

The immediate effect of neuromuscular joint facilitation (NJF) treatment on the standing balance in younger persons

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Abstract. [Purpose] The aim of this study was to investigate the change in standing balance of younger persons after neuromuscular joint facilitation (NJF) treatment. [Subjects] The subjects were 57 healthy young people, who were divided into three groups: The NJF group, and the Proprioceptive Neuromuscular Facilitation (PNF) group and the control group. [Methods] Functional reach test and body sway were measured before and after intervention in three groups. Four hip patterns of NJF or PNF were used. Two-way ANOVA and multiple comparisons were performed. [Results] The rate of change of FRT in the NJF group increased than the PNF group. The root mean square area at NJF and PNF group increased than control group. [Conclusion] The results suggest that caput femoris rotation function can be improved by NJF treatment, and that improvement of caput femoris rotation contributes to improve dynamic balance.

Key words: Neuromuscular joint facilitation, Proprioceptive neuromuscular facilitation, Balance

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INTRODUCTION

Neuromuscular Joint Facilitation (NJF) is used to increase strength, flexibility, and ROM. NJF is a new therapeutic exercise based on kinesiology that integrates the facilitation element of proprioceptive neuromuscular facilitation (PNF) and the joint composition movement aiming to improve the movement of the joint through passive exercise, active exercise, and resistance exercise. It is used to increase strength, flexibility and ROM. NJF is a dynamic approach to the evaluation and treatment of the nerve, the muscle, and the joint at the same time. The main effects of NJF were facilitated normal joint movement and the normal joint capsule and relieve pain¹⁾. Previous studies demonstrate immediate effects of NJF intervention on knee muscle force and electromechanical reaction time of the human rectus femoris^{2, 3)}. Furthermore, NJF treatment not only decreased pain severity, but also improved the walking ability of elderly subjects with knee osteoarthritis⁴⁾. It thought the intervention of NJF can contribute to the fall prevention of the elderly. Fractures are associated with falls, often causing victims to become bedridden. Thus, the prevention of falls, is an important issue for an aging society.

Balance is important for maintaining postural equilibrium and thus for the avoidance of falls. In the posture adjustment of the standing position, the ankle joint, the hip joint, and the trunk were involved to stabilize the center of gravity position⁵⁾. The trunk function is importance on the balance of standing posture and the gait ability^{6, 7)}.

The aim of this study was to investigate the change in standing balance of younger persons after neuromuscular joint facilitation (NJF) treatment.

SUBJECTS AND METHODS

The subjects were fifty seven healthy young people (29 males and 28 females), who were divided into three groups: a NJF group, a PNF group and a control group. The NJF group consisted of 21 subjects, the PNF group consisted of 24 subjects and the control group consisted of 12 subjects. Subject characteristics are detailed in Table 1. All subjects were screened before the start of the study using a medical history questionnaire. The questionnaire addressed whether the subjects had a history of cardiopulmonary, musculoskeletal, somatosensory, or neurological disorders. If so, they were excluded from the study. All subjects gave their informed consent to participation in the study. All experimental procedures in this study were reviewed and approved by the Ethical Review Committee of International University of Health and Welfare.

The functional reach test (FRT) and body sway (BS) were measured before and after intervention in three groups.

FRT was performed using the “yardstick” method reported by Duncan et al⁸⁾. Subjects were asked to remove their shoes

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Table 1. Subject characteristics

	NJF ^a (n=21)	PNF ^b (n=24)	Control ^c (n=12)
Age (yrs)	19.5±0.6	19.3±0.4	21.9±0.7
Height (cm)	166.3±7.2	165.3±8.1	165.0±8.3
Weight (kg)	60.1±12.0	57.6±7.7	62.4±13.7

Values are mean ± SD. There were no significant differences between the groups. ^aNJF group: neuromuscular joint facilitation group. ^bPNF group: proprioceptive neuromuscular facilitation group. ^cControl: control group.

Table 2. Comparison of before and after intervention values

		Before	After
FRT (cm)	NJF ^a	40.5±5.4	42.8±5.4
	PNF ^b	38.6±4.8	37.6±6.0
	Control ^c	38.0±6.4	37.4±4.9
Total length (mm)	NJF ^a	1,361.8±287.8	1,240.3±235.6
	PNF ^b	1,335.6±368.3	1,199.8±328.8
	Control ^c	1,432.7±345.2	1,369.2±305.3
Peripheral area (mm ²)	NJF ^a	300.9±122.7	281.7±86.2
	PNF ^b	349.6±157.8	338.3±177.0
	Control ^c	525.7±288.7	512.3±383.1
Rectangular area (mm ²)	NJF ^a	802.3±371.0	732.1±259.4
	PNF ^b	957.7±498.5	937.3±459.3
	Control ^c	1,379.6±824.1	1,121.3±511.7
Root mean square area (mm ²)	NJF ^a	177.1±76.2	173.5±59.2
	PNF ^b	210.1±104.0	214.0±115.9
	Control ^c	306.4±157.1	234.5±97.5

Values are mean ± SD, *p<0.05

^aNJF group: neuromuscular joint facilitation group. ^bPNF group: proprioceptive neuromuscular facilitation group. ^cControl: control group

and socks and assume an upright standing position with their feet separated at shoulder width. Subjects elevated their left arm horizontally at approximately 90 degrees with extended elbow and grip hand at the starting position in FRT. Then, subjects were asked to reach as far as they could without losing their balance or taking a step. The FRT was performed twice and the mean value was used in the analysis.

To measure the RS, the stabilometer (Active Balancer, Sakai medical) was used. The subjects maintained the right leg standing position on the center of gravity shake meter by open eyes, and the measurement time were 30 seconds. Total lengths, peripheral area, rectangular area, roots mean square area were measured. The sampling frequency was 20 Hz.

Four hip patterns of NJF or PNF were used. The patterns were: hip extension-abduction-internal rotation, hip flexion-adduction-external rotation, hip extension-adduction-external rotation, and hip flexion-abduction-internal rotation. Each pattern was performed three times at random as a passive exercise and as a resistance exercise. In the NJF group intervention, both proximal resistance and distal resistance were performed. In the PNF group intervention, only distal resistance was performed. The Control group took a rest five minutes. The intervention was performed by the same

physical therapist to avoid individual variations in treatment.

To determine whether there were differences between the NJF group and the PNF group, the independent t-test was performed on subject characteristics. Two-way ANOVA and multiple comparisons (Bonferroni test) were used to test for statistically significant differences, and the factors were intervention and group. One-way ANOVA and multiple comparisons were used to compare change rate of each item before and after the intervention. Data were analyzed using SPSS Ver. 17.0 for Windows. The level of statistical significant was chosen as 0.05.

RESULTS

There were no significant differences in the subject characteristics among groups (Table 1).

Two-way ANOVA showed there were no significant main effects or interactions among groups (Table 2). One-way ANOVA showed there were significant main effects on FRT and root mean square area. In the NJF group the FRT significantly increased comparison with PNF group. The NJF group and the PNF group had significantly increased root mean square area (Table 3).

Table 3. The rate of change of before and after intervention values

		The rate of change
FRT	NJF ^a	1.06±0.09 [†]
	PNF ^b	0.97±0.11
	Control ^c	0.99±0.10
Total length	NJF ^a	0.93±0.14
	PNF ^b	0.91±0.21
	Control ^c	0.97±0.15
Peripheral area	NJF ^a	1.04±0.40
	PNF ^b	1.11±0.81
	Control ^c	1.02±0.47
Rectangular area	NJF ^a	1.08±0.65
	PNF ^b	1.12±0.60
	Control ^c	0.92±0.37
Root mean square area	NJF ^a	1.09±0.44 [*]
	PNF ^b	1.19±0.83 [*]
	Control ^c	0.86±0.34

Values are mean ± SD,

[†]p<0.05. Comparison with PNF group. ^{*}p<0.05. Comparison with control group. ^aNJF group: neuromuscular joint facilitation group.

^bPNF group: proprioceptive neuromuscular facilitation group.

^cControl: control group

DISCUSSION

The study investigated the effects of a neuromuscular joint facilitation treatment in healthy young people. After NJF intervention, there were significant increases in the FRT. The FRT is an index of the dynamic standing position balance. An important difference between the intervention methods was that, the rotation function of the caput femoris was emphasized in the NJF group. In the NJF resistance

exercise, the caput femoris rotation was drawn out using proximal resistance on the greater trochanter of the femur. The results suggest that caput femoris rotation function can be improved by NJF treatment, and that improvement of caput femoris rotation contributes to increasing the FRT.

The root mean square area is an index of the static standing position balance. After NJF and PNF intervention the root mean square area increased. It was suggested to have decreased the static balance ability slightly after the exercise therapy in the younger person. At the same time, the dynamic balance function has been improved by the intervention of NJF. The results suggest that caput femoris rotation function can be improved by NJF treatment, and that improvement of caput femoris rotation contributes to improve dynamic balance.

Further studies are needed to investigate the change in the balance function after a long period of NJF.

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