

Immediate Effect of Dry Needling of Tight Hamstrings on Chronic Non specific Low Back Pain and Lumbar Range of Motion: A Quasi-experimental Study

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ABSTRACT

Introduction: The lumbar spine provides both stability and mobility while also protects neural structures. Chronic Low Back Pain (CLBP) is commonly associated with postural dysfunction and reduced core stability, increasing mechanical stress on the lumbar region. Dry Needling (DN), involves insertion of fine needles into myofascial trigger points and is widely used for managing musculoskeletal pain. It helps reduce muscle tension, improve circulation, and modulate pain. Thus, it may be an effective adjunct in the management of CLBP.

Aim: To study the immediate effect of DN of tight hamstrings on chronic non specific low back pain and lumbar range of motion.

Materials and Methods: The present one-group pretest post-test quasi-experimental study was conducted in the Department of Musculoskeletal Physiotherapy of KJ Somaiya College of Physiotherapy, Mumbai, Maharashtra, India from September 2022 to March 2024. Individuals with chronic non specific Low Back Pain (NSLBP) (Numeric Rating Scale (NRS) 4 to 7) and hamstring tightness ($>20^\circ$ on Active Knee Extension Test (AKET)) in the age group of 18 to 45 years were included in the study using purposive sampling. Pre-treatment assessment was done using Numerical pain rating scale for low back pain, Measuring tape for range of motion (modified Schober's test) of back and

universal goniometer (AKET) for hamstring flexibility. DN was administered to the hamstring muscles at the predetermined treatment points. Following the intervention, post-treatment assessment was performed using the same outcome measures as those employed during the baseline evaluation. Following the post-treatment assessment, participants were prescribed a conventional exercise program. Statistical analysis was done using Statistical Package for Social Sciences (SPSS) software version 24. Data normality was checked using Shapiro-Wilk test. For the data that passed normality, paired t-test was used and for the data that did not pass normality Wilcoxon signed-rank test was used Level of significance p -value=0.05.

Results: The mean age group of subjects was 25.3 ± 5.8 years. There were 12 males and 29 females included in the study. It was noted that there was an immediate and significant reduction in low back pain levels ($p < 0.001$) and a significant increase in the hamstring muscle extensibility ($p < 0.001$) was seen but no changes were seen in the lumbar range of motion ($p = 0.131$) on DN the hamstring muscles.

Conclusion: An immediate and significant reduction in low back pain and a significant increase in hamstring muscle extensibility Bilateral (B/L) were seen but no changes were seen in the lumbar range of motion post DN the hamstring muscles.

Keywords: Acupuncture therapy, Myofascial pain syndrome, Rehabilitation, Trigger points, Trigger point therapy

INTRODUCTION

The NSLBP is defined as low back pain not attributable to a recognisable or known specific pathology such as infection, tumour, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome, or cauda equina syndrome [1]. It is typically described as pain localised between the lower rib margin and the gluteal folds [2]. CLBP refers to pain that persists for more than three months or beyond the expected period of tissue healing. Management of CLBP includes a wide range of interventions such as surgical procedures, pharmacological therapy, and non pharmacological approaches including rehabilitation [3].

Alterations in static posture and dynamic movement patterns are commonly associated with low back pain [4]. In a static standing position, muscles such as the erector spinae, hamstrings, abdominals, and hip flexors play a crucial role in maintaining neutral pelvic alignment through balanced muscular activity. Any imbalance among these muscle groups or postural deviations may result in anterior or posterior pelvic tilt [4].

Hamstring extensibility is considered one of the key factors influencing pelvic alignment. The hamstring muscles contribute to stabilising the pelvis in the sagittal plane by controlling anterior pelvic tilt during trunk movements and functional activities [5]. Reduced

hamstring flexibility has been associated with altered lumbopelvic rhythm and increased mechanical stress on the lumbar spine, thereby contributing to low back pain [6].

Additionally, dysfunction in the lower extremities, both proximally and distally, may impair shock absorption and alter load transmission, further increasing stress on the lumbar spine [7]. Individuals with chronic lumbar instability often demonstrate excessive lumbar motion during functional activities, and hamstring tightness is frequently observed in patients with low back pain [8]. Several studies support the association between hamstring tightness and the development or persistence of low back pain [8].

DN is a minimally invasive technique widely used by physiotherapists for the management of myofascial trigger points and musculoskeletal pain. It involves the insertion of thin filiform needles into soft-tissues without the use of any injectable substances. The therapeutic effects of DN are believed to be due to its inhibitory action on the hyperactivity of myofascial trigger points, as well as a reduction in nociceptive and sensitising biochemical substances in the affected tissues [9].

Previous literature has demonstrated that DN is effective in reducing pain, particularly within the first 72 hours following treatment [10]. Although evidence suggests that DN may improve muscle flexibility,

including that of the hamstrings, there is limited research exploring its direct relationship with low back pain [11].

Therefore, the present study was undertaken to investigate the effect of DN on hamstring flexibility and its association with low back pain.

Several studies have investigated the effects of DN on muscle flexibility and pain. Previous research has demonstrated that DN can significantly improve hamstring flexibility and muscle compliance immediately following intervention [11]. A randomised controlled trial comparing DN with stretching also reported improvements in hamstring range of motion, although the superiority over conventional interventions remains inconclusive [12]. Additionally, emerging evidence suggests that DN may be effective in reducing pain and improving functional outcomes in individuals with chronic NSLBP associated with hamstring tightness [13].

However, despite the growing body of literature supporting the role of DN in improving muscle flexibility and reducing pain, most studies have evaluated these outcomes independently [12,14,15]. A very few studies have explored the direct relationship between enhanced hamstring flexibility following DN and its impact on low back pain [11,13].

Therefore, the present study is novel in its approach as it aimed to investigate the combined effect of DN on hamstring flexibility and its association with low back pain, thereby addressing an existing gap in the literature.

MATERIALS AND METHODS

One-group pretest post-test quasi-experimental study was conducted in the Department of Musculoskeletal Physiotherapy of KJ Somaiya college of Physiotherapy, Mumbai, Maharashtra, India from September 2022 to March 2024. Approval from the Institutional Ethics Committee was obtained (Ref No. KJSCPT/487/22-23).

Inclusion criteria: Individuals with NSLBP (NRS 4 to 7) [16] since >12 weeks and hamstring tightness (>20° on AKET) [17] in the age group of 18 to 45 and willing to participate in the study using purposive sampling method.

Exclusion criteria: Patients with acute pain >7 on NPRS, a history of trauma to the back, pelvis or hip region, lumbar canal stenosis or disc herniation, inflammatory conditions like rheumatoid arthritis, uncontrolled diabetes mellitus were excluded. Patients with contraindications for DN- like tendency to bleed, immunocompromised individuals, altered sensations or paraesthesia, lymphoedema, pregnancy, patients with epilepsy, history of allergies and fear of needles were also excluded from the study.

Sample size calculation: Sample size was calculated using the estimates of mean and standard deviation values from Bazzaz-Yamchi M et al., [13].

$$n = (Z\alpha/2 + Z\beta)^2 \cdot 2 \cdot \sigma^2 / d^2$$

where, $Z\alpha$ is the z variate of alpha error (i.e. a constant with value 1.96), $Z\beta$ is the z variate of beta error (i.e., a constant with value 0.84).

Approximate estimates:

1. 80% power
2. Type I error 5%
3. Type II error 20%
4. Pooled standard deviation of 1.880
5. True difference of at least 0.87 units between the time intervals

Substituting the values, $n = (2.8)^2 \cdot 2 \cdot (1.880)^2 / (0.87)^2$

$$n = 36.61$$

Approximately, 37 subjects should complete the study per time interval till the endpoint Also, considering the attrition to be 10% $38 = N / (1 - 0.10)$ $n = 37 / (1 - 0.10) = 40.677$

Hence, a total of 41 patients participated in the study.

Study Procedure

Pre-treatment assessment was done using NPRS for LBP [16]. Measuring tape for ROM (modified Schober's test) of back [18]. The recorded value represents an increase in the distance between the two skin markings {10 cm above and 5 cm below the lumbosacral junction at the level of the Posterior Superior Iliac Spines (PSIS)} during maximal forward flexion. Higher values indicate greater lumbar flexion mobility. An increase of approximately 5-7 cm is considered normal in healthy adults, with lower values indicating restricted lumbar flexion [18]. A universal goniometer (active knee extension) test was used for hamstring flexibility [17]. DN for hamstring muscles was done at pre-determined points for one minute and post-treatment assessment was done using the same outcome measures. Following the post-treatment assessment, all participants underwent a conventional exercise program.

Procedure for DN: Disposable, sterile, single-use filiform needles of sizes 0.25×25 mm and 0.25×40 mm were used for the intervention, selected based on the participant's muscle bulk and depth of the targeted tissue. All procedures were carried out under strict aseptic precautions.

Participants were positioned comfortably in the prone position with the lower limbs in a relaxed state to allow optimal access to the hamstring muscle group. The intervention was performed bilaterally using the rapid insertion (pistoning) technique of DN. Three standardised points were identified over the hamstring muscles on each limb, and each point was needled for a duration of one minute.

To ensure consistency and enhance the therapeutic efficacy of the intervention, needling sites were selected in proximity to the motor points of the hamstring muscles. Anatomical landmarks were used to accurately locate these sites. For the biceps femoris muscle, a line was drawn between the ischial tuberosity and the fibular head. The short head of the biceps femoris was targeted at approximately 30% of the length of this line from the distal end, while the long head was targeted at approximately 60% of the same line [Table/Fig-1] [19].

Similarly, for the medial hamstring muscles, namely the semitendinosus and semimembranosus, a line was drawn from the ischial tuberosity to the medial epicondyle of the femur. Needling was performed at approximately 60% of this line to effectively target these muscles [Table/Fig-1].

The rapid needling technique involved repeated insertion and withdrawal of the needle within the muscle tissue to elicit a Local Twitch Response (LTR), which is considered indicative of effective targeting of myofascial trigger points. Care was taken to monitor patient comfort and avoid adverse effects throughout the procedure.



[Table/Fig-1]: Dry Needling (DN) of the hamstring muscle is demonstrated.

STATISTICAL ANALYSIS

Data from 41 samples were collected and recorded in a Microsoft Excel spreadsheet and analysed using SPSS version 24. Qualitative variables were expressed as absolute numbers and percentages, while quantitative variables were expressed as appropriate descriptive statistics. For data that met normality assumptions, a paired t-test was applied; for data that did not meet normality, the Wilcoxon signed-rank test was used. A p-value of less than 0.05 was considered statistically significant.

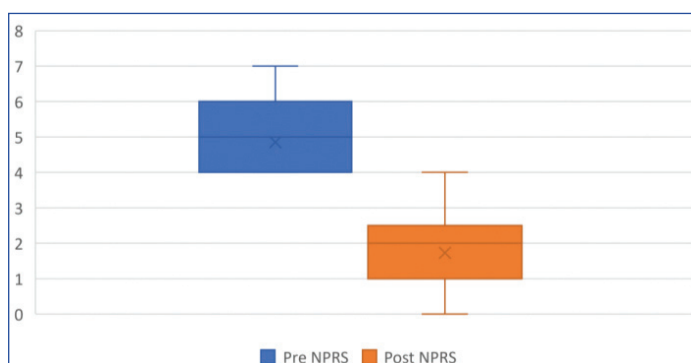
RESULTS

In the present study, 12 male participants and 29 female participants were included with an average age of 25.3 ± 5.8 years and duration of low back pain ranging from three months (minimum) to 36 months (maximum) with an average of 11.7 ± 8.2 months.

A significant difference was seen in pre- and post- treatment values for low back pain measured using NPRS and hamstring extensibility checked using AKET with no change in lumbar range of motion measured using Modified Schober's test [Table/Fig-2].

Outcome measures/Variables	NPRS		Modified Schober's test		Right AKET		Left AKET	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean $\pm$ SD	4.85 $\pm$ 0.98	1.73 $\pm$ 1.18	6.16 $\pm$ 1.27	6.32 $\pm$ 1.4	33.49 $\pm$ 9.2	25.76 $\pm$ 9.12	33.46 $\pm$ 9.6	24.61 $\pm$ 8.41
p-value	<0.001*		0.131		<0.001*		<0.001*	

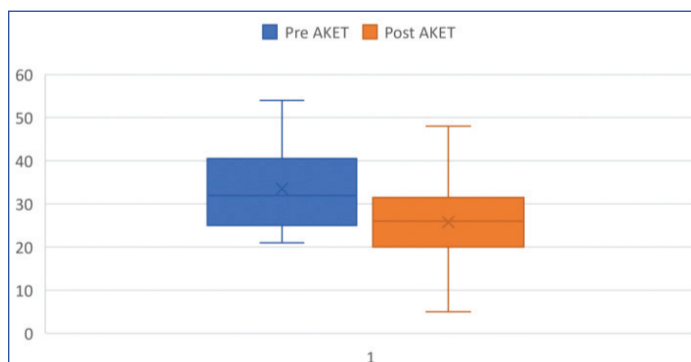
[Table/Fig-2]: Pre-and post-intervention values of all outcome measures. Wilcoxon signed rank test



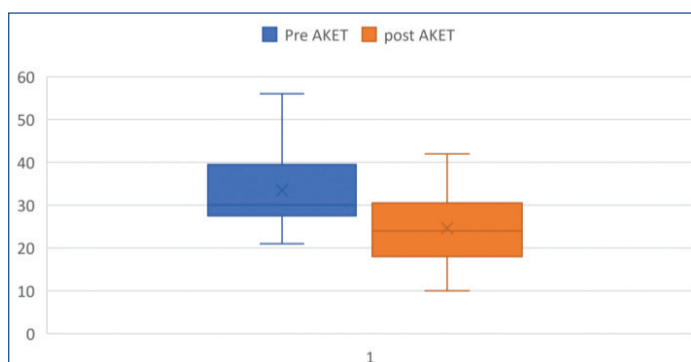
[Table/Fig-3]: Box plot of pre and post NPRS.



[Table/Fig-6]: Box plot of pre and post Modified Schober's test.



[Table/Fig-4]: Box plot of pre and post AKET right.



[Table/Fig-5]: Box plot of pre and post AKET left.

The following box plots give a diagrammatic representation of pre and post-intervention changes in NPRS [Table/Fig-3], right and left AKET [Table/Fig-4,5] and Modified Schober's test [Table/Fig-6].

DISCUSSION

The present research was done to study the immediate effect of DN on hamstrings in patients with chronic NSLBP. The study sample consisted of 41 subjects from age 18 to 45 with mean age 25.3 ± 5.8 years experiencing chronic NSLBP with average NPRS 4.85 ± 0.98 .

The study showed a statistically significant and immediate improvement in hamstring flexibility, as measured by the AKET bilaterally ($p < 0.001$). This improvement can be explained by the known neurophysiological and mechanical effects of DN. When a LTR is elicited during needling, it creates an involuntary reflex contraction that helps release muscle tension and allows shortened muscle fibres to return closer to their normal length [19].

In addition, DN appears to improve local blood flow by reversing the ischemia and hypoxia commonly present in trigger points, thereby restoring oxygen supply to the affected muscle [16].

At a deeper level, DN may also stimulate cellular processes through pathways such as Extracellular Signal Related Kinase (ERK) and Focal Adhesion Kinase (FAK), which enhance energy metabolism and support the muscle in regaining its normal resting state [11].

A significant and immediate reduction in low back pain ($p < 0.001$) was also observed. Tight hamstrings are known to decrease lumbar lordosis, reduce the spine's capacity to absorb shock, and increase mechanical stress on lumbar structures [8]. By improving hamstring extensibility, DN may restore normal lordotic curvature and redistribute load away from the lumbar spine. During forward bending and lifting, greater hamstring length permits increased hip flexion, thereby limiting excessive lumbar flexion and its associated mechanical stress [20]. Additionally, improved lower-extremity flexibility enhances lumbar stabilisation during dynamic tasks, further reducing mechanical load and pain perception [21].

In contrast, no statistically significant improvement in lumbar range of motion was observed via the modified Schober's test ($p = 0.131$). This finding supports the study results and can be understood through three physiological explanations. First, Meraio ACC et al., demonstrated only a weak correlation ($r = 0.2843$) between hamstring flexibility and lumbar mobility as measured by the Schober's test, indicating that improvements in hamstring extensibility do not necessarily translate to measurable increases in lumbar segmental motion [20]. Second, according to Sahrman's movement system impairment framework, movement preferentially

occurs at the path of least resistance when hamstring flexibility increases, greater motion is recruited at the hip and pelvis during forward bending, relatively reducing the contribution of the lumbar spine and thus yielding no net gain on Schober's measurement [22]. Third, biomechanically, increased hamstring length allows forward bending to be accomplished with more hip flexion and less lumbar flexion, which represents a functional improvement but does not alter the Schober's test value [21].

In conclusion, DN appears to be an effective intervention for achieving immediate improvements in hamstring flexibility and pain reduction in individuals with chronic NSLBP; however, its influence on lumbar mobility remains limited, highlighting the need for comprehensive treatment approaches and further research into its long-term effects.

Limitation(s)

The present study evaluated only the immediate effects of DN and did not assess its long-term or carryover effects. Furthermore, the lack of a control group limits the ability to establish causality and compare the intervention's effectiveness against standard care or no treatment.

CONCLUSION(S)

The DN of the hamstring muscles demonstrated an immediate and significant reduction in low back pain along with improved hamstring flexibility. However, no significant changes were observed in lumbar range of motion. These findings suggest that DN may be effective for short-term pain relief and muscle extensibility, though its impact on functional spinal mobility remains limited.

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