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Effect Of Dynamic Stretching VS Neurodynamic Mobilization On Hamstring Tightness In Healthy Individuals

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Abstract

A sedentary lifestyle has significantly contributed to musculoskeletal problems, particularly hamstring tightness among healthy individuals. The human body require daily movement as to maintain flexibility and functioning of body but, due to changing lifestyle and reduction in daily workout tightness of muscle has become a common factor in individual.This study aimed to evaluate and compare the effectiveness of dynamic stretching and neurodynamic mobilization in reducing hamstring tightness.

A randomized controlled trial was conducted on 38 healthy individuals with hamstring tightness, divided into two groups: Group A (neurodynamic mobilization) and Group B (dynamic stretching). Interventions were administered for six consecutive days. Outcome measures included the 90-90 Straight Leg Raise (SLR) test and Active Knee Extension (AKE) test.

Results showed statistically significant improvement within both groups ($p < 0.05$). However, comparison between groups using independent t-test revealed no statistically significant difference ($p > 0.05$), although the neurodynamic group showed slightly higher mean improvement.

The study concludes that both dynamic stretching and neurodynamic mobilization are equally effective in improving hamstring flexibility. These techniques can be used interchangeably based on patient preference and clinical setting.

Keywords: Hamstring tightness, Dynamic stretching, Neurodynamic mobilization, Flexibility, Range of motion

1. Introduction

A sedentary lifestyle has become a major concern in modern society and is strongly associated with reduced physical activity levels [1]. It is characterized by prolonged sitting and minimal movement due to occupational and lifestyle changes.. A sedentary lifestyle contributes to muscle tightness primarily through prolonged periods of inactivity, which disrupt the natural balance and flexibility of the musculoskeletal system. When the body remains in static positions—especially sitting—for extended durations, certain muscle groups become chronically shortened while others are overstretched and weakened. Inactivity limits the delivery of oxygen and nutrients that are necessary for muscle repair and elasticity by decreasing blood circulation to the muscles. Muscles become rigid and lose their pliability when they are not regularly moved, which makes daily tasks like walking, stretching, and bending more challenging and uncomfortable.

The human body requires regular movement to maintain muscular flexibility and joint mobility. Prolonged inactivity reduces blood circulation, leading to decreased oxygen supply to muscles, resulting in stiffness and tightness. Over time, this can disrupt musculoskeletal balance and lead to functional impairments.

Flexibility is defined as the ability of muscles and joints to move through a full range of motion without pain [1]. Reduced flexibility contributes to decreased strength, endurance, and increased risk of injury. Flexibility enhances performance and reduces the risk of injuries like ligament tears or muscle strains for people who participate in sports or other physical activities. When muscles and joints are flexible, even basic activities like walking, climbing stairs, and prolonged sitting become more comfortable.

Human body is made of muscles and the muscle can easily go into tightness, is a common musculoskeletal concern that affects individuals across various age groups and activity levels and the most common muscle is the hamstring.

The hamstring muscle group plays a crucial role in posture, gait, and lower limb function. Tightness in this muscle group can lead to altered pelvic alignment, lower back pain, and reduced mobility.

Stretching techniques has great effect on the tightness it plays very important role in gaining the functional goals and also helps to maintained the fitness and health goal of individual[3]. Stretching techniques are commonly used to improve flexibility. Dynamic stretching involves active movements, whereas neurodynamic mobilization focuses on improving neural mobility. Although both techniques are widely used, limited studies have compared their effectiveness.

By increasing flexibility, lowering discomfort, and reestablishing regular movement patterns, mobilization treatments significantly improve muscular tightness. Tight muscles frequently cause discomfort or dysfunction by limiting joint motion. Mobilization—whether through manual therapy, dynamic stretching, or targeted movement—helps loosen these tight areas by increasing blood flow, stimulating the nervous system, and encouraging the muscle fibers to relax[5] Hamstring tightness is not only causes reduction in range of motion but will also give rise to musculoskeletal problems.[1]

Need of the Study

Hamstring tightness is highly prevalent among young adults, especially those with sedentary lifestyles. While both dynamic stretching and neurodynamic mobilization are effective, there is limited comparative evidence between these two techniques. This study aims to fill that gap.

Aim

To study the effect of dynamic stretching and neurodynamic mobilization on hamstring tightness.

Objectives

To evaluate the effect of dynamic stretching on hamstring tightness

To evaluate the effect of neurodynamic mobilization on hamstring tightness

To compare the effectiveness of both techniques

Hypothesis

Null Hypothesis 1:Both Neurodynamic mobilization and dynamic stretching can be effective on hamstring tightness

Null Hypothesis 2:Both Neurodynamic mobilization and dynamic stretching cannot be effective on hamstring tightness

Alternate 1:Dynamic stretching have better effect than neurodynamic mobilization technique on hamstring tightness in healthy individuals

Alternate 2:Neurodynamic mobilization can be effective than Dynamic stretching on hamstring tightness in healthy individuals

1. Methodology

2.1.Study Design

Randomized Controlled Trial

2.2.Sample Size

38 participants (19 in each group) - [(9.2 +5.95)(1.96 +0.842)/1.5 × 1.5] - where 19 individuals in group A and 19 individuals in group B

2.3.Sampling Technique

Convenience sampling

2.4.Study setting : the study can be carried out in physiotherapy OPD / college in the room which should have high plinth or bed .

Inclusion criteria	Exclusion criteria
• Age 18-40 years	• The individual should not have any low back pain or radiating pain which leads to hamstring muscle involvement [8]
• the individual with the hamstring tightness should have angle less than 125 degrees [6]	• There should be no history of hamstring tear[1]
• Healthy individuals	• Hypermobility of joints (more than 90 degree)
	• Patient with already lower extremity exercise for last 3 months

2. Outcome Measures

3.1. 90-90 Straight Leg Raise Test

test should be recorded on all subject -patient to be in supine position both hips at 90 degree and knees to be bent then patient grasps behind the knee as to stabilize hip at 90 degree of flexion then patient should extent knee as much as possible,for normal hamstring flexibility -knee extension should be within 20 degree of full extension(popliteal angle) if the angle is less than 125 degree the hamstring are considered as tight.[6]

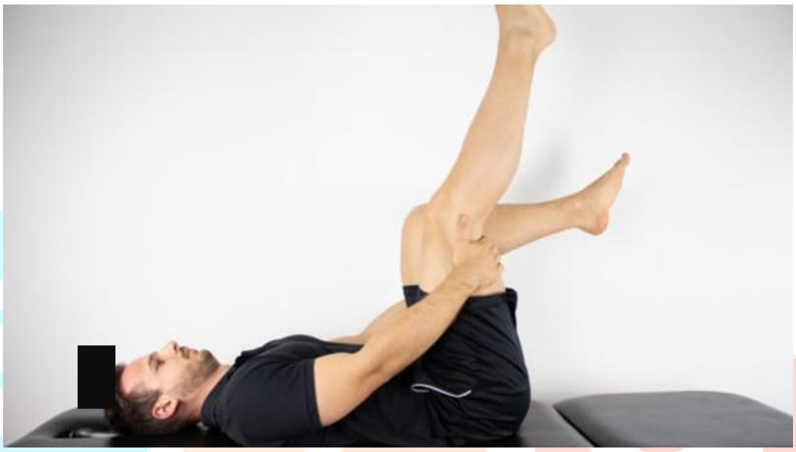

Fig 1:90-90 Straight leg raise test

3.2. Active Knee Extension Test

In this patient lies supine with neck in neutral position one leg (tested) the hip and knee to be flexed in 90 degree and it is held by wooden box and non tested leg to be stabilized to table with help of velcro or strap while maintaining the position subject is asked to extend the extremity as far as possible where individual can fell the stretch at the posterior aspect of the thigh then with help of goniometer the angle is measured with help of two line one drawn from distal to greater trochanter and femoral condyle and other line head of fibula and proximal to the lateral malleolus. 3 measurements are taken and mean angle is recorded.[8]

3. Procedure

4.1.Group A: Neurodynamic Mobilization

Neurodynamic mobilization (fig. 2) in this technique the patient to be in high sitting with the neck and thoracic spine supported in flexion position then patient hip and knee to be in extended position then the position to be altered depending on the resistance of the patient tolerance. The technique is to be given for consecutive 6 days,4 times/day , for 3min/session[8]

Neural mobilization performed

3 min/session, 4 times/day, 6 days

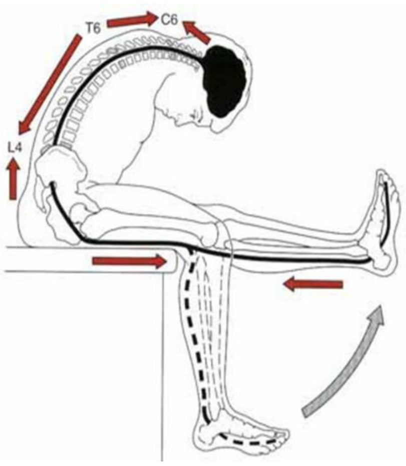

Fig 2:Neurodynamic mobilization

4.2.Group B: Dynamic Stretching

Refer fig 3, in this patient to be in standing position and then by contacting the hip flexor the patient has to move up the leg in forward direction where the knee to be in extended position this is to be performed for consecutive 6 days 4 times/days with 2 sec hold.[9]

Fig 3:Dynamic stretching

4. Data Analysis

In table 1 & 2 as the data between neurodynamic and dynamic was calculated which showed that neurodynamic group data was not normally distributed so as the data for several variables showed positive skewness and high kurtosis, indicating that the distribution was not normally distributed. Since normality is an important assumption for performing a t-test, a square root transformation was applied to the data.

5.1.Square root transformation was applied to normalize data.

NON-PARAMETRIC GROUP

Table 1: Normality Test for Neurodynamic Group [1]

Parameter	90–90 SLR (Right)	90–90 SLR (Left)	AKE (Right)	AKE (Left)
Skewness	1.0426	1.3077	1.8790	2.1817
Kurtosis	0.1640	2.6142	4.9103	6.7888
Interpretation	Moderate skew	Moderate/high skew	High skew	High skew

Table 2: Normality Test for Dynamic Group

Parameter	90–90 SLR (Right)	90–90 SLR (Left)	AKE (Right)	AKE (Left)
Skewness	1.1024	0.9991	0.3920	0.3052
Kurtosis	3.8086	0.6794	-0.4832	-0.9075
Interpretation	Borderline	Normal	Normal	Normal

Parametric group

Table 3 :normality test for neurodynamic group

	90-90 straight leg rise		active knee extension	
	Right	Left	Right	Left
Skewness	0.754962723	0.292087966	1.1913103	1.348509548
Kurtosis	-0.446656939	1.208966706	2.299575651	3.286770547
Interpretation	Acceptable, near normal t-test fine	Acceptable, near normal , t-test fine	Acceptable, near normal , t-test fine	Slightly skewed & heavy tails ,borderline, t-test cautiously acceptable

Table 4: Normality test for dynamic group

	90-90 straight leg rise		active knee extension	
	Right	Left	Right	Left
1.	-0.102682459	0.402176355	-0.080761164	0.105677561
2.	2.672747148	-0.332342999	-0.609626216	-0.940721773
3 .(comments)	Acceptable, near normal → t-test fine	Acceptable, near normal → t-test fine	Very mild skew & light tails → t-test fine	Very mild skew & light tails → t-test fine

In table 3 & 4, after applying square root transformation, the skewness and kurtosis values of all variables were found to be within acceptable limits (|skewness| < 1.5, |kurtosis| < 2.5), indicating that the data approximated a normal distribution. Hence, parametric tests (t-tests) were considered appropriate for further analysis.

[1] SLR- straight leg raising, AKE- active knee extension

5.2.Tests Used:

5.2.1.Paired t-test (within group)

Purpose: To check if each method (Neurodynamic / Dynamic) significantly improved hamstring flexibility.

5.2.2.Independent t-test (between groups)

Purpose: To check whether one method was more effective than the other in improving hamstring flexibility.

5. Results

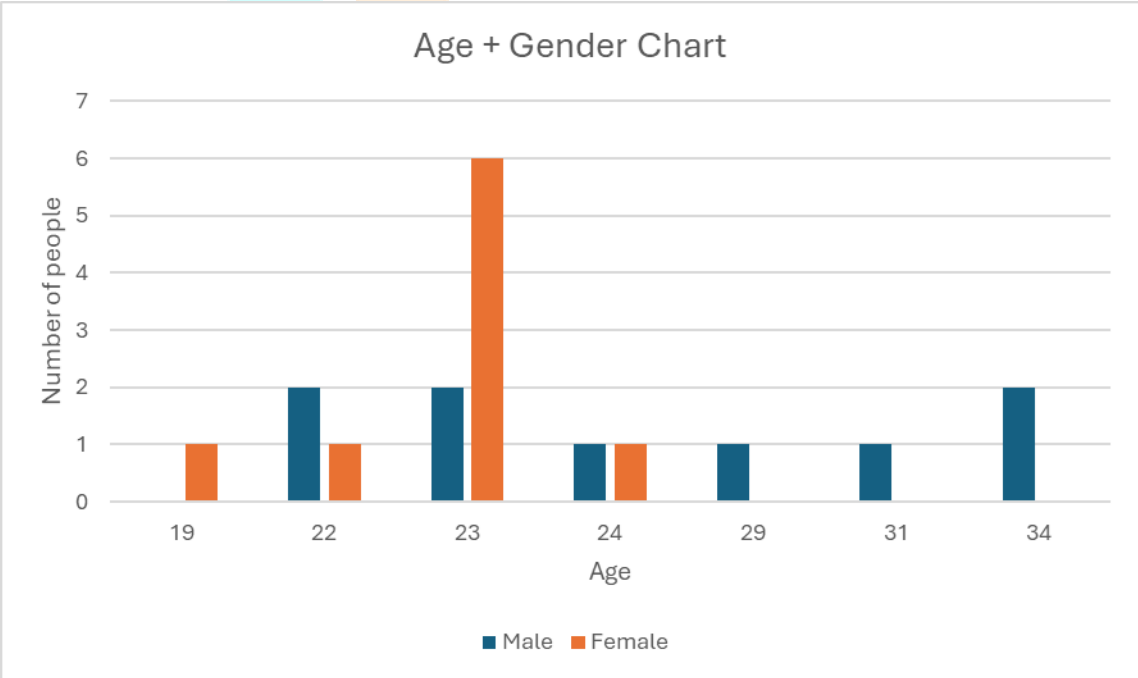

Fig 4: Age and gender distribution

The fig 4. gives the brief about the age group which was included in the study and in same age how many male and female where included.

Both neurodynamic and dynamic groups demonstrated significant improvement in hamstring flexibility following intervention.

Table 5:Neurodynamic and dynamic test results[2]

Test	Leg	Neurodynamic Mean	Neurodynamic SD	Dynamic Mean	Dynamic SD
90-90 SLR	Right	11.68	5.62	9.79	5.02
90-90 SLR	Left	10.95	5.66	9.79	5.5
Active KE	Right	7.89	3.92	8.05	3.58
Active KE	Left	9.53	7.22	7.37	2.87

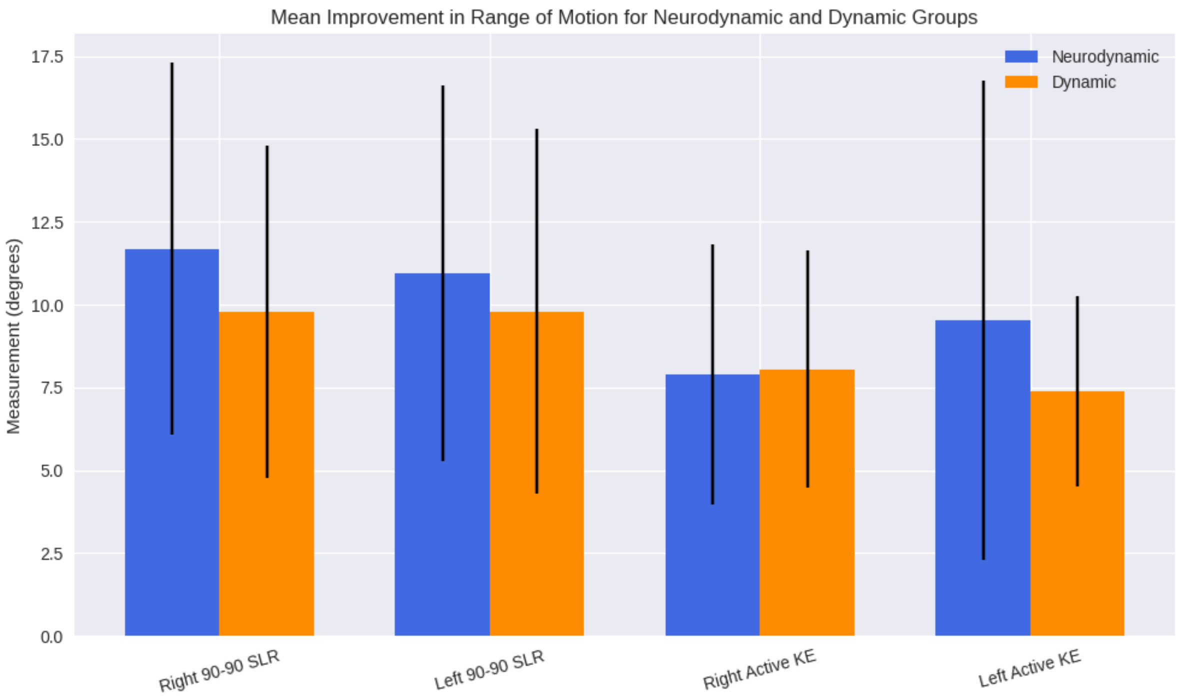

Fig 5:mean improvement in range of motion for neurodynamic and dynamic groups

In table 4 and figure 3 ,Neurodynamic group showed greater mean improvement in SLR and AKE .Dynamic stretching group also showed significant improvement. However, independent t-test revealed no statistically significant difference ($p > 0.05$) between groups.Thus, both interventions were effective, with no clear superiority

[2] SLR- Straight leg raising, KE- knee extension ,SD-standard deviation

Table 6: paired two sample for means (neurodynamic group)

	90-90 straight leg rise - Left		90-90 straight leg rise - Right		Active knee extension - Right		Active knee extension - Left	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	127.8421	138.3684	128.6316	138.2105	136.6316	144.3684	137.0	145.1053
Variance	71.6959	63.0234	93.3567	56.0643	43.1345	33.8012	54.3338	28.2105
Observations	19	19	19	19	19	19	19	19
Pearson Correlation	0.829040864		0.855685485		0.84326065		0.63714029	
Hypothesized Mean Difference	0		0		0		0.00000000	
df	18.000000		18.000000		18.000000		18.00000000	
t Stat	-9.51302988		-8.27177786		-9.52414939		-6.18257325	
P(T<=t) one-tail	1e-08		0.00000008		0.00000001		0.00000389	
t Critical one-tail	1.73406361		1.73406361		1.73406361		1.73406361	
P(T<=t) two-tail	2e-08		0.00000015		0.00000002		0.00000777	
t Critical two-tail	2.10092204		2.10092204		2.10092204		2.10092204	

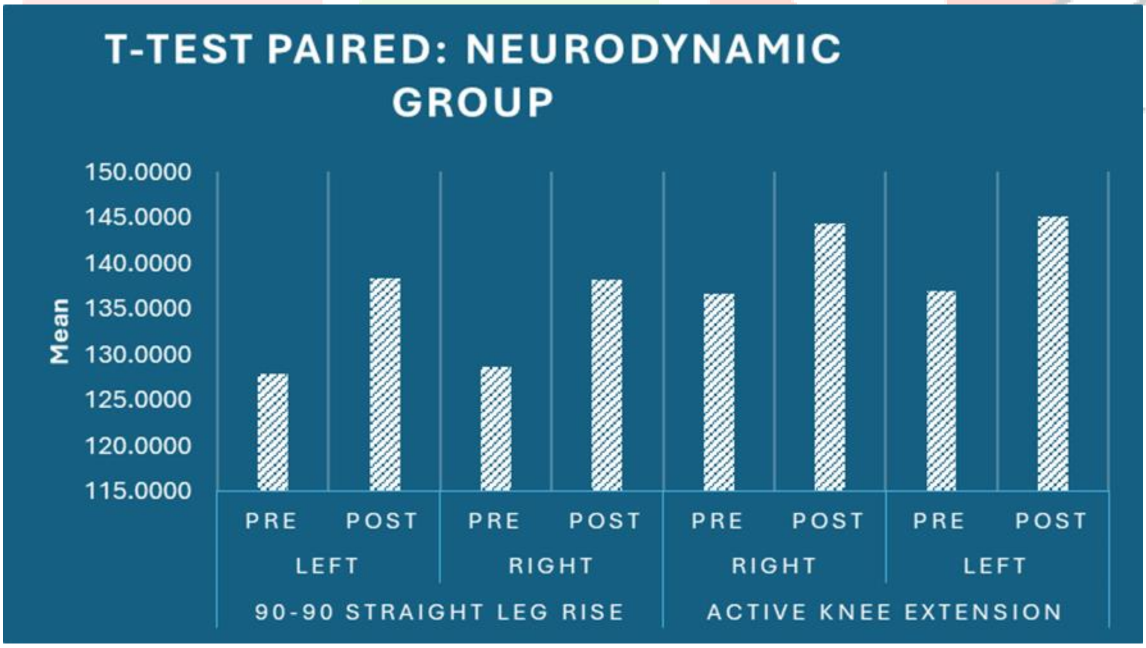

Fig 6: T-test paired for neurodynamic group

Table 7:Paired two samples for means

	90-90 straight leg rise				Active knee extension			
	Right		left		right		left	
Measure	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	124.2632	133.3684	126.6316	135.1053	140.2105	147.7895	140.2105	147.1053
Variance	59.6491	60.6901	67.4678	99.3216	36.0643	28.9532	88.0643	89.8772
Observations	19.0000	19.0000	19.0000	19.0000	19.0000	19.0000	19.0000	19.0000
Pearson Correlation	0.88748582		0.86172936		0.81465517		0.9820837	
Hypothesized Mean Diff.	0.0000000		0.0000000		0.0000000		0.0000000	
Df	18.000000		18.000000		18.000000		18.000000	
t Stat	-10.78445196		-7.2848110		-9.39352425		-16.77283127	
P(T<=t) one-tail	0.0000000		0.0000045		0.0000000		0.0000000	
t Critical one-tail	1.73406361		1.73406361		1.73406361		1.73406361	
P(T<=t) two-tail	0.00000003		0.00000906		0.00000023		0.0000000	
t Critical two-tail	2.10092204		2.10092204		2.10092204		2.10092204	

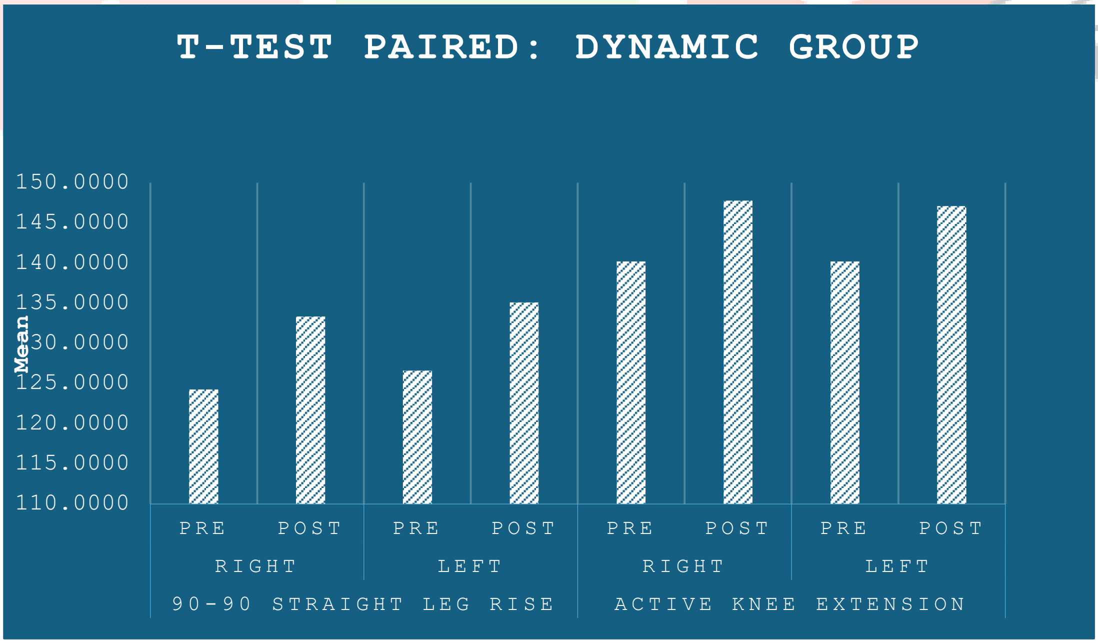

Fig 7:T-test paired for dynamic group

Refering to Table 7 all p-values < 0.05 → Both methods showed statistically significant improvement in all measures (90-90 SLR & Active Knee Extension, both legs).

Conclusion: Neurodynamic and Dynamic groups both improved significantly.

Table 8: Independent T-test sample of 90-90 SLR

	Right		Left	
	NEURODYNAMIC GROUP	DYNAMIC GROUP	NEURODYNAMIC GROUP	DYNAMIC GROUP
Mean	3.171184	2.957294	2.995858	2.709652
Variance	0.496011	0.379910	0.637326	0.728247
Observations	19	19	19	19
Pooled Variance	0.6801		0.6801	
Hypothesized Mean Difference	0		0	
df	36		36	
tStat	0.996364		0.765198	
P(T<=t) one-tail	0.162862		0.224277	
t Critical one-tail	1.688298		1.688298	
P(T<=t) two-tail	0.325724		0.448553	
t Critical two-tail	2.028094		2.028094	

Table 9: Independent T-test sample of active knee extension

	Right		Left	
	NEURODYNAMIC GROUP	DYNAMIC GROUP	NEURODYNAMIC GROUP	DYNAMIC GROUP
Mean	2.2.723962	2.677757	2.690964	2.604701
Variance	0.334473	0.431262	0.356418	0.116395
Observations	19	19	19	19
Pooled Variance	0.382867		0.236406	
Hypothesized Mean Difference	0		0	
df	36		36	
tStat	0.230161		0.546836	
P(T<=t) one-tail	0.409635		0.293933	
t Critical one-tail	1.688298		1.688298	
P(T<=t) two-tail	0.819269		0.587865	
t Critical two-tail	2.028094		2.028094	

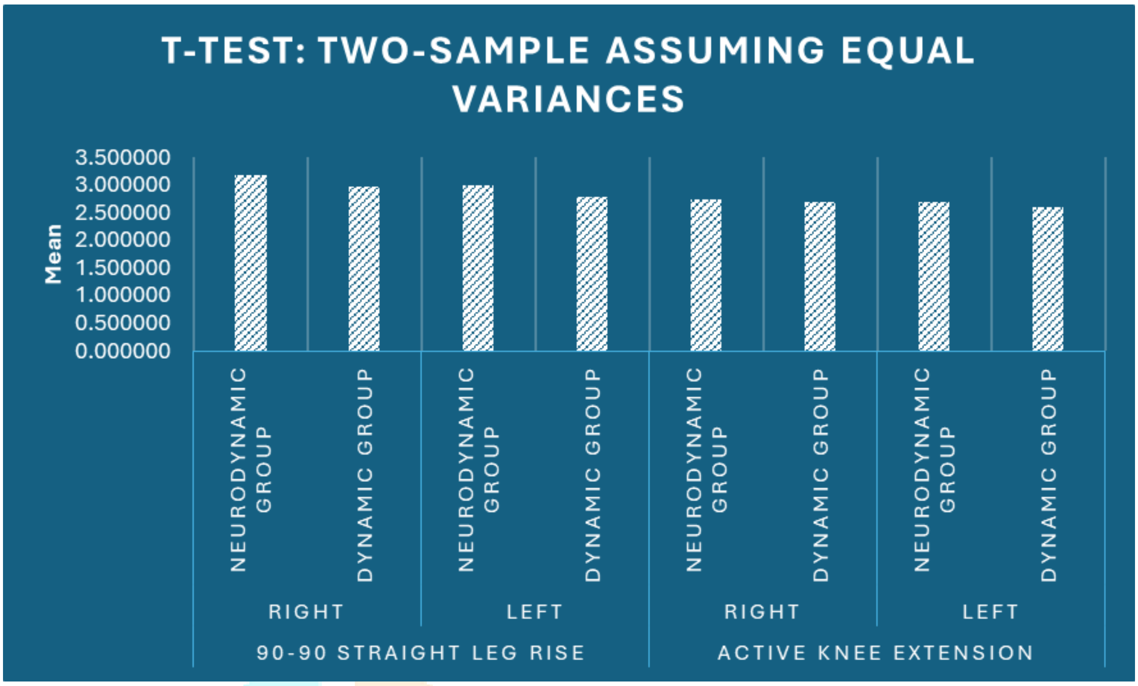

Fig 8: T-test two sample assuming equal variances

6. Discussion

This study evaluated the effectiveness of dynamic stretching and neurodynamic mobilization in reducing hamstring tightness.Both interventions showed statistically significant improvements, supporting previous studies. Neurodynamic mobilization works by improving neural mobility, while dynamic stretching improves muscle elasticity. Although neurodynamic mobilization showed slightly higher improvement, the difference was not statistically significant. This indicates that both techniques are equally effective.

The findings align with previous research suggesting that both stretching and neural mobilization improve flexibility.

7. Conclusion

Both dynamic stretching and neurodynamic mobilization are effective in reducing hamstring tightness. No significant difference was found between the two techniques. Clinicians can choose either method based on patient needs and convenience.

Future Scope

Study on larger sample size

Long-term effects evaluation

Combination of both techniques

Application in athletes and elderly populations

Limitations

Small sample size

Short duration

Limited age group

Clinical Implications

Both techniques are easy to perform

Useful for sedentary individuals

Can be applied in clinical and home settings

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