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Case study

Effectiveness of task-oriented training on upper limb function in post-stroke patients: A case study

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ABSTRACT

Background & Aim: Stroke is one of the leading causes of mortality and long-term disability worldwide, with upper limb impairment being a common consequence that limits functional task performance. This case report aimed to examine the effectiveness of task-oriented training (TOT), a rehabilitation approach emphasizing repetitive practice of functional tasks to promote motor learning and functional recovery, in improving upper limb function in a patient with post-stroke hemiparesis during the sub-acute stage of recovery.

Case: A 56-year-old right-hand dominant male presented four months post-stroke with persistent right-sided hemiparesis, predominantly affecting upper limb function. Neurological examination revealed moderate spasticity (Modified Ashworth Scale grade 2) and reduced voluntary motor control, with movement through approximately half of the range and moderate dysmetria on coordination testing. Baseline assessment showed moderate impairment: with Wolf Motor Function Test (WMFT) score of 28/75, Fugl-Meyer Assessment for upper extremity (FMA-UE) 32/66, and Stroke Impact Scale (SIS) hand function 35/100. The patient underwent an 8-week structured physiotherapy programme based on TOT, consisting of four 60-minute sessions per week. Each session included a 10-minute warm-up followed by 50 minutes of functional tasks such as drinking from a glass, transferring objects, and combing hair. Post-intervention assessment after 8 weeks showed improvements in WMFT (50/75), FMA-UE (50/66), and SIS hand function (70/100), indicating enhanced motor recovery and functional performance.

Conclusions: The findings of this case study showed improvement in upper limb motor function and functional use of the affected hand following task-oriented training in an individual recovering from stroke. Repetitive practice of goal-directed functional tasks appeared to facilitate motor relearning and enhance independence in activities of daily living during the sub-acute stage of recovery.

Keywords: *stroke, task-oriented training, upper limb rehabilitation*

Introduction

Stroke is the second most common cause of mortality and disability in the world (1). Stroke is defined physiologically as an acute, focal vascular injury of the central nervous system that contributes to a local or systemic neurological insult (2). According to the WHO, every year 15 million individuals worldwide suffer from strokes; five million of them are predicted to die and another five million to be permanently disabled (1). Stroke is broadly classified into ischemic and haemorrhagic subtypes, although their distribution varies across populations (3).

Among the various post-stroke impairments, upper extremity (UE) dysfunction is one of the major contributors to long-term disability. Studies have shown that 62% of stroke patients required assistance with everyday tasks like dressing, toileting, and bathing even three years after their stroke onset (4). Nearly two-thirds of stroke patients experience UE weakness or paralysis, and only 5% regain complete functional use of the paretic arm. (5). Recovery of the UE function is often slower than recovery of the lower extremity because it is influenced by multiple factors, including the level of motor and sensory loss, the severity of paresis, and the intensity of spasticity. Persistent UE dysfunction may further lead to pain, joint contracture, limb atrophy and emotional distress, thereby limiting participation in daily activities and reducing long-term rehabilitative outcomes (6).

Stroke rehabilitation primarily aims to restore functional independence and enhance participation in daily activities (4). The International Classification of Functioning, Disability, and Health (ICF) recommends that rehabilitation should focus more on reducing activity limitations and participation restrictions rather than only addressing motor impairments (4). Task-oriented training (TOT) is a patient-centred intervention that incorporates function-based rehabilitation, motor activity, variable practice, motor learning, and motor coordination (6). It involves practicing specific tasks within different environmental contexts to improve motor control, coordination, and functional performance. Unlike conventional impairment-focused interventions, TOT encourages individuals to actively solve movement-related problems during task performance, thereby facilitating motor adaptation and skill acquisition (4). Previous studies have reported that TOT improves upper extremity motor recovery and functional performance in individuals with stroke. Compared with conventional strengthening approaches, TOT appears to enhance movement quality and promote more effective task execution through repetitive functional practice (6).

However, evidence regarding its effectiveness remains inconsistent, as some studies have reported limited or non-significant improvements (4). These inconsistencies may be related to differences in intervention protocols, treatment intensity, duration of therapy, and patient characteristics. Therefore, further research is needed to better understand the effectiveness of TOT in improving upper extremity function among individuals with stroke.

Clinical case

A 56-year-old right-hand dominant male, previously employed as a driver, presented to our physiotherapy clinic on 02.08.2025 with persistent right-sided weakness following a cerebrovascular accident. He initially experienced right-sided numbness on 22.04.2025. A recurrence of numbness affecting the right upper and lower limbs occurred on 24.04.2025, after which he was admitted to the National Hospital of Sri Lanka. On 27.04.2025, he developed complete paralysis of the right upper and lower limbs. His past medical history was significant for type 2 diabetes mellitus of two years' duration, with no previous history of stroke or other neurological disorders.

A non-contrast computed tomography scan of the brain performed during hospitalization revealed an acute left-sided capsular infarct involving the posterior limb of the internal capsule, corresponding to his right-sided neurological deficits. Subtle hypodensity was also observed in the adjacent left corona radiata. There was no evidence of intracranial haemorrhage or midline shift. The patient received five days of inpatient medical management and physiotherapy. Upon discharge, he was advised to continue structured rehabilitation; however, follow-up attendance and adherence were poor.

At four months post-stroke, he presented with persistent weakness of the right upper and lower limbs, reporting difficulty in performing activities of daily living, particularly tasks requiring fine motor control of the right hand. Neurological examination revealed a more marked increase in muscle tone through most of the range of motion, but the affected part is easily moved, consistent with a grade two on the Modified Ashworth scale. Voluntary motor control of the right upper limb was graded as two on this scale, indicating half of the range of motion in pattern and moderate dysmetria on coordination testing.

Upper limb motor function was evaluated using standardized outcome measures. The Wolf Motor Function Test (WMFT), a performance-based assessment that measures UE motor ability through timed and functional tasks evaluating speed, strength, and movement quality, yielded a score of 28 out of 75, indicating moderate impairment. The motor component of the Fugl-Meyer Assessment for UE (FMA-UE), a stroke-specific impairment index assessing motor recovery with a maximum score of 66, was 32/66, reflecting moderate motor dysfunction. Additionally, the hand function domain of the Stroke Impact Scale (SIS), which assesses the patient's perceived difficulty in performing hand-related functional activities on a scale of 0 to 100, showed a score of 35/100, indicating significant limitation in hand function. Overall, the clinical findings were consistent with residual right-sided hemiparesis secondary to a left internal capsular infarction, with predominant impairment in upper limb motor control and functional hand use.

Written informed consent was obtained from the patient before participation and publication of this case report. The patient was informed about the purpose of the study, the intervention procedures, potential benefits and risks, and his right to withdraw at any time without affecting his standard care. All identifying information was anonymised to ensure confidentiality.

Physiotherapy interventions

The patient participated in a structured physiotherapy programme focusing on TOT as part of post-stroke rehabilitation. The intervention was conducted over eight weeks, with four sessions per week, and each session lasted 60 minutes. All treatment sessions were delivered according to a standardized intervention protocol by the same physiotherapist to ensure consistency in treatment duration, task progression, verbal instructions, and therapist guidance.

Each physiotherapy session began with a 10-minute warm-up, consisting of passive range-of-motion exercises and active assisted range of motion exercises for the upper limb, including gentle shoulder, elbow, wrist, and finger movements. Light functional movements were also incorporated to prepare the neuromuscular system for task practice. Following the warm-up, 50 minutes of TOT were carried out.

The selected functional tasks included drinking water from a glass, transferring crystals from a table into a box, and combing hair. These tasks were chosen based on their relevance to activities of daily living and their ability to target essential components of upper limb function. These tasks involve movement patterns commonly affected following stroke, such as reaching, grasping, object manipulation, fine motor control, coordination, and bilateral upper limb

use. In addition, the tasks were individualized according to the patient's specific functional deficits and rehabilitation goals, thereby enhancing task relevance, patient engagement, and the potential for motor relearning through repetitive, goal-directed practice. During the task practice period, the patient practiced continuously, with a 2.5-minute rest period provided after every 15 minutes of activity to prevent fatigue and maintain performance quality (5). Initially, tasks were practiced at a basic level with emphasis on correct movement patterns, postural alignment, and safety. As the patient demonstrated improvement, task difficulty was gradually increased by modifying parameters such as object size, task speed, repetition, and movement precision. Verbal cues and manual guidance were provided as needed during early sessions and gradually reduced to encourage independent task execution (5). Outcome measures were assessed by the qualified physiotherapist at baseline, at the end of week four, and at the end of week eight to evaluate changes in functional performance and motor recovery (5).

Outcome measurements

The WMFT was used to evaluate UE motor ability through a series of timed and functional tasks. This performance-based assessment measures movement speed, strength, coordination, and quality of movement during task execution. The WMFT includes functional tasks that are scored using an ordinal scale, with higher scores indicating better upper limb function. The WMFT has demonstrated good reliability, validity, and sensitivity to change in individuals with post-stroke hemiparesis (7).

Motor impairment and recovery of the upper limb were evaluated using the Fugl-Meyer Assessment for UE (FMA-UE). The FMA-UE is a stroke-specific, impairment-based assessment designed to evaluate motor recovery following stroke. It assesses reflex activity, voluntary movement within and out of synergy patterns, coordination, and speed. The motor component of the FMA-UE has a maximum score of 66, with higher scores representing better motor function. It is considered one of the most reliable and valid instruments for evaluating motor recovery in individuals with stroke (8). Patient-perceived hand function and its impact on daily activities were assessed using the hand function domain of the Stroke Impact Scale (SIS). It is a stroke-specific self-reported measure that evaluates multiple domains related to stroke recovery and quality of life. The hand function domain assesses the patient's perceived difficulty in performing hand-related functional tasks and activities of daily living. Scores in this domain range from 0 to 100, with higher scores indicating better perceived hand function (9).

Results

The patient demonstrated limited upper limb function, with scores of 28/75 on the WMFT, 32/66 on the FMA-UE, and 35/100 on the SIS hand function domain. Following four weeks of intervention, improvements were observed across all outcome measures, with scores increasing to 40/75 (WMFT), 42/66 (FMA-UE), and 55/100 (SIS). By the end of the 8th week, further gains were noted, with scores reaching 50/75 on WMFT, 50/66 on FMA-UE, and 70/100 on SIS.

Table 1. Pre-intervention and post-intervention scores for upper extremity function

Assessment tool	Pre-intervention score (Week 0)	Post-intervention score (end of week 4)	Post-intervention score (end of week 8)
WMFT	28/75	40/75	50/75
FMA-UE	32/66	42/66	50/66
Hand function domain of the SIS	35/100	55/100	70/100

WMFT: Wolf Motor Function Test, FMA-UE: Fugl-Meyer Assessment for upper extremity, SIS: Stroke Impact Scale

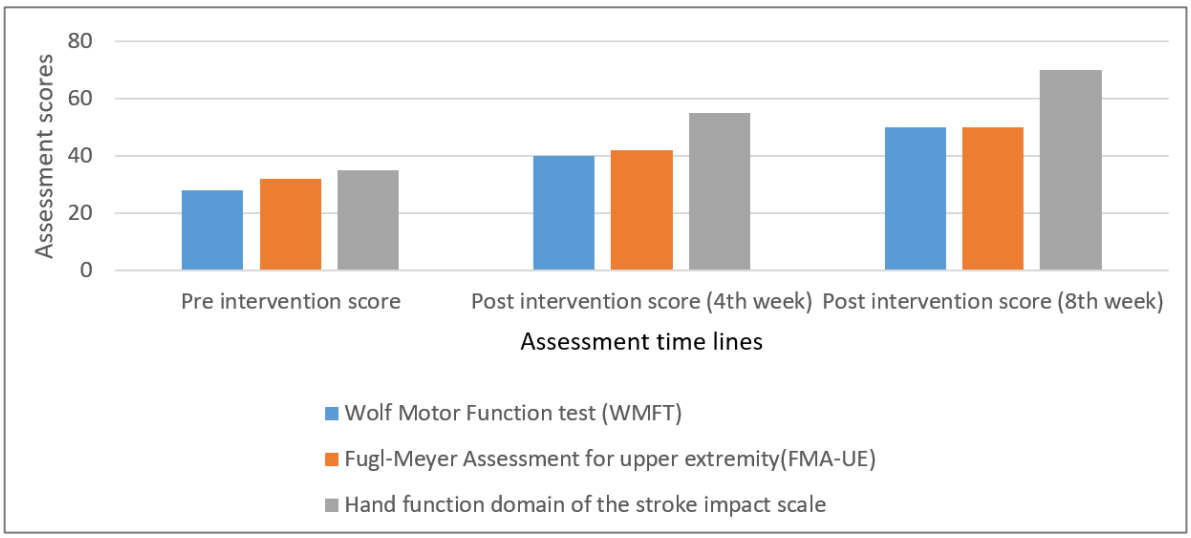

Figure 1. Pre-intervention and post-intervention scores for upper extremity function

The patient showed noticeable improvement in upper limb function over the 8-week intervention period. Scores improved by 22 points on the WMFT, 18 points on FMA-UE, and 35 points on the SIS hand function domain compared to baseline values. The substantial improvement in WMFT scores indicates enhanced upper limb motor performance and functional task execution. Furthermore, the improvement observed in the FMA-UE exceeded the reported minimal clinically important difference for individuals with stroke, suggesting that the changes were not only measurable but also clinically meaningful. In addition, the marked increase in SIS hand function scores reflects better perceived hand use and improved ability to perform daily functional activities. Overall, these findings suggest meaningful recovery in upper limb motor function and hand performance following the intervention.

Discussion

The present case study evaluated the effect of TOT on UE function in a patient with post-stroke hemiparesis. Improvements were observed in upper limb motor recovery, functional task performance, and patient-perceived hand function following the 8-week intervention. These findings suggest that TOT is an effective physiotherapy intervention to improve upper extremity function during stroke rehabilitation.

The improvement observed in the WMFT and FMA-UE scores indicates enhanced functional task performance and voluntary motor control of the affected UE. Similarly, the increase in the SIS hand function score suggests improved patient-perceived ability to use the affected hand during daily activities. These findings are associated with repetitive, goal-directed functional practice, which promotes motor learning and neuroplastic adaptation after stroke. Task-oriented approaches encourage active use of the paretic limb during meaningful activities and may help reduce learned non-use while improving coordination and movement quality. Recent evidence suggests that task-specific rehabilitation can facilitate cortical reorganization and improve upper extremity motor recovery in stroke rehabilitation (10).

The patient in this case study was in the sub-acute stage of stroke recovery, approximately four months after the onset of stroke. Previous literature has reported that the sub-acute phase is associated with enhanced neuroplasticity and responsiveness to rehabilitation interventions (11). Therefore, the improvements observed in this study have been influenced not only by the TOT programme but also by spontaneous neurological recovery commonly seen during this stage of stroke rehabilitation. The findings of our study are in line with previous research conducted in Thailand, which reported that

TOT can meaningfully improve paretic UE function in patients with sub-acute stroke (5). Previous studies have also reported that TOT improves upper limb strength, motor function, and functional task performance in individuals with stroke (6). In addition, evidence suggests that task-oriented approaches enhance movement quality and functional recovery through repetitive, goal-directed activities (4). Similarly, a systematic review and meta-analysis published in 2020 demonstrated that task-oriented training combined with priming interventions improved upper extremity outcomes in individuals with chronic stroke (12). These findings support the idea that repetitive, goal-directed TOT contributes to improved upper limb recovery following stroke. However, direct comparison with previous studies is limited because of differences in intervention duration, training intensity, stroke stage, and outcome measures across studies. In addition, most previous studies included larger samples and controlled study designs, whereas the present study involved only a single participant.

Overall, the findings of this case study suggest that TOT is a beneficial physiotherapy intervention for improving upper limb motor recovery and functional hand use in patients recovering from stroke. However, these findings should be interpreted cautiously because the study involved only a single participant without a control condition. Therefore, the results cannot be generalized to the wider stroke population. Future research involving larger sample sizes and controlled study designs is recommended to further investigate the potential effects of TOT on upper extremity function after stroke.

Conclusions

This case study suggests that TOT improves upper extremity motor function and functional hand use in individuals recovering from stroke. The observed improvements indicate the potential value of repetitive, goal-directed functional activities in stroke rehabilitation. However, as this is a single case, further studies with larger sample sizes are needed to confirm the effectiveness of TOT in post-stroke rehabilitation.

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Author Declarations

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