



Introduction

Many children experience dental anxiety, which activates the sympathetic nervous system and makes dental procedures stressful. This fear can lead to avoidance of care and may persist into adulthood if not addressed. Traditional behavioral techniques, such as “tell, show, do” and positive reinforcement, are sometimes insufficient, leading to the use of sedation or general anesthesia, which carry additional risks.

Non-pharmacological interventions, including diaphragmatic breathing, can reduce anxiety by activating the parasympathetic nervous system, slowing heart rate, and promoting relaxation. Mindfulness-based strategies, such as meditation and music therapy, also reduce stress and improve mood. Binaural beats, a form of auditory stimulation, engage the brainstem, shift attention away from stress responses, and promote emotional regulation. They have been associated with reduced anxiety, improved mood, enhanced cognitive function, better sleep, and increased focus and memory retention.

Although these approaches have shown benefits in children and adults during medical and dental procedures, the combined effect of binaural beats and diaphragmatic breathing has not been explored in pediatric dental patients. Establishing effective, low-cost behavioral strategies is important to improve the dental experience and provide families with tools to support relaxation at home.

Study Objectives

This study hypothesizes that children aged 5–13 who practice diaphragmatic breathing while listening to binaural beats before dental procedures will show reduced dental anxiety, both subjectively and physiologically. The combined effect of these techniques has not been previously studied in pediatric patients. The objective is to introduce an AI generated guided video combining binaural beats with diaphragmatic breathing as a behavioral management tool for dentists. This approach aims to reduce dental anxiety during procedures and improve the overall well-being of pediatric patients.



Interactive content: AI-generated guided meditation video

Methods

Subjects

Participants were children aged 5–13 with ASA I or II and Frankl II–IV requiring operative treatment (Class I–V restorations, pulpotomies, or stainless steel crowns) across at least two quadrants. Treatment was planned at recall or new patient exams and completed over two appointments. A total of 12 subjects (24 appointments) were included.

Patient Selection

Inclusion Criteria: Children aged 5–13 years (ASA I or II; Frankl II–IV) requiring at least two operative dental procedures. Participants must not receive nitrous oxide during the study; those requiring it will be excluded. Demographic factors will not affect eligibility.
Exclusion Criteria: Children under 5 or over 13 years, those classified as Frankl I, or those who become uncooperative during treatment requiring advanced behavior management (e.g., nitrous oxide or sedation).

Data Collection

Each patient was assigned a number and served as their own control, with one visit including a 5-minute guided video and the other without. Visit type was randomized by coin flip. All treatments followed a standardized protocol (tell-show-do, 20% benzocaine, local anesthesia, bite block, and isolation), and no patients received nitrous oxide.

Heart rate was recorded at 5-minute intervals throughout treatment. Subjective measures included the Venham Picture Test (VPT) and Wong-Baker FACES scale. Assessments were completed before and after treatment for the control visit, and before, after the video, and after treatment for the study visit.



*Forbothsubjectivemeasures,alower#score indicates less fear or anxiety reported

Statistical Analysis

Descriptive statistics were calculated for all variables (n = 12), including mean heart rate, Wong-Baker pain scores, and Venham Picture Test (VPT) scores. Changes in Wong-Baker and VPT scores were determined by subtracting pre-procedure from post-procedure values for both control and meditation conditions. Paired t-tests were used to compare differences between conditions, with p < 0.05 considered statistically significant.

Results

1. Subjective Dental Anxiety Measures

Figure 1

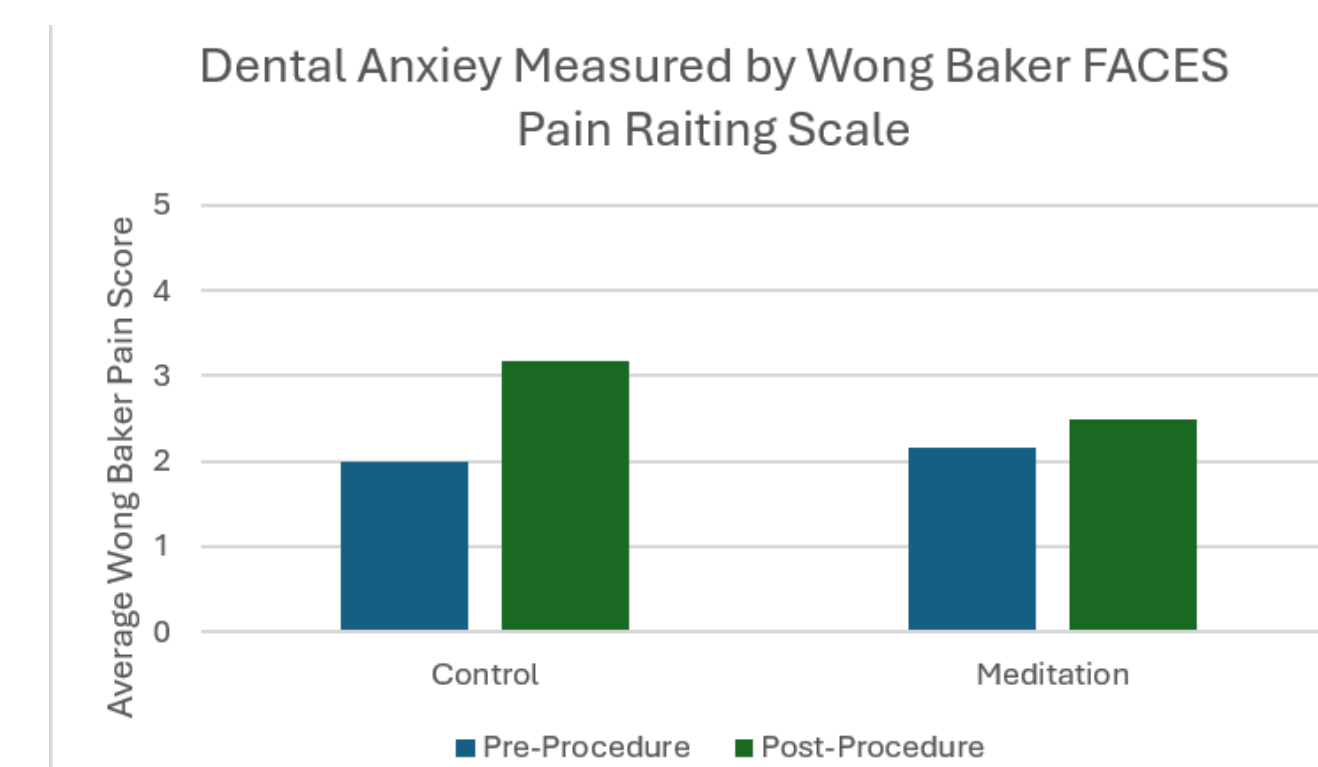


Figure 2

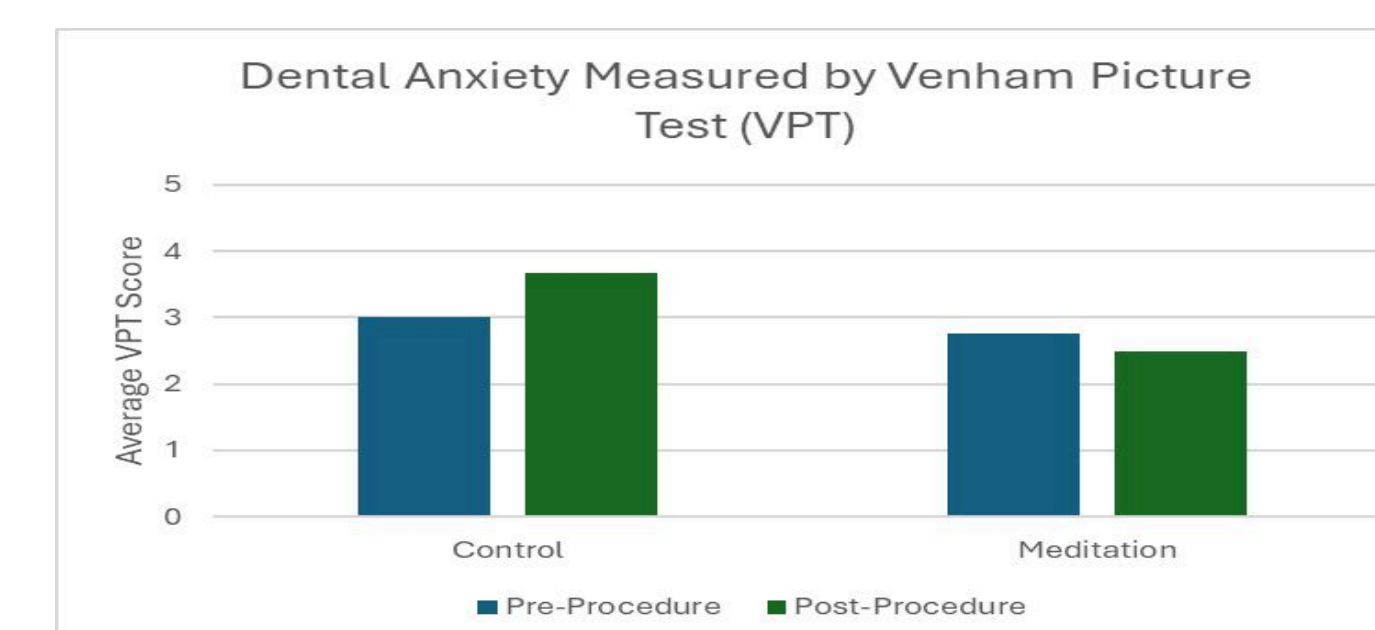


Figure 3 (a)

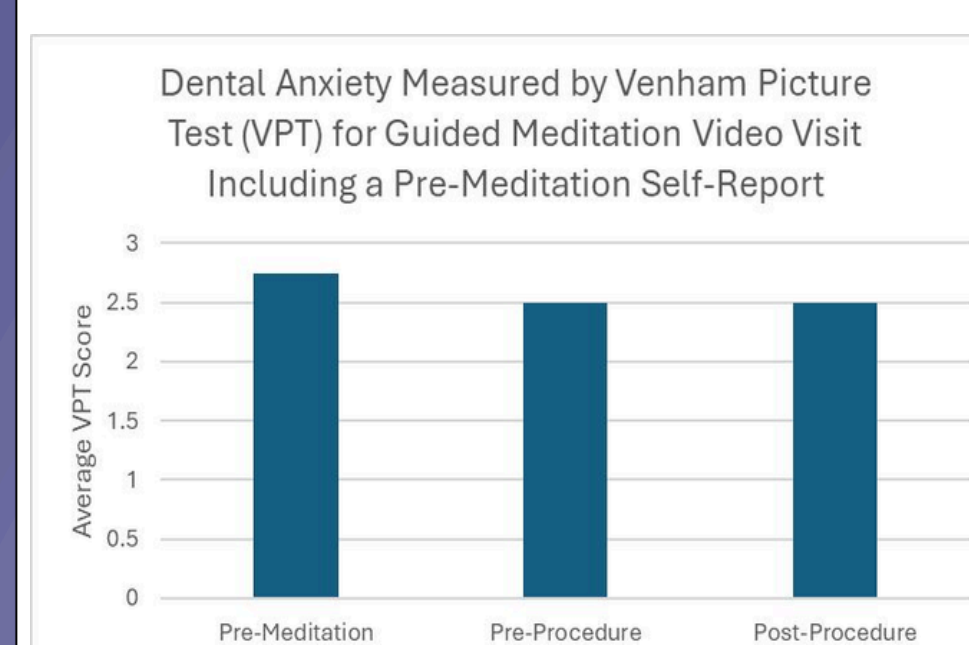
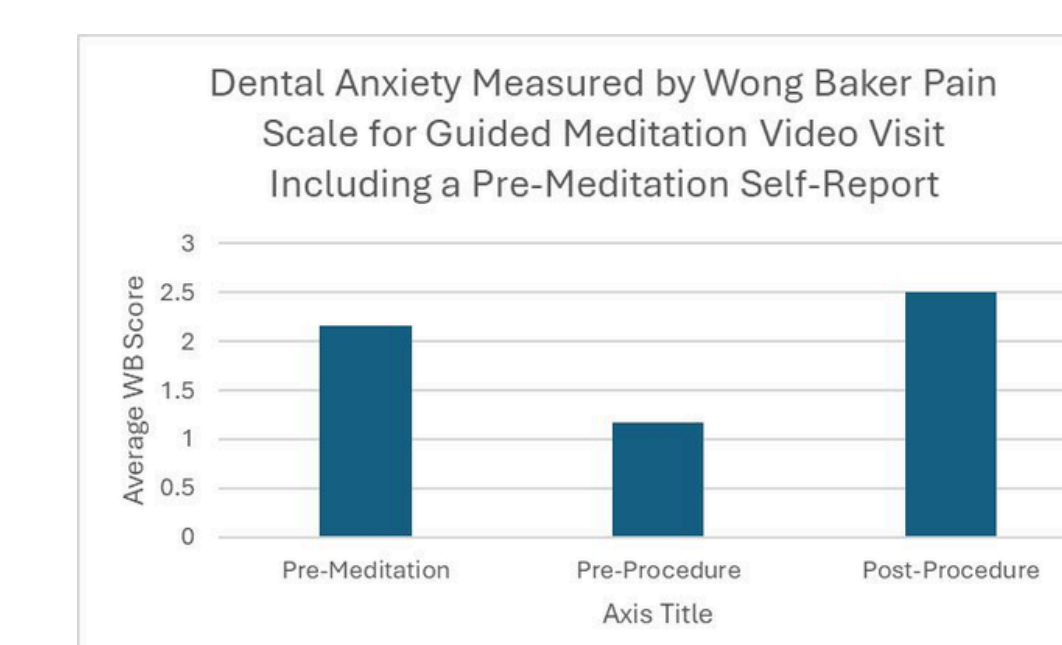
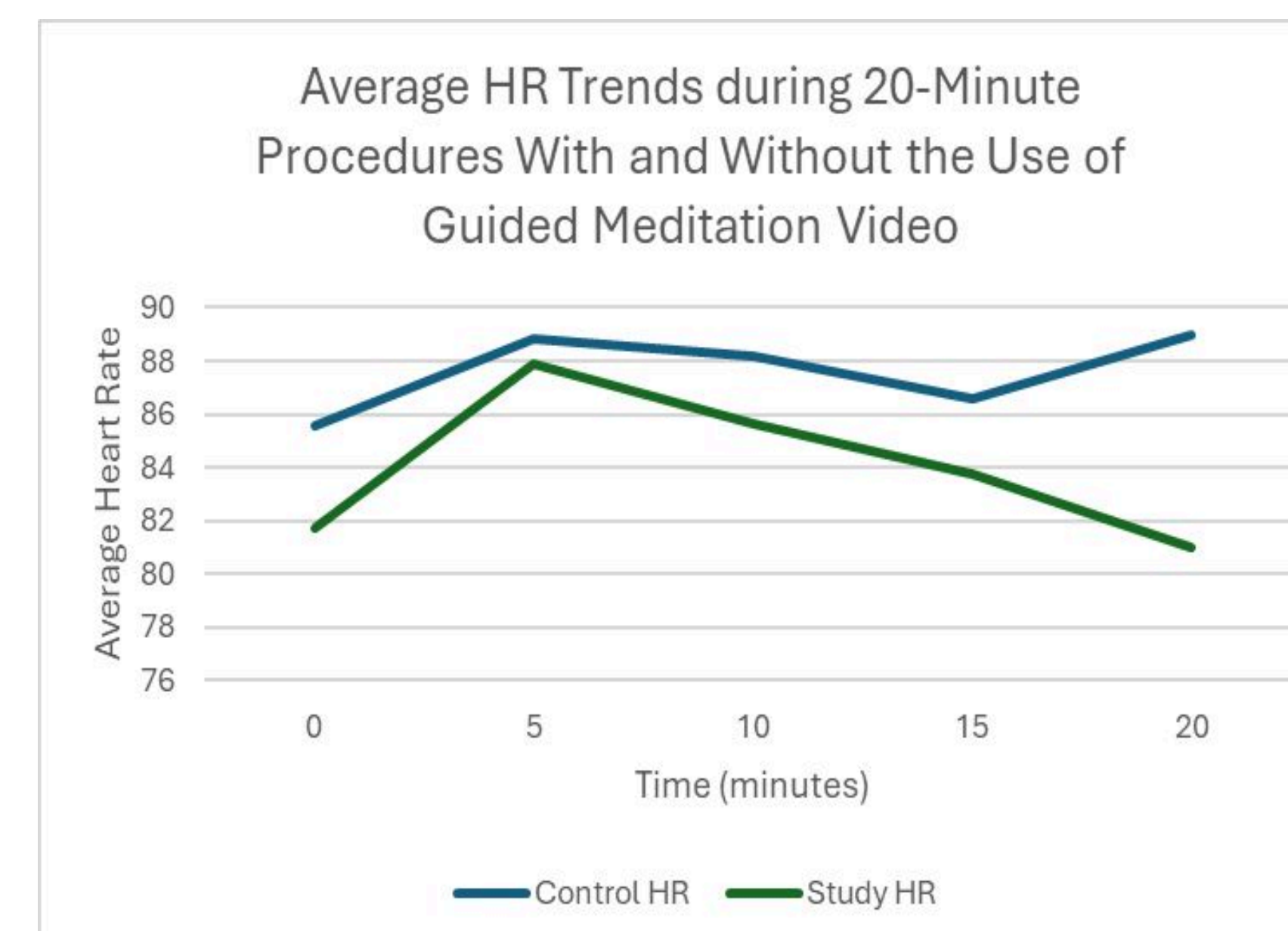


Figure 3 (b)



2 Average HR Trends during 20 Minute Procedures With and Without the Use of Guided Meditation Video



Discussion

No statistically significant differences were observed for Wong-Baker pain scores (p = 0.29) or VPT scores (p = 0.14) between control and meditation visits. Wong-Baker scores increased in both groups, with a less pronounced increase in the meditation group. VPT scores decreased following the meditation intervention and remained lower throughout the procedure compared to control, suggesting reduced anxiety and discomfort.

Heart rate decreased after the meditation intervention and remained relatively stable, whereas the control group showed an initial increase followed by stabilization. Although not statistically significant, these findings suggest a trend toward reduced physiologic stress in the meditation group.

Both Wong-Baker and VPT scores decreased immediately following the intervention, supporting the potential calming effect of diaphragmatic breathing combined with binaural auditory stimulation prior to pediatric dental treatment.

Conclusion

An AI-generated meditation video incorporating diaphragmatic breathing and binaural beats may serve as a promising non-pharmacologic behavior management tool in pediatric dentistry, with observed trends toward reduced anxiety and improved patient comfort. Although statistical significance was not achieved, these findings should be interpreted cautiously given the study's limitations, including a small sample size (n = 12), potential variability between two visits per patient, and a predominantly low-anxiety population (Frankl F3/F4), which may have limited observable effects. Additional confounding factors—such as time of day, patient mood, prior dental experiences, and provider techniques—may have influenced outcomes, and heart rate may not be a fully reliable indicator of anxiety due to procedural and pharmacologic influences. Further research with larger sample sizes and higher baseline anxiety populations is needed to better evaluate the effectiveness of this intervention.

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