Original Article

Cawthorne Cooksey versus vestibular habituation exercises on trunk kinetics and velocity of gait in patients with multiple sclerosis

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ABSTRACT

Background: gait and motor disturbances are common among multiple sclerosis patients. Objective: to measure difference between the effect of Cawthorne Cooksey and vestibular habituation exercises on trunk kinetics and velocity of gait in patients with multiple sclerosis. Methods: Forty five subjects with multiple sclerosis were assigned into three equal groups. Subjects were assessed using Biodex isokinetic dynamometer and clinical test (Timed 10-Meter Walk Test). Results: This study revealed that trunk flexors torque and self-selected velocity are significantly improved in three groups with the best results for group II. Conclusion: Cawthorne Cooksey Exercises could be considered a valuable method for improving trunk kinetics and velocity of gait in multiple sclerosis patients.

Keywords: Multiple sclerosis, Trunk kinetics, velocity of gait, Cawthorne Cooksey, vestibular habituation.

Introduction

There are autoimmune disorders affecting nervous system, rheumatoid inflammatory disease, general autoimmune disorder, inflammatory intestine disease and multiple sclerosis. Multiple sclerosis (MS) is the fourth most common autoimmune disorder. This disease characters with myline degeneration at brain and medulla spinalis. This results in interruption of communication between components of nervous system. This ends up a spread of signs and symptoms, as well as physical, mental, and generally psychiatrical issues [1].

Gait deviations were shown to be a major predictor of patient independence, about eighty five of patients with MS indicate gait disturbances as their main grievance that occur early within the MS unwellness course. Among fifteen years of identification, up to fiftieth of the patients need the help of a walking aid, and tenth are chair dependent [2].

Impairment of walking is one of the foremost common reportable symptoms in patients with disseminated multiple sclerosis. Gait impairment results from the mix of multiple common symptoms and deficits as fatigue, weakness, spasticity, ataxia, vertigo and balance issues, vestibular rehabilitation can alleviate vertigo and decrease impact of it on gait parameters [3].

Vestibular rehabilitation (VR) may be a specialized kind of medical aid supposed to alleviate each the first and secondary issues thanks to vestibular disorders. It's associate degree exercise-based program primarily designed to minimize symptom and dizziness, minimize gaze instability, and/or minimize imbalance and fall risk similarly as address any secondary impairments that are a consequence of the vestibular disorder. For many folks that have a vestibular

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disorder, the deficit is permanent as a result of the number of restoration of vestibular function is incredibly tiny [4].

Methods

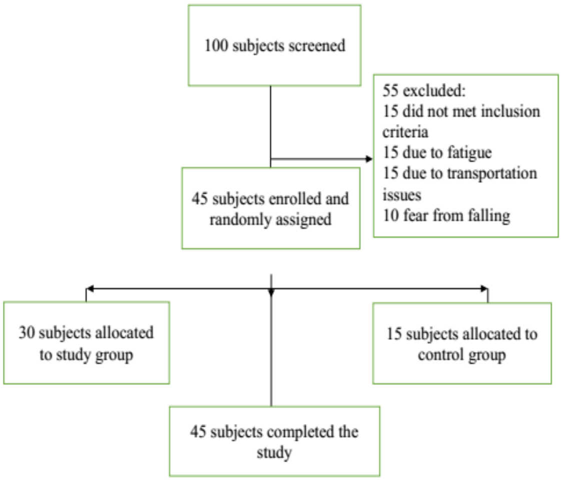

Figure 1: Flow chart of the subjects

Materials and Methods

Subjects

This study was approved by Cairo University committee. Forty five patients from both sexes, consent was informed in written form with the following criteria were included: (1) ambulant without assistance, (2) diagnosed by Neurologist from kasr Al-Ainias relapsing-remitting multiple sclerosis one year ago their ages ranged from 35-55 years with approximately five attacks at relapsing time in form of hemiparesis with muscle tone of 1,1+ according to modified Ashworth scale (MAS) of lower limb muscles and had grade 3 group muscle test (GMT) of lower limb muscles for gait, (3) All the patients were assessed by neurologist to confirm they all had central vertigo according to Dix Hallpike test [5], (4) The degree of disability of multiple sclerosis was from 2 – 2.5 (minimal disability) (according to expanded disability status scale (EDSS)) [6]. Patients with psychological disturbance or seizures, musculoskeletal deformity and inner ear disorders were excluded.

This is Pre and Post treatment study, and patients were assigned to three equal groups randomly: (group I) received traditional physical therapy program (balance training), (group II) received Cawthorne Cooksey Exercises in addition to traditional physical therapy program and (group III) received vestibular habituation exercises in addition to traditional physical therapy program.

All the patients in the three groups were assessed two times before and after treatment for trunk kinetics and gait velocity and all the patients in the three groups received three sessions day after day.

Evaluation procedures:

Isokinetic dynamometer for measurement of trunk kinetics

The isokinetic trunk protocol was performed on a Biodex isokinetic dynamometer. Isokinetic dynamometer is a valid and reliable method to assess muscles power of trunk [7].

The patients were placed on the dual-position back extension–flexion attachment of the dynamometer with the trunk upright, the hips and knees flexed at 90°, The trunk vary of movement was restricted at 50°, with 30° (−30°) of trunk flexion, relative to the anatomic reference position (0°) [8].

Ranges of trunk motion no larger than 50° would isolate lumbar motion, reducing hip flexion–extension. Moreover, the location of the dynamometer axis of rotation at the anterior superior iliac spine level and the use of the pad behind the sacrum and the strap on the pelvis will minimize hip motion during the study.

The protocol of trunk was consisted of 4 sets of 15 consecutive maximum concentric trunk flexion efforts with 1 min rest between sets. It was performed with an angular velocity of 60°/s, this angular velocity was chosen because it was considered to be safe and reliable for measuring peak torque [9].

Timed 10-Meter Walk Test (T10MWT) for assessment of velocity of gait

The 10 meter walk test has demonstrated excellent reliability in measurement of walking speed in several conditions as well as adults and children with neuromuscular disease, multiple sclerosis, neural structure injury and Parkinson's syndrome [10].

The patients walked 10 meters (32.8 feet) without assistance; the time was measured for the intermediate 6 meters (19.7 feet) to allow for acceleration and deceleration, the participants started with their toes of the leading foot crossed the 2-meter mark then ending with their toes of the leading foot crossed the 8-meter mark, then collect three trials and calculate the average of the three trials.

Intervention

Group (I) received traditional physical therapy program (balance training) for each session in form of: (1) forward and backward balance from kneeling (repeat 20 times), (2) side to side balance when kneeling (repeat 20 times), (3) weight Shift Forward and Back; the patient shifts the weight forward and back by arching and rounding the lower back (repeat 20 times), (4) weight Shift Side to Side; Shift weight over the right hip then the left hip. Ribcage should move side to side and hip should lift off of surface (repeat 20 times), (5) standing and keeping static balance with both feet apart, then with both feet close to each other, with eyes opened then with eyes closed (holding for 15 seconds for each), (6) forward and backward lean while standing (repeat 20 times), (7) stepping forward, backward, and sideways on the exercise step (repeat 20 times), (8) standing on non-affected leg (holding for 5 seconds, repeat 20 times).

Group (II) received Cawthorne Cooksey exercises in addition to traditional physical therapy program for each session in form of: (a) In bed; (1) eye movements at first slow, then quick, (2) head movements at first slow, then quick, later with eyes closed, (b) sitting; (1) eye movements and head movements, (2) shoulder shrugging and circling, (3) bending forward and picking up objects from the ground, (c) standing; (1) eye and head movements, (2) changing from sitting to standing position with eyes open and shut, (3) throwing a small ball from hand to hand (at eye level), (4) throwing a ball from hand to hand under knee, (d) Moving about (in class); (1) walking across room with eyes open and then closed, (2) walking up and down slope with eyes open and then closed, (3) walking up and down steps with eyes open and then closed.

Group (III) received vestibular habituation exercises in addition to traditional physical therapy program for each session with repetitions of five times in form of: (1) moving from a sitting position to flat on the back, (2) moving from flat on the back to left side, (3) moving from left side to right side, (4) moving from flat on the back to a sitting position, (5)turning body to right from a standing position, (6) turning body to left from a standing position, (7) touching nose to left knee from a sitting position, (8) touching nose to right knee from a sitting position , (9)turning head to left from a sitting position, (10) bending forward from a sitting position, (11) standing up straight from a sitting position , (12) moving head up and down from a sitting position, (13) turning head to right and lie down quickly from sitting on side of bed, (14) turning head to left and lie down quickly from sitting on side of bed, (15) lying down quickly (head hanging over side of bed) from sitting on side of bed.

Data analysis

The statistical methods for collection presentation and analysis of the results were used according to the following: (1) Descriptive statistics and ANOVA-test were conducted for comparison of the mean age, weight, height, and MMSE of the three groups, (2) Kruskal-Wallis test was conducted for comparison of the median values of MAS, GMT and EDSS between the three groups, (3) Two-way mixed MANOVA test was conducted to compare the effect of time (pre versus post) and the effect of treatment (between groups), as well as the interaction between time and treatment on mean values of T10MWT, trunk flexors peak torque, (4) The level of significance for all statistical tests was set at $p < 0.05$.

Results

Demographic data

The mean values for age, weight and height for each group were presenting at (table 1), Comparing the final characteristics of the patients of three groups revealed that there was no significance difference between the three groups within the mean age, weight, height, and MMSE ($p > 0.05$).

Table 1. Descriptive statistics and ANOVA test for comparison of the mean age, weight, height, and MMSE of the three groups (group I, II, and III).

	Group I	Group II	Group III	F-	p-
	Mean±SD	Mean±SD	Mean±SD	value	value
Age (years)	42.2 ± 5.22	45.46 ± 5.47	41.6 ± 5.96	2.09	0.13
Weight (kg)	66.53 ± 8.14	71.2 ± 7.22	69.06 ± 9.58	1.16	0.32
Height (cm)	163.06 ± 11.07	161.2 ± 8.57	163.46 ± 7.92	0.25	0.77
MMSE	28.46 ± 1	28.2 ± 0.86	28.66 ± 0.81	1.03	0.36

SD: Standard deviation, p value: Probability value

The effect of each treatment protocol on 10 Meter walk test (T10MWT) at self-selected velocity (SSV):

Comparison between groups

From the data represented at (table 2), there was no significant difference for pretreatment between three groups ($p > 0.05$) while for post treatment there was significant difference between three groups ($p < 0.05$). Comparing the mean ± SD values of group II to group I and group III showed significant increase on the velocity for group II and group III ($p = 0.0001$ and $p = 0.0001$ respectively). Comparing the mean ± SD values of group III to group I showed a significant increase in the velocity for group III ($p = 0.0001$).

Comparison between groups

From the data represented at (table 3), there was no significant difference for pretreatment between three groups while for post treatment there was significant difference between three groups ($p > 0.05$). Comparing the mean ± SD values of group II to group I and group III showed significant increase in peak torque of trunk flexors for group II and group III ($p = 0.002$ and $p = 0.01$ respectively). Comparing the mean ± SD values of group III to group I showed no significant difference of trunk flexors peak torque ($p = 1$).

Table 2. Effect of treatment on T10MWT at SSV.

T10MWT at SSV (m/s)					
Group I		Group II		Group III	
$\bar{X}$ ± SD		$\bar{X}$ ± SD		$\bar{X}$ ± SD	
Pre	Post	Pre	Post	Pre	Post
0.096 ± 0.009	0.12 ± 0.007	0.1 ± 0.009	0.18 ± 0.01	0.098 ± 0.009	0.16 ± 0.008
Within group comparison (time effect)					
			p-value	Sig	
Pre vs post		Group I	0.0001	S	

	Group II	0.0001	S
	Group III	0.0001	S
Between group comparison (group effect)			
		p- value	Sig
Pre	Group I vs II	0.2	NS
	Group I vs III	1	NS
	Group II vs III	0.8	NS
Post	Group I vs II	0.0001	S
	Group I vs III	0.0001	S
	Group II vs III	0.0001	S

: Mean
SD: Standard Deviation
p value: Probability value *S: Significant at P ≤ .05

The effect of each treatment protocol on trunk flexors' peak torque:

Table 3. Effect of treatment on trunk flexors' peak torque.

Trunk flexors' peak torque (Nm)					
Group I		Group II		Group III	
$\overline{X}$ ± SD		$\overline{X}$ ± SD		$\overline{X}$ ± SD	
Pre	Post	Pre	Post	Pre	Post
68.74 ± 6.07	81.55 ± 3.68	64.14 ± 7.78	88.68 ± 6.83	66.84 ± 7.01	83.1 ± 4.73

Within group comparison (time effect)			
		p-value	Sig
Pre vs post	Group I	0.0001	S
	Group II	0.0001	S
	Group III	0.0001	S
Between group comparison (group effect)			
		p- value	Sig
Pre	Group I vs II	0.23	NS
	Group I vs III	1	NS
	Group II vs III	0.88	NS
Post	Group I vs II	0.002	S
	Group I vs III	1	NS
	Group II vs III	0.01	S

$\overline{X}$: Mean
SD: Standard Deviation
p value: Probability value *S: Significant at P ≤ .05

Discussion

Findings from this study demonstrate the feasibility of a vestibular rehabilitation program and balance training and its effectiveness on trunk flexor torque and velocity of gait in patients with multiple sclerosis. The improvements were significantly greater for patients in group II and group III (who underwent a vestibular rehabilitation program) than for patients in group I (who underwent a balance training only). Cawthorne Cooksey exercises could be considered a valuable method for treatment because these exercises reduce vertigo and restore the balance.

The vestibular system contributes considerably to the stabilization of body posture throughout locomotion. The vestibulo-spinal tract emerges from the lateral vestibular nucleus within the brain stem and runs unilaterally to the spinal motoneurons of the trunk muscles, vestibular nuclei management byselection the stimulative signals to the antigravity muscles of lower limb, it reinforces the tone of extensor muscles of limbs thus is responsible for normal gait in association with the pontine reticular nuclei via lateral and medial vestibulospinal tracts [11].

Nilsagård et al, (2014) suggested that challenging exercises that promote sensory compensation like vestibular rehabilitation and balance exercises appear to own an impression on dynamic trunk stability and can also improve walking speed [12].

McDonnell and Hillier, (2011) concluded that the vestibular rehabilitation medical aid could be a safe, effective management for patients with proprioception dysfunction which it helps to resolve symptoms like vertigo and balance impairment [13]. Hebert et al, (2011) suggested that vestibular rehabilitation interventions enhance balance, walking speed and quality of life [14].

Beyond that, it found weaker proof for many rehabilitative interventions in MS, Haselkorn et al, (2015) suggested that comprehensive vestibular rehabilitation, personal exercise programs and motor balance training probably are effective however need additional study [15].

Conclusion

The results revealed that there was significant improvement in three groups. The results of this study revealed better improvement of trunk flexors torque and self-selected velocity using Cawthorne Cooksey exercises more than vestibular habituation and balance exercises. Cawthorne Cooksey exercises could be considered a valuable method for improving trunk flexors torque and self-selected velocity of gait in patients with multiple sclerosis.

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