Multi-Disciplinary Journal
ISSN No- 2581-9879 (Online), 0076-2571 (Print)
www.mahratta.org, editor@mahratta.org

Effect Of Nordic Hamstring Exercise And Sciatic Nerve Slider Technique Neural Mobilisation On Hamstrings Tightness In Athletes: A Randomised Clinical Trial

Authors Dr.Shikha Paasi [1], Dr. Sarana Souza Monteiro [2]

1. Dr.Shikha Paasi , Faculty Tilak Maharashtra Vidyapeeth, Pune-37
Email:Shikhavpaasi@Gmail.Com
2. Dr. Sarana Souza Monteiro

ABSTRACT

BACKGROUND: The aim of Nordic exercise is to strengthen the hamstrings, glutes and core muscles.Slider is a neurodynamic manoeuvre which produces a sliding movement of the nerves in relation to their tissues. The Objective of the present study is to find out the effectiveness of Nordic Hamstring Exercise and sciatic nerve slider technique neural mobilization on hamstring tightness in relation to an athlete's functional performance. **METHODOLOGY:** All subjects were recruited after meeting the inclusion and exclusion criteria. 48 participants were allotted and divided into group A,B and C. 16 in group A received Nordic Hamstring Exercise, 16 in group B received sciatic nerve Slider technique neural mobilisation and 16 in group C received Nordic Hamstring Exercises and Sciatic Nerve mobilisation for a period of 2 weeks. All the outcome measures were measured at pre and post intervention. **RESULTS:** In the present study, statistical significance was achieved within the three groups in sargent jump test(SJT)(p<0.05) Lower extremity functional test(LEFT)(p<0.05),Active knee extension test of right leg (AKET)(p=0.0001) along with Hand held dynamometer(HHD)for right leg. In between the groups, statistical significance was seen in between group A and B for AKET in right leg, between group A and C and B and C for AKET of left leg, between group A and C for HHD of right leg. **CONCLUSION:** Group C has not shown any added benefits as compared to the benefits obtained by the interventions when performed individually.

KEY WORDS: Hamstring tightness, Nordic eccentric hamstring exercise, Sciatic nerve slider technique neural mobilization.

Introduction

The hamstrings muscles form the posterior compartment of the thigh. They consist of 3 muscles which are semimembranosus, semitendinosus, biceps femoris and Ischial part of adductor magnus.[1]Tightness of these muscles increase the incidence of severe strains or contribute to problems in sports like high hurdling, sprinting or martial arts[2] The hamstrings are predominantly phasic muscles, which react to small repetitions and dominant movements[1]. These muscles primarily control the forward swing of the leg during the terminal swing[3].Weak and tight posterior thigh muscles are prone to stresses during exercise or game. Strong, flexible hamstrings are known to enhancespeed and increase flexibility for sprinters, runners, footballers, and cyclists[4].

An eccentric muscle contraction occurs when muscle lengthens while under tension or resistance[5].The Nordic hamstring exercises are eccentric in nature.The aim of Nordic exercise is to strengthen the hamstrings, glutes and core muscles[6].

The nerve supply of the hamstring muscles is the sciatic nerve[1]. Hamstring tightness are not always the source of the problem. The symptoms can also come from nerve entrapment/ compression most commonly of the sciatic nerve[2].Neural mobilisation is a gentle movement technique used by physiotherapiststo restore the dynamic balance between the relative movement of neural tissues and surrounding mechanical interfaces, thereby promoting optimal physiological function[7].Slider is a neurodynamic manoeuvre which produces a sliding movement of the nerves in relation to their tissues. The slider maneuver is performed by applying pressure at one end of the nerve tract while tension is released at the other[8].

There is a dearth in literature on studies done to evaluate the combination of Nordic eccentric hamstring exercise and sciatic nerve slider technique neural mobilization and hence the present study is to find out the effectiveness of Nordic Hamstring Exercise and sciatic nerve slider technique neural mobilization on hamstring tightness in relation to an athlete's functional performance.

Methodology

Data was collected from various grounds in, Belagavi ,KarnatakaThe design of the study was a randomised clinical trial with a Non Probability Sampling Design. The sampling method was sample of convenience, where allocation of the participants was done randomly using envelope method. The sample size was 48 participants, 16 in group A received Nordic Hamstring Exercise, 16 in group B received sciatic nerve mobilisation and 16 in group C received Nordic Hamstring Exercises and Sciatic Nerve mobilisation. The duration of the study was for 3 months.Both male and female athletes between the age of 18-25 years, with hamstring tightness and willingness to participate in the study were included.Those with previous history of hamstring, hip or knee related injuries in the last 6 months were excluded from the study.

Procedure

An approval for the study was obtained from the Institutional Ethical Committee. Subjects were recruited as per the inclusion citeria. An informed consent was obtained from the subjects. Subjects were randomly allocated into three groups by using envelope method.

Group A performed Nordic eccentric hamstring exercises for 2 weeks with 1 session per day, in the first week, and two sessions in the second week, starting with 5 repeitions in the first week and addition of 1 repeition each day till end of 2 weeks, according to the time taken by the athelete to complete the repetitions.

Group B performed sciatic nerve mobilisation over a 2 week period, 3 minutes per session once a day, in the first week, increasing with 2 sessions in the following week for a duration of 6 minutes

Group C performed a combination of Nordic eccentric hamstring exercises and sciatic nerve mobilisation over a 2 week period, 6 minutes a session. Following week the sessions were increased twice a day.
In all the three groups, The intervention began after a general athletic warm-up of 10 minutes.

The procedure for the intervention was:

NORDIC HAMSTRING EXERCISE: The Nordic hamstring exercise needed the help of a partner. The beginning position needed the athlete to start on his knees, with kneesflexed at 90 degrees, the hip were slightly flexed, and astraight trunk with the arms across the chest.The partner held the ankles of the athlete to the floor during the course of the exercise. The athlete then pushed forward from the

knees, holding the falling position for as long as possible. As the athlete's upper trunk approached the ground surface the hands were quickly extended towards the ground to resist the fall, letting the chest touch the ground.On finishing one repetition, the athlete immediately returned to the beginning position by pushing themselves up using their upper limbs.[9]

NEURODYNAMIC SLIDING TECHNIQUE OF SCIATIC NERVE: Subjects were made to lie supine with their neck and thoracic spine supported in a forward flexed position. Concurrent hip and knee flexion along with ankle dorsiflexion were made to alternate dynamically with concurrent hip and knee extension along with ankle plantar flexion for 180 seconds on both the extremities.[10]

OUTCOME MEASURES:

SARGENT JUMP TEST:The sargent jump test measured the explosive strength of the lower limb alongwith their jumping height[11].

ACTIVE KNEE EXTENSION TEST : It assessed the range of active knee extension in the position of hip flexion.[12]

LOWER EXTREMITY FUNCTIONAL TEST: 8 multidirectional skills were performed in a standard sequence of 16 steps between targets[13].

The 8 skills incorporated in the LEFT included:

1.Forward running **2.**Retro running **3.**Side shuffling **4.**Carioca **5.**Figure 8 running **6.**45^{o} and 90^{o} cutting **7.** 90^{o} Crossover cutting

HAND HELD DYNAMOMETER: The procedure for the measurement of the strength of the hamstrings was assessed while the patient was in prone position and asked to flex the knee using the Hand-held Dynamometerusing the reference of a study conducted on the test-retest reliability of hand-held dynamometry during a single session of strength assessment[14].

STASTICAL ANALYSIS: Various statistical measures such as mean, standard deviation, and test of significance such as paired t-test were used. Nominal data from subject's demographic data i.e. age, weight and height were compared using ANOVA test. Comparison of the pre intervention and post intervention outcome measures within the 48subjects was done byone –way ANOVA test.

Table 1 : INTRA GROUP COMPARISON USING ONE WAY ANOVA

Outcome Measures	Groups	Mean pre-test	Mean post-test	Mean difference	p-value
S.J.T (in cms)	A	246.59	249.5	2.91	0.0037*
	B	244.06	253.96	9.9	0.0087*
	C	257.61	266.06	8.45	0.0001*
A.K.E.T (in degrees) For Right Leg	A	50.13	58.13	8	0.0001*
	B	48.13	62.44	14.31	0.0001*
	C	51.25	64.38	13.13	0.0001*
A.K.E.T (in degrees) For Left Leg	A	54.44	59.06	4.63	0.0076*
	B	54.69	58.69	4	0.2566
	C	58.75	71.63	12.8	0.0001*
L.E.F.T (in mins/secs)	A	1.78	1.53	0.26	0.0093*
	B	1.94	1.82	0.12	0.0498*
	C	1.74	1.55	0.19	0.0067*
H.H.D (inpounds) For Right Leg	A	23.49	24.08	0.59	0.5103
	B	20.66	19.1	-1.56	0.0230*
	C	25.19	23.44	-1.76	0.0487*
H.H.D (in pounds) For Left Leg	A	22.49	24.44	1.94	0.0268*
	B	20.36	20.48	0.11	0.9319
	C	22.9	23.02	0.13	0.8912

*p<0.05

Table 2 :INTER- GROUP COMPARISON ANALYSIS USING TUKEYS MULTIPLE POSTHOC PROCEDURE

OUTCOME MEASURES	INTER-GROUPS	MEAN *p* VALUE PRE-TEST	MEAN *p* VALUE POST-TEST	MEAN *p* VALUE DIFFERENCE
S.J.T (in cms)	A v/s B	0.9241	0.8245	0.0645
	A v/s C	0.2349	0.0818	0.1706
	B v/s C	0.1165	0.2526	0.8819
A.K.E.T (in degrees) Of Right Leg	A v/s B	0.8226	0.2913	0.0412*
	A v/s C	0.9399	0.0816	0.1154
	B v/s C	0.6229	0.7747	0.8849
A.K.E.T (in degrees) Of Left Leg	A v/s B	0.9957	0.9949	0.9811
	A v/s C	0.2844	0.0061	0.0457*
	B v/s C	0.3264	0.0047	0.0293*
L.E.F.T (in mins/secs)	A v/s B	0.5993	0.0200	0.3649
	A v/s C	0.9664	0.9668	0.7825
	B v/s C	0.4480	0.0367	0.7642
H.H.D (in pounds) For Right Leg	A v/s B	0.1929	0.0007	0.1358
	A v/s C	0.5412	0.8636	0.0500*
	B v/s C	0.0188	0.0030	0.9819
H.H.D (in pounds) For Left Leg	A v/s B	0.4390	0.0500*	0.4276
	A v/s C	0.9718	0.6650	0.4349
	B v/s C	0.3180	0.2775	0.9999

*p<0.05

Results:

In this present study, a total of 48 subjects were randomly allocated in 3 groups , Group A, Group B and Group C. Each had 16 athletes. The distribution of male atheletes in group A was62.50% and female athletes it was 37.50%. I n Group B, the percentage of males was 50% and females was 50%. In group C, the distribution of Males was 68.75% and females was 31.25%

Comparison of Age, weight and height of the subjects in the study was done using the ANOVA test. The age of the participants was between of 18 to 25 years. The mean age of the athletes in group A was 20.19±2.20, in group B was 20.56±1.79 and in group C it was 20.88±2.03. The mean weight of athletes in group A was 55.19±9.13, in group B was 54.50±6.71 and in group C was 62.31±7.60. The mean Height in group A was 166.89±12.07, in Group B it was 164.94±9.99 and in group C was170.63±8.66.

Discussion:

The present Randomized Clinical Trial was aimed to study the effectiveness of Nordic Eccentric Hamstring Exercise and Sciatic nerve slider technique neural mobilization on athletes with hamstring tightness for a period of 2 weeks in terms of increased Active Knee Extension Test using the universal Goniometer, strength improvement of hamstring muscle using the Hand Held Dynamometer, evaluation of their functional performance using Lower Extremity Functional Test and Sargent Jump Test.

In Group A significant improvement was found within the group for all the variables. This is supported in the study which conducted a 10 week randomized trial comparing eccentric v/s concentric strength training in well trained soccer players. The results showed that Nordic Hamstring training for 10 weeks was more effective in developing maximum eccentric hamstring strength in well trained soccer players than a comparable program based on traditional hamstring curl. The difference between this study and the present study is the duration of the intervention which was for 10 weeks and for 2 weeks in the present study and that in the previous study the strength of the hamstring was measured by isokinetic strength dynamometer and in our present study we used the Hand Held Dynamometer which measured the strength of the hamstrings concentrically. The number of repetitions used in the above mentioned study was 2 sets of 6 repetitions to 3 sets of 8 repetitions over 4 weeks and the increasing the load during the final 6 weeks of training. In the present study, it was started with 1 set of 5 repetitions progressed by 1 additional repetition on each following day and was doubled in the second week with 2 sets a day[15]. Group A has shown statistical significance in the increased strength of the left leg compared to the right leg. The reliability and validity of the hand held dynamometer was proved by a study to measure the lower extremity strength in older adults. It was concluded that Hand held dynamometer is a reliable and a valid tool for measuring strength at the hip and knee in older adults[16].

As mentioned by the previous studies, Nordic exercises have proven to increase the strength of the hamstrings thus by eccentrically training the hamstrings, the present study showed an increase in the explosive strength of the hamstrings which was measured by Sargent jump test[17].

Group A has shown statistical significance in the Active knee extension test of both the right and left leg, however clinically right leg has shown a higher significance. The reason could be stated as the right leg was the dominant leg for most of the subjects as it already had a good amount of flexibility as compared to the left leg which is supported by a study done by Ross Clark et al in the year 2005[18].

Group A has shown statical significance in the Lower extremity functional test. A prospective , randomized study was conducted, comparing the effects of walking and forward lunges performed while jumping on hamstring and quadriceps strength and function on thirty two soccer players. Forward lunges are eccentric in nature and do not require any equipment to be performed. The study concluded that both jumping and forward lunges improved hamstring strength and sprinting speed in soccer players[19]. Group A of the present study which performed the Nordic eccentric hamstring exercises also showed improvement in the running speed and hamstring strength. Thus our present study is in agreement with the above mentioned study.

Group B has shown a statistical significance in Sargent Jump Test, Lower Extremity Functional Test, Active Knee Extension Test in the Right leg and hand held dynamometer of the Left leg.

A study was conducted on Immediate Effects of Neurodynamic Sliding versus Muscle stretching on Hamstring Flexibility in Subjects with Short Hamstring Syndrome. The subjects performed the sciatic nerve slider technique neural mobilization for a period of 180 seconds on the dominant lower extremity. This study was used as a reference for setting the duration of the neurodynamic sliding of the sciatic nerve for the present study which was done for a duration of 3 minutes i.e 130 seconds but on bilateral lower extremities in the first week, which then progressed to 6 minutes each lower extremity in the second week[10]. The results of the above stated study stated that the neurodynamic sliding technique improved hamstring flexibility in more amounts than static stretching[10].

A study was conducted on Flexibility Associated with Improved Sprint and Jump Performance concluded that increased hamstring flexibility was associated with a decrease in the vertical jump height[20], which is in disagreement with the present study where there was a significant increase in post values of Sargent jump test in Group B.

A study conducted on Flexibility and Its Effect on Sports Injury and Performance concluded that decreased flexibility has been associated with increased in-line running and walking economy[21] which is in disagreement with the present study where increased flexibility has shown increase in running speed measured by Lower Extremity Functional Test.

Another study conducted by Saurabh Sharma et alon Short Term Effectiveness of neural sliders and neural tensioners concluded that neural sliders and tensioners are both effective in increasing hamstring flexibility which was measured by knee extension angle in degrees[22]which is in agreement with the present study where neural sliders showed an increase in hamstring flexibility on the Right leg which was measured by the Active Knee Extension Test in degrees.
There are no studies done to show that Sciatic nerve slider technique neural mobilization increases the strength of the hamstring muscle, however the present study has shown an increase in the strength of the hamstring on the Left lower extremity using the Hand Held Dynamometer.
The above results have proved to show an increase in the strength of the hamstrings by using Nordic Eccentric Hamstring exercise individually and increase in hamstring flexibility was noted using sciatic nerve slider technique neural mobilization when performed individually, but the present study which was aimed at seeing the effect of the combination of the two interventions denoted as Group C did not show any added benefits as compared to the interventions when performed individually. A probable reason for this could be overlapping of both the interventions where a situation known as quadriceps dominance occurs where the quadriceps muscle overpowers the action of the hamstrings.

Conclusion

This study concluded that the combination of the 2 interventions did not provide any added benefits as compared to the benefits provided by the interventions when performed individually.

Acknowledgement

The authors would like to thank all subjects who participated in the study .

Conflict of Interest

None

References

1.Chaurasia, B.D. HumanAnatomy,Volume 2, Lower Limb,Abdomenand Pelvis. 5th ed. New Delhi: CBS Publishers and Distributors, 2010:93,97

2. laungani D. Hamstring Tightness and L.B.A [Internet]. Physio Rehab. 2015 [cited 25 February 2016]. Available from: http://physiorehab.in/hamstring-tightness/

3. Kisner, Carolyn, and Lynn Allen Colby. TherapeuticExercise, Foundations and Techniques. 5th ed. New Delhi: Jaypee Brothers Medical Publishers, 2007.

4. Greenwood athletic club. Why is hamstring flexibility and strength so important? [Internet]. 2015 [cited 25 February 2016]. Available from: http://www.greenwoodathleticclub.com/blog/2015/01/14/why-is-hamstring-flexibility-and-strength-so-important/

5. Levangie P, Norkin C. Joint Structure and Function, A comprehensive Analysis. 4th ed. New Delhi: Jaypee Brothers Medical Publishers Ltd; 2006.
6. Potter G. the nordic hamstring attack [Internet]. t nation. 2013 [cited 25 February 2016]. Available from: https://www.t-nation.com/training/nordic-hamstring-attack

7. Ellis RF, Hing WA. Neural mobilization: a systematic review of randomized controlled trials with an analysis of therapeutic efficacy. Journal of manual & manipulative therapy. 2008 Jan 1;16(1):8-22.

8. Shacklock M. Clinical Neurodynamics. London: Elsevier; 2005.

9. Sayers A, Sayers B.The Nordic Eccentric Hamstring Exercise for Injury Prevention in Soccer Players. National Strength and Conditioning Association. 2008;30(4).

10. Castellote-Caballero Y, Valenza MC, Puentedura EJ, Fernández-de-Las-Peñas C, Alburquerque-Sendín F. Immediate effects of neurodynamic sliding versus muscle stretching on hamstring flexibility in subjects with short hamstring syndrome. Journal of sports medicine. 2014 Apr 15;2014.

11. topendsports. Vertical Jump Test (Sargent Jump, Vertical Leap) [Internet]. 2016 [cited 25 February 2016]. Available from: http://www.topendsports.com/testing/tests/vertjump.htm

12. l1. Wood R. Hamstring Flexibility Test [Internet]. Topend Sports. 2008 [cited 26 February 2016]. Available from: http://www.topendsports.com/testing/tests/flex-9090.htm

13. Tabor MA, Davies GJ, Kernozek TW, Negrete RJ, Hudson V. A multicenter study of the test-retest reliability of the lower extremity functional test. Journal of Sport Rehabilitation. 2002 Aug 1;11(3):190-201.

14. Bohannon RW. Test-retest reliability of hand-held dynamometry during a single session of strength assessment. Physical therapy. 1986 Feb 1;66(2):206-9.

15. R, Mjolsnes et al. "A 10 Week Randomized Trial Comparing Eccentric Versus Concentric Hamstring Strength Training In Well Trained Soccer Players". ScandJmedSci Sports 14 (2004): 311-317.

16. Arnold CM, Warkentin KD, Chilibeck PD, Magnus CR. The reliability and validity of handheld dynamometry for the measurement of lower-extremity muscle strength in older adults. The Journal of Strength & Conditioning Research. 2010 Mar 1;24(3):815-24.

17. de Salles P, Vasconcellos F, de Salles G, Fonseca R, Dantas E. Validity and reproducibility of the sargent jump test in the assessment of explosive strength in soccer players. Journal of human kinetics. 2012 Jun 1;33:115-21.

18. Clark R, Bryant A, Culgan J, Hartley B. The effects of eccentric hamstring strength training on dynamic jumping performance and isokinetic strength parameters:a pilot study on the implications for the prevention of hamstring injuries. Physical Therapy In Sport. 2005;6:67-73.

19. Jönhagen S, Ackermann P, Saartok T. Forward lunge: a training study of eccentric exercises of the lower limbs. The Journal of Strength & Conditioning Research. 2009 May 1;23(3):972-8.

20. Skaggs J, Joiner E, Pace J, Sini M, Skaggs D. Is Flexibility Associated with Improved Sprint and Jump Performance. Annals of Sports Medicine and Research. 2015;.

21. Gleim GW, McHugh MP. Flexibility and its effects on sports injury and performance. Sports medicine. 1997 Nov 1;24(5):289-99.

22. Sharma S, Balthillaya G, Rao R, Mani R. Short term effectiveness of neural sliders and neural tensioners as an adjunct to static stretching of hamstrings on knee extension angle in healthy individuals: A randomized controlled trial. Physical Therapy in Sport. 2016 Jan 31;17:30-7.