

## Original Article

# Comparative Effects of Static Stretching versus Stretching with Traction on Hamstrings Flexibility in Patients with Backache; A Randomized Controlled Trial

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### Abstract

**Background:** Patients with lower backache commonly complain of hamstrings tightness which is responsible for altering biomechanics of the lower limb and spine. Reduced muscular flexibility affects the functional capacity of an individual and also damages the musculoskeletal system as a result of overuse. **Objective:** The objective is to compare the effects of static stretching versus stretching with traction on hamstrings flexibility in patients with backache.

**Methods:** A single-blinded, controlled trial was conducted on 44 subjects who presented with primary complaints of back pain, hamstrings tightness and pain/tenderness in the back of the thigh. Group A was treated with static stretching and Group B with stretching with traction (Mulligan). Straight leg raise, 90-90 test, and visual analogue scale were used to calculate the scores in the two groups. An independent t-test was calculated to measure the difference between the treatment outcomes of the two groups while paired sample t-test was used to measure the differences within the groups. **Results:** Both groups showed significant results with both tests and pain scores. When both the groups were compared, stretching with traction showed a significant difference from static stretching in relieving hamstrings tightness in patients with backache. **Conclusion:** Stretching of hamstrings with traction is found to be a significant treatment option as compared to static stretching as the participants showed a significant difference in outcome measures in relieving hamstrings tightness in patients having backache.

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**Keywords:** hamstrings tightness; static stretching; stretching with traction

## Introduction

**H**amstring tightness is commonly seen in patients with low back pain.<sup>1</sup> About 90% of the adults suffer from low back pain once in their lifetime, whereas 50% have a recurrence of the episode, while 5-10% develop chronic and disabling back pain.<sup>2</sup> It imposes a major health burden in many industrialized countries with a prevalence of 15-30% and a lifetime prevalence of 50-80%. Several studies on European cost of illness showed the mean cost of €211 per person in Sweden and €260 per person in the UK. The mean cost for a chronically ill patient with low back pain is twice as high as acutely ill persons. Approximately 25% of the cost refers to rehabilitation and therapeutic procedures.<sup>3</sup> Hamstring tightness is a common cause of altered biomechanics of the lower limb and spine. Persistent tightness may cause pain, reduced mobility and others pathologies in the knee joint. Stretching exercises are used to treat muscular tightness.<sup>4</sup>

The flexibility of hamstrings is an important variable because decreased flexibility is considered to be a predisposing factor for injuries and low back pain.<sup>5</sup> It is also found to be involved in hamstring strain injury, patellofemoral pain and tendinopathy. Flexibility induces better muscle performance, coordination, and also helps in the prevention of post-exercise muscle soreness.<sup>6</sup> Literature has enumerated many risk factors for a hamstring strain, tightness, or injuries such as advancing age, low levels of fitness, obesity, muscle imbalance, history of injury, increased endurance training, competitive motivation and smoking.<sup>7</sup> It is an important component in the physical training programs, which in turn improve efficiency and prevent injury.

There are various methods to improve flexibility which involve stretching, soft tissue mobilization and muscle energy techniques. The stretching technique includes static stretching, ballistic stretching and

proprioceptive neuromuscular techniques (PNF).<sup>8</sup> Ballistic stretching involves bouncing rhythmical movements that use the momentum of a muscle to stretch it. Static stretching is a standard for measuring flexibility in which a muscle is elongated to tolerate and sustain the position for a certain period.<sup>9</sup> The most widely used technique is static stretching.<sup>10</sup> It has a viscoelastic response on the muscle-tendon unit resulting in increased tension for a given length of muscle fiber which in turn allows flexibility to be gained. It has been found from various studies that flexibility can be increased after a single session of 4-30 seconds of stretching manoeuvre.<sup>11</sup>

Different tests can be used to assess the hamstrings tightness like a fingertip to floor test (for global flexibility), active knee extension test (incomplete knee extension with hamstring tightness) and electromyographic evaluation.<sup>12</sup> Straight leg raise (SLR) and active knee extension tests (AKE) are most commonly used for the assessment of hamstrings flexibility.<sup>13</sup> In the current study, two maneuvers were used to increase the flexibility of hamstring muscles. The main purpose of the study was to compare the effects of stretching with traction versus static stretching on hamstrings flexibility in patients with backache having hamstring tightness.

## Methods

A sample of 44 patients was taken from the physiotherapy department, Jinnah hospital Lahore. Both male and female subjects having complaints of low backache and hamstring tightness, aged between 35-60 years were included in the study. The subjects with pain radiation below the knee, recent injury, acute onset of pain, pathology of hip, knee and sacroiliac joints, and pregnant females were excluded from the study. All patients with low backache were screened for eligibility to participate in the trial. Participants who fulfilled the selection criteria were informed

about the study and informed consent was taken. Patients were assessed by another physiotherapist who was kept blind and he filled up an assessment form consisting of two sections; demographic data (name, age, weight, gender, height, body mass index) and outcome measures (pain, range of motion on 90-90 and SLR).

The patients were divided into two groups by using the coin toss method. Sealed opaque envelopes were used to ensure concealment. In group-A, patients were treated with moist hot packs on hamstrings for ten minutes and static hamstring stretching three times with 30 seconds hold time and ten seconds rest between two stretches. Group-B patients were treated with moist hot packs on hamstrings for ten



**Figure-I: Histogram of the age of the participants**

minutes and hamstring stretching with traction for three times with 30 seconds hold time and ten seconds rest between two stretches. After the completion of the treatment, patients were reassessed by the assessor physiotherapist. Outcome measures were a pain that was measured by the visual analogue scale and functional disability assessed by SLR and 90-90 tests. Data were analyzed by using SPSS

version 21.0. After fulfilling parametric assumptions using the Shapiro Wilk test, an independent t-test was applied to measure the difference between the treatment outcomes of the two groups while paired sample test was used to measure difference within the group. The  $p\text{-value} \leq 0.05$  was considered significant.

## Results

In the current study, 50 subjects were selected as a sample, out of which six participants did not meet the criteria so only 44 were included, 23 (52%) females and 21 (48%) males with a primary complaint of backache and pain radiating to the leg. Means and standard deviations of age (Figure-I), BMI and outcome measures such as SLR, VAS and 90-90 tests were mentioned (Table-I & II). In Group-A, the pre- and post-treatment measurements for VAS, SLR and 90-90 tests showed significant results ( $p \leq 0.005$ ). Group-B also showed more significant values for all variables, proving that technique is more effective as a treatment of hamstrings tightness for backache patients. (Table-III).

**Table-I: Baseline characteristics**

	N	Mean	S±D
<b>Age</b>	44	38.77	11.41
<b>BMI</b>	44	28.26	5.46

**Table II: Means and standard deviations of outcome measures**

Outcome Measures	Group A	Group B
<b>VAS</b>	5.5 ± 1.81	6.13 ± 1.64
<b>90-90 test</b>	35.45 ± 13.15	40.81 ± 12.74
<b>SLR test</b>	42.86 ± 14.46	43.86 ± 18.40

## Discussion

In this study, 44 patients were recruited with 21 males and 23 females. In Group-A, the pre- and post-treatment measurements for VAS, SLR and 90-90 tests showed significant results. Group-B also showed more significant values for all variables, proving that technique is more effective as a treatment of hamstrings tightness for backache patients. Hamstring stretching with traction showed more significant results as compared to the other group.

A randomized controlled trial (RCT) was conducted by Lim K-I in 2014 on 48 subjects to determine the effectiveness of stretching techniques on balance, ROM and muscle activation. Both the groups showed a significant increase in knee extension angle.<sup>14</sup> A systematic review on the impact of stretching on sports injury concluded that stretching increases muscular flexibility which is the main component for an athlete's better performance.<sup>7</sup> Current study also showed significant changes in pain and functional activity by using stretching techniques. Literature also revealed that there is no significant effect of stretch on the extensibility and tightness of the muscles.

A trial was conducted in 2009 by Law RY to evaluate the effects of stretching on the muscular flexibility and tolerance of stretch in patients with musculoskeletal pain. This RCT has concluded that stretching did not affect the muscular extensibility but enhanced the tolerance to stretch the muscle.<sup>15</sup> The present study contradicts the results of this study. Another study on the effects of duration of the hamstrings muscles stretching for improving ROM in elderly people was conducted and observed that sustained stretching resulted in increased range in the hamstrings group.<sup>16</sup>

An RCT by Ghaffarinejad F in 2007 evaluate the efficacy of static stretching of the muscles around the knee on proprioception.<sup>17</sup> Another study was conducted on the effectiveness of

dynamic, static stretching and warm-up on hamstrings flexibility in injured participants.”

It was found that warm-up and static stretching had marked effects in improving flexibility of hamstrings.<sup>18</sup> Systematic review related to the effects of hamstring stretching on ROM revealed that it increases range with different techniques used.<sup>19</sup> Stretching is linked with both composite and multifactorial relation with hamstrings strain. This would be advantageous if the technique applied and the duration of holding for stretch is sufficient.<sup>20</sup> Various stretching techniques were performed to determine the effects on hamstrings flexibility and ROM. Static stretching, PNF and self-stretching were involved.

Among them, static stretching showed remarkable effects in improving hamstrings tightness.<sup>21</sup> The present study compares static stretching versus stretching with traction for treating hamstring tightness in patients with backache. Ahmed H in 2015 conducted a study determining the immediate effects of PNF stretch along with static stretching and on hamstrings length after one session. It concluded that a significant increase in the range of knee extension was observed after applying static stretch along with PNF in a session. Improvement in range of motion was found in both groups.<sup>22</sup>

## Conclusion

It is concluded that both static stretching and stretching with traction techniques were found effective for improving hamstrings tightness. However, stretching with traction is found to be more significant as compared to static stretching in patients with backache and hamstrings tightness.

## Declarations

**Consent to participate** Written consent had been taken from patients. All methods were

**Table III: Paired sample t-test**

Paired sample t-test										
Group of Patients			Paired Differences					t	df	Sig. (2-tailed)
			Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval				
						Lower	Upper			
Hamstring Static Stretching	Pair 1	AKE Test (90-90) (Pre-treatment)	-7.09091	9.42089	2.00854	11.26790	-2.91392	-3.530	21	.002
	Pair 2	SLR Test (Pre- & Post-treatment)	1.00909	15.02667	3.20370	16.75336	-3.42846	-3.150	21	.005
	Pair 3	VAS Pre- & Post-treatment	.95455	.84387	.17991	.58039	1.32870	5.306	21	.000
Hamstring Stretching with Traction (Mulligan)	Pair 1	AKE Test (90-90) (Pre- & Post-treatment)	-7.54545	9.48546	2.02231	-11.75107	-3.33984	-3.731	21	.001
	Pair 2	SLR Pre- & (Post-treatment)	-1.27273	13.95292	2.97477	-18.91365	7.6746	-4.278	21	.000
	Pair 3	VAS (Pre- & Post-treatment)	2.00000	1.23443	.26318	1.45269	2.54731	7.599	21	.000

performed following the relevant guidelines and regulations.

**Availability of data and materials:** Data will be available on request. The corresponding author will submit all dataset files.

**Competing interests:** None

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**CONSORT Guidelines:** All methods were performed following the relevant guidelines and regulations.

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