



Case Study

Improved functional independence measure facilitates return to home after paralyzed upper-limb training: a case report

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Abstract. [Purpose] We report a case in which rehabilitation that targeted the paralyzed side's upper limb in a hemiplegic stroke patient remarkably accelerated the patient's ability to perform activities of daily living, improved her Functional Independence Measure score, and facilitated the patient's return to home. [Subject and Methods] We provided rehabilitation training to a female patient who experienced a cerebral infarction at a nursing home for the elderly and was admitted to the Kaifukuki recovery phase rehabilitation ward in order to improve her activities of daily living and return home. An intensive rehabilitation program incorporating occupational therapy and physical training for upper-limb function on the affected side was instituted over 170 days. [Results] At presentation, the patient had functional disorders and load-induced pain in both lower limbs requiring her to walk with a fixed-type walker. After the intensive rehabilitation program, her activities of daily living improved and she was able to return home. [Conclusion] This case suggests that activities of daily living training and simultaneous active training of upper-limb function on the affected side in patients with functional disorders or lower-limb pain could effectively improve their Functional Independence Measure scores, promote functional recovery, and facilitate their return to home.

Key words: Home recovery, Limb function, Occupational therapy

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INTRODUCTION

Motor and cognitive impairments in stroke patients result in disability or dependence during activities of daily living (ADL) among the elderly. ADL performance requires optimal motor function in the trunk and upper and lower extremities. Self-reported disability measures, such as the Functional Independence Measure (FIM), are used to determine functional limitations¹⁾. As it is more difficult to recover function in affected upper extremities than it is in the lower extremities, and since ADL can often be performed with only the unaffected side^{2, 3)}, rehabilitation is aimed at improving function in the unaffected upper extremity^{4, 5)} or switching hand dominance⁶⁾. Strategies are designed to improve FIM scores and reduce return-to-home times, as these measures are often also used to evaluate the productivity of rehabilitation clinics and determine budget- and reimbursement-related questions as well⁷⁾. In this setting where training to improve function in the affected upper extremity is seldom prioritized, we experienced a rare case wherein functional improvement in the affected dominant upper extremity greatly improved FIM scores and allowed the patient to return home.

SUBJECT AND METHODS

A 71-year-old female patient had a history of bilateral knee osteoarthritis and low back pain and was diagnosed with and

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Table 1. Changes in assessments

	Initial assessment (Day 20)	Interim assessment (Day 119)	Final assessment (Day 170)
FIM	71	100	105
Fugl-Meyer	31	47	53
STEF	n/a	46	64
12-grade Brunnstrom test (grade: upper limbs-fingers-lower limbs)	5-2-6	7-8-6	10-11-7
MMT (unaffected upper limbs-fingers-lower limbs)	5-5-4	5-5-4	5-5-4
10-second test			
Grip and release test	n/a	6 times	13 times
Finger individual movement test	n/a	20 times	33 times
Hand pronation and supination test	n/a	19 times	19 times
Finger tapping test	n/a	6 times	11 times
MOL (AOU/QOM)	0/0	2.4/2.4	4.1/3.4
Grip strength	n/a	5.9 kg	9.0 kg
Lateral pinch force	0.5 kg	1.5kg	2.0 kg
Left shoulder final range of motion (passive)	90° flexion	170° flexion	170° flexion
Pain at the final range of motion	VAS 6	VAS 0	VAS 0
Knee pain in the standing position (right/left)	VAS 8/4	VAS 3/2	VAS 1/1

AOU: amount of use; FIM: Functional Independence Measure; MMT: manual muscle testing; MOL: motor activity log; QOM: quality of movement; STEF: Simple Test for Evaluating Hand Function; VAS: visual analog scale

surgically treated for pyogenic spondylitis 8 months before presentation. While recovering at a nursing home for the elderly, she had restricted mobility and used a fixed-type walker or wheelchair. At this nursing home, she developed left hemiplegia due to an acute atherothrombotic cerebral infarction at the right corona radiata (Day 1) and was admitted to another hospital. As the patient was motivated to regain her mobility and independence and her family members were concerned about her readiness to return home, she was transferred to the Kaifukuki recovery phase rehabilitation ward to continue post-stroke rehabilitation 20 days after the stroke (Day 20). The case report complied with the ethical standards of Declaration of Helsinki (1975, revised 1983). Written consent was obtained from the patient for publication of this case report.

RESULTS

Results of the initial assessment of the patient are presented in Table 1. The patient had a FIM score of 71 but had no cognitive abnormality (Mini Mental State Examination [MMSE] score of 30). She had limited function in her left hand and a reduced ability to raise the upper arm. Her endurance was poor; it was difficult for her to continue movement for more than 20 seconds. She required assistance for sitting up and wearing clothes, but managed to eat and take care of her appearance by herself. An occupational therapy intervention was designed to facilitate her independence in performing daily routine activities, moving, going to the toilet, and changing her clothes. Individual rehabilitation sessions were provided 7 times per week for 4 months. A step-wise phased approach was taken to first encourage the patient to transition from using a wheelchair to using a fixed-type walker, and ultimately recovering sufficiently to be discharged from the hospital and return home. The course of the intervention was divided into three phases: Phase 1 (Days 20–68), Phase 2 (Days 69–119), and Phase 3 (Days 120–170), and the terminal and final assessments were performed on day 119 and day 170 (Table 1, Fig. 1a).

In Phase 1 (Days 20–68), left upper-limb reach was targeted via active/passive range of motion (ROM) training of the left shoulder joint. Training was also aimed at promoting forward reach toward an object (Fig. 1b); antebrachial pronation/supination by using a Japanese fan (Fig. 1c); flexion/extension of all fingers and grasping by squeezing and releasing a sponge (Fig. 1d), bringing a newspaper closer with the fingers (Fig. 1e), and reaching upward to a bar (Fig. 1f); rotator cuff training using a rubber ball (Fig. 1g) and Thera-Band (Fig. 1h); and building muscular endurance of the left upper limb using BIOSTEP (Fig. 1i). Simple Test for Evaluating Hand Function (STEF) testing was performed to assess hand function (Fig. 2). At the initial evaluation, the patient had difficulty in stretching her fingers to grab a ball or to lift a ball up. At the end of the phase 1, the patient was able to fully extend the left fingers (Fig. 2; top panel) and to grab, lift, and move the ball (Fig. 2; bottom panel). Although her muscular endurance was still poor, she was able to maintain a standing posture using both upper limbs for support and finally was able to get up and move to the wheelchair by herself.

In Phase 2 (Days 69–119), additional training and physiotherapy were introduced to improve motor skills of the left fingers (bring a newspaper closer using each one of the left fingers) and to use a wheelchair, to go to the toilet, and to walk with a fixed-type walker (in collaboration with a physiotherapist). The patient could passively flex her left shoulder up to

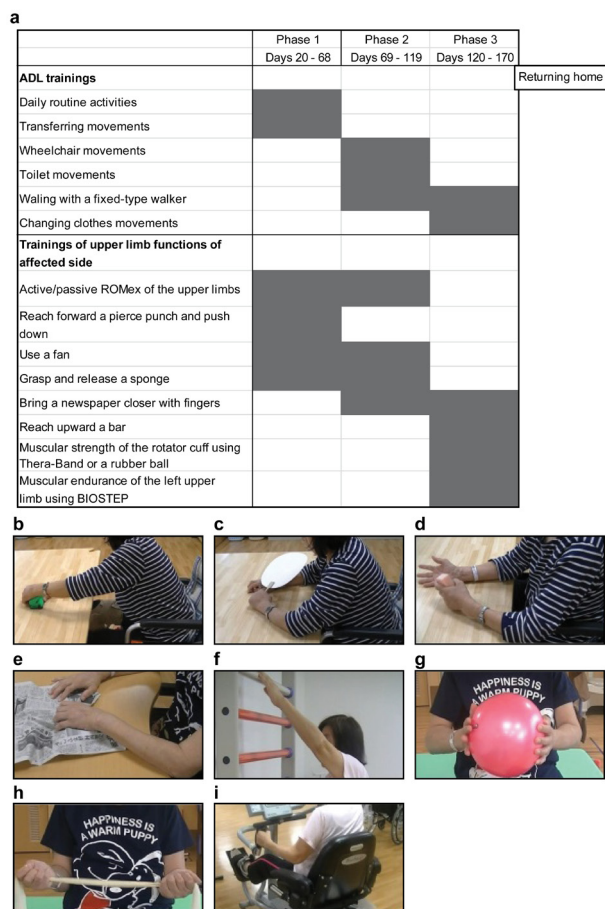


Fig. 1. Occupational therapy intervention plan. Activities of daily living training was provided in three phases (a). Training for affected upper-limb functions involved eight targeted activities (b-i). B: Reach forward to a pierce punch and push down. c: Use a Japanese fan. d: Grasp and release a sponge. e: Bring a newspaper closer with the fingers. f: Reach upward to a bar. g & h: Build muscular strength of the rotator cuff using a rubber ball or Thera-Band. i: Build muscular endurance of the left upper limb using BIOSTEP. ADL: activities of daily living; ROM: range of motion

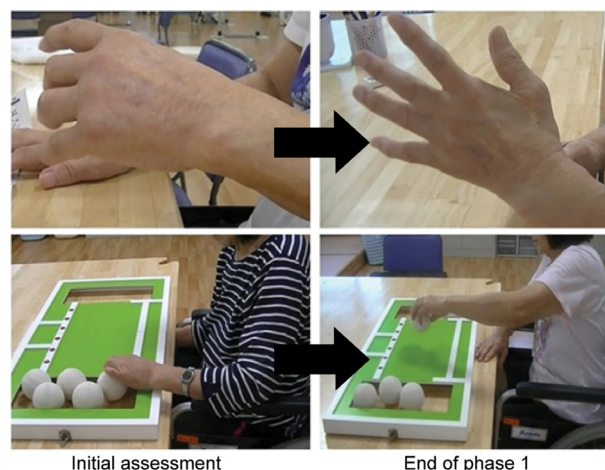


Fig. 2. Differences in left upper-limb function at the initial assessment and at the end of phase 1. The patient could fully extend the left fingers (top panel) and keep the left upper arm raised (bottom panel) at the end of phase 1. These were difficult at the time of initial assessment.



Fig. 3. Walking with a fixed-type walker in phases 2 and 3. The left upper limb was more supportive in phase 3 compared to phase 2; the lateral tilt of the left knee and bilateral knee pain were reduced. The patient could carry her body weight for a longer time.

170° without pain and could briefly maintain a standing position with support of only the left upper limb. She could move independently with a wheelchair, walk for about 5 m using a fixed-type walker if (wearing knee support on both knees), and finally could go to the toilet by herself.

In Phase 3 (Days 120–170), training and physiotherapy were aimed at further improving the muscular strength and endurance of the left upper limb to prolong walking distance and facilitate putting on and removing clothes. Physiotherapy and training included a Thera-Band or a rubber ball to reinforce the muscular strength of the rotator cuff, BIOSTEP to improve muscular endurance of the left upper limb, and reaching movement over the head. At the end of phase 3, the patient could

continue moving her left upper limb for more than 30 minutes and could raise it over the head in the anti-gravity position. She could wash her hair/body or change her clothes more actively and routinely using the upper limb of the affected side. She could walk for more than 50 m without significant tilt, fatigue, or knee pain (Fig. 3).

The patient's FIM score improved from 71 at the initial assessment to 100 by day 119 and to 105 by day 170. Significant improvement was observed in 7 FIM items with interventions performed in this case: cleaning the body, changing clothes (tops), changing clothes (bottoms), toileting, transferring (to the bed, chair, and wheelchair), transferring (to the toilet), and moving (walking and wheelchair). Of these, scores for toilet, 2 items of transferring, and moving (walking and wheelchair) improved greatly, along with improvement of the left upper limb functions.

On day 170, the rehabilitation and care team (therapists, physician, head nurse, social worker, and care manager) observed and reviewed the patient's progress with her family members (husband and son). Based on her general condition, physical abilities, and living environment, as well as social resources available for her, she was discharged from the hospital and returned to home.

DISCUSSION

We report a rare case of an elderly hemiplegic stroke patient for whom intensive and comprehensive inpatient rehabilitation improved her affected upper-limb functions and FIM scores and facilitated her return to home. Hemiplegic stroke patients are generally advised to perform standing pivot transfers to support the entire body weight on the pivoting foot when attempting to stand up or to transfer as needed during many ADL⁸⁾. The diminished muscular strength of the right lower limb and load-induced pain in the osteoarthritic knees prevented the patient from performing such a pivot transfer. However, targeted training improved upper-limb functions, likely playing a crucial role in offloading the lower limbs and improving ADL⁹⁾. The patient's unimpaired cognitive state (MMSE score of 30) and self-motivation for regaining mobility might also have contributed to the improvement in her FIM scores and ADL.

Improved FIM scores and presence of adequate familial/social support are considered key criteria when deciding the readiness of patients to return home from our Kaifukuki recovery phase rehabilitation ward¹⁰⁾. While the patient had intact upper-limb function prior to experiencing the hemiplegic stroke, the previous rehabilitation regimen was not effective in restoring it, as it was likely too short and not as intensive and comprehensive as the inpatient rehabilitation program instituted at the Kaifukuki recovery phase rehabilitation ward was. Furthermore, though the dominant side was affected in this case, we believe involvement of the dominant versus non-dominant side did not influence outcomes, as our rehabilitation method was not directed at fine/elaborate movements but rather at coarse/general movements, such as maintaining posture, that are important for functional independence. The significant improvement in the patient's total FIM score (from 71 to 105) was crucial in convincing the patient's family that the patient could independently perform daily activities and was therefore ready to return home.

It is extremely rare for an elderly patient living in a nursing home to return home after experiencing a stroke causing hemiplegia. This case suggests the promising role of improvement in affected upper-limb function in improving FIM scores and facilitating patients' return to home. We encourage rehabilitation therapists to consider ADL training of the affected upper limb in patients with functional deficiencies in lower limbs. We also emphasize the importance of involving the patient's family along with the physician and the therapists in the rehabilitation process to facilitate the patient's return to home. Controlled studies are required to understand the mechanism by which improvement in affected upper-limb function improves FIM scores and to help incorporate strategies into stroke rehabilitation.

Conflict of interest

The authors have no conflicts of interest.

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