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The Effects of Static and PNF Stretching on Knee Extension Range of Motion among the 10 to 12 Years Old Boys

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ABSTRACT

Background: The muscles flexibility is an important issue in sport and physical fitness. There are three main stretching methods to extend the muscles flexibility. These methods are static, dynamic, and proprioceptive neuromuscular facilitation (PNF) stretching methods. Many studies have been carried out to compare and study the effects of these methods on the muscles flexibility. It has been shown that the static and PNF methods are better than the dynamic method. However, none of these methods has not been introduced as the preferred method**. Objective:** In this regard, this paper aims at comparing and studying of static and PNF methods stretching on knee extension range of motion among the 10 to 12 years old boys. **Results:** The results demonstrate the effectiveness and ability of the proposed tests on the knee extension range of motion**. Conclusion:** The results of this paper about the effects of static stretching exercises (the first hypothesis) on the knee range of motion corroborate the results of the other researchers. The results of this paper about the effects of proprioceptive neuromuscular facilitation (PNF) stretching (the first hypothesis) on the knee range of motion also confirm the results of the other researchers.

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INTRODUCTION

The muscles flexibility is one of the main issues of physical fitness and has always attracted the attention of sportsmen, athletes, physical education teachers, physiotherapists and rehabilitation specialists. The application of stretching exercises to extend the flexibility is generally based on this idea that these exercises may reduce the incidence, duration, and severity of damages in the muscle-tendon joints (Roberts and Wilson, 1999). Nowadays, the stretching exercises for improving the flexibility are known as an important part of any type of physical activity as well as they increase the flexibility and range of motion (Marek *et al*., 2005). Several stretching methods such as static, dynamic and proprioceptive neuromuscular facilitation (PNF) stretching have shown great effects on increasing the flexibility (Sullivan *et al*., 1992). Extending the range of motion (ROM) and flexibility prevent the injuries and help to perform the optimum performance by the athletics. The researches show that there are differences between the three different methods, including static, dynamic and proprioceptive neuromuscular facilitation (PNF). The studies do not clearly show the superior method, but the static and proprioceptive neuromuscular facilitation stretching are more advised. In the static stretching method, the muscle is stretched to the point of feeling resistance and this status is maintained for a period of time. The static technique holds a muscle or group of muscles at a point or angle for 6 to 60 seconds, but the best time to hold is 30 seconds (Bandy *et al*., 1997). The proprioceptive neuromuscular facilitation method develops the neuromuscular mechanisms through the deep neuromuscular neural receivers. A brief contraction before static stretching of a muscle forms the basis of proprioceptive neuromuscular facilitation method to increase the flexibility. PNF stretching, or proprioceptive neuromuscular facilitation stretching, is a set of stretching techniques commonly used in clinical environments to enhance both active and passive range of motion with the ultimate goal being to optimize motor performance and rehabilitation. The literature regarding PNF has made the technique the optimal stretching method when the aim is to increase range of motion, especially in short-term changes. Generally, an active PNF stretch involves a shortening contraction of the opposing muscle to place the target muscle on stretch. This is followed by an isometric contraction of the target muscle. PNF can be used to supplement daily stretching and is employed to make quick gains in range of motion to help athletes improve performance. Aside from being safe and time efficient, the dramatic gains in range of motion seen in a

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short period of time may also promote compliance with the exercise and rehabilitation program. Some previous researches have shown that the proprioceptive neuromuscular facilitation method provide more flexibility in the muscles in comparison with the other methods (Sullivan *et al*., 1992). Although, some advantages of proprioceptive neuromuscular facilitation method has been demonstrated, but the performance and advantageous of this method has not been still proven (Bonnar *et al*., 2004). Some proprioceptive neuromuscular facilitation methods which have been provided by researchers are contraction-rest, keeping the rest, slow contraction-back-keep-rest and contraction-relaxation-muscle-contractions, muscle-traction-recreation (Osternig *et al*., 1990). The most commonly used method of PNF is SRHR method, the researchers believe that this method provides more stretching and flexibility than the other PNF methods (Hardy, 1985). Between the proposed stretching methods (static, dynamic and proprioceptive neuromuscular facilitation), there are many reasons to opposition with dynamic method. In dynamic method, there is a rapid rise of tension at a short time due to reflecting tensile and this can cause tissue tearing or strain, therefore this method is known as an unusual stretching. Thus, in the most researches, the static and proprioceptive neuromuscular facilitation methods are discussed. However, none of these methods has not been introduced as the preferred method (Bandy *et al*., 1997). In this respect, this paper aims at comparing and studying these two methods. Paper (Nelson and Cornelius, 1991) shows that the effects of 3,6 and10 seconds maximal voluntary static contraction at PNF exercise is not different on the range of motion, although, the three proposed times significantly increase the range of motion. Paper (Schmitt *et al*., 1999) shows that the effect of two periods 6 and 12 seconds of maximal voluntary static contraction on the flexibility of hamstring muscle is not meaningful, in despite of significantly increasing the flexibility. The results for two periods 5 and 10 seconds showed that the effect of six-week maximal voluntary static was different on the range of motion of hip joint. Therefore, in addition of significant differences between the groups with the control group, range of motion in the 10-second experimental group was significantly higher than the other group (Rowlands *et al*., 2003). Paper (Sullivan *et al*., 1992) shows that the different stretching of static contraction is effective on the hamstring muscle and there is no difference between these stretching. Paper (Bonnar *et al*., 2004) shows that PNF has positive effect on the hamstring muscle, but there is no difference between 3, 6 and 10 seconds maximal voluntary static contraction. Paper (Spernoga *et al*., 2001) discusses that PNF method provide more flexibility at range of motion of joint than static and dynamic methods. Paper demonstrated that 30 seconds static stretching increases the range of motion twice of the dynamic method.

Methodology:

The under test population has been chosen from 10 to 12 years old boys who have regularly participated in the sport exercise. The current Semi-empirical study aims at denoting the effects of static and PNF exercises on the knee extension range of motion at 10 to 12 years old boys, and the method is based on the comparing the averages and research project of practice and control groups with pre-test and post-test. The under test population have not participated in the regular exercises, do not have the muscular-skeletal abnormality and have not performed any spinal surgery and did not use the certain medications during the study. Nineteen boys were chosen and they divided into two groups as static stretching group (9 persons) and PNF stretching group (10 persons). The AKET test was performed to measure the range of motion of knee joint. The EXT and FLX motions were also performed during the AKET test and Flexible Leighton Gage was used. In order to increase the accuracy of measuring, the test was performed three times and the average was calculated. The procedure of performing the test was as follows:

•Before the test, the foreign epitopes femoral condyle and the middle of the outer surface of the knee were marked to determine the knee EXT changing and greater tuberosity of femur. Then the test was performed over a hard board with two vertical bars and the leg of person was fixed.

•The leg and joint were fixed at 90 degree and the status of leg was measure and recorded. It is worth mentioning that Flexible Leighton Gage was also installed at the outer surface of the foot and 2.5 cm below of the fibula to measure the flexibility.

•All tests were performed at initial of the day and before the daily activities that mainly lead to warming the body.

•In order to having same condition, the tests of the both groups were performed at one day after ending the exercises.

•The training program consists of 4 weeks and each week 5 days and each day 10 minute slow running warm-up exercise and then twenty minutes of stretching exercises and gentle movement. The knee range of the motion was measured by Flexible Leighton Gage and recorded as pre-test. The population was divided into two groups as static stretching group (9 persons) and PNF stretching group (10 persons).

•The purpose of this study was to investigate two knee stretching techniques specifically 1-the static stretch (ss)(2) the hold-relax techniques of proprioceptive neuromuscular facilitation(HR) to determine if a difference existed in knee range of motion (ROM)following a program of stretching both limbs five days per week for four weeks.

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Hold-Relax Technique:

The hold-relax (HR) technique of PNF involves an isometric contraction of the hamstring muscle group. The subjects leg was passively raised by her partner to point of discomfort. The point of discomfort was defined as a verbal signal from the subject of a feeling of discomfort. The subject then extended the hip against the manual resistance of their partner for five seconds. Each subject was instructed to relax for three seconds before actively moving into the new range of hip flexion. At this time, the subject partner applied light pressure to produce a maximal stretch of the hamstring muscle group. The diagonal patterns selected for the HR technique were diagonal 1 extension (d1) and diagonal 2 extension (d2). In the d1 technique, the subjects knee was extended while the investigator resists hip extension, abduction, internal rotation, and ankle plantar flexion (Figure 2). The isometric contraction was held for five second, followed by three seconds of relaxation before moving into the new range of hip flexion. Each pattern was repeated a total of three times on both limbs. Figures 1 and 2 show this procedure in details.

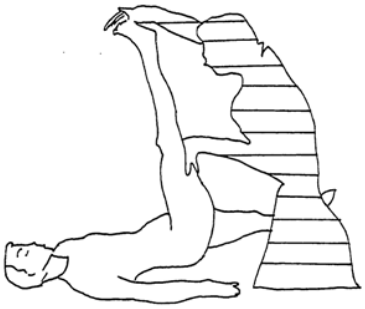

Fig. 1: hold-relax (HR) technique of PNF (first type)

Fig. 2: hold-relax (HR) technique of PNF (second type)

Static stretch:

The static stretching (SS) technique involved the passive stretch of the hamstring muscle group by it an elongated position of stretch, approximately 90 to140 degrees of flexion(Figure 3). From a supine position, the subject s partner passively raised her leg in the sagittal plane into hip flexion to the point of discomfort. This position was also be held 14 seconds. This procedure was repeated two more times on the same limb, with the entire protocol repeated on the contra-lateral limb.

Fig. 3: static stretching technique

Results:

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This research was a semi-empirical study and the static and PNF stretching were considered as independent variable and knee range of motion assumed as dependent variable. For the first hypothesis test, the average of pre-and post-tests at group one was compared by paired T-test and a significant difference was observed. The results for this test case are listed in Table 1. For the second hypothesis test, the average of pre-and post-tests at group two was compared by paired T-test and a significant difference was observed. The results for this test case are listed in Table 2. For the third hypothesis test, regarding the independency of the groups and with regard to this issue that the number of persons at each group is less than 30 people, the T student test was used. For the second hypothesis test, the average of pre-and post-tests at group two was compared by paired T-test and a significant difference was observed. The results for this test case are listed in Table 3.

Table 1: The results of first hypothesis test

Group	Pre-test per degree	Post-test per degree	Extending the range of motion per degree	Calculated Correlation of T	Correlation of T from table	The level of meaningfully	Being meaningful or not
1	62.66	73.11	10.44	9.33	2.306	0.05	

Table 2: The results of second hypothesis test

Group	Pre-test per degree	Post-test per degree	Extending the range of motion per degree	Calculated Correlation of T	Correlation of T from table	The level of meaningfully	Being meaningful or not
2	65.10	74.90	9.8	7.31	2.262	0.05	

Table 3: Comparing the both hypothesis tests

Group	Pre-test per degree	Post-test per degree	Extending the range of motion per degree	Number of persons	Standard deviation	The level of meaningfully
Static	62.66	73.11	10.44	9	2.35	1.11
PNF	65.10	74.90	9.8	10	4.73	1.38

Discussion:

With respect to the proposed results, it can be said that the static stretching has a meaningful and significant effect on the knee range of motion. In additions, it can be seen that the PNF stretching has a meaningful and significant effect on the knee range of motion. The results showed that there is not a significant difference between static and PNF method, while the static method shows better Reponses.

Conclusion:

The results of this paper about the effects of static stretching exercises (the first hypothesis) on the knee range of motion corroborate the results of the other researchers. The results of this paper about the effects of proprioceptive neuromuscular facilitation (PNF) stretching (the first hypothesis) on the knee range of motion also confirm the results of the other researchers. Extending the range of motion (ROM) and flexibility prevent the injuries and help to perform the optimum performance by the athletics. In additions, this paper showed that proprioceptive neuromuscular facilitation (PNF) stretching provides more effects on the knee range of motion (ROM) and flexibility in comparison with the other methods. Thus, in the most researches, the static and proprioceptive neuromuscular facilitation methods are discussed. However, none of these methods has not been introduced as the preferred method. In this respect, this paper compared and studied these two methods.

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