ANIMAL ASSISTED THERAPY:
A SURVEY OF PATIENTS AND CAREGIVERS PERCEPTIONS
IN ORTHODONTICS

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A thesis submitted to the faculty at the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Science in the School of Dentistry (Orthodontics).

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ABSTRACT

(Under the direction of Laura Jacox)

Dental anxiety affects up to 22% of children leading to lifelong dental and orthodontic avoidance. Animal Assisted Therapy (AAT) is used to reduce anxiety and perception of pain in medical settings. To evaluate perceptions of canine AAT in dentistry, a cross-sectional survey (n=721) consisting of pre-tested and validated questions, was conducted of orthodontic patients (n=485) and caregivers (n=236), half randomized to the presence of a therapy dog. Data reveal an overwhelming majority of patients and caregivers expressed little to no concern regarding cleanliness (83%), allergies (81%) and safety (89%) with a therapy animal in a dental setting. All groups believe therapy animals make experiences in dental offices more enjoyable (75%) and reduce anxiety (82%). Interestingly, almost half would preferentially select an office offering AAT. In light of the COVID-19 pandemic, we assessed if perceptions of AAT changed before and after the shutdown of dental offices, with no significant changes found. Across all cohorts, responses strongly support use of AAT in dentistry and suggest it could serve as both a practice builder and anxiety-management tool, with broad public support.
ACKNOWLEDGEMENTS

I would like to first thank my mentor, Dr. Laura Jacox, not only your friendship and encouragement during these last few years, but also your amazing mentorship. You believed in me and gave me the freedom to create a project that I was passionate about, but took on that project like it was your own. You continuously empowered me to become a better clinician, researcher, and person and set such a high example of the woman, both personally and professionally, that I would like to become. Thank you for your drive, persistence, and tenacity to help me through this. I’d also like to thank Dr. Tate Jackson who helped inspire me to pursue this project. You were the first person that gave me the hope that this was possible and I’m so thankful that you enabled me to pursue this endeavor to its fullest. You have been such a great person to learn from and I look forward to our friendship moving forward. Dr. Tim Strauman and Dr. Siggi Saemundsson, your support and attention to detail really tied the project together. It was wonderful getting to know you and I’m grateful for your help and guidance.

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James, you have been with me for the last 6 years and you have made this journey incredible and it wouldn’t have been as enjoyable or fun without you. I couldn’t ask for a better partner to be with me through all my major milestones and I’m looking forward to a lifetime of them with you. I love you so all so much. Thank you for making me who I am.
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAT:</td>
<td>Animal Assisted Therapy</td>
</tr>
<tr>
<td>DA:</td>
<td>Dental Anxiety</td>
</tr>
<tr>
<td>DAS:</td>
<td>Dental Anxiety Scale</td>
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<tr>
<td>MDAS:</td>
<td>Modified Dental Anxiety Scale</td>
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<tr>
<td>OAS:</td>
<td>Orthodontic Anxiety Scale</td>
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CHAPTER I: BACKGROUND OF ANIMAL ASSISTED THERAPY

Introduction

Dental anxiety (DA) affects a 50-80% of adults and 6-22% of children.\textsuperscript{1–4} DA commonly emerges during childhood due to traumatic dental experiences or vicarious learning and often results in lifelong dental-related anxiety and avoidance.\textsuperscript{4,5} DA presents a major challenge to optimizing oral health outcomes and is associated with increased incidence of dental caries, oral infection, and need for urgent care intervention.\textsuperscript{4–9} To reduce lifelong DA, effective behavioral management techniques must be employed during childhood to ensure positive dental experiences.

Dental Anxiety Management Tools

To provide care to children with DA, the American Academy of Pediatric Dentistry (AAPD) advocates the use of pharmacological and non-pharmacological behavior guidance techniques.\textsuperscript{10} Pharmacological sedation, which is typically required for highly anxious patients, carries heightened risk of respiratory depression, loss of protective airway reflexes, cardiovascular instability, neurological injury and death.\textsuperscript{11} Due to the mortality and morbidity associated with pharmacologically assisted management techniques, some parents elect against the use of anesthesia and medications to complete treatment.\textsuperscript{12} This is especially true for orthodontics which is elective care, frequently delayed until patients are capable of complying with treatment; however, this delay can cause patients to miss optimal treatment timing.\textsuperscript{13,14} As a result, non-pharmacological approaches are needed for anxious patients to avoid risks associated with sedation and ensure timely care delivery with positive dental experiences.
Effects of Animal Assisted Therapy

Animal assisted therapy (AAT) is a promising new option for non-pharmacological behavior management in dentistry. AAT is an intervention, typically involving dogs that are trained to be obedient, calm and comforting that is utilized as a goal-oriented treatment modality to help patients. AAT distracts patients and has been shown effective in reducing stress hormones, increasing endorphins, and activating mirror neurons; canines can even smell elevated glucocorticoids and catecholamines, indicative of stress, and respond accordingly. AAT has been widely used in health care settings to successfully reduce anxiety, stress and perception of pain. AAT has been deployed in myriad clinical settings including private homes, day-programs, extended care facilities, nursing homes, hospital in-patient units, psychiatric wards, outpatient clinics and private practices.

Data regarding AAT’s positive effects are encouraging and widespread across medicine, yet the use of AAT in dentistry is in its nascent stages, though initial data are promising. Small studies of AAT use in dentistry have used skin temperature, heart rate, blood pressure and validated survey scales to quantify AAT effects. Dental patients reported a decrease in discomfort and blood pressure, with improvement in the experience with a therapy animal. Havener et al., found that for children who initially verbalized distress, the presence of a therapy dog decreased their physiological arousal while waiting for their dental provider. Another study found improvements in mood and compliance and reductions in salivary cortisol in patients treated with AAT. Though indicative of animal therapy’s promise in dental contexts, further investigation is needed to thoroughly evaluate AAT’s effects using biometrics and questionnaires. A first step to adopting AAT is to investigate acceptability of therapy animals in dental clinics by patients.
CHAPTER II: CURRENT INVESTIGATION

Introduction

Dental anxiety (DA) affects a 50-80% of adults and 6-22% of children.\textsuperscript{1-4} DA commonly emerges during childhood due to traumatic dental experiences or vicarious learning and often results in lifelong dental-related anxiety and avoidance.\textsuperscript{4,5} DA presents a major challenge to optimizing oral health outcomes and is associated with increased incidence of dental caries, oral infection, and need for urgent care intervention.\textsuperscript{4-9} To reduce lifelong DA, effective behavioral management techniques must be employed during childhood to ensure positive dental experiences.

To provide care to children with DA, the American Academy of Pediatric Dentistry (AAPD) advocates the use of pharmacological and non-pharmacological behavior guidance techniques.\textsuperscript{10} Pharmacological sedation, which is typically required for highly anxious patients, carries heightened risk of respiratory depression, loss of protective airway reflexes, cardiovascular instability, neurological injury and death.\textsuperscript{11} Due to the mortality and morbidity associated with pharmacologically assisted management techniques, some parents elect against the use of anesthesia and medications to complete treatment.\textsuperscript{12} This is especially true for orthodontics which is elective care, frequently delayed until patients are capable of complying with treatment; however, this delay can cause patients to miss optimal treatment timing.\textsuperscript{13,14} As a result, non-pharmacological approaches are needed for anxious patients to avoid risks associated with sedation and ensure timely care delivery with positive dental experiences.
Animal assisted therapy (AAT) is a promising new option for non-pharmacological behavior management in dentistry. AAT is an intervention, typically involving dogs that are trained to be obedient, calm and comforting that is utilized as a goal-oriented treatment modality to help patients. AAT distracts patients and has been shown effective in reducing stress hormones, increasing endorphins, and activating mirror neurons; canines can even smell elevated glucocorticoids and catecholamines, indicative of stress, and respond accordingly. AAT has been widely used in health care settings to successfully reduce anxiety, stress and perception of pain. AAT has been deployed in myriad clinical settings including private homes, day-programs, extended care facilities, nursing homes, hospital in-patient units, psychiatric wards, outpatient clinics and private practices.

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Purpose of this study

The purpose of this study is to conduct the first comprehensive evaluation of patients and caregivers’ perceptions of AAT in a dental setting, with participants randomized to presence or absence of a therapy dog. Data collection spanned before and after the COVID-19 pandemic shutdown, allowing us to measure the impact of this crisis on AAT perceptions.

Hypothesis

We hypothesized that AAT is broadly acceptable to orthodontic patients and caregivers alike, with a vast majority (>70%) believing therapy animals would make dental experiences more enjoyable, with infrequent concerns (<30%) for allergies, cleanliness and safety.

Aims of the study

Aim 1: Determine the patient’s and caregivers’ perceptions of therapy animals in dental clinics.

Aim 2: Determine the level of severity and prevalence of anxiety in orthodontic clinics.

Study Design

The study design is a cross sectional survey (IRB approval 19-1908) of patients under 18, over 18, and caregivers of patients at the UNC Adam’s School of Dentistry Graduate Orthodontics Clinic (described below).

Subjects

We conducted a cross-sectional survey of orthodontic patients and their caregivers to determine perceptions of AAT at the University of North Carolina (UNC) Orthodontics Clinic. Our sample includes three groups: minor orthodontic patients (12-17 years old), adult orthodontic patients (18+ years old), and adult caregivers of minor orthodontic patients being treated in the UNC Orthodontics Graduate and Faculty Clinics. Screening questions ensured all participants met inclusion criteria (Table 1). Half of each group was exposed to a therapy dog.
during the survey, as described below. Three cross-sectional quantitative surveys were
developed for our three study populations (see appendix for survey questions). The two patient
surveys (adults and minors) are nearly identical except for modifications for age-appropriate
language with assent and consent processes.

**Survey Development**

Surveys were designed using a combination of 34 pretested or validated published
questions on anxiety and AAT. Validated questions were adapted from the Corah Dental
Anxiety Scale (DAS); it is a widely used, reliable, and useful measure of anxiety of dental
treatment.\textsuperscript{11,27,28} For the Corah DAS, patients are asked a series of validated questions to
determine anxiety levels. Each answer is scored, ranging from 1 point to 5 points. Scores are
then summed to determine the level of perceived dental anxiety. CORAH DAS Score of less than
8 is limited, 9-12 is moderate, 13-14 is high, and 15-20 is severe (Table 6, Fig 4, 5, 6). Those that
fall into the moderate category are considered to have specific stressors that can be managed in
the dental or orthodontic clinics.\textsuperscript{22,29,30} Those that test in the high category usually require a more
significant response, such as anesthesia or medications, to manage anxiety and those in the
severe category are considered to have a phobia that needs management from a professional such
as a psychiatrist.\textsuperscript{22,29,30} An orthodontics-specific version of the DAS was adapted from the
CORAH general dental DAS, pre-tested and included in the survey, to apply directly to
orthodontic dental care (Table 6, Fig 3, 4, 5).\textsuperscript{31-34} For questions where there were not published
or validated tools, the team developed and pre-tested new questions under the guidance of a
survey research expert. New and adapted questions were first assembled by the study team,
before being thoroughly revised by our survey specialist. All questions were then entered into
Qualtrics (Qualtrics XM, Inc., Provo, Utah, USA) and were pre-tested by eight people, including
7 laypeople and 1 dental colleague. Revisions occurred iteratively during pre-testing, until a final draft was approved by the principal investigator and survey expert.

**Survey Distribution**

The survey was administered online via a secure UNC Qualtrics account. Patients were discretely approached in the waiting room of the UNC Orthodontics Clinic by study staff. Patients who verbally agreed to participate were given a card with a QR code linking to consent forms and the Qualtrics survey. Patients filled out the forms and survey on their smartphone. Patients without a smartphone were lent an iPad to fill out consent forms and the survey. The total response rate was 84.9%, of which was 77.4% for patients under 18, 89.0% for patients over 18, and 92.5% for caregivers. Data was collected from patients with and without a certified therapy dog in the waiting room (TND: Time with no dog, TD Time with dog) of the UNC Orthodontics Graduate Clinic. Days were randomly chosen for having the therapy dog, to allow for block randomization of subjects to the dog exposure. All patients and caregivers in the waiting room were approached by study staff for enrollment at roughly 2-hour intervals throughout the clinic day, to ensure patient and caregiver turnover. The dog was positioned near the waiting room sitting area, in a large open air dog pen, and all patients and caregivers were allowed to pet or interact with the therapy dog as desired. There was no specified time or requirement for potential participants to interact with the dog, but participants could see the dog when they checked in and from the waiting room.

Survey distribution began before the COVID-19 pandemic and continued after reopening. Participants who took the survey prior to the shutdown (including n=105 minor patients no dog), did not have questions pertaining to COVID-19. After re-opening, COVID-19 questions were
added to all surveys and roughly half of each group were randomized to a therapy dog AAT exposure (n=294) and no dog exposure (n=315).

Statistics

A row mean differ test was used to test a null hypothesis of equal response location among groups for ordered categorical variables. Descriptive statistics are reported in tables of response frequencies. McNemar’s test to compare dental versus orthodontic anxiety, level of significance was set at p=0.05. Surveys with missing data on variables used in the analysis were removed and not counted in the study. Statistical analyses were conducted using SAS 9 Software (SAS Institute, Cary, NC, USA). Graphs were made using Prism 9 Software (GraphPad Software Inc., La Jolla, CA, USA) and figures were created using Adobe Suite (Adobe Inc., San Jose, CA, USA).
CHAPTER III: RESULTS

Sample

In total, 800 people participated in the study, 194 patients over the age of 18 (adult patients), 291 patients under the age of 18 (minors), and 236 caregivers. The total response rate was 84.9%, of which was 77.4% for patients under 18, 89.0% for patients over 18, and 92.5% for caregivers; this response rate is high, when compared to rates in similar dental studies (71% - 84%). Of those that participated 65.7% (n=460) were female and 34.3% (n=240) were male (Table 2). The majority (68.8%) of participants identified as Caucasian with minority representation of Black (21.6%), Asian (7.57%) and Hispanic (21%) groups, consistent with our patient demographics (Table 2).

71% (n=568) of participants had a pet in their home; 60% of these pets were dogs. Our sample reported a 4% prevalence of canine allergies and 22% prevalence of cynophobia (fear of dogs), including 6% that suffer from a severe phobia, both of which are consistent with the general population.

Concerns about Perceived Impacts of Therapy Dogs in Dentistry

A review regarding AAT in medicine proposed that top hazards of therapy animals in dental offices include safety risks, cleanliness, and allergens including canine allergies and dogs acting as vectors to transmit pollen or zoonotic bacteria. However, our data show that an overwhelming majority of patients and caregivers expressed little to no concern regarding cleanliness (83%), exposure to allergens (81%) or safety (89%) with a therapy animal in a dental setting (Fig 1, Table 3).
In fact, 75% of patients and caregivers indicated that incorporating AAT in dental offices would create a more enjoyable patient experience and 82% indicated that the therapy animal would reduce dental anxiety (Fig 1, Table 4). This overwhelming majority indicates that patients and parents think therapy animals reduce anxiety and increase enjoyment in orthodontic settings. Notably, 44% of parents and 54% of patients under 18 indicated that the presence of a therapy animal in an orthodontic office would be important to deciding which office they select for care. Of these respondents, 88% of parents and 95% of patients under 18 would preferentially select an office offering AAT (Fig 1, Table 5). Data suggest therapy animals may help with practice growth and would be welcomed by many families.
Dental Anxiety and AAT

Corah DAS and Modified DAS (MDAS) have been used broadly as survey tools to measure dental anxiety. Data demonstrate that 45% of all respondents suffer from dental anxiety and (38%) have orthodontic related anxiety (p=0.0003) (Fig 3, Table 6).
Anxiety was widely prevalent, with adult patients reporting less dental and orthodontic anxiety than minor patients and caregivers reporting more dental and orthodontic anxiety than both adult and minor patients (p=0.013 dental, p=0.005 ortho) (Fig 4, Table 6).

**Figure 4. Dental and Orthodontic Anxiety Comparing Age Groups**

Patients under and over 18 reported higher prevalence and severity of dental anxiety than orthodontic anxiety, but nearly one third reported orthodontic anxiety at a moderate or greater level (Fig 4, Table 6). For patients that suffer from a level of anxiety, it is recommended to have some type of intervention to make the patients more comfortable in the dental chair. Those suffering from moderate anxiety would benefit from a non-pharmacologic intervention such as AAT while those in the more severe category usually require a more significant intervention such as nitrous oxide or conscious sedation.\(^{22,29,30}\) With nearly one third of patients reporting orthodontic anxiety necessitating some form of intervention or management is clinically relevant and impactful in orthodontics (U18: p=0.00059, O18: p=0.034). Caregivers’ responses did not have a significant difference in prevalence of orthodontic and dental anxiety (p=0.91), though caregivers had a significantly higher prevalence of severe dental and orthodontic anxiety than patients (p=0.007 dental, p=0.0007 ortho) (Fig 4, Table 6).
On average, men reported similar frequency of dental and orthodontic anxiety (p=0.2364), but women reported significantly higher dental anxiety than orthodontic anxiety (p=0.0001) and had a higher overall prevalence of dental and orthodontic anxiety than men (p=0.0001 dental, p=0.0065 ortho), consistent with published reports (Fig 5, Table 6).22,26,30,46

Figure 5. Dental and Orthodontic Anxiety Comparing Men and Women

<table>
<thead>
<tr>
<th>Anxiety Level</th>
<th>Men: ortho vs dental</th>
<th>Female: ortho vs dental</th>
<th>Dental men vs. women</th>
<th>Ortho men vs. women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited</td>
<td>p = 0.2364</td>
<td>p = 0.0001</td>
<td></td>
<td>p = 0.0065</td>
</tr>
<tr>
<td>Moderate</td>
<td>146</td>
<td>70</td>
<td>125</td>
<td>32</td>
</tr>
<tr>
<td>High</td>
<td>220</td>
<td>63</td>
<td>34</td>
<td>2</td>
</tr>
<tr>
<td>Severe</td>
<td>261</td>
<td>155</td>
<td>21</td>
<td>25</td>
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</tbody>
</table>

Impacts of COVID-19 pandemic on perception of AAT

After the outbreak of SARS-CoV-2 and the resulting COVID-19 pandemic, anxiety levels increased due to pervasive uncertainty and fear of disease.47,48 A large majority (72%) of participants reported an increase in general anxiety during the pandemic, but 75% of respondents indicated that their general anxiety would be reduced by the presence of a therapy dog in day-to-day life (Fig 6, Table 7). A higher percentage of participants (42%) reported a moderate to high level of concern regarding contracting the virus in day-to-day life versus only 27% of respondents were worried about contracting SARS-CoV-2 at a dental or orthodontic office (Fig 6B, Table 8). Adult patients were most concerned about transmission in dental
settings (p=0.03) (Table 8). Despite early reports proposing that SARS-CoV-2 could be spread to and from dogs, concerns regarding contraction of COVID-19 from a dog, including therapy dogs, was low, with 88% of participants reporting little to no fear (Fig 6A, Table 8). A plurality of participants reported feeling uneasy attending visits at dental or orthodontic offices (44.5%), with no significant difference in level of concern between these two dental settings (Fig 6C, Table 9). Patients and caregivers were equally uneasy when considering visiting an orthodontist or general dentist in the wake of the pandemic.

Figure 6: Impacts of COVID-19
CHAPTER IV: DISCUSSION

Discussion of Results

AAT holds promise as a non-pharmacological anxiety management tool in dentistry, with encouraging preliminary studies and widespread adoption in medicine.\textsuperscript{32,51,52} However, for AAT to be adopted in dental clinics, it must be acceptable to patients and families alike, with minimal concern. Editorials and position pieces indicate possible issues with safety, cleanliness and allergens, without evaluating if patients and caregivers share these concerns.\textsuperscript{43,53–55} Research to date has been on smaller samples, sometimes using purely qualitative methods.\textsuperscript{20,35,56,57} To gain a more thorough understanding of perceptions of AAT, we conducted a large cross-sectional survey of orthodontic patients (n= 485, 291 minors under 18, 194 adults patients) and caregivers (n=236) at the UNC Graduate Orthodontic Clinic. More than 80% of all groups reported that they thought AAT would reduce dental anxiety and two out of three people believed a therapy dog would create a more enjoyable patient experience (Fig 1, Table 4). Nearly half of patients and parents indicated that an office with a therapy dog would influence their choice of an orthodontic provider, with an overwhelming majority choosing the practice with a dog (Fig 2, Table 5). This suggests that adding a therapy dog to a practice can provide growth potential, improve the patient experience, and potentially reduce barriers to care in dentistry.

Consistent with our findings, a recent cross-sectional survey found a majority of dental providers and caregivers of pediatric dental patients would accept and exhibit demand for therapy animals in pediatric dental clinics.\textsuperscript{35} As some questions were open-ended, a range of
responses were collected, ranging from positive opinions of the dog’s ability to relax and
distract patients, to negative concerns regarding zoonosis, infection control, and safety. As these
results were qualitative, the prevalence and degree of these perceptions could not be explored.
Our data suggest that the vast majority of caregivers and patients have little to no concern
regarding cleanliness, allergens, or safety for therapy animals in dental clinics (Fig 2). In a
small follow-up study (n=18), Vincent et al. found 100% of parents “liked the therapy dog’s
presence” for management of their child’s anticipatory anxiety and situational fear in the dental
office. Authors concluded that caregivers and dental providers believe therapy animals
provide an, “accessible, non-pharmacologic tool, which is a simple, safe, and cost effective
resource to provide a novel and calming experience” in dental clinics. In a similar vein, Gupta
et al. recommended that dental clinics utilize trained therapy animals, preferably dogs or cats.
Data are consistent across these studies, pointing to widespread acceptance of and demand for
therapy animals.

Although there are few studies regarding anxiety in orthodontics, the process of moving
teeth is a new dental experience that can cause fear and discomfort and therefore be anxiety
inducing. The Corah DAS and MDAS were utilized to determine what anxiety, if any, exists
in general dentistry and orthodontics. Here, we report that approximately 30% of patients
reported moderate dental anxiety (Fig 3, Table 6). We then compared anxiety between general
dentistry and orthodontics and found a significant difference; on average, dental anxiety is more
prevalent than orthodontic-related anxiety, but orthodontic anxiety is still present in about one
third of people (Fig 3). Of those that experience orthodontic anxiety, 28% fall in the moderate
category, indicating that they would be responsive to an anxiety-reducing intervention. It
is evident that orthodontics is anxiety provoking in a sizable fraction of patients, therefore
making it clinically impactful for all practices, and AAT can potentially provide a benefit for anxiety reduction in this anxious patient population.

Given that other studies have demonstrated that women consistently report higher dental anxiety, dental fear, and pain, we next assessed whether gender-specific differences could be found in our cohort. Similar to previous findings, we found that men reported similar anxiety levels between the orthodontic and general dental settings (Fig 5, Table 6). \(^{21,22,26,30,46,60}\) Women, on the other hand, show a significant difference between orthodontic and dental anxiety, indicating that they are more anxious in general dental environments than orthodontic settings (Fig 4, Table 6). When comparing men to women, for both dental and orthodontic anxiety, women report significantly higher anxiety levels in both categories (Fig 5).

Studies have shown that patients over the age of 18 have a higher dental IQ and more optimistic expectations of dentistry than younger patients. \(^{61}\) In agreement with this, we found that adult patients exhibited significantly lower levels of both orthodontic and dental-related anxiety than minors (Fig 4, Table 6). However, 1 in 5 adult patients reported orthodontic related anxiety: a clinically relevant fraction of the population. When performing an intra-age group comparison between dental and orthodontic anxiety, both minors and adults show significant increases in the dental category. This is consistent with our previous finding that adults exhibit more dental related anxiety than orthodontic, but roughly one third of the population suffering from anxiousness at the orthodontist is still notable. Caregivers were the only group to not show significant differences between dental and orthodontic anxiety which could be due to the fact that parents are anxious about what is happening with their kids in an orthodontic setting.

Future studies will address this study limitation and include therapy dog interaction on biometric measures of anxiety. Further investigations are necessary involving a timed and
planned interaction with a therapy animal in order to determine a physiological effect on anxiety levels.

This study was initiated in February of 2020 and enrollment was ongoing when the COVID-19 pandemic shutdown occurred. Thus, we added survey questions to assess the effect of the pandemic on anxiety. The onset of the global COVID-19 pandemic has been shown to cause a significant increase in anxiety and depression, stress, mood disorders, substance abuse, suicidal ideation and sleep disruptions. Over the course of the pandemic, about 4 in 10 adults in the U.S. reported symptoms of anxiety or depressive disorder, up from 1 in 10 adults (in 2019). These increases in generalized anxiety and depression are likely due to loneliness, child-care challenges, job loss, economic uncertainty, and fear of disease; further, this phenomenon has been documented globally, with an elevated level of stress and anxiety across the world.

In line with this, our data demonstrate that a large majority of participants (72%) felt an increase in general anxiety after the onset of the pandemic (Fig 6, Table 7). Our data show that participants think a therapy animal will help with day-to-day stress, as well as dental related anxiety, suggesting that expanded presence of therapy animals could be beneficial in difficult times (Fig 6B). Interestingly, we found no significant differences regarding therapy animal cleanliness or safety (Fig 1) in surveys conducted pre- and post-pandemic, though 11% of patients in our study did report some concern of contracting SARS-CoV2 from dogs (Fig 6A, Table 8). Together, this finding was slightly surprising due to early concerns in the popular press about possible transmission through animals including dogs, despite the CDC stating that risk of human-canine transmission is low. Furthermore, there is no evidence that the virus can spread to people from the skin, fur, or hair of pets, therefore negating pets as a vector for the
spread of COVID-19.\textsuperscript{50,66,69} In light of this, additional patient education regarding the use of AAT during the COVID-19 pandemic could be beneficial to allay any fears.

**Limitations**

The survey sample consists of orthodontic patients and caregivers of minors in orthodontic treatment. The sample was biased by including feedback from people who agreed to participate in a survey administered via smartphone or iPad accessed with QR code; these are more technologically savvy individuals who are comfortable with smart phones and computers. The sample is also biased by enrolling participants who have chosen to pursue orthodontic treatment and presented for appointments, and therefore have manageable levels of dental related anxiety. Data on dental anxiety was also subject to recall bias, as the patients were about to attend an orthodontic visit, and not a general dental visit. The sample was representative of our patient demographics at UNC, with a large majority of Caucasians and non-Hispanic people, with more limited representation of other racial and ethnic groups (Table 2). All patients and caregivers chose to pursue orthodontic treatment at UNC Adams School of Dentistry, which is less expensive than private practice; this likely skews our participant pool lower socioeconomically, but we do not anticipate this impacting our conclusions regarding AAT. Our sample was also limited to residents of the state of North Carolina, and may not be representative of the country, as a whole, or other countries. Future directions include expanding this survey to include patients and caregivers in general and pediatric dentistry, in private practice settings, in other states and countries, and with a more racially and ethnically diverse study population. Surveying dental providers on their incentives and barriers to AAT adoption would also be a valuable next step.
Because the survey was lengthy, the sample was also skewed towards participants who had time to respond before their appointments began; the time in the waiting room is random and unpredictable so it is unlikely to influence the data in one direction or another. Though the length of our survey was likely a deterrent for some potential participants, our response rate of 84.5% was on the higher end of the spectrum when compared to similar dental surveys (71%-84%).\textsuperscript{22,35,36} Despite these limitations, understanding the AAT adoption landscape is valuable to the future development and integration of therapy animals into dental settings. This study indicates widespread acceptability among a large patient population yet does not directly evaluate the physiological impacts of AAT on patients undergoing dental procedures. Therefore, we are conducting a randomized controlled trial using AAT in pediatric dental populations.

\textbf{Future Inquiry}

Despite compelling data indicating low risk to patients, widespread interest and potential promise for AAT in dental settings for anxiety management, there is imminent risk to the continued availability of therapy animals in some places.\textsuperscript{70,71} The North Carolina State Board of Dental Examiners, is the first state to discuss amendments to rules, excluding therapy dogs and other animals, who are not qualified as full service animals, from clinical settings. Their concern is without strict specifications on training guidelines, there is no way to prohibit other types of animals, like boa constrictors.\textsuperscript{70} But there is hope for the future of furry friends in practice because as therapy animals become more accepted and present, education standards to ensure proper animal training to benefit both the patients and the animals should include those outlined by the CDC, SHEA, and Pet Partners.\textsuperscript{71}
The study is highly relevant to orthodontics and pediatric dentistry studies, as the two fields are closely related through dual-specialty practices and sharing a patient base. The promise of AAT is also applicable to adult populations as adult patients and caregivers shared positive perceptions of therapy dogs in dental clinics. AAT has been widely adopted in the US and Europe for medical settings and dentistry is the next frontier, with the high prevalence of dental anxiety leading to avoidance and poor clinical outcome.\textsuperscript{4-9} Future studies investigating the physiological and psychological impact of AAT in dental settings will likely yield valuable results to guide optimal therapy animal implementation in dental contexts. If efficacious, AAT will offer dental providers a non-invasive, low-risk approach to both anxiety and behavior management and providing positive dental experiences to patients. Results presented here indicate that patients and caregivers would welcome therapy dogs into dental settings with few concerns and enthusiasm.
Conclusions

1. Data indicates that the vast majority of families are unconcerned with the potential allergies (81%), safety (89%), and cleanliness (83%) issues of having therapy dogs in orthodontic offices.

2. 3 out of 4 patients and caregivers view AAT as an enjoyable addition to a clinic that would increase their odds of choosing a particular practice.

3. 82% of patients and caregivers believe that AAT will reduce dental related anxiety and

4. Results suggest AAT could be a valuable practice builder and promising anxiety-management tool welcomed by the majority of patients and caregivers.

5. There is a statistically significant uptick in the presence of dental anxiety when compared to orthodontic anxiety, but the presence of anxiety is clinically significant.

6. More than one third of patients under the age of 18, suffer from a form of orthodontic anxiety, indicating a therapeutic need an intervention like AAT.

7. Further investigation into the use of AAT in dental clinics is justified based on the broad acceptability of utilizing therapy dogs in dentistry.
### Table 1: Inclusion/Exclusion Criteria

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Orthodontic patient in the UNC Orthodontics Graduate or Faculty practice (12-17yo or 18+yo) OR -Parent or caregiver of a minor patient in the UNC Orthodontics Graduate or Faculty Practice</td>
<td>-Under the age of 12yo -Prior participant in the survey -Non-fluent English speaker or reader (cannot read English) -Does not consent to participate -For patients- Not undergoing orthodontic care -For caretakers- children not undergoing orthodontic care -Only one caregiver per family unit could be included</td>
</tr>
</tbody>
</table>
Table 2: Sample Demographics

<table>
<thead>
<tr>
<th>Category</th>
<th>Group</th>
<th>Percentage (%) and number per group (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td>Caucasian</td>
<td>68.84% (n=391)</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>21.65% (n=123)</td>
</tr>
<tr>
<td></td>
<td>Asian</td>
<td>7.57% (n=43)</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>1.94% (n=11)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Hispanic</td>
<td>18.75% (n=150)</td>
</tr>
<tr>
<td></td>
<td>Not Hispanic</td>
<td>81.25% (n=650)</td>
</tr>
<tr>
<td>Sex</td>
<td>Female</td>
<td>65.71% (n=460)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>34.29% (n=240)</td>
</tr>
<tr>
<td>Dog Exposure</td>
<td>With dog</td>
<td>41.0% (n=328)</td>
</tr>
<tr>
<td></td>
<td>Without dog</td>
<td>59.0% (n=472)</td>
</tr>
<tr>
<td>COVID</td>
<td>Precovid</td>
<td>16.13% (n=129)</td>
</tr>
<tr>
<td></td>
<td>post-covid</td>
<td>83.87% (n=671)</td>
</tr>
<tr>
<td>Participant groups</td>
<td>Patients who are minorities under 18yo</td>
<td>40.36% (n=291)</td>
</tr>
<tr>
<td></td>
<td>Adult patients</td>
<td>26.91% (n=194)</td>
</tr>
<tr>
<td></td>
<td>Caregivers</td>
<td>32.73% (n=236)</td>
</tr>
<tr>
<td></td>
<td>Total n=800</td>
<td></td>
</tr>
</tbody>
</table>
Table 3: Concerns related to Animal Assisted Therapy (AAT)

When thinking about a therapy dog in a dental setting, how much concern would you have for each of the following?

<table>
<thead>
<tr>
<th>Concern</th>
<th>Little to No Concern</th>
<th>Medium to Large Concern</th>
<th>N</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanliness</td>
<td>83% 599</td>
<td>17% 122</td>
<td>721</td>
<td>0.2</td>
</tr>
<tr>
<td>Allergies</td>
<td>81% 583</td>
<td>19% 135</td>
<td>718</td>
<td>0.245</td>
</tr>
<tr>
<td>Safety</td>
<td>89% 642</td>
<td>11% 76</td>
<td>718</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Table 4: AAT’s Impact on Anxiety and Enjoyment

In general, how much do you think a therapy dog in a dental office would change?

<table>
<thead>
<tr>
<th>Impact</th>
<th>Reduce</th>
<th>No Impact</th>
<th>Increase</th>
<th>N</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>82% 585</td>
<td>9% 66</td>
<td>9% 63</td>
<td>718</td>
<td>0.85</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>4% 30</td>
<td>21% 147</td>
<td>75% 534</td>
<td>711</td>
<td>0.00003</td>
</tr>
</tbody>
</table>
Table 5: AAT’s Impact on Patient and Caregiver’s Orthodontic Office Selection

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Yes</th>
<th>No</th>
<th>N</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 18</td>
<td>54.5%</td>
<td>45.5%</td>
<td>279</td>
<td>0.23031</td>
</tr>
<tr>
<td>Over 18</td>
<td>43.2%</td>
<td>56.8%</td>
<td>185</td>
<td></td>
</tr>
<tr>
<td>Adults</td>
<td>44.2%</td>
<td>55.8%</td>
<td>231</td>
<td></td>
</tr>
</tbody>
</table>

If answered "yes" above, Which practice would you pick?

<table>
<thead>
<tr>
<th>Age Group</th>
<th>With Dog</th>
<th>Without Dog</th>
<th>N</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 18</td>
<td>96.1%</td>
<td>3.9%</td>
<td>152</td>
<td></td>
</tr>
<tr>
<td>Over 18</td>
<td>90.0%</td>
<td>10.0%</td>
<td>80</td>
<td>0.033*</td>
</tr>
<tr>
<td>Adults</td>
<td>88.2%</td>
<td>11.8%</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>Anxiety Category</td>
<td>Limited</td>
<td>Moderate</td>
<td>High</td>
<td>Severe</td>
</tr>
<tr>
<td>------------------</td>
<td>---------</td>
<td>----------</td>
<td>------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>All Participants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental</td>
<td>54.82</td>
<td>33.28</td>
<td>5.88</td>
<td>6.02</td>
</tr>
<tr>
<td>Ortho</td>
<td>62.65</td>
<td>28.76</td>
<td>4.52</td>
<td>4.07</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental</td>
<td>63.5%</td>
<td>30.4%</td>
<td>2.6%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Orthodontic</td>
<td>67.0%</td>
<td>28.1%</td>
<td>4.0%</td>
<td>0.9%</td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental</td>
<td>49.9%</td>
<td>35.2%</td>
<td>7.7%</td>
<td>7.3%</td>
</tr>
<tr>
<td>Orthodontic</td>
<td>60.4%</td>
<td>28.9%</td>
<td>4.9%</td>
<td>5.8%</td>
</tr>
<tr>
<td><strong>Under 18</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental</td>
<td>56.3%</td>
<td>34.6%</td>
<td>4.4%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Orthodontic</td>
<td>64.7%</td>
<td>27.8%</td>
<td>4.9%</td>
<td>2.6%</td>
</tr>
<tr>
<td><strong>Over 18</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental</td>
<td>60.9%</td>
<td>29.6%</td>
<td>5.0%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Orthodontic</td>
<td>73.0%</td>
<td>20.1%</td>
<td>3.5%</td>
<td>3.5%</td>
</tr>
<tr>
<td><strong>Caregivers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental</td>
<td>48.3%</td>
<td>35.1%</td>
<td>8.3%</td>
<td>8.3%</td>
</tr>
<tr>
<td>Orthodontic</td>
<td>52.2%</td>
<td>36.6%</td>
<td>4.9%</td>
<td>6.2%</td>
</tr>
<tr>
<td><strong>Dog present</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental</td>
<td>51.8%</td>
<td>33.5%</td>
<td>9.4%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Orthodontic</td>
<td>57.4%</td>
<td>32.6%</td>
<td>5.2%</td>
<td>4.8%</td>
</tr>
<tr>
<td><strong>No dog present</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental</td>
<td>56.9%</td>
<td>33.4%</td>
<td>3.5%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Orthodontic</td>
<td>66.2%</td>
<td>26.1%</td>
<td>4.1%</td>
<td>3.6%</td>
</tr>
</tbody>
</table>
Table 7: Impact of COVID-19 on stress and AAT

After the outbreak of COVID-19, how has your day to day stress changed? And how do you think a therapy dog in a dental office would change anxiety levels related to COVID-19?

<table>
<thead>
<tr>
<th></th>
<th>Increase</th>
<th>No Impact</th>
<th>Reduce</th>
<th>N</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day to Day Stress</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Q36)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 18</td>
<td>80%</td>
<td>14%</td>
<td>6%</td>
<td>173</td>
<td>0.00006*</td>
</tr>
<tr>
<td>Under 18</td>
<td>58%</td>
<td>33%</td>
<td>10%</td>
<td>168</td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>77%</td>
<td>20%</td>
<td>3%</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td><strong>Therapy Dog's</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Effect on Stress</strong></td>
<td>(Q41)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 18</td>
<td>7%</td>
<td>18%</td>
<td>75%</td>
<td>170</td>
<td>0.0158*</td>
</tr>
<tr>
<td>Under 18</td>
<td>8%</td>
<td>14%</td>
<td>78%</td>
<td>163</td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>10%</td>
<td>18%</td>
<td>72%</td>
<td>226</td>
<td></td>
</tr>
</tbody>
</table>
Table 8: COVID-19 Concerns regarding contraction of virus

<table>
<thead>
<tr>
<th></th>
<th>Little to No Concern</th>
<th>Med to Large Concern</th>
<th>N</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contraction of Virus in General (Q39)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 18</td>
<td>52%</td>
<td>48%</td>
<td>172</td>
<td></td>
</tr>
<tr>
<td>Under 18</td>
<td>64%</td>
<td>36%</td>
<td>166</td>
<td>0.0208*</td>
</tr>
<tr>
<td>Parents</td>
<td>58%</td>
<td>42%</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td></td>
<td>89</td>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>106</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>131</td>
<td>96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contraction of a virus in a Dental or Orthodontic office (Q40)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 18</td>
<td>71%</td>
<td>29%</td>
<td>171</td>
<td></td>
</tr>
<tr>
<td>Under 18</td>
<td>75%</td>
<td>25%</td>
<td>164</td>
<td>0.9466</td>
</tr>
<tr>
<td>Parents</td>
<td>73%</td>
<td>27%</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td></td>
<td>121</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>123</td>
<td>41</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>166</td>
<td>61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contraction of the virus from a dog (Q43)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 18</td>
<td>86%</td>
<td>14%</td>
<td>171</td>
<td></td>
</tr>
<tr>
<td>Under 18</td>
<td>91%</td>
<td>9%</td>
<td>161</td>
<td>0.0368*</td>
</tr>
<tr>
<td>Parents</td>
<td>88%</td>
<td>12%</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td></td>
<td>147</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>146</td>
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</tr>
<tr>
<td></td>
<td>200</td>
<td>27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9: Feelings towards going to a dental office after the COVID-19 pandemic

<table>
<thead>
<tr>
<th></th>
<th>Relaxed</th>
<th>Uneasy</th>
<th>Tense</th>
<th>Anxious</th>
<th>Feel Sick</th>
<th>N</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental (Q37)</td>
<td>38%</td>
<td>44%</td>
<td>9%</td>
<td>8%</td>
<td>1%</td>
<td>6</td>
<td>0.1735</td>
</tr>
<tr>
<td></td>
<td>216</td>
<td>251</td>
<td>49</td>
<td>43</td>
<td>6</td>
<td>565</td>
<td></td>
</tr>
<tr>
<td>Orthodontic (Q38)</td>
<td>40%</td>
<td>45%</td>
<td>8%</td>
<td>6%</td>
<td>1%</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>227</td>
<td>253</td>
<td>45</td>
<td>35</td>
<td>3</td>
<td>563</td>
<td></td>
</tr>
</tbody>
</table>
FIGURES

Figure 1. Patient and caregivers AAT perceptions in orthodontic clinics.

Figure 2. AAT Influence on Patient’s and Caregivers’ Decision Making
Figure 3: Overall Dental vs. Orthodontic Anxiety

![Bar chart showing percentage of Dental vs. Orthodontic Anxiety by anxiety level.](chart1)

Figure 4: Dental vs. Orthodontic Anxiety in Age Groups

![Bar charts showing Dental Anxiety and Orthodontic Anxiety in Under 18, Over 18, and Caregivers by anxiety level.](chart2)
Figure 5: Dental vs. Orthodontic Anxiety in Men and Women

![Anxiety Levels: Men vs. Women](image)

- Men: ortho vs dental: p = 0.2264
- Female: ortho vs dental: p = 0.0001
- Dental men vs. women: p = 0.00612
- Ortho men vs. women: p = 0.0065

Figure 6: Impacts of COVID-19

![COVID-19 Contraction Concern](image)

![Post COVID-19 Anxiety Level](image)

![Concern Regarding Dental Professionals after COVID-19](image)
REFERENCES


69. If You Have Pets. CDC.
