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Original article

ROLE OF TASK-ORIENTED TRAINING AFTER STROKE

DOCU AXELERAD Any[1], DOCU AXELERAD Daniel[2], GOGU Anca[3], JIANU Catalin[3]

Abstract*

Aim. Role of effective task-oriented training focused or repetitive or circuit training after stroke.

Methods. Searches were conducted on stroke subjects after 7 day hospitalization, included duration and frequency of training and stroke stage.

Results. Task performance improved with repetition in both ischemic and hemorrhage stroke. This suggests a motor learning in both groups. Nevertheless, the improvement was less during bilateral compared to unilateral obstacle stepping. We suggest that the greater difficulty in the bilateral task can also be explained by an impairment in dividing attention between concurrent tasks, which plays a role in all bilateral tasks In addition, postural stability is known to be influenced by attention.

Conclusions. Task-oriented training interventions are useful for improving muscle strength and gait relates activities in sub-acute and chronic stroke patients. This study provides evidence of task-oriented training for improving functioning after stroke, further studies are necessary the investigate the effects of training on upper extremities.

Keywords: task-oriented training, stroke, gait

Introduction

A common motor impairment resulting from stroke is hemiparesis. As such, the movement kinematics of a stroke survivor's affected limb is different from their unaffected limb. In a pilot study of reaching with individuals with left hemiparesis, Trombly found that in the unpaired arm of subjects, reaching strategies were continuous, while the impaired limb exhibited discontinuous movement patterns. Because of these movement differences, numerous individuals are unable to perform tasks bimanually after a stroke since many daily task involve in use both arms in a coordinated manner. In order to find evidence-based rehabilitation techniques to retrain the affected limb, many studies have investigated movement dynamics and/or interlimb coupling in bilateral tasks for people with hemiplegia.

Several strategies are used for reducing the burden of stroke but identifying risk factors and intervening to control or modify them remains the most important means of reducing the incidence of stroke.

Stroke is a clinical diagnosis made on the characteristic temporal profile of neurological symptoms and signs, as exemplified by the WHO definition: rapidly developing clinical signs, of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer, or leading to death, with no apparent cause other than of vascular origin.

The incidence of stroke and its major pathological subtypes increases exponentially with age for both men and women. Data from the Perth Community Stroke Study show that the annual risk of stroke in a young person is 1 in 30 000, whereas the annual risk in a person aged 75-84 years is 1 in 45 and the risk in the very old is as high as 1 in 30.

Another way of expressing data on the incidence of stroke is the lifetime risk of having a stroke, assuming no competing risks. The risk of a person aged 45 years having a stroke within 20 years is relatively low (about 1 in 30). However, almost one in four men and nearly one in five women aged 45 years can expect to have a stroke if they live into the ninth decade.

The modifiable risk factors that have been identified in epidemiological studies of stroke are shown in the table overleaf. The importance of a particular risk factor in an individual is expressed in terms of relative risk (the risk of occurrence of disease in a group of individuals exposed to the factor

[1] Department of Neurology, "Ovidius" University, General Medicine Faculty, Constanta, ROMANIA
[2] Physical Education and Sport , "Ovidius" University, Constanta, ROMANIA
[3] Department of Neurology, University of Medicine and Pharmacy "Victor Babes", Timisoara, ROMANIA
E-mail address: docuaxi@yahoo.com
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versus the incidence in individuals not exposed). Many risk factors are inter-related and the presence of more than one risk factor in an individual has an additive effect on the overall risk of stroke.

The stroke for young adults under 45 is a reality and a "sad privilege", considering its biologic, psychic and socio-professional integration consequences. The systemic disease, the disseminated lupus erythematsous can produce large strokes and it is thought that they can appear through inflammatory arteritis, clotting anomalies and heart embolism. Arteriosclerosis is a generic term embracing all varieties of structural changes that result in hardening (and thickening)of the wall of a large and small, and elastic and muscular arteries, arterioles (arteriolosclerosis). Atherosclerosis is one form of arteriosclerosis, characterized by an intimal pool of necrotic, proteinaceous and fatty substances in the hardened arterial wall (Greek athere, '**porridge`** or 'gruel`). Atherosclerosis (or atheroma) mainly affects large (e.g. aortic arch) and medium-sized arteries at places of arterial branching (e.g. carotid bifurcation), tortuositi (e.g. carotid siphon) and confluence (e.g. basilar artery).

Most hemorrhagic strokes are thought to be due to intracranial small vessel disease (lipohyalinosis- fibrinoid necrosis), which is often associated with hypertension. These hemorrhages are usually deep in the brain, in the area supplied by small penetrating arteries, such as the thalamus, putamen, ponds and cerebellum.

The most common cause of lobar hemorrhages is amyloid angiopathy in older individuals and vascular abnormalities such as arteriovenous malformations and aneurysms in younger individuals.

Stroke causes several problems, including activity limitations and participation restrictions among adults.

Stroke rehabilitation focuses on returning the individual to an active lifestyle, and various interventions strategies have been developed. These approaches help facility movement by afferent stimulation and improvements postural control and normal movement patterns. Several types of task-oriented training such as body-weight supported treadmill training (BWSTT), circuit training, walk training, reaching tasks for improving balance, and constraint-induced movement therapy (CIMT) can improve lower and upper extremity function.

Repetitive task training resulted in modest improvement across a range of lower limb outcome measures, but not upper limb outcome measures. Training may be sufficient to have a small impact on activities of daily living. Interventions involving elements of repetition and task training are diverse and difficult to classify: the results presented are specific to trials where both elements are clearly present in the intervention, without major confounding by other potential mechanisms of action. French B et all, 2010

Both walking speed and endurance need to be measured and trained during rehabilitation. Dean CM et all, 2001.

A maximum recovery point is reached in the first 6-9 months, after which the progresses are no longer that significant. Abandoning systematic recovery from various reasons predisposes to tendinous and capsulo-articulatory reactions. The prolonged bed immobilization and passive non-immobilized cases develop achilean retraction, humeral capsulo-articulary retraction and algo-dystrophic syndromes. At this stage it was noticed a net benefit from active kinetictherapy in the case of ACA territory stroke (hemiparesis with crural predominance) and a favorable evolution in the case of ACM stroke (hemiparesis with facio-branchial predominance) where prehension and the fine movements of the fingers were incomplete.

Thus, the practice of a systematized recovery over the first 6-9 months seems to ensure important progress, imposing the realization of a complex, yet individualized, work scheme in order to facilitate psycho-social reintegration.

These approaches focus on motor impairments after stroke. However, the International Classification of Functioning, Disability, and Health (ICF) recommend that rehabilitation intervention show focus on activity limitation rather than motor impairment.

Published reviews of task-oriented training can be categorized into two groups: one that includes all types off task-oriented training mentioned previously, and the other includes only a specific type of training. French et al. 17 (2010) and Rensink et al. 18 (2009) have provided reviews of the former. Reported a Cochrane systematic review of three types of task-oriented training including CIMT, BWSTT and repetitive or circuit training. They concluded that these methods resulted in modest improvement across a range of lower limb outcome measures but not upper limb outcome measures. However, the analyzed studies were randomized control and quasirandomized trials included in French et al. s'17 analysis (2010). A meta-analysis of randomized clinical trials (RCTs) with minimal danger for bias is regarded as the ideal analytic tool for appraising the

beneficial and harmful outcomes of an intervention.

Methods

Study search procedures includes 7 days onset of rehabilitation after ischemic or hemorrhage, following inclusion criteria: (1) stroke survivors in the acute phase, the 7 day rehabilitation phase;(2) stroke type was ischemic or hemorrhagic;(3) intervention outcomes focused on walking, balance, 4) task-oriented training ,including circuit and repetitive task-based training on motor learning.

Methodological quality assessment: The Barthel Index consists of 10 items that measure a person's daily functioning specifically the activities of daily living and mobility. The items include feeding, moving from wheelchair to bed and return, grooming, transferring to and from a toilet, bathing, walking on level surface, going up and down stairs, dressing, continence of bowels and bladder.

The higher the score the more "independent" the person. Independence means that the person needs no assistance at any part of the task. If a person does about 50% independently then the "middle" score would apply. (Mahoney, Barthel, 1965).

Patient Name: _____ **Rater:** _____ **Date:** __/__/__ __:__

Activity	Score
Feeding 0 = unable 5 = needs help cutting, spreading butter, etc., or requires modified diet 10 = independent	0 5 10
Bathing 0 = dependent 5 = independent (or in shower)	0 5
Grooming 0 = needs to help with personal care 5 = independent face/hair/teeth/shaving (implements provided)	0 5
Dressing 0 = dependent 5 = needs help but can do about half unaided 10 = independent (including buttons, zips, laces, etc.)	0 5 10
Bowels 0 = incontinent (or needs to be given enemas) 5 = occasional accident 10 = continent	0 5 10
Bladder 0 = incontinent, or catheterized and unable to manage alone 5 = occasional accident 10 = continent	0 5 10
Toilet Use 0 = dependent 5 = needs some help, but can do something alone 10 = independent (on and off, dressing, wiping)	0 5 10
Transfers (bed to chair and back) 0 = unable, no sitting balance 5 = major help (one or two people, physical), can sit 10 = minor help (verbal or physical) 15 = independent	0 5 10 15
Mobility (on level surfaces) 0 = immobile or < 50 yards 5 = wheelchair independent, including corners, > 50 yards 10 = walks with help of one person (verbal or physical) > 50 yards 15 = independent (but may use any aid; for example, stick) > 50 yards	0 5 10 15
Stairs 0 = unable 5 = needs help (verbal, physical, carrying aid) 10 = independent	0 5 10
TOTAL (0 - 100)	_____

Modified Rankin scale:

0 No symptoms at all

1 No significant disability despite symptoms; able to carry out all usual duties and activities

2 Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance

3 Moderate disability; requiring some help, but able to walk without assistance

4 Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance

5 Severe disability; bedridden, incontinent and requiring constant nursing care and attention

6 Dead (Rankin, 1957, Bonita et al., 1988, Van Swieten et al., 1988)

NIHSS scale:

0= normal

1-4= minor stroke

5-15= moderate stroke

15-20= moderate/severe stroke

21-42= severe (Bradley et al., 2004)

Results

Characteristics of the enrolled subjects

Basic demographics and patient characteristics are summarized in Table 1. The PPV cohort had a mean age of 49 ± 15 years and a mean duration of symptoms of 47 months (range 2; 180). Six patients showed a secondary form of PPV, i.e., an episode of vertigo or dizziness preceded the PPV symptoms (Table 1). Seventeen of the 18 patients with a primary PPV course reported that an unspecific situation or stress or a non-vestibular disease preceded the symptoms.

Twenty-five patients with stroke (12 women; mean age 64 ± 13 years; and 13 men's; mean age 67 ± 11 years; mean participated in the observational group

Table 1 Demographic and clinical data of the enrolled subjects

Stroke	Men	Women
Basic information		
Gender female:male	13	12
Mean age in years	64 ± 13	67± 11
Hypertension	11	9
Cardiac problems (fibrillation)	2	5
Diabetes	2	1
Onset	Sudden	Sudden
NIHSS scale	Mean 10(5-15)	Mean 12(5-15)
RANKIN SCALE	Mean 3(0-6)	Mean 3(0-6)
Barthel scale	Mean 55(0-100)	Mean 60(0-100)
Balance and gait scores		
Median FGA [points] with min; max	15(12,31)	13(11, 30)
Median BBS [points] with min; max	4(3,8)	4(2, 8)
Median FES-I [points] with min; max	16 (15; 59)	17 (16; 57)
Mean ABC [%] with min; max	32.3 (22; 98)	33.4 (20; 100)

FGA functional gait assessment, *BBS* Berg balance scale, *FES-I* falls efficacy scale-international, *ABC* activity-specific balance confidence scale

Only 2 men and 1 women had a non insulin diabetes. The FGA revealed severe gait impairments with a median of 15(12,31) for the men and 13(11, 30) for women. FES-I with a median score of 16 (15; 59) for men and 17 (16; 57) for women. The ABC with a mean of 32.3 (22; 98) for men and 33.4 (20; 100) for women showing a severe fear of falling and balance uncertainty.

Gait characteristics of stroke patients after discharge home (after 7 day hospitalization)

Band walking testing revealed a significant reduction of walking speeds in stroke patients under the conditions of walking at slow speed, the cadence and stride length of stroke patients were severe reduced. We found no significant changes of the base of support and of temporal and spatial gait variability markers between male and female patients. A slight but significant reduction of cadence at women stroke patients was found.

Walking characteristics during cognitive dual task or with eyes closed.

The addition of a DTc (subtracting 7) while walking caused changes of gait parameters in both

stroke (men and women) patient groups: a slight reduction of walking speed, cadence and stride length with an increase of gait cycle parameters (stride time, double support percentage) and gait variability parameters could be detected at both women and men.

Walking with eyes closed also revealed parallel changes in the walking patterns stroke patients: walking speed was reduced with a decrease in cadence and stride length and an increase in gate cycle parameters (stride time) and gait variability. Calculation of the VR revealed that the reduction in walking speed, cadence and stride length was more pronounced in female stroke patients compared to male stroke patients.

No significant correlations were found for FES-I, ABC, and the VR for different gait parameters under walking with eyes closed.

Complex treatment of patients with stroke pursues a number of objectives that we want to improve balance in standing and walking. Effect of functions and kinetic protocol focuses on the main objectives of the study.

Observational study over 6 months in patients with stroke recovery to assess the effect on quality of life and symptoms of dizziness, scores were assessed physical, emotional, functional baseline, one month and six months.

Task performance improved with repetition in both ischemic and hemorrhage stroke. This suggests a motor learning in both groups. Nevertheless, the improvement was less during bilateral compared to unilateral obstacle stepping. We suggest that the greater difficulty in the bilateral task can also be explained by an impairment in dividing attention between concurrent tasks, which plays a role in all bilateral tasks In addition, postural stability is known to be influenced by attention.

Discussion

Task-oriented training helps improve outcomes among patients with stroke. The effects were mainly restricted to training focused on the lower limbs. Our study assesses improvement in locomotion. There has been positive effect observed in studies assessing patients with a relative short period of stroke onset. Twenty-five patients with stroke (12 women; mean age 64 ± 13 years and 13 men; mean age 67 ± 11 years; participated in the observational group.

Gait analysis was performed using at treadmill. All patients had to walk over the band at three different speeds (preferred, slow and maximally fast). Gait was then examined while walking at the preferred speed and performing a cognitive dual task (DTc) (serial 7 task) with the instruction to focus on the cognitive task. Afterwards walking at the preferred speed with eyes closed (EC) was examined. The different gait tasks were performed in a fixed order: walking with preferred speed, walking with slow speed, walking with fast speed, walking with a cognitive dual task, and walking with eyes closed. Each walk was started 1.5 m in front of the mat and continued for 1.5 m beyond it in order to allow steady-state locomotion. Each task was tested twice. During the serial 7 dual task, the calculation steps and the time from the beginning to the end of the condition were documented. The Functional Gait Assessment (FGA), a 10-item gait test developed for patients with balance deficits was used to clinically assess the gait capacity and the Berg Balance Scale (BBS) to assess balance.

All patients competed the Falls Efficacy Scale-International (FES-I) and the Activity-specific Balance Confidence Scale (ABC) .The FES-I compares 16 questions on the subjective fall efficacy in daily life situations. A total score is obtained by adding the scores (1 – 4) of each question. That will give a range from 16 (no concerns about falling) to 64 (severe concerns about falling) points. The ABC is a self-reported questionnaire of 16 questions evaluating the subject's level of self-confidence in daily mobility situations.

The following standard gait parameters were analyzed: Functional Ambulation Profile (FAP), velocity, cadence, stride time, stride length, and base of support as markers for the magnitude of gait variability. These gait parameters comprehensively represent the pace, rhythm, gait cycle, support and the dynamic stability domains of gait behavior.

The previous meta-analysis reported no significant ES of balance assessed by step test from three studies and Berg Balance Scale. Although walking speed is an important index for functional outcomes, Dean et al. (2001) suggested that speed over a short distance tends to overestimate locomotion capacity afther stroke. In analyzing dose parameters, although both acute/sub-acute and chronic phases had large effects for acute/sub-acute phase patients were larger. This result was similar to Dean et al. (2001), supporting the notion that task-oriented training, such as circuit classes, might be more beneficial in rehabilitation, if it is provided for acute sub-acute patients.

Although this study was the first to investigate the effect of task-oriented training according to

exercise mode, we should acknowledge that these findings do not allow us precise assessments of optimal training frequency because we did not obtain data according to task-oriented dose parameters. Although the present study showed large positive effects, some limitations should be noted. First, the number of studies used in this analysis was small, making it difficult to interpret the sub-group analysis. The specific dose parameters should be verified as a way to provide more useful information for clinicians. Thus, given the small number of studies assessed, effective dose parameters could not be identified in each subgroup. Although it is possible to do a meta-analysis on as few as two studies, a small number of studies might lead to large sampling error .Second although there is no standard task-oriented training. Further research is necessary to confirm the effectiveness of task-oriented training for upper extremity functions and dose parameters according stroke stage.

Conclusions

In spite of these limitations, we found that task-oriented training, focusing on repetitive or circuit training, positively affected improved functional outcomes after stroke, especially for lower extremity functioning. Additionally, task-oriented training in the applied sub-acute phase was rather effective. In addition, task-oriented training improved not only functional outcomes, including walking and balance, but also muscle strength. Thus, it is necessary that high volume task-oriented training is applied early on to improve functional outcomes after stroke onset.

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