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KAAP400-FALL 2016
The Effect of Weighted Compression Sleeves on Tremor Suppression in Individuals with Parkinson's Disease

ABSTRACT

BACKGROUND: Parkinson's Disease (PD), the second most common chronic, progressive neurodegenerative disorder, affects millions worldwide. One of the most disabling symptoms of PD is Parkinsonian Tremor, which negatively affects activities of daily living as well as the quality of life of the individual. Weighted compression sleeves, which can provide proprioceptive feedback, will be studied to investigate the effect on the debilitating symptom of PD, tremor.

OBJECTIVE: To determine if wearing a weighted compression sleeve has a significant effect on tremor suppression.

HYPOTHESIS: Men and women with PD displaying tremor will have a suppressed tremor amplitude due to proprioceptive feedback when wearing a weighted compression sleeve, compared to those wearing a weighted sleeve, a compression sleeve, and an unweighted sleeve with no compression.

METHODOLOGY: Forty individuals experiencing PD, ages 50-70 years of age, will be randomly assigned to one of four groups wearing different types of sleeves. Groups include weighted compression sleeves, weighted sleeves, compression sleeves, and unweighted sleeves without compression. Tremor suppression will be measured by determining the accuracy of performing a pegboard test. The task will be timed to measure the speed and error of placing each peg into the board in order to track changes in fine motor skills as they relate to tremor. ANOVA testing will be used to determine significance.

SIGNIFICANCE: Over 5 million individuals are affected by PD each year and further research must be done to manage and alleviate the symptoms of such a disabling disease.

SPECIFIC AIMS

Parkinson's disease (PD) is the second most common chronic, progressive neurodegenerative disorder. This debilitating disorder affects more than 5 million individuals worldwide, with approximately 1 million cases in the United States alone. However, this number is likely to grow. There is a higher prevalence of PD in males compared to females and the typical onset is around fifty to sixty years of age. In addition, there is a lack of external validity in studies of individuals with PD, as women are often not represented in tested populations. Further research involving women would better generalize the results to a larger population. Higher rates are found among Hispanics and non-Hispanic whites compared to Asian and African American populations. Common clinical characteristics of PD include tremor, bradykinesia, muscle rigidity, and postural instability. Additional non-motor symptoms can include depression, anxiety, fatigue, and insomnia. The features of pathology of PD include loss of dopaminergic neurons and reduced dopamine levels. The most common treatment is a pharmacologic replacement of dopamine. Neurosurgical procedures, such as deep brain stimulation, are currently treatment options for PD patients. With a growing prevalence of this disease, management of the symptoms, that do not include medication or invasive procedures, are critical and need further research.

Although some symptoms of PD such as rigidity and bradykinesia are commonly treated with dopamine medication, Parkinsonian tremor have been found to not always respond to dopamine treatment. It had been thought that tremor originated in the thalamus, however, new data shows that the basal ganglia is responsible for triggering tremor. The basal ganglia is a deep brain structure that is responsible for preparing and executing voluntary movements. Deep pressure stimulation is thought to affect deep brain structures including the basal ganglia, which is the structure that is known to be responsible for Parkinsonian tremor. Weighted vests are therapeutic applications that have been widely used to provide deep pressure stimulation to calm the central nervous system of children with sensory integrative disorders, attention deficit hyperactivity disorder, cerebral palsy, and traumatic brain injury. As seen to be effective in children with sensory disorders, stimulating the deep brain structures through weighted compression may suppress the central nervous system in patients with PD.

Tremor negatively affect activities of daily living, and in turn, compromise quality of life of patients with PD. The activities most adversely affected are those that utilize fine motor skills including everyday tasks such as signing your name or buttoning a shirt. There is no known cure for tremor and little is known about whether an external apparatus could be used for tremor suppression. Weighted compression sleeves are an external apparatus that could be utilized to alleviate symptoms associated with tremor. Proprioceptive feedback has been shown to lessen the amplitude of Parkinsonian tremor through feedback loops through the central nervous system using haptic robotics. Weighted compression sleeves would allow for this proprioceptive feedback in an everyday setting. It is expected that wearing this type of sleeve will reduce tremor amplitude in a comfortable manner that will not disrupt daily routines of patients with PD. Previous research involving patients with PD have typically been tested in dominantly male populations, therefore, including research with both sexes must be tested to generalize the results to a broader group. With PD and tremor growing in prevalence, research implementing this apparatus may, in the future, introduce new solutions involving compression garments and the effects on different types of tremors, as well as alternative joints.

<u>Clinical Relevance.</u> Examining patients wearing weighted compression sleeves to provide information to therapists and clinicians about managing tremor in PD patients. The assessment of fine motor manipulations will provide insight into the effectiveness of the weighted compression sleeve.

Specific Aim. To compare the difference in wearing a weighted compression sleeve to those wearing a weighted sleeve, a compression sleeve, and an unweighted sleeve with no compression in order to reduce the amplitude of Parkinsonian tremor in men and women with Parkinson's Disease.
Hypothesis: Men and women with Parkinson's Disease displaying tremor will have a suppressed tremor amplitude due to proprioceptive feedback when wearing a weighted compression sleeve, compared to those wearing a weighted sleeve, a compression sleeve, and an unweighted sleeve with no compression.

SIGNIFICANCE:

Parkinson's Disease (PD) is the second most common chronic, progressive, neurodegenerative disorder with no known cure (1). PD affects 5 million individuals worldwide and 1 million individuals in the United States. There is a higher prevalence of PD found in men than in women, but research should still be conducted using both sexes to increase external validity. The typical age of onset is between fifty and sixty years of age. PD has been found in higher rates among Hispanics and non-Hispanic whites compared to Asian and African American populations (1). The number of PD cases is continuously growing, with research increasing in this field as a result. The pathology of PD includes the loss of dopaminergic neurons and reduced dopamine levels (2). Currently, the most common treatment is a pharmacologic replacement of dopamine. Other treatment alternatives include deep brain stimulation and other neurosurgical procedures, which are invasive treatment options. Clinical symptoms that arise in individuals with PD include, but are not limited to, tremor, bradykinesia, muscle rigidity, and postural instability. Depression, anxiety, fatigue, and insomnia are non-motor symptoms that are also commonly found in individuals with PD (2). These debilitating symptoms affect activities of daily living (ADLs) for people with this disease, negatively impacting their quality of life. Specifically, tremor is of interest in our research, as they interfere with accomplishing many common tasks. Because current treatments are limited to medication and invasive procedures, it is important to look to alternative options to manage the incurable symptoms of PD.

Tremor, which is a common symptom across various other neurological disorders, is characterized by involuntary rhythmic and oscillatory movements affecting about 70% of individuals with PD (3). While not all individuals with PD experience tremor, it is a pronounced physical sign in those who do. Resting tremor is typically presented when the person's muscles are in a relaxed state or at rest and can cease when the individual performs an action, while action tremor is typically presented alongside voluntary muscle contractions and include postural, isometric, and kinetic tremor. Parkinsonian tremor typically presents both resting and action tremor, but differs across individuals. The tremor usually remains on the initially affected side of the body, but through progression of the disease, can spread to the other side of the body (3). While resting tremor is not considered highly disabling, individuals with PD also living with action tremor can experience difficulty with daily activities and fine motor coordination.

Fine motor control that includes writing one's name and buttoning a shirt are commonly utilized skills that can be made difficult with Parkinsonian tremor. Individuals with PD have compensated quality of life due to this incurable tremor. Currently, research has shown that dopaminergic medication can reduce the effects of tremor in individuals with PD, but not all individuals respond to it. Research on non-medicated tremor suppression is not as readily available, with few studies conducted that examined other forms of tremor suppression. Proprioception is an aspect of feedback to the brain that is compromised in early PD stages (4). One study examined tremor suppression that involved a 56 year-old woman with idiopathic PD (5). Four different modalities were tested with different magnitudes of velocity-dependent force feedback. Through electromyography (EMG) recordings, the investigators observed that although tremor EMG signals were not reduced, tremor amplitude was increasingly reduced with increasing force feedback. When the patient was not medicated, she was able to use proprioceptive feedback from a closed-loop force feedback system to experience tremor suppression (5). This study successfully used a haptic robotic apparatus attached to the patient's head and upper limbs by electrodes to promote tremor modulation. This type of equipment requires the patient to remain in a chair, relatively still, and unable to perform many daily activities. There has been no research to date that investigated an external apparatus to induce proprioceptive feedback while allowing the individuals with PD to continue performing everyday activities. Increased proprioceptive feedback from a closed-loop system has shown to reduce tremor amplitude in individuals with PD (4). Previous research using haptic robotics has supported this concept, but restricts the individual in performing daily activities (5). A weighted compression sleeve could allow for proprioceptive feedback similar to that attained by the robotic apparatus. Utilizing a weighted compression sleeve could improve the ability of an individual with PD to perform ADLs that may have been decreased or even lost. Increased proprioceptive feedback in the hand and forearm could suppress tremor by decreasing tremor amplitude. Reduced tremor amplitude in the hand and forearm of an individual with PD allows for better fine motor control to improve common ADLs like cutting vegetables or buttoning a shirt.

Fine motor coordination deficits have been found to be a result of basal ganglia-thalamocortical circuits. The basal ganglia is a deep brain structure that is responsible for preparing and executing voluntary movements. Though originally suspected to start in the thalamus, it has been found that the basal ganglia is responsible for triggering tremor (6). Basal ganglia projects into the supplementary motor area (SMA) and lateral premotor cortices in the brain. These areas of the brain are vital for coordination, therefore in individuals with PD, poor basal ganglia outflow may produce the coordination deficits (7). As a result, disrupted activity in these areas is seen in patients with PD. Neuroimaging studies have shown a strong correlation between coordinated movement and basal ganglia activity (8). Also, individuals with PD experience proprioceptive processing deficits that are consistent with activity in basal ganglia nuclei cells, basal ganglia receiving areas in the thalamus, and SMA showing lack of specificity when responding to limb proprioception (9). In a study comparing intensive and coordinative aspects of movement in grasping, reaching, and lifting tasks between three different groups of individuals, a group with PD on dopaminergic medication, a group with PD not on medication, and a control group, coordination and error was evaluated. Specifically, for the purpose of our research, coordinative deficits in movements, which include deficits in the integration and coordination of movement components that ultimately result in poorly coordinated movements, signified the most novel results. Dopaminergic medication has been shown to improve intensive deficits, such as speed, but did not affect coordinative deficits (10). Patients on and off medication showed greater deficit levels in coordination deficits, tested through tilt error, which is the ability to withstand the effects of gravity while holding an object on an angle, compared to the control group of patients. This revealed that although dopaminergic medication can be effective in treating some symptoms of PD, it is not always effective in suppressing coordination deficits caused by Parkinsonian tremor. If medication cannot be used by some patients or is not effective for some patients, other options like an external apparatus, like a weighted compression sleeve, would be more appropriate. Tremor, a symptom seen to be caused by poor basal ganglia outflow into areas responsible for coordinated movements, could be suppressed through a weighted compression sleeve through stimulating the basal ganglia in patients with PD (11).

Many aspects of an individual's life are adversely affected by the motor symptoms of PD, which in turn, can impair their quality of life. Many ADLs are difficult to complete independently as people with PD experience functional limitations. The ADLs that have been reported with difficulty include, but are not limited to, dressing, bathing, cooking, and housework. A study examined the deficits in independence, adequacy, and safety of 77 volunteers with PD and 57 participants without PD by utilizing the clinic version of the Performance Assessment of Self-Care Skills (PASS) to measure performance (12). The clinic version of the PASS is a highly reliable, empirical measurement of activity performance which can distinguish between clinical groups. Researchers measured the performance of oven use, stovetop use, sharp utensil use, bill paying by check, checkbook balancing, mailing bills, shopping, medication management, and small home repairs. Through objective scoring, it was found that the PD group had lower independence and adequacy for all activities, specifically lowest in fine motor activities such as sharp utensil use and medication management, and there were minor risks observed in safety scores versus non-PD participants (12). Functional limitations due to tremor in individuals with PD lead to decreased levels of independence and quality of life.

Quality of life is the overall life satisfaction of the individual related to their environment, social aspects, and impact of health status. A cross-sectional study of 124 individuals with PD, specifically those with tremor, had their quality of life scored and compared amongst other participants in the study and to the published quality of life norms of the general public (13). To conduct this study, participants were given an examination to document their PD symptoms and their quality of life was measured using three reliable, disease specific instruments. The researchers found that the quality of life of individuals with PD was particularly low regarding impairments in physical and social aspects, rather than pain and emotional functioning compared to the general public's quality of life score (13). Quality of life was especially lower in individuals with increasing progression of PD symptoms and in those who lead more active lives, since ADLs are affected.

Wearing a weighted compression sleeve will be an important contribution to the field of PD research as the sleeve could provide an individual with the proprioceptive feedback necessary to improve ADLs through tremor suppression. Previous research has shown a correspondence with weighted vests and their impact on deep pressure stimulation affecting deep brain structures, which has an organizing effect on the central nervous system. One study involving children with sensory disorders examined the impact that weighted vests have on suppressing the central nervous system. Preschool and young elementary students with conditions ranging from Attention Deficit Hyperactivity Disorder to Cerebral Palsy were observed over time to examine the effects of the weighted vest on their different behaviors involving attention to task and self-stimulatory behaviors (14). Although the results of the weighted vest varied on an individual level due to differences of disorders, the weighted vest had an overall positive effect on stimulating deep brain structures for many of the participants (15). In similar regards, we believe there can be a positive effect for patients with PD in wearing a weighted compression sleeve. Just how the children wearing the weighted vests received increased proprioceptive awareness through this apparatus, individuals with PD could experience the same increased proprioceptive feedback through the weighted compression sleeve. The deep brain stimulation that the children received from the weighted vest could be compared to stimulation of the deep brain structure, the basal ganglia, in patients with PD. The stimulation of the basal ganglia can suppress tremor and lead to improved performance of fine motor skills and activities of daily life and in turn, a higher quality of life.

A previous study, which examined the benefits of compression garments on athletes, hypothesized that compression garments could improve functional performance in individuals with PD (16). Compression garments improve venous return and joint awareness while also reducing muscle oscillations in athletic populations, therefore, researchers believe the same effects could be translated to a PD population. Compression improves performance and endurance in athletes by reducing vibrations within the muscles, which ultimately conserves energy by reducing lactic acid production (16). These compression garments were positioned below the knee to help with gait and mobility, however our study would like to examine the effect on upper limb and tremor. If compression garments provide joint awareness to athletes, the same awareness and proprioception can be translated to the PD population. The study notes that future studies should include trials with participants exercising while wearing the compression garments, as their participants did not train while wearing the garments (16).

We hypothesize that men and women with Parkinson's Disease displaying tremor will have a suppressed tremor amplitude due to proprioceptive feedback when wearing a weighted compression sleeve, compared to those wearing a weighted sleeve, a compression sleeve, and an unweighted sleeve with no compression.

INNOVATION:

This study seeks to take a new approach in research regarding the use of compression sleeves applied to the therapeutic treatment of tremor in individuals experiencing PD. Previous studies suggest the benefits of haptic robotics, however, such methods restrict the individual's performance of daily activities (5). The use of medication, as well as otherwise invasive procedures, have been used in the past to suppress tremor, however not all modes of treatment work for each individual due to adverse drug interaction and limited effect. Previous studies have assessed the effect of compression garments on performance of individuals with PD, but no studies have examined the use of compression sleeves to reduce tremor in upper limbs. The study will apply the use of upper extremity compression sleeves on individuals with PD rather than the typical studies observing lower extremity compression garment effects on the athletic population (16). It is expected that these compression garments, like the haptic robots, will provide joint awareness and proprioceptive feedback to the individual. Further, the addition of weight to the compression sleeve will mimic the function of weighted vests in children with sensory disorders. The combination of weight and compression on the hand and forearm can help stimulate the deep brain structures, as seen with the use of haptic robotics and weighted vests, thus providing proprioceptive feedback while contributing to tremor suppression. It will also utilize data that supports the physiological and overall functional benefits when worn during everyday activity. Physiological and functional benefits would be a result of an external apparatus providing proprioceptive feedback while allowing individuals with PD to continue the performance of everyday activities. This proposal aims to combine different aspects of previous research to create a new approach to minimize tremor amplitude in patients with PD and improve performance of fine motor skills to help increase quality of life.

APPROACH:

Proprioceptive feedback has been shown to lessen the amplitude of Parkinsonian tremor through feedback loops through the central nervous system and stimulating the basal ganglia using haptic robotics and through weighted vests. Given the information about proprioceptive feedback in haptic robotics and weighted vests, this proposal will examine different types of sleeves to assess tremor suppression. For this study, we will contact a neurological rehabilitation center about informing discharged patients of research involving tremor suppression. Inclusion criteria for interested participants will include medically diagnosed Parkinson's Disease with an onset between the ages of fifty and seventy, and have a Parkinsonian tremor for at least one year. Participants must be between the age of fifty to seventy years old to minimize the risk of age-related deficits. Participants must experience tremor that impairs daily functioning to a certain degree, experience tremor bilaterally, must have had tremor for at least one year prior and experience overall pain no greater than a three on a scale of 0-10, to remove pain as an extraneous variable. For the purpose of maintaining consistency, exclusion criteria will include individuals with diagnosed cognitive impairments to ensure that these deficits are not a factor in functional ability, those who are currently taking or have previously taken medication for tremor within the past year, individuals with disabling dyskinesia, or other significant neurological or musculoskeletal conditions that would prevent completion of the protocol. Individuals that may be hypersensitive to compression or have blood flow restrictions may also be excluded.

The study will be explained including the timeframe, procedures and tasks, desired outcome, and possible discomfort they may face from the sleeve. The participants will then complete a baseline questionnaire regarding their daily functional ability. The purpose of this questionnaire is to ensure that all participants are at an equal functional level to remove outliers that may be too high or low functioning. All participants will be asked if they understand the guidelines and questions of the questionnaire. It is assumed that participants will answer honestly and accurately. The questionnaire they will be given is the the 39-Item Parkinson's Disease Questionnaire (PDQ-39) to complete prior to choosing individuals for the study. The PDQ-39 is the "gold standard" questionnaire used in clinical trials that consists of 39 questions to assess the level of difficulty faced across 8 categories of quality of life in the past month. It is widely used for patients with PD because it is a valid, reliable, and easy way to assess quality of life (17). The questionnaire covers 8 discrete categories from ADLs to cognition and bodily discomfort which will be utilized to select the twenty participants based on their PDQ-39 score. The PDQ-39 is scored as a point system from 0-4, which includes 0 as never having discomfort or difficulty in daily activity and 4 as always uncomfortable or cannot perform daily activity at all, to measure self-reported quality of life (17). Forty participants will be chosen after scoring of the PDQ-39 takes place, so every individual has similar baseline functional abilities which will be an average of 2 or higher.

Forty participants will include a combination of males and females with PD that fit all inclusion criteria and lack all exclusion criteria. Demographic data will be recorded on each participant, which will include age, sex, height, weight, past medical history, previous medications taken, personal physician, and a forearm girth measurement. The forearm girth will be measured in centimeters at the greatest circumference to determine the size of the sleeve to be used based on the manufacturer's guidelines.

The forty participants will be randomly assigned to one of four groups. Each group will have ten participants. One group will be given weighted compression sleeves to wear, one group will be given weighted sleeves, one group will be given compression sleeves, and one group will be given unweighted sleeves with no compression. The sleeves will be worn on both hands/forearms. Participants will wear their assigned sleeves over a three month span all day/night except when bathing. The participants will be told to carry out their normal everyday activities, with no restrictions in their routine. Every week, participants will complete a testing session that will measure improvements in fine motor skills. The equipment used to measure fine motor skills will include a pegboard set, which is a wooden board with evenly distributed small holes and pegs that fit into the holes.

Each participant will be numbered 1-40 so that the evaluators are unaware of what group each individual is assigned to in order to remove bias. The participants will wear the assigned sleeves every day for a 5 month period unless they wish to discontinue their participation. On a predetermined day every week, participants will come to the laboratory and perform a series of trials using a wooden pegboard. The participants will be in a room in the lab alone, with no distractions and no one else performing the task at the same time. Participants will be instructed to place each peg in the holes on the wooden board. In order to calculate error, there will be ink on the end of each peg which will mark the wood where the participant incorrectly places the peg. Each trial will be timed using a stopwatch to determine overall completion time. Error will be measured by adding the total number of marks around the hole that indicate missed attempts at placing each peg in the hole. In order to maintain consistency, if participants do not cleanly insert the peg in the hole (without tapping the board), they must lift the peg back up and try again. This rule will prohibit individuals from dragging the peg directly into the hole from off the board. Participants will be given 9 pegs with 9 corresponding holes and will be timed from the second they pick up the first peg until all 9 pegs are placed successfully and in the designated holes. There will be 3 trials conducted with five minutes of rest in between each trial. Each trial will be conducted using a different color ink on the peg to differentiate between trials.

Errors will not be counted until after all trials are completed, and results will not be discussed with patients until the end of the study. This is to preserve motivation and involvement in the study. Error will be measured by counting the number of marks, or dots, that each peg leaves around its respective hole. This will determine the participants inaccuracy in peg placement. The higher the number of dots corresponds with greater amount of error. This information will be examined alongside the amount of time it takes the participants to complete each trial. The longer the amount of time it takes the participant to complete each trial corresponds with greater amount of error. This procedure will occur every week when the participant comes to the laboratory and be recorded. The entire study for the participants will include prescreening and baseline assessment in the first two weeks, followed by three months of the participants wearing their assigned sleeves, and finally one month for additional trials not wearing the sleeve. Additional time will be taken by research members to collect and analyze data. Over time, we hope to see an improvement in performance that would be contributed to suppressed tremor. At the end of the study, participants will once again be given the PDQ-39 to gain subjective, qualitative data. This is to observe if the participants feel they have greater quality of life through improved ability to perform ADL's.

We hypothesize that men and women with Parkinson's Disease displaying tremor will have a suppressed tremor amplitude due to proprioceptive feedback when wearing a weighted compression sleeve, compared to those wearing a weighted sleeve, a compression sleeve, and an unweighted sleeve with no compression. The null hypothesis is that men and women displaying a tremor will not have a suppressed tremor amplitude due to proprioceptive feedback when wearing a weighted compression sleeve compared to those wearing a weighted sleeve, a compression sleeve, and an unweighted sleeve with no compression. The independent variable is the type of sleeve worn by each participant, which is hypothesized to have an effect on completion time and accuracy of the peg placing task. Four groups will be compared according to performance differences with a one-way analysis of variance (ANOVA) test (18). Using ANOVA testing, differences will be analyzed within groups to examine performance changes over time for each individual, as well as across groups to examine significant differences among different sleeve types. An F-ratio will be found to determine if variance is due to the independent variable. In this study, the type of sleeve that each group will wear is the independent variable, and the dependent variable is accuracy, which is the accumulation of speed and error. Speed and error will be examined together as accuracy. The higher the number of dots outside the holes corresponds to less accuracy. In addition, the greater amount of time taken to complete each peg trial corresponds to less accuracy. If the values from the ANOVA test are unequal, then the null hypothesis is rejected and the alternative hypothesis will be accepted (18). This indicates that there are differences across groups due to the independent variable being manipulated. It is hypothesized that the differences between accuracy amongst groups will be statistically significant and not due to chance, by examining the P-value set at an alpha level of $p<0.05$ for significance (18). This means that sleeve type influences tremor suppression and the null hypothesis will be proven to be false, therefore the alternative hypothesis will prove to be true.

After collecting data from the 40 participants over the 5 month span, it is hypothesized that the individuals wearing the weighted compression sleeve will experience the fastest completion time of the fine motor task with the least amount of error due to suppression of tremor as compared to all other groups. This supports our hypothesis that men and women with PD displaying tremor will have improved performance in the fine motor task which could be contributed to a suppressed tremor. Improved performance because of suppressed tremor is due to proprioceptive feedback when wearing a weighted compression sleeve, compared to those wearing a weighted sleeve, a compression sleeve, and an unweighted sleeve with no compression. The combined weight and compression will effectively suppress tremor due to increased proprioceptive feedback leading to greater accuracy of the task.

DISCUSSION:

The hypothesis that men and women with Parkinson's Disease displaying tremor will have a suppressed tremor amplitude due to proprioceptive feedback when wearing a weighted compression sleeve, compared to those wearing a weighted sleeve, a compression sleeve, and an unweighted sleeve with no compression was upheld. Previous literature discovered that tremor suppression can occur through proprioceptive feedback with the use of haptic robotics. In addition, weighted vests were used to stimulate the deep brain structures in children as a form of sensory integration to produce increased proprioceptive feedback. The basal ganglia is the deep brain structure which is the location of tremor production that has been found to cause coordinative deficits, like those seen in patients with PD. Up until this point, there has been a lack of research in non-invasive, non-medicated therapeutic treatments for symptoms of PD. Weighted compression sleeves can be used as a form of treatment for tremor. Increasing proprioceptive feedback to the hand and forearm, as well as providing stimulation to deep brain structures, like the basal ganglia, suppresses Parkinsonian tremor through wearing weighted compression sleeves. Quality of life is compromised in individuals with PD because of difficulty to perform ADLs due to symptoms including tremor. The importance of this study is to investigate the effect of a weighted compression sleeve on Parkinsonian tremor suppression, which can help individuals with fine motor coordination and lead to better performance of ADLs. In the future, the effect of weighted compression sleeves should be investigated in a larger scale study and can be applied to other tremors, such as essential tremor. In addition, weighted compression sleeves could be translated to other limbs or to the trunk to improve postural control and ease problems with gait due to increased proprioception.

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