

“EFFECTS OF VISUAL CUES ON BALANCE AND FUNCTIONAL MOBILITY IN PATIENTS WITH PARKINSON’S DISEASE”

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ABSTRACT

Introduction: Parkinson’s disease (PD) is the second most common neurodegenerative disorder, characterised by the cardinal features of rigidity, tremors, bradykinesia & postural instability. Balance disturbances and gait alteration are common in Parkinson’s disease. The concept of ‘cueing’ relates to the provision of sensory information. It has been suggested that PD patients suffer from deficient internal cue production. External sensory cues (Visual, visual and somatosensory) have been shown to improve motor function in subjects with PD, including improvement of gait. **Method:** 15 patients with age group 40-80 years were selected by convenient sampling. Intervention was given for balance and gait training by using external

Visual cues thrice a week for 4 weeks. Pre and Post assessment was done before starting of 1st session and at the end of 12th session by using TUG, BBS and cadence measurement. Statistical analysis was done by using Wilcoxon signed rank test. **Result:** Significant improvement in pre and post scores of TUG ($p=0.001$), BBS ($p=0.046$) and Cadence measurement ($p=0.026$) was observed. This was found to be statistically and clinically significant. **Conclusion:** This study concludes that Visual cueing has shown significant improvement in overall evaluation of TUG score, BBS score and cadence measurement. So this study accepts the hypothesis that External cueing by using Visual cues is effective in improving balance and Functional mobility in patients with Parkinson’s disease.

KEYWORDS: Parkinson’s disease, Balance, Gait, Visual cue.

INTRODUCTION

Parkinson's disease (PD) is the second most common neurodegenerative disorder, after Alzheimer's disease. PD affects 1% of the population over 60 years of age, and the risk increases proportionally with age. It is a chronic progressive disease of the nervous system characterised by the cardinal features of rigidity, tremors, bradykinesia & postural instability.^[1]

The first published description is contained in an essay on the shaking palsy published in 1817 by James Parkinson as a condition in which the sufferers exhibited "involuntary tremulous motion with lessened muscular power in parts not in action & even when supported with a propensity to bend the trunk forward & to pass from a walking to a running place the senses & intellects being uninjured."^[2&3]

Balance is a complex process involving the reception & integration of sensory inputs and the planning & execution of movement to achieve a goal requiring an upright posture.^[4] Every activity we carry out requires us to react to gravity & our body to adjust accordingly in order to maintain balance.^[5]

Normal balance requires control of both gravitational forces to maintain posture and acceleration forces to maintain equilibrium. Components of balance control ensure stability of the body during widely differing activities.^[6] Balance cannot be separated from the action of which it is an integral component or from the environment in which it is performed. (carr & shepherd 1998).

Also Parkinson's disease gait pattern is characterized by reduced speed, short stride lengths, shuffling steps and, occasionally, freezing episodes. Walking becomes slow with a flexed posture and spontaneous arm. The swing is reduced, adding to the typical profile of the Parkinson's disease gait pattern.^[7&10]

The concept of 'cueing' relates to the provision of sensory information. It has been suggested that PD patients suffer from deficient internal cue production. External sensory cues (auditory, visual and somatosensory) have been shown to improve motor function in subjects with PD, including improvement of gait.^[8]

Craighero, 2004. Morris et al.(1996) described how hypokinesia in PD patients reflects a difficulty in activating the motor system. Other researchers suggested that sensory cueing is

effective in people with PD because of the neural pathways through which the sensory information is processed; namely pathways that bypass the basal ganglia, such as cortical and pre-motor areas.^[9]

Visual feedback cues in the form of transverse lines marking on the ground have been found to improve the walking abilities of patients with PD. Moreover, deficits in the functional neuroanatomy underlying gait in PD patients were found to be compensated by visual cues. Specifically, the right lateral pre-motor cortex, which is mainly regulated by cerebellar inputs, was activated to a greater extent in PD patients than in age-matched healthy individuals by visual transverse lines. Visual feedback is one of the key elements in on-line control of smooth manual tracking.^[7 &10]

METHOD

Patients diagnosed with Parkinson's disease between 40 to 80 years of age and willing to join the study were selected by convenient sampling. Screening was done for them by using MMSE & Hoeh yahr scale. Totally 15 patients were selected for the study who fulfilled the criteria for inclusion.

Written consent was taken from all the patients and they were explained about the procedure and the instructions. TUG, BBS score and cadence measurement were taken as an outcome measure before starting the first session as a part of pre assessment.

Area having 15 feet distance in a straight line which is adjacent to wall was selected. After every 5 feet distance one cardboard on which 'STOP' is written was kept. Then patient was asked to walk in that area and stop just before the "STOP" cardboard paper. Along with that patient can stop when he sees his relative's or therapist's hand indicating stop who were standing by his side. A pause of 7sec was given to patient before resuming walking. After 7sec of pause his relative or therapist used to take his hand down indicating he has to start walking again. During this whole training patient was explained to take larger steps by giving him a reference line on the floor and the squares made by these lines.

This training was given for 3 days a week for 4 weeks. After completion of last session post assessment scores were taken on the basis of outcome measures.

DATA ANALYSIS AND INTERPRETATION

Data analysed by using the SPSS Professional statistics, Version 21 software for windows.

For pre-post comparison for values of TUG score, BBS score and cadence measurement at the end of intervention, Wilcoxon Signed Rank Test was used.

Table 1: Pre-Post Comparison

		PreTUG	PostTUG	Precadence	Postcadence	PreBBScat	PostBBScat
N	Valid	15	15	15	15	15	15
	Missing	0	0	0	0	0	0
Mean		57.2	54.3333	133.1333	128.7333	1.6667	1.4
Median		40	37	140	132	2	1
Std. Deviation		39.13201	39.68927	25.47791	21.23833	0.48795	0.50709

Table 2: Pre-Post TUG Mean.

Visual Cues – TUG	
Pre-TUG	Post-TUG
57.2	54.3

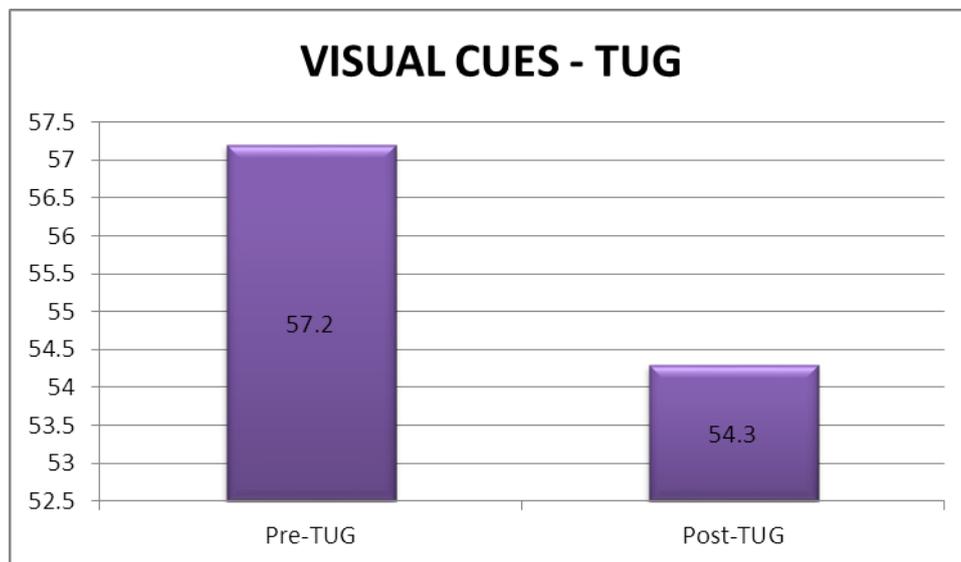


Fig.1: Pre-Post TUG Mean.

Table 3: Pre-Post Cadence Mean.

Visual Cues – Cadence	
Pre-Cadence	Post-Cadence
133.13	128.78

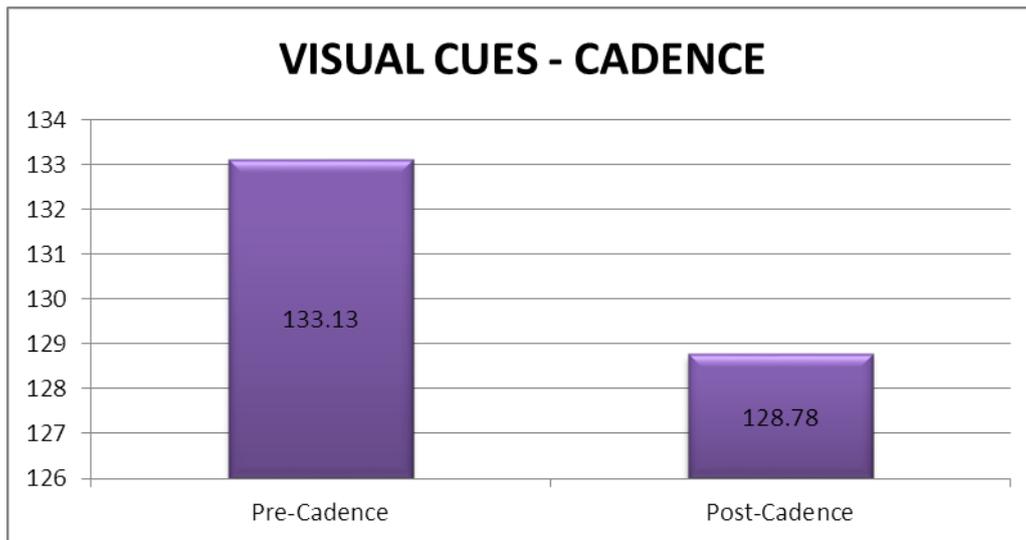


Fig.2: Pre-Post Cadence Mean.

Table 4: Pre-Post BBS Mean.

Visual Cues – BBS	
Pre-BBS	Post-BBS
1.66	1.40

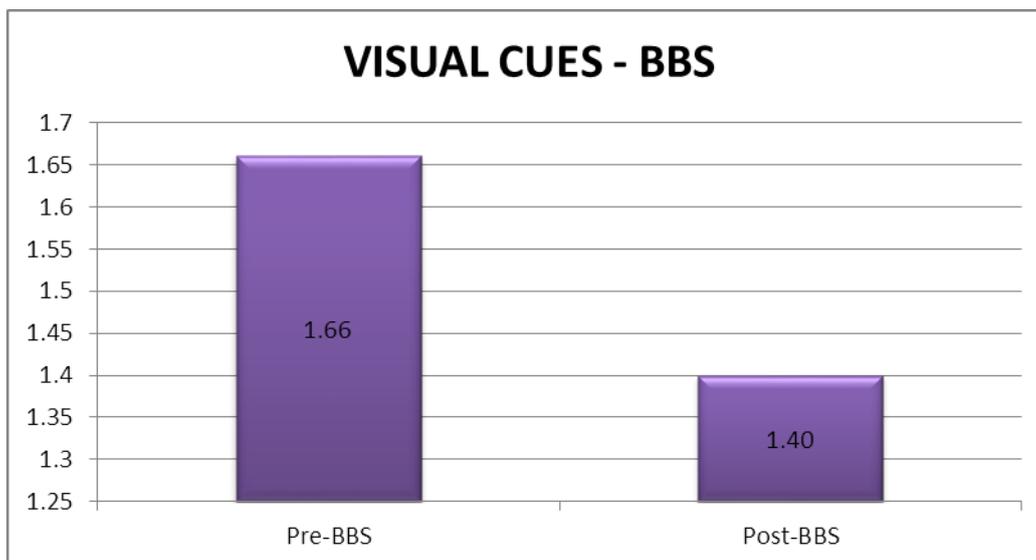


Fig.3: Pre-Post BBS Mean.

RESULT

In this study, 15 Parkinson's patients were included based on the inclusion criteria, Patients were treated by using visual cues. Outcome measures were TUG scale, BBS scale and cadence measurement.

Data analysed by using the SPSS Professional statistics, Version 21 software for windows. Wilcoxon Signed Rank test was used to compare pre and post intervention scores.

1. By applying Wilcoxon Signed Rank test for TUG scores

The mean value for TUG pre training was 57.200 which showed significant reduction indicating improvement in post treatment mean value of TUG 54.333 as shown in table.

Significant reduction in TUG score was observed after training which was 0.001 indicating effectiveness of visual cues.

2. By applying Wilcoxon Signed Rank test for Cadence measurement

The mean value for Cadence pre training was 133.133 which showed significant reduction indicating improvement in post treatment mean value of Cadence 128.733 as shown in table.

Significant reduction in cadence score was observed after training which was 0.026 indicating effectiveness of visual cues.

3. By applying Wilcoxon Signed Rank test for BBS scores

The mean value for BBS pre training was 1.6667 which showed significant improvement in post treatment mean value of BBS 1.400 as shown in table.

Significant improvement in BBS score was observed after training which was 0.046 indicating effectiveness of visual cues.

DISCUSSION

The characteristic hypokinetic gait pattern evident in the patient group under baseline conditions supports previous findings on Parkinson's gait (Knutson 1972; Peterson et al 1972 Murray et al 1978) compared with similar aged control group. The patients demonstrated on average a 24% reduction in gait velocity and 23% reduction in stride length while cadence was relatively comparable. These features are a hallmark of a gait pattern consisting of short shuffling steps taken at a high velocity.

This study (Tanvi Bhatt, Margaret k.Y et al 2013) showed that participants with PD had greater backward stability than participants without PD. These results are consistent with the theory that people with PD compensate for reduced backward stability during the sit-to-stand task by placing their COM more anteriorly relative to their BOS.

Quincy J Almeida et al suggests the positive benefits associated with visually cued walking in PD, little to no studies have evaluated long term benefits of visually cued gait training. Here we present (according to “level of evidence” and “grading of evidence guidelines”) a Silver BIIa evidence study to evaluate the influence of long-term visual cue training. A primary objective of the current study was to isolate visual cues in a static versus dynamic context in order to understand the extent to which optic flow contributes to gait improvements in PD. The two gait interventions were conducted in nearly identical fashions, with the only difference between group training protocols being whether the cues were on the treadmill (TG) or on the ground (OG). In order to remove any other potential confounds, all other variables such as intensity, required step length, frequency of training, and duration of training were kept identical between groups.

Parkinsonian gait has previously been theorized to be the result of a deficient connection between the basal ganglia and supplementary motor area (SMA). The interactions between these two structures are commonly associated with controlling well-learned movements. However, in PD, this disconnect is believed to cause impaired internal cueing within the basal ganglia, often manifesting itself into problematic walking. Visual cues are proposed to bypass this deficient loop and use visual motor pathways in the lateral premotor cortex (PMC) and posterior parietal cortex (PPC), as these areas are activated through externally cued movements and paradoxical movements, respectively. Similar gait results in both training groups is evidence that usual optic flow is not essential, but rather, the transverse lines may be activating these areas regardless of surrounding environmental information.

This study was done on 15 patients with diagnosed Parkinson’s disease. Balance and gait training was given by using visual cues for 3days in a week for 4 weeks. The present result shows significant improvement in balance and gait parameters statistically and clinically. This shows cadence variability when compared with pre assessment outcomes. Along with it good improvement in functional mobility was also noticed.

So in conclusion we can say visual cues are able to improve the balance, functional mobility and gait pattern in patients with Parkinson’s disease.

CONCLUSION

This study concludes that Visual cueing has shown significant improvement in overall evaluation of TUG score, BBS score and cadence measurement. So this study accepts the

hypothesis that External cueing by using Visual cues is effective in improving balance and Functional mobility in patients with Parkinson's disease.

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