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Effectiveness of Nordic hamstring exercise versus muscle energy technique on improving hamstring flexibility among college students

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Abstract
Aim: To study the effect of Nordic hamstring exercise and muscle energy technique on hamstring flexibility among college students.
Background: Hamstring tightness is one of the common faced problem among college students due to their sedentary life style. Hamstring tightness is associated with severe musculoskeletal overuse injuries. Thus, one need to know the most effective and efficient technique to increase hamstring flexibility.
Method and Methodology: This comparative study was conducted on 30 individuals among college students according to inclusion and exclusion criteria. They were divided into two group through convenient sampling. Group A[n=15] received Nordic hamstring exercise and Group B[n=15] Muscle energy technique with conventional exercises for 2 weeks. Functional outcomes were measured before and after the treatment period using popliteal angle measurement respectively.
Result and Conclusion: The study concluded that both the Nordic hamstring exercise and Muscle energy technique are proven effective to improve hamstring flexibility, but Group received Nordic hamstring exercise indicates more effectiveness in comparison with group received muscle energy technique to improve hamstring flexibility among college students.

Keywords: Hamstring flexibility, nordic hamstring exercise, muscle energy technique, college students, popliteal angle measurement

Introduction
Hamstring tightness is a frequent musculoskeletal problem in young adults, particularly among college students, due to prolonged sitting and reduced physical activity [1, 2]. The hamstring group—semitendinosus, semimembranosus, and biceps femoris—is crucial for hip extension, knee flexion, and postural stability [3]. Limited flexibility not only impairs athletic performance but also alters pelvic tilt and lumbar curvature, increasing the risk of low back pain and lower-limb injuries [4].
Risk factors for hamstring strain include modifiable elements such as reduced flexibility, strength imbalance, and inadequate warm-up, as well as non-modifiable factors like age and previous injury [5]. Among flexibility assessment tools, the popliteal angle test is widely used for its reliability in identifying hamstring tightness [6].
Two effective interventions have been identified in the literature: Nordic Hamstring Exercise (NHE), an eccentric strengthening method shown to reduce injury risk and improve muscle extensibility [7], and Muscle Energy Technique (MET), a manual therapy utilizing voluntary muscle contraction to enhance flexibility via neuromuscular mechanisms [8].
This study compares the effects of NHE and MET on hamstring flexibility in college students, aiming to provide evidence-based recommendations for injury prevention and rehabilitation strategies.

Materials and Methods
Materials Used
- Consent form
- Pen
- Paper
- Universal goniometer
- Mat

- Stop watch
- Couch

Study Design
This study was a comparative study

Study Setting
This study was conducted on SRIPMS college of physiotherapy, Coimbatore, Tamil Nadu.

Study Duration
This study was carried out by a period of 6 months

Treatment Duration
This study consists 12 sessions of training done for the period of 5 weeks.

Study Sampling
Convenient sampling method

Sampling Method
30 subjects were assigned into two groups
Group A-Received Nordic Hamstring Exercise
Group B-Received Muscle Energy Technique

Selection Criteria
Inclusion Criteria
1. Male and Females
2. Subjects with Hamstring Tightness
3. Age 18-25 years
4. Inability to achieve greater than 145 degree of knee extension with hip at 90 degree of hip flexion.
5. Subjects who are cooperative and willing to participate

Exclusion Criteria
1. History of lower limb injury within the previous 12 months
2. Any recent surgery of lower limb
3. Any pathological dysfunction
4. Recent history of orthopedic disorder affecting lower limb (femoral fracture, meniscal injury and ligament injuries)
5. Neurological dysfunction

Variables
Independent variable
- Nordic Hamstring exercise
- Muscle Energy Technique

Dependent variable
- Hamstring flexibility

Outcome Measure
Popliteal Angle Measurement

Popliteal Angle Range Measurement
The patient was in supine lying position on the plinth with neck in neutral and arms resting on the side and hip knee 90-90 degree. The therapist stands on the side to be tested and placed the stationary arm of the goniometry parallel to the femur and the movement arm parallel to the fibula. The therapist passively performed passively performed passive knee extension and measures the range pre-treatment and post treatment.

Procedure
Group A: Nordic Hamstring Exercise
Subject position: Hip and knee in 90-90 position with an erect position. The researcher secured the subject's ankle throughout the procedure. The participant then fell forward from the knee, resisting the fall for as long as possible with hamstring. As the participant's upper body approached the couch, the hands were quickly turn out to buffer the fall, letting the chest touch the couch. The participant had to keep the hip slightly flexed position throughout the movement. On completion of movement, the participant had to immediately return to starting position by thrusting themselves back up using their hands to minimize loading in the concentric phase. The exercise had to perform on relatively soft surface.

Group B: Muscle Energy Technique
Subject Position: Lying in the supine position, hip flexion and knee extension

Contacts: One hand on ankle joint and one hand above knee Direction of movement: Alternating hip flexion and knee extension with hamstring muscle passive stretch.

Holding time: 7 to 10 seconds, Repetition: 2

Duration: The technique was carried out for a duration of 3 month (2 days/week for first 1 weeks, 5 days/week for next 2 weeks and 4 days/week for last 2 weeks) approximately 1 hour per each session

Statistical Tool
Data collected from participants of the same group (intra group) were analyzed using paired 't' test and the difference between the 2 groups (inter group) were analyzed using independent 't' test. Difference was considered significant at the level of 0.05%.

Dependent 't' test
The 't' value was calculated using the formula,

$$s = \sqrt{\frac{\Sigma d^2 - (\bar{d})^2 n}{n-1}}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

Independent 't' test
The 't' value was calculated using the formula,

$$t = \frac{\overline{x_1} - \overline{x_2}}{s} \frac{n_1 n_2}{n_1 + n_2}$$

$$s = \sqrt{\frac{\sum(x_1 - \overline{x_1})2 + (\mathrm{x}_2 - \overline{\mathrm{x}_2})2}{n_1 + n_2 - 2}}$$

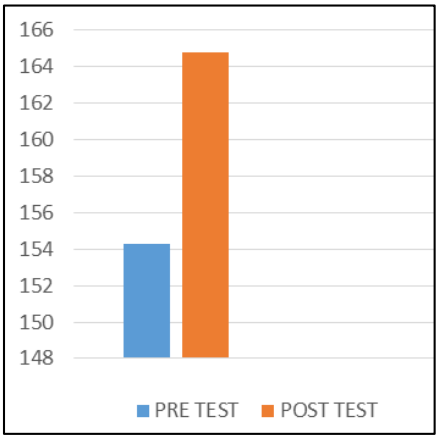
Results
The mean post-test Active Knee Extension score of Group A (164.80°) was higher than its pre-test score (154.27°), with a mean difference of 10.53°. This difference was statistically significant (t = 19.4274, p<0.05).
Group B showed an increase in mean post-test score (155.53°) compared to the pre-test score (150.13°), with a

mean difference of 5.40°. This improvement was also statistically significant (t = 17.6756, $p<0.05$).

The post-test comparison between Group A and Group B revealed a mean difference of 9.27°, which was statistically significant (t = 5.3581, $p<0.05$), indicating greater improvement in Group A compared to Group B.

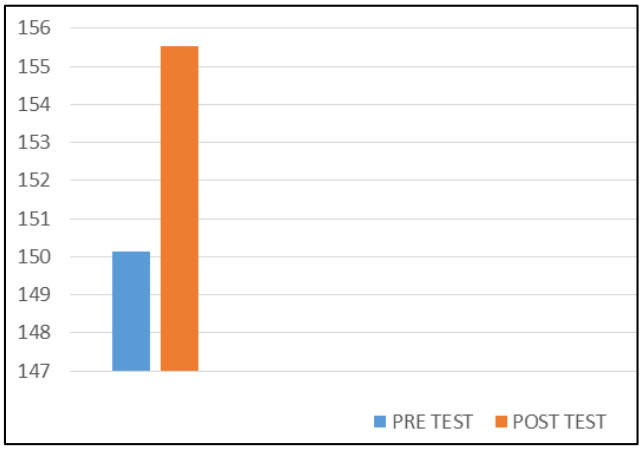
Mean for Group A

S. No	Groupa	Mean	Mean Difference	Standard Deviation	Paired 't' value
1	Pre Test	154.27	10.53	2.101	19.4274
2	Post Test	164.80			



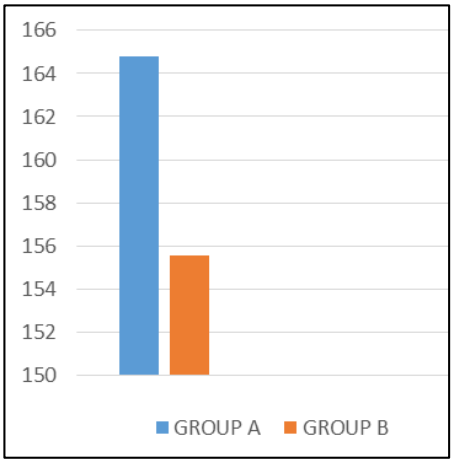
Mean for Group B

S. No	Group B	Mean	Mean Difference	Standard Deviation	Paired 't' Value
1.	Pre Test	150.13	5.4	1.1289	17.6756
2.	Post Test	155.53			



Post comparison of Active Knee Extension

S. No	Post Test	Mean	Mean Difference	Standard Deviation	Unpaired 't' value
1.	Group A	164.80	9.27	4.74	5.3581
2.	Group B	155.53			



Discussion

The present study demonstrated that both the Nordic Hamstring Exercise (NHE) and Muscle Energy Technique (MET) were effective in improving hamstring flexibility among college students with hamstring tightness. However, the improvement was more pronounced in the NHE group, with a mean gain of 10.53° in Active Knee Extension compared to 5.40° in the MET group. Statistical analysis confirmed that these changes were highly significant within each group ($p<0.005$) and between groups ($p<0.005$), indicating that NHE was superior in enhancing flexibility.

These findings align with earlier reports that eccentric training modalities, such as NHE, elicit greater neuromuscular adaptations and structural changes in muscle tissue compared to static or low-intensity stretching methods. Eccentric contractions have been shown to induce an increase in the total number of sarcomeres in series within muscle fibers (Morgan *et al*., 1994), resulting in a permanent shift in the muscle's length-tension relationship and enhanced flexibility. This structural remodeling improves the ability of the muscle to tolerate lengthened positions without excessive stiffness or injury risk.

Nordic Hamstring Exercise is unique in that it combines eccentric loading with closed-chain biomechanics, potentially enhancing proprioception and kinesthetic awareness via joint compression and mechanoreceptor stimulation (Steindler, 1955). This mechanism may explain the superior gains observed in the present study compared to MET, which primarily relies on post-isometric relaxation and neuromuscular inhibition to achieve flexibility gains. While MET has been widely documented as an effective technique for improving range of motion, its effects may be more short-term and less structurally adaptive than those induced by eccentric strengthening.

Previous studies (Brockett *et al*., 2001; Seymore *et al*., 2017) have also reported that eccentric hamstring training not only improves flexibility but also increases muscle strength, tendon stiffness tolerance, and resilience to strain injury. The

repeated application of controlled eccentric overload, as in NHE, triggers microstructural changes—often referred to as "micro-lesions"—that stimulate repair and remodeling, leading to more compliant and functionally longer muscle fibers. This physiological adaptation could explain the significantly greater post-test AKE scores in Group A.

Furthermore, the current findings support the growing body of evidence suggesting that eccentric exercise provides both preventive and therapeutic benefits for hamstring injuries. The dual benefit of improved flexibility and increased eccentric strength makes NHE an ideal intervention for athletic and general populations alike. By contrast, while MET remains a valuable clinical tool for acute flexibility improvement, the present results suggest that its long-term adaptability effect on muscle architecture is less robust than eccentric training.

In summary, the results of this study reinforce the importance of incorporating eccentric-based exercises such as the Nordic Hamstring Exercise into flexibility training programs. These exercises not only produce statistically significant improvements in range of motion but also align with earlier research demonstrating their superior capacity to induce lasting structural adaptations, enhance muscle function, and reduce injury risk.

Conclusion

The study concluded that both the Nordic hamstring exercise and Muscle energy technique are proven effective to improve hamstring flexibility, but Group received Nordic hamstring exercise indicates more effectiveness in comparison with group received muscle energy technique to improve hamstring flexibility among college students.

So null hypothesis was rejected and alternate hypothesis was accepted which states, that there was significant improvement in hamstring flexibility among college students with Nordic hamstring exercise.

Acknowledgments

I Mr/Mrs……voluntary agree to participate in the study conducted on the effectiveness of hamstring Nordic exercise and muscle energy technique on improving hamstring muscle flexibility among college students. I was explained about the procedure of the study and I clearly understand the requirements and benefits of the study. I understand that the purpose of the program is to reduce pain, improve range of motion and functional activities in daily life. I am surely giving my consent for study. My consent in this study is voluntary and that I am free to withdraw at any time, without any reason. The information obtained for the study will be kept confidentially and will be available only the researcher.

References

1. Mitra M, Varma J, Mande M. Comparison of Mulligan's Bent leg raise and Nordic Eccentric Hamstring stretching on Hamstring flexibility in individuals between 18-35 years age group. IJCRT. 2022;10(7):2320-2882.
2. Kaliyaperummal AB, Ramkumar S. Dharshini technique to improving Hamstring flexibility among college students. IJRAR; c2023, 10(3).
3. Kang YH, Kim DK, Ko YJ. Effect of muscle energy technique on hamstring flexibility: systematic review and meta-analysis. Healthcare; c2023, 11(8).
4. Babu SK, Paul A. Effectiveness of Nordic hamstring exercise in improving hamstring muscle flexibility, strength and endurance among young adults. Int J Health Sci Res. 2018;8(3):2249-9571.
5. Shah C, Amin H, Siyani M. Effect of Nordic eccentric hamstring stretching exercise and sciatic nerve slider technique of neural mobilization in college students: A comparative study. Int J Yogic Hum Mov Sports Sci. 2019;4(1):556-558.
6. Mande M, Sharma J, Shah P, Mitra M. To study immediate effect of suryanamaskar verses neurodynamic sliding technique on hamstring flexibility among physiotherapy students. Int J Creat Res Thoughts. 2021;9(7):a740-750.
7. Mande M, Shah P. Comparison of post isometric relaxaxtion and static stretch combine with stabilizing exercises on hamstring flexibility in young adults. Int J Multidiscip Res Dev. 2019;6(11):55-57.
8. Raghav D, Singh V, Verma M, Sharma M. Effect of Mulligan's bent leg raise technique in subject with hamstring trigger point. IOSR J Dent Med Sci. 2014;13(1):48.
9. Kalanekar TA, Koley S. Comparative study of mulligan's bent leg raise verses muscle energy technique in asymptomatic individuals with hamstring tightness. EAS J Orthop Physiother; c2020, 2(3).
10. Babu SK, Paul A. Effectiveness of Nordic Hamstring Exercise in Improving Hamstring Muscle Flexibility, Strength and Endurance among Young Adults. 2018;3:4.
11. Shinde SV, Kanase SB. Effect of Mulligan bent leg raise versus Neural mobilization on hamstring tightness in college students. IOSR J Dent Med Sci; c2017, 16(3).
12. Ribeiro-Alvares JB, Marques VB, Vaz MA, Baroni BM. 4 weeks of Nordic hamstring exercise reduce muscle injury risk factor in young adults. J Strength Cond Res; 2018, 32(5).
13. Pannalal PV. Comparison between the effect of Nordic eccentric hamstring exercise versus positional release therapy on hamstring flexibility and endurance in male cricketers. Int J Physiol Nutr Phys Educ. 2020;5(2):161-164.
14. Ganesh BR, Marwah VV, Joshi VS. Immediate effect of dynamic oscillatory stretching vs. neurodynamic sliding technique on stretch tolerance, popliteal angle range and hamstring flexibility in apparently healthy individuals with hamstring tightness: a pre-post clinical trial. Int J Res Med Sci. 2019;7(5):1862.
15. Chaitlow L, Libenson C, editors. In: Muscle Energy Techniques. 2nd ed. London: Elsevier; 2001. p. 95-106.
16. Brockett CL, Morgan DL, Proske UW. Predicting hamstring strain injury in elite athletes. Med Sci Sports Exerc. 2004;36(3):379-387.
17. Murphy DF, Connolly DA, Beynnon BD. Risk factors for lower extremity injury: a review of sports medicine. 2003;37(1):13-29.
18. De Weijer VC, Gormiak GC, shamus E. the effect of static stretch and warm up exercise on hamstring length over the course of 24 hours. J Orthop Sports Phys Ther. 2003;33(12):727-733.
19. Gibbons J. Muscle energy technique. Int Ther. 2011;97:26-28.
20. Ballantyne F, Fryer G, Mclaughlin P. The effect of muscle energy technique on hamstring extensibility: the

mechanism of altered flexibility. J Osteopathic Med. 2003;6:59-63.
21. Aquino CF, Gonçalves GG, Fonseca ST, Mancini MC. Analysis of the relation between flexibility and passive stiffness of the hamstrings. Rev Bras Med Esporte. 2006;12:195-200.
22. Atalay A, Akbay A, Atalay B, Akalan N. Lumbar disc herniation and tight hamstrings syndrome in adolescence. Child's Nerv Syst. 2003;19(2):82-85.
23. Manire JT, Kipp R, Spencer J, Swank AM. Diurnal variation of hamstring and lumbar flexibility. J Strength Cond Res. 2010;24(6):1464-1471.
24. Narouei S, Imai A, Akuzawa H, Hasebe K, Kaneoka K. Hip and trunk muscles activity during Nordic hamstring exercise. J Exerc Rehabil. 2018;14(2):231.
25. Patel G. To compare the effectiveness of mulligan bent leg raising and slump stretching in patients with low back pain. Indian J Physiother Occup Ther. 2014;8(3):24-28.
26. Fatima G, Qamar MM, Hassan JU, Basharat A. Extended sitting can cause hamstring tightness. Saudi J Sports Med. 2017;17(2):110.
27. Webright WG, Randolph BJ, Perrin DH. Comparison of nonballistic active knee extension in neural slump position and static stretch techniques on hamstring flexibility. J Orthop Sports Phys Ther. 1997;26(1):7-13.