

Comparison of the Efficacy of Aromatherapy and Bubble Breath Play Therapy in Reducing Dental Anxiety in Children: A Randomized Clinical Trial

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ABSTRACT

Aim and background: Managing dental anxiety in children is a challenging aspect of pediatric dentistry, often addressed using various pharmacologic and nonpharmacologic methods. Nonpharmacologic methods are preferred due to their noninvasiveness and minimal adverse effects. This study compares the efficacy of aromatherapy and bubble breath play therapy (BBPT) in reducing dental anxiety in pediatric patients.

Materials and methods: In this randomized clinical trial, 64 healthy children aged 6–10 years with moderate-to-severe dental anxiety and attending their first dental visit were included. Participants were randomly assigned to either the aromatherapy group, where lavender essential oil was diffused, or the BBPT group, where children engaged in bubble blowing for 5 minutes. Anxiety levels were assessed using the Chhota Bheem–Chutki Scale (CBCS), pulse rate (PR), and oxygen saturation (SpO₂) levels at baseline, postintervention, and posttreatment.

Results: Both interventions significantly reduced anxiety levels; BBPT showed a greater reduction ($p < 0.001$) than aromatherapy. PR significantly decreased post-BBPT ($p < 0.05$) but not with aromatherapy. SpO₂ levels improved significantly in the BBPT group ($p < 0.05$). Intergroup comparisons indicated BBPT had superior outcomes in reducing anxiety and PR and improving SpO₂ levels compared to aromatherapy.

Conclusion: Both aromatherapy and BBPT effectively reduce dental anxiety in children, with BBPT offering additional benefits due to its interactive nature. Future research should explore long-term effectiveness and personalized approaches to optimize anxiety management strategies in pediatric dental settings.

Clinical significance: The relatively novel nonpharmacological behavior management techniques of aromatherapy and BBPT can be incorporated into the routine clinical practice of pediatric dentists to effectively reduce the anxiety of the patients. This would improve their cooperation during the treatment procedures, reduce the chairside time, and also improve the treatment outcome and subsequently, the overall quality of health care.

Keywords: Anxiety management, Child behavior, Nonpharmacological interventions, Pain perception.

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INTRODUCTION

Performing dental treatment for children can be a daunting task owing to dental fear and anxiety, which creates a reluctance to comply with dental treatment procedures. Managing dental anxiety is a challenging issue in pediatric dentistry, for which dentists employ various behavior management techniques. Over the years, an array of pharmacologic and nonpharmacologic methods has been developed for the purpose of behavior management of pediatric patients.¹ While pharmacological methods offer reliable results, they are associated with several adverse effects. General anesthesia, sedation, and vagotonic drugs can lead to undesirable adverse effects such as hypoxia, hypothermia, fluid imbalance, and bradycardia.² Owing to the ease of use, feasibility, noninvasiveness, and fewer-to-none adverse effects, nonpharmacological methods of behavior management are generally preferred.¹

Some of the nonpharmacological methods are based on the “gate control” theory of pain focusing on masking the pain perception by introducing pleasant or relaxing sensations.³ Examples of such techniques include audio analgesia or aromatherapy.^{4,5} Aromatherapy involves the use of essential oils to alleviate emotional or physical discomfort. For instance, a blend of lavender, Roman chamomile, and Neroli has shown promising results in reducing anxiety and improving sleep and blood pressure

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stability.⁶ The principal rationale behind these techniques is that the child cannot experience negative sensations when he is provided with positive ones (Fig. 1).

Other nonpharmacological techniques utilize distraction to lower anxiety or divert the child’s attention from pain. Examples of



Figures 1A to D: (A) Lavender essential oil; (B) Patient provided with aromatherapy; (C) Commercially available bubble blowers; (D) Child practicing bubble blowing play technique

these techniques include breathing exercises, bubble breath play therapy (BBPT), storybook method, and audiovisual distraction. BBPT involves blowing bubbles through a blower by the child for a specified duration of time. This distracts the child and the play instills a sense in him that he has control over the situation, making it an effective strategy for coping with stressful events such as dental treatment.⁷

While the techniques of aromatherapy or bubble breath play method offer numerous advantages in managing the behavior of pediatric dental patients, very few studies have been conducted to test their efficacy. The techniques are yet to be popularized, so that clinicians can employ them in their respective dental clinics. Hence, the present study was conducted to compare the efficacy of aromatherapy and bubble breath play methods in the reduction of dental anxiety in pediatric patients.

MATERIALS AND METHODS

The present randomized clinical trial was conducted over a period of 3 months from July 2023 to October 2023. The study was conducted in accordance with the principles of Declaration of Helsinki, and the protocol was approved by the institutional ethical review board. The study participants were recruited from those reporting to the outpatient department of the institutional Department of Pediatric and Preventive Dentistry of a reputed Dental College and Hospital in Hingoli city, India. Healthy

6–10-year-old children (American Society of Anesthesiologists physical status I and II) requiring pulp therapies and extraction of primary teeth with a vital pulp were considered eligible for the study. An informed consent was obtained from the parents following which a detailed case history was elicited.

The child's first dental visit and presence of moderate-to-severe anxiety were indicated by a score of 3–5 on the Facial Image Scale for inclusion in the study. Children with a behavior rating of -, +, or ++ on Frankl's behavior rating scale were included, while those children with a - rating were excluded. Children with systematic illnesses or mental disorders and physical or intellectual disabilities were excluded from the study. Children with impaired learning who could not follow the instructions for the bubble breathing play method or outcome assessment were also excluded. Children allergic to local anesthesia or those who used analgesics until 24 hours before treatment were excluded.

At the baseline, 20 minutes before the commencement of the treatment procedures, the anxiety levels of the children were subjectively recorded by using the Chhota Bheem–Chutki Scale (CBCS). A pulse oximeter was used to objectively record the child's pulse rate (PR) and oxygen saturation (SpO₂) levels. The selected participants were randomly allocated to either of the two groups: aromatherapy or BBPT by using computer-generated codes. Following the baseline recording, the respective allocated interventions were imparted.

For the participants in the aromatherapy group, the lavender essential oil aroma was dispersed by means of a diffuser in a closed air-conditioned room. Two drops of lavender essential oil were dispensed into the cotton wick of the diffuser. A total of 100 mL of distilled water was filled in the tank of the diffuser, and further six drops of the essential oil were added. The children were subjected to aromatherapy for 15 minutes after an initial induction period of 2 minutes. For the participants in the BBPT group, children were provided with a commercially available bubble blower. They were then encouraged to blow bubbles from the blower as big as possible for a duration of 5 minutes. Following the administration of the respective intervention, the objective and subjective parameters were again recorded by CBCS, PR, and SpO₂ levels.

A single trained investigator then administered a local anesthetic injection (2% lignocaine with 1:80,000) by infiltration technique adjacent to the involved tooth. The required treatment procedure (pulpectomy or extraction) was then performed for the child. After the treatment, the outcomes were again recorded as CBCS, PR, and SpO₂ levels.

RESULTS

The study population comprised a total of $n = 64$ participants (32 males and 32 females). The age of the participants ranged from 4 to 10 years with a mean of 5.76 ± 1.05 . The mean age of children in the aromatherapy group was 5.63 ± 1.4 and in the BBPT group was 5.88 ± 1.29 .

A significant difference was observed in the values of CBCS between the different time intervals for both interventions, whereas for PR and SpO₂, in the BBPT group only (Table 1). To further analyze the differences in these values between each distinct time interval, pairwise comparisons were performed (Table 2). Intergroup comparison revealed that all three parameters such as CBCS, PR, and SpO₂ were significantly more improved in the BBPT group compared to the aromatherapy group (Table 3).

Table 1: Comparison of anxiety levels, pulse rate, and oxygen saturation at different intervals

Parameter	Therapy	Before therapy		After therapy		After treatment		p-value
		Mean	SD	Mean	SD	Mean	SD	
CBCS scores	Bubble breath play therapy	3.03	1.03	1.19	0.40	1.53	0.51	0.000**
	Aromatherapy	3.41	1.07	3.00	1.05	2.69	0.93	0.022*
Pulse rate	Bubble breath play therapy	85.63	11.37	76.53	13.06	85.41	10.10	0.002*
	Aromatherapy	83.44	8.47	83.00	8.35	83.16	9.57	0.980#
SpO ₂	Bubble breath play therapy	92.78	8.69	97.19	3.66	96.78	2.95	0.004*
	Aromatherapy	96.84	2.05	96.72	2.08	96.75	1.93	0.967#

**Statistically highly significant ($p < 0.001$); *Statistically significant ($p < 0.05$); #Statistically nonsignificant ($p > 0.05$)

Table 2: Pairwise comparison of the outcomes between different intervals for the two study groups

Therapy	Parameter	Pairwise comparisons		Mean difference	Standard error	p-value
Bubble breath play therapy	CBCS scores	Before therapy	After therapy	1.84	0.18	0.00*
		Before therapy	After treatment	1.50	0.18	0.00*
		After therapy	After treatment	-0.34	0.18	0.13#
	Pulse rate	Before therapy	After therapy	9.09	2.89	0.01*
		Before therapy	After treatment	0.22	2.89	1.00#
		After therapy	After treatment	-8.87	2.89	0.01*
	SpO ₂	Before therapy	After therapy	-4.41	1.43	0.01*
		Before therapy	After treatment	-4.00	1.43	0.02*
		After therapy	After treatment	0.41	1.43	0.96#
Aromatherapy	CBCS scores	Before therapy	After therapy	0.44	0.26	0.21#
		Before therapy	After treatment	0.69	0.26	0.02*
		After therapy	After treatment	0.25	0.26	0.59#
	Pulse rate	Before therapy	After therapy	0.22	2.20	1.00#
		Before therapy	After treatment	0.06	2.20	1.00#
		After therapy	After treatment	-0.16	2.20	1.00#
	SpO ₂	Before therapy	After therapy	0.03	0.51	1.00#
		Before therapy	After treatment	0.03	0.51	1.00#
		After therapy	After treatment	0.00	0.51	1.00#

**Statistically highly significant ($p < 0.001$); *Statistically significant ($p < 0.05$); #Statistically nonsignificant ($p > 0.05$); negative values indicate a rise in the parameter

Table 3: Intergroup comparison of anxiety levels, pulse rate, and oxygen saturation at different intervals

Parameter		Bubble breath play therapy		Aromatherapy		p-value
		Mean	SD	Mean	SD	
CBCS	Before therapy	3.03	1.03	3.41	1.07	0.159#
	After therapy	1.19	0.40	2.97	1.03	0.000**
	After treatment	1.53	0.51	2.72	0.96	0.000**
PR	Before therapy	85.63	11.37	83.44	8.47	0.386#
	After therapy	76.53	13.06	83.22	8.33	0.017*
	After treatment	85.41	10.10	83.38	9.56	0.412#
SpO ₂	Before therapy	92.78	8.69	96.84	2.05	0.012*
	After therapy	97.19	3.66	96.81	2.12	0.618#
	After treatment	96.78	2.95	96.81	1.94	0.960#

**Statistically highly significant ($p < 0.001$); *Statistically significant ($p < 0.05$); #Statistically nonsignificant ($p > 0.05$); CBCS, Chhota Bheem–Chutki Scale; PR, pulse rate; SpO₂, oxygen saturation

DISCUSSION

The present study aims to compare the efficacy of aromatherapy and BBPT in managing dental anxiety among children, with a focus on both subjective and objective measures. Our findings

reveal significant reduction in anxiety levels for both interventions, with BBPT demonstrating slightly superior efficacy compared to aromatherapy. The CBCS used in the present study is a relatively novel scale, first introduced by Sadana et al. in 2016.⁸ The scale has

been proven to have good validity and is easier to comprehend for children in India owing to their familiarity or interest in the characters of the scale.

Aromatherapy, utilizing lavender essential oil, has been widely recognized for its anxiolytic properties. Consistent with the findings of a recent systematic review, our results show a significant reduction in anxiety levels following aromatherapy intervention.⁹ However, the magnitude of reduction in anxiety, as indicated by CBCS scores, was somewhat lower compared to BBPT. This could be attributed to the passive nature of aromatherapy, which may not engage children as actively as the interactive BBPT method.

Bubble breath play therapy, characterized by playful breathing exercises, emerged as a particularly effective intervention for reducing dental anxiety in children. The significant reduction in anxiety levels post-BBPT aligns with previous research, demonstrating the efficacy of interactive play in alleviating pediatric anxiety.¹⁰ The engaging nature of BBPT likely contributed to its higher efficacy, as it not only distracts children from anxiety-provoking stimuli but also promotes relaxation through controlled deep breathing.

While the various scales used in pediatric dentistry such as Venham's anxiety scale, Facial Image Scale, or even CBCS rely on subjective rating of the anxiety level by the child rate, a complementary objective method is usually employed to support the subjective outcomes. PR has been frequently associated with the anxiety level of children across various studies, with higher values corresponding to greater levels of anxiety.¹¹ Additionally, an anxious child tends to have shallow breathing leading to hyperventilation, ultimately influencing oxygen levels in the blood.¹² The rapid breathing causes respiratory alkalosis by reducing the carbon dioxide in the blood, consequently lowering the oxygen saturation.¹³

While aromatherapy did not significantly alter PR or SpO₂ levels, BBPT resulted in a significant reduction in PR and an improvement in SpO₂ levels. These findings are consistent with the notion that deep breathing exercises can modulate autonomic nervous system activity, leading to decreased sympathetic arousal and improved physiological stability.¹⁴ Even a single session has been demonstrated as effective in lowering the vagal tone and anxiety.¹⁵ The improvement in SpO₂ levels post-BBPT further underscores the importance of incorporating breathing exercises in anxiety management protocols to maintain optimal oxygenation.

It is important to acknowledge the limitations of our study. First, the sample size was relatively small, which may limit the generalizability of our findings. Additionally, the study focused on short-term outcomes immediately postintervention and posttreatment; longitudinal studies are needed to assess the long-term effectiveness of these interventions. Moreover, individual preferences and responses to interventions were not explored in depth, which could influence treatment outcomes.

While both aromatherapy and BBPT effectively reduce anxiety, BBPT appears to offer additional benefits due to its interactive and engaging nature. Incorporating interactive methods such as BBPT into pediatric dental care protocols may significantly enhance anxiety management and improve patient experiences. Future research should explore the combined effects of these interventions and investigate personalized approaches to optimize anxiety management strategies in dental settings.

CONCLUSION

The comparative analysis between aromatherapy and BBPT for managing dental anxiety in children in the present study underscored the effectiveness of both interventions, with BBPT demonstrating slightly superior efficacy. Aromatherapy, utilizing lavender essential oil, and BBPT, characterized by playful breathing exercises, effectively reduced anxiety levels immediately postintervention and posttreatment. While aromatherapy offers a passive yet calming approach, BBPT's interactive nature engages children more actively, leading to greater reduction in anxiety levels and improvements in physiological parameters such as PR and SpO₂. These findings highlight the importance of incorporating interactive methods such as BBPT into pediatric dental care protocols to enhance anxiety management and improve patient experiences. Further research is warranted to explore the long-term effectiveness and individual preferences for these interventions, aiming to optimize anxiety management strategies in dental settings.

Clinical Significance

- The relatively novel nonpharmacological behavior management techniques of aromatherapy and BBPT can be incorporated into the routine clinical practice of pediatric dentists to effectively reduce the anxiety of the patients.
- This would improve their cooperation during the treatment procedures, reduce the chairside time, and also improve the treatment outcome and subsequently, the overall quality of health care.
- The CBCS used in the present study was also recently introduced, and very few studies have used it as a tool for the measurement of anxiety. Its utilization in the present study adds supporting evidence to the literature as a preferred tool by researchers owing to the familiarity of the children with the characters.

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