

The Rehabilitation Effect of PNF after Applying Upper Extremity Taping on Patients with Central Nervous System Injuries

Jung-Ho Lee¹, Youn-Bum Sung² and Dae-Hwan Lee^{3*}

¹Dept. Physical Therapy, Kyungdong Univ., Bongpo-ri, Toseong-myeon, Goseong-gun, Gangwon-do, 219-705, Republic of Korea

²Department of Physical Therapy, Daegu University: 201, Naeri-ri, Jinlyang, Gyeongsan-si, Gyeongsangbuk-do, Republic of Korea

^{3*}Dept. Development, Y. H. Life Co., Ltd., B107, CU technocenter, 13-13, Hayang-ro, Hayang-eup, Gyeongsan-si, Gyeongsangbuk-do, 38430, Republic of Korea

¹ljhcivapt@naver.com, ²playeryoon@naver.com, ^{3*}dhlee8510@naver.com

Abstract

This study aimed to investigate the superimposition effects of elastic taping applied to the upper extremities prior to proprioceptive neuromuscular facilitation therapy upper extremity pattern treatment on the rehabilitation of upper extremity functions of stroke patients. In this study, 14 stroke patients who were under hospital treatment at a rehabilitation hospital were selected as subjects. They were randomly divided into an experimental group (n=7), who would receive elastic taping therapy before proprioceptive neuromuscular facilitation, and a control group (n=7), who would not receive elastic taping therapy before proprioceptive neuromuscular facilitation. The action research arm test is an evaluative measure used to assess the functions of the upper extremities. The comparison of difference in the therapeutic effects, according to the therapeutic intervention, showed that the experimental group had more statistically significant differences than the control group. In conclusion, in elastic taping therapy and the therapeutic superimposition effect of proprioceptive neuromuscular facilitation treatment may improve upper extremity function in stroke patients.

Keywords: Proprioceptive neuromuscular facilitation, Taping, Upper extremity, Rehabilitation, Stroke

1. Introduction

A stroke is a disease that is accompanied by various symptoms as a result of the loss of cerebral functions caused by cerebrovascular ischemia or bleeding. A stroke can incur various disabilities depending on the damage location and intensity in the brain [1].

Most stroke patients experience degradation in maintaining posture, functional movements, sense of balance, and gait ability due to asymmetric body alignment. Neurological damage occurs after a stroke, which negatively impacts not only patients themselves but also patients' families and society due to the aftereffects or complications [2].

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A stroke is a disease that should be urgently treated as a medical and social problem, as clinical symptoms of stroke, such as motor disturbance, sensory disturbance, decreased consciousness, dysphasia, and cognitive impairment can be found [3].

Elastic tapes can control changes in length and elasticity, which can be extended according to the movements around the application portion. It is also made of fabric and has an advantage in that it can be variably applied to all physical body portions. Although methods to increase the functional activities of the upper extremities and trunk strengthening exercises through PNF upper extremity patterns have been widely employed in clinical fields, few studies have been conducted on the effect of taping with a positive impact on the increase of muscle strength and muscle re-education prior to applying the PNF pattern in relation to the upper extremities [4].

Thus, this study aims to determine the effect of elastic taping applied to the upper extremities prior to PNF upper extremity pattern treatment on the rehabilitation of upper extremity functions of stroke patients, thereby providing foundational data to improve the activities of daily living in stroke patients.

2. Research methods

2.1. Subjects

In this study, 14 stroke patients who were under hospital treatment at a rehabilitation hospital were selected as subjects.

They were randomly divided into an experimental group (n=7), who would receive elastic taping therapy before proprioceptive neuromuscular facilitation, and a control group (n=7), who would not receive elastic taping therapy before proprioceptive neuromuscular facilitation [Figure 1].

The subjects voluntarily participated in the study after being fully informed of its purpose and contents, experimental procedures, and stability. They also submitted written participation consent before the experiment [Table 1].

Table 1. General characteristics of subjects

	Experimental group (n=7)	Control group (n=7)
Age (years)	60.26±7.65	63.25±8.39
Height (cm)	163.87±15.64	165.19±11.85
Weight (kg)	57.46±7.28	59.48±8.38
Gender (Male/Female)	2/5	3/4

Mean ±SD: Mean ±standard deviation

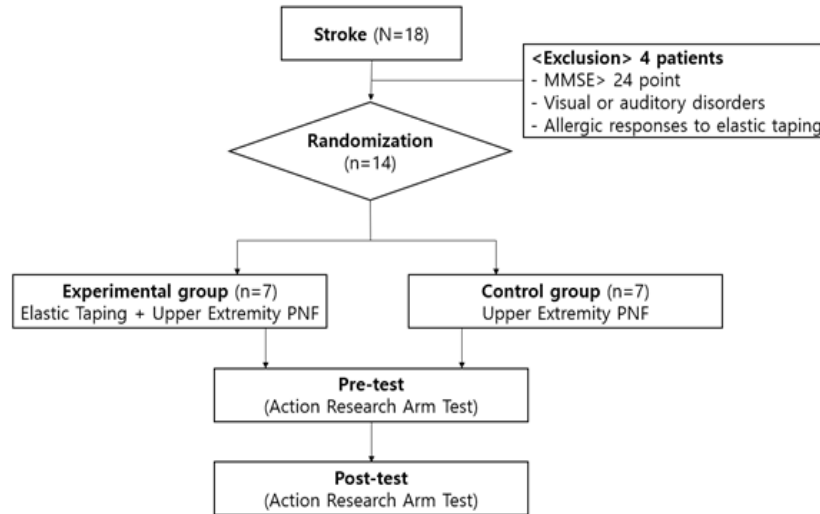


Figure 1. Flow chart

2.2. Treatments

Both the experimental and control groups underwent Proprioceptive Neuromuscular Facilitation (PNF) treatment for 30 minutes, but the experimental group received elastic taping in the affected upper limb before proprioceptive neuromuscular facilitation. Both groups underwent their respective therapeutic interventions 18 times: three times a week for six weeks

2.2.1. Elastic taping

To apply the taping therapy to the upper extremities, taping for shoulder stability and taping for suppression of flexor muscles in the upper extremities were used.

The elastic taping for shoulder stability was applied to the deltoid, supraspinatus, infraspinatus, and pectoralis major, and the taping for suppression of the flexor in the upper extremities was applied to the triceps brachii and wrist extensor.

2.2.2. Proprioceptive neuromuscular facilitation

Among the several types of proprioceptive neuromuscular facilitation was used as a general physical therapy for both groups in this study. The chopping pattern is an upper limb proprioceptive neuromuscular facilitation pattern wherein the subject assumes the hook-lying position (bending the hip and knee joints in the supine position).

In the supine hook lying position, the leading arm on the affected side of the subjects performed shoulder joint flexion/adduction/external rotation, the scapula was in anterior elevation, the elbow joint was in extension-supination, and the wrist was in flexion-radial deviation.

The trailing arm on the unaffected side performed chopping (shoulder joint extension/abduction/internal rotation, the scapula posterior depression, elbow joint extension-pronation, and wrist extension-ulnar deviation) while holding the wrist on the affected side and having the shoulder joint of the arm on the unaffected side in a flexion/abduction/external rotation state, according to the instruction of the researcher.

2.3. Assessments

The Action Research Arm Test (ARAT) is an evaluative measure used to assess the functions of the upper extremities. This test consists of 19 items, and the total possible score is 57 points [5].

Item scores are summed to create four sub-scale scores: grasp (18 points), grip (12 points), pinch (18 points), and gross motor (9 points). Prior tests were conducted before the therapeutic intervention in all of the above assessments, and the post tests were conducted after the final therapeutic intervention.

2.4. Data analysis

In order to verify the effectiveness of the study, the treatment method was used as an independent variable and the action research arm test was used as a dependent variable.

For statistical data processing, mean \pm standard deviation values were derived from descriptive statistics using SPSS version 18.0, and an independent t-test was conducted to identify differences between the groups.

3. Results

The ARAT score had a statistically significant difference before and after the experiment in both the experimental and control groups ($P < 0.05$) [Table 2].

The comparison of difference in the therapeutic effects, according to the therapeutic intervention, showed that the experimental group had more statistically significant differences than the control group ($P < 0.05$) [Figure 2].

Table 2. Comparison of ARAT score between groups

	Experimental group		<i>p</i>	Control group		<i>p</i>
	Pre-test	Post-test		Pre-test	Post-test	
ARAT	25.45 \pm 7.12	36.75 \pm 8.16	.000*	26.19 \pm 6.43	33.17 \pm 7.53	.000*
pre-post	-10.38 \pm 3.71			-6.53 \pm 2.94		
<i>P</i>	.000*					

* $p < 0.5$, Mean \pm SD: Mean \pm standard deviation, ARAT: Action research arm test

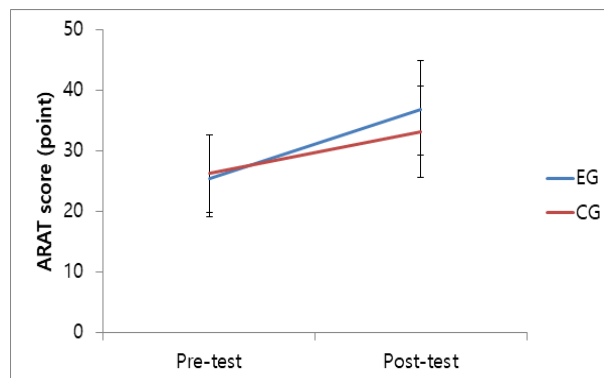


Figure 2. Comparison of ARAT wrist score between groups

4. Discussion

Elastic tape has a similar elasticity to that of human skin. The principle and effect of taping therapy affects the skin, proprioception, muscles, fascia, and joints. Taping increases the circulation of blood and lymph fluid via a skin lift-up action [6].

After applying the taping therapy, taping lifts up the different layers of skin, which relaxes fascia, thereby encouraging blood flow and lymph drainage in the tissue. This can also decrease edema and increase the re-absorption of substances that induce pain by improving the recovery of the damaged portion of the body [7].

PNF is a therapeutic exercise method that combines a facilitation technique that induces physical body functions, improvement of neuromuscles, and motor reactions with functional diagonal movement patterns [8].

PNF can be used to improve muscle strength and endurance, such as stability, mobility facilitation, neuromuscular control, and coordinated movements. It can also be used to strengthen weak muscle groups by facilitating strong muscle groups using diagonal movement patterns through the stimuli of many senses to facilitate or strengthen motor reactions and recover functions [9].

PNF can be used in all steps of rehabilitation, from early steps where isometric exercises can be applicable, to steps where patients can resist and move at faster speeds. Currently, it has been widely applied in sports medicine to treat damage to the CNS and peripheral nervous system and orthopedic and neurosurgical diseases [10].

The trunk and upper and lower extremities in human movements act together as a form of complete synergic muscles, and irradiation occurs from stronger to weaker muscles through the resistance of the patterns that strengthen the upper and lower extremities or trunk [11].

A study on the electromyogram of PNF arm patterns reported that diagonal movements using arms among PNF techniques improved the functional activities of the upper extremities and stabilized the trunk muscles [12].

5. Conclusion

This study investigated the superimposition effects of elastic taping and proprioceptive neuromuscular facilitation treatment on stroke patients' improvement in upper limb function. In the results of this study, the intervention that combined proprioceptive neuromuscular facilitation treatment with elastic taping could be statistically confirmed to improve the function of the upper extremity compared to proprioceptive neuromuscular facilitation treatment alone. This result was obtained because of the synergistic effect of two interventions.

For future studies, the synergistic effect between therapeutic interventions on improving the interventions by stimulating the abilities of factors in relation to patient functions will be investigated.

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