

# The Immediate Effect of Lumbar Spine Patterns of Neuromuscular Joint Facilitation in Young Amateur Baseball Players

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**Abstract.** [Purpose] The aim of the study was to investigate the changes in baseball pitching velocity, the functional reach test (FR) and the simple reaction times (SRT) in young amateur baseball players after lumbar spine patterns of neuromuscular joint facilitation (NJF) treatment. [Subjects] The subjects were 11 young amateur baseball players. An NJF intervention and a proprioceptive neuromuscular facilitation (PNF) intervention were performed. The interventions were performed one after the other with one week between them. The order of the interventions was completely randomized. [Methods] The baseball pitching velocity, the FR and the SRT were evaluated before and after treatment. [Results] In the NJF group, there were significant differences in baseball pitching velocity, FR and SRT after treatment. In the PNF group, there was a significant difference in SRT after treatment. [Conclusion] NJF intervention shortens the SRT, increases the baseball pitching velocity and FR, and may be recommended to improve performance in baseball players.

**Key words:** Neuromuscular joint facilitation, Baseball pitching velocity, Functional reach test

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## INTRODUCTION

Neuromuscular joint facilitation (NJF) is a new therapeutic exercise based on kinesiology that integrates the facilitation element of proprioceptive neuromuscular facilitation and the joint composition movement with the aim of improving the movement of the joint through passive exercise, active exercise and resistance exercise<sup>1)</sup>. It is used to increase strength, flexibility, and range of movement (ROM) and shorten the electromechanical reaction time<sup>2, 3)</sup>.

In the pitching motion of baseball, power from the lower limbs is relayed, and the power will be relayed to the pitching arm by the trunk as a relay point. In a previous study, the lumbar spine pattern of NJF treatment improved trunk rotation function and balance ability<sup>4)</sup>.

The aim of this study was to investigate the changes in baseball pitching velocity, the functional reach test (FR), and the simple reaction times (SRT) for the young amateur

baseball players after lumbar spine patterns of neuromuscular joint facilitation (NJF) treatment.

## SUBJECTS AND METHODS

The subjects were eleven young amateur baseball players (mean age,  $21.6 \pm 0.5$  years; mean height,  $173.0 \pm 4.0$  cm; mean weight,  $68.4 \pm 11.6$  kg). A NJF intervention (NJF group) and proprioceptive neuromuscular facilitation (PNF) intervention (PNF group) were performed on all subjects. The interventions were performed one after the other with one week between them. The order of the interventions was completely randomized. All subjects were screened before the start of the study by filling out a medical history questionnaire. The questionnaire addressed whether 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 for participation in the study. All experimental procedures in this study were reviewed and approved by the Ethics Review Committee of Jilin Dianli Hospital.

A physical therapist conducted the clinical examination, which included measurement of baseball pitching velocity, the FR<sup>5)</sup>, and the SRT.

When measuring the baseball pitching velocity, the dis-

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tance between the pitching rubber and home plate is 18.44 m according to the officially recognized rules of baseball. The velocities of five balls were measured with the pitchers attempting to pitch into the strike zone as quickly as possible. The averaged value was used for analysis. The pitching velocity measurement instrument used was sports radar gun SR3600 (Dynatec Corporation, Kobe, Japan).

A digital audio player/recorder (Rio Japan, Kawasaki, Japan) was used as an auditory stimulator to measure the SRT. The recording device was a digital voice recorder (Panasonic Corporation, Osaka, Japan). An auditory stimulation file was prepared on a computer in advance. The file was created as a series of 16 warning signals and auditory stimuli (50 ms) using the overtone opinion processing software DigiOnSound5 (DigiOn, Fukuoka, Japan). The file was recorded on the digital audio player/recorder; and the digital audio player/recorder was connected to a digital voice recorder and a headset using a two-socket adaptor so as to form an auditory cue box. The timing of the warning signal was completely random and always sounded 2–5 seconds before the auditory stimulus. The auditory cue box was attached to the abdominal region of the subjects to measure the reaction time. The subjects were required to respond to the auditory cues by loudly saying the word “Pa” as quickly as possible. The headset was placed on the subjects. The warning signal, auditory stimulus and response of the subjects were recorded on the digital voice recorder. The SRT was measured a total of five times consecutively while the subjects sat on a chair. Prior to the experiment, the subjects were informed of what would be done in the experiment, and they performed trial runs to familiarize themselves with the procedure. The data were input into a personal computer, and the DigiOnSound5 sound processing software was used for the analysis.

Four lumbar spine patterns of NJF were used. The patterns were the pelvic anterior elevation-proximal fixation pattern, pelvic posterior depression-proximal fixation pattern, pelvic anterior depression-proximal fixation pattern, and pelvic posterior elevation-proximal fixation pattern. Each pattern was performed three times at random as a passive exercise and as a resistance exercise for the right and left sides of the subjects. In the NJF group intervention, both proximal resistance and distal resistance exercises were performed. In the PNF group intervention, only distal resistance exercise was performed. The intervention was performed by the same physical therapist to avoid individual variations in treatment.

Two-way repeated measures ANOVA was 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 set as 0.05.

## RESULTS

In the NJF group, there were significant differences in

**Table 1.** Comparison of the results of physical tests before and after intervention

		Before	After
PV <sup>a</sup>	NJF <sup>d</sup>	100.7 ± 8.3	103.7 ± 8.9*
(km/h)	PNF <sup>e</sup>	98.8 ± 9.3	99.7 ± 7.7
FR <sup>b</sup>	NJF	40.8 ± 4.9	44.0 ± 4.0*
(mm)	PNF	41.3 ± 6.0	43.3 ± 4.5
SRT <sup>c</sup>	NJF	210.2 ± 3.9	186.9 ± 22.8**
(msec)	PNF	205.1 ± 20.8	177.6 ± 17.6**

Values are means ± SD, \*: p<0.05, \*\*: p<0.01; comparison with before intervention, <sup>a</sup>PV: the baseball pitching velocity, <sup>b</sup>FR: the functional reach test, <sup>c</sup>SRT: the simple reaction time, <sup>d</sup>NJF group: neuromuscular joint facilitation group, <sup>e</sup>PNF group: proprioceptive neuromuscular facilitation group

baseball pitching velocity, FR and SRT after treatment. In the PNF group, there was a significant difference in SRT after treatment (Table 1).

## DISCUSSION

The study investigated the effects of a neuromuscular joint facilitation treatment in young amateur baseball players. After NJF intervention, there were significant increases in the baseball pitching velocity and the FR, and the SRT was shortened after treatment.

An important difference between the interventions methods was that proximal fixation of the lumbar vertebrae of the spines was performed in the NJF group. Mobilization of the lumbar facet occurred as a result of proximal fixation. The function of the lumbar facet was improved by the NJF intervention. Trunk function was improved, the power from the lower limbs was transmitted easily to pitch arm, and the pitching velocity was increased in the pitching motion. This implies that the flexibility of the trunk was improved and that the FR was increased by the proximal fixation.

The shortened SRT means that arousal levels and attentiveness were improved after the NJF intervention and PNF intervention. Therefore, NJF may be recommended to improve performance in baseball players.

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