FEASIBILITY AND ACCEPTABILITY OF CONSCIOUS CIRCULAR BREATHING (CCB) TO REDUCE DENTAL ANXIETY

A Thesis
Submitted to
the Temple University Graduate Board

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MASTER OF SCIENCE

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ABSTRACT

Research indicates that around 19% of individuals experience moderate to high dental anxiety. Dental anxiety is multifaceted and subjective to the patient; thus, there is no monotherapy for management. Current management of dental anxiety includes pharmacological intervention and cognitive behavioral techniques. This study aims to explore the feasibility and acceptability of Conscious circular breathing (CCB) technique in reducing dental anxiety in dental patients.

This study recruited 15 patients from Temple University Dental School clinics, aged 18- 65, who exhibit moderate dental anxiety. Eligible participants provided informed consent and completed the following set of questionnaires at baseline and post-intervention: Modified Dental Anxiety Scale (MDAS), Perceived Stress Scale (PSS-4), State-Trait Anxiety Inventory (STAI), and Daily Spiritual Experience Scale (DSES). Participants also completed the Client Satisfaction Questionnaire to determine the acceptability of CCB. The CCB protocol consisted of six sessions over the course of two weeks. Participants attended three live sessions in the first week, where they learned the CCB technique using a guided pre-recorded practice video. For the following week, participants were instructed to practice the CCB up to three times on their own time. Participants also completed a brief survey following each CCB session (up to 6 total) to assess stress and anxiety levels. 12 participants successfully completed the 2-week CCB intervention.

A Student T-Test was conducted to assess differences in anxiety, stress, and spiritual experience before and after the Conscious circular breathing intervention. There were no statistically significant differences for STAI ($t = 0.08$, $p = 0.967$), or DSES ($t = 1.58$, $p = 0.224$) when comparing the baseline to the immediate post-intervention survey results. However, a significant reduction in perceived stress was observed ($t = -2.24$, $p = 0.043$), suggesting the intervention effectively reduced stress levels. In addition, there was a statistical difference for MDAS ($t = 1.88$, $p = 0.020$), suggesting an overall sustained decrease in dental anxiety. The intervention received moderate to high acceptability with a mean CSQ score of 22.13 ($SD = 9.91$), indicating positive participant satisfaction. Findings indicate that Conscious Circular Breathing may be a feasible and acceptable intervention for individuals with moderate dental anxiety, as participants reported high satisfaction and significantly reduced perceived stress levels and dental anxiety over time. Future studies with larger sample sizes and longer follow-ups are needed to explore its potential as an adjunctive anxiety management tool in dental settings.

Dedicado para mis Papas,

Jesus y Guadalupe Vacio

y mi mejor hermano Juan C.

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CHAPTER 1

INTRODUCTION

Dental anxiety is a psychological condition characterized by fear, anxiety, or extreme nervousness associated with dental and oral health care (Saatchi, 2015). Dr. Coriat was the first to coin the term, “dental anxiety” that defined it as “an excessive dread of anything being done to the teeth” (Coriat, 1946). Dental anxiety can vary in intensity, and when it reaches an extreme level, it may develop into a dental phobia, a more severe condition often assessed using tools like the Moderate Dental Anxiety Score (Humphris, 2009).

Current research indicates that around 19% of individuals in the population experience varying levels of anxiety, ranging from moderate to high. (White, 2017). Yet, in an oral surgery clinic, researchers revealed 72.3% of individuals experienced moderate or high levels of anxiety (Alansaari, 2023). This anxiety can trigger a chain of events that result in immediate symptoms like heart palpitations, breathlessness, and dizziness (Szuhany, 2022). While these symptoms appear to be relatively consistent, some subgroups may report varying intensity or new symptoms compared to others (Carter, 2014). Nonetheless, studies show that over time, presence of dental anxiety can also lead to reduced oral health and an increased likelihood of oral diseases (Winkler, 2023).

The prevalence of dental anxiety varies depending on factors such as gender, education level, societal deprivation, and socioeconomic status (Muneer, 2022). Simultaneously, research highlights lower socioeconomic status individuals were more susceptible to dental anxiety (Muneer, 2022 and Carter, 2014). Gender studies found that women are more likely to be dentally anxious compared to men (Samina, 2021 and Carter, 2014). Overall analysis also revealed that adolescents experience the highest dental anxiety and middle-aged adults experience the lowest (Samina, 2021).

Further, numerous studies have explored how individual differences such as gender, marital status, education level, and the origin of dental fear influence both the intensity and expression of dental anxiety. For instance, female patients are consistently shown to report higher dental fear, which may reflect broader gender norms surrounding emotional expression and health-related anxiety (Armfield et al., 2006). Marital status has been associated with anxiety buffering effects, where individuals with a partner may experience reduced stress and greater resilience in healthcare settings (Locker et al., 1999). Likewise, those with higher levels of education often demonstrate lower dental anxiety, potentially due to increased health literacy, exposure to care, and more proactive coping strategies (Humphris et al., 2013). The origin of fear—whether from direct experience, observation, or negative messaging—also plays a pivotal role in how anxiety manifests and should be carefully considered when designing person-centered interventions (Oosterink et al., 2009).

Individuals experiencing dental anxiety tend to refrain from seeking dental treatment because it makes them anxious (Appukuttan, 2016). Avoiding dental treatment becomes a negative feedback loop of dental anxiety, avoidance, and pain. Ultimately, leading to delayed treatment resulting in the need for more extensive and uncomfortable dental procedures. This, in turn, reinforces dental anxiety, making it even more challenging for individuals to break the cycle and seek prophylactic dental care.

Carter et. al. Isolated the origin of dental fear in its multifaceted nature. Dental fear may stem from an array of experiences, including, but not limited to, fear of pain, fear of the unknown, embarrassment, personal space, and financial stress. There are multiple pathways to the origin of dental fear: cognitive conditioning, informative, visual vicarious, verbal threat, and parental (Carter, 2014). Cognitive conditioning refers to Pavlovian theory, classical and operant conditioning weighing on psychological motifs. Informative is an indirect pathway for the acquisition of fear often via media (Carter, 2014). The vicarious, verbal threat, and parental pathway are indirect pathways that differ in the mode of transmission. It is most important to understand the underlying reason behind dental anxiety in order to better curate treatment for patients.

Though we can manage what has already been psychologically wired, we can delve deeper into the mechanisms to manage anxiety. Currently, there are a number of vehicles to deliver dental anxiety treatment. Of which include pretreatment surveys, Cognitive Behavioral Therapy (CBT), computer assisted relaxation learning, hypnotherapy, group therapy, and flooding/implosion therapy (Carter, 2014). While all of these treatments offer reduction in dental anxiety, they're also resource intensive, time consuming, and sometimes inaccessible to the most economically vulnerable patients.

Mindful breathing presents a self-regulatory methodology that offers potential as an *unbound* patient-centered intervention. This approach holds promise for individuals experiencing dental anxiety, concerns of pain, financial stress, or fear of the unknown by providing a self-administered technique requiring minimal guidance or introduction. Consequently, it could circumvent the necessity for additional time and financial resources often associated with conventional therapeutic modalities like Cognitive Behavioral Therapy, pharmacological (Carter, 2014).

Breathing techniques are powerful tools for self-mastery, supported by research demonstrating their ability to reduce stress and anxiety (Balban, 2023). Controlled breathwork with primary endpoints such as enhanced mood and stress management has proven promising on several accounts (Huberman, 2023). While there are many different adaptations of breathwork, a recipe for statistically significant results has been reported. Studies that catered the following outlines, proved effective as a breathing practice: sessions lasting less than 5 minutes, avoiding only fast paced breathes, inclusion of human guidance, multiple sessions, and implementation of long-term practice (Bentley, 2023). These techniques have been found to exert a notable influence on the autonomic nervous system, a key component of our physiological response to stress and relaxation (Zaccaro, 2018). Additionally, these practices are backed by ancient yogic concepts and are implemented with modern science, an effective synergetic relationship (Bentley, 20223).

By engaging in mindful breathing, individuals can modulate the autonomic nervous system, leading to a shift from the "fight or flight" stress response to the "rest and digest" state, thereby promoting a sense of calm and overall well-being (Gerritsen, 2018). The parasympathetic system is most active during this “rest and digest” state which leads to a decrease in heart rate through stimulation of the vagus nerve (Banushi, 2023). Thus, showing that active engagement in breathwork can increase breathing efficiency but also regulate the autonomic functions and vice versa (Banushi, 2023).

Reinforcing the notion that reducing dental anxiety can not only help improve the patient's oral health but also improve the dental-patient relationship, may model better behaviors for future generations. In this sense, we aim to decrease dental anxiety as a way to engage in preventative dentistry.

In recent years, the Wim Hof method has gained increasing popularity and is known for several claimed benefits, including increased energy, reduced stress, improved immune system function, and enhanced mental well-being (Ketelhut, 2023). It is a combination of breathing exercises, cold exposure, and mindfulness. However, these elements hinder the accessibility of the intervention and make conclusive assessments regarding its effectiveness difficult due to its multifaceted nature. The current regimen for dentistry is an extensive and financially strained combination of pharmacology and psychological frameworks (Banushi, 2023).

We aim to propose a non-invasive, non-pharmacological, no cost, self-administered tool rooted in patient-centered care. To address this multifaceted issue, this research proposal aims explicitly to explore the potential of incorporating mindful breathing techniques as a novel and holistic approach to mitigate dental anxiety and improve the overall dental experience.

A pilot study, similarly, aimed to investigate the impacts of conscious breathing retention on individuals experiencing chronic back pain (Pratscher, 2023). Chronic pain is a debilitating sensation that humans are subjected to, and breathing interventions have shown promising results in decreasing such sensations (Pratscher, 2023). We intend to adopt this methodology and implement it in the dental sector to understand if this technique is also well liked and adapted by the dental patients at Temple’s Kornberg

School of Dentistry. This will be the first pilot study to examine the effects of a breathing tool to help decrease dental anxiety in dental patients. If well adapted, we will conduct a larger randomized control trial to further test its efficacy in the dental clinic.

CHAPTER 2

AIMS & HYPOTHESIS

The aim of this study is to implement the Conscious Circular Breathing (CCB) technique within the dental care setting and evaluate its effectiveness in reducing dental anxiety among patients at Temple University's School of Dentistry. Specifically, the study seeks to examine whether CCB is a well-liked, easily adopted, and practical tool for managing dental anxiety, while also assessing its overall feasibility and acceptability within a clinical dental population.

This study is guided by two primary hypotheses:

H_1: Participants will rate the Conscious Circular Breathing (CCB) technique as both acceptable and feasible.

H_2: Participants who engage in the Conscious Circular Breathing (CCB) intervention will report a reduction in dental anxiety following the completion of the intervention.

CHAPTER 3

METHODS

3.1 Participants

Participants were recruited via telephone outreach from Temple University Kornberg School of Dentistry clinics. Participant recruitment began in September, following approval by Temple University Institutional Review Board (IRB #31637). 523 participants were contacted. Of these, 68 participants were screened. Of the screened participants, 23 participants were eligible to participate, and 15 participants signed an informed consent. Participants were eligible if they were English-speaking adults (18–65 years old) with moderate dental anxiety, defined as scoring 11–19 on the Modified Dental Anxiety Scale (MDAS). Exclusion criteria included respiratory disorders, panic disorder, opioid use, uncontrolled hypertension, neurological disease, psychiatric hospitalization in the past year, substance use disorder, pregnancy, or prior participation in a dental anxiety study or daily yoga practice. Upon meeting the criteria, 15 participants provided informed consent and completed the baseline assessments through rolling enrollment. Confidentiality was maintained through de-identified data storage on secure, password-protected servers. Participants were informed that they could withdraw at any time without penalty.

3.2 Procedures

The study was conducted over six weeks, with an intervention phase consisting of two weeks. The first week was active and the second week was a passive phase followed by a one-month follow-up assessment.

The intervention phase took place over the course of one week in January and consisted of three live Zoom sessions, held on Monday, Wednesday, and Friday. Each session was conducted in real-time with an expert-led Conscious Circular Breathing (CCB) practice. Participants were guided through a structured format designed to establish familiarity with the breathing technique and encourage active engagement. The live nature of the sessions allowed for real-time guidance, correction, and encouragement, helping participants integrate the practice into their daily routine as they prepared for self-guided practice in Week 2.

Each Zoom session followed a consistent structure:

1. Introduction and Expectations – At the beginning of each session, facilitators reviewed the objectives of the intervention, outlined expectations for participation, and reinforced the importance of consistency in practicing the technique.
2. Confidentiality Reminder – Participants were reminded that their involvement in the study was confidential, and they were encouraged to respect the privacy of other group members.
3. Guided Breathing Practice – Participants followed along with a structured breathing video, engaging in the practice collectively in real time.
4. Debrief and Reflection – After completing the breathing exercise, participants were given the opportunity to discuss their experiences, share any difficulties or insights, and ask questions. The facilitator provided feedback and support to reinforce correct breathing techniques and encourage continued engagement.

Additionally, participants submitted an attendance questionnaire to ensure that participants stayed engaged and given a platform to share their thoughts after each breathing technique.

During the passive intervention phase, participants were reminded and encouraged to complete the breathing intervention on their own time and at their own pace on Monday, Wednesday, and Friday. To ensure compliance and engagement, the same attendance questionnaire used in the active phase was administered. Participants were only eligible to take part in the passive intervention phase if they had attended at least one session during the active intervention phase, ensuring they were familiar with how to properly execute the breathing technique independently. This structured approach helped maintain participant engagement and allowed for continued self-guided practice while reinforcing the core components of the intervention.

3.3 Measures

To assess dental anxiety, the Modified Dental Anxiety Scale (MDAS) was used. MDAS scores were a primary focus of the intervention as it assesses anxiety related to common dental procedures and anticipatory fear (Humphris, Morrison, and Lindsay, 1995). Each item is scored on a 5-point Likert scale, yielding a total score ranging from 5 to 25. Scores ≥19 typically indicate severe dental anxiety.

To assess stress, the Perceived Stress Scale – 4 item version (PSS-4) was used. PSS-4 scores capture perceived stress levels over the past month (Cohen, S., Kamarck, T., & Mermelstein, R, 1983). Each item is rated on a 5-point scale from “never” to “very often,” yielding a score range of 0–16, with higher scores indicating greater perceived stress.

The State-Trait Anxiety Inventory (STAI) was used to assess anxiety in its state and trait form. It is a gold-standard instrument in anxiety research, enabling the differentiation between situational and baseline anxiety (Spielberger, C. D., 1983). Items are rated on a 4-point scale and scores are computed separately for the State and Trait subscales. Higher scores indicate higher levels of anxiety.

The Daily Spiritual Experience Scale (DSES) was included to assess spirituality experiences that may represent feelings of peace, connectedness, and emotional regulation (Underwood, L.G., 2002). Since CCB is a mind-body technique rooted in mindfulness and intentionality DSES offers a measure to this insight. It is a 16 item Likert scale ranging from “many times a day” to “never or almost never.” Higher scores suggest more frequent spiritual or calming experiences.

The assess client satisfaction, the Client Satisfaction Questionnaire (CSQ-8) was used. The CSQ is a validated tool widely used to measure satisfaction with health and mental health services (Attikisson, C.C., 1984). It is an 8 item Likert scale; total scores provide an overall index of satisfaction, and individual items can highlight specific areas for improvement.

3.4 Analysis Plan

The sample size for this pilot study (N = 15) was informed by a comparable pilot randomized controlled trial conducted by Pratscher et al. (2023), which tested a conscious connected breathing intervention in adults with chronic low back pain. In that study, a sample size of 24 participants (with an estimated attrition rate of 20%) was deemed adequate to assess feasibility and acceptability outcomes without a formal power calculation, as is appropriate for early-stage intervention research. Similarly, given the exploratory nature of our study and practical considerations including recruitment feasibility, resource limitations, and expected attrition, we selected a target sample size of 15 participants, anticipating a 50% attrition rate and final analyzable data from approximately 8 participants. Feasibility will be determined by study recruitment (15 participants), retention (75%, 11 participants), and attendance/session completion (50% of sessions). Acceptability will be assessed using the Client Satisfaction Scale. The program will be determined acceptable if 80% of patients report moderate to high satisfaction with the programs. In addition, Independence t-tests and one-way ANOVA (F-statistic) will be conducted to examine whether baseline demographic characteristics (e.g., gender, education, marital status, onset of dental anxiety) are associated with differences in initial MDAS scores.

3.5 Data Analysis

A total of 12 participants of the 15 enrolled, successfully completed the two-week intervention period. Due to small size, a Student T-test was conducted instead of the Repeated Measures ANOVA to examine the effect of the Conscious Circular Breathing (CCB) intervention on dental anxiety, as measured MDAS, PSS-4, STAI, DSES across three time points: Baseline, Post-Intervention, and One-Month Follow-Up. The CSQ was used to measure the feasibility of CCB intervention and attendance, and retention were used to assess the acceptability of the intervention. Independent samples t-tests were used to compare baseline MDAS scores across binary demographic variables, including gender, education level, and age of onset of dental anxiety (childhood vs. adulthood), while one-way ANOVAs were conducted to examine differences in baseline MDAS scores across multi-category variables such as marital status.

CHAPTER 4

RESULTS

4.1 Sample Demographics

A total of 15 participants were consented into the study, with a mean age of 34.2 years (SD = 12.89) and a median age of 29.5 years, ranging across 41 years. The sample consisted of 66.67% female (n = 10) and 33.33% male (n = 5) participants.

The sample was diverse, with 6 participants (40%) identifying as Black or African American, 8 participants (53.33%) identifying as White/Caucasian, and 1 participant (6.67%) identifying as Asian. No participants identified as American Indian, Alaskan Native, Native Hawaiian, or Pacific Islander. Additionally, 2 participants (13.33%) did not specify their racial identity.

Most participants (47%) were single and never married, while a substantial portion (40%) were currently married or living as if married. A small percentage of participants (7%) reported being divorced, and another 7% chose not to disclose their marital status. No participants identified as separated or widowed.

The majority of participants were college educated. Specifically, 27% of participants had completed a college degree (Baccalaureate), while 20% had attended some college or professional school beyond high school. Additionally, 7% of participants had earned a master's degree, and another 7% held a Doctoral Degree (Ph.D., M.D., J.D., etc.). A small proportion of participants (7% each) reported having some high school education (9–11 years), a high school diploma or GED, or vocational/training school experience. Notably, no participants reported less than a high school education, suggesting a relatively educated sample.

The study population reflects a diverse range of employment statuses. The largest group, part-time employees (n = 4, 27%), was followed by full-time employees (n = 3, 20%) and individuals who were not working (n = 3, 20%), indicating a mix of participants engaged in the workforce and those currently unemployed. Additionally, 1 participant (7%) reported being retired, and another 1 participant (7%) identified as a homemaker or caregiver. No participants reported being disabled or unable to work. A small proportion of individuals (n = 2, 13%) selected "Other" as their employment status, and 1 participant (7%) preferred not to disclose their employment status. From the participants who elected "Other", "self-employed" and "student" were submitted.

The majority of participants (n = 9, 60%) reported that their cost of living was somewhat hard, indicating moderate financial strain, while 5 participants (33%) stated that their cost of living was not very hard at all, suggesting greater financial stability. Only 1 participant (7%) found the cost of living to be very hard, and no participants selected "don't know" or "prefer not to answer", reflecting a clear understanding of their financial situation within the sample.

The majority of participants in the study (n = 12, 80%) reported visiting the dentist twice a year, while a smaller proportion (n = 2, 13%) attended once a year suggesting a relatively engaged study sample in preventive dental care, adhering to the recommended annual check-up schedule. Most participants in the study (n = 13, 33.3%) reported being insured, and one participant (n=1, 7%) reported self-pay.

Interestingly, majority of participants (n = 11, 73%) reported that their dental anxiety began in childhood, suggesting that early experiences played a significant role in shaping their perception of dental care. A smaller portion of participants (n = 3, 20%) developed dental anxiety in adulthood, while 1 participant (7%) did not remember when their anxiety first began. This distribution highlights the long-term impact of early dental experiences and emphasizes the importance of early intervention and anxiety management strategies in pediatric dental care to prevent the persistence of dental fear into adulthood.

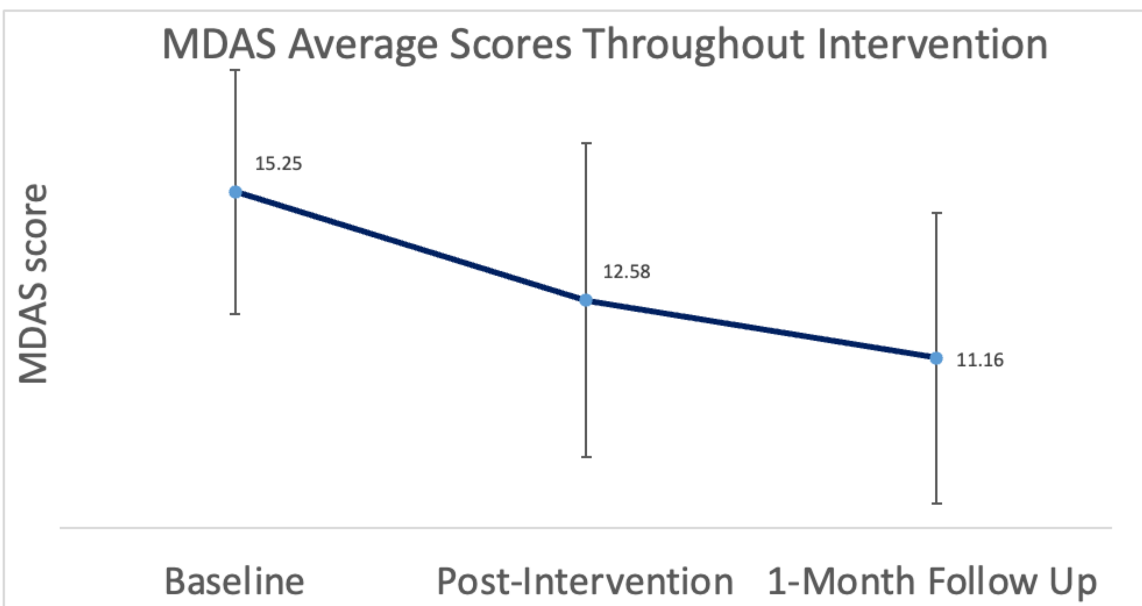
4.2 Baseline Metrics

At baseline, the sample population (n = 15) demonstrated moderate levels of dental anxiety and perceived stress. The Modified Dental Anxiety Scale (MDAS) had a mean score of 15 ± 2.8, indicating moderate dental anxiety within the inclusion criteria range. The Perceived Stress Scale (PSS-4) yielded a mean score of 7.26 ± 3.1, reflecting a moderate degree of perceived stress. For generalized anxiety, the State-Trait Anxiety Inventory showed a mean score of 46.8 ± 7.1 on the State Anxiety subscale (STAI-Y1) and 45 ± 6.6 on the Trait Anxiety subscale (STAI-Y2), suggesting moderate to high levels of both situational and dispositional anxiety. The Daily Spiritual Experience Scale (DSES) had a mean score of 2.62 ± 1.5, indicating relatively low frequency of reported spiritual or calming experiences across the sample. These baseline values establish a psychological profile of participants prior to intervention, highlighting moderate levels of stress and anxiety, and serving as a reference point for assessing intervention-related changes.

4.2.1 Modified Dental Anxiety Scale (MDAS)

The results indicated a statistically significant effect of time on MDAS scores ($p = 0.0205$), suggesting that the intervention had a meaningful impact on reducing dental anxiety over time. To further explore these differences, a student t test was conducted comparing baseline to post-intervention and 1-month follow up. The analysis revealed that the only significant difference was observed between Baseline and One-Month Follow-Up ($p = 0.020$), suggesting that the most substantial reduction in dental anxiety occurred over the full duration of the study, rather than immediately following the intervention. No statistically significant differences were found between Baseline and Post-Intervention or Post-Intervention and One-Month Follow-Up, indicating that anxiety levels continued to decline gradually after the intervention phase.

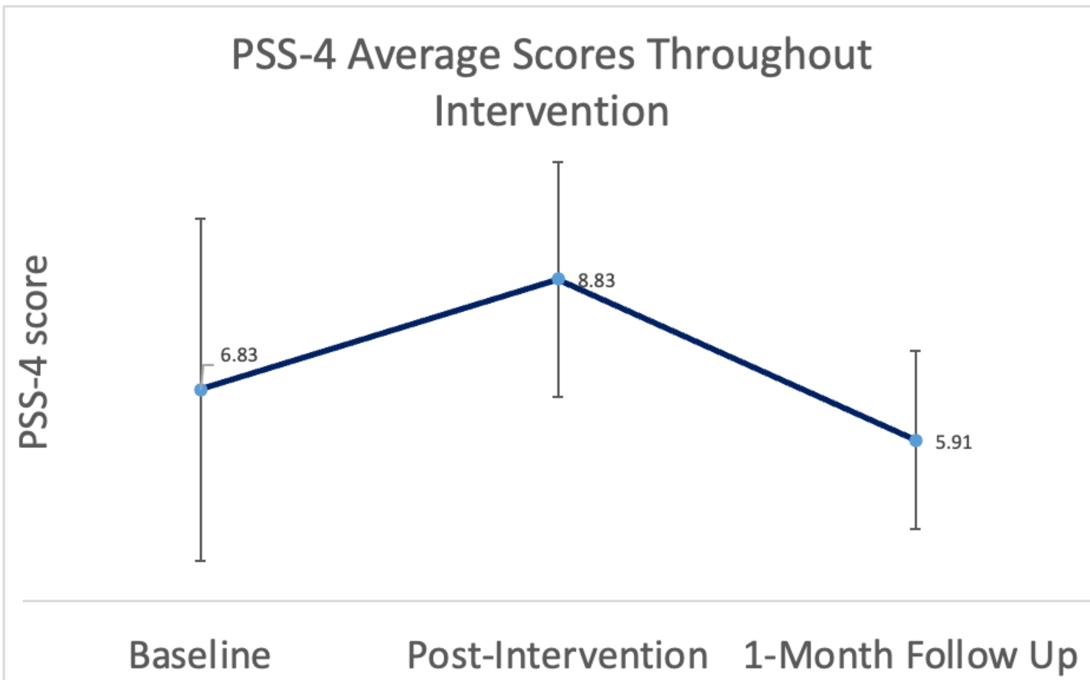
Fig. 1. MDAS average scores at baseline, post-intervention, and one month follow up.



4.2.2 Perceived Stress Scale (PSS-4)

The results PSS-4 results indicated a statistically significant effect of time, suggesting that perceived stress levels changed (p=.017) over the course of the intervention. To further investigate these changes, independent student t test was conducted indicating a statistically significant (0.043) change in perceived stress scale immediately post-intervention, but it was not sustained through perceived stress (p=0.437).

Fig. 2. PSS-4 average scores at baseline, post-intervention, and one month follow up.



4.2.3 State Trait Anxiety Inventory (STAI)

The STAI results indicated that there was no statistically significant (p= 0.267) effect of time on STAI-Y1 scores, suggesting that anxiety levels did not change substantially across the intervention period.

4.2.4 Daily Spiritual Experience Scale (DSES)

The DSES results indicated no statistically significant ($p = 0.685$) effect of time on DSES scores, suggesting that the intervention did not lead to measurable changes in spiritual experience over the study period.

4.2.5 Client Satisfaction Questionnaire (CSQ)

CSQ data indicates strong participant satisfaction with a mean CSQ score of 29.75 (SD = 4.5), reflecting moderate to high acceptability. CSQ is scored out of 32. Thus, intervention scored a 93% on the Client Satisfaction Questionnaire. Additionally, there was 72.22% attendance rates and 80% of participants who provided informed consent followed the study through until 1 month follow-up.

Figure 3. *Attendance to six sessions*

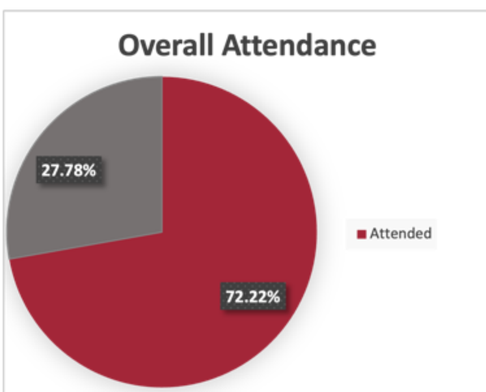


Figure 4. *Overall Study Retention Rate Among Participants (N = 15)*

Note: 80% of participants completed the study, while 20% were lost to follow-up.

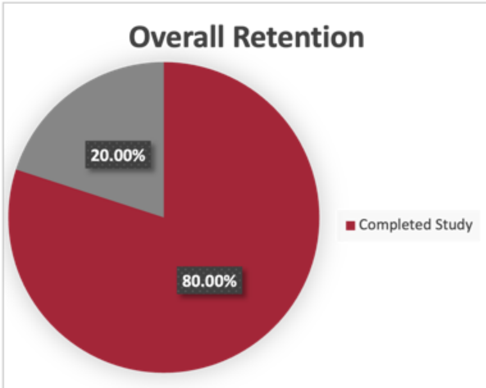
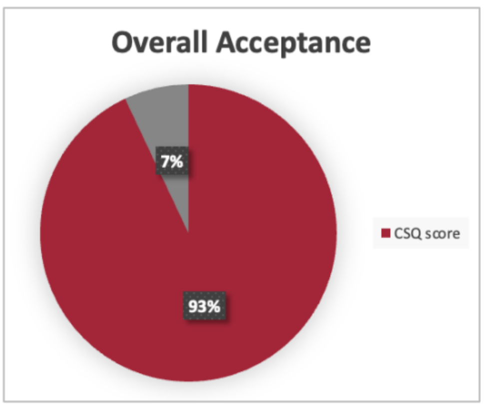


Figure 5. *Acceptance rate*.

Note: Calculated via CSQ-8 scores gathered at post-intervention



CHAPTER 5

INTERPRETATION OF FINDINGS

In examining participant demographics, 40% sample was married. Although prior studies have linked marital status to lower dental anxiety—suggesting that social support from a partner may buffer stress and encourage dental attendance—our findings did not support this relationship. A one-way ANOVA revealed no significant differences in mean dental anxiety scores across marital status groups (single, divorced, married), $F(2, 9) = 0.26$, $p = 0.777$. This suggests that, within our sample, marital status was not a determining factor in the experience of dental anxiety, highlighting the potential role of other influences such as individual coping strategies or prior dental experiences.

Given that CCB is a self-regulatory stress management technique, it may be particularly beneficial for unmarried individuals who lack consistent social support for anxiety coping. Introducing accessible, independent coping strategies like CCB in dental settings could help bridge the gap for individuals who do not have external emotional support networks. Future research should further explore the interplay between marital status, social support, and the efficacy of anxiety management interventions to determine how targeted approaches can enhance treatment engagement across different demographic groups.

The majority of participants in the study identified as female (66.7%), which is consistent with prior research showing that women are more likely to report dental anxiety than men (Schneider & Mehrstedt, 2015; Thompson et al., 1996). While the mean MDAS score for female participants ($M = 15.4$) was higher than that of male participants

(M = 13.67), this difference was not statistically significant ($t = 0.70$, $p = 0.544$). These findings may be due in part to the small sample size, particularly among male participants, which limits statistical power. Nonetheless, the observed trend aligns with existing literature suggesting that women are more likely to recognize and disclose anxiety, particularly in healthcare contexts. This may also explain why women could be more receptive to engaging in non-invasive interventions like Conscious Circular Breathing (CCB), while men may benefit from alternative framing or motivational strategies that resonate more with their behavioral preferences and help-seeking patterns.

Additionally, findings from the demographic table reveal that 73% of participants reported developing dental anxiety during childhood, while only 20% reported onset in adulthood, and 7% could not recall when their anxiety began. However, in our sample, an independent samples t-test revealed no statistically significant difference in mean MDAS scores between participants who developed dental anxiety in childhood (M = 15.38) and those who reported adulthood onset (M = 14.67), $t \approx 0.35$, $p = 0.746$. While the direction of the means aligns with previous literature, the lack of statistical significance suggests that in this small sample, age of onset was not a strong predictor of current dental anxiety levels. This could reflect the influence of other factors, such as individual coping strategies, exposure to supportive dental environments, or intervention effects.

The fact that most participants developed their anxiety in childhood underscores the importance of early interventions to prevent long-term dental avoidance behaviors. Since dental anxiety is often deeply ingrained from a young age, behavioral interventions such as Conscious Circular Breathing (CCB) may serve as an accessible, non-invasive strategy for managing this anxiety in adulthood

Most participants in the study had post-secondary education, aligning with research suggesting that higher educational attainment is associated with lower dental anxiety due to improved health literacy and engagement in preventive care (Berkman et al., 2011; Weiner et al., 2014). In our sample, participants with post-secondary education had a lower mean MDAS score ($M = 14.7$) compared to those with lower education ($M = 18.0$), though this difference was not statistically significant ($t = 1.51$, $p = 0.315$). This may be due to the small sample size, particularly among participants with limited education. Still, the trend reflects existing literature and may indicate that individuals with higher education are more receptive to self-guided anxiety-reduction strategies like CCB.

CHAPTER 6

DISCUSSION

This pilot study found that participants engaging in conscious circular breathing experienced a reduction in perceived stress and dental anxiety over the one-month period. While stress initially increased post-intervention, it later declined, suggesting a delayed effect. The intervention was feasible and acceptable among participants. The demographic composition of the sample had a mean age of 34.2 years, with 66% identifying as female and 53% as Caucasian.

Although the average MDAS score in this study decreased from 15 to 11, remaining within the "moderate dental anxiety" range, this change holds meaningful clinical significance. In real-world practice, even a modest reduction in anxiety can influence a patient’s willingness to engage with dental care. A shift toward the lower end of the moderate range may reflect a patient’s increased sense of control, comfort, or trust during their visit — all of which contribute to the likelihood of returning for future appointments. Ultimately, patient experience and perception are central to care retention, and even small improvements can help break the cycle of avoidance that often characterizes dental anxiety.

The increase of PSS-4 scores from baseline to post-intervention followed by a decline at the 1-month follow up suggests that stress may have temporarily increased independent of the intervention’s effectiveness. This may be attributed to psychological, environmental or tertiary factors. Participants may have felt overwhelmed by participating in the study. Participants were required to learn a new technique and attended six sessions in a two-week period. Participants might've been subject to performance anxiety or the innate nature of societal stressors the end of season brings.

6.1 Limitations

The reported decrease in anxiety and stress scores supports our hypothesis that CCB can reduce dental anxiety. However, there are some limitations. The intervention last only two weeks and consisted of zoom and at home sessions. This limited time frame might not be enough for all participants to experience the full benefits of a behavioral change like conscious breathing. The lack of in-person interaction may have also reduced opportunities for spontaneous feedback, nonverbal cues, and interpersonal connection, potentially diminishing the intervention's impact on stress reduction. Additionally, the study's small sample size and lack of a control group limit the generalizability and internal validity of the findings. Questionnaires were self-administered and self-reported data may be subject to bias. The samples restriction to English-speaking patients at a single urban dental school may not reflect broader populations.

Given its low cost, minimal time commitment, and positive reception, CCB could be integrated into dental waiting rooms, pre-procedure consultations, or at-home care recommendations, specifically for patients with moderate dental anxiety. Future research should incorporate a randomized controlled design with an appropriate control group such as a waitlist, CBT, or pharmacological. This would minimize confound variables and placebo effect. To enhance statistical power and generalizability, larger-scale studies should be conducted aiming for a more diverse sample size. Inclusion of non-English speakers could expand the population it reaches and determine the cultural adaptability of the intervention. Incorporating physiological indicators such as heart rate variability, salivary cortisol levels, or blood pressure could provide objective support for the self-reported reductions in anxiety and stress. Feasibility trails in dental clinic before or during dental appointments could explore how CCB can be integrated into routine dental workflow, possibly improving both patient and provider experience. For broader implementation, it would be useful to conduct economic evaluations comparing CCB to contemporary management strategies such as sedation and CBT. These multimodal approaches would strengthen the credibility of the findings.

In summary, this pilot study provides preliminary support for the feasibility and acceptability of CCB as a low-cost, self-regulatory intervention for reducing dental anxiety and perceived stress. Despite some methodological limitations, including a small sample size, lack of a control group, and limited generalizability, the observed trends suggest that CCB may offer meaningful psychological benefits for patients in dental care settings. As dental anxiety continues to present a significant barrier to care, especially among underserved populations, CCB holds promise as an accessible, non-invasive strategy. With further validation through rigorous research, it could be effectively integrated into clinical practice to enhance patient outcomes and improve the dental care experience.

CHAPTER 7

CONCLUSION

This study examined the feasibility and acceptability of Conscious circular breathing (CCB) as an intervention to reduce dental anxiety in patients at Temple Dental School. The results supported our hypothesis that patients who participated in the CCB intervention experienced a reduction in dental anxiety. The Modified Dental Anxiety Scale (MDAS), Perceived Stress Scale (PSS-4), State-Trait Anxiety Inventory (STAI), and Daily Spiritual Experience Scale (DSES) were used to measure anxiety levels at baseline, post-intervention, and one-month follow-up. A repeated measures ANOVA indicated significant reductions in mean dental anxiety and perceived stress scores over time, suggesting that CCB can be an effective, low-cost, and self-administered technique to help manage dental anxiety.

The demographic composition of the study participants reflects the diverse patient population at Temple Dental School clinics, which served as the primary recruitment site. This diversity is an important consideration in evaluating the generalizability of the intervention's impact on dental anxiety management.

Among those who completed the study, diversity in racial/ethnic backgrounds, income levels, and education levels was observed. Despite an anticipated attrition rate of 20%, retention strategies were effective, with approximately 80% of participants completing the intervention and follow-up assessments. The acceptability of the intervention was high (93%), with most participants reporting a favorable experience with the breathing technique and expressing willingness to incorporate it into their regular dental care routine.

Future research should focus on expanding the sample size to enhance the generalizability of findings, as small sample studies may limit statistical power and the ability to detect meaningful effects (Leon et al., 2011). Increasing the participant pool would allow for a more diverse representation of individuals with varying degrees of dental anxiety, further refining the intervention's applicability across different populations.

Additionally, incorporating a control group in future studies would strengthen the validity of results by allowing direct comparisons between CCB and other anxiety-reduction methods, such as progressive muscle relaxation or standard patient counseling (Kaur et al., 2022). A randomized controlled trial (RCT) design would help distinguish the specific effects of CCB from potential placebo or expectancy effects, offering more robust evidence for its clinical implementation (Schulz & Grimes, 2002).

Beyond self-reported measures, integrating biometric assessments—such as heart rate (HR) variability and salivary cortisol levels—would provide objective physiological markers of stress reduction. HR variability has been extensively used to measure autonomic nervous system regulation, with lower variability linked to heightened stress and anxiety (Thayer et al., 2012). Salivary cortisol, a biomarker of hypothalamic-pituitary-adrenal (HPA) axis activation, is a well-established indicator of physiological stress response, with studies showing elevated cortisol levels in individuals with high dental anxiety (Hill et al., 2013). Incorporating these physiological assessments would offer a more comprehensive evaluation of CCB’s effectiveness, complementing subjective self-report data.

Future research should also explore the long-term sustainability of CCB as an anxiety-reduction strategy by assessing whether patients continue to engage with the technique beyond the study period. Examining adherence rates and patient-reported barriers to continued practice could inform strategies for improving patient compliance and engagement with behavioral interventions in dental settings.

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