

# The Immediate Effect of Neuromuscular Joint Facilitation (NJF) Treatment on Hip Muscle Strength

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**Abstract.** [Purpose] This study investigated the change in hip muscle strength of younger persons after neuromuscular joint facilitation (NJF) treatment. [Subjects] The subjects were 45 healthy young people, who were divided into two groups: a NJF group and a proprioceptive neuromuscular facilitation (PNF) group. The NJF group consisted of 21 subjects (11 males, 10 females), and the PNF group consisted of 24 subjects (11 males, 13 females). [Methods] Participants in the NJF group received NJF treatment. We measured the maximal flexor strength and the maximal extensor strength during isokinetic movement of the hip joint before and after intervention in both groups. The angular velocities used were 60°/sec and 180°/sec. [Results] The NJF group showed significant increases in the maximal flexor strength and the maximal extensor strength after the intervention at each angular velocity. In the PNF group, the maximal flexor strength of 60°/sec and the maximal extensor strength of 180°/sec were significant increases. [Conclusion] These results suggest that there is an immediate effect of NJF intervention on hip muscle strength.

**Key words:** Neuromuscular joint facilitation, Hip muscle strength

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## INTRODUCTION

Strength training of the hip is often executed as a therapeutic exercise. Osteoarthritis (OA) is one of the most common joint diseases in adults<sup>1, 2)</sup>, and is a slowly evolving, degenerative articular disease. Muscle strengthening exercises for the hip joint are often used for hip OA and after the total hip arthroplasty to improve patients' gait abilities.

Proprioceptive neuromuscular facilitation (PNF) is a technique which is used to improve the lower-limb muscle strength and gait function. Neuromuscular Joint Facilitation (NJF) is used to increase strength, flexibility, and ROM. NJF is a new therapeutic exercise based on kinesiology. It integrates the facilitation element of proprioceptive neuromuscular facilitation and the joint composition movement, aiming to improve the movement of the joint through passive exercise, active exercise, and resistance exercise<sup>3)</sup>.

The present study investigated the change in the hip

muscle strength of younger persons before and after neuromuscular joint facilitation (NJF) treatment.

## SUBJECTS AND METHODS

The subjects were forty five healthy young people, who were divided into two groups: a NJF group and a PNF group. The NJF group consisted of 21 subjects (11 males, 10 females), and the PNF group consisted of 24 subjects (11 males, 13 females). 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.

**Table 1.** Subject characteristics<sup>a</sup>

	Age (yr)	Height (cm)	Weight (kg)
NJF <sup>a</sup> (n=21)	20.1 ± 0.6	167.3 ± 8.9	59.2 ± 8.8
PNF <sup>b</sup> (n=24)	19.5 ± 0.5	165.7 ± 8.2	60.5 ± 11.6

Values are mean ± SD. No significant differences between groups at the 0.05 alpha level.

<sup>a</sup>: NJF group: neuromuscular joint facilitation group

<sup>b</sup>: PNF group: proprioceptive neuromuscular facilitation group

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**Table 2.** Before and after intervention comparison of the maximal strength (kg)

	Angular velocity	Maximum extensor strength		Maximum flexor strength	
		before	after	before	after
NJF <sup>a</sup>	60°	22.5 ± 7.7	25.6 ± 9.2**	50.6 ± 18.4	58.7 ± 14.5*
	180°	16.3 ± 7.5	20.5 ± 7.7**	30.4 ± 16.4	35.4 ± 18.0*
PNF <sup>b</sup>	60°	18.3 ± 7.7	19.2 ± 9.0	38.5 ± 10.5	45.2 ± 15.1*
	180°	15.0 ± 6.8	17.1 ± 8.2*	24.3 ± 9.5	23.7 ± 9.0

Values are mean ± SD.

Significant difference after intervention, \*:  $p < 0.05$ , \*\*:  $p < 0.01$

a: NJF group: neuromuscular joint facilitation group, b: PNF group: proprioceptive neuromuscular facilitation group

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 Jilin Dianli Hospital.

We measured the maximal flexor strength and the maximal extensor strength of isokinetic movement of the hip joint. A Biodex System 3 isokinetic dynamometer (Biodex Medical System, USA) was used for all the measurements. Each participant performed a 3-minute warm-up on a cycle ergometer followed by stretching exercises for the lower limbs. Subjects lay supine on the seat with the backrest at a 0-degree angle. Straps were placed over their shoulders and across the waist to ensure the torso was stable. An adjustable lever arm was attached to the subject's right leg with a padded cuff, just proximal to the knee joint. The axis of rotation of the dynamometer arm was positioned just lateral to the femoral epicondyle, and conventional concentric isokinetic tests were performed on the right lower extremity. During the test, the subjects continuously pushed the lever arm of the isokinetic device up and down, through the whole range of motion, between 0° and 100° (0°=straight leg). Each test consisted of a continuous maximal flexion-extension, and was repeated three times. The first was performed at 60°/sec, the second one was performed at 180°/sec. A 3-minute rest was given between tests at each angular speed. To judge the immediate effect, the measurements were performed before and after the intervention.

Four hip patterns of NJF 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 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 and each measure before the intervention. Two-way ANOVA and multiple comparisons (Bonferroni test) were used to test for statistically significant differences, and the factors were intervention and group. If a significant interaction was found, the paired t-test was performed to compare 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 between the NJF group and the PNF group subject characteristics or any of the measures before the intervention (Table 1).

Two-way ANOVA showed there were significant interactions in the maximal extensor strength of 60°/sec and the maximal flexor strength of 180°/sec of the groups, indicating that the change was different between the groups. The NJF group showed significant increases in the maximal flexor strength and the maximal extensor strength after the intervention at each angular velocity. In the PNF group, the maximal flexor strength of 60°/sec and the maximal extensor strength of 180°/sec showed significant increases (Table 2).

## DISCUSSION

The maximal extensor strength and the maximal flexor extensor strength were significantly increased after the PNF and NJF treatments. The functions of the periarticular muscles of the hip joint were improved by the distal resistance. The resistance, the traction and the approximation of the facilitation elements were included in the distal resistance in both groups; therefore, the maximal strength was increased by both the PNF and NJF treatments. The alignment of the hip joint capsule, the functions of the periarticular muscle of the hip joint, and the hip rotation function were improved; therefore, the maximal strengths increased after the NJF treatment. An important difference between the intervention methods was that, the rotation function of the caput femoris was emphasized in the NJF treatment. In the NJF resistance exercise, the caput femoris rotation was drawn out using proximal resistance on the great 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 the increase in strength. Our study provides new evidence that NJF treatment is a more effective exercise than PNF treatment the increasing hip strength. It may serve as a new form of exercise for improving the function of the hip.

Future studies are needed to investigate the change in hip strength after a long period of NJF treatment.

**REFERENCES**

- 1) Anderson JJ, Felson DT: Factors associated with osteoarthritis of the hip in the first National Health and Nutrition Examination survey. *Am J Epidemiol*, 1988, 128: 179–189. [[Medline](#)]
- 2) Sharma C, Dougherty DD, Felson D: The prevalence of patellofemoral and mixed compartment involvement in hip osteoarthritis and their effect on functional status. *J Investig Med*, 1996, 44: 359A.
- 3) Huo M: *Neuromuscular Joint Facilitation*. Tokyo: Ipec press, 2010, p 3.