The Effects of Standing Balance in Patient with Hemiplegia After a Core Stability Strength Exercise in Supine Position - Case Report -

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배경과 목적: 인간의 보행은 일상생활에 있어서 필수적인 움직임의 요소이다. 뇌졸중 발병 후 환자들은 기능적이지 못한 보행의 형태가 부정적인 요소로써 회복에 악영향을 끼칠 수 있다. 이 증례 보고의 목적은 환자가 누운 상태에서 체간 하부의 안정성 강화를 위해 시행한 능동적인 골반 경사 운동이 선 자세에서 균형을 유지하는데 미치는 효과를 알아보기 위함이다.

연구대상: 뇌졸중으로 진단받고 한사랑 아산병원에 입원 및 통원 치료를 받고 있는 여성 1명, 남성 1명, 모두 2명의 성인 편마비 환자를 대상으로 실시하였다. 2명 모두 왼쪽 편마비 환자였다.

치료적 중재: 총 5주 동안 누운 상태에서 각각 환자 특성에 따라 치료가 실시되었으며, 치료 전과 후에 기능적 서기 균형(Functional Standing Balance, 이하 FSB)을 평가하고 Sport Kat(BERGTM, model #1000)을 이용하여 정적으로 서있는 모습과 움직임을 포함하는 동적인 균형 잡기의 모습을 평가하였다.

결과: 5주 치료기간 동안 여성 환자에게서는 보행에 관련한 정적, 동적인 균형측정에 변화를 보였으나 남성 환자에게서는 일부 향상된 모습은 있었으나 현저한 차이점을 발견하지 못하였다.

결론: 누워 있는 상태에서 체간 하부의 안정성 강화를 위해 능동적으로 움직임을 형성하고 활성화시키는 것이 선 자세에서의 균형을 유지하는 데 영향을 주는 것을 알 수 있었다.

Key words: hemiplegia, stroke, postural set, supine position, core stability training

I. INTRODUCTION

1. Background and Purpose

Locomotion in human is very essential for our daily living activities. However, patients who have non-functional movements in their locomotion following CVA have many negative factors for their recovery in the early stage.

The purpose of this project is to describe theoretical backgrounds and demonstrate the processes of treatment and the results for improving selective components of locomotion in patients in supine position following CVA.

2. Case Description

This case report involved 2 patients. one of them was inpatient and the other was outpatient. Both patients have left hemiplegia due to CVA.

3. Intervention

Two patients had treatment sessions for 5 weeks. They were instructed on how to control their hemiplegic body in supine position for their locomotion. According to individual function, each patient was treated with his/her main problem somewhat differently.

4. Results

During the treatments session for 5 weeks, The patient 1 showed improved movements in the tests. However there were no remarkable changes in patient 2.

5. Discussion

The results showed that treatment for the postural set in supine position improved relatively patient's balance in their locomotion. But it strongly needs more clinical practice to have a better idea and extended understanding based on Bobath concept for the patient's recovery.

II. LITERATURE REVIEW

1. Postural set of supine position

Since acute care patients have poor endurance in sitting and may require treatment at bedside, a large proportion of early treatment often is done in supine position. The time spent in this position is a very valuable part of movement reeducation. In supine, the patient's trunk and extremities are supported by the bed or mat. This total support eliminates the need for the patient to balance himself in the upright position and makes it easier for the therapist to establish a symmetric body position and reeducate movements of the hemiplegic trunk, arm, and leg. Supine position is often the first place where the patient is able to activate compatible trunk and extremity movements. Although movement control may not automatically transfer from supine to sitting or standing, where the body's relationship to gravity is different, supine treatment provides the patient with a sensory and motor memory of movement that will be used again in sitting and standing.(Cohen et al., 1998; Ryerson and Levit, 1997)

According to Patricia M. Davies's book 'Right in the Middle', in the early stages after the onset of hemiplegia, when the patient has little control over the movements of his trunk, patients can practise activities in supine in preparation for moving against gravity. Because the patient does not have to hold himself erect against the pull of gravity in this position, the activities can be performed with less extensor activity and effort. Not only in the early stages, but also in every stage of his rehabilitation, the patient will benefit from activities carried out in a supine position for the same reason. He emphasizes mainly on trunk posture in supine position, but also extremities's movement as critical components for the postural set in the same position related to functional activities such as sitting, standing and walking(Davies, 2000).

In terms of movement components from Davies's literature, the critical components are following; ① Rib cage and shoulder girdle: are frequently elevated due to the extension of his spine and the loss of tone in the abdominal muscles. It should be corrected by therapist actively or passively using assisting expiration and facilitating diaphragmatic breathing. ② Flexing and rotating the upper trunk: inhibits spasticity in the limbs when carried out passively and stimulates the oblique abdominal muscles when performed actively. ③ Retraining active protraction of the scapular with activation of oblique abdominal muscles including lifting the elbow into the air; is to correct activity in order to avoid compensatory movements being used. ④ Flexion/rotation of the lower trunk. ⑤ Activating the oblique abdominal muscles in crook position and ⑥ position of the arms. ⑦ Bridging; a useful activity for regaining selective extension of the hip together with abdominal muscle activity. ⑧ Actively controlling the hemiplegic leg through its range of movement(Davies, 2000).

Although each item doesn't have specific and sufficient explanation for the treatment compared to today's improved skill, it's very clear that these must be considered as the basic postural set in preparation for locomotion.

2. Understanding of the locomotion

The term Locomotion is the movement or the

ability to move from one place or another. It can refer to humans, vertebrate or invertebrate animals, and microorganisms(Ayyappa, 1991).

For successful locomotion in humans, essential requirements are needed. Locomotion is characterized by three essential requirements: progression, stability, and adaptation(Patla, 1991; Das and McCollum, 1988). Progression is ensured through a basic locomotor pattern that produces and coordinates rhythmic patterns of muscle activation in the legs and trunk to move the body in the desired direction. Progression also requires the ability to initiate and terminated locomotion and to guide locomotion toward end points that are not necessarily visible(Patal, 1997).

The requirement for stability reflects the need to establish and maintain an appropriate posture for locomotion and the demand for dynamic stability of the moving body. Dynamic stability entails counteracting not only the force of gravity but other expected and unexpected forces as well(Paltal, 1997).

The third essential requirement of locomotion is the ability to adapt gait to meet the goals of the individual and the demands of the environment. Successful locomotion in challenging environments requires that gait patterns be adapted to avoid obstacles, negotiate uneven terrain, and change speed and direction as needed.

Finally, these requirements must be accomplished with strategies that are both energy efficient and effective in minimizing stress to the loco-motor apparatus, thus ensuring the long-term structural integrity of the system over the life span of the person(Patla, 1997)

Human gait can be subdivided into a stance(or support) and swing phase. Certain goals must be met during each of these phases of gait to achieve the three task in variants of successful locomotion(progression, stability, and adaptability). During the support phase of gait, we generate both horizontal forces against the support surface to move the body in the desired direction(progression) and vertical forces to support the body mass against gravity(stability).

In addition, strategies used to accomplish progression and stability must be flexible to accommodate changes in speed and direction or alterations in the support surface.

The goals to be achieved during the swing phase of gait include advancement of the swing leg(progression) and repositioning the limb in preparation for weight acceptance(stability). Both progression and stability require sufficient foot clearance so the toe does not drag on the supporting surface during swing. In addition, strategies used during the swing phase of gait must be sufficiently flexible to allow the swing foot to avoid any obstacles in its path (adaptation) (Shumway and Woollacott, 2001).

3. Core-stability

The term core stability is a generic description for the training of the abdominal and lumbo-pelvic region. To Define core stability, the combination of a global and local stability system has been used. The global stability system refers to the lager, superficial muscles around the abdominal and lumbar region, such as the rectus abdominus, paraspinals, and eternal obliques(Behm et al., 2002; Bergmark, 1989). These muscles are the prime movers for trunk or hip flexion, extension, and rotation. Local stability refers to the deep, intrinsic muscles of the abdominal wall, such as the transverse abdominus and multifidus. These muscles are associated with the segmental stability of the lumbar spine during gross whole body movements and where postural adjustments are required(Marshall et al., 2005; Jemmett, 2003).

III. MEASUREMENTS

The Functional Standing Balance(FSB)(Pyöriä, et al., 2004) was selected as a main measurement for the two patients. Because this instrument has

been well-validated by many researches. This Functional Standing Balance (FSB) differs in the classification of balance from other balance scales that focus on the assessment of strategies. The FSB Scale contains items designed to reflect postural symmetry and standing balance with or without movement. The FSB scale consists of 3 components: weight distribution, balance with movement, and balance without movement(See appendix 1).

These 3 factors were chosen because studies (Bernhardt et al., 1998; Daleiden, 1990) and clinical experience have shown that these components are very useful for patients with stroke. The balance without movement component of this test consisted of 3 tasks, and the balance with movement component consisted of 9 tasks. The Symmetry of weight distribution was measured (in kilograms) using 2 digital bathroom scales. The balance tasks without movement were used to evaluate the subjects' ability to maintain positions of increasing difficulty by diminishing the base of support from standing with feet apart to standing with feet together and finally to standing on one leg. The score is based on the length of time the subject can maintain the stance under each condition.

The balance tasks with movement were used to evaluate balance ability in the context of the performance of movement. The purpose of the 4-point classification is to obtain information on how people with stroke use compensatory postural strategies during tasks that require the center of mass to be moved toward the edge of the base of support. Observation of difficulties and unsteadiness in initiating and performing movements are elements used to rate perfor-mance. For examination of postural control, the rater observes how much patients expand their base of support during tasks by counter-balancing with the arms and legs. They control the instability they exhibit in lifting and reaching tasks by using compensatory movements of the trunk, arm, or leg. The score is based on the length of time the subject can maintain the stance under each condition.

However, because there was no electronic force platform(Good Balance force platform)[1] which was used to measure such postural sway velocity and lateral symmetry as a comparative tool with FSB in that research, I added another thing to the original FSB using Sports KAT[2] (Fig 1), which is computerized to detect displacement for the balance without movement. Also camera video and photographs were used to score objectively for the balance with movement in those 9 components after the patients performances.

Figure 1. Sports KAT

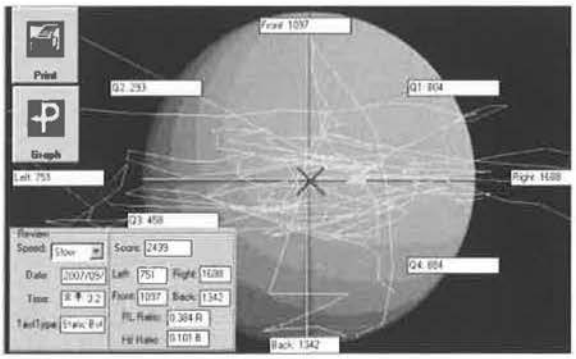

Figure 2. Pre-test of Sports KAT for patient 1

1) Metitur Ltd, Jyväskylä, Finland.
2) BERGTM, model #1000, Canada.

Finally, to describe the postural alignment of the patients, some photographs of patients taken during the treatment session were used.

IV. CASE DESCRIPTION

This case report involved two patients. One of them was inpatient and the other one is out-patient coming five times a week.

1. Case 1

1) Patient History

The patient for case one was a 40-year-old married woman with left hemiplegia due to ICH. She lived with her children and she did not mentioned anything about her husband. Onset date was March 20, 2007. It's been about seven months since her onset date. Her occupation was a factory worker who mostly stood in a small space doing simple movement by the machines. She said she had no remarkable medical complications like diabetes or hypertension before her stroke.

Before she came to see me, she had physical therapy and occupational therapy at an oriental hospital.

In her general features when she first came to our treatment room, she walked into the therapy room leaning to her carer holding carer's arm on non-hemiplegic side.

Her head was towards her hemiplegic foot to see it in a tension so that the gross body weight bearing was over her non-hemiparetic side. And she was unable to transfer her body weight onto her hemiplegic side properly and showed a hyperextension of knee joint in her stance phase.

She tried to move her hemiplegic leg forward using a momentum of total trunk movement pivoting on her right side in her swing phase. There was no active ankle movement as well in her swing phase(Table 1).

Due to her hypotonic shoulder muscles, she wears a hemi-sling on her left shoulder during daytime.

Her chief complaint was an unstable gait pattern and poor hand function. She expected

Table 1. Patient 1 summery

Name	M.S		
Sex	female		
Age	40 years old		
Legion	ICH Lt. hemiplegia		
Onset date	Mar. 20, 2007		
Occupation	factory worker		
Mental condition	RLA Coma Scale	Cognitional Functions	Orientation
	purposeful & appropriate	communication : + calculation : + memory: +	T/P/P : +/+/+
Sensory & Symptom	sensory	subluxation	
	grossly impaired on the hemiside	+ (1 finger)	
Motor Ability	PROM	MMT(hemi-side)	Spasticity
	generally full range	U/E : zero L/E : trace ~ poor	grossly low tone
Functional Ability	Sitting balance	Sit to stand	
	supervision level (poor trunk posture)	moderate assist	

her recovery in a short term. The first goal in her treatment is a good standing and walking without any difficulty in her movement as much as normal patterns.

2) Intervention

According to the results from the examination tools and photographs taken during her performance, I thought that her trunk stability was very unstable and lower extremities were out of control due to insufficient tonus, which could be a very negative factor in normal locomotion. Therefore, I tried to establish her better stability of trunk and facilitate all the muscles involved with hip extension.

In the initial treatment session. the patient had asymmetric abdominal muscles. it means that muscles could not work properly for the stability of trunk as one of core-stability muscles(Fig. 3).

Figure 3. weak abdominal muscles

First, before activation abdominal muscles, It needed to use tonic muscles around pelvic girdle including lower lumbar, such as pelvic floor muscles, multifidus and transversus muscles. I explained the role of those kind of muscles and told her how to contract those muscles by herself. And then I emphasized that there are sequences of contracting from pelvic floor muscles. After several trials, her abdominal muscles started contracting, making her back flat on the mat.

Because it is very critical to be activated on the proximal part of hamstring when hip extension occurred posturing a bridge position, my right hand palpated the proximal part of hamstring to check out whether the muscles were acting together. And the movement of pelvis was mainly posterior tilting because muscles on abdomen and hip were co-activated (Fig. 4).

Figure 4. Pelvic control

When she was in a standing position, her hemiplegic knee joint was too extended. This hyper extension may result from loss of ankle range or control, loss of hip range or control, a combination of loss of ankle and hip control, poor joint alignment caused by muscle shortening or shifting, unbalanced muscle firing patterns, or by combinations of these factors. Certainly, it will produce a bad effect on patient locomotion.

Figure 5. Sensory and motor facilitation of Ankle joint

To prevent her continuous hyper extension,

distal part of quadriceps, a muscle group contributing for a good knee extension, were strengthened in her supine position. Even though ankle dorsiflexion could not move actively, accurate movement passively and repeated sensory summation to have her feel more and more could help facilitate the distal part of the quadriceps during knee extension exercise(Fig. 5)

Figure 6. Training abdominal muscles

For the trunk stability, exercising for core -stability was essential. I focused on core-stability muscles after lower extremities training. From deep muscles such as transversus and oblique muscles, the weakened muscles for a long time were trained and activated not only in single direction but also in different directions for the repetition without repetition.

In supine position, main treatments were to produce better muscle tonus on abdominal so that she could activate her abdominal muscles for lower extremity control by her self(Fig. 6).

Even though every treatment session was not enough for 4~5 weeks, I felt a little change in her muscle tonus day by day. Although there are many different treatments for sitting, standing and even walking. I demonstrated treatments in supine position for this case report. Three weeks later from her first treatment, she participated in examinations again.

2. Case 2

1) Patient History

The patient for case two was a 49-year-old man with left hemiplegia. He was an outpatient

Table 2. Patient 2 summery

Name	K.M		
Sex	male		
Age	49 years old		
Legion	ICH Lt. hemiplegia		
Onset date	May 5, 2006		
Occupation	pastor		
Mental condition	RLA Coma Scale	Cognitional Functions	Orientation
	purposeful & appropriate	communication : + calculation : + memory: +	T/P/P : +/+/+
Sensory & Symptom	Sensory	Subluxation	
	grossly impaired on the hemiside	none	
Motor Ability	PROM	MMT(hemi-side)	Spasticity
	generally full range but hemiplegic ankle is limited	U/E : poor + L/E : fair -	Grade 1 (presented on ankle joint when standing & walking)
Functional Ability	Sitting balance	Sit to stand	
	supervision level	supervision level	

coming three times a week. His occupation was a pastor in a small town and lives with his family now.

The onset was on 5. May. 2006. He had rehabilitation treatments through the general hospitals. He reported that he had no remarkable medical complications like diabetes even hypertension prior to his stroke except that he had a pulmonary tuberculosis 20 years ago. He made a good recovery after several months of rehabilitation and exercise at the gym which is near his house. However, when he was first seen in his locomotion, he was lacking in accuracy of pelvic movement, including leg control because of insufficiency of the isolated movement. Also he showed associated reaction on his left arm when he walked. His chief complaints were abnormal gait pattern and a poor hand function.

2) Intervention

According to the results from the examinations before treatment session, his performances were relatively excellent in each examination tool compared with case one. Although his ability in locomotion is quite good in speed, stability during stance phase and swing phase, his gross pelvic motion was not worked properly related to the back motion that was in hyper extension in walking.

To control his main problems which contained excessive anterior pelvis, hyper back extension, and mass movement in control of leg, I needed to reeducate his trunk and pelvis in supine position.

Due to over-active use of the distal part of hamstring and the extension of his spine, hemiplegic knee joint was bent in spite of resting position, lower trunk was lifted from the mat in supine position.

For the better posture in supine position before treatment, hemiplegic arm with associated reaction was mobilized to lengthen shortened muscles but I did not move his arm passively but waited for his active participation.

The patient's ribs, sternum and his shoulder girdle were frequently elevated when he tried to reach his hemiplegic arm into air. To correct the posture of the thorax, I stood at the head of the bed and placed my right hand over his lower ribs pressing downward and inward while my left hand was holding his hemiplegic arm. Then the patient was asked to make a long steady sound as he exhales as long as he could. It might be helpful for his muscles associated with breathing and abdominal muscles might be activated due to the long exhalation(Fig. 7, 8).

Figure 7. Abnormal trunk(rib cage)

Figure 8. Breathing exercise

Because it is very important to facilitate oblique muscles, I guided him flexing and rotating the upper trunk holding both his hands. I asked him not to use too much neck flexion as he tried to perform these movements. Flexion and rotation of the lower trunk was performed in order to facilitate lower part of oblique muscles. With the patient lying in a relaxed supine position, I flexed both his legs so that

the angle at the hips was approximately 90 degree. To facilitate proprioception of oblique muscles, I moved first his lower trunk passively by flexing his lumbar spine to lengthen the oblique muscles and asked him actively to participate in contracting if he felt the movement.

Maybe non-hemiplegic leg had been used as a fixator as hemiplegic leg was moving. Therefore, the hip adductor was tightened and ankle was slightly inverted due to a long abnormal pattern to maintain his balance in the locomotion. I realigned the shifted patient's leg muscles lengthening the shortened muscles. After re-alignment of the non-hemiplegic leg, I asked him to contract extensor muscles of the leg as if he took a standing position in order to provide him with normal pattern that had not been used since his stroke.

For active dorsiflexion of the hemiplegic foot and toes, I stimulated all toes from the fifth toe with dynamic stimulation such as stroking the tips of the toes. It was very important not to stimulate the antagonists which makes the desired movement impossible, or cause the foot to pull into supination. Because his hemiplegic foot's mobility was not enough, I mobilized all the toes gently, making the small muscles of the foot relaxed. And he was asked to lift his toe and then also asked to push his heel downward. These activities were very helpful for isolated knee extension. To reinforce isolated knee extension, the patient attempted to extend his knee with his foot and toes held in full dorsiflexion by my body repeatedly. Apart from enabling the patient to stand without the foot pushing into plantar flexion, these activities also inhibits spasticity in the calf muscles and can be used before stimulating active dorsiflexion of the foot.

Because his pelvis and lower trunk were locked in anterior tilting all the time, his hip flexors, which might be mostly used as components of hip strategy to maintain his balance in stance instead of using ankle movement, were shortened. While proximal part of hamstring that should be used as a hip extensor were lengthened so that it's ability of contraction became reduced. In order to prevent these problems, I retrained him to use the proximal part of hamstring and abdominal muscles making posterior tilting slowly. It was very important to feel the contraction of proximal part of hamstring as he performed it(Fig 9).

Figure 9. Posterior tilting in supine position

V. RESULTS

1. KAT Sports

Table 3. shows the results from KAT sports which was used to measure the displacements with both leg static. According to the results of patient 1, she had a remarkably reduced total score(3369 to 2439). It indicated that she improved her stability on the moving board in standing position. Also she showed her active effort to maintain her balance with less fear compared with former performances on Aug 3. However, Case 2 showed more scores in his total score(1316 to 1363).

2. Weight distribution

Table 3. Both leg static balance by Sports KAT

Patient 1	Left	Right	Front	Back	Score	RL Ratio	FB Ratio
2007.08.03	1141	2228	2239	1130	3369	0.323R	0.329F
2007.09.03	751	1688	1097	1342	2439	0.384R	0.101B
differential	390 ↓	540 ↓	1142 ↓	212 ↑	930 ↓		
Patient 2	Left	Right	Front	Back	Score	RL Ratio	FB Ratio
2007.07.30	787	529	270	1046	1316	0.195L	0.590B
2007.09.11	760	603	876	487	1363	0.115L	0.286F
differential	27 ↓	74 ↑	606 ↑	559 ↓	47 ↑		

Table 4. summarizes the differences between the weight distributions on pre-test and post-test. In this table, patient 1 had significant change in her weight distribution. The improved percentage for patient 1 was from 21.75% to 39.7% on her left side(hemiplegic side). However there is no remarkable change for patient 2. Patient 2 increased just from 47.91% to 48.3% on his weight distribution examination.

Table 4. Weight distribution. (pre-test and post-test)

Patient 1

Distribution	Total	Percentage		Distribution	Total	Percentage
Ⓛ15.3 kg	70.3kg	**21.75%**	⇨	Ⓛ 28.1 kg	70.8kg	**39.7%**
Ⓡ 55.0 kg		78.25%		Ⓡ 42.7 kg		60.3%

Patient 2

Distribution	Total	Percentage		Distribution	Total	Percentage
Ⓛ 35.6 kg	74.3kg	**47.91%**	⇨	Ⓛ 35.5 kg	73.3kg	**48.3%**
Ⓡ 38.7 kg		52.09%		Ⓡ 38.0 kg		51.7%

Table 5. The Functional Standing Balance (unit: average)

Items	Patient 1		Patient 2	
	Pre-test	Post-test	Pre-test	Post-test
Balance without movement				
Standing with feet together	3	3	3	3
Standing on right leg	1	3	2.5	3
Standing on left leg	1	1	1	1
Balance with movement				
Picking up an object from the floor	3.75	3.75	3.75	3.75
Placing an object with the right arm onto a chair				
On the right side	3	3.75	3.75	3.75
On the left side	2	3	3.75	3.25
Placing an object with the left arm onto a chair				
On the left side	1.25	1.75	3	2.5
On the right side	2	1.75	2.75	2.25
Reaching up for an object with the better arm				
Right foot in front	2.75	3.75	4	4
Left foot in front	2	2.75	3.75	3.5
Turning 360 degrees				
Right side leading	2.25	3	3.25	3.5
Left side leading	2	2.75	2.75	2.5

3. Balance movement

Patient 1 had clinically important improvements in FBS(Table 5). She mostly achieved better results from the performance in FBS. Particularly, there were increases in placing an object with the right arm on to a chair on the left side and reaching up for an object with the better arm, left foot in front.

For patient 2, he had relatively high scores in the prior performances. As shown in the post-test, he had improved scores in some part but there were decreased scores on average for the most part.

VI. DISCUSSION

For patients after stroke, recovering the ability to stand and walk is critical. Standing and walking require complex postural control mechanisms, the nature of which has not been fully determined. Numerous strategies have been suggested for the treatment of postural control deficits that result from stroke(Malezic et al., 1994; Daleiden S, 1990; Winstein et al., 1989; Shumway-Cook et al., 1988).

Although objective clinical evidence exists that functional ability can be improved by participating in a rehabilitation program after stroke(Miller and Pugh, 1997; Ernst E, 1990). this improvement could be caused by the following mechanisms: true neurologic recovery, compensatory strategies acquired by the patient, or a combination of both.

Anticipatory activity in the superficial trunk muscles of poststroke hemiparetic subjects is impaired. The reduced anticipatory activity in the latissimus dorsi, external oblique, and rectus abdominis muscles on the paretic body side requires special consideration because of its association with impaired motor and functional abilities. Thus, rehabilitation treatments should focus on enhancing activation levels of the latissimus dorsi, external oblique, and rectus abdominis muscles on the affected side. Practicing the function of the erector spinae muscles, which were the least affected of the monitored muscles, requires their bilateral involvement(Dickstein et al., 2004).

For five weeks, I had two participants for this case report. Both patients had left hemiplegia but they had different functions in their movement. Patient 1 showed severe instabilities of trunk and leg in standing because of the low tonus prior to treatment. Patient 2 showed commonly limited joint motions and overuses of back extensors that caused wider body sway in his locomotion.

To improve their qualities of movement, I needed to set their postures in supine position and approached the main problem to solve, according to individual features. Postural control and functional mobility are key focus areas for therapeutic intervention after acute stroke (Ballinger et al., 1999).

They had mainly trunk postural problems, regardless of what muscle tonus they had. There were somewhat differences from these tests, especially there were more differences in patient 1 than patient 2.

Patient 1 improved her stability due to controled trunk, pelvis, and leg control. In the initial treatment session, she was focused to create increased muscles tonus around lower trunk. Although she still has difficulties in her walking and standing, in terms of balance performing for the task in the test, she achieved better balance control. It indicates that selective controled components for the locomotion improved.

For patient 2, I hardly say that he has improved a lot in his locomotion. Because he was an outpatient coming intermittently, I could not have enough time to have him for his treatment session. Although outcomes were not significant compared with patient 1, he was satisfied with my help and he mentioned that he

expects better recovery in the near future having my treatment.

In summary, the followings are the main components to improve the patients locomotion in supine position; body alignment(inter-joints), abdominal muscles strengthening, appropriate pelvic control(posterior tilting), foot and ankle active movements, distal part of quadriceps facilitation, distal part of hamstring lengthening and activation of proximal part of hamstring.

VII. CONCLUSIONS

This is the case report to demonstrate two patients based on Bobath concept for the theme 'How can the postural set of supine be actively created and used for improving selective components of locomotion in patients following C.V.A?'

The results showed that treatment for the postural set in supine position improved relatively patient's balance in their locomotion. But it strongly needs more clinical practice to have a better idea and extended understanding based on Bobath concept for the patient's recovery. The patients may need more sessions to come up with a better conclusion.

REFERENCE

Ayyappa E. Normal Human Locomotion, Part 1: Basic Concepts and Terminology. JPO. 1997;91:10-17.

Ballinger C, Ashburn A, Low J, Roderick P. Unpacking the black box of therapy: a pilot study to describe occupational therapy and physiotherapy intervention. *Clin Rehabil.* 1999;13:301-309.

Behm DG, Anderson K, Curnew RS. Muscle force and activations under stable and unstable conditions. *J Strength Cond Res.* 2002;16:416-22.

Bergmark A. Stability of the lumbar spine. A study in mechanical engineering. *Acta Orthop Scand.* 1989;230:20.

Bernhardt J, Ellis P, Denisenko S, Hill K. Changes in balance and locomtion measures during rehabilitation following stroke. *Physiother Res Int.* 1998;3:109-122.

Carr J, Shephered R. Movement science: Foundation for physical therapy in rehabilitation. 2nd ed. Gaithersburg, Maryland, An Aspen Publication. 2000.

Cohen BG, Cardillo ER, lugg D, et al.: Description of movement patterns of young adults moving supine from the foot to the head of the bed. *Phys Ther.* 1998;78:999-1006.

Daleiden S. Weight shifting as treatment for balance deficits: a literature review. *Physiotherapy Canada.* 1990;42:81-87.

Davies PM.: Right in the Middle. Springer-Verlag 1990;31-47,70-91.

Davies PM.: Steps to follow. 2nd ed. Springer-Verlag. 2000;235-276.

Dickstein R, Shefi S, Marcovitz E, Villa Y. Anticipatory postural adjustment in selected trunk muscles in poststroke hemiparetic patients. *Arch Phys Med Rehabil.* 2004;85:261-7.

Ernst E. A review of stroke rehabilitation and physiotherapy. *Stroke.* 1990;21:1081-5.

Jemmett R.: Spinal Stabilization The new science of back pain. Novont health publishing. 2003;13-16.

Marshall PW, Murphy BA. Core stability exercise on and off a Swiss ball. *Arch Phys Med Rehabil.* 2005;86:242.

Malezic M, Hesse S, Schewe H, Mauritz KH. Restoration of standing, weight-shift and gait by multichannel electrical stimulation in hemiparetic patients. *Int J Rehabil Res.* 1994;17:169-179.

Miller K, Pugh K. Relationships between outcome

measures and discharge disposition following stroke. *Synapse.* 1997;27(4):17-20.

Pyöriä O, Era P, Talvitie U. Relationships between standing balance & symmetry measure-ments in patients following recent strokes or older strokes. *Phys Ther.* 2004;84:128-136.

Rothwell J. Conrol of human voluntary movement. Chapman & Hall. 1994.

Ryerson S, Levit K.: Functional movement reeducation. Churchill living stone. 1997.

Shumway-Cook A, Woollacott MH.: Motor Control theory and practical applications, 2nd ed. Lippincott Williams & Wilkins. 2001.

Shumway-Cook A, Anson D, Haller S. Postural sway biofeedback: its effect on reestablishing stance stability in hemiplegic patients. *Arch Phys Med Rehabil.* 1988;69:395-400.

Umphred DA.: Neurological Rehabilitation 5th ed. Mosby Elsevier. 2007;738-739.

Winstein CJ, Gardner ER, McNeal DR, Barto PS, Nicholson DE. Standing balance training: effect on balance and locomotion in hemiparetic adults. *Arch Phys Med Rehabil.* 1989;70:755-62.

Appendix 1 : Functional standing balance

Weight distribution		
Standing on digital scales for 30 seconds		
Right leg		... kg
Left leg		... kg
Balance without movement		
Standing with feet apart for 30 seconds	1=cannot stand	... points
	2=can stand	... points
Standing with feet together (maximum=15 seconds)	1=0-5 seconds	... points
	2=6-10 seconds	... points
	3=11-15 seconds	... points
Standing on one leg (maximum=15 seconds)	1=0-5 seconds	
Right leg	2=6-10 seconds	... points
left leg	3=11-15 seconds	... points
Balance with movement		
Bending down to pick up an object from the floor		
With the better hand		... points
Placing an object with the right arm onto a chair		
On the right side		... points
On the left side		... points
Placing an object with the left arm onto a chair		
On the left side		... points
On the right side		... points
Reaching up for an object with the better arm, feet in walking position		
Right foot in front		... points
left foot in front		... points
Turning 360 degrees on the spot		
Right side leading		... points
Left side leading		... points

4=good control of balance
Control of balance during performance as demanded by the task. The performance is fluent and economic.
3=moderate control of balance
Can perform the task, but the control of the movement and the fluency of the performance is insufficient. Compensatory movement of trunk.
2=difficulties in controlling balance
Difficulties in controlling balance during the task (torches, extra footsteps, grips support at some stage during performance), compensatory movement of upper limbs and/or trunk.
1=unable to control balance
Difficulties in setting in the start position demanded by the task and maintaining balance during performance without the risk of falling.