The effectiveness of exercise in people with Parkinson’s disease
Jaya Chandola (Public Health & Clinical Sciences)

Parkinson’s disease is a neurodegenerative disorder that causes movement dysfunction (Stokes 2004). Symptoms include slowness initiating and difficulty maintaining movement (bradykinesia), rigidity, tremor and postural instability (Kwakkel et al. 2007). Medication is used in the management of Parkinson’s disease, but does not relieve all symptoms (Scandalis et al. 2001). As Parkinson’s is a chronic and progressive disease, other management methods are needed to reduce the level of disability.

Exercise has been used as a one of these management methods. To determine the effectiveness of exercise in people with Parkinson’s disease a review of the evidence is necessary. Medical databases were searched, primarily for randomised controlled trials, which included the keywords ‘exercise’ and ‘Parkinson’s disease’. Although randomised controlled trials are considered to be the highest level of evidence (Phillips et al. 2009), only a limited number of recent randomised controlled trials were found, so the search was expanded to include other trials.

Out of the seven randomised controlled trials found, five included aerobic exercise as an intervention. Aerobic exercise was found to have beneficial effects on Parkinson’s disease in all studies. Bergen et al. (2002) found that a sixteen week aerobic intervention improved aerobic capacity and movement initiation. One weakness in the method was that the control group was told to maintain their usual level of activity during the study, but this was not monitored so there was potential for this to affect the results.

Another factor that queries the reliability of the data is that one participant asked to swap from the exercise group into the control group because he realised the intervention would be too time consuming. This not only means that the participants were not truly randomised, but also highlights the fact that people in the exercise group were prepared to spend a lot of time trying to improve their condition. They are therefore likely to be more compliant and motivated than average Parkinson’s sufferers.

Burini et al. (2006) carried out a randomised controlled trial with cross over design using aerobic exercise and Qigong, which is a Chinese movement and meditation exercise. The
cross over design was beneficial because it meant all participants experienced both forms of exercise, which allowed within group comparisons and reduced the effect of individual variability. However, the design could also have an adverse effect on the results due to possible improvement carry over. The risk of this happening was reduced by having an eight week interval period between the two interventions.

Aerobic training showed significant improvements in the six minute walk test, the Borg scale for breathlessness and cardiovascular fitness, whereas no significant improvement was found in the qigong group. However, these outcome measures are not very appropriate for assessing the benefits of qigong, as this is not an aerobic exercise. Therefore you would not expect cardiovascular fitness or endurance measures to improve. The Berg balance scale may have been a more appropriate outcome measure to include. Qigong was an unknown method of exercise to the participants before the trial. Therefore it may have taken longer to learn and progress in, and for the results to become apparent.

The use of the six minute walk test as a gait outcome measure only indicates change in speed and does not take into consideration the quality of movement. The distance travelled in six minutes could increase, but the quality of movement could deteriorate. This could have a negative impact on the participant, as they may be more likely to fall.

There were no significant changes in any of the other outcome measures including the Unified Parkinson’s Disease Rating Scale (UPDRS) (Fahn et al. 1987) and Parkinson’s Disease Questionnaire (Peto et al. 1995 and Jenkinson et al. 1995). These are more clinically significant measures relating to activities of daily living and perceived quality of life. The fact that there were no significant changes in these outcome measures, but there were in the six-minute walk test, reinforces the opinion that the six minute walk test is not very clinically significant.

Although the randomised controlled trial did not find any benefits of qigong, other trials investigating similar forms of exercise, such as tai chi found positive effects on Parkinson’s disease. A pilot randomised controlled trial by Hackney and Earhart (2008) found tai chi significantly improved Berg balance score. Additionally, Klein and Rivers (2006) found improved balance was frequently reported among participants. This was a qualitative study and participants had to pay fees for the taijiquan classes. This means there was probably a
positive bias towards the intervention and the placebo effect may have influenced results. A focus group was one method of data collection. This was led by the instructor of the classes, which may have put pressure on the participants to say positive things. A study by Li et al. (2007) also found improved function and perceived participant enjoyment. However, the study only lasted for five days and there was no control group.

Although these additional studies have their limitations and are classed as lower levels of evidence, they have similar findings and demonstrate potential for this type of exercise to improve both the symptoms and effects of Parkinson’s disease. This indicates the need for further research in this area.

A randomised controlled trial by Hackney et al. (2007), looking at the effects of tango compared to standard exercise, found tango showed greater improvement on balance and mobility measures. It is acknowledged in the study that this may be due to the fact that a lot of the standard exercises were performed whilst seated. A more beneficial trial could compare tango with another form of aerobic exercise. However, both groups improved on UPDRS. The UPDRS is an appropriate and reliable measure for assessing signs and symptoms of Parkinson’s disease (Movement Disorder Society 2003). This indicates that both forms of exercise have functional benefits for people with Parkinson’s disease.

Two randomised controlled trials (Cakit et al. 2007 and Miyai et al. 2002) chose treadmill training as their form of aerobic exercise and found it caused a significant improvement in walking. Cakit et al. (2007) used walking speed and distance on a treadmill as their outcome measure, and Miyai et al. (2002) used speed and number of steps during a ten metre walk. Neither of these outcome measures, especially walking on a treadmill, is very clinically significant. This is because walking on a hard, flat surface with no obstacles, does not assess how well a person can walk during their activities of daily living, which probably include walking on uneven surfaces and through doorways.

However, both trials also chose the UPDRS as another outcome measure which is more functional and clinically relevant. Cakit et al. (2007) found treadmill training significantly improved UPDRS score, whereas Miyai et al. (2002) did not. This may be due to the fact that the trial by Miyai et al. (2002) only lasted one month, which is half as long as the other trial. This may not have been enough time for functional improvements to occur. Skidmore et al.
(2008) also found that treadmill aerobic exercise significantly improved the participants’ UPDRS score. However, this was a pilot trial which only included five participants. Therefore it cannot be considered reliable evidence on its own, but it is useful because it has similar findings to Cakit et al. (2007).

Hirsch et al. (2003) compared the effect of balance and resistance training compared to balance training alone. They found a statistically significant improvement in balance and muscle strength in both groups. The balance and muscle strength of the combined group improved significantly more than that of the balance group. Muscle strength alone is not clinically significant because it does not give an indication of whether increased muscle strength leads to benefits in the participants’ function.

Balance was assessed using a computerised dynamic posturography, which has the advantage of being more accurate than outcome measures which rely on the human eye. However, as acknowledged in the study, this is not a very functional measure of balance and different results may have been found if a more functional and clinically significant measure was used, such as the Berg balance scale.

A well designed randomised controlled trial by Ashburn et al. (2007) looked at the effects of a home exercise programme which included balance, strengthening and range of movement exercises. A range of functional, and appropriate, outcome measures were chosen, including the Berg balance scale, the UPDRS and the functional reach test. Participants were asked to keep a record of exercise compliance on a standardised form so non compliance could be noticed and not have an adverse effect on results. The results found trends towards fewer falls and statistically significant improvement for functional reach in the exercise group.

There was no statistically significant difference between groups for other outcome measures. This could be due to increasing numbers of the control group receiving treatment outside the trial. This is a downfall in the design of the trial but the investigators thought it would be unethical to ask participants in the control group not to receive rehabilitation during the trial period since the follow up lasted six months.

Although all of the randomised controlled trials showed beneficial effect of exercise on Parkinson’s disease, care must be taken when applying these findings to other Parkinson’s
patients. Most of the studies had a very small number of participants so the statistical findings may not be reliable. The only study to have a larger number of participants was by Ashburn et al. (2007). However their target number of participants to achieve 80% power was 200 and they only had 130, so even their data had reduced statistical power.

There were also some flaws in the methods, which may have affected the reliability of the results. Three of the trials (Bergen et al. 2002, Miyai et al. 2002 and Hirsch et al. 2003) did not specify if the investigators conducting the assessments were blinded to the intervention group of the participants. Although all studies reported randomly assigning their participants to groups, only two (Ashburn et al. 2006 and Burini et al. 2006) stated their method of randomisation. It is important to know this when critiquing a paper because randomisation and blinding are key features in conducting unbiased trials (Moher et al. 2001).

The method of recruiting participants was generally good. Most trials recruited participants from neurorehabilitation centres. Ashburn et al. (2007) recruited their participants from clinical registers of Parkinson’s disease specialists so they were a good representation of the population of people with the condition. Two trials (Miyai et al. 2002 and Cakit 2006) did not state where they recruited their participants from. It is important to know this information so you have some indication of the population of people with Parkinson’s disease that the results may apply to.

Most of the randomised controlled trials used participants who were stages two and three in the Hoehn and Yahr stages of Parkinson’s disease. This means they had mild to moderate disability (Hoehn and Yahr 1967). The results found in these trials cannot be applied to people with other stages of disability. One research question that can be drawn from this gap in the evidence is: what are the effects of exercise on people with mild Parkinson’s disease (Hoehn and Yahr stage one) and does exercise slow down the rate of progression of the disease? Another research question that stems from the gap in the evidence is: what are the effects of exercise on people with severe Parkinson’s disease (Hoehn and Yahr stage four)?

The duration of intervention ranged from six weeks to sixteen weeks in the studies. These are relatively short time frames and may not have been long enough to see improvements in function. Only three studies (Hirsch et al. 2003, Miyai et al. 2002 and Ashburn et al. 2007) collected data for follow up periods. They all found that benefits of exercise were still present.
in the follow up period, although they did start to decrease after the intervention ended. As Parkinson’s is a chronic and progressive disease it would be useful to investigate the effects of long term exercise. There is currently a lack of evidence in this area so another appropriate research question is: what are the effects of long term exercise programmes for people with Parkinson’s disease?

References


Jenkinson, C., Peto, V., Fitzpatrick, R., Greenhall, R., Hyman, N. 1995. ‘Self reported functioning and well being in patients with Parkinson's disease: Comparison of the Short Form Health Survey (SF-36) and the Parkinson's Disease Questionnaire (PDQ-39)’, Age and Ageing 24, 505-509.


