Original Study

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Comparison of Muscle Energy Technique versus Eccentric Training on Hamstrings Extensibility among Adolescent Girls

Smriti[1], Jaspreet Kaur[2], Amandeep Singh[3], Abhay Kapoor[4], Saloni[5]

[1]MPT Student, [2]Associate Professor, [3]Associate Professor, [4]MPT Student, [5]MPT Student, Baba Farid University of Health Sciences, Faridkot.

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Abstract

Background: Hamstrings extensibility is affected as a result of lack of physical activity causing a limitation of extension motion of the knee joint, increases posterior pelvic tilting and reducing lumbar lordosis that can result in nonspecific low back pain.

Aim: To compare the effects of muscle energy technique versus eccentric training on hamstrings extensibility among adolescent girls.

Methods: Based on Inclusion and Exclusion criteria, 60 adolescent girls of age group 15-24 years were assessed & selected using Active Knee Extension Test for a lag in extension of around 20 degrees during performance of the test. The subjects were divided into three groups of 20 each. Group A (Control Group) was given Conventional treatment as Hot Pack as warm up over the Hamstrings muscle for both the lower limbs & Static Stretching. Thereafter, Group B (Experimental Group 1) was given Muscle Energy Technique & Conventional treatment and Group C (Experimental Group 2) was given Eccentric Training & Conventional treatment for total 6 sessions as 3 sessions a week for 2 weeks respectively.

Results: Data was meaningfully assorted through calculation of Mean and Standard Deviation. Thereafter, T test was applied for comparison between the MET group and Eccentric Training group and Control Group. The level of significance was fixed at $p<0.05$. There was significant difference within and between the MET group and Eccentric Training group for both the limbs.

Conclusion: The study concluded that MET was better than Eccentric Training in improving Hamstrings extensibility among Adolescent Girls.

Keywords: active knee extension test, adolescent girls, eccentric training, hamstring flexibility, muscle energy technique, sit and reach

Introduction

As we recognize that adolescence is the period of growth and development of a human framework throughout during which many physical modifications occur, physiologically and physically

Corresponding Author: Smriti, MPT student, Baba Farid University of Health Sciences, Faridkot.

as well. As keeping in with the current edge scenario, girls in this period may develop low back pain due to reasons like postural errors, lack of physical exercise, menstrual disorders, and sedentary way of living etc.[3]. It is found that each sedentariness and really high levels of physical activity have been associated to the occurrence of Low Back Pain in adolescents[11].

The hamstrings muscle group is made up of the semimembranosus, the semitendinosus and the biceps femoris muscles and is accountable for hip extension in conjunction with knee flexion besides providing stability of the hip and knee joints throughout walking[8]. Hamstrings muscle tightness is usually associated with the incapacity of the knee to extend completely when the hip is flexed and is accompanied by discomfort or pain along the posterior thigh or knee[12]. A possible outcome of shortening of the hamstrings is the limited of motion of the knee joint, which bounds a person's ability to run and walk. Furthermore, it will increases posterior pelvic tilting and reduces lumbar lordosis, contributing to a flat back that can bring about low back pain[13].

Flexibility is described as a physical feature accountable for the voluntary execution of greatest joint range of motion either by a single or numerous joints, within the morphological limitations, without any risk of injury. Thus, good flexibility may be of remarkable benefits for both athletic and non-athletic population[5]. Hamstring tightness is considered as the inability to acquire greater than 160° of knee extension with hip at 90° of flexion[19]. Flexibility exercises are considered to increase tissue elasticity, thereby increasing range of motion of certain joints[16]. Mechanical, thermal, ice, stretch and spray, ultrasound, soft tissue massage, short wave diathermy, myofascial release therapy, and muscle energy technique are some of the successful ways of treating hamstring tightness[4].

For this reason physiotherapy is often aims at increasing flexibility of hamstrings9. One of the methods for treatment of shortened hamstrings is Muscle Energy Technique (MET) which is a technique that involves a maximal contraction of muscle followed by a static stretch[7]. MET has been found to be useful in management of trigger points in the myofascial pain and found that MET is very effective in treating myofascial pain and restoring resting length of the affected muscle[18]. MET is a manual technique evolved by osteopaths and is used by several manual therapy professions and is proved to be effective for a variety of purposes such as a lymphatic or venous pump to aid the drainage of fluid or blood thus increasing the range of motion of restricted joints[2]. The benefits of MET include strengthening weak muscles, preparing the muscle for subsequent stretching, restoring normal tone in hypertonic muscles and improved joint mobility[1].

Eccentric Training alludes to muscular action in which muscles are lengthened in a controlled manner. It is likewise referred to as negative resistance training[10]. Eccentric contractions permits the muscle to lengthen naturally and this length is acquired by eccentrically contracting the antagonist muscle to move the joint through complete available range in a slow controlled manner so as to stretch the agonist muscle group[17]. Eccentric Training, involves dynamic muscle contractions that produce force while lengthening. It is an effective training strategy to improve muscle length but also is used to increase in strength and protect against muscle damage[6].

A number of treatment protocols are available for increasing extensibility of Hamstrings muscle. But there is dearth of studies as per peer review about the comparison of the Muscle Energy Technique and Eccentric Training on Hamstrings Extensibility in Adolescent Girls.

Methods

Participants

As per the discussion with the statistician it was determined that a sample size of 60 participants were needed for the present study conducted under Baba Farid University of Health Sciences, Faridkot in 2022. Participants were adolescent girls aging from 15-24 years who were not involved in any routine sports training and conditioning program and had decreased hamstrings muscle extensibility on both the lower limbs. The subjects were free from any pathology, recent trauma and surgery of Lumbar Spine and Lower Limb. Written informed consent were provided by all participants prior to participation.

Procedure

60 subjects were selected by purposive sampling and the subjects were divided into 3 Groups of 20 each as Group A (Control Group), Group B (Experimental Group 1) & Group C (Experimental Group 2).

Hamstrings Extensibility was evaluated on both the lower limbs by using Active Knee Extension Test (AKET) and Sit & Reach Test respectively.

Active Knee Extension Test: The subject was in supine with a strap placed across the anterior superior iliac spines and another across the mid-thigh of the non-testing lower extremity. The subject actively maintains his testing hip at 900 of flexion and the knee fully flexed. The goniometer was aligned with its fulcrum placed at lateral condyle of femur, stationary arm aligned with lateral aspect of thigh and movable arm aligned with lower leg secured with a strap at the thigh and lower leg respectively. The subject was asked to actively extend his knee and readings were obtained at the goniometer.

Sit and Reach Test: The subject was instructed to be in long sitting position with shoes removed with soles of their feet against the sit and reach box. The subject was instructed to perform a smooth forward curling action with both hands over laid in front of them. The subject was instructed to momentarily hold that position when maximal flexion was achieved. The best of three trails were recorded with a rest of 30 sec between the trials.

Group A (Control Group) including 20 subjects were given a Conventional treatment as Hot Pack on Hamstrings muscle over the posterior aspect of thigh of both the lower limbs for 10 min Thereafter, Static Stretching of Hamstrings was given for both the lower limbs with 30 seconds hold for 3 repetitions respectively. Protocol was given for 3 sessions per week for two weeks.

Group B (Experimental Group 1) including 20 subjects were given Conventional treatment as Hot Pack on Hamstrings of both the lower limbs for 10 min. Thereafter, Static Stretching of Hamstrings was given for both the lower limbs with 30 seconds hold for 3 repetitions. Thereafter, Muscle Energy Technique was given. The subjects were made to lie supine. The hip was flexed with the knee extended by the therapist to the position where hamstring stretch sensation was encountered, and moderate isometric contraction of the hamstrings muscle was elicited for five seconds. The subject was asked to relax the muscle so that the knee was further extended to a new barrier. The procedure was given with rest for 5 seconds & hold of 10 seconds for 10 repetitions. Protocol was given for 3 sessions per week for two weeks.

Group C (Experimental Group 2) including 20 subjects were given a Conventional treatment as Hot Pack on Hamstrings of both the lower limbs for 10 min. Thereafter, Static Stretching of Hamstrings were given for both the lower limbs with 30 seconds hold for 3 repetitions respectively. Thereafter, Eccentric Training was given. The subjects were made to lie supine with fully extended legs. Around the heel of the subject a 3 feet long piece of black elastic resistance band was wrapped the ends of the band were held in each hand. This was followed by keeping the opposite knee locked in complete extension and the hip neutral throughout the entire activity. Next the test hip was brought into full hip flexion by pulling on the resistance band attached with the foot and both arms, making sure that knee was locked in full extension at all times. With the pulls the hip into full flexion the subject was instructed to simultaneously resist the hip flexion by eccentrically contracting the hamstring muscle during the entire range of hip flexion. The procedure was given with a hold of 10 seconds for 10 repetitions. Protocol was given for 3 sessions in a week for two weeks.

Results

Table 1: Comparison of PRE and POST intervention values of Hamstrings Extensibility by AKET of Left side

T Test	Left											
	Pre-Test		Post-Test		Pre-Test		Post-Test		Pre-Test		Post-Test	
	Group A	Group B	Group A	Group B	Group A	Group C	Group A	Group C	Group B	Group C	Group B	Group C
Mean	42.75	44.5	42.55	31.60	42.75	45.30	42.55	38.00	44.50	45.30	31.60	38.00
S.D.	7.51	9.18	7.35	8.97	7.51	8.09	7.35	6.46	9.18	8.09	8.97	6.46
t-value	0.66		4.22		1.03		2.07		0.29		2.58	
Result	NS		S		NS		S		NS		S	

Table 2: Comparison of PRE and POST intervention values of Hamstrings Extensibility by AKET of Right side

T Test	Right											
	Pre-Test		Post-Test		Pre-Test		Post-Test		Pre-Test		Post-Test	
	Group A	Group B	Group A	Group B	Group A	Group C	Group A	Group C	Group B	Group C	Group B	Group C
Mean	42.95	42.70	42.75	33.20	42.95	46.40	42.75	39.15	42.70	46.40	33.20	39.15
S.D.	6.03	7.77	5.97	7.59	6.03	4.94	5.97	4.95	7.77	4.94	7.59	4.95
t-value	0.11		4.42		1.97		2.07		1.79		2.93	
Result	NS		S		NS		S		NS		S	

Table 3: Comparison of PRE and POST intervention values of Hamstring Extensibility by Sit and Reach

T Test	Pre-Test		Post-Test		Pre-Test		Post-Test		Pre-Test		Post-Test	
	Group A	Group B	Group A	Group B	Group A	Group C	Group A	Group C	Group B	Group C	Group B	Group C
Mean	5.23	5.55	5.03	17.28	5.23	6.13	5.03	12.13	5.55	6.13	17.28	12.13
S.D.	7.35	8.02	7.02	7.83	7.35	8.25	7.02	8.21	8.02	8.25	7.83	8.21
t-value	0.13		5.20		0.36		2.93		0.22		2.03	
Result	NS		S		NS		S		NS		S	

Discussion

T test was applied for comparison between Group A, Group B and Group C. For groups A and B t value for AKET left was 4.22, AKET right was 4.42, sit and reach was 5.20 which was statistically significant with $p<0.05$. For groups A and C t value for AKET left was 2.07, AKET right was 2.07, sit and reach was 2.93 which was statistically significant with $p<0.05$. For groups B and C t value for AKET left was 2.58, AKET right was 2.93, sit and reach was 2.03 which was statistically significant with $p<0.05$.

The result of Group B which received MET came out to be significant in correlation to the study conducted to see the effect of hamstrings and calf muscles on flexibility and sprinting performance in Sprinters. The above study revealed that effect of MET on the length of hamstrings and calf and shows significant change in sprinting performance when comparing the values of the study. The concept for MET and its practice based applications to lengthen and increase in tissue extensibility produces viscoelastic and structural change. This is followed by astronomically mediated changes in extracellular fluid dynamics and fibroblastic transduction for the therapeutic effect of MET as mentioned by Naik[14].

The result of Group C who received eccentric training came out to be significant in correlation to

the study which compared the effects of eccentric training and static stretch on flexibility of hamstring in high school and college athletes. The group receiving eccentric training showed significantly higher gains in flexibility than the static as well as control group not only from one bout of training, but also over a six week training program. This is because the muscle adapts to the imposed demand of eccentrically training which reduces the injury rates since most injuries takes place during the eccentric phase of activity. Eccentrically training through a complete range of motion, improves the functional ability of the extremity by improving not only the flexibility but also the strength in that range. Also, strength gains from eccentrically training a muscle would also improve the performance.

Eccentric training is strengthening the muscle by contracting it as it lengthens. A patient eccentrically training through a complete range of motion will be gaining range of motion and strength at the same time, thus, making the activity more functional. This type of training is also time saving by combining the strengthening and flexibility components into one activity as mentioned by Nelson[15].

The comparison between all the three groups i.e. Group A (control group), Group B (MET) and Group C (Eccentric training) showed significant improvement of hamstring flexibility in adolescent girls of group B and group C, whereas, Group A did not show any improvement. The improvement was more in Group B who received MET for hamstring than group C which received Eccentric Training.

Conclusion

On the basis of the results, it can be concluded that, the current study showed evidence to state that MET provided highest gains for hamstring extensibility in adolescent girls followed by eccentric training group than the control group.

Ethical Clearance: Taken from Institutional Ethical committee, Baba Farid University of Health Sciences, Faridkot.

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