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Cueing Effect of Gait Ability in Parkinson's Disease

Areerat Suputtitada*

Department of Rehabilitation Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok Thailand

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***Corresponding author:** Professor Areerat Suputtitada, MD, Department of Rehabilitation Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok Thailand, Email: areerat.su@chula.ac.th/prof.areerat@gmail.com

Abstract

Abnormal gait patterns are commonly found in patients with Parkinson's disease (PD). These often consist of short shuffling steps, decreased walking speed, increased cadence and freezing of gait. External cues have been tested for improving gait ability in patients with PD. Advanced rehabilitation techniques have been evidenced over the years: these included treadmill walking, direct current stimulation, transcranial magnetic stimulation and ground training with cues. Traditionally, visual cues had been used in the form of a series of strips located on the floor in transverse lines for the patient to walk over and pole striding which has been shown to reduce gait variability. In addition, laser guided-walking cues have been proposed which can be in the form of goggles with a light emitting diode (LED), laser guided-walking cane, or a laser-assisted device (LAD).

Auditory cues in the form of music beats or metronomes, have been shown to help PD patients' gait. A number of studies have considered different kinds of rhythmic somatosensory cues such as an electrical stimulation, rhythmic vibration or an insole with a vibratory device. Cues are defined as external stimuli of different type, that is, instructional, auditory, visual, and sensory, and are applied to improve gait ability via the activation of different strategies of motor control. Auditory cues, for instance, are believed to provide an external rhythm that bypasses internal rhythm deficit and visual cues engage the visual cerebellar motor pathway to facilitate the generation of a better gait ability, whereas somatosensory cues enable the voluntary activation of the dorsolateral premotor control system, thus bypassing the failure of supplementary motor area in controlling automatic movement. Abnormal gait patterns often persist despite treating with optimal pharmacological or deep brain stimulation. Evidences of cueing for improve gait ability are beneficial for delay dependency and bed ridden in patients with PD. The most beneficial of cueing are effectiveness, highly safety, easy to use and low cost.

Keywords: Cueing; Gait ability; Parkinson's disease

Introduction

The idiopathic Parkinson's disease (PD) results from a degeneration of dopamine-producing cells in the substantianigra which leads to cardinal symptoms of hypokinesia, bradykinesia, postural instability, rigidity and tremor. These symptoms lead to difficulties in motor performance such as gait ability and falls. Even optimal medication therapy, gait problems associated with PD are often characterized by a decreased stride length and walking speed, an increased cadence and double limb support, shuffling gait, gait festination and freezing.

Morris et al. [1,2] proposed that the basal ganglia are involved in two separate components of motor control. First, they involved in providing phasic cues to the supplementary motor area (SMA), which is responsible for activating and deactivating each sub-movement within the movement sequence. Second, they involved in the transmission of motor set information, i.e., they are responsible for accurate execution of each sub-movement [1,2]. With this hypothesis, it is possible to explain two primary gait deficiencies seen in PD. First, the movement execution is not smooth because internal rhythmic cues are not being properly supplied. Two of the hallmark features of PD, freezing and festination, may be manifestations of a problem of an internal gait rhythm. Second, because of the deficient motor set, there are abnormalities in the actual movement elements [3-5]. Thus, PD gait is characterized by short, shuffling steps and decreased or absent arm swing.

Advanced rehabilitation techniques have been evidenced over the years: these included treadmill walking, direct current stimulation, transcranial magnetic stimulation and ground training with cues. The use of external cues to improve gait in Parkinson's disease patients has been confirmed from clinical trials supports, pre-clinical studies, systemic reviews and research articles as an efficient assistance for improving gait, reducing gait initiation, and freezing of gait [6,7].

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an external rhythm that bypasses internal rhythm deficit and visual cues engage the visual cerebellar motor pathway to facilitate the generation of a better gait ability, whereas somatosensory cues enable the voluntary activation of the dorsolateral premotor control system, thus bypassing the failure of supplementary motor area in controlling automatic movement [3-7]

Traditionally, visual cues had been used in the form of a series of strips located on the floor in transverse lines for the patient to walk over and pole striding which has been shown to reduce gait variability. In addition, laser guided-walking cues have been proposed which can be in the form of goggles with a light emitting diode (LED), laser guided-walking cane, or a laser-assisted device (LAD). Auditory cues in the form of music beats or metronomes, have been shown to help PD patients' gait. A number of studies have considered different kinds of rhythmic somatosensory cues such as an electrical stimulation, rhythmic vibration or an insole with a vibratory device. Abnormal gait patterns often persist despite treating with optimal pharmacological or deep brain stimulation.

A systematic review with meta-analysis for all randomized-controlled trials was performed to investigate the effect external sensory cued therapy on activities of daily living (ADL) performance that include walking and daily tasks such as dressing for patients with PD. Six studies with 243 patients with PD yielded positive findings of an improvement in ADL performance, in favor of external sensory cues [8,9].

A systematic review of 259 articles collected, seven (six RCTs and one QRCT) to evaluate the benefits of external cues on the gait ability and psychomotor performance of patients with PD was performed. The seven RCT contained of the follows; two consider visual cues, two consider auditory cues, one considers verbal instructions, one considers combined cues and one considers sensory cues. Cues generally led to a statistically significant improvement in the step and stride length, speed of gait, cadence and UPDRS.

Nieuwboer A et al. [10] studied a total of 133 patients with PD while in the on phase of the medication cycle. The effect of 3 different cue modalities on functional turning performance was investigated, involving a 180 degrees turn while picking up a tray. Time to perform this task was measured using an activity monitor. Tests were performed without cues and with auditory, visual, and somatosensory cues delivered in a randomized order at preferred straight-line stepping frequency. Rhythmical cueing yielded faster performance of a functional turn in both freezers and non-freezers. This may be explained by enhancing attentional mechanisms during turning. Auditory cues made turning significantly faster than visual cues ($P < 0.01$) but not compared with somatosensory cues, except in non-freezers.

Suputtitada A et al. [11] invented cueing device which consists of visual cues that is laser beam, auditory cue that is metanome, and somatosensory cue that is vibration at the contact skin. They studied in 20 patients with PD with Hoehn and Yahn stage 2-3 and found that there are improvement of step length, speed and rhythm of walking in all cueing types without any significant different between types of cueing.

Mehrholz J et al. [12] systematic reviewed of 18 RCT trials, involving 633 patients with PD concluded that treadmill training did improve gait speed, and stride length; but walking distance and cadence did not improve.

In conclusion, evidences of cueing for improve gait ability are beneficial for delay dependency and bed ridden in patients with PD. The most beneficial of cueing are effectiveness, highly safety, easy to use and low cost.

References

1. Morris ME, lansek R, Matyas TA, Summers JJ (1994) The pathogeniesis of gait hypokinesia in Parkinson's disease. Brain 117: 1169-1181.
2. Morris ME, lansek R, Matyas TA, Summers JJ (1994) Ability to modulate walking cadeniceremainis intact in Parkinson's disease. J Neturol Neutrosuirg Psychiatrvy 57(12): 1532-1534.
3. Lim I, Van Wegen E, De Goede C, Deutekom M, Nieuwboer A, et al. (2005) Effects of external rhythmical cueing on gait in patients with Parkinson's disease: a systematic review. Clin Rehabil 19(7): 695-713.
4. Rochester L, Hetherington V, Jones D, Nieuwboer A, Willems AM, et al. (2005) The effect of external rhythmical cues (auditory and visual) on walking during a functional task in the home in people with Parkinson's disease. Arch Phys Med Rehabil 86(5): 999-1006.
5. Rocha PA, Porfirio GM, Ferraz HB, Trevisani VF (2014) Effects of external cues on gait parameters of Parkinson's disease patients: a systematic review. Clin Neurol Neurosurg 124: 127-134.
6. Spaulding SJ, Barber B, Colby M, Cormack B, Mick T, et al. (2013) Cueing and gait improvement among people with Parkinson's disease: a meta-analysis. Arch Phys Med Rehabil 94(3): 562-570.
7. Nieuwboer A, Kwakkel G, Rochester L, Jones D, Van Wegen E, et al. (2007) Cueing training in the home omproves gait-related mobility in Parkinson's disease: the RESCUE trial. J Neurol Neurosurg Psyciatr 78(2): 134-140.
8. Cassimatis C, Liu KP, Fahey P, Bissett M (2016) The effectiveness of external sensory cues in improving functional performance in individuals with Parkinson's disease: a systematic review with meta-analysis. Int J Rehabil Res 39(3): 211-218.
9. Rocha PA, Porfírio GM, Ferraz HB, Trevisani VF (2014) Effects of external cues on gait parameters of Parkinson's disease patients: a systematic review. Clin Neurol Neurosurg 124: 127-134.
10. Nieuwboer A, Baker K, Willems AM, Jones D, Spildooren J, et al. (2009) The short-term effects of different cueing modalities on turn speed in people with Parkinson's disease. Neurorehabil Neural Repair 23(8): 831-836.
11. Suputtitada A, Sriyuthsak M, Pongmala C (2009) Cueing devices for gait ability in Parkinson patient using motion analysis. Gait and Posture 30(2): S127.
12. Mehrholz J, Kugler J, Storch A, Pohl M, Elsner B, et al. (2015) Treadmill training for patients with Parkinson's disease. Cochrane Database Syst Rev 22(8): CD007830.

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