The investigation of mid-term effect of different intensity of PNF stretching on improve hamstring flexibility

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Abstract

Introduction: the aim of this study was investigated of mid-term effect of different intensity of PNF stretching on improve hamstring flexibility. Methodology: seventy five male students with age 18-26 years were selected randomly and divided in five groups: first group was as control, second, third, fourth and fifth groups exerted maximal voluntary of muscle isometric contraction sequentially at 20, 40, 60 and 80 percentages. Experimental groups take a part in CR PNF training for 5 days. Results: research findings showed that there are significant differences between experimental groups in compare with control group after CR PNF training, but there are no significant differences between experimental groups in range of flexibility. Discussion and Conclusion: use of sub-maximal CR PNF training on Hamstring led to more flexibility, also when muscles stretched in this range will be decreased muscles damages probability.

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1. Introduction

Flexibility is considered to be a valuable component of athletic performance and injury reduction. Most of the studies have been conducted to assess the effects of stretching exercises on range of motion (ROM). Stretching is part of many pre-game warm-ups. Several stretching methods, including static, ballistic, and proprioceptive neuromuscular facilitation (PNF), have been shown to increase flexibility (Etnyre & et al., 1986). PNF stretching has been reported to be more effective at improving range of motion than static or ballistic techniques (Wallin, 1985, Funk, 2003). Among stretching techniques, proprioceptive neuromuscular facilitation (PNF) stretching, Which inhibits tonic reflex activity as a limiting factor during stretches, and increases ROM markedly. (Moore & Hutton, 1980; Etnyre and Abraham, 1986; Guissard et al, 1988). Both mechanical and neural adaptation mechanisms are responsible for these changes during stretching (Guissard and Duchateau, 2004). Studies suggest that autogenic and reciprocal inhibition mechanisms occur during the PNF stretching technique application.

There are many variations of PNF stretching. The contract-relax (CR) method is a technique that uses a maximum voluntary isometric muscle contraction (MVIC) followed by relaxation. It has been shown that the most beneficial PNF contraction duration is 3–10 seconds, with six seconds being preferred (Schmitt, 1999). The correct intensity of a stretch has not been well defined, and very few studies have used different intensities in static10 and PNF (Schmitt1999) stretching protocols. Contraction intensities in PNF stretching as low as 50% have been reported to produce similar flexibility gains to MVICs, (Feland, 2004) although the primary purpose of that article was to show alterations in blood pressure. Submaximal contraction intensities could also reduce the risk of contraction induced injuries and delayed onset muscle soreness. To date, there are no studies on the effect of CR PNF stretching.
at different intensity. Therefore, the purpose of this study was to determine the effect of varying intensities (20,40,60 &80%) of contraction used in CR PNF stretching on improving flexibility of the hamstring muscle group.

2. METHODS

2. 1. Participants
This was a randomised controlled clinical trial in which 75 non athletic healthy colleges age 18-26 qualified to participate by exhibiting tight hamstrings (defined as the inability to reach 70’hip flexion in a straight leg raise). We obtained approval from the institutional review board to use human subjects.

2. 1. 1. Measurements
Subjects were then randomly assigned to one of five test groups: 1, control (no stretching); 2, 20% of MVIC; 3, 40% of MVIC; 4, 60% MVIC; 5, 80% MVIC. The subjects were tested each day for five days. Each subject’s hamstring flexibility was measured twice a day, once before and once after stretching using a 12 inch goniometer. All subjects participated in a training session on a Biodex System-3 isokinetic machine one week before actual testing to determine MVIC in a stretch position.

2.1.1.1. Procedure
Participants sat upright at 90’hip flexion. Only the right leg was tested. With the right leg restrained at the mid thigh and ankle, a tester passively moved the lower leg through knee extension until the stretch in the hamstrings began to feel ‘uncomfortable’ to the subject. The isokinetic arm was locked in position, and the subject performed a maximal isometric contraction with the hamstring muscles for six seconds, followed by 10 seconds of relaxation. During the 10 seconds of relaxation, the tester slowly extended the subject’s leg further until the same level of discomfort was felt. If the subject still considered the stretch to be uncomfortable, it was kept at the previous position. The subject then performed two more six second maximal contractions (for a total of three contractions) with 10 second relaxation periods in between. Each subject’s maximum contraction was calculated by taking an average of the four MVIC trials. Participants Laid supine with their left leg straight (being held to the table by an assistant), and their right leg at 90’ hip flexion. The right lower leg was then passively extended to the point of initial resistance, and measured. The same tester took all flexibility measurements, but an assistant recorded the scores so the tester was blinded to previous flexibility measurements of each subject. After recording of initial flexibility levels, the subject then performed three trials on the Biodex as previously explained. All subjects contracted for six seconds followed by 10 seconds of relaxation and further extension. The only varying factor was the intensity of contraction, whether it was 20%, 40%, 60%, or 80% MVIC. Contraction torque was displayed visually as bar-type graph on the computer monitor to allow the subject to visually maintain a 20%, 40%, 60% or 80% contraction for each six second repetition. The 15 control subjects (group 1) were also measured twice with about five minutes between measurements to simulate the time it took to set up and Stretch the subjects in the intervention groups. Dependent T-test was used to Comparison the mean on the pre and post for each group. Multi-way ANOVA was used to Comparison groups

3. Results

The findings of this research (Table 1&2) showed that there are significant difference between pretest and posttest in groups of 20, 40, 60 & 80 percent following the CR PNF stretching. (P<0.05)

Table1: Mean and SD groups

| Variable - groups | control | 20% | 40%  | 60%  | 80%  |
|-------------------|---------|-----|------|------|------|
| flexibility       | Pre test| 66.60±1.80 | 65.20±5.49 | 65.87±5.81 | 61.80±6.46 | 62.67±5.93 |
|                   | Post test| 66.73±1.83 | 73.20±3.29 | 74.33±9.86 | 71.00±3.92 | 71.73±4.24 |
For comparing the groups, first the differences between average marks of flexibility pretest and post test among groups were estimated and then by ANOVA test were compared.

Considering the table No.3, the result of ANOVA test shows the significant difference among groups. For finding the difference, we used Tukey test which its results are shown in table No.4.

### Table 2: Results of t-test in each group

| groups | Variable | f | t. obs | t. cri | N | Significant |
|--------|----------|---|--------|--------|---|-------------|
| control | flexibility | 4 | -0.435 | 2.145 | 15 | Non sig |
| 20% | flexibility | 4 | -7.055 | 2.145 | 15 | sig |
| 40% | flexibility | 4 | -5.590 | 2.145 | 15 | sig |
| 60% | flexibility | 4 | -6.747 | 2.145 | 15 | sig |
| 80% | flexibility | 4 | -4.90 | 2.145 | 15 | sig |

### Table 3: Result of ANOVA test

| Variable | Sources of change | df | F.obs | F.cri | Significant |
|----------|------------------|----|-------|-------|-------------|
| flexibility | The group | 4 | 4.73 | 2.51 | sig |
|         | Within a group | 70 | 4.73 | 2.51 | sig |

### Table 4: Results of Tukey test for flexibility

| Variable | groups | mean difference | SD | Significant |
|----------|--------|-----------------|----|-------------|
| Flexibility | Control-2 | -6.47 | 1.966 | sig |
|        | Control-3 | -7.60 | 1.966 | sig |
|        | Control-4 | -4.27 | 1.966 | sig |
|        | Control-5 | -4.80 | 1.966 | sig |
|        | 2-3 | -1.13 | 1.966 | Not sig |
|        | 2-4 | 2.20 | 1.966 | Not sig |
|        | 2-5 | 1.67 | 1.966 | Not sig |
|        | 3-4 | 3.33 | 1.966 | Not sig |
|        | 3-5 | 2.80 | 1.966 | Not sig |
|        | 4-5 | -0.53 | 1.966 | Not sig |

### 4. Discussion & Conclusion

The Tukey test result showed no significant difference between experimental groups and the only difference observed belonged to control group in comparison with other experimental groups.

The result of this research shows that CR PNF with different intensities of 20, 40, 60 and 80 percent, maximum voluntary isometric muscle contraction cause significant changes in flexibility. Researchers such as Feland and Marin(2004) reported CR PNF as the best way for improving flexibility and mentioned that use of submaximal contraction intensities has better effects on improving flexibility. In research done by Schmitt and et al.(1999), it is suggested that PNF stretching better works when it is submaximal and progressive. Russell and et al.(2004) suggested that changes in the length of soft tissue most likely is neurological rather than stable changes, because other tissues are more resistant toward muscles. In other hand Magnusson and et al(1996) suggested that PNF traction changes the level of tension perceive. Marin and et al(2004) said that among submaximal contraction intensities of 20 and 60 percent, CR PNF contraction of hamstring muscles are like those with 100 percent intensity. Therefore, they suggested using 20 percent intensity because it is easier and the risk of damage is lower. The findings of this study is compatible with Schmitt and et al.(1999), Marin(2004), Magnusson and et al.(1996) researches. In this study, it is shown that using all types of traction intensities have positive effect on flexibility. Although in maximum intensities (60, 80) this change is more. But considering the fact that repeated maximum intensity CR PNF can be harmful, so, CR PNF stretching using submaximal contractions is just as beneficial at improving hamstring flexibility as maximal contractions.
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