

Effectiveness of Otago Exercise Program Versus Modified Otago Exercise Program on Balance and Fall Efficacy in Parkinson's Disease Patients: A Comparative Study

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Abstract

Background and Purpose: Parkinson's disease (PD) is associated with postural instability, impaired balance and an increased risk of falls. The Otago Exercise Program (OEP) is a structured strengthening and balance program used for fall prevention, while a Modified Otago Exercise Program (MOEP) may incorporate walking to increase functional challenge. This study compared the effects of OEP and MOEP on balance and fall efficacy in individuals with PD.

Methods: A comparative study was conducted among 72 individuals with Parkinson's disease with balance impairment. Participants were allocated into an OEP group and an MOEP group (36 participants per group) and received their respective programs for four weeks. Balance and fall efficacy were assessed before and after intervention using the Berg Balance Scale (BBS) and Falls Efficacy Scale (FES). Within-group changes were analyzed using paired t-tests, and post-intervention group differences were compared. Data were analyzed using GraphPad InStat 3.05.

Results: Both groups demonstrated statistically significant improvement in BBS and FES scores after four weeks ($p < 0.0001$). In the OEP group, BBS improved from 37.78 ± 6.94 to 44.44 ± 7.02 , while FES decreased from 57.42 ± 6.95 to 41.08 ± 9.41 . In the MOEP group, BBS improved from 39.25 ± 5.62 to 46.00 ± 5.96 , while FES decreased from 59.33 ± 4.05 to 41.08 ± 8.22 . Post-intervention comparison showed no statistically significant difference between groups for BBS ($p = 0.1688$) or FES ($p > 0.9999$).

Conclusion: Both OEP and MOEP were effective in improving balance and fall efficacy over four weeks in individuals with Parkinson's disease. MOEP produced a slightly higher post-intervention BBS mean, but the difference was not statistically significant. Both programs may therefore be considered practical exercise-based approaches for neurorehabilitation and fall-risk management in PD.

Keywords: Parkinson's disease; Otago Exercise Program; Modified Otago Exercise Program; balance; falls efficacy; neurorehabilitation.

1. Introduction

Falls are unplanned events that result in a person coming to rest at a lower level and represent an important public-health problem in older adults. Consequences include fractures, traumatic injuries, reduced mobility, loss of independence and social participation. The risk of falling increases when age-related changes in the neuromusculoskeletal and sensory systems interact with impaired balance and reduced adaptability.

Parkinson's disease is a progressive neurodegenerative disorder characterized by motor features including bradykinesia, rigidity, tremor and postural instability. Individuals with PD commonly experience gait and balance impairment, and their ability to respond to unfamiliar or challenging postural demands may be reduced. Balance deficits may involve limitations of stability, altered perception of verticality, impaired postural reactions and delayed postural responses.

Balance is maintained through the integrated contribution of musculoskeletal, neurological, sensory and cognitive systems. Static, dynamic, proactive and reactive components of balance are clinically relevant to fall risk. Fear of falling or reduced falls efficacy may further restrict activity, creating a cycle of reduced mobility, deconditioning and increased fall risk.

The Otago Exercise Program is a structured exercise intervention emphasizing lower-limb strengthening, balance training and walking practice. It was developed as a fall-prevention program and has demonstrated benefits in older adults. The present study examined whether a modified version incorporating a walking component provides additional benefit compared with the conventional program in people with PD.

Two clinical outcome measures were used. The Berg Balance Scale (BBS) is a 14-item performance-based measure of functional balance, while the Falls Efficacy Scale (FES) evaluates concern or confidence related to falling during everyday activities. Together, these measures provide objective and subjective perspectives on fall-related function.

The study therefore aimed to compare the effects of OEP and MOEP on balance and fall efficacy after four weeks of intervention in individuals with Parkinson's disease.

2. Methodology

Study design and setting: The study used a comparative design. Participants were recruited from Parkinson's rehabilitation centers in and around Pune city. The study population comprised individuals with Parkinson's disease who had balance impairment. The protocol duration was four weeks and the overall study duration was 18 months.

Sample and sampling: The dissertation reported a total sample of 72 participants. Purposive sampling was used. Participants were divided into two groups by an odd-even allocation method: Group 1 received OEP and Group 2 received MOEP.

Inclusion criteria: Diagnosed Parkinson's disease; stable medication; ability to understand and follow therapist instructions; willingness and ability to participate in a structured exercise program; and Modified Hoehn and Yahr stage 2.5–4.

Exclusion criteria: Severe cognitive impairment or dementia affecting participation; other musculoskeletal or neurological conditions restricting participation; recent fracture; previous deep-brain stimulation surgery; uncontrolled cardiovascular conditions; uncontrolled orthostatic hypotension; other medical conditions affecting participation; and participation in another PD-specific exercise program during the preceding six months.

Ethical considerations: The dissertation states that the study commenced after ethical clearance and that participants were informed about the purpose and duration of the research before written informed consent was obtained. Participation was voluntary and participants could withdraw at any time.

3. Intervention

Otago Exercise Program: The program consisted of warm-up activities, lower-limb strengthening exercises and balance exercises. Warm-up activities included head movements, neck movements, back extension, trunk movement and ankle movements. Strengthening included front knee strengthening, back knee strengthening, side hip strengthening, calf raises and toe raises. Balance activities included knee bends, walking and turning, sideways walking, heel-toe standing, one-leg standing, heel walking, toe walking, sit-to-stand practice, backward walking and stair walking.

Modified Otago Exercise Program: The MOEP used the same core strengthening and balance exercise program with an additional 15-minute walking component. The dissertation also describes progression through increased exercise intensity and repetitions according to feasibility and participant ability.

Assessment procedure: Baseline BBS and FES assessments were completed before intervention. Participants then completed the assigned four-week program, followed by reassessment using the same outcome measures.

4. Outcome Measures

Berg Balance Scale: The BBS contains 14 functional balance items, each scored from 0 to 4, giving a maximum score of

56. Higher scores indicate better balance performance. The dissertation reports that scores below 45 indicate greater fall risk and reports high reliability for the scale.

Falls Efficacy Scale: The FES used in the study contains 16 activities rated from 1 (not at all concerned) to 4 (very concerned), producing a total score from 16 to 64. Higher scores indicate greater concern or fear related to falling.

5. Statistical Analysis

Data entry and analysis were performed using Microsoft Excel 2019 and GraphPad InStat version 3.05. Descriptive statistics included mean and standard deviation. The Shapiro–Wilk test was used to assess normality, and the dissertation reported that the data followed a normal distribution. Parametric analysis was therefore applied. Paired t-tests were used for within-group comparisons, and statistical significance was set at the 5% level.

6. Results

A total of 72 participants with Parkinson's disease completed the study. Twenty-eight participants (38.88%) were aged 55–70 years and 44 (61.11%) were aged 71–85 years. There were 39 males (54.2%) and 33 females (45.8%). The reported mean age of the overall sample was approximately 74 years.

Table 1. Pre- and post-intervention outcomes in the OEP group

Outcome	OEP Pre Mean $\pm$ SD	OEP Post Mean $\pm$ SD	p
BBS	37.78 $\pm$ 6.94	44.44 $\pm$ 7.02	<0.0001
FES	57.42 $\pm$ 6.95	41.08 $\pm$ 9.41	<0.0001

Table 2. Pre- and post-intervention outcomes in the MOEP group

Outcome	MOEP Pre Mean $\pm$ SD	MOEP Post Mean $\pm$ SD	p
BBS	39.25 $\pm$ 5.62	46.00 $\pm$ 5.96	<0.0001
FES	59.33 $\pm$ 4.05	41.08 $\pm$ 8.22	<0.0001

Table 3. Post-intervention comparison between OEP and MOEP

Outcome	Post OEP Mean $\pm$ SD	Post MOEP Mean $\pm$ SD	p	Result
BBS	44.44 $\pm$ 7.02	46.00 $\pm$ 5.96	0.1688	Not significant
FES	41.08 $\pm$ 9.41	41.08 $\pm$ 8.22	>0.9999	Not significant

7. Discussion

The present comparative study evaluated whether the Modified Otago Exercise Program provided greater benefit than the conventional Otago Exercise Program for balance and fall efficacy in individuals with Parkinson's disease. Seventy-two participants completed the four-week intervention. Both groups demonstrated statistically significant within-group improvements in BBS and FES scores.

Balance: BBS scores increased significantly in both groups. The OEP group improved from 37.78 $\pm$ 6.94 to 44.44 $\pm$ 7.02, while the MOEP group improved from 39.25 $\pm$ 5.62 to 46.00 $\pm$ 5.96. These findings are consistent with the rationale for exercise-based rehabilitation in PD, where repeated balance and strengthening practice can improve functional postural control. The MOEP group had a slightly higher post-intervention BBS mean; however, the between-group difference was not statistically significant ($p = 0.1688$).

The additional walking component in MOEP may provide a functional opportunity to practice dynamic balance and gait-related control. Previous work cited in the dissertation on modified Otago exercise in older adults has reported improvements across static, dynamic, anticipatory and reactive balance domains. However, the present results do not establish superiority of MOEP over OEP.

Fall efficacy: FES scores decreased significantly in both groups, indicating reduced concern about falling. OEP scores decreased from 57.42 $\pm$ 6.95 to 41.08 $\pm$ 9.41, while MOEP scores decreased from 59.33 $\pm$ 4.05 to 41.08 $\pm$ 8.22. The identical post-intervention mean of 41.08 in both groups was not statistically different ($p > 0.9999$). Thus, the addition of walking did not produce measurable additional benefit in the subjective fall-efficacy outcome used in this study.

The findings support the broader evidence summarized in the dissertation that exercise-based physiotherapy can improve balance, physical function and fall-related confidence. The results also reinforce the clinical importance of individualized exercise prescription in PD, particularly when interventions need to be feasible, low-cost and adaptable to the participant's functional capacity.

The absence of a statistically significant difference between groups should be interpreted alongside the four-week duration and sample size. The study demonstrates meaningful short-term within-group changes, but it does not establish that one intervention is superior to the other over the longer term.

8. Clinical Implications

Both OEP and MOEP can be considered feasible exercise-based approaches for addressing balance impairment and fall-related concerns in people with Parkinson's disease. The conventional OEP

provides a structured combination of strengthening and balance activities, whereas MOEP offers an additional walking component that may be useful when gait and dynamic balance practice are clinically indicated.

9. Limitations

The intervention period was limited to four weeks and therefore does not establish long-term maintenance of gains. The sample size may have limited the ability to detect small between-group differences. FES is a subjective measure and may be complemented in future studies by additional measures of quality of life, physical activity, dual-task performance, gait or instrumented postural control.

10. Future Directions

Future studies should use larger multicenter samples, longer intervention and follow-up periods, and more comprehensive outcome batteries. Studies could also examine whether adding cognitive or external cueing strategies, gait-specific practice or instrumented balance assessments produces additional benefits in people with Parkinson's disease.

11. Conclusion

Both the Otago Exercise Program and Modified Otago Exercise Program produced significant improvements in balance and fall efficacy after four weeks in individuals with Parkinson's disease. Although the MOEP group demonstrated a slightly higher post-intervention BBS mean, the difference between groups was not statistically significant. FES outcomes were also not significantly different between groups. The findings therefore support the use of either program as a practical exercise-based intervention for balance and fall-related rehabilitation in Parkinson's disease.

12. References

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