# *Therapy Dog Support in Pediatric Dentistry: A Social Welfare Intervention for Reducing Anticipatory Anxiety and Situational Fear in Children*

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# Therapy Dog Support in Pediatric Dentistry: A Social Welfare Intervention for Reducing Anticipatory Anxiety and Situational Fear in Children

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**Abstract**
Children often experience anticipatory anxiety and situational fear (AA&SF) as a common reaction to perceived environmental threats. Animal-assisted interventions (AAI) with certified therapy dogs have been increasing in commonality within social work and medical practice as a non-pharmaceutical intervention to increase relaxation. This pilot study explored the impact of certified therapy dogs on youth in a known AA&SF triggering experience – the dental office. Canine Support in Pediatric Dentistry was designed and evaluated as an innovative, non-pharmacological behavior management strategy to support children, ages 8–12, with known AA&SF of the dentist. A time-series design utilized a convenience sample (n = 18) for current patients with known AA&SF. Measures of survey, observation, and salivary analyte analysis assessed biopsychosocial changes, including a refined methodology for oxytocin. The intervention as deemed acceptability by guardians at a rate of 83%. Guardians further supported the intervention with 100% stating that the liked the therapy dog's presence for their child. No safety issues were observed. Oxytocin trended positively from baseline across majority of sample; though not statistically significant. Cortisol tended to decreased over the three time points, while alpha-amylase appeared to follow the trend of oxytocin more than cortisol. The findings support that Canine Support in Pediatric Dentistry is a feasible AAI in the pediatric dental clinic, which provides a model generalizable to other medical environments and experiences that may provoke AA&SF in children. Collection and measurement of salivary analysis is a feasible and practical method to explore biopsychosocial change in social welfare research.

**Keywords** Veterinary social work · Human-animal interaction · Pediatric dentistry · Oxytocin · Anticipatory anxiety · Dental fear

Social welfare seeks to understand individuals within the context of their environment. For the majority of Americans, dogs are prominent in environment either by interaction or ownership (Risley-Curtiss, Rogge & Kawam, 2013). It is likely that children have had positive interactions with dogs given their prevalence in America— 68% of U.S. households own a pet, of which 60.2 million are dog owners (American Pet Products Association, 2018). Thus, including dogs as therapeutic agents is consistent with many children's home environment (McConnell, 2009).

Therapy dogs are pets who are well trained and pass a standardized test through a national accrediting organization (e.g. Therapy Dogs International, Pet Partners) and maintain current membership. Certified therapy dogs are often requested to visit hospitals, senior homes, schools, and other community-based organizations on a volunteer basis to provide attention, novelty, and interaction to individuals (Fine, 2016). Media stories have highlighted the integration of therapy dogs in oncology units (e.g. Webmed, 2018),

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supporting social workers with patients talking through interpersonal violence (e.g. Izadi, 2015), and in work with older adults (e.g. Adler, 2019).

Animal assisted-interventions (AAI) are often utilized to support relaxation and comfort in children. Specifically, AAI has been associated with reductions in: anxiety symptoms (Berget, Ekeberg, Pedersen & Braastad, 2011; Nepps, Stewart & Bruckno, 2014), depression (Souter & Miller, 2007; Virués-Ortega, Pastor-Barriuso, Castellote, Población, & de Pedro-Cuesta, 2012), and improved well-being (Barak, Savorai, Mavashev & Beni, 2001). However, there is a lack of research about feasibility and the effects of these interventions. In a systematic review by O'Haire et al. (2015), the sample size of current empirical studies ranged from 1 to 153, and designs varied from case-study to randomized controlled trial. Nimer and Lundhal (2007) conducted a meta-analysis across forty-nine empirical studies yielding a moderate effect size for AAI interventions aiming to improve outcomes of negative behavior and emotional well-being. Studies without control groups did not significantly differ from those with a control group (Nimer & Lundahl, 2007).

Typically, an AAI with a certified therapy dog visit is requested to provide distraction, promote relaxation, and reduce anticipatory anxiety and situational fear (AA&SF) before and during medical care. This service may include interaction in the waiting room or allowing the dog to lie on a treatment table/bed next to a patient (Pet Partners, 2018). Patients are encouraged to interact with the dog howsoever they are comfortable, so long as the dog is accepting. The duration of most visits is 5 to 20 min, though the effect of duration has not been specifically studied (Barker, Knisely, McCain & Best, 2005; O'Haire, Guérin, & Kirkham, 2015; Wu Niedra, Pendergast & McCrindle, 2002).

The medical setting is often the environment of choice for AAI research because of the imminent need to provide quality care, and the inherent control of personnel, training, patient population, and services provided. Since fear of doctors and medical environments is a rather generalized experience, researchers have explicitly sought to measure the application of AAIs towards reducing negative emotions and behaviors (Morgan et al., 2017). From a social work perspective, AAI may impact internalizing and externalizing behaviors, which are indications of child distress in the dental setting. AAI thus is aimed at increasing the child-centered outcomes of reducing indicators of distress and increasing comfort. Social work professionals are well integrated into medical settings and social work interventions are often targeted towards reducing the fears and anxieties of those undergoing assessment and treatment (NASW, 2011).

## An Exemplar Collaboration: Dentistry and Social Work

In 2015, the American Dental Association encouraged dentists to partner with dog visiting programs, grounded in the belief of a positive relationship among children and therapy dogs sans empirical evidence of therapeutic benefits (American Dental Association, 2015). Within the last five years, the national professional organizations for dentistry and dental forums have published multiple stories on emergent field of AAIs. In dentistry, Christman and Johnson (2017) called for therapy dogs to become part of dental teams. The American Association of Pediatric Dentistry's primary communication to members, *Pediatric Dentistry Today* has published several anecdotal stories about dogs in dental clinics (e.g. Paretsky, 2016; Solana, 2015). Beyond anecdotes, research efforts include a national survey (Morales, 2018), and a current clinical trial in Norway (Gussard, 2017). With such a breadth of interest, dentists and social workers find it advantageous to delve into this topic collaboratively.

Empirical research about the impact and effect of AAIs with therapy dogs is still an emergent field. The dental environment provides a controlled environment, with a known behavior (i.e. AA&SF), to test a strengths-based intervention for the benefit of children's health. While social work may not often dove-tail with dentistry, medical epidemics, obesity, asthma, diabetes, poverty, and health access are independently acknowledged as social welfare issues. Therefore, so too are caries, as are the children inflicted. Caries, commonly known as cavities, are a breakdown in the tooth enamel caused by bacteria and a sugary substrate that can cause deterioration, abscess, or infection (Centers for Disease Control and Prevention, 2014). Caries were recognized as a public health concern in 1990 and remain the most common chronic childhood disease in the United States (Centers for Disease Control and Prevention, 2014). As an exemplar to social work practice and research, dentistry provides a controlled environment in which to explore the potential effect of AAIs on children's behavior and reduction in AA&SF, which could reduce the use of sedation and increase positive behaviors towards cooperation (e.g. refrain from biting, yelling, etc.). AAI has the potential to positively impact children's oral health, reduce time spent with the dentist, and reduce family financial burden.

The role of AA&SF in dentistry potentially leads to negative behaviors and barriers to dental care. Theoretically children who have AA&SF tend to demonstrate negative behavior (Taani, El-Qaderi & Abu Alhaija, 2005). Children who exhibit negative behaviors tend to avoid treatment care, or are re-scheduled for multiple

appointments or for treatment with sedation; both leading to potential increased risk and expense (Sinner, Becke, & Englehard, 2014). If children avoid care, caries progress and health problems increase. Social work should be invested in adopting AAI because of the potential as a non-pharmacological behavior management strategy. The prospective therapy dog intervention can be brought in ahead of the externalizing behaviors for children with AA&SF to shift behavior before the trends toward increased health risk and care avoidance occur. Reframed in as strengths-based perspective, AAI provides a child-centered approach to address the needs of the child while providing the necessary medical care. AAI is an exemplar of how AAI can work for social welfare interventions across various challenges and settings for children.

In a review of literature, Klingberg and Broberg (2007) found that AA&SF was prevalent in about nine-percent of the pediatric population. AA&SF precludes some children from receiving optimal treatment. Consistent with other medical environments, dental treatment for children with AA&SF typically includes the use of mild sedation (i.e. nitrous oxide), physical restraint (i.e. a dental assistant applying pressure to extremities to keep a child from hitting or kicking), distraction, and/or dividing appointments into additional visits (American Academy on Pediatric Dentistry, 2015; Anthonappa, Ashley, Bonetti, Lombardo & Riley, 2017; Casamassimo et al., 2009). Despite use of non-pharmacological interventions, the use of sedation and other means of treatment do not address the causes of AA&SF, nor the long- term relationship of AA&SF and dental care including delay to seek treatment or complete avoidance of treatment. For these reasons, exploring effects of non-pharmacological solutions to AA&SF of dental care is an important social welfare, and may be a helpful, simple, safe, and cost-effective resource. Given the epidemic proportion of caries, and the prevalence of AA&SF, there is clinical need to advance intervention strategies—enter certified therapy dogs.

AAIs are a potential child-centered tool to facilitate a positive experience for children experiencing AA&SF. One of the few studies to explore AAI in dentistry was conducted by Schwartz and Patronek (2002) who compared children ages 7 to 11 (n = 12) visiting an inner-city university dental clinic compared children visiting a suburban private clinic (n = 6). At the university, two groups were established: one group had a dog sit beside them in the dental chair, while the other group had no dog present. The researchers note that their measures of heart rate, the Observational Scale of Behavioral Distress, and self-report "did not provide good measures of anxiety" (p. 292). However, even with limitations, the positive anecdotal and observational data supported AAI as a potential resource in environments where AA&SF presents a barrier to children receiving medical care. Being one of the few pieces of empirical literature in this area, their study is an important reference and served as a foundation for developing this feasibility study; especially their acknowledgement of the importance to include salivary analyte analysis.

## Key Constructs

### AA&SF

*Anticipatory anxiety* (AA) is a fearful emotion when there is a perceived lack of control over one's environment in response to negative environmental stimulus, leading to functional impairment and potential avoidance (Taani, El-Qaderi, & Abu Alhaija, 2005). *Situational fear* (SF) is a response to a perceived and impending, threatening stimulus (Appukuttan, 2016). AA&SF are distinct biological and psychological reactions that often appear in tandem. In typically developing children, anxiety and fear often present with negative externalizing behaviors, including hitting, kicking, yelling. In the pediatric dental environment, AA&SF is defined as a patient's fear of the dentist or the dental procedure they are anticipating.

### AAI

Canine Support in Pediatric Dentistry (CSPD) is an AAI for pediatric dental patient engagement with therapy dog before and during a dental treatment appointment. AAI is a type of human-animal interaction offering a goal-oriented intervention that intentionally includes animals in health and human services, specifically for therapeutic gains (International Association of Human-Animal Interaction Organizations, 2014). Participation in AAI has been associated with increased relaxation and communication—behavior modification often sought to decrease or diminish AA&SF and increase positive behavior (Diercke, Ollinger, Bermejo, Stucke, Lux, & Brunner, 2012; Morgan et al., 2017). Children have expressed feeling safe when they are in the company of a therapy dog in an anxiety-provoking situation (Fine 2016). Feeling safe is closely aligned with feeling secure. Because children are in an inherently vulnerable position in the dental office (i.e. physically separated from their caregiver, reclined in a chair, with their mouth open), feeling safe may be associated with successful treatment. AAI may facilitate feelings of safety and security in a dental setting for pediatric patients while maintaining high medical standards of care.

## Theoretical Foundation

Literature about AAI is grounded in constructs of attachment theory (Chandler, 2012; Fine, 2016). Although much

of the pediatric dental literature does not explicitly employ theory, the focus has been on the mother/caregiver-child relationship in formative years of the child's development (Havener et al., 2001; Schwartz & Patronek, 2002). Attachment theory presupposes that children innately lack the ability to cope with environmental stimuli independently. They easily become biologically, psychologically, or socially distressed and unregulated, requiring a responsive caregiver to soothe them (Bowlby 1982; Schore & Schore, 2008). The dynamic between caregiver and child provides the child the tools to allow caregivers to soothe them in the absence of their maternal/primary caregiver (i.e. grandparent; AAT therapy dog) (Bowlby, 1982; Schore & Schore, 2008). It is through the mechanisms of attachment, *internal working model* (IWM), that children develop strategies for self-regulation of emotions including internalization/processing and externalizing/behaviors (Hofer, 1995). Thus, this study utilized a model of attachment theory which emphasized the IWM within the context of biopsychosocial framework (Hofer 1995).

When children arrive at the dental clinic with their caregiver, their attachment style is established; changing their relationship is not the intention of the dental appointment. However, understanding the dynamic of the caregiver/child relationship can provide insight into strategies that may shift the child's IWM and subsequent behaviors. In practice, the physical contact between human and therapy dog can foster subjective feelings of trust, increased cognitive functioning, and decreased anxiety (Matuszek 2010); each associated to the environment through a biological, psychological, and social experience. In this pilot study, the relationship between the child and the dog augments the biopsychosocial constructs of the environment. Hypothetically, a child who presents with AA&SF can have a positive dental experience with the intervention of a therapy dog to augment their environment into a calming stimulus.

## Objectives

In this study, researchers from social welfare and pediatric dentistry collaborated to explore the impact that certified therapy dogs have on children (ages 8–12) towards reducing AA&SF in a controlled environment. Children were established patients at the university pediatric dental clinic in an urban Midwestern city, USA. The therapy dogs were certified by a leading national organization (Pet Partners or Therapy Dogs International), and has successfully completed the Hospital's orientation and training to participate in their Pet Pals program. The overarching research question was to determine the feasibility of Canine Support in Pediatric Dentistry. Secondary research questions then sought to understand: (1) if children who engage with a therapy dog for fifteen minutes prior to dental treatment were able to tolerate a dental visit; (2) if oxytocin, alpha-amylase, and cortisol be obtained, and analyzed as valid and reliable measures of AA&SF. The hypothesis was that CSPD will mediate the child's negative response when anticipating dental treatment, anticipation that is typically associated with situational fear expressed as negative externalizing behaviors. Such behaviors are measured by: the dentist provided Frankl Scale score, self-report, observation, and salivary analyte analysis.

Given the stated research questions and hypothesis, this work advances current literature by conducting a rigorous, empirical research study in a field dominated by literature review and theoretical speculation. Additionally, the study served as a beta-site to test oxytocin via salivary analyte analysis to measure physiological reaction to the intervention. Researchers sought to advance practice research concerning certified therapy dogs in dental practice (e.g. Havener et al., 2001; Schwartz & Patronek, 2002) by strategically evaluating the feasibility of therapy dogs in the dental clinic, using Bowen's model for feasibility studies for new healthcare interventions (Bowen et al., 2009). This model specifically addresses: acceptability, demand, adaptation, and expansion. An additional facet of assessing feasibility was the integration of salivary analyte analysis in collecting 1 mL of pooled saliva, and specifically measuring oxytocin. Finally, researchers included measures to evaluate the therapy dog's wellness during and post-intervention.

Prior to the pilot study, researchers surveyed the dental clinic populations including dental professionals (n = 72) and caregivers (n = 148) to explore biases about therapy dogs, known fears/allergies, and their desire to have the therapy dog intervention in the clinic for the children. Simultaneously, certified therapy dogs from the Hospital's therapy dog visiting program, Pet Pals, were welcomed into the clinic during a break in the schedule to see if the handlers and dogs had any adverse reactions (i.e. sounds of drill, smells, linoleum floors). Once the surveys were analyzed, trends for desire of therapy dogs from dental professionals (62%, N = 79), caregivers (68%, N = 199), and their children and children (67%) supported efforts to move towards a pilot study to evaluate the feasibility of a structured intervention.

## Salivary Analyte Analysis

There has been an increasing trend to include biological indicators in social science research as a means to understand biopsychosocial impact of interventions. An analyte is a measure of a specific substance. In this study, the analytes were measured via salivary analyte analysis, as opposed to measuring analytes in blood or urine samples. As such, there has been an increase in the development and accessibility of procedures to noninvasively measure differences in neurobiological activity including

the hypothalamic–pituitary–adrenal axis and autonomic nervous system for a plethora of populations and environments (Granger & Johnson, 2012; Nater, Rohleder, Scholtz, Ehlert, & Kirschbaum, 2007).

The biological systems of emotional regulation are associated with hyperactivity of the sympathetic nervous system and hypothalamic–pituitary–adrenal axis, the brain and body's stress response that directs the reaction of *fight-freeze-flight* (Friedmann & Tsai, 2006; Beetz, Uvnas-Moberg, Julius, & Kotrschal, 2012; Cirulli, Borgi, Berry, Francia, & Alleva, 2011). While cortisol is dominant in social science research, oxytocin is relatively new and gaining traction. Often cited as the "happiness hormone", oxytocin is responsible for multiple intimate feelings including sexual intimacy, social support, trust, and relaxation (Heinrichs et al., 2003; Kosfeld, Heinrichs, Zak, Fischbacher & Fehr, 2005). Furthermore, oxytocin may be responsible for diminishing the *fight-freeze-flight response* (Powell, Guastella, McGreevy, Bauman, Edwards, & Stamatakis, 2019).

Social science research often measures negative responses (i.e. cortisol, referred to as a "stress hormone"), oxytocin is a potentially important indicator of quantifiable positive feedback from an intervention. Oxytocin is a neuropeptide produced in hypothalamus, a system of neurons that signals molecules that influence cortical activity, which has been measured during the formation of affiliative bonds (Beetz et al., 2012). Affiliative bonds are present in social bonding, sexual activity, maternal bonding (i.e. lactation), cooperation, forgiveness, and empathy (Cassidy & Shriver, 2002; Crittenden, 1995; Hofer, 1995). Research by Handlin et al. (2011) found oxytocin levels in participant's blood peaked between 1–5 min after intervention with dogs.

As such, researchers have included oxytocin and cortisol in AAI research (e.g. Beetz et al.., 2015; Nagasawa et al., 2015). Although the precise mechanisms underlying the function of oxytocin remains suspect, it can reliably be measured in blood or urine (Cassidy & Shriver, 2002), and in potentially saliva (Salimetrics, 2018). The utilization of salivary measures can support longitudinal or static assessment of differing groups, or to compare effect of interventions. Salivary analytes were collected at baseline, mid-, and post-intervention, which allowed for analysis of change within one case and across cases (i.e. a baseline sample can serve as a control to assess change over time, rather than comparing a case to a control-group mean).

Though the technology to collect and test salivary oxytocin has improved, the precise time of peak oxytocin release, and implications of oxytocin changes on behavior is undefined (Beetz et al., 2012; Salimetrics 2018). Techniques for collection, management, and analysis are relatively easy to learn and cost efficient (Dickerson & Kemeny, 2004). The consideration of saliva as a noninvasive measure is a primary factor for why it has been increasingly integrated in social science research (Beetz et al., 2012).

## Methodology

Grounded in the prior literature, a time series study design was developed as an innovative, non-pharmacological behavior management strategy for children, 8–12 years of age, with mild to moderate AA&SF. The intervention occurred from March to October 2018. Each treatment session was approximately one-hour, including consent and survey completion. Measures of self-report, dentist reports, and salivary analyses were included.

All dogs were certified therapy dogs with either Therapy Dogs International or Pet Partners. Additionally, all dogs had to attend an orientation, training, and be in good standing with the University and Hospital's visiting program. At the scheduled appointment, children were provided a separate waiting room to interact with the dog prior to treatment, devoid of other patients and distractions (e.g. television). Child patients were provided an isolated waiting area with freedom to interact with the certified therapy dog, as the dogs are comfortable (see Image 1). The children were encouraged by the handler to play with, or sit and pet the dog as they felt comfortable. All children were provided the same opportunities for interaction and were encouraged to consistently interact with, and pet the dog for as much of the time allotted as comfortable. After 15 min of interaction, the patient and the therapy dog were taken to a private exam room. All appointments for treatment were provided in single-bed, closed door clinical treatment rooms. The therapy dog sat in a chair within arm's reach of the child (accessible to be pet) for the duration of the dental treatment; approximately 30-min. The dog was always on a leash, and the handler sat next to the dog to maintain control at all times (see *Image 1 &2*).

**Image 1** Therapy dogs of the pilot study

## Recruitment

Researchers reviewed current patients of the university dental clinic who were between the ages of 8–12 with an appointment scheduled within the preceding six months at random. Per IRB (# 2017–2091) approved protocol, charts were screed for preliminary inclusion criteria: Frankl score recorded in their chart from prior visit, present age, and treatment needed. Exclusion criteria included contraindications to receive therapy dog support, including fear of dogs and allergies (IAHAIO, 2014).

AA&SF was operationalized by the Frankl Scale (Frankl, Shiere, & Fogels, 1962; Jamieson & Vargas, 2007; Weinstein et al., 2009). The Scale offers four options for ranking children's external behavior of cooperation (Lee, Chang & Huang, 2007; Taani et al., 2005). On one end of the scale, an F4 indicates a child who demonstrates positive behavior (i.e. cooperative and accepting) of the dental treatment, whereas an F1 represents a child who requires sedation to provide treatment (either because they are uncooperative or have complex medical history). The mid-categories of the scale, F2 and F3, represent children that may present with AA&SF and may be advised to use sedation to successfully complete the treatment (Taani, et al., 2005). With an appropriate intervention, children in the F2-F3 category can move towards demonstrating no resistance of treatment and exhibiting in cooperative behavior (Frankl et al., 1962). Thus, child patients with a Frankl Scale score of F2–F3 with a scheduled for a restorative treatment were identified called by the researcher and invited to participate in the study.

Eighteen patients were recruited and completed measures and treatment. The sample size was dictated by the number of salivary kits accessible to the research team within the specified study design. The researcher identified patient charts at random to review and screen; since charts were reviewed prior to communicating with the parent, all were eligible upon screening. If caregivers were interested in having a therapy dog provided for their child prior and during their dental treatment, then the researcher asked screening questions including the single Dental Anxiety Question, a single item dental fear scale ($\alpha = 0.91$) (Neverlien, 1990). Then, the researcher re-scheduled their appointment for a research-approved time of either 1:00 pm EST, or 3:00 pm EST for purposes of saliva collection to account to diurnal rhythm (Granger, Johnson, Szanton, Out & Schumann, 2012). Ten (56%) were recruited and did not show up for their appointment or cancelled in advance. Only one caregiver decided not to participate after arriving at the clinic and completing consent.

## Measures

Upon arrival to the clinic, the pre-treatment questionnaire was verbally administered by the research assistant to the parent/caregiver with child. This measure included the General Trust Scale, Self-Efficacy Scale, Questions of Cooperation, Children's Fear Survey Schedule-Dental Subscale (CFSS-DS), the Facial Image Scale, and demographic information. Salivary analytes were measured by collecting 1 mL of pooled saliva at three intervals throughout the intervention (see Table 1 for all measures).

The General Trust Scale, originally an eight-item scale ($\alpha = 0.72$) developed for the general public (Yamagishi & Yamagishi, 1994), was modified to six items specific to the dental environment in order to measure participant's beliefs regarding other people; "I trust my dentist" was added for this research. The Self-Efficacy Scale is a 100-point scale, ranging in 10-unit intervals from 0/ "Cannot do" through to complete assurance 100/ "Highly certain can do" (Bandura 1976). Questions ask participant's self-efficacy regarding "Let a dentist/dental hygienist clean my teeth", "A shot", and "Fixing my tooth". Reliability of scales asking the same questions about other medical procedures range from $\alpha = 0.69$—0.85 (Ryckman, Robbins, Thornton, & Cantrell, 1982).

Cooperation was measured by a modified self-efficacy 100-point scale, ranging in 10-unit intervals from 0/ "Not willing at all to help" through to complete assurance 100/ "Highly willing to help". Participants were asked of their willingness of cooperation to: "Let a dentist/dental hygienist clean my teeth", "A shot", and "Fixing my tooth". Mirroring the Self-Efficacy Scale, reliability of scales asking the same questions about other medical procedures range from $\alpha = 0.69$—0.85 (Ryckman, Robbins, Thornton & Cantrell, 1982).

Dental fear/anxiety was measured by the CFSS-DS (Cuthbert & Melamed, 1982) consisting of 15 items with a 5-point Likert scale ranging from 1/not afraid to 5/very afraid. The scale has been utilized to measure parental perception of their children's dental fear with minor wording changes from "you" to "your child". The total score on the CFSS-DS ranges from 15–75, with high scores indicating high dental fear. The scale has been assessed to have strong internal consistency ($\alpha = 0.91$) and test–retest reliability ($r = 0.90$), as well as good criterion validity ($r_s = 0.51$) (Nakai et al., 2005). This scale is the most common measurement for children's dental fear (Wogelius, Poulsen, & Toft Sørensen, 2003). The Facial Image Scale was adapted from the common Venham facial scale (Veham, Gaulin-Kremer, Munster, Bengston-Audia, & Cohan, 1980). The facial scale is used to assess situational fear and anxiety among children 3–18 years of age; though the original is

**Table 1** Study procedures

| Time | Measures | Range | Reliability |
|---|---|---|---|
| Screening | • Identify children/parents/caregivers of potential participant | | |
| | • Eligibility screening | | |
| | ○ Frankl Score | F1-F4 | α = 0.90 |
| | ○ Dental Anxiety Question | 5-point Likert scale | α = 0.91, |
| Baseline | • IRB approved Consent | | |
| | • Pre-treatment questionnaire | | |
| | ○ General Trust Scale | 5-point Likert scale | α = 0.72, adapted |
| | ○ Self-efficacy scale | 0–100 | α = .69–85, adapted |
| | ○ Cooperation | 0–100 | α = 0.69 – 0.85 |
| | ○ Children's Fear | 5-point Likert scale | |
| | ○ Survey Schedule-Dental Subscale | 5-point Likert scale | α = 0.91 adapted |
| | ○ Facial Image Scale | | |
| | • Baseline saliva sample (1 mL) | | |
| T0—T15 | • A therapy dog support isolated from other patients | | |
| | • At 10 min | | |
| | ○ 2nd saliva sample (1 mL) | | |
| At T—15 | • 15 min | | |
| | ○ 3rd saliva sample (1ML) | | |
| | • Child moves to a treatment room with therapy dog | | |
| Intervention | • Dental treatment by dentist with therapy dog and handler | | |
| Post-Treatment | • Treatment Feasibility Record | Qualitative Response | Not applicable |
| | • Abbreviated Acceptability Rating Profile | 5-point Likert scale | α = 0.93–0.97 |
| | • Information About Therapy Dog | Qualitative Response | Not applicable |
| | • Handler's Assessment Report | Qualitative Response | Not applicable |
| | • Therapy Dog Support Record | Qualitative Response | Not applicable |
| | • Post-treatment Handler Survey | Yes/No Response | Not applicable |

cited as having moderate reliability (α = 0.70), the scale was adapted for use in this study (Buchanan & Niven, 2002; Venham et al., 1980). Lastly, demographic information was recorded on a researcher-created instrument that captured age, gender, race and ethnicity.

Prior to engaging with the dog, 1 mL of pooled saliva was collected from each child using sterile pipettes and eppendorf tubes. Saliva samples were taken a second time after ten minutes of therapy dog interaction, and a third time five minutes later. Samples were analyzed for changes in alpha-amylase, cortisol, and oxytocin. To address prior methodological challenges (Powell et al., 2019), the refined methodology (Salimetrics, 2018), provided increased sensitivity that no longer requires a pre-assay sample (i.e. use of reagent material), which allows for unconcentrated testing of the saliva. Analysis of samples required at least 1 mL of pooled saliva per collection. Samples were moved to a freezer immediately upon collection and stayed in the freezer for the duration of the study until sent to the laboratory for analysis. Cortisol and alpha-amylase were tested in duplicate, while oxytocin was tested in triplicate (Salimetrics, 2018). This method was used to address the research question regarding the feasibility of collecting saliva, and measuring any change from baseline oxytocin levels during the interventions as an indicator of impact.

At the end of the dental treatment, a short post-treatment questionnaire was completed by child and another by the parent/caregiver of the child, both providing their own perception of the intervention. The parent/caregiver were asked to complete the Abbreviated Acceptability Rating Profile (AARP), an 8-item survey that assess acceptability of treatment. Good psychometrics have been demonstrated with the AARP (α = 0 0.93—0.97). The survey was minimally modified to reflect research participation for saliva sampling and therapy dog engagement (Caporino & Karver, 2012; Tarnowski & Simonian, 1992).

Post-treatment, the Treatment Feasibility Record was completed by the dentist to capture data about the dental exam and treatment (Bowen et al., 2009). This process included reviewing the patient's chart, a standard process conducted at the research site by the dentist. The therapy dog handler completed the summary of information about the therapy dog, (i.e. certifying organization, breed, size, and health/welfare) a form similar to demographic information for humans, but modified for the dogs to better understand the value and variation of animal collaborators (Ng et al., 2014). The handler also completed the researcher created Handler's Assessment Report on the efficacy of the interaction, a short, open-ended, self-report completed by the handler regarding their opinion of the

intervention and of what they observed between the dog and child (Sonntag & Overall, 2014; Ng et al., 2014). A short survey was sent to all handlers to review the impact volunteering had on their dog 24-h post-service (Glenk, 2017). The research assistant completed the Therapy Dog Support Record, capturing observations regarding the therapy dog interaction by the researcher.

## Results

Data analysis was conducted using SPSS v24. Scales were computed as described by the measure and analysis was conducted on the total scale. Race was recoded into three categorical variables of black, white, and other. The preliminary analysis plan included creating the scales in SPSS, then checking assumptions of normality of distribution; continuous variables yielded normal distribution. Pearson Correlation was run to understand linearity between variables. Significance was assessed at the alpha criterion of $p < 0.05$, with a confidence interval of 95%.

Within the sample, there were twice as many females (n = 12) as there were males (n = 6). The sample was predominantly white (n = 9, black n = 6, and other n = 3). Though the age range was 8 to 12 years, the majority of the patients were younger: 8 years old (n = 8), 9 years old (n = 4), 10 years old (n = 2), 11 years old (n = 3), and 12 years old (n = 1).

### Pre-treatment Questionnaire

#### General Trust Scale

While majority of children (53%, n = 9) stated that they feel neutral in their opinion that "most good and kind", 67% (n = 12) responded that they strongly agree that "most dentists are good and kind". Additionally, 89% (agree n = 6, strongly agree n = 10) responded that dentists are trustworthy, and 100% responded that they trust their dentist (agree n = 3, strongly agree n = 14).

#### Children's Fear Survey Schedule-Dental Subscale

Only four children stated self-reported that they have no fear of the dentist; in contrast, 40% (n = 8) self-reported no fear of the doctor. Regarding aspects of the dental treatment, 89% expressed fear of injections. The only 11% (n = 2) expressed no fear of the drill or sight of the drill (n = 4), 50% (n = 9) were not afraid of the noise of the drill.

#### Self-efficacy Scale and Cooperation

A Pearson correlation demonstrated higher self-efficacy was moderately correlated with higher willingness ($r = 0.617$, $p = 0.006$). Similarly, higher self-efficacy was correlated with higher situational anxiety ($r = 0.582$, $p = 0.011$). And, treating age as a continuous variable, years of age and willingness demonstrated a positive correlation ($r = 0.639$, $p = 0.004$).

#### Facial Image Scale

None of the children responded that they were presently unhappy. Most spanned the range of happy.

### Post-treatment

#### Treatment Feasibility Record

The children were asked verbally by the researcher how helpful they perceived the dog to be as a support for them during the dental treatment (agree n = 1, strongly agree n = 14). All children responded that they would like to have a therapy dog at their next dental visit; thirteen responded "definitely yes".

#### Abbreviated Acceptability Rating Profile

At the conclusion of treatment, parental responses on the AARP measure regarding their acceptability of the therapy dog treatment was entirely positive with all answers noted as: somewhat agree, agree, or strongly agree. All parents responded in the affirmative that they agree that CSPD is an acceptable treatment for the child's dental care, all responded that they like the therapy dog support, and that therapy dog support was a positive way to manage their child's behavior. Eighty-three percent responded that they agree or strongly agree that their child's behavior was severe enough to justify having a therapy dog present.

#### Salivary Analyte Analysis

Feasibility of salivary analyte analysis was assessed two ways: 1. assess feasibility of collecting 1 mL of pooled saliva at three time points throughout the intervention; 2. determine if the refined methodology reliability measured salivary oxytocin. Since cortisol and alpha-amylase established as valid and reliable indicators (Granger et al., 2006; Granger, Kivlighan, El-Sheikh, Gordis, & Stroud, 2007). Cortisol and alpha-amylase were also included in analysis to compare effect, and ensure that the measures were capturing change over time (see Fig. 1).

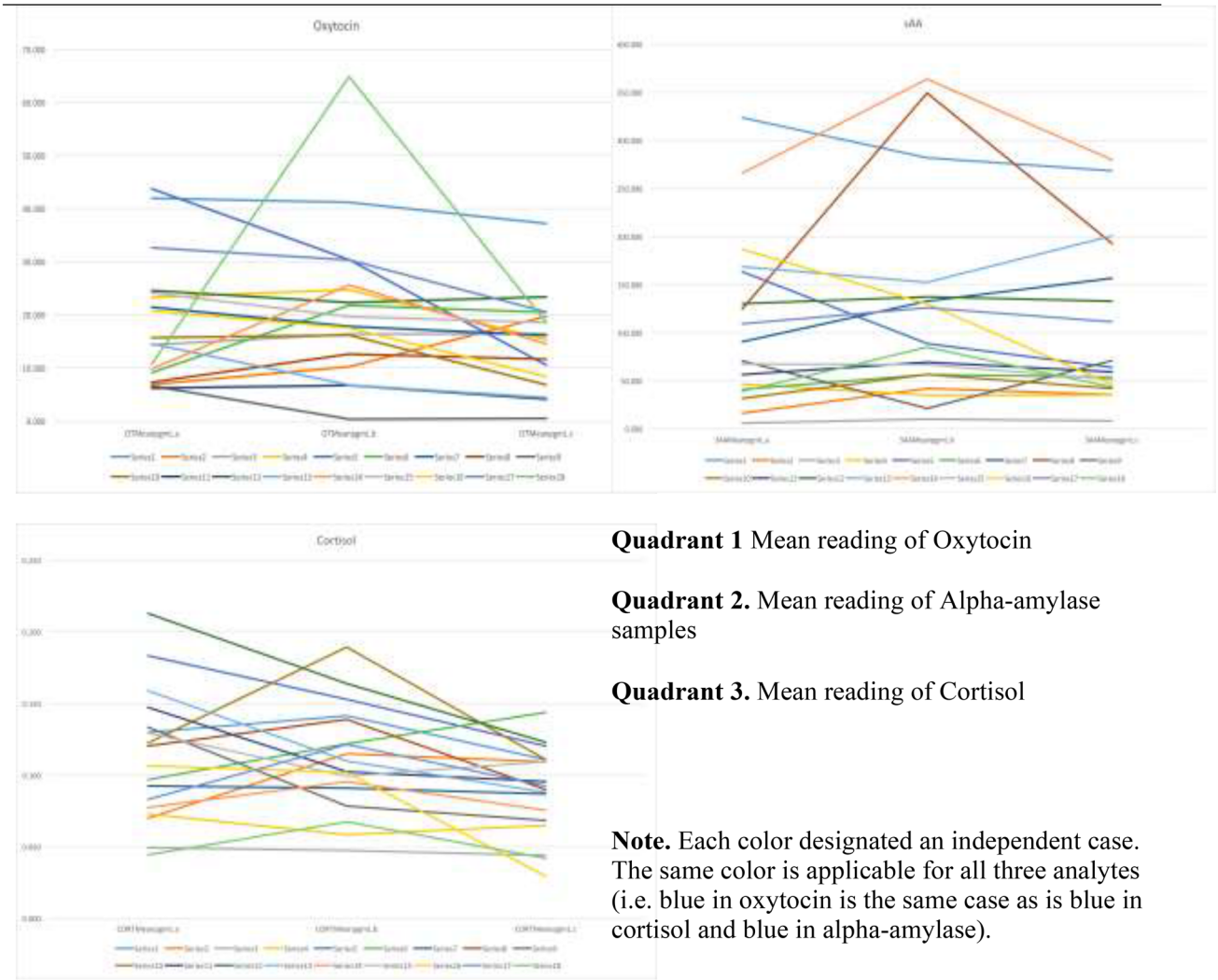


**Fig. 1** Visualization of change throughout intervention per case

All saliva samples yielded appropriate quantity of pooled saliva to conduct assays towards data collection. In preliminary analysis, the correlations between the three analytes did not indicate multicollinearity. The average changes of each measurement were as follows: cortisol (T0–T1: − 0.002 pcg/mL, range − 0.05–0.067, T1–T2: − 0.02 pcg/mL, − 0.079–0.022), alpha-amylase (T0− T1: 14.80 pcg/mL, − 75–224.90, T1–T2: − 19.58 pcg/mL, − 156.60–49.90), oxytocin (T0–T1: 1.36 pcg/mL, − 11.98–25.14, T1–T2: 5.15 pcg/mL, 8.25–21.79). As oxytocin was the primary measure of interest to identify feasibility of collection and analysis, Table 2 details the median readings for each sample and change from baseline. One sample of oxytocin did not read above a |4| and was deemed not reliable (Salimetrics 2018).

Data reported is strictly descriptive since the purpose of the research was to explore feasibility of collecting 1 mL of saliva at three specific time points, storing and shipping saliva, and garnering valid and reliable data from the samples. The descriptive data allows for theoretical postulations about the biological effect occurring throughout the intervention, however there is no appropriate mechanism to statistically analyze the data. Researchers postulated looking at area under the curve, but given the small sample size, and descriptive nature of the questions, this was deemed neither appropriate nor necessary.

Figure 1 provides a visualization of each analyte independently, yet color codes each case for comparison. Cortisol decreased over the three time points for majority of the cases. Alpha-amylase appears to follow the trend of oxytocin more than cortisol. While half of the cases did note an increase in oxytocin between baseline and second collection, the other half of the cases either stayed the same or decreased.

**Table 2** Change of oxytocin throughout CSPD intervention

| Case ID | Baseline | T1 | T2 | Change: baseline to T1 | Change: baseline to T2 |
|---|---|---|---|---|---|
| 1 | 41.54 | 41.14 | 36.60 | − 0.40 | − 4.94 |
| 2 | 6.66 | 11.50 | 19.76 | 4.84 | 13.10 |
| 3 | 14.83 | 15.14 | 16.85 | 0.31 | 2.02 |
| 4 | 24.33 | 24.78 | 14.18 | 0.46 | − 10.14 |
| 5 | 42.59 | 30.61 | 8.82 | − 11.98 | − 33.77 |
| 6 | 8.37 | 21.30 | 21.21 | 12.93 | 12.84 |
| 7 | 20.91 | 17.57 | 12.63 | − 3.33 | − 8.28 |
| 8 | 7.42 | 14.22 | 11.07 | 6.80 | 3.65 |
| 9 | 6.43 | 0.17 | 0.63 | − 6.26 | − 5.80 |
| 10 | 16.14 | 17.22 | 6.33 | 1.08 | − 9.81 |
| 11 | 6.63 | 7.10 | 4.03 | 0.46 | − 2.60 |
| 12 | 22.73 | 22.00 | 27.28 | − 0.73 | 4.55 |
| 13 | 13.59 | 6.68 | 3.63 | − 6.91 | − 9.96 |
| 14 | 9.19 | 27.43 | 13.01 | 18.24 | 3.82 |
| 15 | 27.91 | 20.66 | 19.25 | − 7.26 | − 8.66 |
| 16 | 19.54 | 16.29 | 8.80 | − 3.25 | − 10.74 |
| 17 | 32.77 | 27.18 | 20.15 | − 5.59 | − 12.63 |
| 18 | 10.70 | 35.84 | 19.79 | 25.14 | 9.09 |

*Median values reported

**Image 2** Therapy dog in dental treatment

## Therapy Dog Support Record

The questions to assess the feasibility yield positive support of CSPD in the waiting room and the treatment room. There were no problems associated with the presence of, and interaction with the therapy dog for any patient in regards to resources, time, or commitment. The environment was augmented for every case to provide an additional two chairs in the treatment room for the dog and handler. The dog sat or laid in one chair for the duration of the appointment (see Image 2).

In all interactions, neither dog nor handler disrupted the dental treatment. Only one dog was not comfortable sitting in the chair; the dog sat on the floor within arms-reach of the child. No other arrangements were made or needed. There were no safety issues (i.e. harm to dog, harm from dog to child) observed. One minor safety concern arose when one of the dogs licked the dental mirror as the dentist was holding it over the child's chest demonstrating the procedure for the child. The mirror was removed and replaced with a sanitized mirror. One dog sat in the chair next to the child. In response to the child, the dog learned in towards the child and almost slipped from the dental chair; however, the handler supported the dog from falling.

## Handler's Assessment Report

All dogs were present prior to the appointment and had no issues staying for the duration of the treatment. Handlers shared their observed feedback of their dog's participation with the patient in the waiting room and in the treatment room. One handler wrote: "I was surprised that after sitting next to the boy that [she] felt comfortable enough to curl into a ball in the chair.[She] occasionally licked his hand. The boy petted and held [her] leash". This interaction is demonstrated in the image above, with the boy holding the dog's leash in his left hand and reaching out with his right hand to pet the dog without prompting (see *Image 2*). Another handler shared:

When the tooth had to be extracted and the child's tension visibly rose, she [dog] immediately started licking the child's hand and nudging him to pet her. She went from being relaxed to paying close attention to him. He petted her and settled back down. The dentist removed the tooth so quickly, even the boy was surprised!

Handlers (n = 6) completed the Post-treatment Handler Survey sharing that there were no health concerns (i.e. lack of appetite, abnormal bodily movement, vomiting) as a result of volunteering. One dog had an increased appetite following their volunteer service, one sought closeness to their human more than usual, and one was observed to yawn more than usual; which can be a sign of stress. Two dogs had an increased water intake post service. Five out of the six dogs were observed to sleep more than normal following their visit.

## Discussion

Being a feasibility study, the primary focus was on the ability to collect the necessary amount of saliva, manage the study protocol for handling of saliva, and successfully send the saliva out for analysis. Then, the aim was to successfully measure oxytocin in the saliva assay using the newly refined methodology. Both aims were successfully achieved. The results of no significant findings were postulated at the outset of the study merely based on the small sample size. Yet, even with a small sample, there was still meaningful data.

The inclusion of salivary oxytocin is important an important consideration given the interest in salivary analyte analysis and desire for rigorous measures in AAI research. Based on a thorough review of the existing literature, out of the approximately fifty-four HAI focused, peer-reviewed empirical articles that reference oxytocin only five include primary methodology. Of the five, most are blood and urine samples. This is data towards validation of oxytocin as a reliable measure to assess AAI interventions.

As noted in Fig. 1, cortisol decreased over the three time points for majority of the cases, while alpha-amylase appeared to follow the trend of oxytocin more than cortisol. As biologically complex systems, this is logical, however, this finding also runs counter intuitive to some of the literature (Granger et al., 2006, 2007). Though some literature speculated that the saliva samples required more time than blood or urine, the visual data demonstrates that researchers may have missed the peak window for oxytocin; ten minutes may have been too long to wait for the second saliva collection (Powell et al., 2019). This study served to find descriptive attributes, which allows for many postulations about the unique and complex biological reaction(s) occurring, but very limited ability to empirically test any potential outcomes of CSPD.

Children who can actualize self-efficacy skills were also more willing to support the dentist throughout treatment. This is an important consideration towards understanding child behavior because it suggests that children's negative externalized behavior may not be a demonstration of lack of willingness, but rather their inability to articulate their fears and anxiety—a lack of self-efficacy in the moment. Though novelty is perceived as a threat to validity in some research, the therapy dogs served as positive distractions, calming sources of attention, and provided safe, tactile experiences, to relieve stress. A dog may serve as a conduit for understanding children's needs by modeling behavior to elicit willingness. As noted on the AARP, all children and parents reported that they liked having the therapy dog present before and during the treatment, and would welcome one again.

The data showed no difference by race which is contrary to the assertion in prior literature suggesting that black children may not like or respond to dogs positively given cultural assumptions (Schwartz & Patronik, 2002). Data from this pilot study suggests that children across race and gender may benefit from therapy dogs so long as they, individually, so not have fear or allergic reaction.

As a pilot study, researchers worked closely with the therapy dog program, Pet Pals, and with the handlers to ensure safety. With our efforts, there were no adverse events to report. However, as a standard practice, it must be recognized that dogs are living, sentient beings, they are not machines— though precautions can be established, accidents can happen.

Although it could be perceived as a limitation, the diversity of dogs was a strength of the study. Researchers analyzed the data to determine if there was any variance across feasibility measures for dogs depending on breed or size; none was found. Observationally, researchers noticed that the smaller dogs (i.e. Maltipoo and Cavachon) appeared to be more tired than the larger dogs (i.e. German Shepard and Golden Retriever) by the end of the appointment. This information is helpful because reliance on one dog is very taxing; however, knowing that multiple dogs can provide comfort and relaxation opens practices to the possibility of soliciting multiple volunteers to provide companionship of their certified therapy dogs.

From this study, feasibility for the inclusion of therapy dogs arrives at the nexus of the clinician, client/child, therapy dog, and handler (Fig. 2). Best practices for the inclusion of therapy dogs include: ensuring all handler-dog teams are appropriately certified, limit the amount of volunteer time for each dog to one-hour per day, having a specified place of respite, accessible water, clearly defined space for play with the child, and a clearly defined space for work. In the treatment room, a chair large enough for the dog to sit on was made available so that the dog did not have to share the dental-chair with the child, nor was the child expected to reach to the dog. Before beginning any procedure, the dentist ensured that both the child and the dog were comfortable.

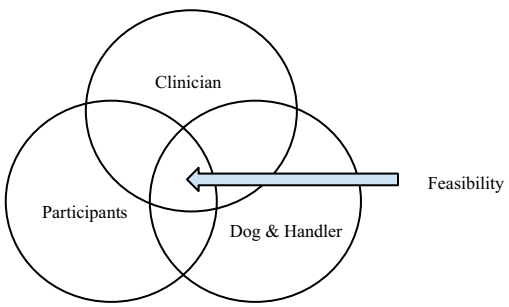


**Fig. 2** Nexus of a feasible AAI intervention

Throughout the procedure, maintaining the dog's comfort was the handler's responsibility. Those seeking to integrate a therapy dog program into private practice are recommended to connect with a therapy dog organization (ex: Therapy Dogs International, Pet Partners), or a professional expert (i.e. International Association of Veterinary Social Work) for consultation and support.

### Strengths and Limitations

The primary limitation of this study is the study design; being a convenience sample and not a randomized control trial (RCT) limits the strength of the potential conclusions. It is not plausible to state the efficacy or impact of this intervention due to the sample size and study design. The sample was based on the convenience of current patients with scheduled appointments, though their files were chosen and reviewed at random. Researchers would have preferred to include more participants; however, the salivary analysis kits dictated the number of cases total, thereby establishing the sample size.

The current study focused on the feasibility of the intervention and methods. In future research, Jacobson and Traux's (1991) framework for understanding clinical significance may prove useful to ascertain the reliability of change experienced post-intervention at an individual level. This is in alignment with the current salivary analyte analysis which measures an individual's baseline saliva sample against their own mid, and post-sample. Therefore, the framework may be ideal for understanding individual impact in a subsequent study.

This pilot study offers various strengths to the research community inclusive of social work, dentistry, and allied fields. All patients were provided treatment by the same dentist, ensuring a consistency of care provided. The researchers were consistent throughout the full study, meaning that all patients interacted with the same person, from consent through to the post-treatment survey. The application of standardized measures ensures a level of quality and rigor. The only researcher-created measures were in direct response to questions raised in previous literature that had no measure available. Reliability and validity metrics were to run on the augmented measures prior to their use.

Limited knowledge about the window of time in which oxytocin peaks was a limitation to assuring appropriate design to successfully measure analytes. While data does support change from baseline (Table 1), researchers cannot yet determine the precise time at which oxytocin peaks. Though the research design was conceptualized from prior empirical research, given that the half-life of oxytocin is only 3–5 min, it is likely that even the 10-min window was too long. Thus, further research may aid in understanding the timeline of oxytocin peaks and falls. Also, further research is needed to determine the correlation between oxytocin levels and expressed behavior as behavior may be an indicator of changes in analyte levels. Another limitation of the saliva samples in this particular environment is that the three time points for collection were all prior to dental treatment. Since the assay is sensitive to blood contamination, sample collection post-dental treatment was not acceptable.

This study successfully evaluated the feasibility of CSPD in a controlled environment; however, eighteen participants does not generalize to a full dental practice, or any other medical practice. Thus, an area of growth would be for researchers to apply the same methods and measures to a larger population, including a control group that receives treatment as usual. This would afford researchers the opportunity to explore within and between group differences across measures. It is arguably important for future research to replicate this study using the same instruments to further advance the research field.

## Conclusion

Results of this pilot study support that CSPD with certified therapy dogs is a feasible intervention in the dental environment. The controlled nature of the dental environment provides insight to generalize the therapeutic effect of CSPD to other similar environments which children may experience AA&SF. This study was a collaborative effort between social welfare and pediatric dentist. As such, social work practitioners are encouraged to continue expanding the scope of practice to include AAI in research and interventions. Both professions are committed to the health and wellness of children. Dentists and medical professionals are encouraged to open their practice doors and research opportunities to social workers and therapy dogs as a non-pharmaceutical approach to providing treatment to children with AA&SF as supported by the findings of this study.

**Author's Contributions** AV: substantial contribution to the conception, design, data analysis and interpretation, and discussion content. MH: substantial contribution to the conception, design, discussion content. KF: substantial contribution to the conception, IRB oversight, interpretation. All authors have approved the final version for submission.

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**Data Availability** The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no competing interests.

**Ethics Approval** All applicable international, national, and/or institutional guidelines for the care and use of animals were followed. All procedures performed in studies involving therapy dog volunteers were in accordance with the ethical standards of the institution at which the studies were conducted (University and Hospital) and with the national organization for the certification of the therapy dogs.

**Informed Consent** Informed consent was obtained from all caregivers/parents of child participants, researchers, and dog-handler volunteers included in the study. Informed consent was obtained from all child participants, researchers, and dog-handler volunteers included in the study.

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