MANAGEMENT OF A GENTLEMAN WITH PARKINSON’S USING A PILATES PROGRAMME
DEVISED AND TAUGHT BY A PHYSIOTHERAPIST.

Sarah Sessa BSc (Hons) Physiotherapy. MCSP. Specialist Physiotherapist and Pilates
Instructor at the Pilates Studio, Bristol.

Introduction

Parkinson’s is a degenerative neurological disorder that occurs in 1 in 500 people in the UK
with prevalence slightly higher in men than women. Usual onset is after the age of 50
although early onset Parkinson’s is sometimes diagnosed under the age of 40 (Parkinson’s
UK 2013). The disease process affects the dopamine producing neurones of the substantia
nigra within the basal ganglia which project to the striatum.

The basal ganglia are responsible for: pre-movement planning and preparation, initiation of
movement, sequencing and timing of movement, maintaining cortically selected movement,
habit building and shifting of motor and cognitive sets. They are anatomically linked to the
limbic system so depletion of dopamine will not only affect motor function but non-motor
and psychological function too. Physiotherapists are mainly concerned with the effects of
motor symptoms but must take into account possible problems with emotional response,
mood, retaining new information, recognition of names and faces and autonomic
dysfunction. Other possible non-motor symptoms that can be encountered are sleep and
sensory disturbances (Aragon et al 2007).

Motor symptoms can include bradykinesia, rigidity of muscles, tremor and decreased
postural control mechanisms. The bradykinesia and muscle rigidity often leads to flexed
body posture, sometimes with lateral flexion and decreased mobility of the trunk.
Consequently there maybe secondary muscle weakness and tightness in other areas.

Function

Balance: Decreased trunk mobility and poor postural mechanisms may affect balance as
can decreased sensory processing within the basal ganglia. Together, these factors
increase the risk of falls.

Walking: Stride length, trunk rotation, arm swing and walking speed are reduced. Gait can
become shuffling and festinating. Loss of internal cueing mechanism of automatic
movements such as walking means clients with Parkinson’s encounter problems with
freezing and inability to initiate movement, particularly on meeting obstacles or doorways.
Dual tasking when walking can become difficult.

Fine motor activities: Writing and fastening buttons become increasingly hard as reaching
and grasping are affected.

Transfers: These will become difficult due to motor symptoms.

(Keus S et al 2004)
A combination of non-motor and motor symptoms can lead to the person with Parkinson’s becoming more sedentary, consequently increasing the risk of falls and to have problems with constipation and decreased cardiovascular efficiency. The prevalence of osteoporosis is also higher in people with Parkinson’s which can be positively affected by exercise. Reduced bone mineral density in this population may be due to several factors such as decreased activity, decreased muscles strength, low body weight and vitamin D deficiency (Speelman A et al 2011).

**Physiotherapy, exercise and Parkinson’s.**

The European Guidelines for Physiotherapy in Parkinson’s Disease (KNGF) published in 2004 are based on scientific research and make therapeutic recommendations for physiotherapists so that they can provide optimum treatment to Parkinson’s patients. The guidelines suggest different goals of therapy for each stage of the disease as classified by Hoehn and Yahr (1967). Within this classification there are 5 stages progressing from stage 1 where there are mild, unilateral symptoms which are not disabling, to stage 5 where the patient is fully dependant with no walking or standing. The goals for the early stage (H&Y 1-2.5) should be: prevention of inactivity, prevention of fear of moving or falling and to improve physical capacity. In the mid phase (H&Y 2-4) where symptoms can vary between bilateral with minimal disability to severe symptoms with very poor mobility and support at home, physiotherapy will aim to maintain and improve activities such as transfers, mobility and reaching/grasping. Therapy should include work on balance and body posture as well as continuing as for stage 1. Late phase management (H&Y 5) continues as for the mid phase but should also provide maintenance of vital functions and prevention of pressure sores and contractures (Keus S et al 2004).

Over the last few years there have been a number of studies looking at exercise and Parkinson’s. Morris et al (2010) describes several studies that included treadmill training, Tai Chi, graded intensity training and movement and musculoskeletal exercise, all of which demonstrated improvement. Morris et al concluded that people with mild to moderate Parkinson’s can benefit from interventions that incorporate flexibility, lower limb strengthening and cardiovascular work. This is important in preventing secondary musculoskeletal complications, improving balance, gait and function and also to prevent or reverse declines associated with the ageing process. To sustain benefits, individuals should exercise several times each week incorporating it into their daily routine. They should be assessed at least annually by a physiotherapist in the early stages and more often in later stages.

Speelman et al (2011) discussed a meta-analysis of several studies looking at the effects of exercise and physiotherapy on motor disability concluding that exercise can improve physical function, strength, balance, posture and gait.

A randomised control trial looking at Tai chi and Parkinson’s was published by Li et al (2012) and concluded that this balance based exercise method appears to improve postural control, functional capacity and reduce falls in patients with mild-moderate Parkinson’s. The NICE guidelines for Parkinson’s also suggest that The Alexander technique may be useful to patients (NICE 2006).
There is positive anecdotal information regarding exercise methods such as the Alexander technique, Tai chi, Yoga and Pilates. These posture-rich techniques all use cognition to promote posture and body awareness (Parkinson’s UK 2013).

**Pilates and Parkinson’s.**

Pilates was created by Joseph Pilates in the 1920’s and its benefits are acknowledged worldwide. This technique comprises of a large number of exercises that concentrate on strength (particularly of the core or deep stabilising muscles such as transversus abdominus and multifidus), flexibility, balance, co-ordination, correct breathing and stress relief, all of which have been deemed important in the management of Parkinson’s.

Pilates has been recognised by physiotherapists as beneficial to several rehabilitation populations. The Australian Physiotherapy and Pilates Institute (APPI) have designed a modified Pilates programme described as “A form of dynamic stabilisation retraining that reconditions the body from the central core to prevent the recurrence of and treat a range of postural, musculoskeletal and neurological conditions”. And in the area of neuro-Pilates the aim is “to retrain low threshold activity of local muscles to increase stability, develop postural control and improve alignment, improve strength, improve balance reactions, improve proprioception, regain extensibility of and decrease over-active global muscles, improve body awareness and visual- spatial co-ordination, improve gait” (Withers et al 2009).

Pilates Instructors are updating their qualifications and specialising in rehab populations such as Parkinson’s as more and more anecdotal and research based evidence becomes apparent (Hudson 2013).

Royer and Waldmann (2007) suggest that Pilates for patients with Parkinson’s should include: (a) spine mobility exercises especially through extension, lateral flexion and rotation, (b) scapular patterning prior to upper limb exercises integrated with spine movement, (c) hip mobility especially through extension, rotation, adduction and abduction, (d) then integrated into gait with progressions to maximize the client’s balance and coordination abilities and (e) applications to daily activities or sport.

Pilates is based on 8 principles:

**Concentration:** During a Pilates session the client should be mindful of each exercise. With decreased automatic control of movement encountered with Parkinson’s, this more cognitive approach can be helpful.

**Breathing:** Breathing control is an integral part of Pilates and may help improve respiratory function that is decreased in Parkinson’s due to postural changes. Breathing control allows early activation of transversus abdominus which increases local muscle stability and improves postural control (Hodges et al 1999).

**Centering:** The centre is the “powerhouse” from which the arms and legs are moved. A strong core allows efficient movement and greater local stability which improves postural control.
Control: Improved muscle control can be achieved as the patient progresses and lead to better movement quality.

Precision: The patient aims to perform the exercises with precision leading to greater conscious and kinaesthetic control. “Kinaesthetic cueing” occurs when the patient focuses on how a movement feels and how it relates to the body (Royer et al 2007). This precision can be very useful when automatic control is decreased.

Flowing movements: Pilates exercises are fluid, smooth and continuous. This may have positive effects on bradykinesia and decreased range of movement due to rigidity.

Isolation: Mindfulness of each exercise allows the client and therapist to recognise incorrect movements so they can then isolate them and make corrections.

Routine: Pilates forms part of a weekly routine. Cognitive and cueing strategies.

With the disturbance of internal cueing mechanisms and decreased automatic control of movement alternative cueing and cognitive techniques can be used dividing tasks into single components (Keus S et al 2004). Using these during Pilates may help to improve movement and as the disease progresses the client maybe familiar with these techniques when he or she needs to use them for transfers and gait. There are several different intrinsic and extrinsic cues that can help and 3 examples pertinent to Pilates are listed below:

Mental Rehearsal:

The client prepares for the task/exercise by mentally rehearsing it before they carry it out. This primes the body so it is ready to perform more effectively.

Visualisation:

Visualisation and imagery can improve positioning and alignment and can be useful to Parkinson’s clients who may use such strategies to combat the lack of automatic control.

Verbal cues: (external cue)

Words such as ‘flowing’, ‘gentle’, ‘smoothly’ will supplement visualisation methods and can help to reduce global muscle over-recruitment as well as the intention tremors which can delay or stop an intended motion (Royer et al 2007).

PATIENT CASE STUDY

HISTORY

In February 2011, R, presented to his GP with a tremor of the right hand and was diagnosed with early stage Parkinson’s as classified by Hoehn and Yahr in 1967. No medication was indicated. In September 2011 R self-referred for Pilates as he wanted to increase flexibility
in stiff joints and muscles, maintain his mobility and balance and be as pro-active as possible as this increased his sense of well-being.

R was investigated for TIs in the summer of 2011 and although cleared was placed on Clopidogrel 75mg to prevent clotting and Simvastatin 40mg to maintain cholesterol levels.

R lives with his wife in a house and is a retired accountant. He is very active and has two donkeys so spends a lot of time outdoors tending to them and working in his large garden.

**PHYSICAL ASSESSMENT**

R can walk several miles with no aid and is independent in all personal care and transfers and he drives. He reports no problems with balance or falls. A full objective assessment was carried out, and a problem list and Pilates based treatment plan were devised.

**Initial problems.** (September 2011)

1. Tremor right hand.
2. Decreased range of right shoulder flexion (145 degrees)\(^1\) thought to be due to general muscle weakness and tightness. Right hand reaches 20cm lower than left hand when running fingers up wall.
3. Decreased hip rotation bilaterally (half ROM) due to tightness of hip adductors and weakness of the gluteal muscles.
4. Decreased trunk control on right side during prone swimming exercise. This was manifested as decreased ability to transfer weight and stabilise through the right side of his trunk meaning he could not lift his left arm off the floor.
5. Tightness of the right hamstrings. Decreased end range knee extension (-15 degrees).
6. Decreased ankle dorsiflexion and plantar flexion due to joint stiffness. Right=5 degrees dorsiflexion and 30 degrees plantar flexion. Left= 10 degrees dorsiflexion to 40 degrees plantar flexion. In child pose exercise R could not bring his bottom back on his heels due to ankle discomfort and stiffness.

7. Decreased trunk rotation during gait.
8. Decreased cervical spine ROM, all movements.
10. Potential decreased balance strategies and function. Currently R demonstrates high level balance function with no falls and is able to work on rough uneven terrain and run.

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\(^{1}\) ROM of joints was measured by goniometry, tape measure or visual estimation (Petty NJ 2007) and were all done by the same therapist each time.
GOALS

The Pilates programme designed also addressed the general goals set out on the UK Quick Reference Card 4 (QRC4) “Treatment Strategies” (Parkinson’s UK 2009):

- Maintain independent transfers.
- Conscious normalisation of posture.
- Improve reaching, grasping and manipulating moving objects.
- Improve balance.
- Improve gait.
- Preserve or improve physical function.
- Prevent falls.

The therapist and R decided goals that he wished to achieve making them as measurable as possible as for SMART goals (Porter S 2013). The GAS-light was used as a valid tool by which R’s progress could be measured and provided an individual set of goals unique to R. The GAS requires the therapist to predict as accurately as possible, the expected outcome. In the full GAS model each score from -2 to +2 will have a specific goal description as compared to the GAS-light where only the expected outcome is specified (which scores zero). Simple statements are then uses such as “much worse” (-2), “a little worse” (-1), “a little better” (+1), “much better” (+2) (Turner-Stokes L 2009).

Below are 4 key goals that had the GAS-light applied to them to assess whether goals were being achieved throughout the intervention.

1. Improve right shoulder elevation through flexion, especially when running hands up wall.
2. Improve ability to lift left arm up off floor during prone swimming. I.e. improve right trunk stability.
3. Decrease stiffness of right knee and reduce flexion deformity.
4. Improve ankle ROM, R particularly wanted to perform child pose comfortably, with his bottom back on his heels.

R was highly motivated with great desire to be able to perform the exercises as correctly as he could, achieving positions that were challenging to him. These goals were pertinent to R and the therapist as they demonstrated a physical improvement as well as measuring objective markers. For the purpose of the study the two measurements for the GAS-light were taken at the start and end of the 10 month programme although reassessment of objective and subjective markers was continuous throughout. No balance or functional outcome measure (e.g. Berg) were used as R was high functioning and a ceiling effect would have occurred.

TREATMENT

Physiotherapy management from the KNGF guidelines (Keus S et al 2004) relevant to this case study are:
1. Frequency and duration of treatment: At least 1 treatment a week for 4 weeks is thought to decrease limitations in function. To improve physical activity 8 weekly sessions are indicated.

2. Application of cognitive and cueing strategies can improve performance of transfers and can be incorporated into functional practice and the exercise programme.

3. Exercise programmes should offer improvement in co-ordination of muscle activity aiming to allow performance of tasks to become easier.
4. Changes in posture can be corrected by verbal or visual feedback.
5. Cueing and cognitive strategies and avoidance of dual tasking can improve reaching, grasping and moving objects.
6. Relaxation methods can decrease tremor and tone.
7. Balance exercises and strength training can improve postural control.
8. Exercises that focus on walking, joint mobility and muscle strength, such as Tai chi decrease the number of falls in healthy, elderly individuals.
9. There are indications that gait improves with strengthening of the lower extremities and maintenance or trunk mobility.
10. Exercise programmes that focuses on improving joint mobility with activity related exercises (balance and gait) can improve activities of daily living (ADL) function.
11. Exercise programmes should be designed to meet the person’s needs taking into account his/her individual problems.

From these guidelines a Pilates programme was devised to work on improving range of movement throughout the body, targeting any specific decreased flexibility. It also worked on core strength, postural control, co-ordination and mind-body awareness. Exercises were changed regularly to ensure they never became too automatic. They were progressed as appropriate using gravity, props such as the foam roller or gym ball and Pilates machines such as the reformer and cadillac which use springs to assist or resist movement. Standing and balance re-education exercises were included to ensure principles of Pilates were always translated into everyday function. The exercises shown in the table below were appropriate to R’s problems and related to the treatment strategies laid out on the QRC4 “Treatment Strategies”

### Treatment table

<table>
<thead>
<tr>
<th>Pilates Exercise</th>
<th>Aims, particular to R</th>
<th>QRC strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing exercises</td>
<td>1, 4.</td>
<td>Cognitive strategies, aerobic capacity, muscle strength training, (breathing control will initiate early activity of transversus abdominus), relaxation.</td>
</tr>
<tr>
<td>Deep neck flexor isolation, neck rotations supine.</td>
<td>8, 9.</td>
<td>Trunk (neck) mobility, improves posture, will aid visual input.</td>
</tr>
<tr>
<td>Static abdominals, small pelvic tilts, shoulder bridge, shoulder bridge with arm</td>
<td>4, 7</td>
<td>Cognitive movement strategies, relaxed, co-ordinated movements, muscle strength, trunk and joint mobility.</td>
</tr>
</tbody>
</table>
movements, straight and oblique abdominal curls.

| Hip twist, clam. | 3 | As above. |
| Scissors, all levels. | 4 | As above. |
| Single leg stretch, dying bugs. | 4, 2, 5, 6 | As above, lengthening of hamstrings. |

Chicken wings, dumb waiter, arm circles, thread the needle, arm openings side lying, *Foam roller can be used to combats thoracic spine flexion during chicken wings exercise.*

| Bugs, 4 point and prone swimming. | 2, 4, 5, 6 | Joint mobility and trunk. |
| Arm extension in sitting, dumb waiter. | 4 | Posture awareness, visual cue if using a mirror, joint mobility, strength training. |
| Cat stretch, child pose. | | Relaxation, joint mobility. |
| Spine twist. Use gym ball or stand to challenge balance. Can also be done in standing. | 7, 10 | Strength training, joint mobility, trunk mobility. |
| Weight transference/balance exercises, stepping all directions. 8 pilates principles applied. | 10 | Practice of appropriate tasks to identify (potential) balance loss. Maintain balance, train strength. Practice walking. |
| R also did a number of exercises in prone lying to inhibit flexion patterns and encourage extension. E.g. prone hamstrings, diamond press, arrow, prone swimming. | 9 4 8 | Relaxed, co-ordinated movement, training muscle strength, joint mobility, posture. |

Refer to [www.sarahsessaphysio.co.uk](http://www.sarahsessaphysio.co.uk) for explanation of exercises.

Verbal cues and feedback were used throughout the treatment sessions as well as imagery and mental rehearsal.
1. **Improve shoulder mobility and decrease stiffness.**
   - Improve right shoulder elevation through flexion. When running hands up wall: right hand to be only 10cm or less lower than the left hand. Active flexion through elevation to be at least 160 degrees.
   - **1**
   - **Yes**
   - **R** had full right shoulder elevation through flexion. On reaching up the wall both hands reached the same height.
   - **+2**
   - **R**’s better than expected outcome may be due to the fact he was highly motivated and determined and practiced daily at home.

2. **Perform prone swimming exercise.**
   - Improve ability to lift left arm up off floor during prone swimming. I.e. improve right trunk stability and take weight over to this side more easily.
   - **1**
   - **Yes**
   - **R** could now lift his left arm up off the floor.
   - **+1**
   - Although he found this difficult and the movement was not smooth it was till better than expected.

3. **Decrease stiffness of right knee.**
   - Reduce flexion deformity to less than 10 degrees.
   - **1**
   - **Yes**
   - **R** had a flexion deformity of 5 degrees at final assessment so it was improved but not absent.
   - **0**

4. **Perform child pose.**
   - Improve both ankle ROM. **R** particularly wanted to perform child pose comfortably, with his bottom
   - **1**
   - **Yes**
   - **R**’s ankle ROM improved except on right plantarflexion which
   - **+1**
   - **He** could now get his bottom back completely on his heels.
Results

Final results using the GAS-light as recorded at reassessment in July 2012. The GAS equation was applied to the scores and results are below:

\[
\text{GAS score} = 50 + \frac{10 \sum w(x_i)}{\sqrt{(7 \sum w_i^2) + 3 \sum w_i}}
\]

Baseline GAS T-score: 31.9    Achieved GAS T-score 64.5

Results show that R achieved a higher score than was expected. i.e. >50. As explained in the variance column it was felt that R was particularly motivated and determined to achieve goals that he found difficult. This would be taken into account when deciding his expected outcomes for his next set of goals.

Patient feedback.

- R reported improvement in flexibility and balance.
- Less discomfort during functional outdoor tasks (such as mending his sit on mower) and able to complete them in a shorter time.
- No longer freezes when walking although this only happened occasionally.
- Improved sense of well-being: feeling more positive that he has found something he can do to help himself that works.

DISCUSSION

This study illustrates how Pilates has the potential to benefit Parkinson’s patients by improving flexibility and strength and maintaining functional ability and balance.

Improvements in joint flexibility were seen with related goals being achieved. It is hypothesised that these improvements were due to a regular Pilates programme that became part of R’s weekly routine and without it he may have become less flexible and balance and function may have decreased. Each client will present with different problems and the varied repertoire of Pilates means programmes can be tailor made to the individual’s needs. It is also possible that the cognitive nature of the Pilates method allows the client to become familiar and practiced with cueing techniques.
Although this is only one case study, the improvements seen and felt by the client suggest that a Pilates programme monitored by a physiotherapist could be of benefit to people diagnosed with Parkinson’s. It may not be realistic or financially viable for a client to see a private physiotherapist weekly, on a long term basis and this amount of input would not be available within an NHS physiotherapy department.

But perhaps (ideally after initial physiotherapy assessment), clients could benefit from weekly Pilates sessions with an instructor who has appropriate training in managing Parkinson’s clients and who has links with a physiotherapist. This may be much more achievable and cost effective.

**Limitations**

- Verbal feedback was received from R but a quality of life measure such as the Parkinson’s Disease Questionnaire (PDQ-39) as suggested in the UK QRC 1: Diagnostic Process (2009) might be useful in providing greater validation.
- The GAS-light was deemed adequate for this single case study but for studies with larger client numbers the full GAS model should be used.
- This is a single case study: more case studies need to be done.
- Comparative studies (with greater client numbers) between other structured Parkinson’s exercise programmes and Pilates need to be undertaken to determine whether one approach is more beneficial than another.
- Studies to look at usefulness of Pilates in the mid and late stages of Parkinson’s should be conducted.
- Group sessions need to be investigated as this may be more accessible for many. Patients may also feel more supported and motivated within a group setting.

**CONCLUSION**

Specialist and individualised Pilates sessions for those with Parkinson’s could provide this population with another means by which they can maintain independence and be symptom free for longer. This might improve quality of life for them and their families. R presented with bradykinesia, tremor and muscle stiffness. Through Pilates he found his flexibility, strength and function improved and had a greater sense of well-being. He also learned cognitive and cueing strategies that may be useful in the later stages of the disease. His balance was very good on initial assessment but his Pilates programme was tailored to maintain this. R’s symptoms are common in the early stages of Parkinson’s and such a programme could be of benefit to others. This should be investigated further.

(word count 3912 not including references)

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