

Effect of Postural Enhancing Wheel Walker in Patient with Parkinson 's Disease: A Case Report

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Abstract

Objectives: To increase awareness of rehabilitation team for patient with Parkinson's disease (PD) with instability of walking (Hoehn & Yahr = 4) in enhancing independent walking ability by using gait assistive devices as the example of this case report which using the postural enhancing wheel walker.

Setting: Thai Red Cross Rehabilitation Center

Subject: A 53-year-old Thai man had been diagnosed as PD for 7 years. The severity of the symptom has been increasing from time to time and currently he is in Hoehn & Yahr stage 4. He had abnormal, severe and involuntary forward flexion of thoracolumbar spine, which become manifest during standing and walking and subsides in the recumbent position which called "Camptocormia". This abnormal posture resulted in imbalance, instability of standing and walking leading to fear of falling and avoidance of walking.

Method: Report a case on the effect of using the postural enhancing wheel walker which invented by the authors.

Result: The patient used the postural enhancing wheel walker which invented by the authors for independent walking. This walking aid had upright bars and belt wrap around the body which provide body support and somatosensory stimulation for balance. These lead to extension of the thoracolumbar spine and set the good alignment of trunk, hip and knee joints. In addition, the pressure at hand pieces of this walking aid can enhance the balance of the center of body staying within the base of support. It had the stable base which prevent fall in all directions and can support the weight for 1032.67 newton (105.30 kilogram) which had highly safety.

Conclusion: The using of this invented postural enhancing wheel walker can enhance patient with PD who has "Camptocormia" and instability of walking (Hoehn & Yahr = 4) in confidence of standing and walking, and also enhance safety walking.

Keywords: Parkinson's disease; The postural enhancing wheel walker; Walking; Balance

Introduction

Parkinson's disease (PD) is a degenerative disease of the nervous system. Patients with PD are more likely to have mobility problems, especially in patients with more severe disease, with restriction in walking. Hoehn and Yahr Staging of PD in stage 4 are defined as severe symptoms, can still walk to a limited extent, rigidity and bradykinesia, no longer able to live alone, tremor may be less than earlier stage. Patients with PD in Stage 5 are in bed or have to live in wheelchairs. [1] Patients with PD who are in Stage 4 are likely to become stage 5 due to severe mobility limitation, this results in reduced daily activities. [2,3] The incidence of falls in patients with PD was as high as 68% [4] since loss of balance during standing or walking, less movement of the knee, [5] stoop posture, tremor and staggered. [6] This results in falling in several directions, [3,7] resulting in fractures. In addition, in fallen patients, fear of falling causes the patient to be in a state of inadequate moving and bedridden which needs more care [3]

Objective

We reported this case in purpose to increase the awareness of rehabilitation team for patients with PD who had instability of walking (Hoehn & Yahr = 4) in enhancing independent walking ability by using gait assistive devices as the example of this case report which using the postural enhancing wheel walker. We invented this postural enhancing wheel walker with the basic knowledge of good alignment center of gravity and using cueing and rhythm during walking will enhance walking ability in patient with PD. Since available walker or wheel walker or even laser gait aids couldn't help patient with PD with Hoehn and Yahr stage 4.

Case Report

The 53-year-old man has been diagnosed as PD for 7 years. The intensity of the symptoms is increasing, Hoehn & Yahr is in the fourth stage. The patient has abnormal, severe and involuntary forward flexion of the thoracolumbar spine, which becomes manifest during standing and walking and subsides in the recumbent position called "Camptocormia." This disorder results in loss of balance, insecurity while standing and walking lead to fear of falling and avoid walking. Patients prefer to use a wheelchair in the movement. Whenever the patient walks with this walking device, he can walk on his own independently, can adjust the balance of the body, can stretch the spine and hip directly in the support, and also prevent all directions of falling with high security, as shown in Figure 1.

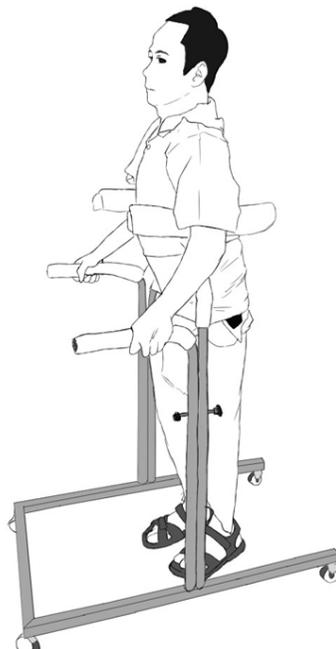


Figure 1: Patient using this invented postural enhancing wheel walker.

The invented postural enhancing wheel walker

The invented postural enhancing wheel walker is designed to help patients walk independently. There are several important components, as shown in Figure 2, which consists of the axilla support bars of the device that stimulate the body and supports the axis, the handle, the belt, the body, the base, and the wheels. It allows the patient to move the device in different directions. The front wheel can be rotated for the benefit of turning. The rear axle is locked in a straight alignment only to assist in steering and can be adjusted to suit the individual's ability. The axilla support bars of the device stimulate the body to stabilize and support the body, adjusting the low and high levels, and stimulate the patient to align the body. With a large fabric belt attached to the axis of the device to help stabilize. The axilla support bars and the large fabric belt with straps will also action as somatosensory cue for enhance walking ability. The handles of the device can be adjusted to low and high levels as appropriate for each patient. Patients can align their body straight, makes the balance of the body in the base of support. This invented postural enhancing wheel walker has a sturdy base that prevents any fall. By calculating the maximum load of the beams, the walker can support 1032.67 Newton (105.30 kilogram).



Figure 2: The component of this invented postural enhancing wheel walker.

(1) axilla bars, (2) handle bars, (3) large fabric belt with straps around the body, (4) sturdy base, (5) wheels.

Discussion

This patient was able to walk for doing his daily activities with confidence. The highlight of the device are as follows; there is a sturdy base can support the weight of patient up to 1032.67 Newton (105.30 kilogram) which is highly safely stability, fall prevention in all directions. The axilla support bars and the large fabric belt with straps will also action as somatosensory cue for enhance walking ability. In addition, the patient can stretch to help align the body, stretching hip and knee joints with the axilla support bars and the handle bars. In addition, pressure on the axilla support bars and the handle bars of the walker can also enhance balance and support the body.

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]

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 [9] 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.

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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 ($P < .01$) 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 Yahr 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.

Suputtitada A [13] did mini review of cueing effect of gait ability in Parkinson's Disease. 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. 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.

This invented postural enhancing wheel walker consists of the axilla support bars and the large fabric belt with straps around the body might act as somatosensory cue to help stabilize and stimulate walking. And also the wheel walker might produce rhythmic walking with similar effect of treadmill walking with enhance the walking ability in patient with PD as well.

Conclusion

The using of this invented postural enhancing wheel walker can enhance patient with PD who had "Camptocormia" and instability of walking (Hoehn & Yahr = 4) in confidence of standing and walking, and also enhance safety walking. The rehabilitation team for Parkinson patient with instability of walking (Hoehn & Yahr = 4) should enhance independent walking ability by using proper gait assistive devices which not only cueing for walking ability but also safety concern of the devices as well. This concern can slower the progression of the severity of PD stage, not fast leading to the wheelchair dependency or bedridden condition.

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Conflict of Interest

The authors report no conflicts of interest.

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