Task oriented training for Stroke Rehabilitation: A mini review

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Abstract

Stroke is the leading global cause of death and disability and the need for stroke rehabilitation services in increasing. The usual stroke rehabilitation protocol involves a combination of therapeutic exercises, occupational therapy, speech therapy and counselling sessions depending upon the severity of the deficit and associated co-morbidities. However, there is a need for better protocols and new therapies for improving outcomes after stroke rehabilitation. The term 'task-oriented training' (TOT) refers to guided rehabilitation training of patients' limb function using goal oriented tasks, which can be used to enhance neuroplasticity in brain after injury. Task oriented training could be modified with action selection and environmental enrichment to fulfill the limitations of stroke like, holistic approach, outcome/goal based intervention, proper dosage for desirable outcomes. This mini review provides an overview of the TOT and to identify gaps and challenges in stroke rehabilitation related to integrating TOT.

Keywords: Stroke, Rehabilitation, holistic approach, task oriented training.

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Introduction

Stroke is the leading cause of deaths and disabilities globally and its incidence in the developing countries is on the rise. The 2022 WHO global statistics fact sheet suggests that 1 in 4 persons will have stroke in lifetime with 50% increase in risk, 70% increase in incidence, 43% increase in mortality, 102% increase in prevalence and 143% increase in Disability Adjusted Life Years (DALY). The factsheet highlighted that 86% stroke related mortality and 89% DALYs occur in low and lower middle income countries (LIC/LMIC).[1]

Pakistan is a LMIC, with underdeveloped health care system and the incidence of stroke in young is high. However, nationwide epidemiological data of stroke in Pakistan is limited with small samples, reported mostly from hospitals located in major cities only.[2] A research on stroke was conducted in 24 districts of Khyber Pakhtunkhwa province. The prevalence of stroke was 1.2 % (1200 per 100,000 population).[3] A Karachi based study reported 4.8% prevalence of stroke with most of the stroke under the age of 45 years.[4] Another community-based survey reported 21.8% of stroke prevalence in an urban slum of Karachi.[5] The data on availability of stroke rehabilitation services is lacking in Pakistan.

Holistic and Interdisciplinary team approach for stroke rehabilitation

Stroke results in multiple impairments like upper and lower extremity motor deficits, sensory impairments, balance disturbance, cognitive and emotional deficits. Stroke rehabilitation interventions should ideally be delivered by interdisciplinary team for better results. This includes rehabilitation medicine physician, physical therapist, occupational therapist, speech and language pathologist, clinical psychologist, and rehabilitation nurse. This interdisciplinary team approach allows focusing on all impairments holistically at the same time by common goals sharing between the patients and rehabilitation team members.[6]

The Rehabilitation team members usually focus more on the motor dysfunction after stroke. This is due to increased incidence of motor impairments after stroke, resource constraints and lack of trained manpower. However, stroke may result in impairments other than motor dysfunction. These may include sensory impairments, trunk issues, balance problems and cognition dysfunction. There is some evidence that a holistic approach of addressing all the impairments caused by stroke at once or in a single session might be more beneficial. There is need to develop protocol/equipment which can address the rehabilitation for upper and lower limb motor dysfunction, sensory, balance and cognitive impairments. This may lead to better overall recovery than treating individual impairments.[7]

Task oriented training

Task oriented training (TOT) is a protocol which encourages motor activities performed in real life situations involving the complete functional tasks and its prerequisites with the whole limb.[8] TOT involves repetition of specific tasks for example towel wiping over the table, grasping and releasing activity using a tennis ball, pouring water from

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glass, combing hair etc.[8] The stroke rehabilitation delivery usually has two challenges: putting innovative ideas into practice to enhance long-term outcomes and customizing rehabilitation plans to address the needs of the individual stroke survivor.[9] The proposed mechanism of action of TOT is based on the assumption that high number of repetitions performed in a single session, can stimulate the associated areas of brain for specific task and enhance the learning phenomena. TOT may be helpful depending on the dosage of training (number of movement repetitions), although the ideal training programme's dosage is yet uncertain.[10] TOT can also induce neuroplasticity changes which are important aspect of learning new tasks and most of the rehabilitation strategies involve repeating task activities for better outcomes. Repeating the tasks results in stimulating motor cortex and associated areas of the brain results in better outcomes.[11]

Evidence suggests that combinational therapy provide a significant chance of maximizing functional recovery following stroke by utilizing the various complementary mechanisms of actions of different interventions involving neuroplasticity and restoration. TOT could be combined with environmental enrichment to further enhance stroke recovery. When compared to standard housing, environmental enrichment that improves motor, cognitive, sensory, and social stimulation has been shown to increase neuroplasticity in rodents.[9]

Task oriented training versus goal oriented training

Task oriented training involve single task for one movement and repeat that task to achieve the goal. The goal oriented training aims to achieve goal of one movement with multiple tasks for that specific goal. Individuals' post-stroke behavioural performance of goal-directed activities can change in response to changes in task conditions or practice instructions.[10]

Repeating a single task (for example pouring water from glass-an example of TOT) will help patient learn that specific task while the goal was to achieve pronation and supination at the wrist by providing Action Selection method with multiple tasks options to do pronation-supination. If we change the task of pronation-supination to door handle opening activity that might challenge the patient's capabilities. Instead of repeating the single task, allow the patient to perform multiple tasks for a single goal.[12]

Along with movement execution, successful performance of skilled motor activities requires a range of movement preparation procedures. One of these movement preparation processes is action selection (AS) or choosing an action from a list of options. A network of frontal and parietal brain regions with dorsal premotor cortex (PMd) was consistently shown to be engaged by task conditions that increase AS demands, leading to a prolonged movement preparation phase. As a result, premotor and prefrontal activity may be altered in a practice condition that involves AS demands throughout training.[10]

Limitations of task oriented training:

Stroke usually results in motor deficits in upper and lower limb of one side, trunk instability, sensory impairments, perceptual deficits, cognitive problems, emotional impairments, balance, and gait disturbances. However, TOT has mainly been used for upper and lower limbs. The role of TOT in managing sensory impairments and trunk stability training has not been studied much and needs further elaboration.[13]

Some studies suggest that the sensory and motor systems interact closely because cortico-spinal tract fibers originate from motor as well as somato-sensory areas. There is reason to believe that combining sensory and motor training can help stroke survivors with functional outcomes. However, literature on the results of integrated sensory and motor training is currently very limited.[14]

The goal of cognitive rehabilitation in stroke is to enhance cognitive abilities, facilitate recovery of cognitive function and learn new skills to compensate for cognitive deficits. Although all tasks performed in TOT require cognition but specifically targeting the cognition is still not part of many rehabilitation protocols. For this purpose virtual reality based games involving TOT can be incorporated along with motor and sensory training for stroke.[15]

Dosage of the intervention is important and there is a lot of debate regarding dosage and intensities of task oriented training, suitable for stroke population. High intensities of TOT is related to high number of repetitions of tasks, duration of intervention, total number of sessions for better outcomes. Some studies support the long duration of TOT sessions with frequent rest intervals. However, high intensity interventions may be a challenge to both stroke survivors as well as their caregivers. Similarly, there is a possibility that individuals may perform inadequate repetition of tasks with prolonged rest intervals and the true effect of the intervention may not be achieved which is the repetition of the task to achieve the desired goal. Some patients may perform more repetitions than required to achieve a goal. This may result in adverse effects like fatigue, pain, and loss of interest in performing a task. The number of sessions per week and the number of repetitions in a single session of TOT required to enhance the motor learning in the upper limb which are different from that of the lower body. It is suggested that, for stroke

rehabilitation number of repetitions per session may be more beneficial than total duration hours/session.[11]

Conclusion

Rehabilitation protocol for stroke survivors must involve an interdisciplinary team to treat the patient holistically instead of treating motor deficits alone. Depending on the deficits, training should be performed for upper and lower limb, trunk stability, posture, balance, cognition, and perceptual deficits without considering only the more affected areas involved. TOT can be modified according to need of rehabilitation and combined with mirror therapy, virtual reality or constraint induced movement therapy. Tasks designed for rehabilitation should be goal oriented (multiple tasks) and performed in an enriched environment so that patients can engage themselves without losing interest in repeating a single task. Action selection movement preparation phases may have promising effects on cortical brain areas. Dosage and intensities differences for proper outcomes should be experimented with different groups, incorporating low, moderate, and high intensities in terms of repetition or prolong the sessions or increasing frequencies of session or increasing speed to perform tasks.

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