Comparison between the effects of task oriented program and balance training on postural stability in stroke patients

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Abstract

Background: Sensorimotor cortex is responsive to peripheral and central stimulation by mechanisms that are important for learning motor tasks. The purpose of this study was to investigate difference between the effect of task oriented program and balance exercises on postural stability in stroke patients.

Subjects and procedures: Thirty stroke hemiparetic subjects were assigned into two equal groups (group I and II): group ( I ) received task oriented training program in addition to selected physical therapy program ( PNF technique, weight bearing exercises and gait training ) while group ( II ) received balance exercise in addition to selected physical therapy program ( PNF technique, weight bearing exercises and gait training ). Subjects were assessed using biodex stability system including postural stability test.

Results: This study revealed that balance is significantly improved in both groups with the best results for group I.

Conclusion: Task oriented training could be considered a valuable method for treating balance in stroke patients.

Introduction

Stroke is described as a clinical issue including 'rapidly making clinical signs of focal (from time to time around the world) unsettling impact of cerebral limit, enduring over 24 hours or prompting demise with no obvious reason other than that of vascular inception'. A transient ischemic assault (TIA) is characterized as stroke side effects and signs that resolve inside of 24 hours. Be that as it may, there are restrictions to these definitions. For instance, they do exclude retinal manifestations (sudden onset of monocular visual misfortune), which ought to be considered as a major aspect of the meaning of stroke and TIA. The side effects of a TIA as a rule resolve inside of minutes or a couple of hours at most, and anybody with proceeding with neurological signs when initially surveyed ought to be expected to have had a stroke. The term 'mind assault' is in some cases used to portray any neurovascular occasion and possibly a clearer and less equivocal term to utilize. A non-incapacitating stroke is characterized as a stroke with indications that keep going for over 24 hours, however later resolve, leaving no perpetual handicap.
Maintaining balance requires coordination of input from multiple sensory systems including the vestibular, somatosensory, and visual systems. Vestibular system: sense organs that regulate equilibrium (equilibriopception); directional data as it identifies with head position. Somatosensory system: senses of proprioception and kinesthesia of joints; data from skin and joints (weight and vibratory senses); spatial position and movement relative to the bolster surface; development and position of diverse body parts relative to each other. Visual system: reference to verticality of body and head movement; spatial area relative to objects.

Balance can be severely affected in individuals with neurological patients who suffer stroke. It has also been determined that impaired balance is strongly connected with future capacity and recuperation now and again, particularly in stroke patients. Additionally, balance problems have been distinguished as the most grounded indicator of falls.

There is evidence that therapists treating people affected by a neurological disorder should be prescribing task oriented training in their therapy. Task oriented training is a term that has evolved from the movement science and motor skill learning literature and is defined as training or therapy where patients ‘practice context-specific motor tasks and receive some form of feedback’. In the field of skill learning, it may be associated with different practice conditions, feedback and conditions of transfer.

Following a review of the task-specific evidence, it is possible to recommend five strategies to guide application of task-specific training in clinical practice. The strategies are presented ‘practically speaking prepared’ dialog with the point of helping advisors in translating them into clinical practice. To facilitate recall, they have been formulated as the five ‘R’s’: (i.e. task specific training should be relevant, randomly ordered, dreary, point towards reproduction of the entire assignment and positively reinforced).

Methods Design

Participants

The study was performed in an Out Patient Clinics of Neurology and Internal Medicine in Kasr Al- Aini Hospitals and Out Patient Clinic of Neurology, Faculty of Physical Therapy, Cairo University. All participants were outpatients. Inclusion criteria included: (1) Patients were diagnosed as an ischemic left side stroke, according to MRI, CT scans and according to neurological examination, (2) Duration of illness from 6 – 9 months post stroke, (3) Participants who were selected in the study were ambulant. Subjects were excluded in case of (a) Subjects with musculoskeletal deformity, (b) Subjects with diabetes mellitus, (c) Patients with visual impairment or tremors influence balance.

Design

This is Pre and Post treatment study, subjects were assigned to two equal study groups randomly: (group I) Consist of fifteen patients with ischemic stroke and received task oriented training program in addition to selected physical therapy program (PNF technique, weight bearing exercises and gait training) for 12 sessions every other day, each session for 1 hour, (group II) Consist of fifteen patients with ischemic stroke and received balance exercise in addition to selected physical therapy program (PNF technique, weight bearing exercises and gait training) for 12 session every other day, each session for 1 hour.

Data collection

All participants underwent a pre-treatment and post-treatment baseline assessment, The Biodex balance system (Biodex-medical system. Inc., brook baren R&D plaza, 20 Ramsey road, box 702, Shirley, Newyork 11967-0702) was used to assess balance pre and post treatment, this machine consists of a multiaxial standing platform which was adjusted to provide varying degrees of platform tilt or platform instability. A maximum of 20° of platform surface tilt can be selected, but level eight will be selected. With this degree of surface tilt, a dynamic situation is created, similar to actual functional activities that result in instability. The ability of the patient to maintain foot position during standing postural on this unstable tilting platform will be assessed. The Biodex balance system consists of: (1) foot platform, (2) safety support rails, (3) display panel key and main menu. Parameter of The Biodex stability system is stability index.

The Postural Stability Test emphasizes on patient’s ability to maintain center of balance. The patient’s score on this test assesses deviation from the center, thus a lower score is more desirable than a higher score.

Platform stability can be varied during a this test by selecting (More Options) from the Postural Stability Testing screen. It was proved that trial time, number of trials, starting and ending platform stability, rest countdowns or bilateral test can be set. To perform postural stability test, there were steps should be followed: (1) Support handles were positioned as per patient protocol, (2) Display height was positioned and tilt for patient comfort, (3) Patient data were taken and entered; (a) patient name, (b) patient age, (c) patient height, (d) patient weight, (4) Biodex balance system offers eight levels of platform control as well as static force setting, level 8 of platform control was selected, (5) The patient was positioned on the system and explain to him the test protocol. On the display, press start to activate the cursor and have the patient move the cursor to the center point on the grid.
Intervention

All participants engaged in usual individual physiotherapy for one hour every other day. Group I performed task oriented program in form of: (1) Heel lifts; lifting non-affected leg with adduction and abduction movements of leg and drawing an "8" on the ground with feet (repeat 10 times), (2) unilateral and bilateral slow arm movements and slow forward and backward walking (repeat 10 times), (3) dual task of moving while holding ball in unaffected hand and stopping on a verbal order given by therapist (repeat 10 times), (4) walking 3m, turning around a target point and coming back (repeat 10 times), (5) standing up from a chair, walking four steps forward, turning to the right, stepping over the exercise step, turning to the right again and walking forwards to the chair (repeat the exercise circuit in opposite direction) (repeat 10 times), (6) from a sitting position on a 85-cm Swiss ball, patient hold a ball in unaffected hand and also perform reaching and grasping while sitting on a Swiss ball (repeat 10 times), (7) from standing position on balance board, patient hold a ball or cane in unaffected hand and also perform reaching and grasping while standing on balance board (repeat 10 times), (8) from standing position on balance board, patient perform abduction in non affected arm (repeat 10 times), (9) from standing position on balance board, patient perform squatting (repeat 10 times).

Group II performed balance exercises in form of: (a) Forward and backward balance from kneeling (repeat 20 times), (b) Side to side balance when kneeling (repeat 20 times), (c) Weight Shift Forward and Back; the patient shift the weight forward and back by arching and rounding the lower back (repeat 20 times), (d) 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), (e) 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), (f) Forward and backward lean while standing (repeat 20 times), (g) stepping forward, backward, and sideways on the exercise step (repeat 20 times), (h) Standing on non affected leg (holding for 5 seconds, repeat 20 times).

Data analysis

The statistical methods for collection presentation and analysis of the results were used according to the following: (1) Data was summarized using range, mean and standard deviation for quantitative variables and frequency and percentage for qualitative ones, (2) Comparison between 2 groups was performed using sample t-test for quantitative variables and chi-square or fisher’s definite test for subjective ones, (3) P-values less than 0.05 were considered statistically significant and less than 0.01 were considered highly significant, (4) Statistical analysis was conducting using SPSS 18.

Results

Two Groups of 30 patients of both sexes were selected from the Out Patient Clinic of Neurology and Internal Medicine in Kasr Al- Eini Hospitals and Out Patient Clinic of Neurology, Faculty of Physical Therapy, Cairo University. Each patient in the two groups was evaluated pre and post, the assessment using Task oriented training in group I and the balance exercise in group II. Both techniques are being compared according to their effect on postural stability in ischemic stroke patients. The collected raw data of the current study were statistically analyzed to evaluate the results of the two groups to investigate the effect of task oriented programming and balance exercises on postural stability in stroke patients.

General characteristics

The patients participated in this study were classified into two groups of equal number;

The group I: include fifteen subjects of both sexes (6 females 40% and 9 males 60%) with age ranged from 45 to 55 years with the mean value of (46 ± 4.6). The weight ranged from 70 to 86 Kg with the mean value of (77.33 ± 4.97), the height ranged from 166 to 177 cm with the mean value of (170.5 ± 2.89). The modified Ashworth scale M.A.S. Ranged from 1 to 1+ with (8 are 1 and 7 are 1+). The mini-mental state examination score M.M.S.E. Ranged from 27 to 29 with the mean value of (27.93 ± 0.79). The muscle power degree is fixed at degree 3 with the mean value of (3 ± 0) as shown in Table (1) and Figure (1).

Group II: include fifteen subjects of both sexes (9 females 60% and 6 males 40%) with age ranged from 45 to 55 years with the mean value of (47.7 ± 4.9). The weight ranged from 70 to 85 Kg with the mean value of (76.87 ± 4.66), the height ranged from 164 to 174 cm with the mean value of (168 ± 2.62). The modified Ashworth scale M.A.S. Ranged from 1 to 1+ with (7 are 1 and 8 are 1+). The mini-mental state examination score M.M.S.E. Ranged from 27 to 29 with the mean value of (28 ± 0.84). The muscle power degree is fixed at degree 3 with the mean value of (3 ± 0) as shown in Table (1) and Figure (1).
Table 1: The mean values within the two groups.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Mean ± SD</th>
<th>median</th>
<th>Max - Min</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>Group I</td>
<td>46 ± 4.6</td>
<td>45</td>
<td>54 – 40</td>
<td>0.964</td>
<td>0.343 NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>47.7 ± 4.9</td>
<td>47</td>
<td>55 – 41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>Group I</td>
<td>77.33 ± 4.97</td>
<td>77</td>
<td>70 - 86</td>
<td>0.812</td>
<td>0.398 NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>76.87 ± 4.66</td>
<td>76</td>
<td>70 - 85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>Group I</td>
<td>170.5 ± 2.89</td>
<td>170</td>
<td>166 - 177</td>
<td>0.884</td>
<td>0.244 NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>168 ± 2.62</td>
<td>167</td>
<td>164 - 174</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMSE</td>
<td>Group I</td>
<td>27.93 ± 0.79</td>
<td>27</td>
<td>27 - 29</td>
<td>0.665</td>
<td>0.445 NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>28 ± 0.84</td>
<td>28</td>
<td>27 - 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscle Power Degree</td>
<td>Group I</td>
<td>3 ± 0</td>
<td>3</td>
<td>3</td>
<td>0.000</td>
<td>1.000 NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>3 ± 0</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1: The mean values within the two groups.

As indicated from descriptive data of the two groups, patients participated in two groups were homogenous.

**Stability index**

Table (2) and Fig (2) demonstrate that there was a significant difference in the paired t-test between pre and post mean treatment values of group I and II, also there was a highly significant difference between pre and post treatment in group I while there was significant difference between pre and post treatment in group II, percentage of improvement in group I was 53.33% with P value (0.000) while the percentage of improvement in group II was 29.903% with P value (0.026).

Table (3) showed no significant difference in pre treatment values between both groups where P value was (0.129), but there was a significant difference in the post treatment values of both groups where P value was (0.000).
Table (2): Comparing the mean values of Overall Stability Index within the two groups.

<table>
<thead>
<tr>
<th>Overall Stability Index</th>
<th>Group I</th>
<th>Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre treatment</td>
<td>Post treatment</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>3.028 ± 0.16</td>
<td>1.41 ± 0.07</td>
</tr>
<tr>
<td>% of improvement</td>
<td>53.33%</td>
<td>29.903%</td>
</tr>
<tr>
<td>t-value</td>
<td>36.684</td>
<td>16.211</td>
</tr>
<tr>
<td>p-value</td>
<td>0.000</td>
<td>0.026</td>
</tr>
</tbody>
</table>

* significant  ** highly significant

Table (3): Comparing between pre and post treatment mean values of Overall Stability Index between the two groups.

<table>
<thead>
<tr>
<th>Two Groups</th>
<th>Overall Stability Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre treatment I</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>3.028 ± 0.16</td>
</tr>
<tr>
<td>MD</td>
<td>0.075</td>
</tr>
<tr>
<td>t-value</td>
<td>-1.153</td>
</tr>
<tr>
<td>p-value</td>
<td>0.129</td>
</tr>
</tbody>
</table>

* significant

Fig. 2: Pre and post treatment mean values of Overall Stability Index within the two groups.
Discussion

The present study showed significant improvement of balance in the group (I) treated with task oriented training and this can be explained by the basis of neural re-organization. Excitatory mechanisms of motor cortical system can be significantly modulated by sensory flow. This impact would have an amazing significance in favoring synaptic proficiency components. It is realized that an afferent molding info from the same body locale where the muscle “focus” of the cortical engine yield is found incites an introductory decrement of volatility.

This study revealed the efficacy of balance exercises on the postural stability in stroke patients with superiority of task oriented training, this result agreed with Kim et al (2012)7 whom evaluated the effect of task oriented training program on stroke patients for trunk control ability, balance and gait. The experimental group showed significant improvements in trunk control ability, balance and gait. Their study concluded that task oriented training after stroke can improve the trunk control ability, balance and gait, which be effective in stroke rehabilitation.

Task oriented training could provide proper visual input and substitutes for absent or reduced proprioceptive input from the affected body side. Task oriented training improved motor performance, motor control strategies, sensory recovery, and daily function more than the traditional treatment.

This was explained by Bayona et al, (2012)10 who proved that recovery after task oriented training occur due to learning as well as cortical plasticity related to acquisition and recovery of function. Also brain-functional imaging studies describe the recovery from hemiplegic stroke to be associated with a marked reorganization of activation patterns of specific brain structures after task oriented training11.

Kalra, (2012)12 has recommended that developments performed in the vicinity of a practical errand target (e.g., coming to forward to take a refreshment) are smoother and quicker than developments performed without such questions (e.g., reaching forward to a spot without an assigned focus) amid situated coming to undertakings.

Chevan et al, (2013)13 uncovered that amid the concurrent execution of a psychological and postural errand, decrements in execution were found in the postural strength measures as opposed to the subjective measures. In the current study there was a significant difference of balance in stroke patients through assessment of sway velocity of COG during double stance. These results were supported by Niam, et al, (2010)14 who reported in their study that the assessment of the sway velocity of COG during double stance has the great advantage of objectively measuring postural responses. By controlling tactile (visual and proprioceptive) data through influence referencing and/or eyes open/shut conditions, this convention methodically dispenses with significant visual and/or bolster surface data and makes circumstances of tangible clash.

The result of this study goes with Di Fabio and Beadle, (2012)15 who evaluated standing balance in ten subjects with hemiplegia using the assessment of the sway velocity of COG during double stance. The assessment is a timed balance test which evaluates somatosensory, visual, and vestibular function for maintenance of upright posture. These findings suggest that the ability to integrate somatosensory information from the lower extremities for balance is compromised after cerebrovascular disease.

Visual feedback therapy in bilateral standing shows no statistically significant effects on symmetry of weight distribution between paretic and non-paretic leg, postural sway in bilateral standing, gait and gait-related activities16.

Finally we can conclude that task oriented training training program is effective on maintaining postural stability in stroke patients than balance exercises. Task oriented training program is a useful tool for treatment in stroke patients.
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