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THE EFFECTS OF A THERAPY DOG INTERVENTION ON DISTRESS IN ADULT PATIENTS UNDERGOING DENTAL PROCEDURES

by

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A thesis submitted to the Faculty of the
Comprehensive Dentistry Graduate Program
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DEDICATION

To my loyal and loving family, Joseph and Zeus Skopowski.

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ABSTRACT

The Effects of a Therapy Dog Intervention on Distress in Adult Patients Undergoing Dental Procedures

Dominique Alana D'Anthony, DMD, 2023

Thesis directed by: John E. Schmidt PhD, MS; Chair, Department of Psychology, Naval Postgraduate Dental School

Introduction: Dental anxiety is a subject of increasing interest in oral health care as it not only hinders the patient's ability to receive adequate treatment, but also impedes the dentist's ability to deliver quality care. While the use of dogs has demonstrated efficacy in medicine and mental healthcare, there is little research on using dogs as a therapeutic intervention for dental anxiety. **Objectives:** This study aimed to explore the affective and physiological impact of therapy dogs on self-reported dental anxiety. **Methods:** Adult patients with dental anxiety were randomized into an intervention group (DOG, n=19) and standard care group (SC, n=14). DOG group participants received a ten-minute intervention with a therapy dog prior to initiation of dental treatment for two dental treatment visits. Participants in the SC group sat quietly for ten minutes prior to initiation of dental treatment for two dental treatment visits. Standard self-report measures were used to assess dental anxiety, depression, and generalized anxiety. Continuous ECG recording was completed during dental treatment to assess physiological reactivity. **Results:** Nearly the entire study sample reported significant dental anxiety (91%) and

seven met criteria for dental phobia. Participants in the DOG group reported being ‘very satisfied’ with the therapy dog intervention at both visits. Anxiety, Comfort, and Heart Rate Variability measurements were not statistically significant. **Conclusion:** Therapy dog intervention for adults with dental anxiety can effectively manage dental anxiety in patients with mild-moderate dental anxiety.

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LIST OF ABBREVIATONS

AAT	Animal-Assisted Therapy
AAI	Animal-Assisted Intervention
AEGD	Advanced Education in General Dentistry
CBT	Cognitive Behavioral Therapy
DFA	Dental Fear and Anxiety
DHQ	Dental Health Questionnaire
DOG	Dog Intervention Group
ECG	Electrocardiographic
GAD	Generalized Anxiety Disorder
HF	High Frequency
HIPAA	Health Insurance Portability and Accountability Act
HRV	Heart Rate Variability
IDAF-4C	Index of Dental Anxiety and Fear
IRB	Institutional Review Board
LF	Low Frequency
NPDS	Naval Postgraduate Dental School
OHIP-14	Oral Health Impact Profile short form (OHIP-14)
PTSD	Posttraumatic Stress Disorder
RMSSD	Root Mean Square of Successive Difference
SC	Standard Care
TSS	Therapy Satisfaction Scale
VAS	Visual Analog Scale

KEY WORDS

Animal Assisted Therapy

Dental Fear and Anxiety

Therapy Dog

CHAPTER 1: Introduction

DENTAL ANXIETY AND IMPACT ON DENTAL CARE

Dental anxiety is the state of apprehension that occurs either prior to or during dental treatment. While dental fear refers to the emotional and physiological fight or flight response to an object or situation such as a needle or noise from a dental handpiece. Collectively, the term "dental fear and anxiety" (DFA) is used to refer to strong negative feelings associated with dental treatment among children and adolescents (Armfield & Heaton, 2013). While DFA varies in degrees, it has been estimated that up to 20% of the adult population has moderate to high DFA (White, Giblin, & Boyd, 2017), with females of any age reporting being more afraid to go to the dentist than males (Carter, Carter, Boschen, AlShwaimi, & George, 2014). Dental fear and anxiety can have a detrimental effect on oral health care. Delay in seeking dental treatment may make conservative treatment modalities no longer a viable option as the state of disease progresses.

In an exploratory study of procrastination and dental attendance, higher levels of DFA and lower levels of oral health self-efficacy were significantly correlated to a delay of dental care. Further, those with moderate and severe DFA had almost a three times higher probability of delaying dental care (Steinvik, Svartdal, & Johnsen, 2023). In another study, evaluating the impact of DFA on anticipated pain prior to dental procedures, individuals reporting a greater preoperative DFA prior to removal of impacted mandibular third molars was correlated with greater heart rate variability at the start of the procedure and heightened post-operative pain compared to patients not reporting DFA (Sbirkova, 2021), Lin, Wu, & Yi, 2017). These less positive experiences noted in patients with DFA can lead to a vicious cycle, further intensifying DFA, leading

to further avoidance of future appointments and the need for more expensive and invasive treatment as the state of disease progresses without preventive measures.

Identification and Management of Dental Anxiety

A key to successful dental treatment is early identification and management of DFA. Considering phobias typically develop from fear to avoidance (Eaton, Bienvenu, & Miloyan, 2018), it is important to stop this cycle early to prevent a negative impact on the dental health of a patient. Physiological signs of DFA markers such as heart palpitations, tachycardia, dry mouth, increased blood pressure, hyperventilation, tremors, and sense of suffocation can be identified while screening and interacting with patients. Further, factors that may favor dental phobia include predisposition to anxiety in general, presence of other phobias or mental illness, depression, severe stress, or drug use or alcoholism (De Stefano et al., 2019).

There are numerous ways one can measure DFA. To measure subjective factors, dental questionnaires have been utilized. DFA can also be measured in physiological changes such as heightened postoperative pain using the Visual Analog Scale (VAS), an increase in cerebral blood flow, higher mean values of both systolic and diastolic blood pressure, and higher heart rate variability (Sbirkova, 2021). Physiological responses have the advantage of providing more objective measurements.

Intervention Strategies for DFA

Current intervention strategies to treat DFA include behavioral therapy, pharmacological agents, and distraction techniques. Recently, techniques such as aromatherapy have been introduced with some success (Arslan, Aydinoglu, & Karan, 2020). Behavior modification techniques include voice control, positive reinforcement,

distraction, relaxation techniques, hypnosis, and cognitive behavioral therapy (CBT). Cognitive behavioral therapy uses both behavior modifying techniques and cognitive restructuring procedures to change disruptive beliefs. It also involves the gradual presentation of anxiety or fear inducing stimuli while in a relaxed state, thus modifying the individual's response and behaviors (Anthonappa RP, 2017). Pharmacological interventions include varying degrees of consciousness with oral sedation, nitrous oxide, and intravenous sedation. These agents present several drawbacks such as increased cost, time required for onset, potential dependency or tolerance, requirement for an escort at the time of the procedure, and undesirable side effects to include nausea and drowsiness that can affect cognition and function following the procedure (Fiorillo, 2019). However, animal assisted therapy (AAT) can serve as an anxiolytic without similar drawbacks.

ANIMAL-ASSISTED THERAPY

Domestication of animals into human society has occurred over the course of thousands of years through a common need for food, shelter, and protection. Presently, it is estimated that as many as sixty-seven percent of American households have pets with this human-animal relationship continuing to evolve (Barchas, Melaragni, Abrahim, & Barchas, 2020). Once sought out for the protective roles, animals, specifically dogs, are now being adopted for their role as loving companions as "human's best friend." Studies have reported that pet ownership and its associated responsibilities can improve health and help adults manage chronic health conditions more effectively through increased physical activity and social support (Barchas et al., 2020). Pets have been further employed as "emotional support animals," to aid in the daily tasks and mental health of their owners. The positive benefits of pet ownership have since been adopted in

healthcare settings for a more structured intervention with the use of animal-assisted interventions (AAI).

Animal -assisted therapy, or AAT refers to goal-oriented and structured interventions that incorporate animals in health, education, and human services for the therapeutic gain of humans (Barchas et al., 2020). AAT has established benefits related to mental health conditions including depression, dementia, and PTSD through a reduction in patient agitation and caregiver distress (Charry-Sanchez, Pradilla, & Talero-Gutierrez, 2018). In a systematic review on canine-assisted psychotherapy and their role in the treatment of mental health disorders, canines were associated with positive impacts including increased engagement and socialization behaviors as well as a reduction in disruptive behaviors (Jones, Rice, & Cotton, 2019).

The precise pathway that the interaction between dogs and humans may confer health benefits is still under debate and requires further investigation. Physiological changes associated with human-dog interactions most reported involve cardiac parameters and hormones (Teo, Johnstone, Romer, & Thomas, 2022). In a systematic review; of 129 published studies, the main positive findings associated with human-dog interactions were increases in heart rate variability and oxytocin and decreases in the stress hormone, cortisol (Teo et al., 2022). The speculated mechanism to explain this effect is an activation of the parasympathetic nervous system and oxytocinergic system and down regulation of the hypothalamic-pituitary-adrenal axis (Teo et al., 2022). Other theories suggest that the use of animals serves as a distraction mechanism as part of the gate control theory, preventing fearful thoughts from entering an individual's minds (Barchas et al., 2020).

Considering it has been long established that dogs provide a noteworthy place in providing comfort in modern medicine((Barchas et al., 2020) (Jones et al., 2019), it can be hypothesized that the introduction of therapy dogs in the practice of dentistry will also have its merits. This intervention could potentially serve as a non-invasive and economical way to reduce DFA and provide comfort for patients undergoing dental procedures.

While the use of therapy dogs is periodically referenced in a dental setting to provide comfort and manage anxiety, there is little formal research on the potential efficacy of therapy dogs for managing DFA (Fox, 2019). In 2019, a pilot study sought to evaluate the effect of dog-assisted therapy for individuals with a history of anxiety related to dental visits. The study enrolled twelve participants and involved the presence of a therapy dog for the duration of a prophylaxis cleaning appointment. Each patient's discomfort was assessed with a Likert scale before and after receiving dental treatment, and their blood pressure was recorded prior to, during, and after the procedure. The study results showed an average decrease in the patient's blood pressure when taken in the middle of dental treatment as well as a decrease in perceived discomfort during the dental procedure. While the results demonstrated an improvement in controlling negative emotions such as dental anxiety in patients without disabilities, the small number of participants prevented generalization of the results (Cruz-Fierro, Vanegas-Farfano, & Gonzalez-Ramirez, 2019).

STUDY OBJECTIVES

The purpose of this pilot study was to assess the efficacy and practicality of a therapy dog intervention in patients reporting DFA. Outcomes were assessed using self-reported

anxiety and comfort levels, and physiological reactivity during dental care. The expected outcome of the study was an increased level of comfort coupled with a decreased level of anxiety, as expressed in questionnaires, and a marked improvement in heart rate variability in subjects receiving the therapeutic dog intervention.

CHAPTER 2: Materials and methods

STUDY PARTICIPANTS

This study was reviewed and approved by the Walter Reed National Military Medical Center Institutional Review Board, IRB# 2016-0016. Eligible study participants were patients of record at the Naval Postgraduate Dental School (NPDS), Naval Medical Leader & Professional Development Command, Bethesda, MD (Fox, 2019). Eligible patients were Department of Defense beneficiaries who were active-duty service members, retirees, or dependents of active-duty service members (Fox, 2019). These participants may require a combination of endodontic therapy, periodontal treatment, oral surgery, prosthodontic or other restorative procedures as dictated by each patient's individual treatment plan (Fox, 2019). Eligible participants required a minimum of three treatment sessions and were treated by one of the residents in NPDS' Comprehensive Dentistry Department from 2017 to 2023 (Chilcutt, 2020) (Fox, 2019).

Individuals who reported "nervousness" on the Dental Health Questionnaire or verbally expressed that they have dental anxiety and are interested in participating in the study were identified as potential study participants (Fox, 2019). Exclusion criteria included fear of dogs, dislike of dogs, severe dog allergy, pregnant or breast-feeding women, history of schizophrenia or other chronic psychotic disorder, acute psychiatric symptoms that impair ability to function in non-psychiatric setting and being less than 18 years of age (Fox, 2019). If the potential study participant met all criteria and was interested in enrolling in the study, an informed consent was reviewed and signed by the study participant (Fox, 2019).

STUDY DESIGN

Study participants were randomly assigned to either the intervention (DOG) group or the Standard Care (SC) group (Fox, 2019). The SC group was a wait-list control condition and all participants in the SC group had the opportunity to interact with the therapy dogs after two initial dental treatment sessions (Fox, 2019).

The available therapy dogs consisted of two Golden Retrievers, one Yellow Lab, three Black Labs, and one German Shepheard supplied by the Walter Reed Bethesda Facility Dog Program. The facility dogs were originally bred and specifically trained to be service dogs for the disabled and have since been reassigned as military hospital facility dogs with a goal of providing Animal Assisted Interventions (AAI) to reduce stress and increase overall feelings of well-being among patients and staff. In addition to the dogs' role as dental therapy dogs, they attend specific events including staff resiliency activities and military ceremonies (i.e. promotions, retirements, awards, parades, funerals, change of commands and parties). One facility dog program manager is responsible for the seven dogs and four dog handlers care for the dogs during their interaction with dental patients. The facility dog handlers are active-duty service members and civilian personnel who are required to complete training and an evaluation by the director of training and senior handlers prior to handling the dogs independently.

After consent and the Demographics Questionnaire (Appendix A) were completed, each participant completed study self-report measures (the Generalized Anxiety Disorder (GAD-7, Appendix B), the Patient Health Questionnaire (PHQ-9, Appendix B), the Oral Health Impact Profile (OHIP, Appendix C), and the Index of Dental Anxiety and Fear-4C (IDAF-4C, Appendix D) to establish a baseline assessment of dental anxiety and fear (Chilcutt, 2020). Each participant was assigned to either a one

or two-year Advanced Education in General Dentistry (AEGD) resident and scheduled to return for their first appointment with the assigned resident provider (Chilcutt, 2020) (Fox, 2019).

The intervention sessions took place during the first two dental treatment sessions. All study participants completed self-report measures in the clinic waiting area prior to treatment. Once the participant was brought back to the dental treatment room, a Bodyguard Heart Rate device (Firstbeat Technologies, Ltd, Jyvaskyla, Finland) was attached (Chilcutt, 2020). The Bodyguard is a two-lead portable heart rate recording device. The ECG device recorded data from the start of the DOG intervention (or SC group resting period) to 45 minutes into the dental treatment visit. Participants in the DOG group spent 10 minutes with a treatment dog accompanied by the dog handler prior to initiation of dental treatment (Fox, 2019). During the intervention, the handler was allowed to give the participant dog treats to facilitate an interaction with the dog. The dog handler did not interact with the participant any further to avoid any confounding interactions (Fox, 2019).

At the end of the 10 minutes, the dog handler reported what specific type of interaction occurred between the participant and therapy dog. Due to the different personalities between individual dogs, which led to slight variations in interactions between the patient and dog, the specific therapy dog used at each treatment session was recorded (Chilcutt, 2020). The instructions given to each patient in the DOG group by the dog handler were: "You may sit with, pet, feed, hug, kiss, and interact with the dog as you like for the next 10 minutes. When the 10 minutes are up, we will begin your dental treatment (Fox, 2019)." In contrast, participants assigned to the SC group spent 10

minutes in the operatory quietly resting (reading magazines, etc.) prior to the initiation of dental treatment (Chilcutt, 2020) (Fox, 2019).

Following the 10-minute period for both groups, each participant completed the Index of Dental Anxiety and Fear-4C (IDAF-4C). Each participant also completed the study Visual Analog Scales (VAS, Appendix E), measuring anxiety and comfort level, at the end of each dental treatment appointment. At the end of both intervention visits, participants in the DOG group also completed the Therapy Satisfaction Scale (TSS, Appendix F) (Chilcutt, 2020) (Fox, 2019).

The final study session (dental visit 3) for participants in the DOG group began with the completion of the study self-report measures in the clinic waiting area. Once the participant was brought back to the operatory, the ECG device was attached. Prior to the start of dental procedures, the participant completed the IDAF-4C. After the completion of all dental procedures, the participant completed the VAS and the TSS. At this point, the participant was released from the study and thanked for participating. Any miscellaneous provider notes were documented (Chilcutt, 2020) (Fox, 2019).

Participants in the SC group were given the opportunity to interact with a therapy dog at their third intervention visit (Fox, 2019). The final study session for participants in the SC group began with the completion of study self-report measures in the clinic waiting area. Once the participant was brought back to the operatory, the ECG device was attached (Fox, 2019). SC group participants interacted with the therapy dog for 10 minutes. Prior to the start of dental procedures, the participant also completed the IDAF-4C (Fox, 2019). After completion of all dental procedures, the participant completed the VAS and the TSS. At this point, the participant was released from the study and thanked

for participating. Any miscellaneous provider and handler notes were documented (Chilcutt, 2020) (Fox, 2019).

SELF-REPORT MEASURES

Demographics and Health History Questionnaire:

All participants completed a brief demographics and health history questionnaire after study enrollment. Information recorded here included date of birth, gender, ethnicity, race, marital status, job status, as well as questions about dental and medical history, current medications, and current use of nonprescription supplements (Fox, 2019).

Index of Dental Anxiety and Dental Fear (IDAF-4C):

The IDAF-4C (Armfield, 2011) is a 23-item measure that contains three modules assessing dental anxiety, phobia, fear, and feared dental stimuli. This measure also assesses emotional, behavioral, physiological, and cognitive components of the anxiety and fear response. All items are on a 5-point Likert scale. The IDAF-4C provides a total score and four subscale scores (cognitive, physiological, behavioral, and emotional). The IDAF-4C has demonstrated good internal consistency, validity, and test-retest reliability (Armfield, 2011).

Oral Health Impact Profile short form (OHIP-14):

The OHIP-14 is a 14-item measure of the social and psychological impact of oral health on general well-being (Slade, 1997). It includes two items from each of seven domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. The patient answers each item on a 5-point Likert scale resulting in a total score with higher scores being

indicative of poorer oral health-related quality of life. The OHIP-14 has demonstrated good reliability and validity and has been translated into many languages and used clinically throughout the world (Slade, 1997).

Generalized Anxiety Disorder (GAD-7):

The GAD-7 (Spitzer, Kroenke, Williams, & Lowe, 2006) is a 7-item measure used to assess presence of symptoms of generalized anxiety over the previous two weeks. Spitzer and colleagues showed that 89% of patients with clinically diagnosed GAD scored >10 on this measure. The GAD-7 is a widely used assessment instrument and has demonstrated good psychometric properties in clinical and research applications (Spitzer et al., 2006).

Patient Health Questionnaire-9 (PHQ-9):

The PHQ-9 (Kroenke, Spitzer, & Williams, 2001) is a 9-item measure of the presence and severity of depressive symptoms over the previous two weeks. Mild, moderate, moderately severe, and severe symptoms are reflected in scores of 5, 10, 15, and 20, respectively. Test-retest reliability, internal consistency, and convergent validity have been established (Kroenke et al., 2001).

VAS measures:

The following VAS (Visual Analog Scale) measures were completed by all study participants after the completion of dental treatment on the intervention days. Each VAS has a 100mm lines anchored at each end with the following descriptors:

1. Please place a slash (/) on the line below to indicate your present level of comfort.

2. Please place a slash (/) on the line below to indicate your present level of anxiety.

Therapy Satisfaction Scale:

Participants were asked to rate their satisfaction with the intervention program using a 5-point scale ranging from “Strongly disagree” to “Strongly agree”. This measure has eight items assessing participant satisfaction and perceived impact of the intervention in dental anxiety (Oei & Shuttlewood, 1999).

STATISTICAL ANALYSIS

Data were analyzed using SPSS (IBM, Armonk, NY). Demographic characteristics of each study group are expressed in percent frequency. Select demographic statistics, self-report measures, and HRV (time and frequency) are expressed as means [standard deviations (SD)]. T-tests were performed to compare baseline demographics (age, height, weight), as well as self-report measures and HRV time- and frequency-domains between the DOG and SC groups at each visit. F-values and p-values were calculated, with a pre-established threshold for statistical significance set at $\alpha = 0.05$.

CHAPTER 3: Results

PATIENT DEMOGRAPHICS

A total of 33 participants enrolled in the study between April 2017 and October 2022. A total of 33 patients were enrolled in the study. Through random assignment, nineteen were assigned to the DOG group and fourteen were assigned to the SC group. Of the nineteen in the DOG group, seventeen completed the second intervention, and fifteen completed the third intervention. Of the thirteen in the SC group, eleven completed the second intervention, and nine completed the third intervention.

The average age of the participants in the DOG group was 32.50 (SD=11.1) years old, while the average age of the participants in the SC group was 36.93 (SD=11.5). Study participants were mostly female (78.8%), Caucasian (72.7%) and married or partnered (54.4%). See Tables 2 and 3 for demographics of the study sample.

SELF-REPORT MEASURES

The IDAF 4C was completed prior to the therapy intervention. An Anxiety and Fear score of 1.0-1.49 represents no to low fear, 1.50-2.49 represents low to moderate fear, 2.50-3.49 represents moderate to high fear, and greater than 3.50 represents extreme fear.

The Anxiety and Fear scores for the Dog Group at each assessment ranged from 3.21 to 3.64, while the scores for the SC Group ranged from 2.30 to 3.10. There were no significant differences between the group on IDAF Anxiety and Fear Scores at each assessment. Nearly all (30 out of 33) participants met the criteria for significant dental

anxiety and seven study participants met the criteria for dental phobia (DOG=4, SC=4). See Table 5 for mean and total scores on the IDAF 4C.

The Index of Dental Anxiety and Fear assessed severity of 10 different anxiety triggers including pain, feeling embarrassed or ashamed, lack of control, sick, queasy, or disgusted, numbness, not knowing what the dentist is doing, cost, needles, gagging or chocking, and an unkind dentist. Triggers most identified by participants in the DOG group prior to the first intervention were pain (mean= 4.32, SD=1.1), lack of control (mean= 3.47, SD=1.6), and needles (mean= 3.11, SD=1.7) for the first visit. The most notable triggers identified by participants in the SC group prior to the first intervention were pain (mean= 4.36, SD=0.9), lack of control (mean= 3.29, SD=1.3), and needles (mean= 4.00, SD=1.5) for the first visit. No significant difference were noted between the groups.

There was no significant difference between groups on the VAS for anxiety after the intervention or between visits (p's>0.05). Further, the results for the VAS for comfort was not statistically significant (p >0.05) for either intervention between groups. No significant difference was noted between the two groups for both anxiety and depression as assessed by the GAD-7 and PHQ-9 at any study assessment.

Out of a possible score of 35, participants in the DOG group reported being very satisfied with the dog intervention on the Therapy Satisfaction Scale (Time 1 mean = 32.64 and Time 2 mean = 33.36). Participants in the SC group who elected to receive a dog at the third intervention, also reported being very satisfied with the intervention on the Therapy Satisfaction Scale (mean = 33.55).

PHYSIOLOGICAL MEASURES

Heart Rate Variability was assessed during two-time segments: 1) the 10 minute dog or control intervention period and 2) the first 45 minutes of the dental treatment. HRV was assessed in both the time domain (RMSSD) and the frequency domain (LF/HF ratio). The time domain HRV index of RMSSD is the most robust of the time domain indices for assessing vagally mediated changes in HRV (Shaffer, McCraty, & Zerr, 2014). This index is less affected by respiratory activity than the other HRV time domain indices (e.g., SDNN, SDANN) and is a measure of parasympathetic activity in the autonomic nervous system. Higher values of RMSSD suggest higher parasympathetic tone (Shaffer & Ginsberg, 2017). No significant differences were found between the two groups on RMSSD at any of the three study visits (all p's>0.05). Please see Table 9.

Frequency domain indices for HRV were also calculation and compared. Frequency domain HRV is measured in the Low Frequency (LF: 0.04-0.15Hz) power range and High Frequency (HF: 0.15-0.40Hz) power range. Power in the HF range is driven by parasympathetic activity in the autonomic nervous system while power in the LF range is a combination of both sympathetic and parasympathetic activity (Shaffer & Ginsberg, 2017). The ratio of LF to HF (LF/HF) is an index that is used to represent balance in the autonomic nervous system. An LF/HF score of 1.5 and above signifies dominant sympathetic tone, while an LF/HF score below 1.5 suggests balance between the sympathetic and parasympathetic nervous systems (Nunan, Sandercock, & Brodie, 2010).

During the intervention at Time 1, there was a significant difference between groups on LF/HF HRV with the participants in the DOG group experiencing higher LF/HF HRV (DOG = 4.19 (SD=2.0) vs. SC = 1.99 (SD=2.1); p=0.008), but not during

the intervention at Time 2 (DOG = 3.94 (SD=1.7) vs. SC = 2.51 (SD=3.0); p=0.201). During the dental procedure, there were no statistically significant differences between the two groups on LF/HF HRV at either Time 1 or Time 2 (p's>0.05).

CHAPTER 4: Discussion

The Index of Dental Anxiety and Fear-4C was completed prior to the first therapy intervention. Although a single-item self-report metric was utilized to screen and recruit patients, scores on the IDAF-4C demonstrate that appropriate patients were enrolled. With the IDAF-4C, nearly all (30 out of 33) participants met the criteria for significant dental anxiety and seven study participants met the criteria for dental phobia (DOG=4, SC=3).

There was no statistically significant change in heart rate variability, comfort levels, or anxiety levels, between the SC and Dog groups and between Times 1, 2, and 3. Although not statistically significant ($p > 0.05$), there is a trend in the DOG group toward lower reported anxiety at subsequent visits. The DOG group even reported lower anxiety at the third visit in which they did not receive a dog, which may indicate the use of the therapy dog has a lingering impact, changing the patient's perception of the dental operatory from a fearful, to a more pleasant experience. Further, while not statistically significant, the SC groups anxiety decreased at the third visit when the dog was present.

The most clinically significant self-report data assessing the efficacy of the therapy dog came from the Therapy Satisfaction Scale (TSS) in which all participants reported high levels of satisfaction. All participants, except for one participant who was neutral, either agreed or strongly agreed that they were satisfied with the quality of the intervention provided and that their needs were met by the intervention. When questioned how the intervention helped deal with dental anxiety, 80% of participants stated that the intervention made things a lot better or made things somewhat better, while 20% of participants stated that the intervention made no difference. These positive results

indicate that the use of the therapy dog can effectively help manage patient's dental anxiety.

A recurrent response from the TSS was patients stating, "the duration of the intervention was not long enough." One patient commented, "The intervention was great, but once the dog was gone, my anxiety started to come back." With this feedback, it may be beneficial to explore the possibility of having a dog present for the duration of the procedure, consider utilizing smaller lap dogs, yet maintain infection control in the operating sphere.

The presence of a therapy dog could result in a decrease in heart rate variability representing increased parasympathetic activity, as would be anticipated when an individual is at ease or relaxed. Instead, an increase in heart rate variability was found during the intervention representing a dominance in sympathetic tone. Increased sympathetic tone typically correlates with anxiety or periods of distress, however it can also correlate with positive experiences such as periods of exercise or increased stimulation and arousal, including pleasant interactions with an animal. Additionally, due to the high variability in dental procedures, only the first 45 minutes of the procedure was recorded with the heart rate monitor, and we were unable to correlate the timing of certain triggers, such as injections or handpiece usage, with heart rate variability. A simpler physiological measure to investigate pre- and post-intervention blood pressure and pulse may be considered for future studies.

The therapy dogs had varying personalities, from Luke, still a young puppy, eager to interact, to Dillon, an older dog, who was much more focused on treats than a meaningful bond with the participants. These facility dogs are shared throughout the

hospital and are employed in a range of activities from staff resiliency activities to attending retirement and graduation ceremonies. They are trained to form a range of general tasks. Employing therapy dogs specifically trained for interaction with dental patients with anxiety, such as laying still while the dentist works and placing their head on the patient's lap, along with desensitization to the dentist's handpiece, could further enhance the therapeutic effect.

STUDY LIMITATIONS

This study recruited active duty, dependents, and retirees affiliated with the military. While dental anxiety can contribute to several missed dental appointments, active-duty personnel have the obligation of attending all dental and medical appointments to maintain their readiness as service members. Additionally, the dependents and retirees accepted to receive care in a military postgraduate dental training program are not charged for the dental care provided, likely increasing their motivation to make their appointments. With these factors, it was difficult to assess the impact of offering a therapy dog during the dental appointment in motivating patients to make their appointments and reduce broken appointments.

Further, with the constant cycling of permanent duty stations in active-duty military members, it was difficult to find patients available to satisfy the three-appointment requirement. Once active-duty service members meet their required time to serve at a particular duty station, they must relocate. Additionally, active-duty members may be called upon for unforeseen deployments or temporary changes in location. Coordinating with the facility Dog program manager for availability, managing the program requirements of a residency program, and fulfilling the requirements of the

patient in a timely fashion all added additional levels of complexity to this scheduling struggle for this study.

Furthermore, in the era of COVID-19, during periods of heightened concern, the dental clinic was placed on an emergency only status and many of appointments were placed on hold or canceled due to illness. This significantly impacted the recruitment process as well as the ability to bring patients in for appointments to complete study requirements. During the COVID-19 pandemic, social distancing played a crucial role in mitigating the spread of COVID-19. This isolated status may have significantly hindered willingness to schedule routine dental care and led to heightened dental anxiety. In a questionnaire of 519 patients receiving treatment at private dental clinics, individuals reporting feeling anxious, afraid, or panicked over the pandemic would only seek dental care in the case of a dental emergency and significant association between feelings about the COVID-19 pandemic and level of willingness to attend a dental appointment were noted (Peloso et al., 2020)

Considering there are varying degrees of complexity associated with different dental procedures from simple one surface operative procedures to dental extractions which are ranked at the top of procedures causing dental anxiety (De Stefano, 2019)**,** it is difficult to compare the treatment experiences within this study. Further, performance among providers including isolation preference (rubber dam, isolite, cotton rolls, etc), injection techniques (use of topical anesthetic prior, ability to provide profound anesthesia with adjunctive injection techniques), or provider's demeanor, offers an additional layer of complexity when evaluating a patient's experience at the dentist.

FUTURE RESEARCH

This study strongly supports the need for continued research on both patient acceptance and the physiological effects of the use of therapy dogs to manage dental anxiety. Future research should include a larger study population, variations in the protocol or exposure time with the therapy dog, and an analysis on characteristics that qualify an ideal therapy dog in a dental setting. Additionally, future directions should include analyzing risks to health and safety and the issuance of evidence-based guidelines from regulatory bodies and professional organizations on the use of therapy dogs in a dental treatment setting.

While the Americans with Disabilities Act allows people with disabilities to bring service animals into health care facilities, there is currently a lack of regulation or instruction in most states pertaining to the use of dogs in general, including emotional support dogs, therapy dogs, and pets in a dental setting (Barchas et al., 2020). Virginia, New Jersey, and Georgia are the only states that specifically prohibit animals, with the exception of service animals, in dental facilities, whereas there is nothing prohibiting providers from bringing an untrained "pet" into a dental office in most other states (Crouch, 2021). Potential hazards include dogs as a source of zoonotic pathogens and human diseases, exposure to canine allergens, adverse animal behavior, and dangers associated with high activity in a congested dental clinic operatory (Gussgard, Weese, Hensten, & Jokstad, 2019).

Concerns for patient safety and sanitation prompted North Carolina to be the first state to mandate requirements in the training of dogs present in dental operatories. This regulation went into effect in June 2021 and allows the introduction of "a certified facility dog," which by the regulation's definition must be trained in a program accredited by an

organization that promotes training standards for assistance dogs, such as Assistance Dogs International or Animal Assisted Intervention International. The regulation also requires the dog's handler to be trained and certified (Crouch, 2021). Guidance on best practices to minimize and control risks for patients, the dentist, and the dental clinic staff include hand hygiene of all team members, avoiding contact with the dental therapy dog's saliva and mucous membranes, discouraging licking the patient, avoiding offering treats to the dental therapy dog, regular visual inspection for fleas and ticks and open wounds on the therapy dog along with regular health checks, required vaccines, and deworming. Further, the dental therapy dog should be washed prior to work, the therapy dog should wear socks to avoid unintentional scratches and to protect the chair upholstery, and the dog handler must control the dental therapy dog to avoid accidental bites or scratches. Additional guidance is aimed at avoiding hazards associated with animal training through proper temperament testing of dogs, examination of physical discomfort of the dog, and regular re-evaluation, training, and recertification of the dental therapy dog team (Gussgard et al., 2019) While this guidance has recently been published, it requires further investigation and has not been widely accepted or practiced to date.

CHAPTER 5: Conclusions

The results of this study show that introducing a therapy dog into the dental setting can be a feasible intervention that is well-received by patients and results in an improved dental experience for adult patients with mild to moderate dental anxiety. The satisfaction scale responses were significant and overwhelming positive in favor of the use of the therapeutic dog. Further, all participants were adherent to their appointments which may indicate the dogs were a factor in incentivizing patients to make their appointments. Future directions include establishing clinical guidelines for the use of therapy dogs in a dental setting and exploring the possibility of a therapy dog remaining with the patient for the duration of the dental procedure.

Table 1. Number of Assessments Completed

	DOG Group (n=19)	SC Group (n=14)
Assessment 1	19	14
Assessment 2	17	11
Assessment 3	15	9

Table 2. Demographic Characteristics of Sample (n=33)

	DOG Group (n=19)	SC Group (n=14)	F	p
Age	32.50 [11.1]	36.93 [11.5]	1.252	0.272
Height [in]	65.42 [3.8]	66.21 [3.8]	0.347	0.560
Weight [lb]	162.11 [50.7]	175.00 [38.8]	0.631	0.433

Table 3. Demographic Characteristics Continued of Sample (n=33)

	%
Sex (female)	78.8
Ethnicity (% Hispanic)	37.3
Race	
White	72.7
Black	12.1
Asian	6.1
Other	9.1
Marital Status	
Married/partnered	54.5
Single/never married	33.3
Divorced/separated	6.0
Widowed	6.1
Highest Education	
H.S. or GED	18.2
Some College	24.2
Bachelor's	24.2
Master's or higher	33.3
Employment Status	
Work full time	72.8
Work part time	15.1
Homemaker	3.0
Retired	3.0
Disability	6.0

Table 4. Self-report measures, Oral Health Index, Anxiety, and Depression

	DOG Group (n=19)	SC Group (n=14)	F	p
T1 GAD-7	8.21 [7.0]	6.46 [4.7]	0.619	0.438
T2 GAD-7	6.88 [6.4]	5.27 [2.9]	0.616	0.440
T3 GAD-7	5.87 [7.1]	7.10 [5.0]	0.223	0.641
T1 PHQ-9	7.37 [7.7]	6.54 [5.4]	0.111	0.741
T2 PHQ-9	6.47 [7.2]	4.18 [3.3]	0.980	0.331
T2 PHQ-9	5.10 [6.7]	4.60 [4.2]	0.039	0.844

Table 5. Self-report measures, IDAF-4C

	DOG Group (n=19)	SC Group (n=14)	F	p
T1 IDAF 4C SUM	29.16 [7.7]	24.79 [7.1]	2.760	0.107
T2 IDAF 4C SUM	25.65 [9.8]	23.73 [8.5]	0.283	0.599
T3 IDAF 4C SUM	26.07 [10.6]	23.40 [9.4]	0.403	0.532
T1 IDAF 4C AVE	3.64 [1.0]	3.10 [0.9]	2.760	0.107
T2 IDAF 4C AVE	3.21 [1.2]	2.30 [1.1]	0.283	0.599
T3 IDAF 4C AVE	3.26 [1.3]	2.93 [1.2]	0.403	0.532

Table 6. Self-report measures, IDAF-S – triggers of anxiety (T1 Only). Scores can range from 0-5. The averages are reported.

	DOG Group (n=19)	SC Group (n=14)	F	p
Pain	4.32 [1.1]	4.36 [0.9]	0.013	0.911
Embarrassed or ashamed	2.84 [1.6]	1.57 [0.9]	7.210	0.012
Lack of control	3.47 [1.6]	3.29 [1.3]	0.131	0.720
Sick, queasy, disgusted	2.63 [1.4]	1.86 [0.9]	3.110	0.088
Numbness	1.84 [1.4]	2.29 [1.3]	0.828	0.370
Not knowing what dentist is doing	2.58 [1.5]	2.57 [1.6]	0.000	0.989
Cost	2.00 [1.7]	1.58 [1.4]	4.627	0.039
Needles	3.11 [1.7]	4.00 [1.5]	2.446	0.128
Gagging or choking	2.84 [1.5]	3.00 [1.6]	0.084	0.774
Unkind dentist	2.89 [1.8]	2.50 [1.4]	0.479	0.494

Table 7. VAS anxiety and comfort levels at end of each appointment.

	DOG Group (n=19)	SC Group (n=14)	F	p
T1 Anxiety VAS	36.47 [18.6]	47.93 [14.7]	3.644	0.066
T2 Anxiety VAS	38.18 [20.5]	51.55 [19.6]	2.940	0.098
T3 Anxiety VAS	37.36 [27.1]	33.80 [21.7]	0.118	0.735
T1 Comfort VAS	63.63 [22.9]	66.71 [22.9]	0.146	0.705
T2 Comfort VAS	60.88 [22.1]	56.45 [17.4]	0.314	0.580
T3 Comfort VAS	51.64 [29.6]	62.90 [20.9]	1.065	0.313

Table 8. Therapy Satisfaction Scale. Score out of possible 35

	DOG Group (n=19)	SC Group (n=14)
T1 TSS	32.62 [4.7]	--
T2 TSS	33.36 [3.3]	--
T3 TSS	--	33.55 [3.4]

Table 9. RMSSD (Time-domain HRV comparisons between groups)

	DOG Group (n=19)	SC Group (n=14)	F	p
T1 Intervention (10 minutes)	33.08 [11.1]	40.66 [15.1]	2.317	0.140
T2 Intervention (10 minutes)	35.81 [20.1]	29.76 [16.7]	0.439	0.517
T3 Intervention (10 minutes)	36.78 [22.4]	31.13 [12.4]	0.173	0.687
T1 Procedure (45 minutes)	37.53 [11.1]	41.89 [20.6]	0.503	0.485
T2 Procedure (45 minutes)	39.01 [16.3]	33.56 [20.7]	0.362	0.556
T3 Procedure (45 minutes)	32.40 [20.9]	32.31 [19.6]	0.001	0.994

Table 10. LF/HF (Frequency-domain HRV comparisons between groups)

	DOG Group (n=19)	SC Group (n=14)	F	p
T1 Intervention (10 minutes)	4.19 [2.0]	1.99 [2.1]	8.213	0.008
T2 Intervention (10 minutes)	3.94 [1.7]	2.51 [2.0]	1.769	0.201
T3 Intervention (10 minutes)	3.78 [2.5]	2.32 [1.5]	1.339	0.277
T1 Procedure (45 minutes)	2.36 [1.1]	2.01 [1.1]	0.673	0.419
T2 Procedure (45 minutes)	2.39 [0.8]	1.78 [1.0]	2.158	0.161
T3 Procedure (45 minutes)	3.57 [1.7]	2.17 [0.8]	2.746	0.132

Figure 1. Team photo of Therapy dogs.
Photo obtained from Walter Reed Facility Dog Program Manager, Amy O'Connor, and taken by Public Affairs Officer.

Figure 2. Example of Patient Interaction.
Photo taken by Dr. Dominique D'Anthony. Consent received from photo participants.

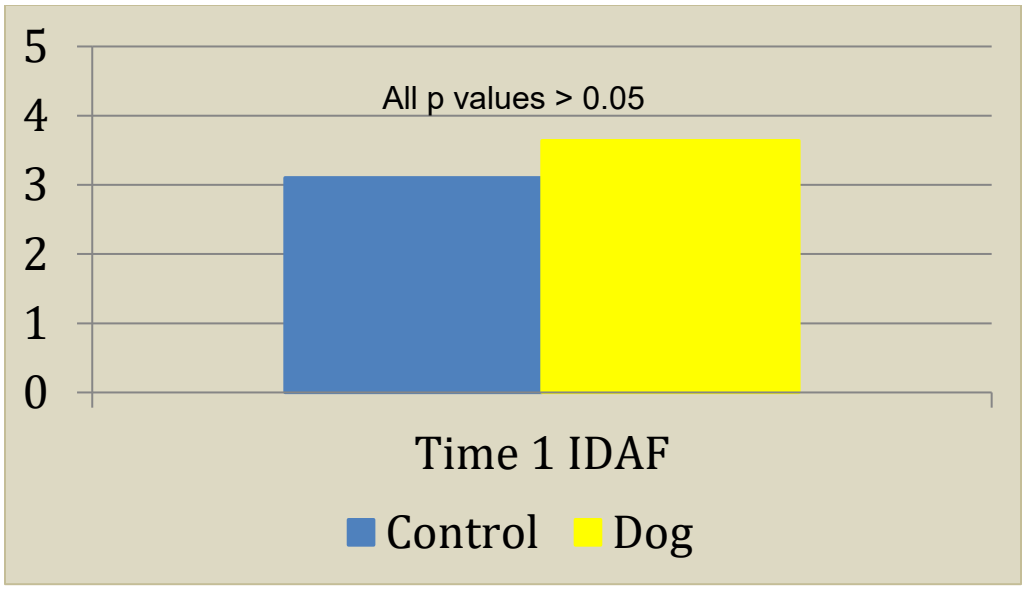

Figure 3. IDAF-4C Mean Dental Anxiety Scores by Group measured at Time 1

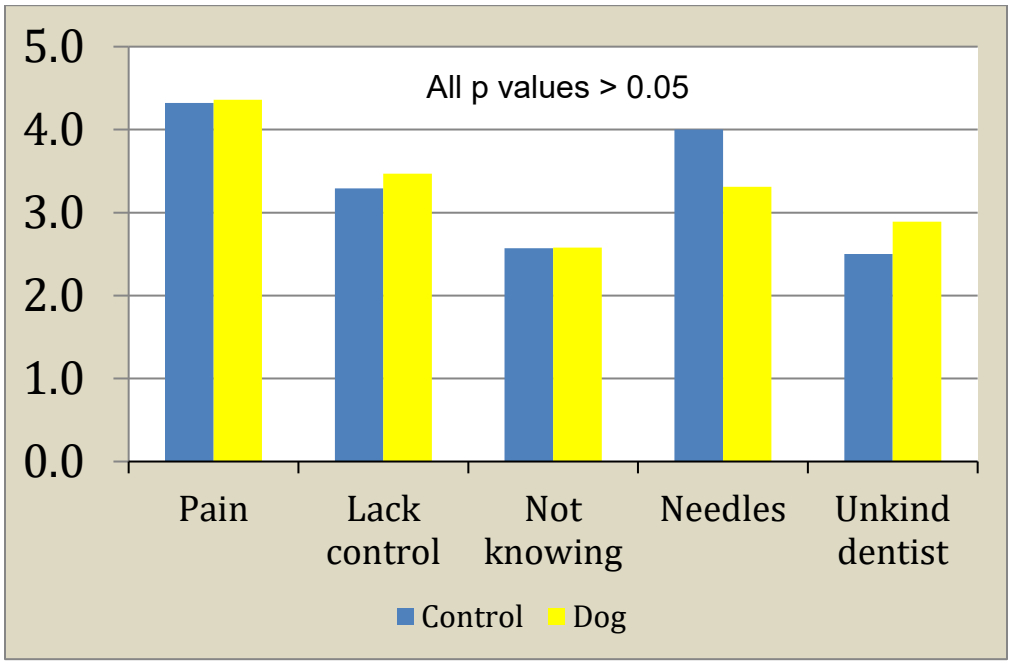

Figure 4. Dental Anxiety Triggers at Time 1

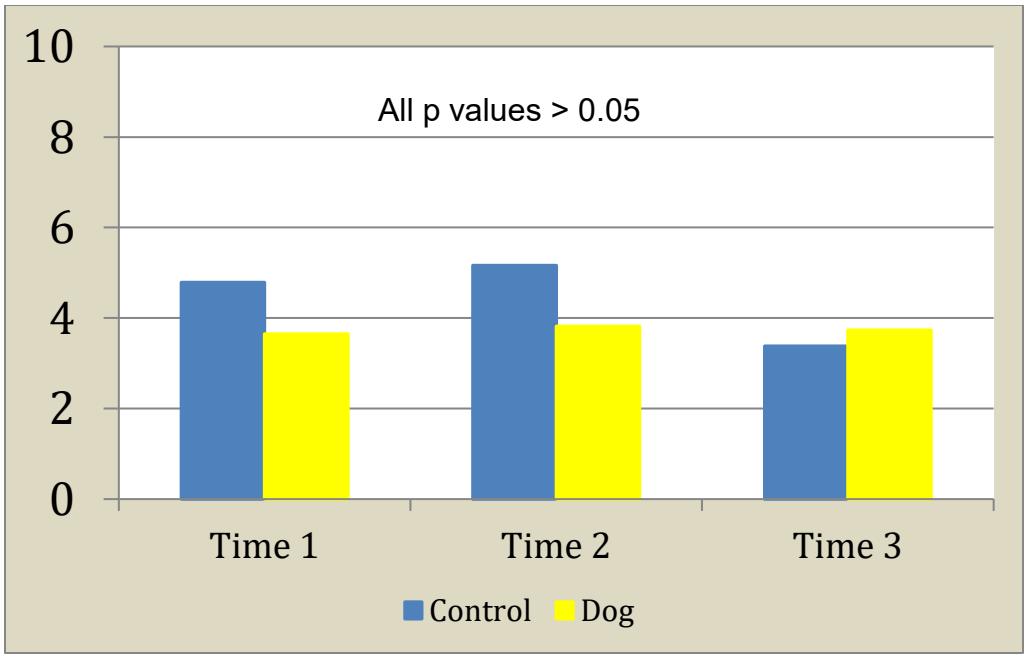

Figure 5. Visual Analog Scale- Anxiety

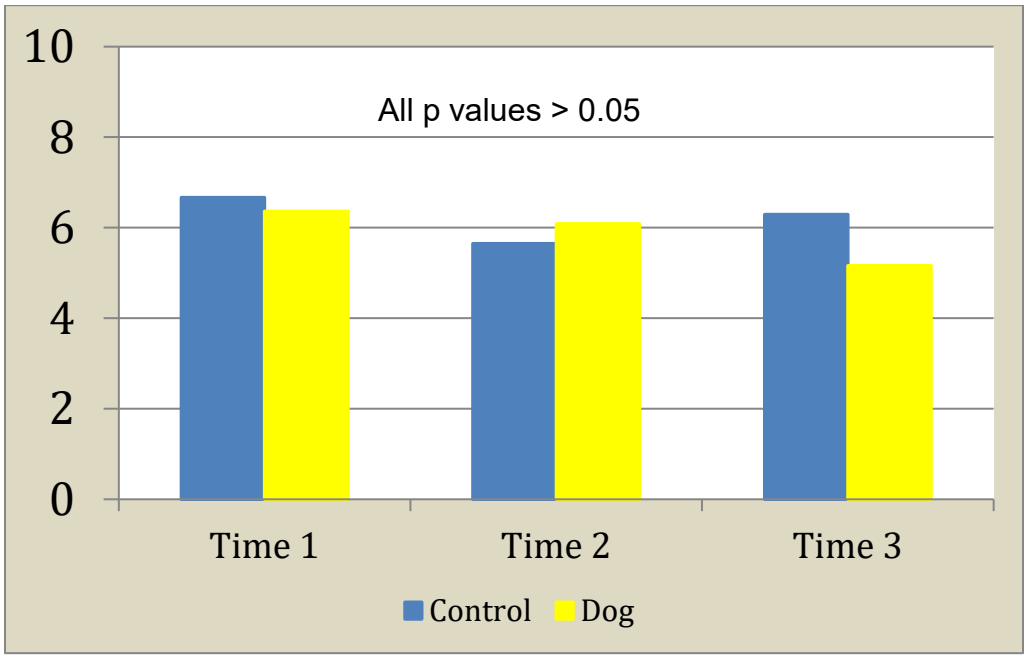

Figure 6. Visual Analog Scale- Comfort

APPENDIX A
Demographics Questionnaire

1. **What is your gender?** ☐1 Male ☐2 Female
2. **What is your date of birth?** ___ ___ / ___ ___ / ___ ___ ___ ___
   Month *Day* *Year*
3. **What is your current age?** _____
4. **What is your height and weight?** _____ feet _____ inches _____ pounds
5. **Do you consider yourself to be of Latin or Hispanic origin?**
   - ☐1 Yes
   - ☐2 No
6. **What is your race/ethnicity?** (check all that apply)
   - ☐1 White/Caucasian
   - ☐2 Black/African American
   - ☐3 American Indian or Alaska Native
   - ☐4 Asian
   - ☐5 Native Hawaiian or Other Pacific Islander
   - ☐6 Other (specify): _____
7. **Are you…** (check one)
   - ☐1 Currently married
   - ☐2 Currently living with partner
   - ☐3 Separated
   - ☐4 Divorced
   - ☐5 Widowed
   - ☐6 Never married
8. **What is your current employment situation?** (check all that apply)

☐ Working:	☐1 Full time at job	☐2 Part time at job
☐ On Leave:	☐3 On leave with pay	☐4 On leave without pay
☐ Not employed:	☐5 Seeking work	☐8 Not seeking work
	☐6 Receiving disability	☐9 Not self-supporting
	☐7 Homemaker	☐10 Retired
☐ Student:	☐11 Full time	☐12 Part time

9. **What was the highest grade of school that you completed?**
   - ☐1 Less than 8th grade
   - ☐2 8th to 11th grades
   - ☐3 High school graduate or equivalent (GED)
   - ☐4 Technical or vocational school
   - ☐5 Some college
   - ☐6 College graduate
   - ☐7 Post-graduate degree
10. **Have you taken any medications or natural supplements in the past 2 weeks?**
    - ☐1 Yes IF **YES**, Please specify below.
    - ☐2 No IF **NO**, Skip to **14**.

Drug/Supplement	Dose	Since

(Pain)	_____	_____	_____
(Sleep)	_____	_____	_____
(Heart)	_____	_____	_____
(Birth Control)	_____	_____	_____
(Hormones)	_____	_____	_____
(Other)	_____	_____	_____
(Other)	_____	_____	_____

11. **Males skip to 16: How would you characterize your menstrual status during the last 12 months?**
    - ☐1 Still having periods and not going through menopause
    - ☐2 Still having periods but possibly going through menopause
    - ☐3 Still having periods and on hormone replacement therapy
    - ☐4 Going through menopause
    - ☐5 Postmenopausal (no periods for at least 1 year)
    - ☐6 Was pregnant
    - ☐7 Other (please specify): _____
    - ☐8 Don't know

12. **When was your last menstrual period? (check one)**
    - ☐1 1-7 days ago
    - ☐2 8-14 days ago
    - ☐3 15-21 days ago
    - ☐4 22-35 days ago
    - ☐5 More than 35 days ago
    - ☐6 My menstrual periods have stopped (no periods for at least 1 year)

13. **Have you had surgery before?** ☐1 Yes ☐2 No

If yes, when? Date(s)	For what?

14. **Have you ever had a disease lasting longer than 2 months?** ☐1 Yes ☐2 No

If yes, when? Date(s)	For what?

APPENDIX B

Generalized Anxiety and Patient Health Questionnaire

Over the last two weeks, how often have you been bothered by the following problems?

	Not at all	Several Days	Over Half the Days	Nearly Every Day
Feeling nervous, anxious, or on edge	0	1	2	3
Not being able to stop or control worrying	0	1	2	3
Worrying too much about different things	0	1	2	3
Trouble relaxing	0	1	2	3
Being so restless that it's hard to sit still	0	1	2	3
Becoming easily annoyed or irritable	0	1	2	3
Feeling afraid as if something awful might happen	0	1	2	3
Little interest or pleasure in doing things	0	1	2	3
Feeling down, depressed, or hopeless	0	1	2	3
Trouble falling or staying asleep, or sleeping too much	0	1	2	3
Feeling tired or having little energy	0	1	2	3
Poor appetite or overeating	0	1	2	3
Feeling bad about yourself – or that you are a failure or have let yourself or your family down	0	1	2	3
Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
Moving or speaking so slowly that other people could have noticed. Or the opposite, being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
Thoughts that you would be better off dead, or of hurting yourself in some way	0	1	2	3

How difficult have these symptoms made it for you to do your work, take care of things at home, or get along with other people? ❑ Not difficult at all ❑ Somewhat difficult ❑ Very difficult ❑ Extremely difficult

APPENDIX C
Oral Health Impact Profile

HOW OFTEN have you had the problem during the last year?

	NEVER	HARDLY EVER	OCCAS-IONALLY	FAIRLY OFTEN	VERY OFTEN	DON'T KNOW
1. Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5
2. Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5
3. Have you had painful aching in your mouth?	0	1	2	3	4	5
4. Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5
5. Have you been self-conscious because of your teeth, mouth or dentures?	0	1	2	3	4	5
6. Have you felt tense because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5
7. Has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5
8. Have you had to interrupt meals because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5
9. Have you found it difficult to relax because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5

10. Have you been a bit embarrassed because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5
11. Have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5
12. Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5
13. Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5
14. Have you been totally unable to function because of problems with your teeth, mouth or dentures?	0	1	2	3	4	5

APPENDIX D

The Index of Dental Anxiety and Fear (IDAF-4C^{+})

The following questions relate to how you feel about going to the dentist.

1. How much do you agree with the following statements?	Disagree	Agree a little	Somewhat agree	Moderately agree	Strongly agree
(a) I feel anxious shortly before going to the dentist.	1	2	3	4	5
(b) I generally avoid going to the dentist because I find the experience unpleasant or distressing.	1	2	3	4	5
(c) I get nervous or edgy about upcoming dental visits.	1	2	3	4	5
(d) I think that something really bad would happen to me if I were to visit a dentist.	1	2	3	4	5
(e) I feel afraid or fearful when visiting the dentist.	1	2	3	4	5
(f) My heart beats faster when I go to the dentist.	1	2	3	4	5
(g) I delay making appointments to go to the dentist.	1	2	3	4	5
(h) I often think about all the things that might go wrong prior to going to the dentist.	1	2	3	4	5

2. Do the following statements apply to you?	Yes	No
(a) Going to the dentist is actively avoided or else endured with intense fear or anxiety.	1	2
(b) My fear of going to the dentist has been present for at least 6 months.	1	2
(c) My fear, anxiety or avoidance of going to the dentist significantly affects my life in some way (dental pain, avoiding eating some foods, embarrassed or self-conscious about appearance of teeth or mouth, etc.).	1	2
(d) I am afraid of going to the dentist because I am concerned I may have a panic attack (abrupt fear with sweating, pounding heart, fear of dying or losing control, chest pain etc.).	1	2
(e) I am afraid of going to the dentist because I am generally highly self-conscious or concerned about being watched or judged in social situations.	1	2

3. To what extent are you anxious about the following things when you go to the dentist?	Not at all	A little	Somewhat	Moderately	Very much
(a) Painful or uncomfortable procedures.....	1	2	3	4	5
(b) Feeling embarrassed or ashamed.....	1	2	3	4	5
(c) Not being in control of what is happening.....	1	2	3	4	5
(d) Feeling sick, queasy or disgusted.....	1	2	3	4	5
(e) Numbness caused by the anesthetic.....	1	2	3	4	5
(f) Not knowing what the dentist is going to do	1	2	3	4	5
(g) The cost of dental treatment.....	1	2	3	4	5
(h) Needles or injections	1	2	3	4	5
(i) Gagging or choking.....	1	2	3	4	5
(j) Having an unsympathetic or unkind dentist.....	1	2	3	4	5

APPENDIX E
Visual Analog Scale

Please place a slash (/) on the line below to indicate your present level of **comfort**:

Very uncomfortable	Very comfortable

Please place a slash (/) on the line below to indicate your present level of **anxiety**:

No anxiety	Worst anxiety

APPENDIX F
Therapy Satisfaction Scale

Please circle the number that best describes your satisfaction with the intervention.

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	I am satisfied with the quality of the intervention I received.	1	2	3	4	5
2.	My needs were met by the intervention.	1	2	3	4	5
3.	I would recommend the intervention to a friend.	1	2	3	4	5
4.	I would return to the intervention if I needed help.	1	2	3	4	5
5.	The therapy dog was friendly and warm towards me.	1	2	3	4	5
6.	I am now able to more effectively deal with my dental anxiety.	1	2	3	4	5
7.	I thought the intervention was an appropriate length.	1	2	3	4	5

8. How much did the intervention help you deal with your dental anxiety? (check one)

Made things a lot better	____
Made things somewhat better	____
Made no difference	____
Made things somewhat worse	____
Made things a lot worse	____

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