Systematic review

A need to reconsider the rehabilitation protocol in patients with idiopathic Parkinson’s disease: Review analysis

Deepa S., Kumaresan A., Prathap Suganthirababu, Ramana K., Surya Vishnuram, Vignesh Srinivasan

Saveetha College of Physiotherapy, Saveetha Institute of Medical and Technical Sciences, Thandalam, Chennai, 602105, Tamil Nadu, India

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Corresponding author: Kumaresan A. Email: kresh49@gmail.com

ABSTRACT

Idiopathic Parkinson’s disease is the second most debilitating and progressive neurodegenerative disease affecting the functional activities in day-to-day life. The motor and non-motor symptoms have shown to be a huge functional loss for the subject which has led to compromise their independence. There are varieties of treatment programs proposed as pharmacological, surgical, rehabilitation, allied therapies but none have proven to be the disease modifying treatments in managing the symptoms of Parkinson’s disease patients. Research has shown that discontinuity in the treatment and diminished effects of treatments have drained care givers physically, emotionally, and financially. In this study we explore the available physiotherapy treatment strategies highlighting the research gaps in articles (n=36). The articles were taken from the databases such as PubMed, Science Direct and Google Scholar by considering the inclusion and exclusion criteria. Though the present research has shown to be significant in improving the motor and non-motor symptoms there are still unanswered questions on the rehabilitation protocols whether they can modify the disease and improve the quality of life among Parkinson’s disease in long term. Exercise have proven to be beneficial, cost effective and low risk which improves the overall health and independence of the patient, however, the mechanism involved are less understood.

Keywords: Parkinson’s disease; physiotherapy intervention; rehabilitation; functional execution.

INTRODUCTION

Parkinsonism (PD) is a well-known progressive neural disease involving basal ganglia of the brain, resulting in cardinal features of rigidity, slowness in movement, tremors, and unstable posture. Pathologically it shows the presence of abnormal intra-neuronal aggregates of alpha-synuclein which are called as Lewy bodies and Lewy neurites (1). Incidence increases dramatically with increase in age; recent studies suggest that people above the age 50 are at more risk of getting PD (2). There are less than 10 new cases per one lakh under age 50 while there are at least 300 new cases per 1 lakh ages 80-99 years annually. A small percentage (4 -10 percent) develop young -onset PD, appearance of initial symptoms before the age of 40. Men and women are affected almost equally (3). The pathophysiological mechanisms of this sporadic or idiopathic PD are directed towards the increased generation of reactive oxidative stress, abnormal mitochondrial presentation, and rise in intracellular calcium uptake, evidence also shows that the immune, inflammatory and protein degradation are impaired (4).

In addition to the cardinal features, forward stooping and freezing of gait were also significant among people with PD. These symptoms can end up in adverse effects such as mobility and balance impairment thus leading to reduced quality of life. Because of the heterogeneous nature of the disease and lifestyles adapted by the patients it is very important that the assessment must be based on their symptoms present and customized needs of each patient (1).

Much evidence-based studies have vouched more for pharmacological therapy for treating PD, having said that some have even shown the side effects of excessive levodopa administration as fatigue, freezing and other non-motor symptoms like excessive day time sleepiness, nocturia, anxiety and depression. Drugs have shown to have neuro-protective effects, but the side effects are the main stay which shows aggravating symptoms and disease progression; hence it is wise enough to explore more of rehabilitative interventions (5).

Patients have been reporting to outpatient departments only when the motor symptoms set in, but research shows that fatigue and other non-motor symptoms have shown to set in 5 to 10 years earlier before the disease diagnosis. Thus, these non-motor symptoms could be a predisposing factor in the diagnosis of PD. With the disease progression motor symptoms becomes predominant because of the drugs, and physical activity is highly advised to improve the functional abilities and to avoid secondary complications which could enhance recovery (1).

Deep Brain Stimulation (DBS) is a novel technique which also had become the most sorted intervention after taking medications; it is mostly considered in the advanced stages where tremors and freezing have
been interfering in the day-to-day life activities. Surgical approaches mostly consist of lesion or stimulating the thalamus, sub-thalamic nucleus and the globus pallidus. But studies have shown a common side effect as impaired cognitive functions following surgery (6). Such interventions could be frustrating inters of financial and physical burden both on care givers and the patients themselves undergoing the disease progression.

The protocol provided by the ACSM for PD was mainly focused to improvise the independent functions and prevent further complications. Physical therapy and its regime targeted six major elements controlling the smooth ADL: gait, balance, transferring skills, posture control, and enhanced coordination. Customized therapy sessions must be adopted for each patient to cope up their demands and needs on time to time basis; but their evidence lacks on robust treatment protocol that can be applied on all

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### Table 1: Articles reviewed in this study

<table>
<thead>
<tr>
<th>Author</th>
<th>Sample size (n)</th>
<th>Methods</th>
<th>Outcome measures</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vivas et. al.,(8)</td>
<td>11</td>
<td>Over ground therapy (control) and aqua therapy (experimental) 4 weeks, twice a week, for 45 minutes per session</td>
<td>Functional Reach Test, Berg Balance Scale, UPDRS, 5-m walk test, and TUG test.</td>
<td>Aquatic therapy has shown to be more effective than ground-based</td>
</tr>
<tr>
<td>Chaiwanichsiri et. al.,(9)</td>
<td>30</td>
<td>Group A treadmill + home walking + music Group B Treadmill + home walking 3 days/week Group C Home walking 6 days / week</td>
<td>TUG test, Expanded TUG test, Single leg stance, and 6MWT</td>
<td>Rhythmic music could enhance treadmill-training effects on gait and balance performance in early PD patients</td>
</tr>
<tr>
<td>Santos et. al., (10)</td>
<td>33</td>
<td>strengthening, stretching and flexibility exercises for 12 weeks</td>
<td>UPDRS scale</td>
<td>home program can be an adjunct therapy to physical therapy treating PD patients.</td>
</tr>
<tr>
<td>Vitório et. al., (11)</td>
<td>34</td>
<td>Multimodal exercise programme versus regular physical activity for 6 months</td>
<td>UPDRS scale MEMS Hoehn &amp; Yahr Scale</td>
<td>Experimental group with multimodal showed greater improvements in gait parameters.</td>
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<tr>
<td>Jitkritsadakul et. al., (12)</td>
<td>30</td>
<td>electrical muscle stimulation (EMS) using tremor glove</td>
<td>Demographics, UPDRS scale, and tremor parameters</td>
<td>Experiment showed significant changes in reducing resting hand tremor.</td>
</tr>
<tr>
<td>Gandolfi et. al., (13)</td>
<td>76</td>
<td>VR tele-rehabilitation versus sensory integration balance training (SIBT) 7 weeks</td>
<td>Berg Balance Scale DGI</td>
<td>VR showed reduction in postural instability in PD patients.</td>
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<tr>
<td>Franzoni et. al., (14)</td>
<td>33</td>
<td>Nordic walking versus free walking for 9 weeks</td>
<td>UPDRS- III, Hoehn &amp; Yahr Scale, Berg Balance Scale, stabilometric tests.</td>
<td>Both groups showed significant effects.</td>
</tr>
<tr>
<td>Cozwig et. al., (15)</td>
<td>15</td>
<td>Resistance training twice a week for 12 weeks</td>
<td>strength, Bio-impedance, anthropometry, functional capacity</td>
<td>Resistance training showed significant results</td>
</tr>
<tr>
<td>Xin et. al.,(16)</td>
<td>238</td>
<td>Balance, strength and strategy training programme for 12 months</td>
<td>quality-adjusted life-years (QALYs)</td>
<td>intervention is effective on quality of life for 6 months</td>
</tr>
<tr>
<td>Valenzuela et. al., (17)</td>
<td>40</td>
<td>Dual-task training twice a week</td>
<td>Velocity and spatiotemporal parameters of gait</td>
<td>Dual-task training showed improvements in Gait parameters.</td>
</tr>
</tbody>
</table>

RM= repetition maximum, RTG = resistance training group, CG = control group, EMS=electrical muscle stimulation, ADA= age displacement amplitude, RMS= root mean square, QALY= quality adjusted life of years.
The PD patients (2).

The vast range of treatment interventions were administered by physiotherapists in the past, like PNF exercises, verbal cueing, and cognitive movement strategies, LSVT-big exercise, exergames, tele-rehabilitation and martial arts. However, guidelines were as follows: Providing cues for walking, posture and transfers, cognitive movement strategies, etc. to improve or maintain balance, and flexibility and strength training to maximize independency (7).

This study is focused to systematically review treatment strategies and their effectiveness on cardinal features of PD and measuring with an appropriate outcome measure as a prognostic tool.

Search criteria
Type of studies
Articles published from 2010 to 2021 were included in the study. Studies were identified using PubMed, Science Direct, Google Scholar databases and all types of study designs were selected. The exclusion criteria were systematic analysis, reviews, newsletters, no medical or surgical intervention or comparison with any other alternative therapies, duplicate articles and articles published before 2010.

Type of participants
Subjects of all age groups diagnosed with primary PD with any stage and at any duration of the treatment.

Type of technique
Only physiotherapy intervention compared to another.

Data collection
The authors individually identified and assessed the articles by the search criteria mentioned above and found 57 published articles. Full papers were assessed for methodology used and proper clinical outcomes. Studies published in English language on effectiveness of physiotherapy were included in this review. Thirty six articles were selected as mentioned in Table1, which gives an idea about the tabulation done and the information which was extracted from each article.

DISCUSSION
This study was focused to analyze the availability of rehabilitation protocol and to understand their effectiveness. We found in this study that there are numerous exercises protocols available, but they are not standardized due to which selection of these interventions during assessment creates a gap between the disease prognosis and recovery of the patient. This gap strains the patients care givers, emotionally, financially, and there is a pressure on the therapist to show prognosis among the PD patients. This review can be used clinically and scientifically for both clinicians and researchers involved with PD patients. The limitation of the study was lack of good quality evidence based methodological studies. Only studies published in English were reviewed and therefore might have missed some other studies. Exercises have shown to alter the dopamine receptor availability among PD patients.

The heightened variability amidst the heterogeneous physiotherapy interventions, comparing between it were difficult to interpret the proper results. Hirsh and his coworkers (18) showed evidence that activity in the form of motor modules increases brain derived neurotrophic factor (BDNF) among PD patients with effects on dopaminergic pathways.

Physical therapy which focuses on transfers, posture, balance improvement, fall prevention, reduction of fatigue and other non-motor symptoms, upper limb functions, cardio-respiratory capacity maximizes the independent activities, capabilities and minimizes complications as explained in the study done by Tomlinson et al., (19).

Optimized learning environments have shown to be safe and simulating to improve functional activities. Commercial use of the technology has added value to other therapies provided which technology has not got enough evidence to prove it effectiveness, this has been discussed in the study done by Feng et al., (20). Hence there is a pattern seen with the usage of variety of treatment interventions and its effects on the symptoms but have failed to prove their efficiency over each other. Thus, creating a wide option in choosing therapy which is also a reason for delayed prognosis as the choice of selection is not universal.

Limitations
The limitations of this study: long term effects of the interventions were not studied; studies dated before 2010 were omitted; interventions for severe Parkinson’s disease were less reported.

Future recommendations
Recommendations are directed towards obtaining a robust protocol in treating Parkinson’s disease. This can be done when there is a proper understanding of pathophysiology, neuroimaging changes during exercises and biomarkers to get a gold standard intervention approach can be introduced, for which further experimental studies with adequate sample size to be considered.

CONCLUSION
The articles reviewed showed evidence that physiotherapy is effective in Parkinson’s rehabilitation program. Implementation and evaluation in the clinical environment would strengthen the evidence base. The proposed rehabilitation protocols have been proved to be
effective for mobility, balance, fear of falls, cognitive impairments, non-motor symptoms, fatigue, improving quality of life, improve independency and reduce care giver stress. Although the interdisciplinary interventions have been unresearched they still have showed to be a promising regime. Due to lack of evidence the road to recovery is still untouched and underachieved. This study emphasis the need to undertake more RCT’s to establish a standard protocol.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES