Mobility Dog Assistance Effect on Gait Patterns

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Introduction

The benefits of the use of service dogs for people with disabilities has been increasingly acknowledged in research since the implementation of the Americans With Disabilities Act of 1990 Crowe, et. al, 2014). Service dogs can be trained to assist individuals with mobility impairments in their daily occupations such as propelling from wheelchairs, retrieving objects, opening doors, and providing balance (Herlache-Pretzer, et al., 2017). Additionally, service dogs provide companionship and emotional support such as increased happiness, well-being, and enhanced self-esteem (Crowe, et. al, 2014). Service dogs can assist people with activities of daily living (ADLs) and increase independence while performing these daily tasks, such as opening doors, retrieving necessary items, bathing/showering, feeding, personal grooming, or assisting in home or community mobility (Crowe, et. al, 2014).

One key area where service dogs can be of assistance is for individuals with mobility issues by assisting with gait and stability (Fjeldstad & Pardo, 2017). Dogs differ from other stability devices such as walkers or canes due to having the potential to be trained according to their handler's needs. The literature documenting the effect service dogs have on chronic conditions and mobility disorders is continually growing. Longitudinal and cross-sectional studies have found positive correlations overall on the effects service dogs can have on improving the quality of life for individuals suffering from mobility disorders. Individuals suffering from a variety of disabilities including physical impairments, functional disabilities, cerebral palsy, multiple sclerosis, and stroke benefit from the assistance of a service dog specifically trained to assist with mobility impairments (Crowe, et al., 2014; Rondeau et al., 2010; Herlache-Pretzer et al., 2017).

Review of Literature

One area of research where more studies are needed is in the use of service dogs trained for mobility and their impact on gait dysfunction and rehabilitation. Two studies focused specifically on the use of service dogs trained for mobility assistance include Fjeldstad & Pardo, (2017) and Rondeau et al. (2010). Fjeldstad and Pardo state the following about gait alterations, "Gait alterations can include slower speed, shorter stride length, and decreased distance walked, giving the individual the perception of decreased ability to perform activities of daily living (p. 40).

To measure the impact service dogs can have on walking impairments, Fjeldstad and Pardo designed a study to measure the effect of service dogs on walking speed and gait dysfunction. They utilized a convenience sample of 44 Individuals with gait abnormalities due to multiple sclerosis (MS). Participants completed two timed 25-foot walking tests separated by 15 minutes for rest (Fjeldstad & Pardo, 2017). Each set included one walking test assisted by a service dog and one unassisted walking test. The dogs were fitted with a special harness and trained to walk beside the participant at a steady pace. The results indicated that individuals walked faster with the aid of the service dog (Fjeldstad & Pardo, 2017).

Dogs differ from other stability devices such as walkers or canes due to their potential to be trained according to their handler's needs. One rehabilitation facility implemented using rehabilitation dogs as walking aids instead of devices such as walkers or canes (Rondeau, et al., 2010). The facility's goal was to "explore the effectiveness of rehabilitation dogs, both as a gait retraining approach and as a walking aid, to improve walking speed and gait pattern" (Rondeau, et al., 2010, p.160).

The study by Rondeau, et al. (2010) looked at the use of service dogs for rehabilitation and retraining of gait following a stroke. This single case study looked at four individuals, three men and one woman, who had recently experienced a recent stroke with hemiparesis. Participants ranged in age from 56 to 63 years old and were recruited from an inpatient rehabilitation unit. Researchers decided to document, through the use of a pilot study, the effectiveness of utilizing trained service dogs for therapy and as a walking aid for patients who had hemiparesis. Their interest in this topic came from observations of patients in their facilities that appeared to have more fluid motion, better gait, and more traditionally sized steps when walking with an assigned service dog (Rondeau, et al., 2010).

The study utilized an ABA experimental design; A - walking retraining with dog, B - retraining with dog, and A - measurement after the end of retraining. Patients participated in 60-minute training sessions four times a week. The service dogs used in the study were specifically trained and wore a leather harness with metal bar for use as a walking aid. Patients walked a distance of 10 meters and walking speed was measured both with the dog and with the cane. Gait pattern was analyzed using the Rancho Los Amigos Observational Gait Analysis to identify deficits in walking phases and visually analyze the gait pattern (Rondeau, et al., 2010).

The results of the study found that rehabilitation dogs are an effective walking aid following strokes. Additionally, this study concluded that clients walking with a service dog have improved fluidity of movement along with more normal gait cycles (Rondeau, et al., 2010). The limitations of the study were the small sample size and the lack of a control group utilizing a different form of rehabilitation (Rondeau, et al., 2010).

Though the two studies focused on gait included patients with different physical disabilities, multiple sclerosis, and stroke, they found similar results on the impact of utilization

of service dogs for gait rehabilitation and training (Fjeldstad & Pardo, 2017; Rondeau et al., 2010). The combined outcomes of these studies indicated that individuals who utilized service dogs for rehabilitation showed increased walking speeds and improved gait patterns regardless of disability (Fjeldstad & Pardo, 2017; Rondeau et al., 2010). Although these studies provided support for the use of rehabilitation dogs as walking aids for individuals with a variety of disabilities to improve functional mobility including gait and speed, there has been inadequate existing research performed to represent how assistance dogs can provide stability and improve walking patterns in patients who have not had a serious health condition.

The social and functional benefits of service dog partnerships have been thoroughly researched and suggested to have positive benefits on people with functional mobility disorders (Crowe, et. all, 2014; Fjeldstad & Pardo, 2017; Herlache-Pretzer, et al., 2017). However, further research is needed on the effect of mobility dogs, which are a type of service dog suited in a mobility harness, and how they can assist with walking in individuals of all ages. There is inconsistency among the advantages and disadvantages of mobility dogs, especially the stress the use of a mobility dog may place on the body and the imbalances that may occur due to only having support on one side of the body.

Some studies state human kinematics are affected by mobility dog partnership in the shoulder and hip of the side of the body relying on the dog by negatively affecting the body's joints (Altman et al.,2021), while other studies show positive effects of factors such as walking speed increasing and more consistent gait patterns (Rondeau, et al., 2010). Before health practitioners prescribe mobility dogs for patients with mobility disorders, there is a need for research on whether the mobility dog partnership is more beneficial than detrimental to the body. This can be done by observing the gait cycle in parameters, which is a person's pattern of

walking and coordination with movement, to observe if the mobility dog is causing an imbalance in the body. The purpose of this experimental study is to explore how mobility dogs affect the gait cycle and to observe if mobility dogs are a useful device for people with mobility-related disabilities.

Methods

To observe the effect mobility dogs have on gait patterns, this study was implemented in a biomechanics lab at a university. The study took place over two data collection days with each participant having one 30-minute trial with seven days between trials. Participants included approximately 11 individuals ranging in age from 19 to 23 enrolled at Radford University. Instruments used to measure gait included a G-walk Triaxial accelerometer, which was used to measure acceleration of the pelvis. The accelerometer was placed just above the gluteal cleft to monitor pelvis motion to determine gait motion.

The dog identified for the study belonged to the researcher and completed training in obedience, good citizenship, and is enrolled in training to become a certified mobility dog. Tape was placed on the floor to guide individuals in walking approximately 4 meters, and then turning around to walk back to the starting point to observe normal gait patterns. The accelerometer was connected to the Bioengineering and Therapeutic sciences (BTS bioengineering system), which captured the data related to gait patterns. The parameters recorded include left and right quality index, spatial temporal values (stride length, step length, steps) and propulsion. Data was analyzed to allow for comparison of the parameters of pretest gait analysis without the use of the mobility dog to posttest gait analysis with the use of the mobility dog to determine the impact of use of the dog on gait patterns.

Results

Gait patterns of the participants from pretest gait analysis to the post test gait analysis changed every aspect of the recorded gait patterns. Alterations were indicated in three main gait parameters, including quality index, spatial temporal range (including strife length, step length, and number of steps), and propulsion symmetry index. Quality index, which was how long the participant is in the stance phase of gait compared to the swing phase, increased in half of the participants, and decreased in the remaining half, indicating the mobility dog alters this gait parameter differently depending on the individual.

One spatial-temporal parameter that had a consistent decrease from pre to posttest gait analysis was stride length. Stride length decreased from a range from 1 inch to 12 inches in 10 out of 11 participants from walking without to walking with the use of the dog. The number of steps taken increases from pretest gait analysis to most test gait analyses, which correlates with decreasing stride length. Steps increased from a range of 0-3 steps among all participants. This could be due to unfamiliarity of the use of a mobility dog causing more concentration and balance coordination, causing the participants to take more steps. However, step length remained inconsistent among participants mainly due to this correlating with the participants height.

Additionally, propulsion symmetry index, which is the symmetry during the final stage of the stance phase of gait, differed from pretest gait analysis to posttest gait analysis, indicating the mobility dog's influence on gait parameters. Overall, there is no consistent trend to ensure mobility dogs have a positive effect on gait patterns. Due to the mobility dog's impact on multiple parameters, this study concluded that the effect a mobility dog has on the body varies by individual.

Discussion

The strengths of the study included that participants selected for the study were young healthy individuals who did not suffer from any gait disorders or abnormalities. This allowed for clear analysis of the impact on gait both with and without the use of the therapy dog with harness. Additionally, the use of the Biomechanics lab and accelerometer provided a consistent environment within which to conduct the study including the monitoring of various gait parameters including spatial temporal range, propulsion, tilt, obliquity, and rotations for both pre-test and post-test analysis.

Limitations of the study included the fact that the harness could not be adjusted to accommodate for different heights and arm lengths of participants which may have impacted gait. Additionally, though the dog was currently being trained to serve as a therapy dog, it did not have any specialized training in assisting with mobility issues. Participants were not given the opportunity to participate in trials with the therapy dog prior to data collection cycles to allow participants gain familiarity with the dog and the harness. Future research may also want to include a larger sample size. The current study included ten participants, but additional participants may lead to more conclusive results.

References

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