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Animal-Assisted Therapy in Dentistry: A Review

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Abstract

Animal-assisted therapy (AAT) is considered a beneficial method to improve children's and adolescents' mental and physical health, especially in medical settings. It is a recent phenomenon in dentistry as an advanced behavioral management technique to reduce anxiety. It is generally applied in children, patients with known dental phobia, patients who cannot benefit from other behavior management techniques such as those with autism spectrum disorder or Down syndrome, and patients who are not appropriate for sedation or general anesthesia. The aim of AAT in dentistry is reducing anxiety toward dental procedures and improving patient satisfaction. The interest of humans in animals comes from the fact that primitive human survival depended in part on animals in the environment, which is correlated with the biophilia hypothesis. When animals are in a peaceful state, especially dogs, the situation can signal safety, security, and a sense of well-being for both humans and animals. Dogs are appropriate therapy animals for dentistry because they have developed human-like social skills during their domestication over time. They are sensitive to human posture, attentional situations, and emotions. This review aims to investigate and summarize the use of AAT in dental care. Various articles in the literature were reviewed. The main results indicate that AAT is an effective method for controlling anxiety in dental settings, but further investigations and studies should be performed to determine definitive results.

Keywords: Animal-assisted therapy, dental anxiety, dentistry, pediatric dentistry

What is already known on this topic?

- *Animal-Assisted Therapy (AAT) is an effective behavioral management technique in various medical and psychiatric fields, including pediatrics and rehabilitation, to reduce anxiety and improve patient cooperation.*
- *AAT has been shown to decrease anxiety and pain perception in different healthcare settings, leading to reduced reliance on pharmacologic sedation and general anesthesia.*
- *Although AAT is a promising approach in dentistry, its use is still limited and not widely researched.*

What this study adds on this topic?

- *This review consolidates existing research on AAT in dentistry, highlighting its effectiveness in reducing dental anxiety and improving patient experience, especially in pediatric patients and those with special needs.*
- *It discusses the practical applications of AAT in dental clinics and the necessary considerations, such as animal selection, patient suitability, and clinical environment adjustments, for successful implementation.*
- *It emphasizes the need for further large-scale studies to establish standardized guidelines and confirm AAT's long-term benefits and safety in dental practice.*

INTRODUCTION

Dental anxiety is a reaction to a known or perceived threat or danger in the dental environment. It is very common in both adults and children in the community and leads to the avoidance of dental examinations and treatments, which eventually results in oral and general health problems, reducing the quality of life. To avoid these outcomes and increase dental attendance, many methods were developed to cope with dental anxiety.[1]

The American Academy of Pediatric Dentistry (AAPD) recommends pharmacologic and non-pharmacologic methods to overcome dental anxiety. Behavior management techniques (BMTs) have been studied and used in recent years because pharmacologic methods require advanced clinical settings and experienced physicians for their application. Conventional BMTs include methods such as tell-show-do, distraction, voice control, and desensitization, but they are not limited to these.[1] Animal-assisted therapy (AAT) is one of the emerging methods of BMT in dentistry. Animals and humans have had a positive relationship over centuries, but integration of animal-assisted

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interventions (AAIs) in healthcare is a recent phenomenon. Animals are considered socialization tools for people, and this theory has been used especially in psychiatric hospitals since the 18th century.[2] Even though animals are appreciated for their effectiveness in making ill people feel better, the professional use of these methods was not harbored until the 1960s. Since then, the use of animals as a therapy method has featured in the literature, especially in medical fields.[3]

The AAPD includes AAT in guidelines of BMTs, but it is not a completely affirmed intervention in the area of dentistry for reducing anxiety. Even though AAT and AAI have shown good results in the medical field, it is little used and researched in dentistry despite promising early findings. This review aimed to collect and summarize data about the use of AAT in dentistry.[1]

Management of Anxiety in Dentistry

Anxiety is a feeling of uneasiness that originates from the anticipation of danger. In cases of dental anxiety, the danger lies in visiting a dentist or undergoing any dental treatment. Dental anxiety is the fifth most common type of anxiety in the community, according to Agras et al.[4] Fear or phobia is a reaction to a known or perceived threat that evokes a fight-or-flight response. Both dental anxiety and phobia arise due to multiple reasons, such as painful stimuli, lack of understanding, and previous traumatic experiences. Patients with anxiety have increased pain perception, resulting in difficulty in the treatment process for both the patient and the dentist. Additionally, these patients avoid dental visits, which results in a vicious cycle of poor oral health leading to more anxiety. Patients with anxiety should be identified and managed appropriately for a better treatment experience and improved oral health outcomes.

Anxiety management starts with the dental environment, which has contributors such as the ambiance of the dental office, behaviors of the dental team, and the waiting time of the patient. Bidirectional communication between the dentist and patient is crucial to build trust. Management of dental anxiety includes psychotherapeutic interventions, pharmacologic methods, or a combination of both. Behavior management techniques involve strategies of relaxation, guided imagery, biofeedback, modeling, tell-show-do, ask-tell-ask, positive reinforcement, distraction, hypnotherapy, acupuncture, desensitization, enhancing control, voice control, and AAT. The AAPD stated that AAT was an adjunctive technique for decreasing a patient's anxiety, emotional distress, and pain. Pharmacologic methods should only be sought when the patient is not responsive, uncooperative to psychotherapeutic interventions, not willing to undergo this type of treatment, or has dental phobia. These methods are conscious sedation, inhalation sedation, and general anesthesia.[5]

Terminology Regarding Animal-Assisted Therapy

Animal-assisted therapy is a form of therapy that involves animals as an important part of an individual's treatment. The most common animal types used in this technique are dogs, followed by cats, small animals such as rabbits, birds, and fish, and large animals, mostly horses, elephants, and dolphins. The International Association of Human-Animal Interaction Organizations (IAHAIO) indicated that there was a huge variation in definitions of AAT, and in 2018, the organization published a final glossary and guideline regarding human-animal interaction activities. According to this guideline, AAI is a structured intervention that incorporates animals in health, education, and human services for the purpose of therapeutic gains in humans.[6] Animal-assisted therapy is a therapeutic intervention delivered by a trained expert to enhance the physical, cognitive, behavioral, and socio-emotional well-being of humans.[7] Providing human and animal well-being are 2 main guidelines of AAT. Human well-being includes the safety of the human recipient and handlers. Animal well-being includes using animals that are healthy (both physically and emotionally) and enjoy this type of activity.

Human-Animal Bond and History of Animal-Assisted Therapy

Throughout human history, animals have been a centerpiece of human survival, health, and healing. The domestication of animals resulted from a mutual cooperation based on common needs such as shelter, food, and protection. Evidence shows that wolves, ancestors of dogs, lived in settlements with humans for over 14 000 years.[8]

The human–animal bond is a beneficial and dynamic relationship between people and animals that is influenced by behaviors considered essential to the health and well-being of both. Companion animals (pets) have become important in the lives of humans. The reason behind this is that humans are a social species and domestic animals, with which humans live in symbiotic relationships, are also social species that find comfort in the company of humans. Boris Levinson stated that domestication was solely based on man's physiologic needs.[9] The potential of animals as a therapeutic tool was first recognized in the 19th century when Florence Nightingale performed several experiments with patients who were mentally disabled. She discovered that small pets comforted patients in psychiatric hospitals, and later AAT was investigated as a method for reducing anxiety. In the 20th century, Freud used his dog Jofi during his sessions and realized that the proximity of Jofi to the patient highly affected the relaxation level of the patient. Also, most of Freud's patients who were resistant to talking with him started to talk through Jofi, which eventually started the communication between the patient and the therapist. In the 1960s, Boris Levinson, who would later be remembered as the father of AAT, discovered that a nonverbal child began to communicate when Levinson's dog was near him. He realized the same pattern with children who were resistant to communication.[10]

Within the last 30 years, extensive medical literature has confirmed that any relationship that makes a person feel cared for, loved, or esteemed is a positive relationship,

improving human health and survival. Even though animal companionship provides this kind of effect, recognition of this method is at a low level in the medical field, and it is financially undersupported.

Application and Use of Animal-Assisted Therapy

Animal-assisted therapy incorporates specifically selected and trained animals into therapeutic plans directed at a human recipient to promote their general their well-being. It is planned and delivered by a person who has been educated in, is licensed for, or has graduated from a specific discipline within healthcare or social welfare services. They also need additional education related to AAT. The intervention may be delivered in a variety of settings with a range of ages and may be individual or group in nature. For instance, in dentistry, AAT is provided in a waiting room with children by allowing interaction to occur between a therapy dog and pediatric patients to make them more comfortable just before the examination or treatment. Additionally, AAT can be provided in a dental operation room by allowing the therapy animal to sit on the lap of the patient during the treatment period, which is generally around 40-45 minutes. According to O'Callaghan and Chandler,[11] AAT can be implemented through various methods, all designed to foster a positive and cooperative relationship during the treatment process. These methods may involve observing and commenting on the interactions between the patient and the therapy animal to provide positive reinforcement, encouraging the patient to engage with the animal through activities like petting, or, if the animal must remain at a distance, the healthcare professional can share information about the therapy animal or narrate animal-themed stories to the patient. This intervention requires 4 equally involved components, which are the participant, the animal handler, the healthcare provider, and the animal.

The use of AAT includes several steps:

1. Preparation and planning: the animal handler should complete a visit to the facility to perform a risk assessment and management plan. Therapists working in AAT should have basic information about the requirements of AAT and what can be achieved through the program. Prior to the program implementation, identification of the areas that AAT will be used should be made by animal handlers, and therapists should plan the treatment goals and measure the client performance.
2. Professional qualifications and ethical guidelines: AAT sessions should be practiced within a specific scope of disciplines, and all information and documentation regarding the AAT program should be confidential.
3. Mentoring and supervision: AAT professionals who are new to the practice should collaborate with mentors with experience.
4. Documentation: participant records should include professional documentation from healthcare or human service providers to demonstrate their role in AAT. Additionally, the animal handler is responsible for recording assessments of the animal's behavior and health, as well as documenting any incidents.
5. Goal-directed activities: The focus of the treatment should always be on the therapeutic goals and outcomes, which may include the setup, planning, and organization.
6. Termination of services: Once the therapeutic goals are no longer supported, the treatment should be discontinued.[12]

Key components of the successful use of AAT are interdisciplinary collaboration, establishing realistic goals, determining possible problems during the planning phase, supervision, and appropriate animal selection according to type, breed, age, sex, and intended use. Additionally, consideration of animal–human health and environmental concerns.[13] Animals involved in AAT generally have basic obedience skills, predictable behaviors, and enjoy being with people. This requires proper training. The animal should be trained in such a way that it does not eat anything on the floor, such as dropped medications or solutions, and can handle loud voices and chaotic environments such as dental settings. Most of the time, the appropriate animals used in dentistry and the medical field are dogs for relaxation because they are more obedient and are more relatable to humans. Animal-assisted therapy should only be conducted when both the patient and the therapy animal can remain in a state of well-being. Achieving this requires adherence to specific standards. Healthcare professionals must minimize risks for patients by addressing potential issues such as allergies, immunosuppression, and zoonotic infections. Additionally, providers should be prepared to explore and discuss alternative treatment options with patients who may have differing opinions or beliefs about animals that could restrict the use of AAT.[14]

Guidelines for incorporating animals in AAT include basic requirements, preparation of the therapy animal, and consideration of safety and comfort guidelines. Basic requirements include that all animals should have excellent temperament, be calm and gentle, prepared for unusual circumstances such as unexpected sights, sounds, and smells, be obedient, able to regain self-control after excitement, sit quietly for long periods, navigate through crowds, and be attentive to the handler. Preparation of the therapy animal includes the aim of the animal being comfortable with strangers, walking comfortably on a leash, sitting–staying–coming–lying down on command, being able to ignore other animals, practicing self-control, and refraining from any aggressive responses. The main rule of AAT to follow is always protecting the therapy animal by removing the animal from all stressful conditions, giving the therapy animal breaks including walks and play breaks, having fresh water and toys ready, and establishing a safe space away from any stimulation.

Animal-assisted therapy is used in fields of medicine, psychiatry, and dentistry, and it is also used in nursing homes, old-age homes, hospitals, and prisons. In medicine, it is generally used to control anxiety and pain. It has been shown that the requirement for pain medications is reduced after animal interactions prior to or during sessions, and anxiety levels of patients decrease after AAT interventions in emergency units, orthopedics, intensive care units, internal medicine, and gynecology and obstetrics clinics.[15-20] Animal-assisted therapy is also commonly used in pediatric hospitals to increase mood and self-esteem during post-treatment, reduce anxiety towards subsequent treatments, and control pain. Especially in pediatric oncology patients, pain is significantly reduced, and confidence is improved after AAT. Even a weekly interaction with a dog has been shown to be effective.[21-24] In psychiatry and psychology, the use of AAT is extensive: pervasive developmental disorders that appear in early childhood and cause underdeveloped social skills and behaviors, such as autism spectrum disorder, can be improved with AAT. Also, companion animals positively affect the daily social functioning of children and adults by contributing to their social change.[25] Stress and anxiety, which are the main contributors to cardiovascular diseases, can be decreased by animal companions. As AAT reduces stress and anxiety, it can be beneficial for depression. It was observed that AAT was as effective as traditional speech therapy for aphasia because it provided relaxation to patients.[26] Animal Assisted Activities (AAA) and AAT are both beneficial for schizophrenia, dementia, and Alzheimer's disease by developing motivation and creating positive influences on social behaviors and physical activities.[24,27] Animal-assisted therapy is considered an auxiliary method to palliative care, especially in nursing homes for the elderly. It has been shown that animal friendship has physical and physiological benefits in older people in hospitals and nursing homes. Nutritional intake, body weight, physical activities, patient satisfaction, and socialization were improved, and anxiety and depression levels were decreased during AAA/AAT application sessions in the elderly.[28-30] As AAT has been proven to be effective in psychotherapy and medicine, it is a newly emerging method in dentistry. It is generally applied in children, patients with known dental phobia, patients who cannot benefit from other BMT such as patients with autism spectrum disorder or Down syndrome, and patients who are not appropriate for sedation or general anesthesia. The aim of AAT in dentistry is reducing anxiety towards dental procedures and improving patient satisfaction. Although a diverse range of animals is used in the medical field, such as birds, dolphins, horses, dogs, fish, and cats, the literature shows that dogs are more popular during dental procedures.[31]

Benefits and Risks of Animal-Assisted Therapy

Animal-assisted therapy has a wide range of positive outcomes on the physical and psychological state of an individual. Many studies have focused on frail groups including children, the elderly, and psychological inpatients. Communication and social skills, which are generally compromised in these groups of people, can be improved by AAT and AAI. It has been shown in many studies that animal contact reduces aggressiveness, which can be considered a handicap during treatments, especially in the consent phase, because patients generally find opening up easier in the presence of an animal. Also, teaching animal tricks and commands improves the self-esteem of the patient. Since anxiety, depression, and pain are the main reasons for neglecting dental treatment, commonly these 3 components are commonly assessed as outcomes in studies related to AAT. Animal-assisted therapy has been shown to be an effective method to control pain both in medical and surgical areas, reducing the need for oral pain medication, increasing patient satisfaction, and improving systemic health. Anxiety symptoms have been evaluated using physiological indicators and surveys in most AAT studies, and anxiety is nearly always decreased with AAT during a wide range of treatment types. Even having an aquarium in a waiting room or a corridor of a hospital decreased the anxiety levels of patients by having contact with fish. Animal-assisted therapy can also be considered as a healing power according to Charnetski et al[32] because even 20 minutes of contact with therapy animals increases salivary immunoglobulin A in patients, indicating a healthy immune system. Neurotransmitters such as oxytocin, prolactin, dopamine, and norepinephrine are released during AAT, especially during physical contact such as having an animal lying on a patient's lap, petting an animal in the waiting room, or holding the paws of a dog. These neurotransmitters, especially oxytocin, have several positive outcomes. Oxytocin reduces depressive and anxiety-related symptoms, improves memory, and impacts the immune system by increasing the pain threshold and providing anti-inflammatory effects, which reduces inflammation and decreases healing time.[31] The American Heart Association indicated that AAT lowered blood pressure and stress levels, which improved the quality of life of cardiac inpatients.[33]

Despite the benefits of AAT being well-established in scientific literature, there is a lack of information regarding the potential risks and disadvantages of AAT. Animal-assisted therapy requires great effort, time, and budget to be able to use at all because every staff member in the AAT process should be educated professionally regarding both AAT and animal behaviors. Furthermore, it requires more staff compared with conventional methods, which makes it more expensive. Also, the clinical setting should be made into an ideal environment that has enough space, ideal temperature, and efficient air conditioning and sterilization suitable for the staff, patients, and the animal.[34]

According to Gussgard et al,[35] the main concerns about AAT in medical and dental settings are zoonotic infections, exposure to allergens, unexpected and adverse animal behaviors, and other hazards related to a congested surgical environment. Pathogens may be transferred from

an infected therapy animal to the patient by body fluids during treatment sessions, causing mild symptoms or life-threatening disease. Infective pathogens that may be transmitted via saliva from a therapy dog are *Brucella canis, Capnocytophaga canimorsus, Francisella tularensis, Pasteurella multocida*, and *Lyssa-virus*. All these pathogens cause serious symptoms in humans. The risk of infection is minimized with precautions such as hand hygiene, vaccination of the therapy dog, and controlling animal behavior. Animal allergens are abundant in the dental clinical setting because it is a closed environment with aerosols that may be contaminated by animal secretions. Due to this risk, dental therapy animals should be newly bathed and trimmed just before entering the dental clinical setting and licking of the patient by the animal should be avoided. These risks can be minimized with precautions but cannot be completely eliminated, which causes concerns both for patients and physicians and dentists.

Even though a detailed anamnesis of patients is taken prior to AAT, fear of animals may be an issue, especially if the patient does not acknowledge their own fear of animals. Also, cultural variations require different approaches regarding AAT. For instance, in many European countries, AAT is an accepted method in medicine and as a BMT, but in Türkiye and Asia, dogs are viewed as unsanitary, irritating, or filthy. These should be considered even before offering a patient AAT or sometimes specific modifications can be made.[36]

Literature Review

The studies conducted have been summarized based on the study design, sample characteristics, main objectives of the study, anxiety measurement tools, and study outcomes (Table 1).

The influence of AAT on 12 adults with a history of dental anxiety during the receiving prophylactic dental procedures (teeth cleaning) was evaluated in the study of Cruz-Fierro.[37] Mean and SD of the Corah's Dental Anxiety Scale (CDAS) were used to evaluate the patients' history of dental anxiety, and a questionnaire was used to determine the changes in dental anxiety levels. Physiological responses were determined before, during, and at the end of the intervention using heart rate (HR) and blood pressure values. A significant positive outcome was obtained between how the patient felt in previous (no therapy dog) visits and the current visit (with animal-assisted therapy) for each participant, and each patient agreed that going to the dentist with the assistance of AAT was better than conventional methods. Physiological values showed that the presence of a dog relaxed the person in the middle of the procedure. The results support the hypothesis of the study, which was that the presence of a dog would decrease patient anxiety. The authors also recommended using AAT for patients with disabilities because scientific data justify the use of non-invasive behavioral guidance methods for these patients.

Gussgard et al[38] conducted a study with children who had previously avoided dental treatment due to dental fear. These children were examined intraorally with the presence of a therapy dog. Sixteen children were included in this study, which involved 2 visits to the dental clinic for conventional clinical examinations: the first with a therapy dog and the second without a therapy dog (for the first group, n=8), or the reverse (for the second group, n=8). The children were empowered to interact with the dog during the examination. The primary outcome was whether the child showed compliance during the examination or exhibited disruptive behavior. Both the patient and the parent or guardian of the patient completed a questionnaire before and after the examination. Saliva samples were also collected before and after the examination from the children. The aim was to comfort the children by allowing them to select the type of interaction type with the therapy dog. Clinical examinations were conducted with air-water syringes, mirrors, and probes without any excavation or radiographs. During the procedures, a Biopac MP36R was used to measure HR variability and skin conductance of each patient. The hypothesis of this study was that higher patient compliance would be anticipated when the therapy dog was present compared to no therapy dog presence. The results supported the hypothesis of the study; after undergoing clinical examinations with the dental therapy dog present, each study participant reported the highest possible satisfaction scores, and all parents/guardians, with only 1 exception, agreed that the child was supported by the dog or appreciated meeting the dog. The change in salivary cortisol levels was not significant in the presence of the therapy dog, and electrophysiologic measurements were not included due to weak reliability.

Havener et al[39] conducted a study with 40 children undergoing dental clinical examinations and interventional procedures in a private dental clinic, half with the presence of a dog in the room and the other half without a dog, to evaluate the effects of the dog on behavioral distress. The children were purposely selected at ages 7-11 years because this group can classify, sort, and organize facts about their experiences. Behavioral distress was measured using the Observational Scale of Behavioral Distress scale. The score of the experimental group was higher than the control group, but the difference was not significant. The children in the experimental group mentioned that they enjoyed having a dog for company during the visit. Peripheral skin temperature was measured repeatedly, which revealed no significant differences between the control and experimental groups. Even though this study's results were not consistent with previous studies that concluded the companionship of an animal during dental visits was beneficial, the study showed that the children who were most stressed about dental visits experienced less physiological arousal when the dog was present compared with those who did not have the dog. This result was not consistent with the aim of the study, but it showed the need for further research about AAT in more controlled

Table 1. Summary of Reviewed Studies

Reference	Study Design	Sample	Objectives	Measurement Tools	Animals	Outcomes
Cruz-Fierro et al[37]	Questionnaire-based pilot study	12 adults with a history of dental anxiety with a mean age of 31.5 years.	Evaluating the changes in dental anxiety when introducing a therapy dog during a prophylactic procedure.	CDAS to evaluate the prior anxiety level. A questionnaire designed as a Likert scale to identify differences between the participants' prior experiences and what was experienced during the session. Blood pressure to evaluate the physiologivc responses.	4 adult dogs of different breeds (all were evaluated by a canine trainer for selection).	A decrease in discomfort and an improvement in the patient's evaluation of the dental treatment are observed, but data regarding AAT use in dentistry should be expanded.
Gussgard et al[38]	Randomized clinical trial with a cross-over design	16 children aged between 6 and 12 years with anticipatory anxiety and situational fear.	Evaluating whether the presence of a certified therapy dog specially trained for working in a dental setting may facilitate dental care of anxious pediatric patients.	Happy-sad-face-diagram completed by children and CFSS-DS questionnaire completed by parent/guardian to record baseline anxiety and to evaluate the patients' experience during the examinations. Salivary samples to measure the salivary cortisol level as an indicator of anxiety.	An adult Labrodoodle specially trained as a dental therapy dog.	The presence of a dental therapy dog in an operatory room facilitates intraoral clinical examinations of pediatric patients with anticipatory anxiety and situational fear.
Havener et al[39]	Randomized controlled pilot study	40 pediatric dental patients between the ages of 7 and 11 years.	Evaluating the effects of a companion animal on physiological arousal and behavioral distress among children undergoing a dental procedure.	The Observational Scale of Behavioral Distress to measure behavioral distress. Peripheral skin temperature, measured with a YSI (Yellow Springs Instruments) telethermometer to measure physiologic arousal.	An adult Golden Retriever, who was obedience-trained and certified as a therapy dog.	Even though no significant differences between experimental and control groups were found, children who initially verbalized distress were comforted by the dog.
Pinheiro et al[40]	Non-randomized clinical trial	20 children aged between 4 and 14 years scheduled to undergo anxiety-inducing procedures such as anesthesia, restorative dentistry, oral surgery, endodontics, or impressions.	Evaluating the applicability of dog-assisted therapy to control anxiety during pediatric dental treatment.	Heart rate measured with a fingertip pulse oximeter to assess anxiety before, during, and after the procedures. CDAS to evaluate the anxiety prior, during, and after the treatments.	Certified therapy dogs.	Even the results of this study support the use of AAT as an auxiliary tool for the control of anxiety in children during dental care, there is no substantive scientific evidence in the literature regarding AAT use in dentistry.
Vincent et al[41]	Non-randomized clinical pilot study	18 children aged between 8 and 12 years who have mild to moderate anticipatory anxiety and situational fear.	Exploring the impact certified therapy dogs have on children towards reducing anticipatory anxiety and situational fear in a dental clinic.	General Trust Scale, Self-Efficacy Scale, Questions of Cooperation, CFSS-DS, the Facial Image Scale are completed verbally by parent/caregiver with the child pre-operatively. Salivary samples are collected to analyze changes in alpha-amylase, cortisol, and oxytocin as an indicator of the impact of therapy dog during the treatment.	Certified therapy dogs attended an orientation, training, and are in good standing with the University and Hospital's visiting program.	Dental treatment aided with certified therapy dogs is a feasible intervention, especially for pediatric dental patients with anticipatory anxiety and situational fear.

(*Continued*)

Table 1. Summary of Reviewed Studies (*Continued*)

Reference	Study Design	Sample	Objectives	Measurement Tools	Animals	Outcomes
Thakkar et al[42]	Randomized controlled clinical study	102 pet-friendly children between 5 and 10 years of age who require simple dental procedures.	Evaluating the impact of AAT on children undergoing simple dental procedures, and acceptance of this technique by children and parents.	Modified Child Dental Anxiety Scale-Faces (MCDASF) to record anxiety. Pulse rate measured with a pulse oximeter at 3 time intervals before, during, and after the dental treatment is a biological parameter to measure anxiety and fear.	2 adult golden retrievers who were obedience-trained and certified as therapy dogs.	AAT is an effective behavior management strategy for children but certain guidelines need to be followed since this concept is in its infancy for dentistry.
Charowski et al[43]	Randomized controlled pilot study	47 healthy patients aged between 6 and 10 years who need sealant placement.	Examining the effects of a companion dog on physiologic responses and discomfort level in children undergoing sealant placement using a dental isolation system.	FACES version of a MCDAS questionaire to evaluate baseline anxiety score. Wong-Baker FACES Pain Rating Scale to evaluate the pain experienced at the beginning, during, and after the procedure procedure. Pulse and behavior measured by Frankl and Houpt scales recorded at various time points throughout the procedure.	A certified emotional support dog.	Even though high levels of satisfaction were observed among pediatric users of AAT, it should be studied more to substantiate its effectiveness as a non-pharmacological option in behavior management techniques.

AAT, animal-assisted therapy; CDAS, Corah's Dental Anxiety Scale; CFSS-DS, Children's Fear Survey Schedule-Dental Subscale; MCDASF, Modified Child Dental Anxiety Scale-Faces.

environments with more reliable measurement tools and larger sample sizes.

The applicability of AAT to control anxiety during pediatric dental treatment was evaluated by Pinheiro in a study of 20 children divided into 2 groups: control (using conventional methods) and AAT (children interacted with a dog in the reception area and operating room).[40] Operational interventions included local anesthesia applications, restorative procedures, endodontic treatments, extractions, and impressions. All were applied in both the control and AAT groups in different numbers. HR values before and after the treatment were obtained to measure the anxiety levels. A questionnaire was also used to evaluate the anxiety in children before and after the treatment based on Corah's Dental Anxiety Scale. In the control group, a significant increase in CDAS-measured anxiety was found, but in the AAT group, there was no significant change in this parameter, which shows the positive experience of children contacting the therapy dog. Also, a continuous decrease in HR during and after the treatment was seen, but increased during treatment in the control group. These results support the use of AAT as an adjunctive method to control anxiety in children during dental treatments.

Vincent and Farkas[41] performed a study including the collaboration of social welfare researchers and pediatric dentists to evaluate the impact of therapy dogs on children towards reducing anticipatory anxiety and situational fear. A questionnaire based on the General Trust Scale, Self-Efficacy Scale, and Children's Fear Survey Schedule-Dental Subscale was administered to each patient or the parent/guardian of the patient prior to the treatment to measure the participants' beliefs regarding other people, cooperation, and dental anxiety. Saliva samples were also collected from each patient before engaging with the dog, during engagement, and after the engagement to measure alpha-amylase, cortisol, and oxytocin. A post-treatment questionnaire was also completed by the patient or parent/guardian to evaluate the perception of the intervention. All participants agreed or strongly agreed that a therapy dog near them in their next dental visit would be beneficial. Also, most parents agreed or strongly agreed that a therapy dog was needed during examinations or interventions according to the child's behaviors. Cortisol, alpha-amylase, and oxytocin followed the trend of reduced anxiety or stayed the same during measurements. As for the American Dental Association (ADA)'s recommendation that dentists should include AAT in dental interventions, this study shows that AAT is helpful in reducing anticipatory anxiety and situational fear.

Thakkar et al[42] conducted a study evaluating the impact of AAT on children undergoing simple dental procedures such as prophylaxis, fissure sealants, fluoride application, impressions, and restorations, and the acceptance of both children and parents towards this technique. One hundred 2 children

were selected for this study, but 2 dropped out during the interventions. The Modified Child Dental Anxiety Scale-Faces (MCDASF) was used to record the dental anxiety levels of each child. Heart rate was also used as a biological indicator of stress levels. The difference between the control and experimental groups regarding the reduction in anxiety was found highly significant as measured using the MCDASF. The reduction in HR was found highly significant in both groups during and after the treatment. Feedback collected from both the children and parents/guardians showed that the dental experience of the children was good with the presence of a therapy dog and almost none of the children cried or were anxious during the treatment. As a result, this study showed that AAT was an effective method for behavioral management protocols for pediatric dental patients.

The influence of a companion dog on physiologic responses, perception of pain, and behaviors in children experiencing fissure sealant application under an isolation system was investigated by Charowski et al[43] with 47 patients aged 6-10 years. Only 1 attendant dropped out of the study. The MCDASF questionnaire was used to evaluate the difference in anxiety levels of the patients in the control and AAT groups. The cooperation levels of the children were measured using the Frankl and Houpt scales, and anxiety was evaluated using pulse oximetry and HR. Pain was evaluated by asking children their pain levels with the assistance of the Wong-Baker FACES Pain Rating Scale. All of these were measured before the treatment, after the sealant was placed on one side, after switching the isolation system to the other side of the mouth, and at the end of the session. Then, a post-operative evaluation of the children was conducted. Even though no significant differences were found in physiological measures, Houpt scale values were significantly lower in the AAT group when compared with the control group. Also, Frankl scale values in the AAT group were higher. This study concluded that high levels of satisfaction were observed in pediatric patients using AAT, but the study also mentioned that AAT was currently only an auxiliary method that should be used with other behavioral guidance methods.

CONCLUSION

Dental anxiety or fear affects most patients and causes neglection of the preventive and curative dental care. Many methods, including BMT and pharmacologic techniques such as sedation and general anesthesia, are adapted to the daily routine of each dental clinic and team to perform treatments in an environment that minimizes anxiety and discomfort for patients. New methods are being generated and studied for efficacy because all these methods have adverse effects. One such contemporary method is AAT.

Even though there is significant data regarding the use of AAT in areas of rehabilitation, geriatrics, and psychiatry, the number of studies addressing the use of AAT in dentistry is currently small. In this review, studies related to AAT use in dentistry are evaluated, and all indicated that studies with larger populations in different areas of dentistry should be performed. Currently, studies are more focused on pediatric dentistry. Overall, the use of AAT as a part of anxiety-reducing therapy during dental treatment is a feasible and cost-efficient method and has the potential to improve the dental experience of patients with anxiety and poor compliance, but it has no precision currently.

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