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Effectiveness of Gait Training Supported by Overhead Harness in Patients with Spinal Cord Injury (SCI) at Rehabilitation Centre in Bangladesh

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Abstract

Background: Walking is one of the desired functions for Spinal Cord Injury (SCI) patients. A significant number of patients with SCI have some chance to regain motor recovery, function and walking ability during rehabilitation.

Objectives: To determine the effectiveness of overhead harness gait training partially supported by overhead harness in walking ability, muscle strength, balance and mobility capacity of patients with SCI.

Methods: Quasi-experimental study design was chosen to fulfil aims of the study. 15 samples were selected by simple random selection process from inpatient SCI unit of Centre for the Rehabilitation of the Paralysed (CRP) from July 2017 to September, 2017. Neurological function was measured by ASIA (American Spinal Injury Association) scale, mobility capacity by using Spinal Cord Independence Measurement (SCIM) scale, gait speed was measured by using 10 m Walk Test (10MWT) and Berg Balance Scale (BBS) was used for measuring balance ability. Socio-demographic data were collected by a semi-structured questionnaire. Data was analyzed by using SPSS software version 20 which focused through descriptive statistics and paired t-test.

Results: A significant improvement was found in walking speed in both self-velocity and fast velocity measure ($p<0.05$). Moderately significant change was found in balance. No improvement was found in mobility and neurological function.

Conclusion: The study found that gait training supported by overhead harness is effective for the patients of SCI to improve their gait quality in perspective of walking speed and balance. It is assumed to be cost effective and easy to train. Further study need to be done to compare partially supported overhead harness gait training approach with other methods of training with larger sample size to explore the effectiveness of this walking device.

Keywords: Spinal cord injury; Customized Overhead Harness; Body weight supported gait training; Bangladesh

Introduction

Spinal Cord Injury (SCI) is a medically complex condition as well as life-destructing condition. It refers to damage or tear to the spinal cord which may arise from trauma or any disease or degeneration of the spinal cord [1]. Globally, the incidence of SCI from literature lies between 10.4 million per year and 83 per million per year in the patients who had been survived before hospital admission [2]. The annual incidence of SCI in developed countries varies from 11.5 to 53.4 per million populations [3]. The incidence of people having Spinal Cord injury in Bangladesh has been estimated as 2.5% cases per million [4]. SCI is an unexpected and unpredicted condition. It is not only devastating but also costly for individuals as well society [5]. It also has an Impact on quality of life, life expectancy and consequence towards economic burden [6]. The disease and injury, which affect the spinal cord and damage the neurological structures, are the important health problem in this subcontinent, so they carry high rates of morbidity and mortality [7]. One of the main expectations of spinal cord injury patients is to achieve the walking ability. Approximately 50% of SCI patients are incomplete patients and these numbers are increasing day by day. Around 75% of incomplete patient has some chance to regain ambulatory function, motor recovery and also walking ability is mainly occurred within first two months of injury [8]. The walking ability or improving mobility improves Quality of Life (QoL) of patients with spinal cord injury [8]. Physical Therapist performs several approaches of gait training for SCI patients and meta-analysis suggests, robot assisted walking practice is an adjacent treatment of choice [9] but it slightly more effectiveness than manual approach [10]; moreover manual approach needs more physical effort and resources. The Robotic system is not available in developing countries in Bangladesh. The aim of this study is to determine the effectiveness of overhead harness supported gait training in walking ability, muscle strength, balance and mobility capacity of patients with SCI. This study will help the researcher to identify that, walking with this customized & suspended device is effective or not for the patients and this study can add a new horizon in SCI rehabilitation in low resource countries like Bangladesh.

Methodology

Quasi-experimental study design was chosen to fulfil aims of the study. 15 samples were selected by a simple random sampling procedure [11] according to inclusion criteria from hospital admitted patients for this study from CRP in between July 2017 to September, 2017 from Spinal Cord Injury unit.

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Interventions

Patient participated in a 4 weeks gait training program included a body weight support gait system by a overhead harness 30 min a day, 6 days in a week. Subject selected as per inclusion criteria from both ASIA complete A and ASIA incomplete (B, C, and D). Age limitations were from 14 to 65 years. Only male were include in this experiment. A person having any known cardiovascular complication, severe psychological impairment was excluded from the study. All intervention was guided by a clinical physiotherapist. Before treatment a pre assessment has been done from 15 subjects and after 4 weeks gait training post assessment has been completed. Informed consent was obtained from all subjects (Figure 1).

Outcome Measure

Motor function was measured by using ASIA scale, mobility capacity by using Spinal Cord Independence Measurement mobility section (SCIM), gait speed was measured by using 10 m Walk Test (10MWT) and also Berg Balance Scale (BBS) was used for measuring the balance. Socio-demographic data were collected by a semi-structured questionnaire.

Data Analysis

Both descriptive and inferential statistics was used to analyze data. The SCIM, 10MWT and BBS is a valid and reliable tool for measuring mobility, gait speed and balance. All the tools have been used by two physiotherapist expert enough. Thus the data has been considered as parametric data and to find out pre & post outcome paired sample T test was used. Data was analyzed by using SPSS software version 20. Data was focused through column and paired t-test.

Result

Among the patients 67% were male & their mean age was 34.73 years. Education level of the 40% patients were secondary level and around 26% were primary level and their main cause of injury was fall from height (40%) and road traffic accident was considered as the second cause 27% (Table 1).

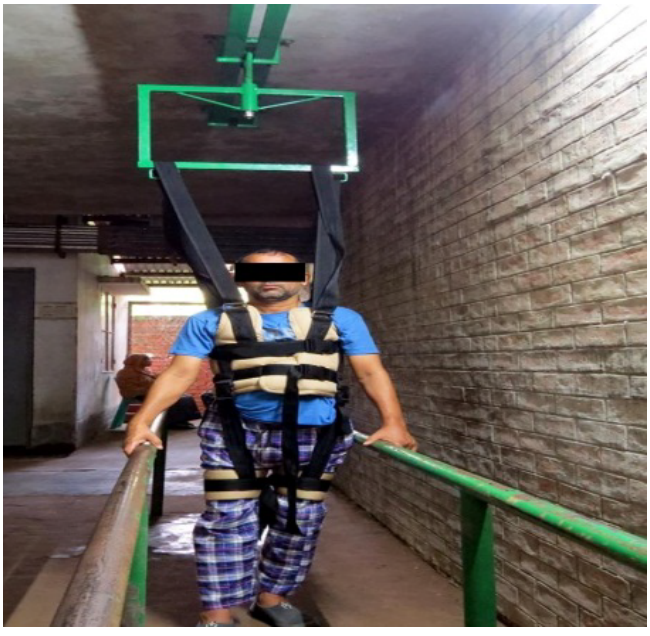

Figure 1: Partial Body weight supported harness gait training.

Injury Related Characteristics

60% patients were tetraplegia. Among all patients Complete A were (21%), Incomplete B were (33%), Incomplete were C (20%) and Incomplete D were (26%). Mean motor score of the patients during admission upper extremity (34.7) and lower extremity 18.4.

In outcome measure Berg Balance scale, 10 m wall test (Self-selected & fast velocity), SCIM mobility section was used. Paired sample T test was used for outcome evaluation. Significant improvement was found in walking speed in both self-velocity (mean difference 24.3, $p<0.05$) and fast velocity measure mean difference (12.4, $p<0.05$). Moderately significant change was found in Berg Balance score (Mean difference 7.9, $p=0.051$). No improvement was found in mobility and motor function ($p>0.05$) (Figure 2).

Discussion

This is the only study to evaluate the effectiveness of customized overhead harness partially supported gait training on their gait speed, balance and mobility as manual manoeuvre. The study found that partially supported overhead harness gait training is effective for the patients with incomplete SCI to improve their gait quality in perspective of walking speed and balance. The interpretations of the results rely on articulating a minimally worthwhile treatment effect for gait quality in perspective of walking speed and balance. Evidence found [12] most of the trials included in systematic review were vulnerable to bias regarding several approaches of body weight supported gait training.

Age	Mean Age ± SD	34.73 ± 11.5 years
Sex	Male	67 %
Education	Secondary	40%
	Primary	26%
Cause of injury	Fall from height	40%
	Renal Tubular Acidosis (RTA)	27%
Type of injury	Tetraplegia	60%
Severity of injury	Complete A Incomplete B Incomplete C Incomplete D	21% 33% 20% 26%
Mean motor score during admission ± SD	Upper extremity Lower extremity	34.7 ± 16.68 18.4 ± 7.02

Table 1: Demographic distribution of the SCI patients (n: 15)

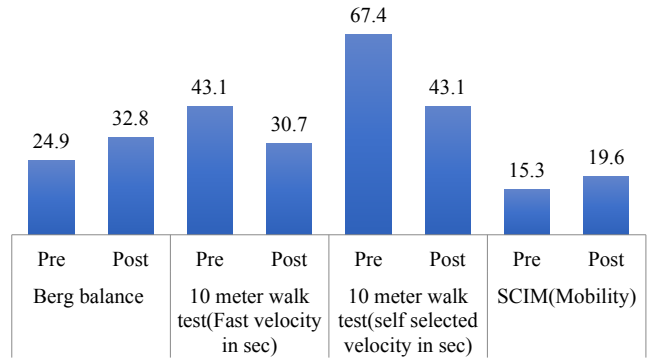

Figure 2: Mean pre and post score difference among participants (n: 15)

Only a few trials were rated as low risk of bias for random sequence generation, concealed allocation and blinding of assessors. The other trials had high or unclear risk of bias for one, two or three of these items. Bias tends to inflate the relative effectiveness of partial body-weight-supported overhead harness gait training and robotic-assisted gait training compared to over ground gait training and there were a little difference among them. Future trials need to pay particular attention to methodological quality to ensure that their results are not biased.

The study demonstrated 30 min walking supported by partially body weight supported overhead harness, 6 days a week and for 4 weeks. To compare with other studies, the dosage of training differed markedly between trials. For example, some trials provided body-weight-supported harness gait training for 4 weeks while others provided it for 16 weeks. Similarly, some treatment sessions were 25 min while others were 60 min [13]. It is not unreasonable to believe that the effectiveness of partially body weight supported overhead harness gait training may be dependent on dosage and that some trials may have provided an insufficient dosage. However, and importantly, all trials provided the same dosage of treatment to all groups in their trials. Therefore, if the dosage of partially body weight supported overhead harness gait training was insufficient then so too was the dosage of other forms of gait training as wee physiotherapy interventions. Therefore, the inclusion of trials with low dosages of treatment would not have systematically biased the results one way or the other although they may have decreased the precision of the pooled estimate. There is always the possibility that certain types of participants respond better to an intervention than other types of participants. This may also be the case for body-weight-supported harness gait training. For example, perhaps those with AIS C or AIS D lesions respond better to body-weight-supported harness gait training than those with AIS A or AIS B lesions, or perhaps those with more recent injuries respond better than those with more established injuries. However, there were insufficient trials and participants to conduct subgroup analyses, and results of subgroup analyses are often difficult to interpret [14].

The results for walking distance fail to rule out the possibility that partially body weight supported overhead harness gait training with body weight gait system improve walking distance more than over ground gait training and other forms of physiotherapy do. It depends on the time, cost, inconvenience and potential for harm (to both patients and therapists) of partially body weight supported overhead harness gait training. The study also indicates that customized overhead harness made by local resources is cost effective and easy to train. The overhead harness in CRP was mode of local resources and cost less than 300 USD.

Limitations

A limitation of this quasi-experimental study is our time limitations. If this is not the case then our point estimates are overly precise because we have the adequate number of patients and soulful contributors. Another limitation is that only we had to do it in a single group, the results would be more fruitful if we could do this study in the randomized control trail design. In our country we have cultural limitation as because the experimental settings are in outside of CRP that's why women's are not interested to involve in this research. That's why only male subjects are included. Quasi-experimental studies in the field of rehabilitation present a real challenge. This is especially true for evaluating interventions in SCI, due to the small and clinically heterogeneous patient group. Though the result cannot be generalized, further study need to be done in control group compared with partially body weight supported overhead harness gait training approach with large sample size to find out the effectiveness of this walking device.

Conclusion and Recommendation

The study found that, partially body weight supported overhead harness gait training is effective for the patients with SCI to improve their gait quality in perspective of walking speed and balance. As physiotherapist faces challenge in ambulatory training in SCI patients and they have fear of fall, customized harness made of local resources is cost effective, safe and easy to train in SCI rehabilitation in low resource countries like Bangladesh. Moreover, a larger scale randomized trial with follow up in rehabilitation center and community setting is highly recommended to explore the effectiveness.

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Conflict of interest

No conflict of interest.

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