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Original Article

Music therapy and aromatherapy on dental anxiety and fear: A randomized controlled trial

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Music therapy

Abstract *Background/purpose:* Dental anxiety and fear in children are major public health concerns. This study aimed to determine the effectiveness of music therapy combined with aromatherapy, in reducing the children's dental anxiety and fear.

Materials and methods: A total of 128 school-age children aged 10–12 years were randomly allocated into 4 groups: a control group with 32 volunteers, an experimental group that received music therapy, with 33 volunteers, an aromatherapy experimental group with 31 volunteers, and 32 volunteers in an experimental group with music therapy combined with aromatherapy.

Results: The results found that within-group comparisons before and after the experiment revealed the outcomes with a statistically significant change at the 0.05 level of each group as follows. The control group had increased heart rate. The music therapy group showed decreased dental anxiety and fear and systolic blood pressure. The aromatherapy experimental group exhibited increased oxygen saturation. The experimental group receiving music therapy combined with aromatherapy showed decreased dental anxiety and fear, heart rate, and systolic and diastolic blood pressure as well as increased oxygen saturation values. In addition, it was found that music therapy combined with aromatherapy had a co-influence on dental anxiety and fear ($F = 22.22, P < 0.001$) and oxygen saturation ($F = 17.40, P < 0.001$), and the two main treatments also significantly influenced these outcomes at the 0.05 level.

Conclusion: The results showed that music therapy in combination with aromatherapy reduced children's anxiety and fear of dental services better than a single treatment.

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Introduction

Dental anxiety and fear are recognized in many countries as one of the major public health problems, as it deprives cooperation and increases dental treatment failures.¹ Studies in many countries around the world have found prevalence between 3 and 43%.^{2–5} In Thailand, the prevalence of dental fear among 12-year-olds is 23.6%.⁶

Children's dental anxiety and fear are caused by several factors. Previous studies have found that young age and females are factors that increase dental anxiety and fear.⁷ A study by Wu and Gao found that family structure and sibling presence were important factors for children's dental anxiety and fear.⁸ Additionally, childhood dental anxiety and fear were associated with a higher prevalence of tooth decay, toothache, and extraction. This pain also worsens the quality of life in terms of oral health in children.⁹ Over time, this effect will result in more and more serious oral health problems in children, making treatment more complicated. This is a reinforcement that causes children to have more anxiety and fear.¹⁰

The goal of reducing children's anxieties and fears is to involve them in cooperation with dental personnel, which is critical to the success of treatment.¹¹ Methods for managing anxiety and fear in dentistry are both pharmacological and non-pharmacological. Pharmacological methods of suppressing anxiety and fear in dental services include inhalation, sedative (nitrous oxide), and intravenous and oral sedatives. This sedative has some unwanted side effects and risks, such as lethargy, rash, dizziness, nausea, headache, or confusion.¹² It also increases the cost of dental treatment. Therefore, patients appreciate a non-drug approach to management. This is because the use of the drug may have unwanted risks.¹¹ There are many ways to reduce dental anxiety and fear without medication, but one that is simple and non-invasive, and suitable for pediatric patients is a distraction and environmental manipulation of the clinic such as music therapy and aromatherapy.

Today, music therapy is used in many medical and therapeutic procedures, such as in patients undergoing biopsy for breast cancer screening,¹³ and in reducing anxiety while waiting for dental services.¹⁴ Therefore, music therapy is recognized as an effective method of reducing anxiety and fear. Having patients choose music according to their preferences has a beneficial effect on reducing anxiety and fear.¹⁵ Another therapy is aromatherapy, which is used as an adjuvant in medical practice.¹⁶ A study on anxiety and fear of dental services found that the smell of the dental lab had a strong effect.¹⁷ There are several studies conducted a study on the effects of lavender on dental anxiety, which confirmed its effectiveness in reducing dental anxiety.^{18–20} One of the most popular essential oils is lavender oil. The active ingredients linalool and linalyl acetate act as sedatives by affecting the amino acid butyric acid receptors in the central nervous system, calming the brain and reducing anxiety.²¹

In summary, music therapy and aromatherapy are practical, effective, cost-effective and appropriate methods of dental treatment in pediatric patients who may have anxiety and fear.

There are limited studies of these two non-drug approaches in pediatric dentistry. Only one study by Pradopo and colleagues concluded that pandan aromatherapy and soothing music could reduce anxiety levels in pediatric patients undergoing dental treatment.²² However, a study by James and colleagues looked at the effects of the two non-drug approaches but did not consider the effects together. They concluded that these non-invasive techniques, alone or in combination, may be used in orthodontics of pediatric dentists for cooperating patient molding.²³ In addition, the effect of music therapy and aromatherapy on anxiety reduction in other groups such as nurses²⁴ and nursing students²⁵ was also studied. Therefore, it is unclear whether to report the effect of music therapy combined with aromatherapy in reducing anxiety among dental pediatric patients. This study aimed to examine the effect of music therapy combined with aromatherapy on anxiety and fear of dental services among school-aged children.

Materials and methods

Study design

This was a randomized controlled trial with a 2 × 2 factorial design that evaluated the clinical efficacy of a music therapy in combination with aromatherapy for reducing anxiety and fear of dental services among school-age children. Participants, dentists and assessors are not blind to the allocation mode of organizing a treatment group. The trials were divided into 4 groups: 1) control group, 2) experimental group receiving music therapy, 3) experimental group receiving aromatherapy, and 4) experimental group receiving music therapy combined with aromatherapy. The study was following the Declaration of Helsinki guidelines and was conducted according to CONSORT recommendations. Ethical approval was obtained from The Institutional Review Board of Naresuan University, Thailand (COA No.: 509/2021; IRB No.: P3-0152/2564) and the clinical trial register (<http://www.thaiclinicaltrials.org/show/TCTR20220220001>). Informed consent was also taken from all patients before starting treatment.

Participation and recruitment

This randomized clinical trial was conducted in Sirindhorn College of Public Health, Phitsanulok. One hundred thirty-two school-age children were recruited from three primary schools in Wang Thong Sub-district, Wang Thong District, Phitsanulok Province of Thailand during February 2022. The inclusion criteria were: 1) school-aged children aged 10–12 years studying in grades 4–6; 2) being in good health without congenital diseases, not allergic; 3) being subject to coating services a dentition is a tooth with narrow and deep pits and grooves, teeth that have not yet decayed or have started to appear white and cloudy; 4) having a normal body temperature between 36.0 and 37.5 °C; and 5) voluntary and with the consent from the parent. Exclusion criteria were: 1) having problems with smelling or sinusitis;

2) having problems with hearing; and 3) having a history of oil allergy or essential oils.

The sample size was calculated using the effect size value from the previous research²⁶ with mean diastolic blood pressure in the experimental and control groups 118.8 ± 12.1 and 127.8 ± 9.5 , respectively. The sample size was calculated using the Bernard (2000) formula.²⁷ The type I error was defined as 5% and the power of the test was 90%. At least 31 samples were used per group. In addition, the sample size for drop out was increased by 5%, so the sample size was 33 per group. Subjects were divided into four groups with block randomization by the research team.

Outcomes and measures

Dental anxiety and fear scores were the primary outcomes of the trial. Secondary outcomes were vital signs: blood pressure, heart rate and oxygen saturation. These variables were measured only once, with pre-and post-treatment assessments by the research team.

Data collection tools include record forms of baseline characteristics and outcome variables, standard measurement forms, and scientific instrumentation. The Children's Fear Survey Schedule (CFSS-DS)¹ and Facial Image Scale (FIS)²⁸ were applied to measure dental anxiety and fear using 15 questions on CFSS-DS. To ask the question and have the children choose the answer to each question by selecting five different facial expressions, in order from the most anxious (a score of 5) to the least anxious (a score of 1), which was also assessed for reliability, had Cronbach's alpha coefficient of 0.795 for school-age children aged 10–12 years.

Interventions

Each experimental group underwent three different interventions while receiving the sealant services from the institution's dentist. In the first group of music therapy, the most popular instrumental Thai pop songs were played, which were surveyed by researchers before the trial began. By dividing the songs into four sets, then choosing 1 set of the most desired sets to play music during dental services. This offers volunteers an option to listen to their favorite music through an MP3 player by turning the music through a Bluetooth radio transmitter to a speaker that can be adjusted at a certain volume level. The sound does not exceed 60 dB and has a letter plate in front of the service room (It says "Music therapy activities, please do not disturb) to prevent disturbing the patient while listening to music therapy. In the second group of aromatherapy, use the aroma diffuser (MUJI Retail, Thailand) to start by adding 300 ml of water at room temperature to the receptacle of the device. Lavender (*Lavandula officinalis* var. maillette, France) scent into 3 drops, then turn on the device half an hour before the procedure. Finally, add water and 3 drops of lavender essential oil every 2 h. And the last group of music therapy with aromatherapy, the subjects received both of the above programs together during dental treatment.

The control group arranged the environment, placement of the music player, Bluetooth speaker, and procedures, as in the three experimental groups, using only water-only essential oil diffusers. Additionally, no music was played

during the sealant procedure and the volunteers were restricted from other activities.

The experimental procedure was carefully organized to prevent contact between the subjects during the experiment. All study participants were arranged to rest in the lounge. Then take the 1st and 2nd volunteers to the waiting room. To collect information before receiving dental services from vital signs, including heart rate, blood pressure, and oxygen saturation and the researchers inquired about dental anxiety and fear questionnaire. Then, the first research participant was taken to the dental service room for sealant (3M™ Clinpro™ Sealant Refill, St. Paul, MN, USA) treatment. This takes about 10–15 min when the sealant is finished. The researchers recorded the same data after one more service and then took the volunteers to rest in another room.

Statistical analysis

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 17.0 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used by number and percentage for categorical data, and the mean and standard deviation for continuous data. The baseline characteristics of the participants in the four arms were compared using Chi-square tests for categorical variables and one-way analysis of variance for continuous variables. Differences in outcomes (change in the dental anxiety and fear scores, blood pressure, heart rate, and oxygen saturation before and after treatment) were compared within groups with paired t-tests. In case the data is non-normally distributed, non-parametric statistics are used. Finally, the main effect and the interaction effect of music therapy and aromatherapy were analysed by 2×2 factorial analysis of variance. The level of significance was set at 0.05.

Results

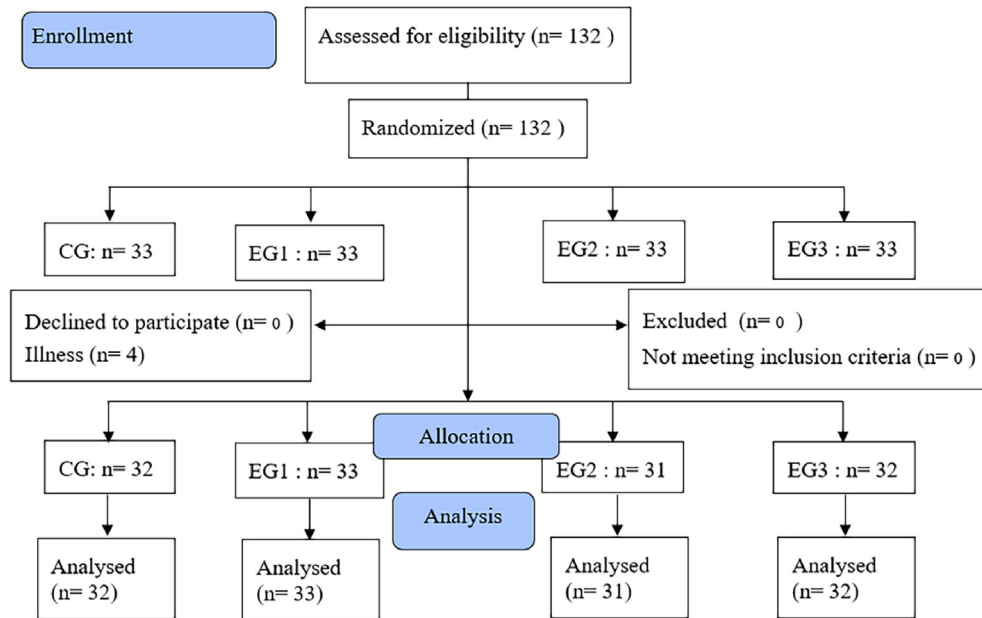
Baseline characteristics

A total of 132 volunteers were randomly assigned to each group prior to the trial date, 33 participants per group. Overall, data for 128 school-age children were used in the final analysis; these patients were divided into the control group ($n = 32$), an experimental group with music therapy ($n = 33$), an experimental group with aromatherapy ($n = 31$), and experimental group with music therapy combined with aromatherapy ($n = 32$) as shown in Fig. 1.

There was a balance of baseline data between groups for demographic and clinical characteristics (Table 1). Except for quantitative data, dental anxiety and fear scores were not balanced between groups ($P = 0.013$). Therefore, the pre-and post-treatment difference of the outcome variable was used to compare between groups as shown in Table 3.

Effects of music therapy and aromatherapy

Within-group comparisons before and after the experiment revealed that the control group had no change in outcomes



CG: control group EG1:Music therapy group EG2:Aromatherapy group EG3:Music therapy with Aromatherapy group

Figure 1 The CONSORT flow diagram.

except increased heart rate values. For the three experimental groups, the change in outcome was statistically significant at the 0.05 level as follows: The music therapy group and the aromatherapy group had dental anxiety and fear, and systolic blood pressure decreased and the oxygen saturation value increases. For the experimental group receiving music therapy combined with aromatherapy, there was a positive change in outcomes for all variables, including dental anxiety and fear, heart rate, systolic and diastolic blood pressure decreased, and the oxygen saturation value increased (Table 2).

Main effect and interaction effects of music therapy and aromatherapy

Assessment of the between-subject effects revealed a significant interaction effect between music therapy and aromatherapy on dental anxiety and fear ($F = 22.22$, $P < 0.001$) and oxygen saturation ($F = 17.40$, $P < 0.001$). The main effects of music therapy and aromatherapy were both statistically significant at the 0.05 level for all outcomes (Table 3).

Discussion

Children's dental anxiety and fear are major problems in dental services as anxiety and fear deprive them of cooperation and increase dental treatment failures. The main reasons why some children do not visit dental personnel despite toothache are lack of time and dental anxiety and fear. As a result, children avoid visiting dental personnel, resulting in a decrease in their quality of life of the child.¹ In this study, music therapy combined with aromatherapy

was found to be effective in managing the anxiety and fear of dental care in school-aged children as a non-pharmacological manipulation in the intervention. Anxiety is both a physiological and psychological structure. The two interact with each other, and their effects can be measured by central nervous system activity, heart rate and respiration, among others.²⁹

In the present study, the experimental group receiving the music therapy had decreased dental anxiety and fear and decreased systolic blood pressure and increased oxygen saturation values. This is consistent with a previous study by Kaur and colleagues who enrolled 30 children aged 4–8 years, the children were divided into three groups: control group, music group and audiovisual group. It was found that the use of video and audio or music alone reduced stress in children better than in the control group.³⁰ This is also consistent with the study by Singh and colleagues. It was found that listening to their favorite music was effective in reducing anxiety among 60 children aged 6–12 years while having their teeth extracted. Therefore, it is important to consider music preferences when giving music therapy.²⁶

We also found that the aromatherapy experimental group had reduced dental anxiety and fear and systolic blood pressure and increased oxygen saturation supported by several studies^{18,31} Ghaderi and Solhjoui found that saliva cortisol, pulse rate and lavender's Face Rating Scale scores could reduce children's stress and pain perceptions during dental treatment.³² A study by Arslan and colleagues found the effect of inhaling lavender reduced the intensity of pain during tooth extraction.³³ Because lavender oil, the active substances linalool and linalyl acetate, act as a sedative by affecting the aminobutyric acid receptors in the central nervous system, calming the brain and reducing anxiety.²¹ Lavender essential oil improves

Table 1 Baseline characteristics of the participants in the four groups.

| Parameters | CG (n = 32) | EG1 (n = 33) | EG2 (n = 31) | EG3 (n = 32) | P |
|------------------------|--------------|--------------|--------------|--------------|--------------------|
| Sex | | | | | 0.434 ^a |
| male | 19 (59.4) | 13 (39.4) | 16 (51.6) | 17 (53.1) | |
| female | 13 (40.6) | 20 (60.6) | 15 (48.4) | 15 (46.9) | |
| Age (years) | 11.00 ± 0.88 | 11.00 ± 0.83 | 10.94 ± 0.89 | 10.88 ± 0.87 | 0.955 ^a |
| Religion | | | | | 0.424 ^a |
| Buddhism | 32(100.0) | 33(100.0) | 31(100.0) | 31(96.9) | |
| Islam | 0(0) | 0(0) | 0(0) | 1(3.1) | |
| Education | | | | | 0.989 ^a |
| Grad 4 | 12(37.5) | 13(39.4) | 13(41.9) | 14(43.8) | |
| Grad 5 | 8(25.0) | 10(30.3) | 7(22.6) | 8(25.0) | |
| Grad 6 | 12(37.5) | 10(30.3) | 11(35.5) | 10(31.3) | |
| Sibling | | | | | 0.916 ^a |
| Yes | 29(90.6) | 28(84.8) | 27(87.1) | 28(87.5) | |
| No | 3(9.4) | 5(15.2) | 4(12.9) | 4(12.5) | |
| Dental history | | | | | 0.773 ^a |
| Never | 1(3.1) | 2(6.1) | 2(6.5) | 3(9.4) | |
| Used To | 31(96.9) | 31(93.9) | 29(93.5) | 29(90.6) | |
| Filling | 19(59.4) | 19(57.6) | 12(38.7) | 16(50.0) | 0.342 ^a |
| Extraction | 18(56.3) | 20(60.6) | 15(48.4) | 14(43.8) | 0.524 ^a |
| Scaling | 7(21.9) | 13(39.4) | 5(16.1) | 8(25.0) | 0.174 ^a |
| Apply fluoride sealant | 22(68.8) | 28(84.8) | 19(61.3) | 25(78.1) | 0.153 ^a |
| sealant | 3(9.4) | 4(12.1) | 3(9.7) | 5(15.6) | 0.861 ^a |
| SBP | 104.7 ± 13.0 | 104.2 ± 12.9 | 105.2 ± 10.7 | 104.0 ± 5.6 | 0.971 ^b |
| DBP | 67.7 ± 10.4 | 68.9 ± 8.7 | 68.0 ± 6.9 | 70.2 ± 4.6 | 0.587 ^b |
| HR | 85.0 ± 6.2 | 83.6 ± 10.8 | 81.9 ± 8.8 | 84.5 ± 8.9 | 0.513 ^b |
| SpO2 | 98.3 ± 1.1 | 98.2 ± 0.9 | 98.1 ± 1.0 | 98.4 ± 0.9 | 0.644 ^c |
| FIS, CFSS-DS | 35.2 ± 7.4 | 35.3 ± 5.1 | 39.4 ± 5.9 | 38.2 ± 6.0 | 0.013 ^b |

CG, control group; EG1, music therapy group; EG2, aromatherapy group; EG3, music therapy with aromatherapy group; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, Heart rate; SpO2, oxygen saturation; FIS, Facial Image Scale; CFSS-DS, The Children's Fear Survey Schedule

The data are presented as the mean ± standard deviation (SD) for continuous data; n (%) for categorical data.

^a The *P*-value was obtained by Chi-square test.

^b The *P*-value was obtained by one-way ANOVA.

^c The *P*-value was obtained by Kruskal-Wallis test.

mood, and reduces anxiety because it depresses the parasympathetic nervous system, which is the autonomic nervous system.³⁴ It is believed that the effect of breathing begins with the absorption of volatile odor molecules. The odor molecules are then converted into chemical signals in the olfactory bulbs. The amygdala and the limbic system stimulate the secretion of certain hormones such as enkephalins, endorphins and serotonin, thereby creating a feeling of pleasure.³⁵

The results showed that the experimental group who received music therapy combined with aromatherapy had decreased dental anxiety and fear, heart rate, systolic and diastolic blood pressure and increased oxygen saturation. Systolic and diastolic pressure were the main factors in controlling anxiety levels. But heart rate variability, especially those that increase during contiguous periods, risks mental health, cardiovascular health, and mortality.³⁶

By contrast, another study by Aitken and colleagues¹¹ about the efficacy of music therapy on forty-five children aged 4–6 years old who were about to undergo dental treatment showed no significant differences statistically

between those who listened to the upbeat music group, relaxing group, and no music group. And likewise, the study used the music therapy-only program by Gupta and colleagues. They studied three groups of pediatric patients aged 3–7 years: upbeat music, relaxing music, and control. Studies have shown that music does not reduce pain, anxiety, or disruptive behavior.³⁸

Additionally, our study found that music therapy combined with aromatherapy had an interactive effect on dental anxiety and fear and oxygen saturation. The benefits of music therapy are stimulating the brain to produce alpha-wave and bringing a relaxing effect on the listeners. Music therapy can help overcome anxiety caused by psychological effects, such as by lowering blood pressure, pulse rate, and respiration rate so that the patient becomes more relaxed and calmer. And the benefits of aromatherapy affected the gamma-aminobutyric acid (GABA) receptors. GABA receptor is an important target for hypnotic sedative components in humans that can cause relaxation and decrease anxiety levels.²² Using a single program is not enough to effectively reduce dental anxiety and fear. The findings are supported

Table 2 Functional outcomes (baseline vs post-treatment) for the four groups.

| Groups | Scale | Baseline | Post-treatment | ΔChange | t / Z | P |
|--------------|--------------|--------------|----------------|------------|-------|-----------------------|
| CG (n = 32) | SBP | 104.7± 13.0 | 106.5± 11.7 | -1.8 ± 1.4 | -1.28 | 0.210 ^a |
| | DBP | 67.7 ± 10.4 | 69.2± 9.8 | -1.5 ± 1.0 | -1.45 | 0.158 ^a |
| | HR | 85.0 ± 6.2 | 91.5± 9.1 | -6.5 ± 1.4 | -4.74 | <0.001*, ^a |
| | SpO2 | 98.3 ± 1.1 | 98.0± 1.0 | 0.3 ± 0.2 | 0.98 | 0.409 ^b |
| | FIS, CFSS-DS | 35.2 ± 7.4 | 33.6± 10.8 | 1.6 ± 1.4 | 1.08 | 0.288 ^a |
| EG1 (n = 33) | SBP | 104.2 ± 12.9 | 101.2± 11.3 | 3.0 ± 1.2 | 2.63 | 0.013*, ^a |
| | DBP | 68.9 ± 8.7 | 67.3± 7.9 | 1.6 ± 1.1 | 1.45 | 0.156 ^a |
| | HR | 83.6 ± 10.8 | 82.6± 9.9 | 1.0 ± 1.5 | 0.63 | 0.535 ^a |
| | SpO2 | 98.2 ± 0.9 | 99.4± 0.9 | -1.2 ± 0.2 | -5.29 | <0.001*, ^b |
| | FIS, CFSS-DS | 35.3 ± 5.1 | 22.4± 7.3 | 12.9 ± 1.3 | 9.65 | <0.001*, ^a |
| EG2 (n = 31) | SBP | 105.2 ± 10.7 | 101.8± 8.4 | 3.4 ± 1.2 | 3.00 | <0.001*, ^a |
| | DBP | 68.0 ± 6.9 | 66.7± 7.2 | 1.3 ± 1.1 | 1.26 | 0.218 ^a |
| | HR | 81.9 ± 8.8 | 79.6± 11.1 | 2.3 ± 1.8 | 1.28 | 0.210 ^a |
| | SpO2 | 98.1 ± 1.0 | 99.4± 0.8 | -1.3 ± 0.2 | -5.78 | <0.001*, ^b |
| | FIS, CFSS-DS | 39.4 ± 5.9 | 19.8± 6.7 | 19.6 ± 1.2 | 16.63 | <0.001*, ^a |
| EG3 (n = 32) | SBP | 104.0 ± 5.6 | 95.2± 6.0 | 8.8 ± 1.1 | 8.13 | <0.001*, ^a |
| | DBP | 70.2 ± 4.6 | 65.0± 5.3 | 5.2 ± 0.8 | 6.73 | <0.001*, ^a |
| | HR | 84.5 ± 8.9 | 80.6± 8.5 | 3.9 ± 1.2 | 3.17 | <0.001*, ^a |
| | SpO2 | 98.4 ± 0.9 | 99.2± 1.0 | -0.8 ± 0.2 | -3.82 | <0.001*, ^b |
| | FIS, CFSS-DS | 38.2 ± 6.0 | 19.6± 3.9 | 18.6 ± 1.3 | 14.34 | <0.001*, ^a |

CG, control group; EG1, music therapy group; EG2, aromatherapy group; EG3, music therapy with aromatherapy group; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; SpO2, oxygen saturation; FIS, Facial Image Scale; CFSS-DS, The Children's Fear Survey Schedule

The data are presented as the mean ± SD

ΔChange in value before vs after treatment.

* Statistically significant at P-value < 0.05

^a The P-value was obtained by the paired samples t-test.

^b The P-value was obtained by the Willcoxon signed-rank test.

Table 3 Assessment of between-participant effects.

| Outcome Variables | Source of Variation | SS | df | Mean Square | F | P ^f |
|-------------------|---------------------|---------|----|-------------|-------|----------------|
| ΔSBP | Music | 827.42 | 1 | 827.42 | 17.57 | <0.001* |
| | Aroma | 970.18 | 1 | 970.18 | 20.60 | <0.001* |
| | Music and Aroma | 1.44 | 1 | 1.44 | 0.031 | 0.861 |
| ΔDBP | Music | 388.67 | 1 | 388.67 | 12.26 | 0.001* |
| | Aroma | 334.27 | 1 | 334.27 | 10.55 | 0.001* |
| | Music and Aroma | 5.38 | 1 | 5.38 | 0.17 | 0.681 |
| ΔHR | Music | 660.21 | 1 | 660.21 | 9.34 | 0.003* |
| | Aroma | 1087.74 | 1 | 1087.74 | 15.38 | <0.001* |
| | Music and Aroma | 262.33 | 1 | 262.33 | 3.71 | 0.056 |
| ΔSpO2 | Music | 5.94 | 1 | 5.94 | 3.92 | 0.050* |
| | Aroma | 11.52 | 1 | 11.52 | 7.59 | 0.007* |
| | Music and Aroma | 26.42 | 1 | 26.42 | 17.40 | <0.001* |
| ΔFIS, CFSS-DS | Music | 878.68 | 1 | 878.68 | 15.89 | <0.001* |
| | Aroma | 4493.10 | 1 | 4493.10 | 81.26 | <0.001* |
| | Music and Aroma | 1228.31 | 1 | 1228.31 | 22.22 | <0.001* |

Music, Music Therapy; Aroma, Aromatherapy; SS, type III sum of squares; ^f Factorial Between-Subjects;

SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; SpO2, oxygen saturation; FIS, Facial Image Scale; CFSS-DS, The Children's Fear Survey Schedule. ΔChange in value before vs after treatment.

* Statistically significant at P-value < 0.05

by the research of Toet and colleagues that found that neither apple nor orange was effective in reducing expected anxiety in waiting patients in dental clinics. Results can be

affected by noise sources such as crowds and people.³⁷ Pradopo and colleagues,²² they studied four different treatments: control group, pandan leaves aromatherapy

group, relaxation music group, and combination group. The study found significant differences of blood pressure and pulse rate between the control group and the other groups, while the most significant difference was experienced by the combination group ($P < 0.05$). This is consistent and confirmed efficacy from multiple studies. Combining aromatherapy with music therapy may be more effective at improving basic nursing skills and reducing anxiety and stress than using just one treatment.^{24,25}

The efficacy found in this study may be due to the strength of the methodology which used both objective and subjective measurement techniques. This method of measurement is critical for a successful assessment of anxiety in children. However, the study had limitations that the subjects and assessors could not be concealed. Therefore, the dental salon environment attempts to minimize external influences by optimizing the environment for olfactory and music therapy. This indicates that the results of this study could be applied to any dental service situation. In conclusion, the results show that the use of a music therapy program in combination with aromatherapy reduces anxiety and fear of dental services in school-aged children than using either therapy alone. Indicates the clinical importance of an integrated approach to reducing dental anxiety and fear in school-aged children.

Declaration of competing interest

The authors have no conflict of interest relevant to this article.

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