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POST STROKE ARM REHABILITATION BASED ON A COMPREHENSIVE ASSESSMENT AND SMART GOALS: A CASE-STUDY

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Abstract

The physiotherapist has a specific role in regaining, learning, and maintenance of physical function after a stroke. Physiotherapist need to develop the skills that will allow them to choose measurement tools based on their knowledge and clinical experiences. The selection of suitable measures to evaluate practice is critical in enabling therapist to planning a safe intervention based on clinical reasoning, to accurately characterize the effectiveness of their intervention and to monitor changes occurring during rehabilitation. The goal is to define the patient's potential and how we can reach optimal function within the frame of available resources. Specific, measurable, achievable, realistic and time frame (SMART) is a multidisciplinary tool that actively involves and encourage patients and therapists jointly to participate in goal setting with a client centered perspective. This patient's active involvement in goal setting increases their motivation with regard to their participation. This case study is based on a comprehensive assessment and on the use of SMART. At the core of rehabilitation should be this strong drive for physiotherapists to determine the effectiveness of their treatment by evaluation and measuring patient outcomes and by setting SMART goals.

Introduction

Assessment and treatment are integrated in a continuous process, so, before a treatment can be started, the therapist must perform a detailed and accurate patient assessment and linked this with the clinical reasoning process. The patients' needs are central to the choice of interventions. The assessment helps to focus on intervention to enable it to be goal orientated and specific to the patient [1]. The aim of assessement is twofold: To create a hypothesis about the patients' potential and to find why the patient moves as he does [2].

Clinimetry is used to measure and objectify the results of the treatment and this is necessary in order to demonstrate the effectiveness of the treatment. The characteristics of good outcome measures are: relevant, valid, reliable, sensitive to change, practicable and the results should be easily communicated [3].

The World Health Organization's International Classification of Function, Disability and Health (ICF) was the reference to the selection of outcome measures

in this case study of post stroke rehabilitation. This classification provides us a useful framework to assess and evaluate systematically at all levels of function. The International Classification of Functioning, Disability, and Health (ICF) is a classification of health and health-related domains that describes body functions and structures, activities, and participation [3,4].

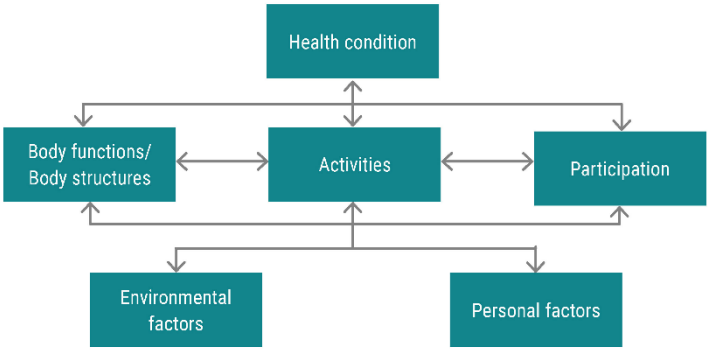

Fig. 1. All dimensions of the ICF model

After assessment and documenting the existing capabilities and problems, a discussion begins with the patient to determine the treatment goals. The therapist chooses a short-term goal together with the patient. The goal should be task related and relevant to the patient's problems, resources, and needs, and to be achievable. The therapist decides the prerequisites for the goal achievement: quality, environmental factors, relevance for daily activities, and what kind of assistance, if needed [2,5]. Goal setting in rehabilitation practice often proves to be challenging and is not always as patient centered as it should be with regard to people with severe language or cognitive impairment, poor insight, or a low state of awareness [2].

An objective should be formulated using the SMART analysis. SMART stands for:
S = specific: directed toward the patient's individual target goal.
M = measurable.
A = acceptable: be accepted by the patient as well as by the treatment team.
R = realistic: always be an attainable goal.
T = time related: be achievable within a realistic time frame [3,6].

The achievable treatment goals that have been determined should comprise a logical and structured process based on clinical reasoning [3].

Material-method

The case presentation included the following:

• Assessment and tests.
• Goal setting.
• Interventions based on evidence practice and clinical experience.
• Evaluation, including test results.
• Recommended self-management and future plans.

Assessment

- *Relevant medical information*

A 70-years-old patient was admitted to the neurology department in 14.03.2023 with symmetrical facies and right limbs motor deficit, confusion and mixed aphasia. On admission, the patient has a CT scan, which showed a left temporo-parietal acute ischemic stroke. During hospitalization, the patient received treatment under which the evolution of the patient was favorable. The neurological assessment at discharge found the patient to be conscious and cooperative, temporo-spatially oriented, with a right-limb motor deficit (predominant brachial right hemiparesis), able to walk without support (FAC 5 – Functional Ambulation Category), to formulate and respond to simple questions, able to comprehend either written or spoken language, mild aphasia, dysarthria and right Babinski. The patient's medical record reveals the following diagnoses: bilateral carotid atheromatosis, mild peripheral arterial circulatory insufficiency of the left lower limb, grade II sclerotic arterial hypertension.

- *Patient, family, doctor's expectations*

The family's and patient's expectations are to increase performance in dexterity during object manipulation with the affected arm and to be able to do essential unilateral and bimanual tasks of daily living activities (for example, dressing, toileting, eating, proper use of cutlery, open a door, transferring, transportation, reaching, grasping, holding, manipulation, loosening objects with the affected hand like a cup, bottle, a plates, fork and knife, phone utensils etc.

- *Relevant informations about work, leisure, living circumstances*

Mrs. X is a very nice lady, totally independent and lives alone in an apartment. She can take care of herself, get up/sit down in bed by herself, walk without support, dress/undress, feed herself, hydrate herself, make simple snacks to feed herself, comb her hair, wash herself, she has no difficulties in getting into the bathtub, she can go down/up the stairs by herself holding on to the railing. The perfect patient? Not yet! The point is that for all the activities listed and not listed, the patient predominantly uses only the unaffected left hand because she does not trust the affected hand and it is easier to choose the easy way and to do the activities with the healthy hand than to struggle to use the affected one. She can use the affected arm if she forced but not in a good performance.

- *Tests*

Measurements at the level of body structure/function and activity: MRC – Medical Research Council, dynamometry, goniometry, MIS - Motricity index, MAS – Modified Asworth Scale, TIS - Trunk Impairment Scale, Nottingham Sensory Assessment, BFM – Brunnstrom Fugl-Meyer, FAT – Frenchay Arm Test, SULCS – Stroke Upper Limb Capacity Scale, ARAT- Action Research Arm Test, Upper extremity – Motor Activity log).

On the initial tests assessment (at 16 days after stroke), it was observed impairments in:

- muscle weakness (resulting from MRC – Medical Research Council, MIS-Motricity index, hand dynamometry – more distal than proximal, weakness of wrist and fingers muscles);
- problems in upper extremity control and dexterity during ADL performance (FAT – Frenchay Arm Test);
- slight spasticity on the biceps (MAS – Modified Asworth Scale);
- decrease ROM (goniometry - more distal than proximal);
- selectivity problems (TIS -Trunk Impairment Scale);
- grasp impairments, in-hand manipulation problems (little, fine and smooth movement handling) and holding impairments (BFM – Brunnstrom Fugl-Meyer, SULCS – Stroke Upper Limb Capacity Scale, ARAT- Action Research Arm Test);
- during the UE-MAL (Upper extremity – Motor Activity log) interview I found that my patient not use very often the affected arm during functional activities and when she do it the quality of her movement is poor.
- problems in selectivity of the arm (elbow - pronation supination), wrist (circumduction, radial and ulnar deviation), individuated finger control (FMA UE – Fugl Meyer Assessment Upper extremity).

It was found that the optimal prediction of outcome of dexterity can be made within the first month after stroke by measuring motor recovey of the upper limb. Studies found that the optimal prediction of outcome can be made within 4 to 5 weeks after stroke onset and it's suggest that early return of voluntary motion of the paretic arm within the first weeks after stroke is considered to be a good prognostic sign. Based on the Fugl-Meyer scores of the flaccid arm, optimal prediction of arm function outcome at 6 months can be made within 4 weeks after onset. At the end of week 4, a probability of 94% was found in those patients who had an FM UE of 19 points. [7]. My patient at 16 days after stroke had an FMA UE of 42 points. By analyzing the clinical outcome measurement I can predicted a good dexterity of the affected arm established within 6 month.

Goal setting. SMART analysis of Mrs. X

Main goal – taking a dinner at the restaurant with family members.

S (specific) – visit a restaurant with her family to take a dinner.

M (measurable) – take dinner within 15 minutes.

A (achievable) – yes, because she already taking dinner but at her home.

R (relevant) –yes, because is part of her expectation, she what to improve performance in dexterity during object manipulation with the affected arm and to be able to do essential tasks of daily living activities (for example, dressing, toileting, eating, proper use of cutlery, open a door).

T (time frame) – 6 weeks.

Subgoals

In order to achieve the patient's main goal, I set some subgoals:

- Increase grip strength and arm strength;
- Improve grasp, and release as smoothly as possible each day a variety of items/objects (cup, phone, utensils) trying to get the thumb fully around every object;
- Improve coordination and individuated finger control such as fine grip force control and finger coordination movements (work on tasks that require finger .isolation and strengthen thenar and hypothenar muscles, practice thumb work, e.g. pick up coins, use remote control, turn pages, practice texting, use flashlight, practice keyboarding, practice handwriting, use phone);
- Teaching Mrs. X how to use the cutlery;
- Teaching Mrs. X how to wrap the hand around a diffferent bottles, lift and pour water in her glass and let go of the cup;
- Teaching Mrs. X how to improve the affected arm function during activity daily living such as in-hand manipulation tasks (separate coins, wring out/reposition washcloths), eating (using a cup and spoon, use utensils, build up handles as needed, stack/wash dishes), dressing (wearing and taking off a shirt, using a belt and zipper), personal hygiene (using a towel, combing, tooth brushing, hair).

Interventions based on evidence practice and clinical experience

According to the Canadian Stroke Best Practice Recommendations (2019) Strength training should be considered for persons with mild to moderate upper extremity impairment for improvement in grip strength [Evidence Level: Early-Level A; Late-Level A) [8].

Traditional or modified constraint-induced movement therapy (CIMT) should be considered for a selected group of patients who demonstrate at least 20 degrees of active wrist extension and 10 degrees of active finger extension, with

minimal sensory deficits and normal cognition [Evidence Level: Early-Level A; Late-Level A] [8]. The two key features of CIMT are restraint of the unaffected hand/arm and increase practice/use of the affected hand/arm.

According to the Canadian Stroke Best Practice Recommendations (2019) Functional Electrical Stimulation (FES) targeted at the wrist and forearm muscles should considered to reduce motor impairment and improve function [Evidence Level: Early-Level A; Late-Level A] [8].

The Evidence-Based Review of Stroke Rehabilitation states: "There is strong evidence that FES treatment improves upper extremity function in acute stroke (<6 months post onset) and chronic stroke (>6months post onset) when offered in combination with conventional therapy or delivered alone. [9]

Task-specific practice is required for motor learning to occur. The best way to relearn a given task is to retrain for the task. Task-specific, low-intensity regimens designed to improve use and function of affected limb have reported significant improvements. [9]

FES cand also be used to help strenghthen other weak upper extremity muscles such as the fingers extensors and thenar muscles can be targeted for strenghthening, combinet with repetitive practice of tasks that require actiovation of those muscle group.[10]

Therapeutic session to achieve one of the subgoal in order to reach the main goal – 60 minutes

Subgoal - Use the cutlery

Beginning of the recovery session: The therapist arrives at the patient's home, checks the patient's vital signs and homework for the day, and then begins the actual therapy session.

-Task specific training for using the cutlery - Mrs. X has to hold the knife and pick up the knife from the place setting with the dominant hand (affected arm). She has to hold it with the index finger along the top part of the handle. With the non-dominant hand she has to hold the fork points-down and pick up the fork from the table. She has to hold it with the points facing downward towards the food (plasticine) and the index finger on the back of the handle. This task requires locating the target (eye-hand movement coordination), proximal and distal arm active range of motion to reaching the object, the ability to open the hand in preparation for grasping and a good individuated finger control for properly grasping the cutlery, and lifting, cutting (with fine and smooth movement handling) and release the cutlery.

-I used Chattanooga NeuroMuscular Electro Stimulators (NMES). To ensuring the greatest effectiveness of the programmes, first I use the Motor Point Pen supports in locating the optimal electrode position for the muscle stimulation. The motor point is a point where the motor nerve enters the muscle, which is an extremely localised area where the motor nerve is at its most excitable. This very useful tool in combination with the dedicated programme helps to ensure the optimal electrode placement [11]. I place one electrodes for fingers extensors and one on fingers flexors, chattanooga programme – Agonist/Antagonist. The alteranative stimulation of the antagonistic groups has the advantage of allowing the active mobilisation of a joint while inducing muscle work which is beneficial to functional recuperation. I combined with repetitive practice of tasks that require activation of those muscle group. I used the guidance technique and exteroceptive, verbal and tactile stimuli to initiate movement with the patient, for example:

,,- Wrap the hand around a cup and let go of the cup. Bring your arm forward slowly toward the table in front of you. Strainghten your elbow as you reach for the cup. Open your fingers and thumb as your hand approaches the cup on the table, opening your fingers and thumb just wide enough to go around the cup (I tried as many grips possible with many object with different diameter) when the muscle stimulation is on extensors fingers. Grasp the cup gently between your fingers and thumb, when the muscle stimulation is on flexors fingers. Squeeze your fingers and thumb hard enough to lift the cup slightly off the table without spilling it. Put down and let go of the cup when the muscle stimulation is on extensors.'' [10].

- Exercises that encourage individuated finger control such as fine grip force control and finger coordination movements. I used the guidance technique and exteroceptive, verbal and tactile stimuli to initiate movement with the patient, for example:

- pinching clothespins, picking up small objects like buttons, coins, etc, turning pages over, practicing writing, crumple a sheet of paper into a ball and than spreading it back out into a flat piece of paper using only the affected hand, rolling a pencil between the thumb and fingers, stacking pennies, practicing keyboarding and texting, lifting and sorting different small objects with pinch grip 3rd finger, 2nd finger, 1 finger and thumb.
- filling a bowl with rice and placing objects in the rice. Trying to find the objects with your hand without looking.
- picking up small objects (e.g. marbles or checkers) one at a time transferring each one to the palm of hand and holding onto it as she picking up the next object. Then without letting objects fall out of the hand, she has to place each object back down one at a time.
- translation exercises by moving objects from the fingertips to palm and from the palm to fingertips. Trying to lift each finger one at a time off of the table.

- Exercises at Canadian board such as assemble nuts and bolts, lighting the light bulb, removing the switch from the socket, opening the faucet, closing and unzipping the zipper.

Evaluation, including test results

Table 1 Test results of the chosen outcome measures

Tests	Initial assessment	Final assessment
BFM UE	42/66	58/66
Dynamometer (compared with the other side	9/32	23/32
ARAT	30/57	57/57
FAT	1/5	5/5
SULCS	4/10	8/10
MRC	3/5	4/5
MAS	1	1
TIS	19/23	19/23
UE-MAL	47-33	88-88
MIS	67/100	75/100

Recommended self-management and future plans.

I told to Mrs. X to use her hand for EVERYTHING, even if it doesn't go very well at first and I gave her some homework at the level of activities, for a specific new goal: Communicate through WhatsApp with her sisters.

- Handwriting (as appropriate) – write a journal with daily activities or write one page a day in the same notebook to compare the progress.
- Turn pages in a book or newspaper.
- Grasp, hold and release as smoothly as possible each day a variety of items/objects (cup, phone, utensils) trying to get the thumb fully around every object.
- Practice texting and keyboarding.
- Using a remote (to change the channels on the TV until she finds her favourite movie/tv show) using her thumb and touching each button slowly.

Results

The main goal of this case study was achieved in 6 weeks, Mrs. X was very satisfied with the results obtained, she has improved her hand strength and

dexterity regarding of the main goal (main goal - take a dinner at the restaurant with family member) and she learned to use more and to perform more activities that involve the use of the affected limb.

Conclusions

The physiotherapists have a special responsibility to focus on capabilities of the patient and to proposes a hypothesis regarding the cause of the restrictions on the level of activity. The hypothesis should be formed as formed as a result of the assessment in all ICF domains. At the core of rehabilitation should be this strong drive for physiotherapists to determine the effectiveness of their treatment by evaluation and measuring patient outcomes and by setting SMART goals.

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