



## Effect of Rhythmic Auditory and Visual Cues On Balance in Parkinson Disease: A Clinical Case Protocol

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### **Abstract**

Parkinson's disease (PD) presents a combination of symptoms, such as resting tremors, bradykinesia, rigidity, postural instability, freezing of gait and cognitive impairment. The aim of this clinical case was effect of rhythmic auditory and visual cues in balance training. The following case study illustrates a 54-year old man with middle stage Parkinson's Disease, marked by difficulties with gait, increased stiffness and reduced range of motion (ROM), cogwheel rigidity, resting tremor, and some issues with coordination. Patient-centered goals were developed, surrounding increasing Timed-Up and Go (TUG) score, improving ROM and coordination, 12 session were performed till 4 weeks. UPDRS score and Mini-BEST test score was taken pre and post treatment. The patient's UPDRS score did improve by 10 points and there also was improvement in the Mini-BEST test score. There was even reduced time for Timed up and go test after 4 weeks of intervention.

**Keywords:** NIL.

### **INTRODUCTION**

Parkinson's disease (PD) affects about one million people in the United States. People with Parkinson's disease have significant functional limitations, particularly in the areas of motor function, functional gait, postural stability, and balance control.<sup>1</sup> Some people with Parkinson's disease have a condition known as freezing gait, which is defined as "a momentary, episodic absence or marked reduction of forward motion of the feet despite the intention to walk."<sup>2</sup> Freezing gait can aggravate mobility issues and lead to a loss of independence as well as falls. Fall rates rise as gait and balance become more difficult. with or without freezing gait and people acquire a fear of falling (FoF) which leads to less participation in life

and family duties as well as lower re-creation participation. This is further frequently linked to mental health issues.<sup>3</sup>

### **PATIENTS INFORMATION and clinical presentation**

A 62-year-old man had a 7 months' diagnosis of middle stage Parkinson's Disease. The patient is a retired Accountant who was previously very active with a history of hypertension in the last 5 years. The gradual onset of his disease started when patient having difficulties with regular tasks around the house because he was experiencing 'shaking' and noticed that a lot of his movements were much slower and was

difficult to get from sit to stand. he frequently "freezes" when walking through confined places and hesitates when turning, as well as experienced limited cervical and thoracic rotation, range of motion in the shoulder, elbow, hip, and knee, and minor postural abnormalities. He also has cogwheel rigidity in both upper extremities. The overall strength of patient is 3/5. Bradykinetic movement, dysmetria, and mild to moderate trouble with rapid alternating movement are all symptoms of Bradykinetic movement.

## DIAGNOSTIC ASSESSMENT

Diagnosis was done on the basis of subjective and objective examination and also MRI findings for early Parkinson's disease were carried out.

## THERAPEUTIC INTERVENTION

### Protocols of the conventional balance training

**Warm-up:** Before beginning the treatment session, 5 minute warm up session was carried out to obtain more efficient results.

with decreasing and increasing of the base of support, with and without support (support bar or chair).

**Cues management:** All the exercises were to be performed in front of the mirror (visual cues). The

auditory rhythmical cues were delivered in an open-loop fashion (throughout the whole duration of the exercises) by a metronome at 50, 80, 100, 120, or 140 beats per minute (bpm), according to the exercises. When the patient was unable to perform the movement safely or with sufficient quality, the rhythm was personalized and the patient was instructed to use double the actual time to execute the movements (e.g., 100 bpm instead of 50 bpm).

**Duration and Doses:** Training sessions (50 minutes per session, for 4 weeks, 3 times / week alternate days in a week) were conducted during the medication period at the participants' home. Each session included a 10-minute warm-up along with 5-minute cool down session.

**Cool down:** After end of the session 5 min of cool down.

## OUTCOMES MEASURES

The patient's UPDRS score did improve by 10 points and there also was improvement in the Mini-BEST test score. There was even reduced time for Timed up and go test after 4 weeks of intervention. the score were shows in below table:

	1-3 Session	4-6 Session	7-9 Session	10-12Session
Supporting surface	Solid floor	Solid floor	Compliant foam	Compliant foam
Manipulative task	No	Holding a volleyball with arms extended	No	Holding a volleyball with arms extended
Static posture maintaining (10 min)	Stance width from wide to narrow, including: Shoulder width Narrow width Partial tandem Tandem 1 leg	Stance width from wide to narrow, including: Shoulder width Narrow width Partial tandem Tandem 1 leg	Stance width from wide to narrow, including: Shoulder width Narrow width Partial tandem Tandem	Stance width from wide to narrow, including: Shoulder width Narrow width Partial tandem Tandem
Dynamic weight shifting (10 min þ 10 min)	Sensitivity: high to low  Ball maze OR Table tilt (learning)  Cooking OR Cloth washing (indoor)  Car racing OR Park walking OR Apple catching (outdoor)	Speed: Low to high Step size: Small to big Choice stepping Rope crossing (forward/backward ) Rope crossing (rightward/leftward )	Speed: Low to high Step size: Small to big Choice stepping Rope crossing (forward/backward ) Rope crossing (rightward/leftward )	Speed: Low to high Step size: Small to big Choice stepping Rope crossing (forward/backward ) Rope crossing (rightward/leftward )

OUTCOMES	Pre-treatment	Post treatment
<b>Unified Parkinson's Disease Rating Scale</b>	86	<b>76</b>
<b>Mini-BESTest:</b>	<b>20/28</b>	<b>22/28</b>
<b>Timed Up and Go</b>	<b>17 seconds</b>	<b>15 seconds</b>

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## DISCUSSION

The effect of conventional balance training along with visual and auditory rhythmical cues on balance training in a patient with Parkinson's diseases showed improvement in Unified Parkinson's Disease Rating Scale score and Mini-BEST test score.

A recent meta-analysis found that exercise has long-term positive impacts on balance, gait speed, motor function, and quality of life approximately 2–6 months after the intervention ends in patients with Parkinson's Disease.<sup>4</sup>

Balance training lasting for 4–12 weeks significantly improved balance (as measured by mini-BEST scores<sup>5</sup>, latency of postural response<sup>6</sup>, single-leg-stance performance and functional reach distance), gait velocity and stride length<sup>7</sup>. Cueing has been extensively researched as a training method in PD rehabilitation Morris et al.<sup>8</sup> Cued training yielded greater improvements in gait speed, UPDRS-II scores and UPDRS-III scores of participants than did general exercise or non-cued training.<sup>9</sup>

In healthy individuals, the basal ganglia are thought to generate internal cues to enhance movement initiation and execution. By contrast, research has suggested that individuals with PD use external cues

as a compensatory strategy to facilitate movement by bypassing the defective basal ganglia circuit and instead rely on frontal cortical and cerebellar mechanisms.<sup>10</sup>

The cues mostly influenced temporal aspects, facilitating sensory-motor integration, as suggested by previous studies.<sup>11</sup> Therefore, auditory cues may facilitate anticipatory responses sufficiently early to avoid loss of balance in the same way that they may promote compensatory responses. The compensatory adjustments depend on detection of the imbalance through different sensorial modalities.<sup>12ss</sup>

The patient's UPDRS score did improve by 10 points, with the majority of improvements noted in Part II (Motor aspects of Experiences of Daily Living) and Part III (Motor Examination). Part 2 improvements are related to changes in the capacity to successfully engage in hobbies, bed mobility, tremor, walking, and balance, as well as freezing, whereas Part 3 gains are mostly due to improvements in rigidity, gait, and tremor. In case of dyskinesia, there was also a modest reduction in overall time.

The current study showed that the effect of conventional balance training along with visual and auditory rhythmical cues improve balance in a patient with Parkinson's disease. However, this study varies from previous research in such way that treatment sessions that were held on alternating days and the treatment period was short too.

## DECLARATIONS

## Conflicts of Interest

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

## Patient Perspective

The patient shared his perspective that compared to day one he found significant changes in his balance and gait pattern hence, improvement in quality of life.

## Consent

As per international standard or university standard patients' written and informed consent has been collected and preserved by the authors. Acknowledgment: The authors thank the participant of the study for his co-operation.

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