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The Effect of Four Different Muscle Stretches on the Flexibility of Hamstring Muscles in University Boys of 18 to 28 Years Old of Mahabad Payame Noor University

[1]Mohammad nasiri, [2]Mansour balavar, [3]Akbar asghari, [4]Aslant khodamoradi and [3]Masoud Imanzadeh

[1]Khoy Branch, Islamic Azad University, Khoy, Iran
[2]High School Teacher of Education Department, Mahabad, Iran
[3]Ardabil Branch, Islamic Azad University, Ardabil, Iran
[4]Malekan Branch, Islamic Azad University, Malekan, Iran

Abstract: Flexibility or stretchiness of soft tissues like muscle, tendon, fascia, joint capsule around the joint is necessary to complete joint movement range during performance activities. To increase flexibility, muscles should be stretched. This study was done to identify the most effective stretch method for returning hamstring flexibility during last possible time in male students of Mahabad Payame Nour University. Sixty 18-28 year old female students were sampled for clinical test. The samples were randomly assigned into four 15-people groups: static stretch, stretch using Hold Relax (HR), Past Isometric Relaxation (PIR), stretch using Reciprocal Inhibition (RI). The stretch lasted for six weeks, 5 days a week and two minutes a day. The movement range of active extension, knee, pasio and flexion of leg was measured by set-square, the distance between hand fingers and toes in sitting state by tape measure, waist column movement in pelvic-waist rhythm by Shuber test and waist Lordez angle by flexible ruler before stretching and in weekly intervals. Then one-side variance analysis and variance analysis were used with repetitive data. Results indicated that the movement range of knee active extension in static stretch group was increased from 155/5°±6/6° to 168/5°±5/5°, as well as HR group from 158.5°±4.9° to 172.5°±5.4°, in PIR group from 156.7°±6. to 169.7°±5.7°, in RI group from 157.1°±6.4° to 168.1°±6.7° ($p<0.0001$). The average range of knee pasio extension in static group was increased from 158.1°±6.8° to 171.8°±4.3°, in HR group from 160.6°±5.5° to 174.7°±5.2°, in PIR from 158.3°±6.4° to 172°±5.6° around in RI group from 159.4°±6.5° to 172.5°±5.8° ($p<0.0001$). The study indicated that none of these techniques has superiority over other techniques for improving hamstring flexibility.

Key words: Hamstring · Stretch · Flexibility · Movement range · Knee

INTRODUCTION

The movement ad flexibility of soft tissues around joints is an important factor to prevent hurting soft tissues [1]. The reduction of the movements leads in increasing cross and tenacity of larger fibers. If one muscle has no movement for a long time, it will lose its natural movement and will shorten due to structural changes of jointed tissues [2]. The new Fibers in Scar tissues will stick together or to other natural tissues if they are not organized in direction of forces against the tissues which limits the movement [3, 4]. Sometimes, the muscle has miasmatic contractor which in there is no special tissue pathology and tendon muscle unit was shortened correspondingly which reduces movement range [5]. Pathologies due to trauma, flamation, bleeding, surgery cut and burn leads in Fibreized tissues which replace natural jointed tissue. So they will lose elasticity and plasticity and length-tension relationship of muscle is changed. Also, muscle is weakened and movement range of joint is reduced. The muscle and soft tissue will be painful due to lack of flexibility [1].

Hamstring group (semi tendinosus, semi membranous and bispas Femurs) are muscles that often are shortened [6]. They surround back thigh and can produce power as much as 22 kg weight (2/4 power of Gluteus Magzimus) [6, 7]. The bispas femur sticks to ligament of Sacrotubruz [8-6]. These ligament and hamstring muscle group have a role in lumbosacral rhythm. The cooperation of these structures and stomach muscles lead in till of back pelvis. Also, their forces hinder forward movement of Sacrum (Notation) so that sacroiliac joint is locked and pelvis can

Corresponding Author: Mohammad nasiri, Khoy Branch, Islamic Azad University, Khoy, Iran.

be fixed [6]. For lifting objects, body flexion is moved so that waist Lordez is flattened. This movement is controlled by exocentric contraction of back-waist extensor muscles. When flexion is 45°, back ligaments are tensier and contraction of extensor muscles is stopped. The continued flexion causes Sacrom flexion among pelvis bones. Bispes forums controls Sacrom flexion and back ligaments of sacroiliac and sacrotobrus limit this movement. The continued flexion of body causes pelvis flexion around width axis of thigh joist (pelvic-waist rhythm) which is controlled by eccentric contraction of hamstring muscles. The shortness of hamstring causes disorder in this rhythm which leads in lumbago [6-8]. Pelvic movements are limited because of hamstring shortness and the most of the movements happen in waist area. So a ligament of waist is extremely stretched and starts to ache. The repetition of these stretches causes instability of waist joints because of stretching of limited ligaments [8].

So far, different ways have been used for increasing flexibility of hamstring muscular group. For example, interrupted and continued ultra sound therapy [9], superficial or deep warmth [10], different static and dynamic stretch technique changing stretch parameters like stretching time duration a day, stretching time every time, the number of stretch a day [11-13]. Despite related studies, there is controversy about the efficiency of different methods of stretching.

Ferber *et al*. (2002) indicated that PNF stretch techniques of facilitating patterns increases flexibility of flexor muscles of knee among elders using deep sense [11,14]. The results of the study done by Bonnar *et al*. [15] indicated that hold-relax stretch technique has more effect on increasing movement range in comparison with static and Ballistic stretch [15]. Spernoga *et al*. [16] believe that PNF stretch techniques increase movement range of related join rather than static, Ballistic and pasio stretches. On the other hand, Webright *et al*. [17] indicated that there is no difference between static and dynamic techniques regarding the improvement of muscle flexibility.

But Bandy *et al*. (1995) indicated 30-second static stretch increases twice as much movement range as dynamic stretch [18]. With respect to the role of Hamstring muscle group in pelvis, waist and knee movements, the effect of hamstring reflexibility reduction on these movements and its disadvantages as well as opposite results of researches, this study was designed. The purpose of this study is the investigation of effects of four different muscle stretch techniques on flexibility of hamstring muscle group 18-28 year aged male students of Zahedan Medical University. So, there were four methods employed: static stretch, stretch using Hold Relax (HR) technique, Post Isometric Relaxation stretch (PIR), stretch using Reciprocal Inhibition (RI) were used to return flexibility of hamstring muscle and obtained results were compared. The hypothesis was that movement range of knee pasio and active extension, flexion of thigh pasio and waist Lordez will be increased using mentioned techniques and waist movement and the distance between hand and fingers and toes will be reduced. Also, the effect of four methods on studied variables will be identical.

MATERIALS AND METHODS

This clinical research was carried out in Mahabad Payame Nour University in 2006. A rudimentary study was made to identify number of samples and 60 students were estimated with 95% confidence and 90% test efficiency. 18-28 year aged male students were selected. The age average of students and standard deviation was: in static stretch group 22.53±2.83, in HR group 22.67±2.74, in PIR group 22.6±2.89 and in RI group 22.7±2.76. The student's hamstring group was short and they did not exercise regularly and there was no stroke or surgery or abnormality in lower parts or spinal column. The participants gave consent in written form. People who did not have hamstring shortness or did not complete treatment sessions, were out liered.

Hamstring Shortness and Flexibility Tests: Two testers who did not have any information about study grouping gave tests. To identify hamstring shortness, the person is positioned in a supine and tester raises the lower part with straight knee and his coworker measures the angle between thigh and horizon surface using set-square. The set squares axis was placed on a big Tracounter, fixed arm along horizon on bed and mobile arm along external Kendal of femur. The angle under 70° was considered as short hamstring [19], so sixty people were selected. Also, thigh pasio flexion was recorded as one of indices of flexibility in hamstring muscle group.

Flexibility index was measured and recorded by set square. To measure the movement range of knee active extension, the person is in supine position and tester places thigh joint in 90° and asks the participants to strain his knee in active way. Then the coworker measures the angle between thigh and foreleg placing Set Square's axis on Femur's external Kendal, fix arm along thigh and mobile arm along ankle. The movement range of knee pasio

extension was measured in this way. But tester himself strained the knee. To measure the distance between fingers and toes, tester asked the participants to touch toes in sedentary position. Tester recorded the distance by tape-measure [20].

The movement range of waist vertebra in waist-pelvic rhythm was measured using Shuber test in blending position. The person is in standing position. The tester joins all top back flank prickles and marks 5cm about and 10cm under the line. The tester asks the participant to blend as much as possible and measure the distance between two mentioned points and calculates the difference [20, 21].

To measure the waist bow, the flexible ruler was used. That is, tester marks two eleventh vertebra and first vertebra of Sacral. To find the first vertebral of Sacral, the average distance of two top black flank prickle can be found which corresponds second Sacral vertebra. To find eleventh vertebra, twelfth rib can lead in twelfth back vertebra. Its above vertebra is eleventh [21]. The ruler is placed between these two points and ruler is pressed into waist bow and there will be curvature in ruler and waist curve will be calculated through following formula:

$$\theta = 4\,[\mathrm{Arctg}\,(2h/l)]$$

θ is considered as arc angle, l as distance between first and last point of arc and has perpendicular [22].

After recording the results by two testers, the participants were randomly assigned into four clinical physiotherapist using succession of numbers. The codes were put in envelopes. Then, following stretch techniques were used for 6 weeks, 5 days a week and one session a day, for all groups. Every session lasted for two minutes but the numbers of stretches were different in different groups. Flexibility indices of hamstring muscle group were measured and recorded. As a whole, every variable was measured 7 times.

Stretch Methods

Static Stretch Group: The person is in supine position and thigh and knee joint is 90° (Lazeg test condition). It is necessary to fix pelvis while stretching in order to prevent pelvic back tilt and extra flexion of waist. So tester must straighten waist on bed. The tester does this pressing the leg downward [20]. The other one catches the above and down part of knee joint and raises the leg to straighten knee in maximum and feel stretch under his hand. The stretch is in gradual manner for 30 seconds not to stimulate stretch reflex and muscles augment. There is a 5-minute-break after every stretch and stretch is repeated for 4 times [1].

Stretch with HR Technique: The person is in supine position. This technique is for D1F (Digonal flexion) pattern of lower part [23]. Hamstring muscle is positioned in its normal condition. Lower part is placed in position pattern that is D1F (thigh muscle in extension, internal turn, abdaxion, knee joint straightened and ankle in plantar flexion), then hamstring isometric contraction is carried out against tester's maximum resistance for 10 seconds. Then the participants are asked to loosen hamstring muscle and to lengthen hamstring in D1F pattern using active contraction of Antagonist muscle group for 15 seconds. There is a 5 minutes break after every stretch and then the stretch is repeated for 8 times [1, 24, 25].

PIR Technique Stretch Group: The person is in supine position and hamstring muscle is along the first resistance against the movement. This will be a superficial isometric contraction against barrier in hamstring muscle for 10 seconds. The participant is trained to use just 1% or 20% of his power. There is equal and opposite resistance by tester and he is asked to breath in and out after contraction and loosen the muscle.

Data Analysis: Data were analyzed through SPSS software. The normal distribution was investigated through Smirnoff Gologrof Test. For in group comparison, one way variance analysis was used. For within group comparison, repeated measure of analysis was used. The significance level set below 0.05.

RESULTS AND DISCUSSION

Mean and standard deviation of the comparison of under study variables in the static stretching group among the amounts of the 1st, 2nd, 3rd, 4th, 5th and 6th weeks of the testing within the group has been shown in Table 1. After fifteen sessions of static stretching, the mean range of active knee Ectonsion ($p<0.0001$), passive thigh bone Floksion ($p<0.0001$), waist Lordez ($p=0.001$) increased and the mean of Shuber changed test ($p=0.004$) decreased. The mean of passive knee Ectonsion ($p=0.004$) increased and space between tip of fingers and foot ($p=0.004$) decreased after 10 sessions.

Table 1: the comparison of under study variables in the static stretching group among the amounts of the 1st, 2nd, 3rd, 4th, 5th and 6th weeks

Statistics	Primary amount	First Week	Second Week	Third Week	Fourth Week	Fifth Week	Sixth Week
Variable	M & SD	M & SD	M & SD	M & SD	M & SD	M & SD	M & SD
Active knee Ectonsion	155.5±6.6	155.7±6.4	156.3±6.5	159.5±5.8	162.7±4.9	165.5±5	168.5±5.5
Passive knee Ectonsion	158.1±6.8	158.5±6.6	159.9±6.1	162.9±5.5	165.9±5	169±4.5	171.8±4.3
Passive thigh bone Floksion	65.0±5.2	65.1±5.1	66.3±4.4	68.7±4.4	71.1±3.8	73.1±3.5	75.8±3.5
Waist Lordez	28.6±9.1	30.4±5.9	30.5±5.9	31.1±5.9	31.7±5.7	32.6±5.7	33.5±5.7
Shuber changed test	22±0.57	21.9±0.55	22±0.55	21.8±0.5	21.6±0.5	21.3±0.62	21.1±0.6
Space between tip of fingers and foot	12±1.8	11.9±1.8	11.7±1.7	11.5±1.9	11.1±1.8	10.6±2.1	10.5±1.8

* shows that numbers with p<0.5 are significant.

Table 2: the comparison of under study variables in the Hold-Relax stretching group among the amounts of the 1st, 2nd, 3rd, 4th, 5th and 6th weeks

Statistics	Primary amount	First Week	Second Week	Third Week	Fourth Week	Fifth Week	Sixth Week
Variable	M & SD	M & SD	M & SD	M & SD	M & SD	M & SD	M & SD
Active knee Ectonsion	158.5±4.9	158.7±5.2	159.1±4.7	161.5±5.2	164.4±5.4	167.5±5.2	172.5±5.4
Passive knee Ectonsion	160.6±5.5	161.1±5.5	162.5±5.8	164.5±5.7	167±4.8	180.9±4.8	174.1±5.2
Passive thigh bone Floksion	67.7±3.9	68.5±4.6	69.4±4.4	71.1±4	72.6±4.2	75.4±4.6	78.8±5.5
Waist Lordez	29.1±6	29.3±6.1	29.4±6.1	30.1±5.9	30.9±6.1	31.9±5.8	33.2±5.3
Shuber changed test	22.3±0.4	22.3±0.36	22.2±0.41	22.1±0.46	21.8±0.52	21.6±0.66	21.2±0.77
Space between tip of fingers and foot	11.6±1.8	11.4±1.9	11.2±1.9	10.9±1.9	10.5±1.9	10±1.9	9.5±1.9

* shows that numbers with p<0.5 are significant.

Table 3: the comparison of under study variables in the PIR stretching group among the amounts of the 1st, 2nd, 3rd, 4th, 5th and 6th weeks

Statistics	Primary amount	First Week	Second Week	Third Week	Fourth Week	Fifth Week	Sixth Week
Variable	M & SD	M & SD	M & SD	M & SD	M & SD	M & SD	M & SD
Active knee Ectonsion	156.7±6.8	156.±57.3	157.5±6.9	159.2±6.3	162.5±6	165.7±5.8	169.7±5.7
Passive knee Ectonsion	158.3±6.4	158.1±6.4	159.4±5.9	161.7±5.3	165.1±4.9	168.5±5.6	172±5.6
Passive thigh bone Floksion	68.7±5.7	68.9±5.3	69.8±5.2	72.2±4.9	74.2±4.6	75.8±4.8	78.7±5
Waist Lordez	35.9±6.9	35.9±6.8	36±6.9	36.7±6.7	37.3±6.5	38.1±6	39±5.8
Shuber changed test	21.8±0.81	21.9±.76	21.9±0.75	21.66±0.71	21.5±0.66	21.4±0.59	21±0.62
Space between tip of fingers and foot	11.5±1.8	11.5±1.8	11.2±1.7	10.9±1.7	10.5±1.7	10.2±1.7	9.8±1.6

* shows that numbers with p<0.5 are significant.

Table 4: the comparison of under study variables in the RI stretching group among the amounts of the 1st, 2nd, 3rd, 4th, 5th and 6th weeks

Statistics	Primary amount	First Week	Second Week	Third Week	Fourth Week	Fifth Week	Sixth Week
Variable	M & SD	M & SD	M & SD	M & SD	M & SD	M & SD	M & SD
Active knee Ectonsion	157.1±6.4	157.3±6.8	157.7±6.8	159.7±6.79	161.9±7	164.8±6.9	168.1±6.7
Passive knee Ectonsion	159.4±6.5	159.9±6.5	160.5±6.4	162.7±6.3	166.1±6.6	169.2±6.4	172.5±5.8
Passive thigh bone Floksion	66.8±3.6	67.2±4	67.5±4.4	68.5±3.9	71.1±4.5	73.8±3.9	76.7±5.1
Waist Lordez	33.1±5.1	33.2±5.2	33.3±5	33.9±5.3	34.5±5.2	35.2±5.2	35.7±5.2
Shuber changed test	22.2±0.54	22.1±5.58	22.14±0.51	22±0.5	21.7±0.51	21.4±0.49	21.1±0.56
Space between tip of fingers and foot	12.7±1.8	12.7±1.7	12.5±1.8	12.3±1.7	11.8±1.6	11.1±1.6	10.6±1.6

*shows that numbers with p<0.5 are significant.

Table 5: p value of the one-side variance analysis test among four groups of static stretching, HR, PIR, RI

Measuring time Variable	Primary amount	first Week	second Week	third Week	Fourth Week	fifth Week	sixth Week
Active knee Ectonsion	0.62	0.65	0.67	0.74	0.69	0.63	0.18
Passive knee Ectonsion	0.68	0.55	0.54	0.6	0.82	0.65	0.61
Passive thigh bone Floksion	0.19	0.13	0.14	0.06	0.16	0.25	0.24
0.01 0.01 0.01 0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Shuber changed test	0.13	0.25	0.28	0.11	0.48	0.55	0.92
Space between tip of fingers and foot	0.23	0.24	0.16	0.16	0.15	0.35	0.21

* shows that numbers with p<0.5 are significant.

Mean and standard deviation of the comparison of under study variables in the HR stretching group among the amounts of the 1st, 2nd, 3rd, 4th, 5th and 6th weeks has been shown in Table 2. After fifteen sessions of stretching with HR technique, the mean range of active (p=0.04) and passive (p=0.01) knee Ectonsion, wrist Lordez (p=0.002) increased and the mean of Shuber changed test (p=0.01) decreased. The passive thigh bone Floksion (p=0.036) increased and space between tip of fingers and foot (p=0.004) decreased after 10 sessions.

Mean and standard deviation of the comparison of under study variables in the PIR stretching group among the amounts of the 1st, 2nd, 3rd, 4th, 5th and 6th weeks has been shown in the table 3. After fifteen sessions of stretching with PIR technique, the mean range of active (p=0.01) and passive (p=0.003) knee Ectonsion, passive thigh bone Floksion (p=0.0001), wrist Lordez (p=0.02) increased. The mean of space between tip of fingers and foot (p=0.005) decreased after 10 sessions of therapy and Shuber changed test (p=0.007) decreased after 25 sessions of therapy.

Mean and standard deviation of the comparison of under study variables in the IR stretching group among the amounts of the 1st, 2nd, 3rd, 4th, 5th and 6th weeks has been shown in the table 4. After fifteen sessions of stretching with IR technique, the mean range of active (p=0.001) and passive (p=0.002) knee Ectonsion, passive thigh bone Floksion (p<0.02) increased. The mean of Shuber changed test (p<0.0001) decreased after 20 sessions of therapy. After 10 sessions of therapy, the amount of the mean of space between tip of fingers and foot (p=0.003) decreased and waist Lordez (p=0.04) increased.

The results show that the variables under study of all four groups are changing (p<0.05) during all weeks.

The p value of the one-side variance analysis test among four groups of static stretching, HR, PIR, RI has been shown in Table 5.

As the results show, there is no significant difference among the movement means of active and passive knee Ectonsion, passive thigh bone Floksion, Shuber changed test and space between tip of fingers and foot (p>0.05) during seven weeks of measuring them. The difference among four groups in the mean of wrist Lordez in every seven sessions were significant (p<0.05). For this reason, the difference and mean of each session of all groups ware evaluated and compared. There was no difference in the mean of the wrist Lordez among groups and of course in the amount of improvement (p>0.05).

DISCUSSION

This study shows that all four groups of stretching (static, HR, PIR and RI) cause increase in the Hamstring flexibility and the movement range of active and passive knee Ectonsion, passive thigh bone Floksion, waist Lordez increased after therapy with four techniques and the degree of wrist movement and space between tip of fingers and foot decreased in comparison with the past degree. So, there were no differences on the effect of all four types of the stretching- static, HR, PIR and RI- on the under investigation variables. The differences in the degree of wrist Lordez in four groups were obvious. As far as there were no differences in the degree of the improvement within groups, these differences were no significant and had no effect on the results of the study.

A number of the other studies advocate that the PNF stretching causes more flexibility of the muscles than the static stretching. Some researchers insisted that because these techniques use active instead of the passive stretching and increase in the range of movement of abilities of PNF techniques is because of decrease in the activities of muscles. It means that the effect of PNF techniques is as a result of reflexive activities decrease [14-16]. The theoreticians emphasized on Nero physics principles and said that stimulation detritals of neurological spindles of muscles or brittle detritals from *glogy* tendon, or both of these detritals are responsible for techniques effects [27-29].some others believe that the reason of more effect of dynamic techniques is increase in metabolic processes. This increases the body temperature and decreases viscosity of the muscles and lets the muscles constrict gradually. The warmed-up muscles incorporate with energies and increase the flexibility of the muscles [30]. But some other research showed that in spite of increase in the range of motion in a group which PNF techniques had been used, electromyography activities of muscles is more than the group which used static stretch [31]. On the other hand, because some researchers showed that static stretch increase range of motion two times more than dynamic stretch and also because of less muscles with static stretch, therapists prefer to use static stretch more [18]. Some say that because of the long duration of the stretch in static stretch and its activities stop, the result of this relaxation is lengthening of the muscles [11, 33]. Some other research showed that ballistic stretch is effective in fast lengthening of the short muscles. But review of the literature shows that there is a threat of stimulation and

this is not a reliable method [33]. Sullivan *et al*. (1992) indicated that there is no difference between PNF stretch technique and other stretch techniques like static and ballistic stretches [34,35]. Webright *et al*. [17] and Bonnar *et al*. [15] also proved that both static and dynamic techniques in creases muscle flexibility and movement range of thigh flexion. Gill *et al*. [36] indicated that every type of hamstring stretch increases movement range of SIR. Spernoga *et al*. [16] believe that the difference in results of different studies is due to differences in research methods and data analysis. Other factors like stretch during, stretch frequency, participants' age have an important role in result of study [11, 37]. Regarding results of studies and preventing effects of these variables, we used identical variables for all four groups. As other researches, this research indicated no difference between static and dynamic stretch. But in this study, first two isometric contraction stretch methods and stretch using antagonist contraction were used which both were based on neurophysiological principles. Second, four different methods were compared which makes this study more comprehensive. Two PIR and RI techniques were used which differ with two already-used techniques. The reason for using PIR and RI techniques is the application of potential power of muscle to benefit the effect of techniques. One of the purposes of these techniques is to suggest relaxation in hyper tone muscles and relaxation stretch [26]. One superficial contraction in opposite direction of barrier happens in hyper tone muscle. It has been indicated that if contraction cover was more than 25% of muscle power, they get shortened instead of postural fibers and for stretching, phase 1 fibers of muscles get mobilized [38]. Other researches have showed that light isometric contractions are adequate for relaxation after contraction and facilitating stretch after contract ion and PIR and RI techniques are more superficial and safer because cramp, tissue damage or pain, is unlikely in light contractions [39]. Lewit [39] indicated that a few fibers get active and others are controlled. Second, in relaxation stage (which in shortened muscle is taken in to new barrier slowly and without stretch), stretch reflex is avoided. This reflex gets active even with pasio stretch and without pain. PIR is reduction subsequent to Short-term isometric contraction in one muscle or muscle group. Using PIR Technique, the effect of continuer reaction to such contraction, muscle and tandon is controlled and are placed in a new length [40]. Liebenson [38] believes that symptoms of existence of PIR receivers are in muscle, not in skin or related joint. RI method is physiologic responses of muscle Antagonists which are in contracted isometric condition.when are muscle is contracted in isometric mallner, it is antagonist is controlled and reduction I immediately observed. So, antagonist of one muscle or shortened muscle group can be contracted isometrically in order to facilitate the movement and to increase movement potential in shortened tissues. Despite knowledge of reciprocal control trend, exact reasons of RI efficiency are not known. When acute or chronic pain disorders controlled contraction of muscle, medical use of Antagonists is valuable[26]. After isometric contraction, either Agonist or antagonist, there is a nostimalation stage for 15 seconds in which, during that, it is easier to return a new condition of joint or muscle because of reduction [26].

CONCLUSION

There are no differences among four stretch techniques: static, HR, RIR and RI, to return hamstring flexibility observed. Hence, it can be concluded that:

- No muscle hurt after dynamic technique was reported and if yes, it had no effect on study results.
- Reflex activity in dynamic stretch methods which have been accepted according to physiologic principles, did not hinder the increase in hamstring muscle flexibility.
- Metabolic trends and other influencing trends in improving flexibility of dynamic in these methods meaningful in comparison with static technique.
- Considering the results of this study and controlling interfering variables, it was indicated that there is no difference among different stretch techniques in spite of different theoretic discussions about effects of the techniques and all of these techniques can be used for stretching hamstring muscle group in considering the patient's condition.
- As mentioned before, the shortness of hamstring muscle group causes pain in knee and waist, so that natural rhythm of pelvic-waist will be disordered and abnormal tensions will be against body's natural structure like back bone. Regarding our life style, these muscles are often in short form and training stretch movements to all people is recommended. In this way, medical expenses will be decreased and work force cut, because of problems due to hamstring muscle shortness, will be decreased.

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