Effects of Agility Training with Light Equipment on Balance and Mobility in People with Parkinson's Disease

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Introduction

Parkinson's Disease (PD) is often known for its symptoms, which are the major contributors to disability and decreased quality of life. Impaired balance and general mobility are common complications of PD and are largely attributable to slow and reduced movement (bradykinesia). Bradykinesia increases the likelihood of falls as the reactions to a sudden loss of balance are often small and weak. Therefore, an average of 60% of people with PD report at least one fall per year, and around 40% are recurrent fallers.

Although previous studies have shown that patients can increase the speed and amplitude of movement with training, apathy, which is also common among people with PD, reduces this prospect.

Apathy affects around 40% of patients with PD. It is a behavioural symptom characterized by a lack of interest or motivation, so it can be a significant barrier to maintain regular physical activity. As a result, patients with PD tend to be less active than their peers and therefore need more motivation during training. Motor learning also occurs slower for people with PD. Studies have shown that persistent and repeated training can counteract to the deterioration in motor skills that often are affected due to the disease. By increasing the amount of external feedback provided through training it can enhance the acquisition, automaticity and retention of motor skills.

Training with light equipment such as Blazepod® (https://blazepod.eu//) was originally developed for athletes to enhance agility in a way that was motivating. It consists of small wireless light pods controlled with an app on a phone or a tablet. There is a variability in how the system can be set up, the number of lights in use, colour and time between lights, etc. The use of this kind of system in rehabilitation does not have a long history and has not been studied on individuals with Parkinson's disease to our knowledge. By arranging lights around an individual it would require him to take quick and large steps in different directions, bend around the knees and hips, turn on the spot and challenge various aspects of balance. Therefore, this could be an ideal training format for individuals with PD. Because the lamps are in different colours and give fast performance feedback, it can potentially promote exercise that is motivating and thus increase adherence to exercise.

The purpose of this study was to see whether agility training with light equipment affects balance and general mobility of individuals with Parkinson's disease and how motivating they experience the training over the period.

Method

This is an interventional longitudinal study with no control group. Seven individuals with Parkinson´s Disease participated in the study. It is designed as a pilot study for further studies with larger samples and a control group.

Inclusion criteria

- **Confirmed diagnosis of PD by a neurologist**
- **"Akinetic-rigid"** motor subtype
- **Unified Parkinson's Disease Rating Scale (UPDRS)** from chapter 1.1, 2.12. 2.13, 3.10, 3.12, 3.14
- **Hoehn and Yahr scale** scores of II – III
- **None other diseases, signs or symptoms** that affects mobility
- **Minimum attendence** 8 out of 12 training sessions

Measurements

Measurements were performed one and a half weeks before training, at the beginning and at the end of the training program.

Assessments

- **Mini-BESTest** assessed balance
- **Timed Up and Go (TUG)** assessed general mobility
- **5x Sit to Stand** evaluated transfer skills
- **10-meter walking test** measured walking speed
- **360° Turn Test** assessed the ability to turn on the spot
- **Likert scale (0-10)** assessed the motivational aspects of training

Training Program

Each participant completed individual training three times per week for four weeks. The training session consisted of five rounds, in each round participants had to turn off 20 lights and then had one minute to rest between rounds. After each round, the program provided feedback on how long it took the person to finish one round, i.e. turn off 20 lights, and the average response time at each light (lights/sec).

All participants were barefoot during the training session.

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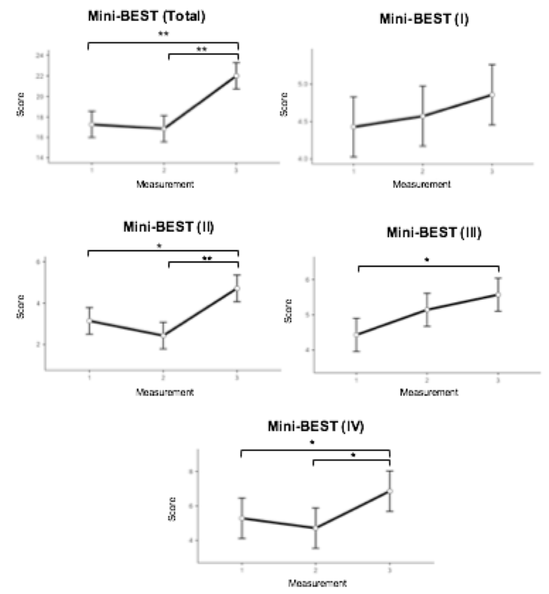
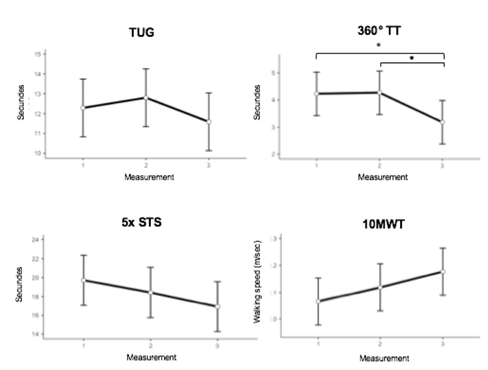
Result

Mini-BESTest total score increased significantly after the training period (p<.001). The training affected all aspects of the Mini-BESTest except part I which assesses anticipatory balance. There were no significant differences in TUG, 5x Sit to Stand or 10-meter walking test, but there was a significant difference in the 360° Turn Test (p=0.013).

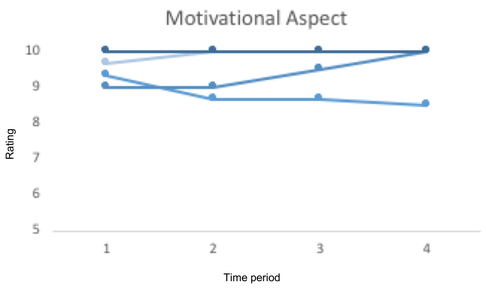


Mini-BESTest score.
*p<0,05 and ** p<0,005 from multiple linear mixed model



Performance tests that measure general skill.
*p<0,05 and ** p<0,006 from multiple linear mixed model

Four out of seven participants rated the motivational aspects of training 10 out of 10 throughout the training period. The motivational ratings increased over the training period for two participants and decreased for one.



Discussion

Four weeks of agility training with light equipment three times per week for four weeks improved balance for people with PD, but there was a significant difference in the Mini-BESTest total score before and after training. In the aspects of balance, it mainly had an impact on postural control and dynamic gait balance. This is what we expected before the study, as the training focuses on taking large, fast steps in different directions. Step training seems to have a greater adaptability to everyday life than the volitational stride training where people are usually exposed to a sudden loss of balance. Step training creates more imbalance and therefore stronger stimuli to prevent falls with feed-forward control. The training also affected sensory integration, but as shown on the graph, there was only difference between basic measurement and after training, and not between before and after training as in the other tests. Therefore, it cannot be affirmed that training alone affects sensory integration.

General skills did not increase during the training period, according to TUG but there was a tendency for improvement, therefore it cannot be ruled out that such training could be effective if a larger sample was studied or if the training covered a longer period of time. Within general skills the training only had an effect on turning on the point, but transfer skills and walking speed did not significantly change over time.

All participants experienced the light equipment as a significant motivating part of training. The motivation decreased for one participant, which was due to a misinterpretation of the question in which he rated himself on performance at any given time instead of the motivation effect of the training equipment. All participants also improved their response time, as well as experiencing enhanced physical function after the training period ended. 5 out of 7 people experienced a big physical difference and thought they were generally faster in movements, such as in rotation and thinking. 2 out of 7 people experienced a slight difference and thought they were a little more agile in movements.

The study shows that training agility with a lighting system is a simple and efficient way for physiotherapists to use in balance training, in particular reactivity and walking balance, combined with rotation capabilities in individuals with Parkinson's disease. As this training is easy to implement, short, motivating, and logically safe, it is also ideal for this group of clients to use at home. Using this system could possibly result in less expenses for the health system by providing them with the option of regular training that would impact their physical performance and activities in everyday life that tend to be affected by Parkinson's disease.

Conclusion

Four weeks of agility training with light equipment can improve balance, especially reactive postural control and dynamic gait balance along with turning ability in people with PD. However, it is not possible to conclude that this type of training affects general mobility (according to TUG) in other respects, such as transfer skills (according to 5x Sit to Stand) or walking speed (according to 10 meter walking test). A similar study is needed with a larger sample and a control group. This form of training seems to be motivating and could promote exercise adherence.