double-blinded randomized controlled trial. Int J Clin Pediatr Dent. 2021;14(1):88-96.

38. Preethy NA, Jeevanandan G, Mathew MG, Subramanian EM. Evaluation of quality of obturation using two different rotary files and hand files in primary teeth: a randomized controlled trial. Int J Clin Pediatr Dent. 2021;14(4):471-4.
39. Aishuwariya T, Ramesh S. Comparison of quality of obturation using radiographs-a retrospective study. Int J Dentistry Oral Sci. 2021;8(6):2833-8.
40. Sruthi S, Jeevanandan G, Govindaraju L, Subramanian E. Assessing quality of obturation and instrumentation time using Kedo-SG blue, Kedo-SH, and reciprocating hand K-files in primary mandibular molars: a double-blinded randomized controlled trial. Dent Res J (Isfahan). 2021;18:76.
41. Jeevanandan G, Govindaraju L. Clinical comparison of Kedo-S paediatric rotary files vs manual instrumentation for root canal preparation in primary molars: a double blinded randomised clinical trial. Eur Arch Paediatr Dent. 2018;19(4):273-8. doi:10.1007/s40368-018-0356-6
42. Jeevanandan G, Thomas E. Volumetric analysis of hand, reciprocating and rotary instrumentation techniques in primary molars using spiral computed tomography: an in vitro comparative study. Eur J Dent. 2018;12(1):21-6.
43. Jayachandar D, Gurunathan D, Jeevanandan G. Prevalence of early loss of primary molars among children aged 5-10 years in Chennai: a cross-sectional study. J Indian Soc Pedod Prev Dent. 2019;37(2):115-9.
44. 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):44-9.