EFFECTIVENESS OF RAPID MOBILIZATION, APPROXIMATION AND BRIDGING ON EARLY TERM FUNCTIONALITY IN A STROKE PATIENT: A CASE REPORT

EFICIENŢA MOBILIZĂRII PRECOCE, A TELESCOPĂRII ŞI TRANSLĂRII ÎN FUNCŢIONALITATEA IMEDIATĂ A PACIENTULUI DUPĂ ACCIDENT VASCULAR CEREBRAL: STUDIU DE CAZ

***Nilufer Cetisli Korkmaz*[1]**
***Tuba CAn*[2]**
***Emre BASKAN*[3]**

Key –words: stroke, rehabilitation, mobilization, approximation, bridging

Abstract: Muscle weakness and impaired postural control in individuals with stroke lead to decreased weight bearing on the hemiplegic lower limb that result with moderate to severe impairment in functionality. The aim of this study was to emphasis the effectiveness of rapid mobilization, approximation and bridging exercises on regaining functionality from the early terms in a stroke patient.

Subject and Methods: A stroke patient, whom was 38 years old woman, with left sided hemiplegia included to this case report. Before and after the treatment patient was assessed with sensation tests, The Stroke Rehabilitation Assessment of Movement (STREAM), Berg Balance Scale, Functional Independence Measurement (FIM), Hospital Anxiety Depression inventory (HAD) and Nottingham Health Profile (NHP). The patient was treated totally 20 sessions with neurorehabilitation program. The exercises (e.g. mobilization, approximation, bridging) were chosen from Bobath concept for strengthening and improving mobility.

Results: While initial treatment scores of STREAM was 19, it increased to the 49; especially improvement in the mobility and lower limb movements'(LE-STREAM) scores were higher than the upper limb movements'(UE-STREAM) score.

Cuvinte cheie: accident vascular, recuperare, mobilizare, telescopare, translare

Rezumat: Slăbiciunea musculară şi controlul motor afectat la aceşti pacienţi duc la o încărcare deficitară a greutăţii pe membrul afectat, ceea ce conduce la o afectare gravă a funcţionalităţii. Scopul acestui studiu a fost să accentueze importanţa telescopării şi a exerciţiilor de ridicare a bazinului din culcat dorsal în ceea ce priveşte recâştigarea funcţionalităţii la debutul AVC.

Subiect şi metode: Studiul urmăreşte cazul unie femei de 38 de ani, cu hemiplegie stângă postAVC. Înainte şi după tratament, pacientei i-a fost evaluată sensibilitatea, Stroke Rehabilitation Assessment of Movement (STREAM), Berg Balance Scale, Functional Independence Measurement (FIM), Hospital Anxiety Depression inventory (HAD) and Nottingham Health Profile (NHP). Pacienta a urmat 20 de şedinţe de recuperare. Exerciţiile (e.g. mobilizări, telescopări, translări) au fost alese din metoda Bobath, pentru îmbunătăţirea forţei şi mobilităţii.

Results: In vreme ce scorul STREAM iniţial a fost 19, acesta a crescut la 49; s-a îmbunătăţit în special mobilitatea membrelor inferioare (LE-STREAM) scorul obţinut fiind mai mare decât scorul (UE-STREAM) obţinut la membrele superioare.

[1] PT.PhD.Assist.Prof., Pamukkale University, School of Physical Therapy and Rehabilitation, Denizli TURKEY
[2] PT.MSc., Pamukkale University, School of Physical Therapy and Rehabilitation, Denizli TURKEY
[3] PT.PhD., Pamukkale University, School of Physical Therapy and Rehabilitation, Denizli TURKEY

And also BBS score (0 to 38) and FIM-motor subscale score (78 to 35) improved. It was obtained that the approaches that were used in neurorehabilitation program have a positive effect on health profile, anxiety and depression.

Conclusion: Functionality from the early terms should be one of the first targets in early term neurorehabilitation of a patient with stroke, therefore rapid mobilization, approximations and bridging exercises in the neurorehabilitation programs could aid to achieve this aim.

De asemenea, scorul BBS (de la 0 la 38) şi scorul subscalar FIM – motor (de la 78 la 35) s-au îmbunătăţit. S-a observant că abordările adoptate în procesul de neuroreabilitare a avut efecte positive asupra sănătăţii, anxietăţii şi depresiei.

Concluzii: Funcţionalitatea precoce trebuie să fie unul dintre primele scopuri ale recuperării precoce a pacientului cu AVC, totuşi, mobilizarea cât mai rapidă, telescoparea şi translarea introduce în procesul de recuperare ajută la obţinerea acestui obiectiv.

INTRODUCTION

Stroke is one of the most common neurological disorders leading to chronic disability. It is an acute onset neurological dysfunction due to an abnormality in cerebral circulation with resultant signs and symptoms that correspond to involvement of focal areas of the brain **[1]**. The most common manifestations of stroke are deficits in motor control that involve abnormal synergistic organization of movements, impaired force regulation, muscle weakness, sensory deficits and loss of range of motion. Muscle weakness and impaired postural control in individuals with stroke lead to decreased weight bearing on the hemiplegic lower limb that result with moderate to severe impairment in functionality **[2-4]**. As a result of this impairment of posture, balance and stability also affects the ability to perform the activities of daily living and causes inactivity **[5]**. If inactivity is not replaced with activity, the reduction of function will lead to disability **[6]**.

Rehabilitation following stroke aims to maximize recovery through the provision of labor-intensive treatment. However, European and American investigations in the 1980s found that patients spent most of their day alone and inactive and that therapy occupied a small percentage of day **[7]**. Several important factors underscore the potential value of exercise training and physical activity in stroke survivors. Previous studies have demonstrated the trainability of stroke survivors and documented beneficial physiological, psychological, sensorimotor, strength, endurance, and functional effects of various types of exercise. Although they require additional validation by randomized clinical trials and other appropriately designed studies, these observations make recommendations for stroke survivors to participate in regular physical activity highly compelling at the present time. Clearly, stroke survivors can benefit from counseling on participation in physical activity and exercise training. However, most healthcare professionals have limited experience and guidance in exercise programming for this diverse and escalating patient population **[8]**. This case report is intended to help bridge the current knowledge gap of effectiveness of rapid mobilization, approximation and bridging on early term functionality in a stroke patient.

Impaired postural control greatly influences the activities of daily living (ADL), independence and gait. Therefore, it's essential to rapidly achieve postural control in order to improve independence, social participation and general health. In spite of the multiple therapeutic approaches to promote recovery of postural control, no definitive conclusions can be drawn on which one is the best. For this reason, the present case study is designed to improve postural control with rapid mobilization, approximations and bridging exercises and to emphasis the effectiveness of this neurorehabilitation program on regaining postural control, balance and functionality from the early terms in a stroke patient. Also it was planned to assess its effect on functional independence, depression and health status levels.

Subject and methods

Case Description:

Stroke was defined as an acute event of cerebrovascular origin causing focal or global neurological dysfunction lasting more than 24hrs, and diagnosed by a neurologist and confirmed by magnetic resonance imaging (MRI).

A stroke patient, whom was 38 years old woman, had complained from vertigo and eye pain before the onset of hemiplegia and admission. After then left sided paralysis developed in the following days. There was not any specialty in her personal and family history. Acute infarct areas were seen in surface of centrum semiovale and basal ganglion including the putamen and inferior globus pallidus on MRI. It was seen that patient was left sided flask hemiplegic.

Measurements:

Before and after the treatment and after the follow-up period patient was assessed with The Stroke Rehabilitation Assessment of Movement (STREAM), Berg Balance Scale (BBS), Functional Independence Measurement (FIM), Hospital Anxiety Depression Scale (HADS) and Nottingham Health Profile (NHP).

To assess the patient's voluntary motor ability of the upper and lower extremities and basic mobility activities the STREAM was used, which has good inter-rater and intra-rater reliability and internal consistency, and is sensitive to changes in people with stroke. The STREAM was developed as an outcome measure for assessing the motor impairments and basic mobility of people with stroke. It contains 30 items divided among 3 subscales: 10 items for voluntary motor ability of the upper extremity (UE-STREAM), 10 items for voluntary motor ability of the lower extremity (LE-STREAM), and 10 items for basic mobility. A 3-point ordinal scale is used for scoring voluntary movement of the limbs, and a 4-point ordinal scale is used for basic mobility. The extra category for basic mobility was added to allow for one of the score choices to be independent in the activity without the help of an aid (e.g., walking aid, splints). A total score for each subscale is calculated, out of 20 points for the UE-STREAM and LE-STREAM subscales and 30 points for basic mobility. To allow for the possibility that occasionally an item can not be scored, the subscales are converted to a percentage score out of 100 even though the scores are not interval based, and the total score is calculated as an average of scores obtained for the 3 subscales. The STREAM requires approximately 15 minutes for administering **[9]**.

Assessing the balance was important to evaluate the functional level of patient. For this purpose, Berg Balance Scale (BBS) was used for the assessment of the balance in different activities such as reaching, balancing on one limb, and transferring. The BBS is a 14-item test (56 points maximum) using a 5-point (0–4) scale to rate each item, with 0 indicating an inability or need for maximal assistance to complete the task or performs task with safety concerns and 4 indicating independent and safe ability to perform task. Concurrent validity of data for the BBS has been examined in people with stroke **[10]**.

To assess the functional independence level in daily living activities like locomotor, transfer, self and home-care physiotherapist generally prefer to use FIM. The FIM consists of 13 motor and 5 social-cognitive items, assessing self-care, sphincter management, transfer, locomotion, communication, social interaction and cognition. It uses a 7-level scale anchored by extreme rating of total dependence as 1 and completely independent as 7 **[11]**.

It was shown that stoke has really severe effects on patients mood and general health status. And more than these the patients' self-perception of these, affects the functionality more than we expected. Because patient could have good motor performance but if he/she has depression patient will not participate to the rehabilitation program and as a cause of depression immobility will increase motor impairment in stroke patients. As a result of these, patients' actual motor and

functional levels will progressively decrease. To prevent these, our case's depression and anxiety level was assessed with HAD, while the general health status was evaluated with NHP. We had chosen these questionnaires because they are easy and each of them just takes 5min to complete. The HAD is a self-report rating scale of 14 items on at 4-point Likert scale (range 0–3). It is designed to measure anxiety and depression (7 items for each subscale). The total score is the sum of the 14 items, and for each subscale the score is the sum of the respective seven items (ranging from 0–21) **[12]**.

The NHP is a questionnaire designed to measure social and personal effects of illness. It is used as a measure of need for health care and as an outcome measure in evaluation. It has 38 questions (requiring a yes/no response) on energy, pain, emotion, sleep, social isolation, and mobility, and the scores on each component are weighted to give a score from 0 to 100; a higher score indicates more problems **[13]**.

Intervention*:*

The intensive training was performed 1 hour per day for 2 weeks (totally 10 sessions) with neurorehabilitation program, from the 3rd day of onset. At present, the Bobath concept, based on neurophysiological principles, remains probably the most widely used approach. The exercises were chosen from Bobath concept for strengthening and improving mobility. This approach aims to improve recovery of the hemiplegic side by focusing on normalizing tone and movement patterns with the guidance of a therapist using specialist handling techniques, preferably within real life situations **[14]**.

Strength of the trunk muscles is cornerstone of the posture, balance and stability. Meanwhile, balance testing of patients with hemiparesis secondary to stroke has revealed a greater amount of postural sway during static asymmetry with greater weight on the non-paretic leg, and a decreased ability to move within a weight bearing posture without loss of balance. Furthermore, researches demonstrated moderate relationships between balance function and gait speed, independence, appearance, dressing, wheelchair mobility, and reaching **[15]**. Trunk stability relies on correct perception of body attitude and on the development of adequate muscular responses. With these basic knowledge, in neurorehabilitation program of our stroke case, scapular mobilization, bridging activity, approximation to the lower extremities in bridging, straight leg rise in bridging, rapid mobilization, weight shifting and approximation to the upper extremity in sitting position, were chosen to improve trunk stability and sensory input. For ambulation coming to sitting and standing position from different height levels were taught to the patient. In addition to these, balance training started in sitting position with the conscious/unconscious proprioceptive education. In gait training funeral gait was used for the treatment of balance and decreased range of motion in hip and knee during swing phase. Rehabilitation program was progressed according to the patient's level.

Mobilization of acute stroke patients – in bed and out of bed as early as possible – is currently recommended to prevent general and neurological complications. However, mobilization protocols are poorly defined and need to be standardized in order to evaluate their clinical benefits **[16]**. Our patient's mobilization had started in bed level from the 3rd day of the onset and then progressed to the walking activity.

Bridging activity, which is a pelvic elevation to maximal hip extension with knees flexed and feet fixed by the examiner, is one of the basic bedside activities that almost all stroke patients can perform even early in a rehabilitation program **[6]**. Bridging activity also improves trunk movement control which is an indispensable basic motor ability for the execution of many functional tasks. In the first sessions to come to bridging position and then to keep bridging position was wanted from the patient. To help and increase the muscular activity in trunk and lower extremities, approximations were done from the flexed knees. After increasing co-contraction in lower extremity muscles with approximation, rhythmic stabilization from proprioceptive neuromuscular facilitation

technique was done to hip to increase co-contraction activity of hip and trunk muscles more. Following these first steps, rehabilitation program was improved to the straight leg rise in bridging position. By this way, more trunk and hip control wanted from the patient.

Because the motor control and balance were the best predictors of gait performance, in all exercises approximation was added. With the approximation, there was a common regulation of posture and spatial components of the movement. Somehow, subjects consider the upcoming mechanical effect of the movement on balance control. It also suggested that balance constraints can play an important role in endpoint trajectory formation **[17]**.

Balance is defined as a complex process involving the perception and integration of sensory inputs, planning and execution of movements, to achieve a goal requiring upright posture **[1]**. Therefore, balance is an essential part of all daily living activities, especially for sitting, coming sit to stand and walking. And postural control is fundamental to maintain balance. Because of this, balance training was started in sitting position with keeping the position and then progressed to the conscious/unconscious proprioceptive education. To improve trunk control and sensory input and to correct the posture, weight shifting to the hemiplegic side was added. Also to increase sensory input to the hemiplegic left upper extremity weight shifting and approximation to the upper extremity in sitting position was done. In the last stage of the balance treatment, coming to sitting and to standing positions from different height levels were taught to the patient.

As the patient gain more control in trunk, gait training was added to the rehabilitation program. In gait training free and self paced walking and also funeral gait with auditory input were used for the treatment of balance and decreased range of motion in hip and knee during swing phase.

Results

While initial treatment scores of STREAM was 19, it increased to the 49 after the treatment; especially improvement in the mobility and lower limb movements' (LE-STREAM) scores were higher than the upper limb movements' (UE-STREAM) score. After the patient was treated with 20 sessions, she obtained maximum level in the LE-STREAM score (Table 1). It was recorded that also the basic mobility-STREAM scores improved significantly from 7 to 25 (Table 1), especially in the activities those had been taken place in the neurorehabilitation program of her.

Table 1. Pre- and post-treatment and follow-up results of STREAM scores.

	Pre-Treatment		**Post-Treatment**		**Follow-Up**	
STREAM-UPPER EXTREMITY	**0/20**		**4/20**		**7/20**	
Scapular protraction	0	0	0	0	0	0
Elbow extension while supine position	0	0	1a	1	1a	1
Scapular elevation	0	0	0	0	1c	1
Raising hand to touch top of head	0	0	0	0	1c	1
Moving hand on to sacrum while sitting	0	0	0	0	1b	1
Raising arm to fullest elevation	0	0	0	0	0	0
Supination and pronation	0	0	1a	1	1c	1
Making a fist	0	0	1b	1	1b	1
Total extension of fingers	0	0	1a	1	1c	1
Opposition	0	0	0	0	0	0
STREAM-LOWER EXTREMITY	**12/20**		**20/20**		**20/20**	
Bending hip and knee while supine	1b	1	2	2	2	2
Hip flexion while sitting	1b	1	2	2	2	2

Knee extension while sitting	2	2	2	2	2	2
Knee flexion while sitting	2	2	2	2	2	2
Dorsi flexion while sitting	2	2	2	2	2	2
Plantar flexion while sitting	2	2	2	2	2	2
Knee extension and dorsi flexion while sitting	2	2	2	2	2	2
Effected hip abduction with knee extension while standing	0	0	2	2	2	2
Knee flexion while standing	0	0	2	2	2	2
Dorsi flexion while standing	0	0	2	2	2	2
STREAM-BASIC MOBILITY	**7/30**		**25/30**		**25/30**	
Rolling	3	3	3	3	3	3
Bridging (i.e., raising hips off bed)	1b	1	3	3	3	3
Moving from supine to sitting	3	3	3	3	3	3
Moving from sitting to standing	0	0	3	3	3	3
Standing for 20 counts by the rater	0	0	3	3	3	3
Placing affected foot onto first step	0	0	3	3	3	3
3 steps backward	0	0	1b	1	1b	1
3 steps to affected side	0	0	2	2	2	2
10 meter walking	0	0	2	2	2	2
Walking down 3 stairs	0	0	2	2	2	2
STREAM-TOTAL	**19/70**		**49/70**		**52/70**	

When we compared pre and post treatment BBS score it was seen that score increased from 0 to 38. This indicates that she could do most of the activities independently, but she still has risk of fall. FIM scores; especially motor subscale was improved from 78 to 35. It was obtained that the approaches that were used in neurorehabilitation program have positive effects on health profile; anxiety and depression which were assessed with HAD inventory. Anxiety and also depression scores decreased respectively; from 11 to 1, from 10 to 2. After the neurorehabilitation program 5 dimensions in NHP (energy, pain, emotional reactions, sleep and physical activity) were significantly different from the pre-treatment assessments (Table 2).

Table 2. Pre and post treatment result of BBS, FIM, HAD and NHP.

		Pre-Treatment	Post-Treatment	Follow-Up
BERG		0	38	56
FIM Total		63	113	126
	FIM cognitive	28	35	35
	FIM motor	35	78	91
HAD Total		21	3	2
	Anxiety	11	1	1
	Depression	10	2	1
NHP Total		307.59	102.48	48.93
	Energy level	100	36.8	0
	Pain	9.99	0	0
	Emotional reaction	48.63	9.31	23.75
	Sleep	60.51	0	12.57
	Social isolation	0	0	0
	Physical activity	88.46	56.37	12.61

Discussion

Hemiplegic patients with stroke have decreased trunk control, poor bilateral integration and impaired automatic postural control those were resulting in balance dysfunction. Impaired balance and increased risk of falling toward the hemiplegic side is found to be significantly correlated with locomotor function, functional abilities, length of stay in inpatient rehabilitation facilities and early term rehabilitation **[3, 14]**. Therefore, strategies on improving trunk control, as well as falls and injury prevention strategies are suggested as an integral part of each patient's rehabilitation plan after stroke **[18]**. While the early rehabilitation increases the possibility of recovery, dysfunction compensation; decreases stroke results and has influence on further patient's history, many stroke patients could not begin rehabilitation program from the onset of stroke **[8]**.

The terms 'early mobilization' and 'early neurorehabilitation' after stroke are not well defined. They include various interventions beginning within 1 day up to 3 months after stroke onset **[16]**. Our case's neurorehabilitation program had begun within the 3rd day of onset and as the patient's medical status had became stabile. International guidelines recommend early mobilization (the application of fascilatory techniques during bed rest) and mobilization (getting out of bed) as early as possible after stroke, but do not give precise information about the scientific basis, rapidity and the way to proceed for heterogeneous stroke patients **[16]**. Although our patient has flasticity and could not ambulate herself, the intensive training was performed 1 hour per day for totally 20 sessions with neurorehabilitation program.

The exercises were chosen from the Bobath concept for strengthening and improving mobility, such as scapular mobilization, approximation to the lower extremities in bridging, straight leg rise in bridging, weight shifting and approximation to the upper extremity in sitting position, were applied. For ambulation coming to sitting and standing position from different height levels were taught to the patient. In addition to these, balance training was started in sitting position with the conscious/unconscious proprioceptive education. In gait training funeral gait was used for the treatment of balance and decreased range of motion in hip and knee during swing phase. Rehabilitation program was progressed according to the patient's level.

The benefits of this early mobilization in and out of bed and of neurological rehabilitation have not been tested in randomized trials. Diserens K, Michel P and Bogousslavsky J showed that the introduction of rehabilitative efforts within the first few weeks, as opposed to later, favors better recovery and is cost-effective **[16]**. It was obtained that our case had gained functionality and mobility, all scores of the STREAM, BBS, FIM and NHP improved significantly. As she became more mobile, she discharged soon than expected. As a result and in association with the literature we concluded that neurorehabilitation program of a stroke patient could begin in the first week of the onset and as soon as the patient became medically stabile. Also it was thought that shorter time to start of mobilization/training and neurorehabilitation was the most important factor associated with discharge to home.

The most common deficits of stroke are abnormal synergistic organization of movements, impaired force regulation and muscle weakness. These impairments have the potential to affect function. Therefore, in addition to early rehabilitation postural control, balance and functional mobility are the key focus areas for therapeutic intervention after stroke **[14, 19]**. In the literature also the effects of different intensities of arm and leg rehabilitation training on the functional recovery of activities of daily living, walking ability and dexterity of the paretic arm, were investigated. It was concluded that greater intensity of leg rehabilitation improves functional recovery and health-related functional status, whereas greater intensity of arm rehabilitation results in small improvements in dexterity, providing further evidence that exercise therapy primarily induces treatment effects on the abilities at which training is specifically aimed **[16]**. In our case study, it was found that patient's STREAM scores for lower extremity and basic mobility activity

improved more than the upper extremity scores (Table 1). In addition to improvements in lower extremity and mobility, it was also found that the balance and independence in functional activities improved dramatically, which were shown by the BBS, FIM and NHP.

Prolonged bed rest may increase the risk of orthostatic hypotension at the time of mobilization. With the prolonged bed rest muscle strength and trunk control worsens. In a stroke patient, decreased postural stability is the common problem which increases the risk of falling on paretic side. Trunk control allows the body to remain upright, to adjust to weight shifts, to control movement against the constant pull of gravity **[14, 19]**. Meanwhile, balance is a somewhat ambiguous term used to describe the ability to maintain or move within a weight-bearing posture without falling. Balance can further be broken down into three aspects: steadiness, symmetry, and dynamic stability. All of these components of balance (steadiness, symmetry, and dynamic stability) have been found to be disturbed following stroke **[15]**. The importance of trunk muscles in providing adequate spine stability is well established and the role of trunk muscles during a variety of tasks has been well documented. Our neurorehabilitation protocol provided increased postural and trunk control thus they might help in improving balance. Therefore the gains of trunk control improved the mobility, lower limb activity and balance for sitting

Physiotherapy intervention, using a 'mix' of components from different 'approaches' is more effective than no treatment control in attaining functional independence following stroke. There is insufficient evidence to conclude that any one physiotherapy 'approach' is more effective in promoting recovery of disability than any other approach **[14]**. But it was thought that Bobath concept with bridging activity and approximations helped in regaining symmetry. Because with these exercises, symmetry has been addressed by providing feedback on the percentage of weight on the paretic limb and by having subject maintain her body in the center. Dynamic stability, which was referring to movement within the limits of stability, was done by subject with shifting her weight. Exercises like the weight shifting, straight leg rise, coming to sitting and standing from different height levels, balance training in sitting position with the conscious/unconscious proprioceptive education, funeral gait had given support for the training of dynamic stability. The training protocol which provides increased postural & trunk control thus may have improved balance. Because post-treatment results of STREAM and BBS scores showed that subject could shift her weight almost normally. In the future studies, more different exercises could be chosen that contains shifting component.

Conclusion

Increased steadiness, decreased asymmetry, and enhanced dynamic stability are consistent with the therapeutic goals set for most patients with hemiplegia secondary to stroke. This case study shows a clear benefit of early neurorehabilitation after stroke, which includes rapid mobilization in bed and out of bed, approximation and bridging exercises, on regaining functionality from the early terms in a stroke patient.

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