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Investigate the Principles and Applications of Task-Specific Training in Neuro-Physiotherapy Rehabilitation

Mohammed A Alsultan[1]*, Ghalib Abdulah Alghamdi[2], Abdulkarim Sulaiman Alhumaid[3]

[1] FRCPC (EM, CCM), King Saud Bin Abdulaziz University for Health Sciences (KSAU-HS), KSA

Email: malsultan@msn.com

[2] Neuro Rehabilitation Manager, Rehabilitation Services at King Abdulaziz Medical City, Riyadh,KSA.

[3] Chief PT at PSMMC, Riyadh, KSA

Abstract - In India, the third leading cause of mortality is a neurological damage known as a stroke, which happens when blood flow to the brain is interrupted. Disabilities in the hands and legs are among the most prevalent effects of stroke on humans. Exercise and rehabilitation are crucial in the healing process after a stroke. While there are a variety of exercises that may help with stroke management, job specific training is a typical recommendation. Proprioceptive Neuromuscular facilitation (PNF) is another prominent approach utilised in Proprioceptive Neuromuscular facilitation (PNF). Evidence for the efficacy of task-specific training in neurological rehabilitation is growing. Stroke patients' quality of life was the primary outcome of this research, which sought to identify the impact of an ICF model-based exercise programme that was both task- and context-based. Mann Whitney U test, intention to treat analysis, and repeated measures ANOVA with generalised estimating equations using the log link function was used to analyse the data. Patients were surveyed in a more casual setting to assess feasibility. Patients' reports of pleasure, their level of adherence to the exercise programme, and the absence of adverse events all pointed to the program's viability. Stroke patients living in the community may have benefited more from an exercise programme that focused on the structure/function, activity, and involvement domains of the ICF than from traditional physiotherapy, according to one research. So, it's clear that while creating an intervention, it's important to concentrate on all of the ICF domains. Stroke patients were able to benefit from a fitness programme that was both task and context driven.

Keywords: Neuro-Physiotherapy, Rehabilitation, Task-Specific Training, Stroke, Patient

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INTRODUCTION

Increasing research suggests that therapists working with patients who have neurological disorders should include task-specific training into their treatment plans. When patients "practice context-specific motor tasks and receive some form of feedback," they are engaging in task-specific training, a phrase that has developed out of the literature on motor skill development and movement science. Various forms of practice, feedback, and transfer circumstances may be linked to it in the domain of skill acquisition. With the help of goal-oriented practice and repetition, task-specific training in rehabilitation aims to enhance performance on functional activities. Instead of focusing on impairment-specific training, such muscular building, the emphasis is on training for functional activities. Repetitive functional task practice, repetitive task practice, task-related training, and task-oriented treatment are other words that describe the same thing. Its scientific foundations are the task-specific training approach's strongest point. Human studies with 'healthy' subjects and after injury have built on the foundational science research in animals and the motor control and learning literature in psychology to guide task-specific training (Chen, J. C., Shaw, F. Z. 2014). Additionally, training-related neuronal plastic changes are becoming more and more evident. According to reports, learning is optimised for the job that was learned. Crucially, it's possible that changes in cortical representation cannot be achieved only by repeated usage. Instead, alterations are linked to the acquisition of certain skills, in line with a concept of brain plasticity that is reliant on learning. The importance of the item or activity performed in the planning of movement is also supported by neurophysiological data. It seems that cortico-motor neuron pools are structured more according to activities than to individual muscles. Stroke survivors may be able to keep their motor skill acquisition abilities under the same circumstances

as healthy volunteers, according to some important findings.

Rehabilitation science, exercise physiology, and theoretical motor control and learning are all included into neurorehabilitation's movement training programmes. As a valuable conceptual framework for identifying impairments, activity levels, engagement, and facilitators and obstacles to rehabilitation, the International Classification of Functioning (ICF) has been accepted by the rehabilitation field. Adaptation, restoration, maintenance, and prevention are four goals of neurorehabilitation movement training that are likely to be applicable to any branch of physical therapy (Lennon et al., 2018). On the other hand, movement training treatments lack a standardised categorization system that would allow for the systematic identification and labelling of the various training active components (Hart et al., 2014). Physical therapy, exercise physiology, impairments, sensory systems, techniques, philosophies, equipment, orthoses/prostheses, actions, approaches, and original concept inventors are just a few of the many categories into which treatments fall. Some examples of these categories are vestibular and proprioceptive systems, which are involved in walking and balance, pain and tremor, respectively. Other categories include mobilisation, facilitation, and equipment, treadmill training, robotics, orthos Such contradictory labelling might make it very difficult to disseminate knowledge in the present evidence-based learning atmosphere. There will inevitably be 'growing pains' with multidisciplinary rehabilitation language, and those pains might manifest as misunderstandings and arguments. The lack of utilisation of isolated treatments by clinicians immediately distinguishes clinical practice from several simple or unique study design procedures (Hayward et al., 2014; Kleynen et al., 2017). One recurring feature that hinders the understanding and execution of study results is poor intervention reporting. For instance, it has been acknowledged as a top priority to establish stronger reporting and design criteria for future research on stroke rehabilitation (Bernhardt et al., 2019). With the merging of different clinical disciplines and research fields, a shared vocabulary of movement training principles could enhance cross-disciplinary communication and collaboration, direct research towards real-world problems, and support clinical reasoning (Esculier et al., 2018; Hart et al., 2014).

Task-specific instruction and the application of routine tasks

"Movement emerges from an interaction between the individual, the task, and the environment in which the task is being carried out," as the saying goes. This paradigm aligns with the occupational therapy emphasis on tasks and occupations. Some have hypothesised that contextual factors have a favourable effect on how the upper limbs are organised to reach. Additionally, in healthy volunteers, the kinematics of upper-limb movement differs under various contexts, such as simulated vs real-life activity. In a similar vein, van Vliet et al. (1995) discovered that the kinematics of the upper limb changed when the objective was to drink from a glass as opposed to just moving a water glass, which goes to show how important the aim is. The use of actual, functioning items may help stroke survivors improve their ability to move their affected arm efficiently, smoothly, and in unison, according to research by Wu et al. (2000). In order to facilitate functional recovery, task-specific training often employs "real-world" or commonplace activities. Its goal, in conjunction with extensive massed practice, is to attain optimum function, which the patient or client may then use to their full potential in carrying out their daily tasks. It may be 'preaching to the converted' to discuss the significance of tasks and ordinary activities in neurorehabilitation and then report this to occupational therapists. Nonetheless, the authors imply that this corpus of research supports the idea that neuromotor therapies should centre on specific jobs, tasks, and activities. Neuromotor therapies are task-specific and grounded in and around daily activities; academics and opinion leaders believe that this is supported by considerable evidence. Training or intervention that primarily employs commonplace, daily tasks that are important to the client or patient, either on an internal or extrinsic level, is called task-specific training in this context.

LITERATURE REVIEW

Globally, stroke has emerged as a major health concern. Along with a great deal of mortality and impairment, it is among the top causes of death in India (Pandian, J. D., Sudhan, P. 2013; Rajsic, C., Gothe, H., Borba, H. H., Sroczynski, G., Vujcic, J., Toell, T., et al. 2019). Stroke prevalence estimates in India vary between 84 and 262/100,000 in rural regions and 334 to 424/100,000 in urban areas, according to studies. Recent population studies have shown an incidence rate of 119–145 cases per 100,000 people. A stroke occurs when there is insufficient blood flow to the brain, preventing the delivery of oxygen and nutrients to the tissues and ultimately damaging them. Disabilities are a constant companion for the vast majority of stroke survivors. Typical signs included a loss of sensation or tingling in one or more limbs all at once, which may make it hard to move the affected limbs, walk, maintain balance, or coordinate movements. According to Singh and Pradhan (2013), people with hemiplegia have trouble with ADLs and have impaired mobility in their upper and lower limbs. Stroke puts a lot of financial strain on the patient and their family due to the direct and indirect costs that the patient must bear. Families often shoulder the financial burden of continuing rehabilitation and long-term care. Diabetes, coronary heart disease, and stroke cost India an estimated 8.7 billion USD in 2012 (Prasad, K., Vibha, D., Meenakshi). These patients must be mobilised and treated as soon as possible. A multidisciplinary team consisting of doctors, nurses, OTs, speech therapists, occupational therapists, and social workers manages stroke patients. Rehabilitation after a stroke is greatly aided by this

group. It is critical, nevertheless, to have rehabilitative procedures that may be used generally. According to O'Donnell, Denis, and Liu (2012), the existing medical system has a significant problem in formulating an important strategy. Rehabilitation after a stroke has been found to benefit from physical activities and exercises. It is difficult to bridge the gap between the illness and physical exercise. Stroke survivors face a significant obstacle in the form of rehabilitation. In the field of rehabilitation, there are several treatment techniques that are now accessible. The most popular methods include the following: the Rood method, sensory motor approach, neurodevelopmental treatment, Bobath technique, Brunnstrom's movement therapy, and PNF. Rehabilitating stroke survivors often involves the use of PNF (Gallanagh, S., Quinn, T. J., Alexander, J, Walters, M. R. 2011).

METHODS

In order to find out how a task and context based exercise programme can help stroke patients with their structure and function, activity and participation, and contextual factors, as well as how physiotherapists and patients perceive these issues after a stroke, this study set out to do just that. Saudi Arabia is the focus of the study. Those who have survived a stroke are the subjects of this research.

Sampling

Purposive sampling was used to do the sample. Age (those under 40 vs. those over 40) and stroke type (ischemic vs. hemorrhagic) were the two factors used to stratify the participants.

Sample size

Fifty stroke victims were required for this part of the research.

Inclusion criteria

The following were the topic inclusion criteria:

- Discharged from the hospital were patients who had their first stroke.
- People who are 30–65 years old.
- Individuals who have been hospitalised for at least three months after a stroke.
- Patients who can walk at least 7 metres with guidance or assistance.
- Patients who can comprehend and follow basic directions.

Exclusion criteria

The following were not included:

- People who have a history of serious, unmanageable, or unstable heart disease.
- People who have other systemic conditions that make exercise unsafe.
- People who are critically sick.
- Individuals who are deaf or have low vision.
- Individuals with other medical issues make it difficult for them to take part in treatment plans or submit results for evaluation.

Pragmatic trial

A pragmatic trial is one that is both thorough and conducted in a typical clinical environment to determine the effectiveness of an intervention. The purpose of this sort of study is to test the hypothesis that an intervention is effective in a real-world setting. In routine clinical settings, interventions are evaluated in comparison to either traditional or innovative forms of the same or other types. These studies evaluate various outcomes, the majority of which are focused on the patient. (Patsopoulos, 2011)

Data analysis

The data was analysed using SPSS version 15.0. The demographic characteristics of the participants were reported using descriptive statistics, including mean and standard deviation, median and interquartile range, and percentage. To compare the baseline measurements across the groups, the following statistical tests were utilised: Independent t test (t), Mann Whitney U test (U), Pearson Chi-Square test ($\chi 2$), and Fisher's exact test (f).

Secondary outcome measures

- **Motricity index (MI):** The strength of the paretic lower and upper extremities is evaluated using MI, a measure of motor impairment. Three tests for the arms (pinch grip, elbow flexion from 90^k and shoulder abduction) and three tests for the legs (ankle dorsiflexion, knee extension and hip flexion) are part of mixed-impact screening. Every test has an arm and leg dimension with scores ranging from 0 (no movement) to 33 (normal) according to MRC grading; the overall score (side score) is 100.
- **Bi-Berg Scale (BBS):** The 14-item Balance Assessment Scale (BBS) is a quantitative tool for evaluating balance in relation to functional activities. There are 56 possible points, with 0 representing an inability to accomplish the item and 4 representing an ability to do so.

Measurements

All individuals had their baseline, 8, 12, and 16 week outcomes measured.

RESULTS

Analysing the muscle tightness index as a secondary outcome measure within the body structure and function domain

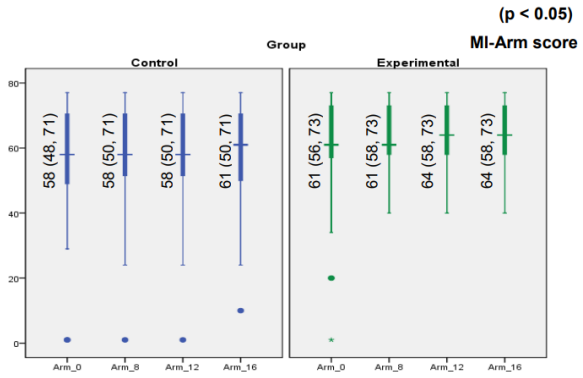
Specifically, we compare the changes in the median score of the ICF's secondary outcome measure for the body structure/function domain (MI) A Mann Whitney U test with Bonferroni corrected alpha error was used to illustrate the arm and leg scores between any two time point measurements from baseline (0 week) to follow-up (16 weeks) in table 1.

Table 1. Analysis of the inter-group variability (IQR) in MI-Arm and leg scores measured over time (n=50)

Sl. No	MI Domains	Time	Control group	Experimental group	z	p
			Median difference (IQR)			
1.	Arm Score	0 and 8 weeks	0 (0, 4)	0 (0, 5)	-0.061	0.951
		0 and 12 weeks	0 (0, 4)	0 (0, 6)	-0.567	0.571
		0 and 16 weeks	0 (0, 5)	0 (0, 6)	-0.188	0.851
		8 and 12 weeks	0 (0, 0)	0 (0, 0)	-0.736	0.460
		12 and 16 weeks	0 (0, 0)	0 (0, 0)	-0.586	0.556
2.	Leg Score	0 and 8 weeks	0 (0, 0)	0 (0, 0)	-0.530	0.595
		0 and 12 weeks	0 (0, 0)	0 (0, 0)	-0.395	0.691
		0 and 16 weeks	0 (0, 0)	0 (0, 0)	-0.197	0.842
		8 and 12 weeks	0 (0, 0)	0 (0, 0)	-0.476	0.632
		12 and 16 weeks	0 (0, 0)	0 (0, 0)	-1.402	0.160

At either of the two time points measured between baseline (0 week) and follow-up (16 weeks), there was no statistically significant change in the median score of the secondary outcome measure under the body structure/function domain of the ICF (MI Arm and leg score) when comparing the groups. This is shown in table 1.

Figure 1 shows the comparison of the groups over time measures (baseline, 8 weeks, 12 weeks, and 16 weeks) for the secondary outcome measure under the body structure/function domain of the ICF, which is motor impairment evaluated by MI Arm and leg score. The experimental group outperformed the control group on the secondary end measure within the body structure/function domain of the ICF, namely the MI Arm and leg score, during the baseline, 8-week, 12-week, and 16-week assessments (figure 1).



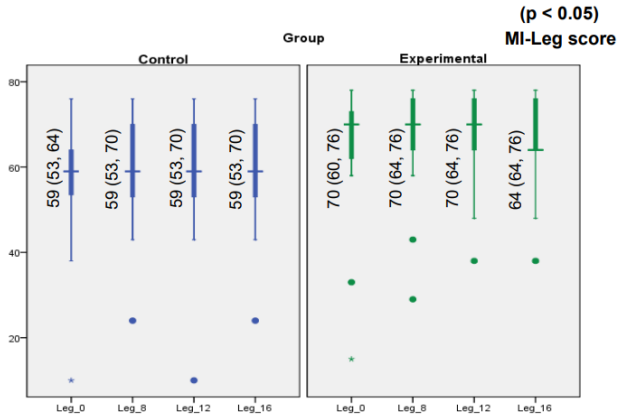


Figure 1. Statistical analysis of the groups' median (IQR) MI-Arm and leg scores as measured throughout time (n=50)

Evaluation of Activity Domain Secondary Outcome Measures: Balance

Using a Mann Whitney U test with Bonferroni corrected alpha error, table 2 displays the changes in the median score of the Balance (Berg balance scale-BBS) score, a secondary outcome measure under the activity domain of the ICF, from any two time point measurements from baseline (0 week) to follow-up (16 weeks).

Table 2. Median variation (IQR) of BBS score readings over time compared between groups (n=50)

Sl. No	Time	Control group	Experimental group	z	p
		Median difference (IQR)			
1.	0 and 8 weeks	0 (0, 2)	1 (1, 4)	-3.117	**0.001**
2.	0 and 12 weeks	0 (0, 3)	2 (1, 4)	-2.885	**0.003**
3.	0 and 16 weeks	0 (0, 2)	2 (1, 6)	-3.086	**0.001**
4.	8 and 12 weeks	0 (0, 1)	0 (0, 0)	-0.870	0.383
5.	12 and 16 weeks	0 (0, 0)	0 (0, 0)	-1.998	0.045

Table 2 shows that there was a statistically significant change in the median score of the Balance (Berg balance scale-BBS) assessment at 8 weeks, 12 weeks, and 16 weeks from baseline (0 week) when comparing the groups at interweek time points within the activity domain of the ICF. Figure 2 shows the groups' comparisons across time measures (baseline, 8 weeks, 12 weeks, and 16 weeks) of the Balance (Berg balance scale -BBS) score, which is a secondary outcome measure under the activity domain of the ICF.

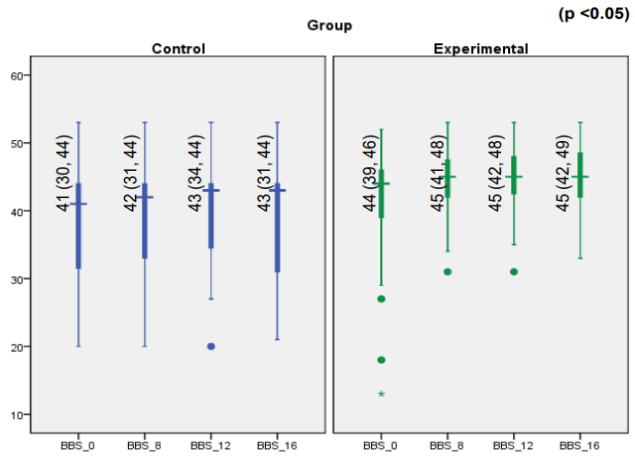


Figure 2. Analysis of the groups' median (IQR) BBS scores across time measurement sets (n=50)

At baseline, 8, 12, and 16 weeks, the experimental group outperformed the control group on the Balance (Berg balance scale-BBS) score, a secondary outcome measure within the activity domain of the ICF (figure 2).

DISCUSSION

Median scores on secondary end measures within the body structure/function domain of the ICF (MI Arm, leg, and side score) improved in the task and context based training group compared to the control group at baseline, 8 weeks, 12 weeks, and 16 weeks. Statistical significance was not shown in either of the two time point assessments from baseline (0 week) to follow-up (16 weeks) when comparing the change in the median score of MI Arm, leg, and side score across interweek time points between groups. Consequently, there was no statistically significant improvement in motor impairment, an area pertaining to body structure and function, in this research. Research conducted by da Silva, Antunes, Graef, Cechetti, and Pagnussat (2015) examined the impact of loaded exercises on the recovery of upper limb functions in 20 stroke survivors with chronic hemiparesis. The results suggested that strength training should play a crucial role in the task-oriented rehabilitation programme for survivors with mild impairments following a stroke.

In the activity domain of the ICF, task and context based training significantly improved the median score of the secondary outcome measure, Balance (Berg balance scale-BBS) score, compared to the control group at baseline, 8 weeks, 12 weeks, and 16 weeks. In addition, at 8, 12, and 16 weeks from baseline (0 week), there was a statistically significant change in the median BBS score compared to the other groups at interweek time periods. The inclusion of task-specific sitting and standing balancing exercises in the experimental group may have contributed to the observed improvement with task and context based exercise programmes. Task and context based training did provide some progress, but it wasn't enough to warrant clinical significance. Although the least clinically important difference (MCID) for the berg balance scale was not determined, patients with chronic stroke need change scores greater than 3 for an improvement to be deemed clinically relevant and not attributable to measurement error (MDC) (Liston & Brouwer, 1996). Subjects in the current research demonstrated a 2-point improvement on the BBS after therapy, in contrast to a 0-point improvement in the control group. This lines up with the findings of a recent analysis (French, et al., 2010) that looked at the efficacy of repeated task training in restoring functional capacity after a stroke. Similarly, that evaluation found no evidence that it improved balance whether standing or sitting.

CONCLUSION

We can say that although several rehabilitation methods have showed promise in easing stroke patients' road to recovery, whether or not they will be effective in the long run is an open topic. Relearning routine tasks is at the heart of the task-oriented approach, which aims to enhance motor control in the brain. The motor control model, central to kinesiology theory, is the basis for its operation. Motor control and the pattern of movement for each particular activity may be better learned with task-specific training as opposed to generalised movement instruction. In a study conducted by the International Classification of Functioning (ICF), it was discovered that a task and context oriented exercise programme that focused on the body structure/function, activity, and participation domains might be more effective than traditional physiotherapy in improving stroke patients' quality of life. When assessing stroke patients, physiotherapists looked for issues with their patients' structure and function, level of activity, and level of engagement. Compared to traditional physiotherapy, a task and context-based exercise programme that targeted the structure/function, activity, and participation domains of the International Classification of Functioning (ICF) was more effective in improving stroke patients' quality of life.

In the future scope, it is important to assess the long-term effects of contextual elements in the future experiments. In the future, researchers will also try to do long-term follow-up.

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Corresponding Author

Mohammed A Alsultan*

FRCPC (EM, CCM), King Saud Bin Abdulaziz University for Health Sciences (KSAU-HS), KSA

Email: malsultan@msn.com