TREATING THE BRAIN, NOT ONLY THE HAND

PART 1
REACHING THE BRAIN FOR FUNCTIONAL MOTOR RELEARNING

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PART 2
HAND ROBOT-ASSISTED REHABILITATION: IMPLICATIONS AND RESULTS ON ADULTS AND CHILDREN

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at Department of Physical Medicine and Rehabilitation, Taipei Medical University Shuang Ho Hospital

Tuesday, 8th June, 2021 8:30 - 10:00 a.m. GMT+2

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CENTER FIZIOTERAPIJE
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“Treating the brain, not only the hand”

“Reaching the brain for functional motor relearning”

Tatjana Jeglič, PT., director of CFL., IBITA Basic Course Instructor

The hand

- " ***<u>The hand has several advantages over the eye, it can see in the dark and it can see around corners, most important of all it can interact with the environment rather than just observe it</u>***" (John Napier; Hands. Nature, 1962)
- In addition to fine movements and object manipulation skills, the hand provides extensive CNS sensory information from and about the environment.
- Thus, it plays a very important role in upgrading the body scheme and promotes the postural orientation of the individual.

Recovery from the stroke

- ✓ Poorer recovery of the upper limbs leads to limitation of daily activities and quality of life.
- ✓ Differentiation of phases is that recovery-related processes post-stroke are time-dependant.
- ✓ Recovery profiles greatly vary between subjects, with some patients recovering faster and better than others.
- ✓ The level of impairment and stroke location seems to be better suited to acknowledge the complex, non-linear nature of stroke recovery.

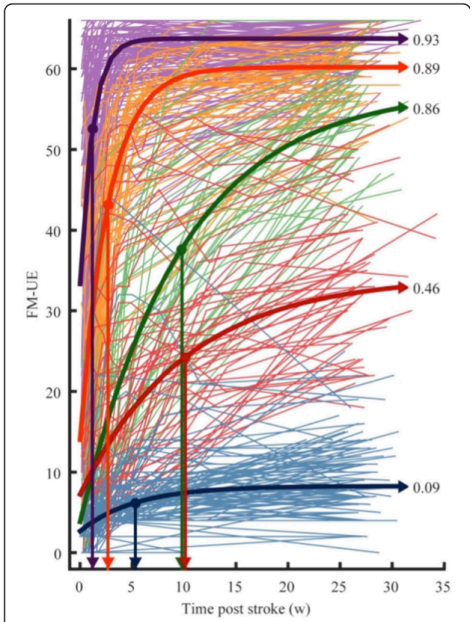

Fig. 2 Motor recovery after stroke in a sample of $n = 412$ ischemic stroke patients based on the Fugl-Meyer upper extremity (FM-UE) score. Patients with mild initial deficits make on average better recovery than patients with severe deficits. Different colors represent different recovery subgroups based on a longitudinal mixture model. The numbers next to the recovery graphs represent the proportional recovery coefficient r_K which denotes how much of the potential recovery has been achieved based on the FM-UE score. The downward arrows indicate the time constants τ_k in weeks, i.e., how fast patients recovered (here: reaching $1\text{-}e^{-1}$ = 63.2% of total recovery). Of note, also initially severely affected patients (green curve) can achieve a good outcome with a relatively high recovery coefficient ($r_k = 0.86$) but a longer time constant (τ_k = 9.8 weeks) compared to the other subgroups. From Van der Vliet et al. [71]

- Christian Grefkes and Gereon R. Fink. Recovery from stroke: current concept and future perspectives. Neurological Research and Practice (2020)
- Van der Vliet et al. Predicting upper limb motor impairment recovery after stroke: a mixture model. 2020, Annals of Neurology.

Is More Better? Using Metadata to Explore Dose–Response Relationships in Stroke Rehabilitation

Keith R. Lohse, PhD; Catherine E. Lang, PT, PhD; Lara A. Boyd, PT, PhD

Background and Purpose—Neurophysiological models of rehabilitation and recovery suggest that a large volume of specific practice is required to induce the neuroplastic changes that underlie behavioral recovery. The primary objective of this meta-analysis was to explore the relationship between time scheduled for therapy and improvement in motor therapy for adults after stroke by (1) comparing high doses to low doses and (2) using metaregression to quantify the dose–response relationship further.

Methods—Databases were searched to find randomized controlled trials that were not dosage matched for total time scheduled for therapy. Regression models were used to predict improvement during therapy as a function of total time scheduled for therapy and years after stroke.

Results—Overall, treatment groups receiving more therapy improved beyond control groups that received less (g=0.35; 95% confidence interval, 0.26–0.45). Furthermore, increased time scheduled for therapy was a significant predictor of increased improvement by itself and when controlling for linear and quadratic effects of time after stroke.

Conclusions—There is a positive relationship between the time scheduled for therapy and therapy outcomes. These data suggest that large doses of therapy lead to clinically meaningful improvements, controlling for time after stroke. Currently, trials report time scheduled for therapy as a measure of therapy dose. Preferable measures of dose would be active time in therapy or repetitions of an exercise. (***Stroke*. 2014;45:2053-2058.**)

Key Words: rehabilitation ■ stroke ■ therapy

RESEARCH ARTICLE

Content of conventional therapy for the severely affected arm during subacute rehabilitation after stroke: An analysis of physiotherapy and occupational therapy practice

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Abstract

Background and Purpose Physiotherapy (PT) and occupational therapy (OT) are key professions providing treatment for the arm after stroke; however, knowledge about the content of these treatments is scant. Detailed data are needed to replicate interventions, evaluate their effective components, and evaluate PT and OT practice. This paper describes PT and OT treatment for the severely affected arm in terms of duration, content according to components and categories of the International Classification of Human Functioning, Disability and Health, and to analyze differences between professions.

Methods Design: This is a retrospective analysis of randomized trial data. Participants: 46 patients after stroke with poor arm motor control recruited from inpatient neurological units from three rehabilitation centers in the Netherlands. Procedure: PTs and OTs recorded duration and content of arm treatment interventions for 8 weeks using a bespoke treatment schedule with 15 International Classification of Human Functioning, Disability and Health categories.

Results PTs and OTs spent on average 4–7 min per treatment session (30 min) on arm treatment. OTs spent significantly more time providing arm treatment and treatment at the activities level than PTs. PTs spent 79% of their arm treatment time on body functions, OTs 41%. OTs spent significantly more time on "moving around using transportation," "self care," and "household tasks" categories.

Conclusions Patients after stroke with a severely affected arm and an unfavorable prognosis for arm motor recovery receive little arm-oriented PT and OT. Therapists spent most arm treatment time on body functions. There was a considerable overlap in the content of PT and OT in 12 of the 15 categories. Results can be generalized only to patients with poor arm motor control and may not represent practice in other countries.

Review > Clin Rehabil. 2015 Dec;29(12):1234-43. doi: 10.1177/0269215514565395. Epub 2015 Jan 7.

Dose of arm activity training during acute and subacute rehabilitation post stroke: a systematic review of the literature

Kathryn S Hayward [1], Sandra G Brauer [2]

Abstract

Aim: To determine the dose of activity-related arm training undertaken by stroke survivors during acute and subacute rehabilitation.

Methods: A systematic review of PubMed, CINAHL and EMBASE up to December 2014 was completed. Studies were eligible if they defined the dose (time or repetitions) of activity-related arm training using observational methods for a cohort of adult stroke survivors receiving acute or subacute rehabilitation. All studies were quality appraised using an evidence-based learning critical appraisal checklist. Data was analysed by method of documented dose per session (minutes, repetitions), environment (acute or subacute rehabilitation) and therapy discipline (physiotherapy, occupational therapy).

Results: Ten studies were included; two observed stroke survivors during acute rehabilitation and eight during subacute rehabilitation. During acute rehabilitation, one study reported 4.1 minutes per session during physiotherapy and 11.2 minutes during occupational therapy, while another study reported 5.7 minutes per session during physiotherapy only. During inpatient rehabilitation, activity-related arm training was on average undertaken for 4 minutes per session (range 0.9 to 7.9, n = 4 studies) during physiotherapy and 17 minutes per session (range 9.3 to 28.9, n = 3 studies) during occupational therapy. Repetitions per session were reported by two studies only during subacute rehabilitation. One study reported 23 repetitions per session during physiotherapy and occupational therapy, while another reported 32 repetitions per session across both disciplines.

Conclusion: The dose of activity-related arm training during acute and subacute rehabilitation after stroke is limited.

Neuropsychologia
Volume 77, October 2015, Pages 1-9

Deficits of reach-to-grasp coordination following stroke: Comparison of instructed and natural movements

Benjamin Baak [a], Otmar Bock [a], Anna Dovern [b, c], Jochen Saliger [d], Hans Karbe [d], Peter H. Weiss [b, c]

Show more

https://doi.org/10.1016/j.neuropsychologia.2015.07.018

Highlights

- Prehension movements are modulated by behavioral context.
- Unilateral (left hemisphere) stroke also affects ipsi-lesional prehension.
- Stroke-related deficits mainly involve the temporal organization of movements.
- These prehension deficits are much more pronounced in an everyday-like context.
- Clinical motor assessments should focus on everyday-like activities.

- In order to achieve neurogenesis and neuroplasticity we need to practice (TEN PRINCIPLES OF NEUROPLASTICITY - Kleim and Jones, 2008).
- Motor functions are using similar motor patterns - reaching toward the glass and drink, reaching towards the tooth paste and brush your teeth.
- As therapists we need to analyse the motor activity, so we can determinate which component or part of the body/upper extremity is mostly impaired.
- As well we need to analyse which body function or body structure is mostly impaired.
- So we need to do clinical examination very thoroughly and we need to do tests on different levels - either on body functions, body structures and on participation level.

Unilateral/bilateral movements of UE

- Everyday life activities includes unilateral and bilateral movements of upper extremity like cooking, personal hygiene, feeding, toileting, caring objects, driving, using modern technology, etc - facilitating participation of patient and ability to resume life roles.
- Unilateral upper limb training includes repetitive task-related training and constraint-induced movement training (CIMT).

- Bilateral upper limb training (BULT) is another stroke motor rehabilitation strategy in which the subjects are required to perform motor tasks with both upper limbs. Here, the unimpaired limb is used to increase the functional recovery of the impaired limb by facilitating coupling effects between the two limbs. BULT includes bilateral functional task training, bilateral robotic-assisted training and bilateral arm training with rhythmic cueing.

- Systematic review by Pie-ming Chen and colleagues published in 2019.
- They included twenty-one studies involving 842 subjects with stroke.
- Compared to UULT, BULT yielded superior improvements in the improving motor impairment of people with stroke, as measured by the FMA-UE. However, these strategies did not yield significant differences in terms of the functional performance of people with stroke, as measured by the WMFT, ARAT and BBT.

- *Pie-meng Chen at al. Comparison of bilateral and unilateral upper limb training in people with stroke: A systematic review and meta-analysis. 2019, Plos One*

Action observation therapy

- Action Observation (AO) is a dynamic state during which the observer can understand what the other is doing by simulating the actions and outcomes that are likely to follow from the observed motor act.
- Action Observation Therapy (AOT) is a top down approach and is grounded in basic neuroscience and the recent discovery of the mirror neuron system (MNS).
- AOT commonly includes action observation and action execution and allows patients to safely practice movements and motor tasks.

Our intensive programs

- Small clinic in Ljubljana;
- Specialised in rehabilitation of stroke survivors and other clients with neurological lesions;
- Intensive programs for 3h/day for three weeks
- The basic in Bobath Concept;
- Including CIMT programs for UE and LE, motor imaginary, behavioural therapy, task-orientated therapy, robotics assisted therapy - Gloreha, sensory re-education program, Tipstim glove,...
- Sign of behavioural contract! Including relatives/caregivers;
- Outsourcing: speech therapy, kineziotharapy, lymph drainage, engineer of orthotics and prosthetics, clinical psychologist.
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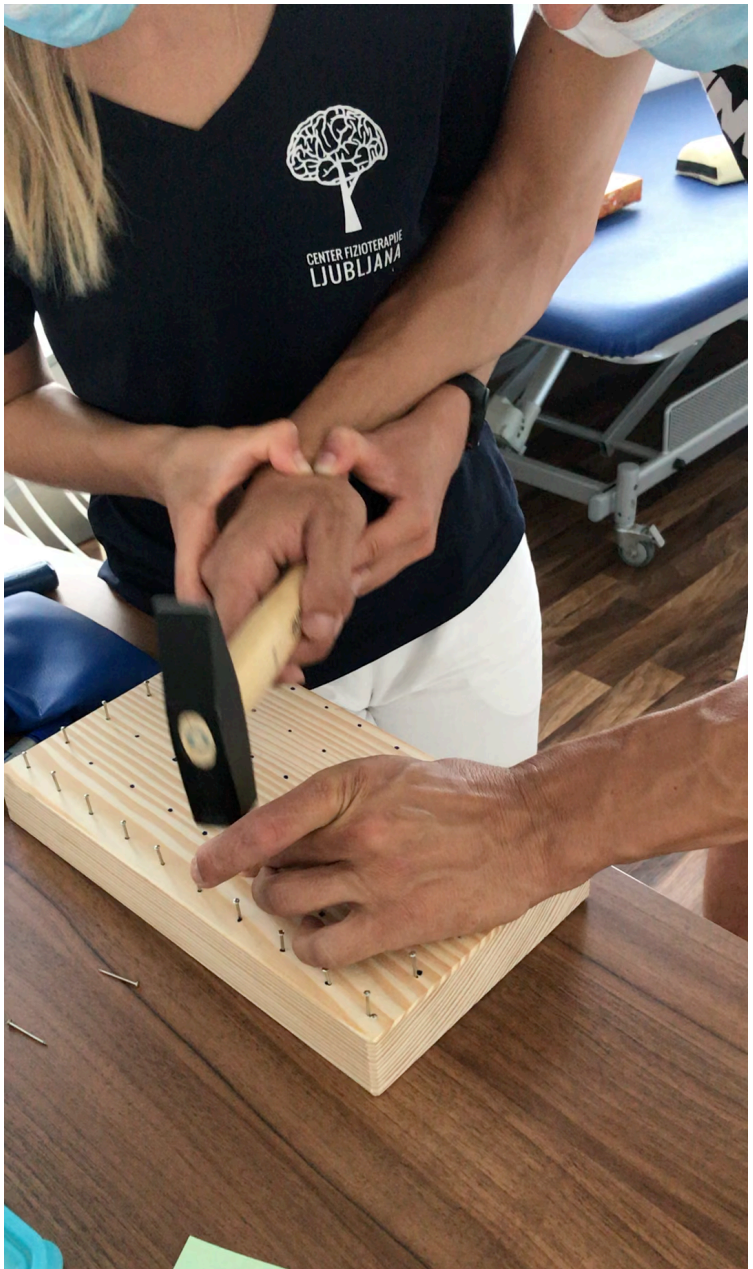
STOP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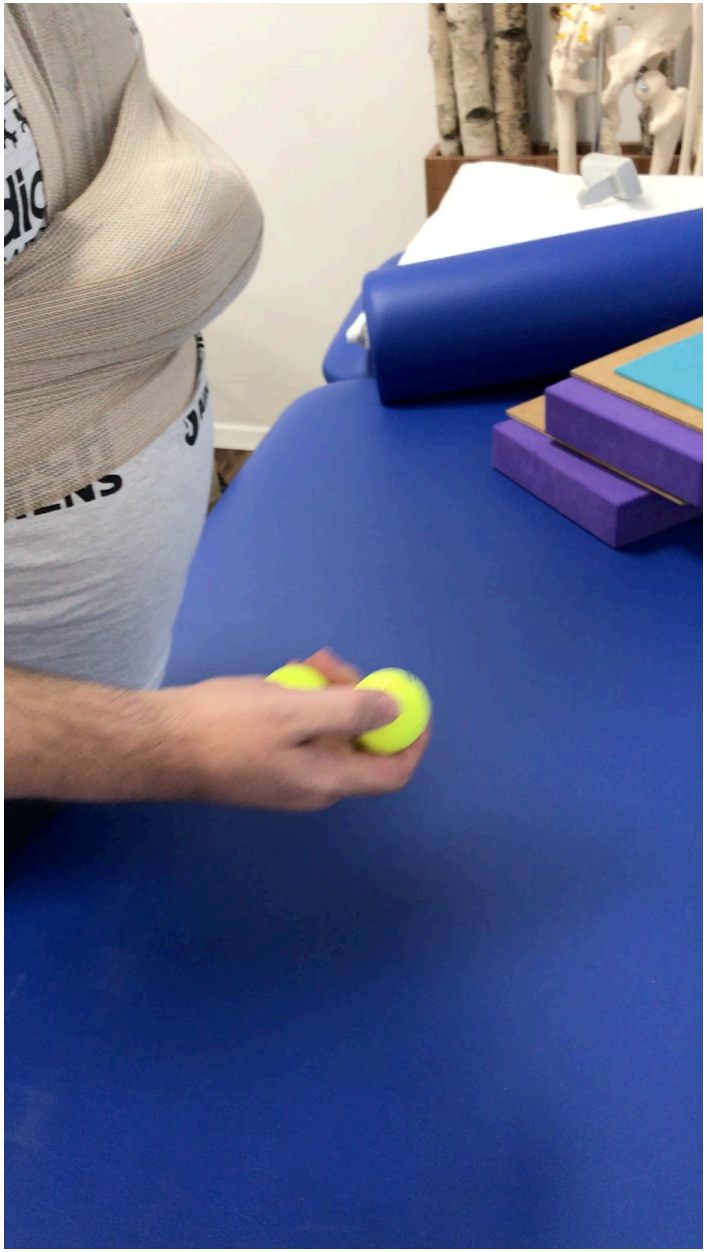
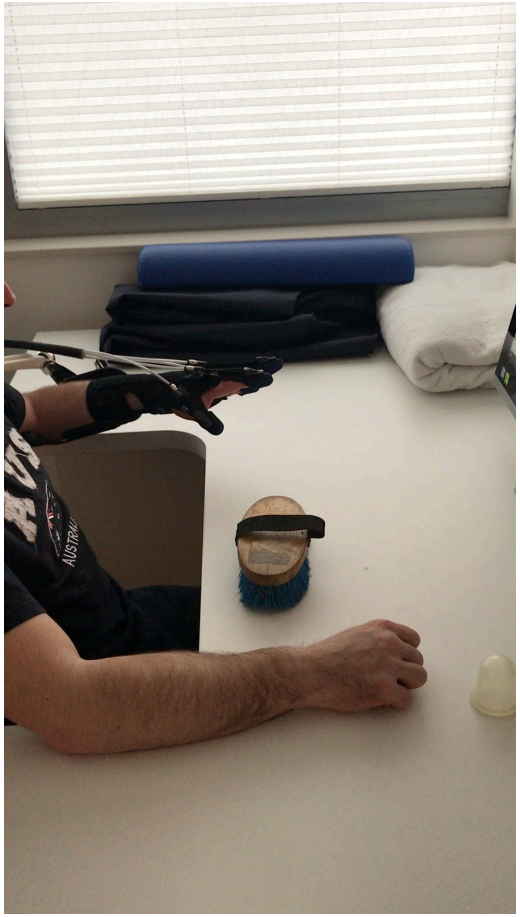



ARTENGO

Why Gloreha?

- Robotics assisted therapy which allow the reaching and grasping/manipulating with real objects;
- Light exoskeleton
- It can facilitate different selective movements in the hand;
- It can facilitate different grips of the hand - power and precision grips (pinch between all five fingers, cylindric grip, spherical grip, hook grip);
- It allows manipulation with real objects - task orientated therapy;
- We can practice unimanual or bimanual or bilateral functional tasks;
- Action observation therapy and problem solving in order to complete the task;
- The program allows different settings individualised for client (speed of movement, ROM, reference framework of the screen for attention, different levels of difficulty, different areas of the upper extremity, forearm, wrist or the hand, sensitivity of the sensors, personalise therapy program according to clients impairment level ...)
- Dynamic arm support - taking of the weight of the upper extremity
- Task or games;
- Challenging and motivating for the client;

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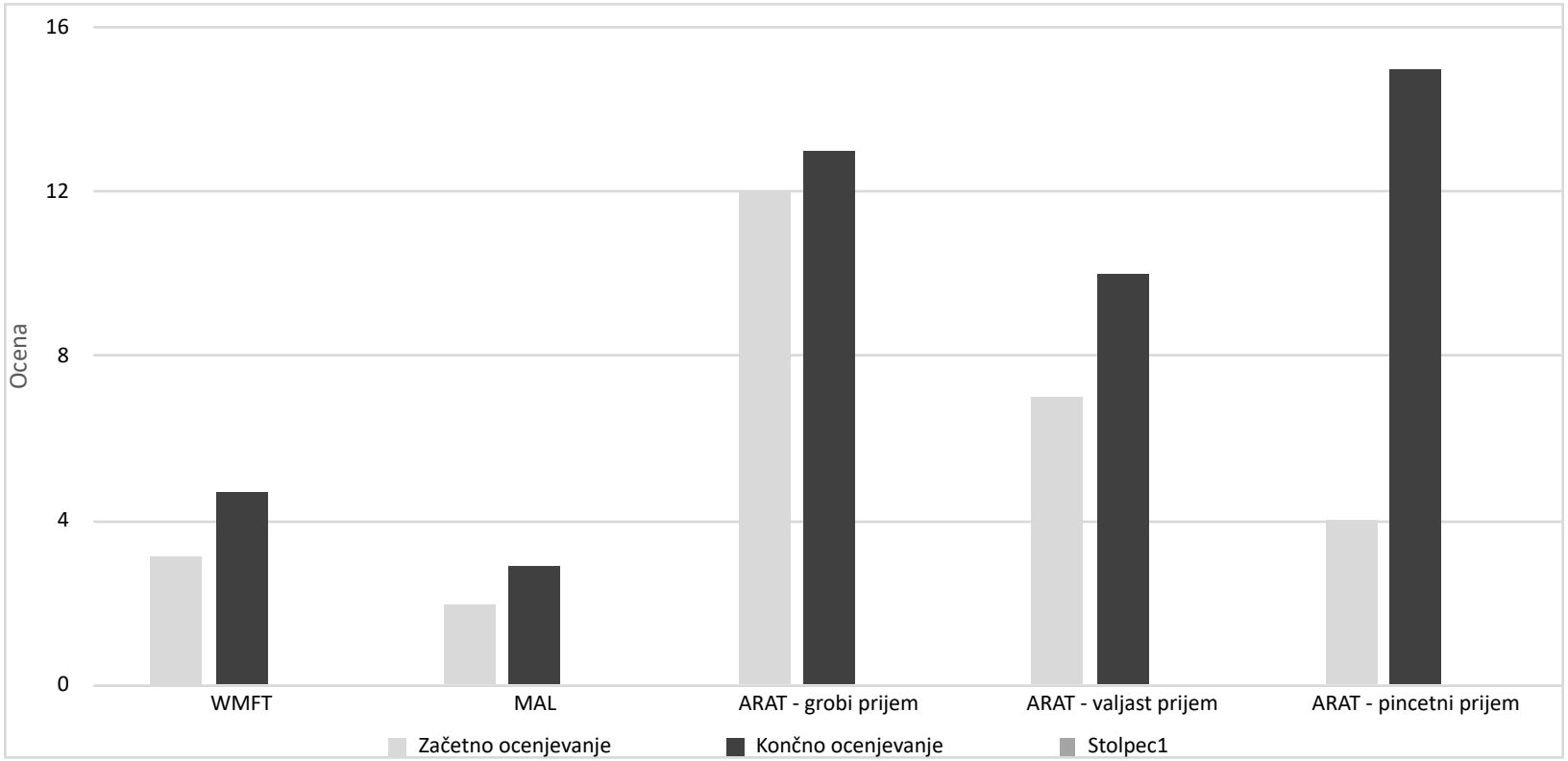
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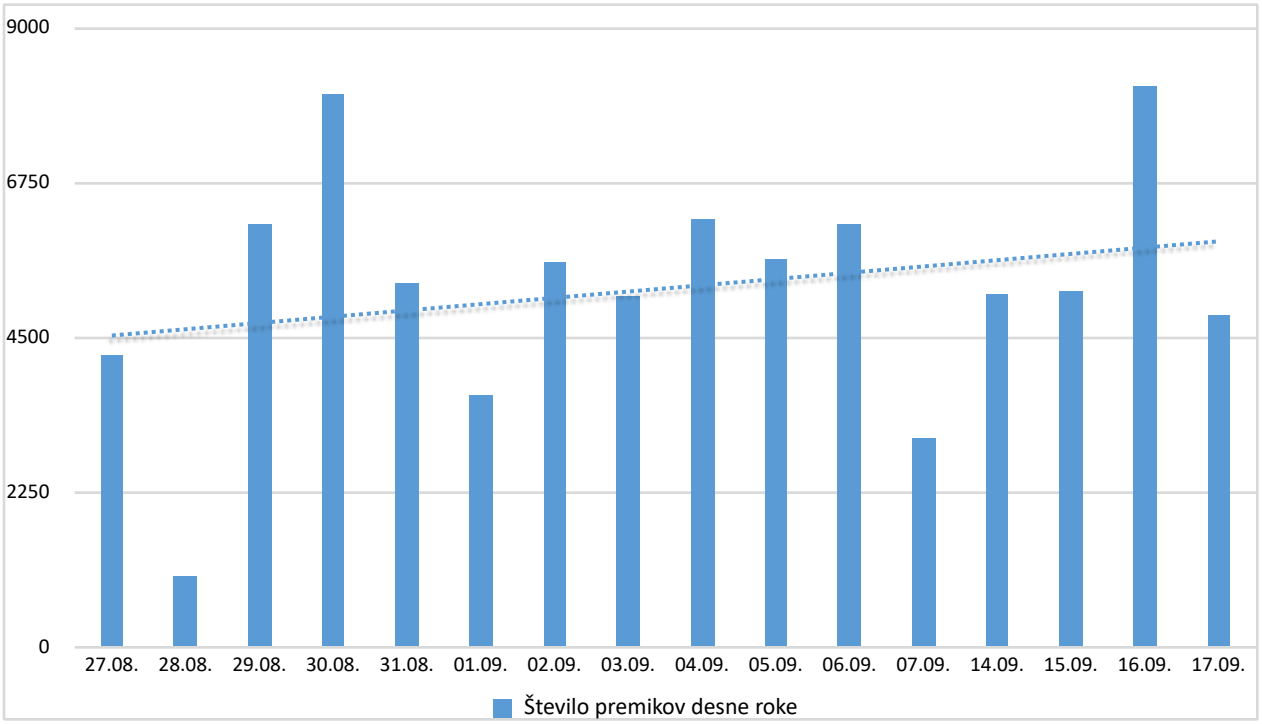
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Our aim?

To change motor behaviour of clients

To teach them to solve motor problems in everyday life

To use their abilities that they have in their brain and their body

To be active and to take control of their life after the brain lesion