



LASER THERAPY OF PAINFUL SHOULDER AND SHOULDER-HAND SYNDROME IN TREATMENT OF PATIENTS AFTER THE STROKE

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ABSTRACT

The common complication after stroke is pain and dysfunction of shoulder of paralyzed arm, as well as the swelling of the hand. The aim of this study was to determine the effects of LASER therapy and to correlate with electrotherapy (TENS, stable galvanization) in subjects after stroke. We analyzed 70 subjects after stroke with pain in shoulder and oedema of paralyzed hand. The examinees were divided in two groups of 35, and they were treated in the Clinic for Physical Medicine and Rehabilitation in Tuzla during 2006 and 2007. Experimental group (EG) had a treatment with LASER, while the control group (CG) was treated with electrotherapy. Both groups had kinesis therapy and ice massage. All patients were examined on the admission and discharge by using the VAS, DASH, Barthel index and FIM. The pain intensity in shoulder was significantly reduced in EG ($p < 0,0001$), swelling is lowered in EG ($p = 0,01$). Barthel index in both groups was significant higher ($p < 0,01$). DASH was significantly improved after LASER therapy in EG ($p < 0,01$). EG had higher level of independency ($p < 0,01$). LASER therapy used on EG shows significantly better results in reducing pain, swelling, disability and improvement of independency.

KEY WORDS: Stroke, pain, LASER, electrotherapy

INTRODUCTION

According to WHO, stroke is a rapid development of symptoms of focal or global cerebral dysfunction that lasts longer than 24 hours, without any other obvious reason than the vascular one. Consequences of stroke are total or partial paralysis of one part of the body. In addition to the motor deficit, patients often have dysfunction of speaking, eyesight, sensor deficit, problems in maintaining their balance, as well as significant cognitive and psychological changes. A common complication after the stroke is pain in shoulder of the paralyzed arm, as well as swelling of the hand. Bristol Stroke study (2001) shows that 40% survivors after the stroke have more or less permanent disability. Level of disability depends on the level of the damage of the paralyzed arm after the stroke. About 80,0% persons have the pain in the shoulder after the stroke (1). The most common causes of pain in shoulder are subluxate, contracture, CRPS (Complex Regional Pain Syndrome), injury of rotational cuff of the shoulder, misbalance in spasticity of the muscles of glenohumeral joint (2). In early phase after the stroke, flaccidity of the muscles contributes to subluxate and stretching joint capsules (3). Abnormal tonus and model synergists influence rotational cuff and instability of the scapula. Subluxate as the cause of the pain, is a significant clinical problem. It may range from few millimetres to full subluxate. The pain appears from 2 weeks to 2 months after the stroke (4). LASER therapy is a significant analgesic method also used to treat limited function of the joints (5), as is the case with the shoulder joint of the paralyzed arm after the stroke. The aim of this study was to determine the effects of the LASER therapy and compare them to electrotherapy (TENS, stable galvanization) in subjects after the stroke

SUBJECTS AND METHODS

The research was consecutively conducted in 2006 and 2007. Research criteria included: paralysis of an arm after the stroke, pain in the shoulder of the paralysed arm and pain and swelling in dorsum of the hemiplegic hand. The research did not include patients who had significant cognitive deficit or aphasia, because it has not been possible to establish an adequate cooperation with such patients. We analyzed 70 subjects after the stroke with pain in the shoulder and oedema of the paralyzed hand. The subjects were divided in two groups of 35, which were treated in the Clinic for PM&R in Tuzla. Experimental group (EG) has undergone treatment with the LASER, the control group (CG) was treated with the electrother-

apy. Both groups had kinesis therapy and ice massage. The first group (experimental, EG) was treated by LASER applied on the painful points in the shoulder and area of swelling dorsum of the hand. The treatment was conducted by the LASER machine BTL 2000 with LASER probe of 50mW and wave length of 830 nm. Three J was applied on each painful point by a contact LASER probe. The second group (control group, CG) consisting of 35 examinees was treated with TENS applied on the painful shoulder because of its analgesic effects, as well as stable galvanization of the hand because of its anti-oedema effect bellow anode. Physical treatment lasted for 6 weeks, i.e. every-day treatment for 3 weeks during the working days, then three times a week for 2 weeks. During the last week, the treatment was conducted two times. The following methods have been used: anamnesis and demographic data; NIHSS (Scale of the American National Health Institute used for the assessment of stroke)(6); VAS scale (Scale of visual analogue) for assessment of pain (7); range of motion of the shoulder and hand wrist measured by goniometry; manual muscle test for assessment of the muscle strength of the arm; swelling of the dorsum of the hand of the hemiplegic arm – range measured by the centimetre band; measure of disability of the arm, shoulder and hand (DASH questionnaire)(8); everyday life activities – Barthel index (9); Functional Independence Measurement (FIM) (10); Index of depression in accordance to Zung (11). Elaborate anamnesis data were gathered (place and character of pain, intensity of the pain, propagation of the pain, numbness in the shoulder along the hemiplegic arm. All examinees gave information on their gender, age, beginning of their illness, marital status, education, risk factors, personal and family anamnesis and previous hospitalizations. The NIHSS (Scale of the American National Health Institute used for the assessment of stroke, Stanford University) contains 11 groups of questions in relation to state of consciousness, understanding, range of eye sight, mimetic and motor muscles of upper and lower extremities, ataxia, sensibility and speech dysfunctions and unilateral neglect. For each question, the score may be from 0 to 4. The VAS scale (Scale of visual analogue) is a subjective patients' assessment of pain intensity ranging from 1 to 10. The VAS gives us an opportunity to make a subjective experience of pain an objective category. Range of motion in the shoulder of the hemiplegic arm has been determined in accordance with the mobility scale (12) with scores from 0 to 4 (score 0 – full range of motion, score 1 – loss of motion up to 25%, score 2 – range of motion up to 50%, score 3 – loss of

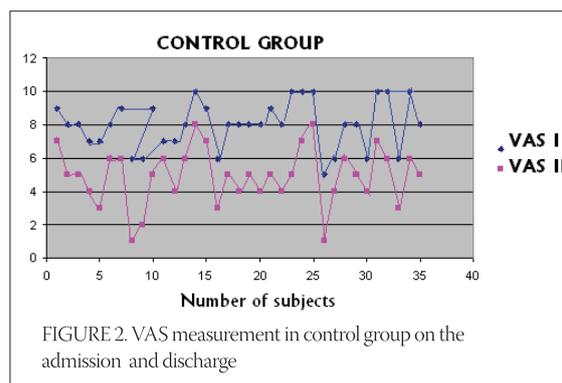
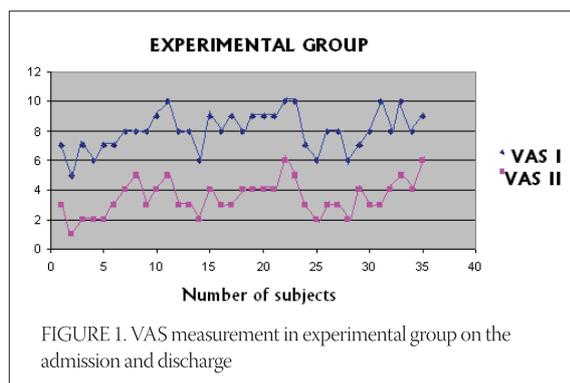
motion up to 75%, score 4 – no motion in the joint). Oedema of the hand has been verified by the centimetre band by measuring around the hand's dorsum. The DASH test (Disabilities of the Arm, Shoulder and Hand) is a questionnaire suggested by the American Academy of Orthopaedic Surgeons and accepted by the American Association for Plastic and Reconstructive Surgery. It is a specific test for measurement of disability and symptoms for the arm's area. The questionnaire has 30 questions. There are 5 optional answers for each question which are scored from 1 (without difficulties) to 5 (with maximum difficulties). This questionnaire measures daily activities, ability to get involved in everyday activities as well as the level in which pain reduces activities and performance of certain functions. DASH score may be from 0 (without disability) to 100 (gravest disability). If 10% of the questions are not answered, the test isn't valid. Barthel index is used in its modified form according to Sach S. Vaclay F. Cooper B from 1989. It assesses ability to maintain personal hygiene, to bath, to feed, go to toilet, and get dressed, to climb the stairs, transfers, control of micturition, bowel control and mobility. There are the following groups according to the score obtained: from 0 to 20 – full dependence on other person's assistance, from 21 to 60 – heavy dependence, from 61 to 90 – moderate dependence, from 91 to 99 – small dependence, 100 – independent. FIM (Functional Independence Measurement) gives data on motor and cognitive deficit. FIM contains 18 items that are scored from 1 to 7 so that the lowest score is 18 and highest 126, in case the examinee are fully independent. The listed tests have been conducted prior to and after the physical treatment. The Zung Self – Rating Depression Scale (Zung SDS), we used and patient made self testing their symptoms. If index is: below 50% - no depression, from 50 to 59% - small-scale depression, 60 to 69% - moderate depression, 70% and above – grave depression. The descriptive statistics has been done: measure-

ment of central tendency and measures of dispersion. Results have been tested by the Student t-test, χ^2 test, Odds Ratio and Fisher test. The differences were assessed as statistically relevant at the level of significance $p < 0,05$. Correlation has been done according to Pearson and Spearman at the level of significance $p < 0,01$.

RESULTS AND DISCUSSION

The research included 70 examinees of average age of $63,4 \pm 8,8$ years. In research (13) in which 88 patients after the stroke were analysed, the average age was $65 \pm 11,9$ years, and in research (14) in which 117 patients were analysed, the average age was $66,3 \pm 9,3$ years. This again confirms the fact that persons in their seventies are most likely to suffer the stroke. The pain intensity in the shoulder was significantly reduced in EG ($p < 0,0001$) (Figure 1 and 2).

Pain in the shoulder of paralyzed arm appears in 80% persons who do not have movements or who have small range of movements in the shoulder after the stroke (1). The pain in the shoulder significantly extends the time of hospitalization because the poor recovery of the patients in the first 12 weeks after the stroke (15). The LASER treatment of the painful shoulder after the stroke should start by the treatment of the sensible painful points on rotators, the joint of deltoid muscle to the brachium, m. stratus anterior, m. biceps longus, m. pectoralis minor. During the LASER treatment the best position of the shoulder is the outer rotation (16). Research (17) of the LASER treatment of patients with tendonitis of rotator cuff has shown significant difference in pain reduction (on VAS scale LASER therapy improvement 3,6 cm, with placebo 1,2 cm), and improvement of the range in the painful shoulder of the patients which were treated by the LASER compared to the group of the patients which had placebo. Swelling is lowered in EG ($p = 0,01$). It is shown in Figure 3 and 4.



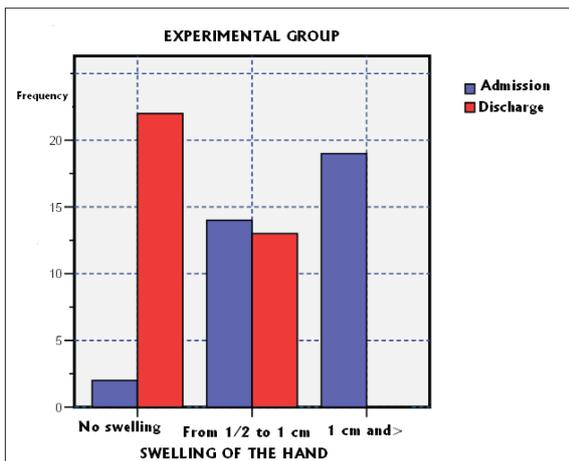


FIGURE 3. Swelling of the hand in experimental group on the admission and discharge

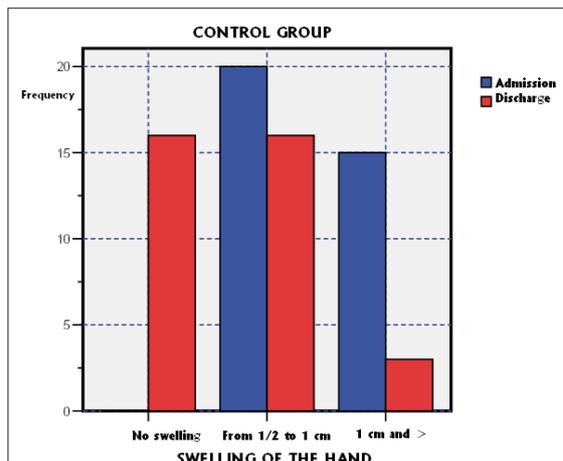


FIGURE 4. Swelling of the hand in control group on the admission and discharge

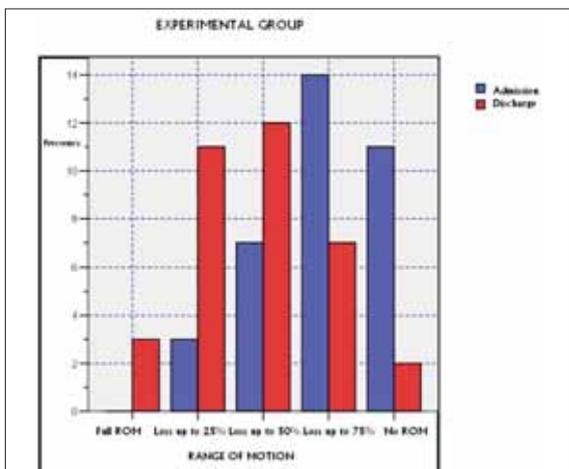


FIGURE 5. Range of motion in the shoulder prior and after the physical treatment in EG

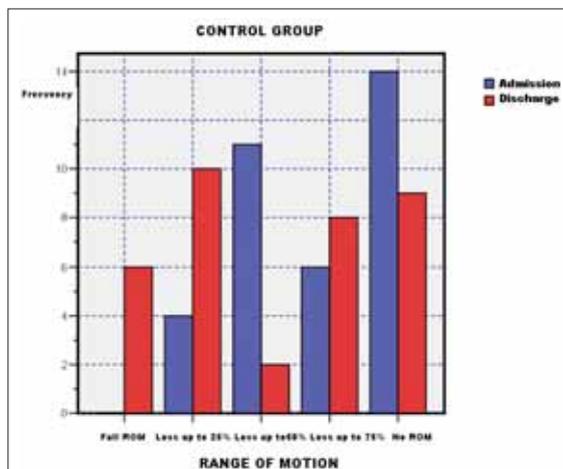


FIGURE 6. Range of motion in the shoulder prior and after the physical treatment in CG

Reduction in intensity of pain during the rehabilitation has a positive influence on the possibility to achieve wider range of mobility through program of passive and active-assisted exercises. In this research, range of mo-

tion of the shoulder of the affected arm prior and after the treatment has been analysed. According to the data gathered by the goniometry, the patients had scores ranging from 0 (full range of motion) to 4 (no motion

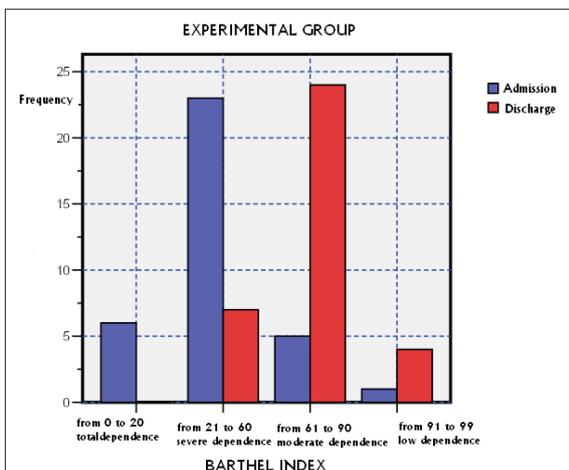


FIGURE 7. Barthel index in experimental group on the admission and discharge

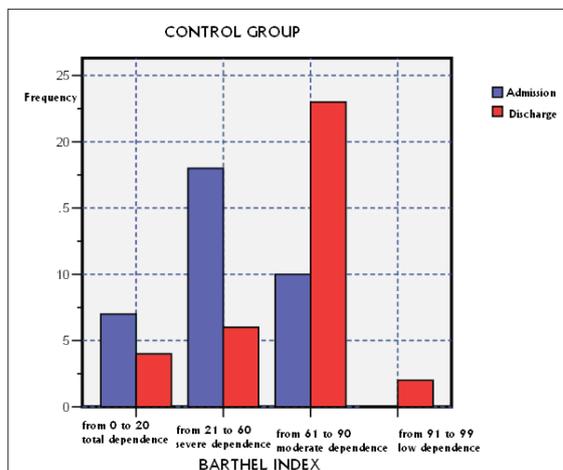


FIGURE 8. Barthel index in control group on the admission and discharge

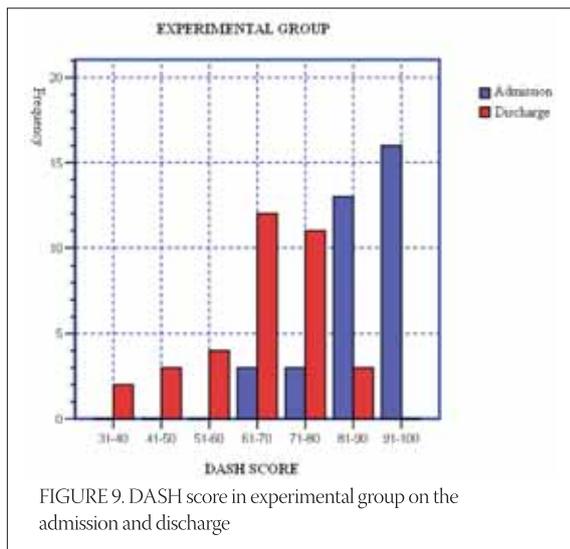


FIGURE 9. DASH score in experimental group on the admission and discharge

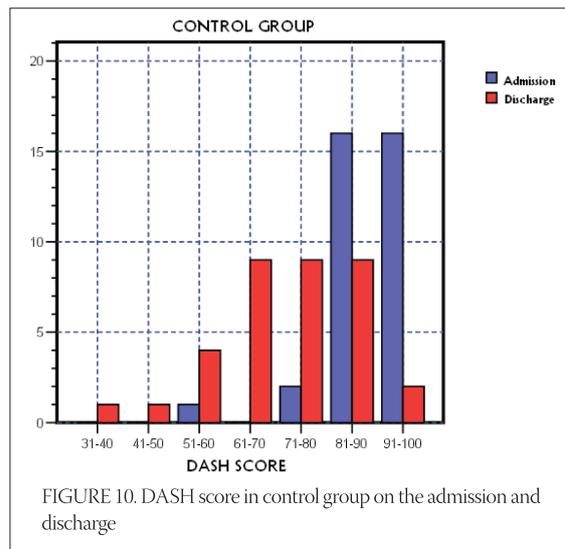


FIGURE 10. DASH score in control group on the admission and discharge

in the shoulder joint). The groups have been tested by χ^2 test. It has been demonstrated that the degree of improvement in mobility depends on the group. We have also conducted Odds Ratio, and it has been concluded that the improvement odds are 15% higher in the Experimental group than in the Control group (Figure 5 and 6). Barthel index in both groups was significantly higher after the treatment ($p < 0,01$), but no differences between groups (Figure 7 and 8).

Use of Barthel index in persons after the stroke is tested by Sulter, Steen, De Keyser (18). The research goal was to analyze the results of evaluation of patient's status after the stroke by Barthel

index and modified Rankin scale. The conclusion is that satisfying indicators for measurement of independence of the patients according to those tests.

DASH was significantly improved after the LASER therapy in EG ($p < 0,01$) (Figure 9 and 10). DASH questionnaires are used in the Study (19) which analyzed appearance of pain in worker's shoulders. Brazilian – Portuguese version of DASH questionnaires and McGill pain questionnaires were used. The conclusion of this research is that DASH questionnaires are significantly helpful in clinical evaluation of the painful shoulder. EG has had higher level of independence after the treatment than CG ($p < 0,01$) (Figure 11 and 12).

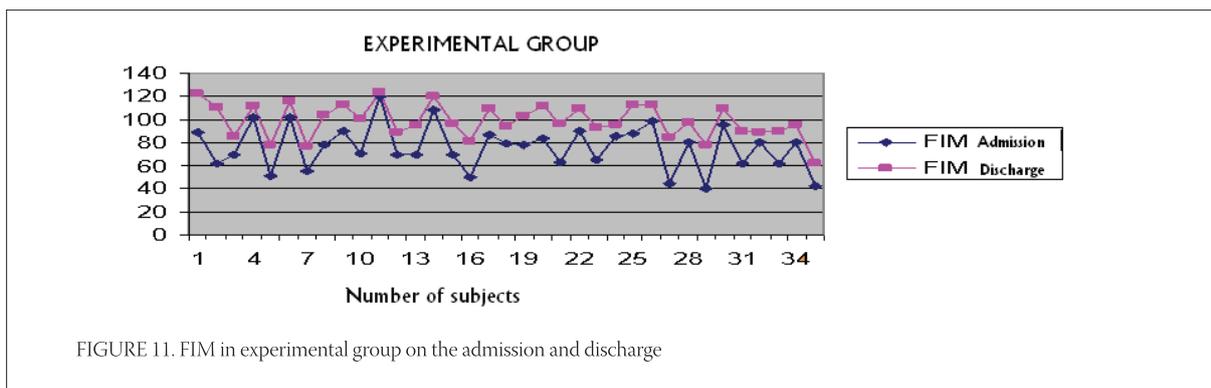


FIGURE 11. FIM in experimental group on the admission and discharge

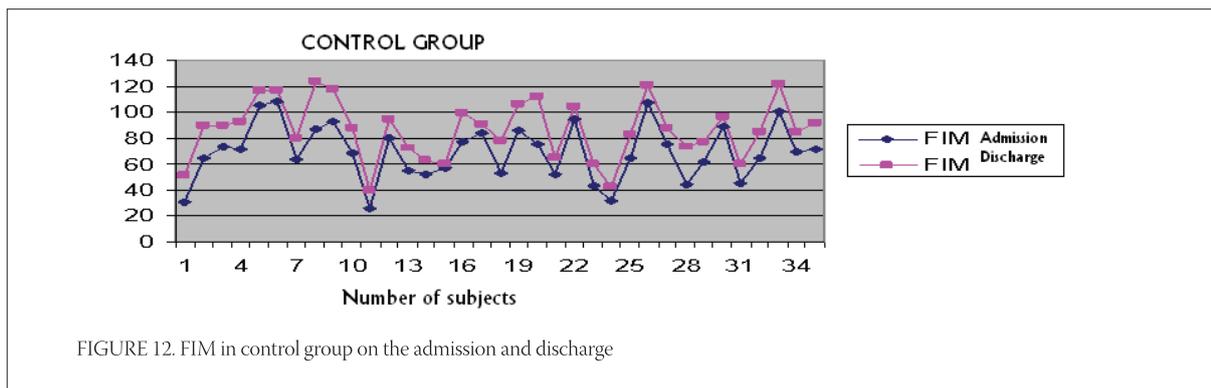


FIGURE 12. FIM in control group on the admission and discharge

In a research study (20), the aim of which was to assess the quality of life of people older than 65 after the stroke, the Barthel index has been used to assess the life quality, the Mini mental status was used to measure cognitive status, and Self testing scale according Zung was used to assess depression. Results showed significant increase in value of the scales after the discharge ($p < 0,01$). Tests were done after 6 and 12 months, but the differences were not statistically relevant. In our study once during the hospitalization, examinees conducted Index of

depression in accordance to Zung Analysis of the results showed that the most examinees in both groups suffered a significant level of depression: (60,2 %) in the Experimental group and 51,3 % in the Control group. In the Experimental group 25,7 % of examinees and 20,0 % of examinees in the Control group did not suffer from depression. The depression is very common after the stroke. The cause is an emotional response to drastic changes in the patient's life due to disability. The depression is also a consequence of organic brain damage (21).

CONCLUSION

LASER therapy, as an analgetic and decreasing oedema therapeutic procedure, causes significant reduction of pain in shoulder and hand of the hemiplegic arm, as well as an improvement in the range of motion in the shoulder of the affected hand compared to the application of electrotherapy (TENS, stable galvanization).

LASER therapy applied onto the painful shoulder and hand of the hemiplegic arm along with kinesis and ice therapy does not produce better results in improvement of abilities to perform in everyday life activities compared to application of electrotherapy onto the painful shoulder and oedema hand, but it showed significant improvement in the level of independency in the Experimental group ($p < 0,01$). DASH was significantly improved after the LASER therapy in EG ($p < 0,01$), and show us that LASER therapy decreased level of disability and improved Range of motion in the painful shoulder after stroke.

List of Abbreviations

PM & R	- Physical Medicine and Rehabilitation
EG	- Experimental Group
CG	- Control Group
LASER	- Light Amplification by Stimulated Emission of Radoation
TENS	- Transcutaneous electrical nerve stimulation
NIHSS	- American National Institute of Health Stroke Scale
DASH	- Disabilities of the Arm, Shoulder and Hand
FIM	- Functional Independence Measurement
Zung SDS	- Zung Self-Rating Depression Scale

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