Int J Pharm Bio Sci 2014 July; 5(3): (B) 228 - 233

Research Article **Physiotherapy**

International Journal of Pharma and Bio Sciences **ISSN 0975-6299**

EFFECT OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION STRETCHING AND DYNAMIC SOFT TISSUE MOBILIZATION ON HAMSTRING FLEXIBILITY IN SUBJECTS WITH LOW BACK ACHE - SINGLE BLINDED RANDOMISED CONTROLLED STUDY

K.KOTTEESWARAN[1*], JOSYULA SNIGDHA[2] AND JAGATHEESAN ALAGESAN[3]

[1]K.Kotteeswaran, Assistant Professor, Saveetha College of Physiotherapy, Saveetha University, Chennai, India
[2]Josyula Snigdha, PG Student, Saveetha College of Physiotherapy, Saveetha University, Chennai, India
3.Jagatheesan Alagesan, Associate Professor, Saveetha College of Physiotherapy, Saveetha University, Chennai, India

ABSTRACT

Low Back Ache (LBA) is the second most common cause of disability. Proprioceptive Neuromuscular Facilitation (PNF) is a form of flexibility training that involves both the stretching and contraction of the muscle group being targeted. Recent advances have shown that Dynamic Soft Tissue Mobilization (DSTM) is an effective means to produce beneficial effects such as increase in muscle perfusion and decrease muscle stiffness in improving hamstring flexibility in patients with LBA. The aim of this study is to compare the effectiveness of PNF stretching and DSTM on hamstring flexibility in subjects with LBA.103 subjects satisfying selection criteria in the age group of 20-35 years were randomly allotted in to PNF or DTSM group and were assessed for hamstring flexibility and pain using Active Knee Extension (AKE) test and Numeric Pain Rating Scale (NPRS) respectively. Subjects were treated as per their group allotment for four weeks. Within group analyses showed significant difference in both outcome measures with p less than 0.0001. This study concludes that Dynamic Soft Tissue Mobilization is more effective than Proprioceptive Neuromuscular Facilitation Contract Relax Antagonist Contract stretching in improving hamstring flexibility and decreasing pain in low back ache subjects.

KEY WORDS: Hamstring Flexibility, Contract Relax Antagonist Contract Stretching, Dynamic Soft Tissue Mobilization.

K.KOTTEESWARAN
K.Kotteeswaran, Assistant Professor, Saveetha College of Physiotherapy, Saveetha University, Chennai, India
k.kotteeswaran@gmail.com

***Corresponding author**

INTRODUCTION

Low back Ache (LBA) occurrence at a frequency of at least once a week within the past 6 months was regarded as the primary outcome, similar to the classification used by Mikkelson et al and Brattberg.[1,2] LBA represents the most common cause of disability in persons less than 45 years of age. It is the second most common cause of disability in adults and a common reason for lost work days. LBA occurs in people with a wide variety of professions, including those involving, repetitive work activities and extended sedentary postures.[3]In India, occurrence of LBA is also alarming; nearly 60 percent of the people in India have significant back pain at some time or the other in lives.[4] Hamstrings extend the hip with or without resistance, as well as serving as knee flexors. If the hip is extended and the knee is flexed to 90 degrees or more, the hamstrings may not be able to contribute much to hip extension force because of active insufficiency. Extension forces in hip increase by 30% if the knee is extended during hip extension.[5] Flexibility is the ability to move a single joint or series of joints smoothly and easily through an unrestricted, pain-free range of motion. Muscle length in conjunction with joint integrity and the extensibility of peri articular soft tissues determine flexibility.[6] A sedentary lifestyle often results in diminished flexibility.[7] Flexibility increases body awareness, better posture and enhances performance of skilled movements.[8] Mainly hamstring flexibility may prevent acute and chronic musculoskeletal injuries, LBA problems, postural deviations, gait limitations and risk of fall.[9] Hamstring muscle tightness is present in almost all population of the world.[10] Lesser amounts of hamstring tightness are reportedly associated with a posterior rotation of the pelvis in standing. It is thought that, due to the attachments of hamstrings to the ischial tuberosity, hamstrings tightness generates posterior pelvic tilt and decreases lumbar lordosis, which results in LBA.[11] Poor hamstrings flexibility, has been associated with low back pain in cross-sectional studies in both adolescents and adults.[12-14]

Proprioceptive Neuromuscular Facilitation (PNF) is a form of flexibility training that involves both the stretching and contraction of the muscle group being targeted. PNF stretching was originally developed as a form of rehabilitation. While there are several variations of PNF stretching, they all have one thing in common; they facilitate muscular inhibition. Various PNF stretching techniques based on Kabat's concept are: Hold Relax, Contract Relax, and Contract Relax Antagonist Contract (CRAC) etc. In Contract Relax - Antagonist Contract (CRAC) technique, isometric contraction of the shortened muscle followed by relaxation and later concentric contraction of the opposing muscle or muscle group were performed.[15] It is hypothesised that incorporating active contraction into a massage protocol may increase muscle perfusion and decrease muscle stiffness. Dynamic soft tissue mobilization (DSTM) follows a relatively recent development in manual therapy techniques in that it combines with the therapist delivered manual treatment, passive joint and soft tissue positioning and movements and/or active movements involving either concentric or eccentric muscle activity. A distinguishing feature of DSTM is the targeting of specific areas of tight hamstring muscles and end range procedures (passive concentric then eccentric contractions).[16] DSTM was developed with the aim of increasing muscle length. It utilises a combined technique of classic massage followed by a dynamic component, where the limb is moved through its range. Determining a specific area of tightness, where the treatment is concentrated, proceeds the dynamic component. In addition the DSTM model has standardized massage parameters for the most time effective clinical use.[17]

METHODS

Subjects attending physiotherapy outpatient department of the study centre were included in the study if they are in the age group of 20-35 years, presenting with LBA and 20-40 degrees of active knee extension loss with hip in 90 degrees flexion.[18,19] Subjects with recent fractures in the lower limb, recent hamstrings injuries, neurological symptoms in lower limb

and intervertebral disc prolapse were excluded from the study.[19-21] All subjects were explained about the procedure and informed consent was obtained. A total of 126 subjects with LBA were screened, (Figure-1) 19 found not eligible, 4 declined to participate and 103 were included in the study. Subjects were assigned in to PNF CRAC group (n=51) or DSTM group (n=52) by using a closed envelope method of randomisation after baseline assessment. The outcome measures used were Active Knee Extension test (AKE) to measure hamstring tightness by universal goniometer[22] and Numerical Pain Rating Scale (NPRS) to measure pain.[23] Both outcome measures were tested by an evaluator blinded to group allotment before and after intervention.

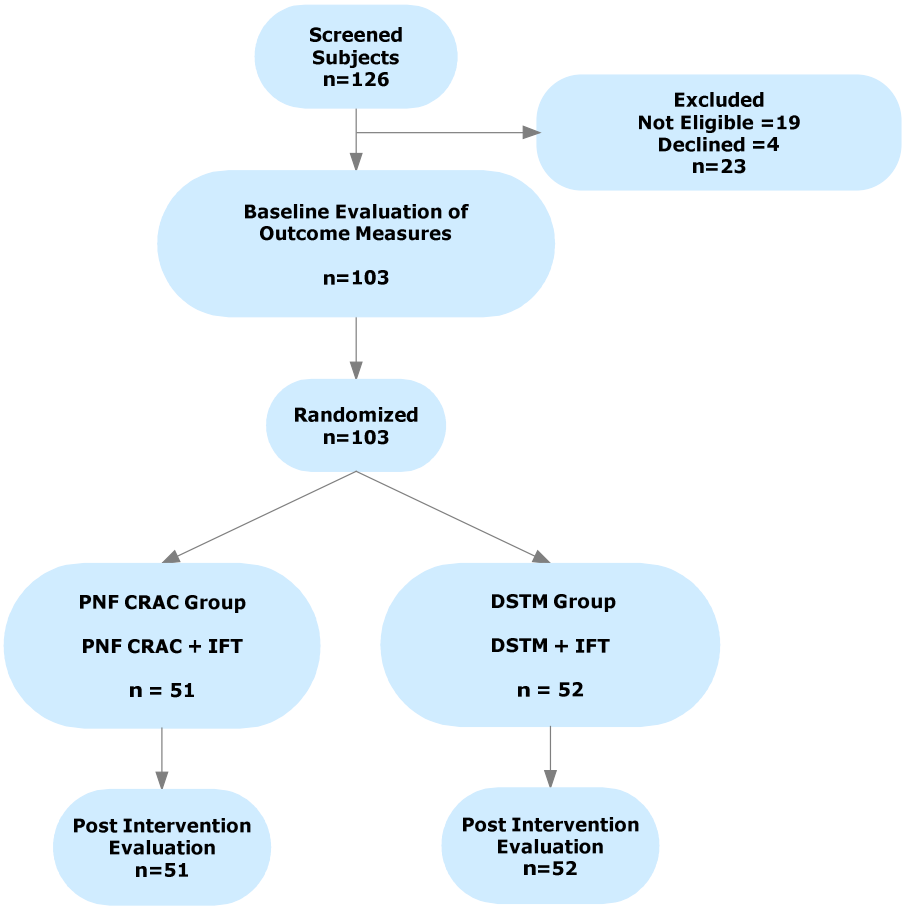

Figure-1
CONSORT Diagram of randomized clinical trial: number of participants screened, randomized, and retained and analyses

Intervention
PNF CRAC group
Subject was positioned in supine with their left lower extremity strapped down the treatment table. The hamstring was stretched by passively flexing the hip with knee fully extended, avoiding hip rotation. The hamstring muscle was stretched until the subject first reported a mild stretch sensation; this position was held for 7 seconds. Next, the subject isometrically contracted the hamstring muscle for 3 seconds by attempting to push his leg down towards the table against the resistance of the investigator. Subjects were asked to concentrically contract the quadriceps muscle, by attempting to further raise the leg, for 7 seconds.[24]

DSTM group
Subject was positioned in prone and deep longitudinal strokes were applied to the entire hamstring muscle group to locate the specific area of hamstring muscle tightness. Once the specific area of was located, the remaining treatment was limited to this target area. After that the subject was positioned supine with the hip and knee flexed to 90 degrees. Deep longitudinal strokes were applied in a distal to

proximal direction to the area of hamstring tightness when the leg was passively extended. Then the next progressive, dynamic technique was applied. During this technique, the subject was required to actively extend their leg, in order to achieve reciprocal inhibition of the hamstrings. In this final procedure, the subject was instructed to contract the hamstring muscle group eccentrically against the resistance offered by the investigator's hand as the muscle is elongated up to the end range of motion. During this movement, five deep distal to proximal longitudinal strokes over the reduced hamstring area of muscle tightness are performed.[17] The above procedures were first performed on the right side then on left side as per the subject's group allotment. Both groups were treated for five repetitions with a rest of 20 seconds between repetitions in one session. Both groups received interferential therapy over the lower back with a beat frequency of 80-120 Hertz, four pole vector mode for 10 minutes. Intervention was given for three days per week for four weeks, one session per day.

RESULTS

There were 32 males and 19 females in the PNF CRAC group and 29 males and 23 females in DSTM group. The Mean ± SD age of the PNF CRAC Group is 26.83±6.24 years and DSTM Group is 27.42±5.23 years. There were no dropouts in both groups. The homogeneity of variances of the data at baseline and significant differences of post intervention data were analysed by Independent t-test and significant changes within the group was analysed with paired t test for both outcome measures. An overall significance level was maintained at p-value less than 0.05. The independent t test for between group analyses at baseline to AKE test shows p value equal to 0.984 and for NPRS equal to 0.260proves homogeneity of groups at baseline. Table 1shows the details of within group analysis of before and after intervention values of PNF CRAC group and DSTM group analyzed by paired t-test. The p value for both variables in both groups is less than 0.0001 proves PNF CRAC and DSTM are effective in increasing AKE and reducing pain in subjects with LBA.

The post intervention mean ± SD value of AKE test in PNF CRAC group is 20.38 ± 4.23 and DSTM group is 18.10 ± 4.55. The post intervention mean ± SD value of NPRS in PNF CRAC group is 4.41 ± 0.95 and DSTM group is 2.31 ± 1.04. The independent t test for between group analyses after intervention for AKE test and NPRS shows significant difference between groups with p less than 0.0001. DSTM is more effective than PNF CRAC in increasing AKE and reducing pain in subjects with LBA.

Table -1

Comparison of before and after intervention values with in group

Group	n	Outcome		Mean	SD	t	p
PNF CRAC	102	AKE	Before	28.77	4.70	24.00	<0.0001
			After	20.38	4.23		
	51	NPRS	Before	6.63	0.81	18.99	<0.0001
			After	4.41	0.95		
DSTM	104	AKE	Before	29.63	4.59	19.43	<0.0001
			After	18.10	4.55		
	52	NPRS	Before	6.90	0.76	30.34	<0.0001
			After	2.31	1.04		

DISCUSSION

The Hamstring muscles are commonly linked with movement dysfunction in the lumbar spine, pelvis and lower limbs, and have been coupled with low back ache and gait abnormality. Hamstring strains are regularly cited as a sport-related injury, with high risk of recurrence and lengthy recovery times.[25] Muscle tightness is one of the limiting factors for restricted range of motion and reduced flexibility of joint. Hamstring muscles are more

prone for tightness causing musculoskeletal problems.[10]This study focused on checking effects of PNF CRAC and DSTM in increasing flexibility of subjects with hamstring tightness. Lesser amounts of hamstring tightness are reportedly associated with a posterior rotation of the pelvis in standing. It is thought that, due to the attachments of hamstrings to the ischial tuberosity, hamstrings tightness generates posterior pelvic tilt and decreases lumbar lordosis, which results in LBA.[11] PNFCRAC, involves two physiological mechanisms, autogenic inhibition via recruitment of the golgi tendon organs and reciprocal inhibition which causes inhibition of the target muscle following the contraction of the opposing muscle. This stretching leads to relaxation or inhibition of the stretched muscle and thus leading to a decrease in the low back pain.[24] In Dynamic Soft Tissue Mobilization, it is hypothesised that incorporating active contraction into a massage protocol may increase muscle perfusion and decrease muscle stiffness.[17] In this study, it is proved that DSTM has an immediate, significant effect on hamstring length. This result is well supported by previous study on hamstring flexibility in a sample of 45 males, concluded that DSTM significantly increases hamstring flexibility in healthy male subjects when compared to control group and classic soft tissue mobilization group. They also demonstrated that a significant increase in hamstring length could be achieved by identifying a specific area of hamstring tightness and targeting treatment to this area using dynamic techniques.[16]

CONCLUSION

This study concludes that Dynamic Soft Tissue Mobilization is more effective than Proprioceptive Neuromuscular Facilitation Contract Relax Antagonist Contract stretching in improving hamstring flexibility and decreasing pain in low back ache subjects.

ETHICAL CLEARANCE

This study was conducted at the outpatient department, Department of Physiotherapy, Saveetha Medical College and Hospital, Saveetha University, Chennai, India and was approved by the Institutional Human Ethical Committee.

REFERENCES

1. Mikkelsson M, Sourander A, Piha J, et al. Psychiatric symptoms in preadolescents with musculoskeletal pain and fibromyalgia. Pediatrics, 100:220-7,(1997)
2. Brattberg G. Back pain and headache in Swedish school children: a longitudinal study. Pain Clinic, 6:157-62, (1993)
3. Faas A, Chavannes AW, Van Eijk JT, Gubbels JW. A randomized, placebo-controlled trial of exercise therapy in patients with acute low back pain. Spine 1993; 18:1388-95.
4. ShyamalKoley. Severity of Disability in Elderly Patients with Low Back Pain in Amritsar, Punjab. Anthropologist, 10(4):265-8, (2008)
5. Inman V, Ralston HJ, Todd F. In: Human walking. Williams &Wilkins, Baltimore (1981)
6. Kisner C, Colby LA. In: Therapeutic exercise foundations and techniques, 5th ed. FA Davis Co, Philadelphia (2007)
7. Campanelli, L.C. Mobility changes in older adults: Implications for practitioners. Journal of Ageing and physical activity, 4(2):105-8, (1996)
8. Wang SS, Whitney SL, Burdett RG, Janosky JE. Lower extremity muscular activity in long distance runners. Journal of orthopaedics & sports physical therapy, 17(2):102-7, (1993)
9. American college of sports medicine, (ACSM) Guidelines for exercise testing and prescription, 6:158-62, (2000)
10. Erukula G, Demirkan F, Aiper B. Hamstring shortening in healthy adults.Journal of back and muskuloskeletal rehabilitation, 16 (2): 77-81, (2002)
11. Alston W, Carlson KE, Feldman DJ, Grimm Z, Gerontinos E. A quantitative

study of muscle factors in the chronic low back syndrome. J Am GeriatrSoc, 14:1041-47, (1966)
12. Mierau D, Cassidy JD, YongHing K. Low-back pain and straight leg rising in children and adolescents. Spine, 14:526-8, (1989)
13. Kujala UM, Taimela S, Oksanen A, et al. Lumbar mobility and low back pain during adolescence. Am J Sports Med, 25:363-8, (1997)
14. Salminen JJ, Maki P, Oksanen A, et al. Spinal mobility and trunk muscle strength in 15-year-old schoolchildren with and without low-back pain. Spine, 17:405-11, (1992)
15. Etnyre BR, et al. Chronic and Acute Flexibility of Men and Women Using Three Different Stretching Techniques. Research Quarterly for Exercise and Sport,59(3): 222-8,(1988)
16. Hopper D, Deacon S, Das S, Jain A, Riddell D, Hall T, Briffa K. Dynamic soft tissue mobilization increases hamstring flexibility in healthy male subjects. British Journal of Sports Medicine, 39:594-8, (2005)
17. Hopper D, Conneely M, Chromiak F, Canini E, Berggren J, Briffa K. Evaluation of the effect of two massage techniques on hamstring muscle length in competitive female hockey players. Physical Therapy in sports,6:137-45, (2005)
18. Ashby PE, McCale KL, McQuain JA, Wine JM. The effectiveness of three stretching techniques on hamstring flexibility using consistent stretching parameters. J Strength Cond Res,19 (1):27-32, (2005)
19. DePino GM, Webright WG,Arnold BL. Duration of maintained hamstring flexibility after cessation of an acute Static stretching protocol. Journal of Athletic Training, 35(1):56-59, (2000)
20. DraperDO, Miner L,Knight KL, Ricard MD. The carryover effects of Diathermy and Stretching in developing hamstring flexibility. Journal of Athletic Training, 37(1):37-42, (2002)
21. Odunaiya NA, Hamzat TK, AjayiOF. The Effects of Static Stretch Duration on the Flexibility of Hamstring Muscles. African Journal of Biomedical Research, 8:79-82, (2005)
22. Gajdosik R, Lusin G. Hamstring muscle tightness - Reliability of an active knee extension test. PhysTher, 63(7): 1085-90,(1983)
23. Williamson A, Hoggart B. Pain: a review of three commonly used pain rating scales.Journal of Clinical Nursing, 14: 798-804,(2005)
24. Nagarwal AK, Zutshi K, Ram CS, Zafar R. Improvement of Hamstring Flexibility: A Comparison between Two PNF Stretching Techniques. International Journal of Sports Science and Engineering,4(1):25-33, (2010)
25. Marr M, Baker J, et al. The effects of the Bowen technique on hamstring flexibility over time: A randomized controlled trial. Journal of Bodywork and Movement Therapies,15:281-90, (2011)