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Comparison Study of the Immediate Effect of Active Release Technique and Dynamic Oscillating Stretching Technique in Young Adults with Hamstring Tightness

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ABSTRACT

Background: Hamstring tightness is prevalent among young adults in sedentary occupations, limiting range of motion, contributing to lumbar spine overload, and impairing physical function. While Active Release Technique (ART) and Dynamic Oscillating Stretching Technique (DOS) have individually shown effectiveness in improving hamstring flexibility, no study has directly compared their immediate effects.

Objective: To compare the immediate effect of ART and DOS on hamstring tightness in young adults.

Methodology: A quasi-experimental comparative study was conducted on 68 subjects (aged 20–40 years) with hamstring tightness, divided into two groups of 34. Group A received a single session of ART and Group B received a single session of DOS. Popliteal angle was measured pre- and post-intervention using a universal goniometer. Paired t-test and unpaired t-test were used for intragroup and intergroup analysis, respectively.

Results: Both groups showed statistically significant improvement post-intervention. Group A (ART) showed a mean reduction from 34.44° to 30.21° ($t = 20.45$, $p < 0.0001$) and Group B (DOS) from 34.82° to 29.68° ($t = 12.24$, $p < 0.0001$). Intergroup comparison revealed no significant difference between the two techniques ($t = 0.52$, $p = 0.60$).

Conclusion: Both ART and DOS are equally effective in producing an immediate improvement in hamstring flexibility in young adults, with no significant difference between them.

Keywords: Hamstring tightness, Active Release Technique, Dynamic Oscillating Stretching Technique, Popliteal angle

INTRODUCTION

The long, strong group of muscles that runs along the back of the thigh is known as the hamstrings. One of the main things impeding performance in daily activities is hamstring tightness [1]. Tight hamstring muscles prevent the pelvis from tilting anteriorly during spinal flexion, aggravating muscle and ligamentous tension in the lumbar region and increasing the compressive loads on the lumbar spine significantly [2]. Other postural modifications brought on by hamstring tightness may indirectly affect the stability of the sacroiliac joint [3]. The prolonged sitting times required in educational

settings, work environments, and most occupations are to blame for the weakened flexibility of soft tissues, particularly at two joint muscles [4]. The prevalence of hamstring tightness is highest in the 18 to 25 age group, as well as among young university students and sewing workers who spend a lot of time sitting down (82% and 83%, respectively) [4,5,6,7]. Therefore, hamstring flexibility is essential for overall health and top physical fitness [8].

Flexibility of the muscles is essential for everyday human activity. A person's level of function can be significantly impacted by limited flexibility, which has been shown to predispose a person to a number of musculoskeletal overuse injuries [9]. Normal joint flexibility is influenced by a variety of factors, such as injury, inactivity, and stretching. The flexibility of the soft tissues surrounding the joint will have an impact on its range of motion. The Straight Leg Raising (SLR) test, Active Knee Extension (AKE) test, and Passive Knee Extension (PKE) test are three different ways to measure hamstring flexibility [10]. The straight leg raise test is primarily used to assess. hamstring tightness, but because the pelvis moves during the test, the hamstring muscle is less specifically assessed. Because of this, the straight leg raise test is only partially appropriate for determining the degree of hamstring tightness. Because it involves movement at the knee joint rather than the hip joint, the active knee extension test is regarded as being very specific for determining how tight the hamstring is. While a straight leg raise involves both knee and hip movement. SLR is essentially a passive test in which the physiotherapist applies the force, and its solely force-dependent conclusion. While the AKE test is an actively performed test, the end position during this test completely depends on the subject's tension, which is developed in the subject's quadriceps and in the available pain-free range of motion of the joint [11]. Since the user specifies the end point in the AKE test, this test is safer. The subject's range of motion is tested while it is in the pain-free zone. Therefore, this test is more reliable than any other [12].

Numerous stretching techniques can help you become more flexible. Active stretching, where range of motion is increased by voluntary contraction, and passive stretching, where range of motion is increased by external assistance, are the two main types. Active stretching, passive stretching, ballistic stretching, static stretching, dynamic stretching, Muscle Energy Technique, Bowen Technique, Dynamic Soft Tissue Mobilization, Massage Therapy, Active Release Technique, and Proprioceptive Neuromuscular Facilitation are techniques used to increase hamstring flexibility. [13,14,15].

A soft-tissue and non-invasive treatment method called Active Release Technique is used to break up adhesions and scar tissue that are the source of pain, stiffness, weakness, and other physical dysfunctions [16]. Active Release Technique (ART) is a manual soft tissue treatment approach developed by Dr. P. Michael Leahy. The technique involves the application of targeted manual pressure to areas of soft tissue restriction while the patient actively moves the affected tissue through a specific range of motion. [17]. Hamstring active release technique therapy aims to reduce tightness and pain while assisting the hamstring in getting back to normal condition. It has three unique objectives: Restoring free and unimpeded movement of soft tissue, the release of entrapped nerves, vasculature and lymphatic, and to re-establish optimal texture, resilience and function of soft tissues [18]. The typical course of treatment is to first feel for soft tissue injury. The tissue is then moved with a specific hand contact from a shortened position to a fully lengthened position. This enables the contact to travel longitudinally through the lesion and the fibres of the soft tissue. The aim is to remove adhesions that might have developed from soft tissue scarring. Additionally, ART also aims to return strained or stiff soft tissue structures to their previous healthy state. [13].

Static stretching is frequently used to improve performance, increase range of motion, lower the risk of injury, prevent injuries, and alleviate delayed onset muscle soreness [19]. However, research consistently demonstrates that SS is largely extensible in achieving the aforementioned outcomes [8, 19], aside from improving extensibility. The dynamic oscillating stretching technique is a novel stretching method that is introduced in the current study. A modified form of proprioceptive neuromuscular facilitation is called Dynamic oscillating stretching technique (DOS). In that the agonist exerts the stretching force on the antagonist's muscle, DOS is similar to agonist contract relax [20]. In this study, the quadriceps femoris muscle is contracted to actively move the lower extremity into increased ROM using the reciprocal inhibition mechanism when attempting to stretch the hamstrings.[20, 21] The dynamic oscillatory and passive stretching components of DOS therefore comprise it. In a 2017 randomised controlled trial, Arie Michaeli et al. examined the effects of dynamic oscillatory stretching technique on the length of the hamstring muscle, its flexibility, and its tolerance to pain brought on by stretching the hamstring muscle. They came to the conclusion that dynamic oscillatory stretching technique was more effective than static stretching in achieving a rapid increase in the length and flexibility of the hamstring muscles [22]. Various techniques have been found to be effective in reducing hamstring tightness. Different studies suggested that dynamic oscillatory stretching and ART stretching both have been effective in improving the hamstring flexibility. Our aim is to compare them specifically to reduce hamstring tightness in young adults with hamstring tightness as this yet remains a problem as most professions require long standing/sitting hours in today's time. Thus, the purpose of the study will be to compare these two techniques in young adults with hamstring tightness under the parameter of popliteal angle range in an attempt to identify the more competent technique which will help the general population lead a more proficient lifestyle.

MATERIALS & METHODS

Study Design – Quasi Experimental Study

Sample Size - The sample size was calculated using WinPepi software, based on a mean difference of 5.37° and standard deviation values of 8.93 and 6.63 for the popliteal angle, derived from pilot data. At a significance level of 5% ($\alpha = 0.05$) and a statistical power of 80%, the calculated sample size was 68 subjects — 34 in each group.[23]

Sampling Technique - Convenient sampling

Inclusion Criteria: Participants between the ages of 20 and 40 years of either gender who presented with hamstring tightness, defined as a popliteal angle between 21° and 40°[25], were included in the study.

Exclusion Criteria:

Participants were excluded if they had any upper or lower motor neuron lesion, were currently engaged in structured sports or gymnasium activity, had undergone any surgery around the hip or knee joint within the preceding one to two months, or were unwilling to provide informed consent.

Outcome Measure: Popliteal Angle

The popliteal angle was used as the primary outcome measure to assess hamstring tightness. The participant was positioned in supine with the test limb placed in 90° of hip flexion and 90° of knee flexion, stabilised using a belt secured around the lower femur just above the knee joint line. The contralateral limb was maintained flat on the plinth with a stabilising belt. A metal goniometer was positioned with its fulcrum over the lateral joint line of the knee, the proximal arm aligned parallel to the femur, and the distal arm parallel to the fibula. The participant was then instructed to actively extend the knee as far as possible until they perceived a mild stretch sensation in the

hamstrings. The angle of end-range knee extension was recorded as the popliteal angle. This measurement was taken immediately before and immediately after the intervention in both groups.[24]

Intervention Procedures –
Group A – Active Release Technique (ART):
Participants were positioned in supine with the test limb in 90° of hip and knee flexion. The therapist palpated the hamstring muscle belly to identify areas of soft tissue restriction, tenderness, or abnormal tissue texture indicative of adhesions. Sustained manual pressure was applied to the identified point of restriction using the thumb or fingers. While maintaining this contact, the participant was instructed to actively extend the knee from the flexed position to full extension. This combined contact-and-movement sequence was repeated three to five times per session.[26]

Fig 1: Active release technique

Group B – Dynamic Oscillating Stretching Technique (DOS):
Participants were positioned in supine. The therapist passively elevated the test limb into hip flexion with the knee extended until the participant reported a mild stretch sensation in the hamstrings — the first onset of resistance. At this position, the participant was instructed to contract the quadriceps femoris muscle and hold the contraction. The therapist simultaneously applied three slow, gentle oscillatory movements at the end-range position. Following the oscillations, the participant was instructed to release the quadriceps contraction as the therapist slowly lowered the limb. This sequence was repeated for three sets.[22]

Fig 2: Dynamic oscillating stretching technique

Statistical Analysis

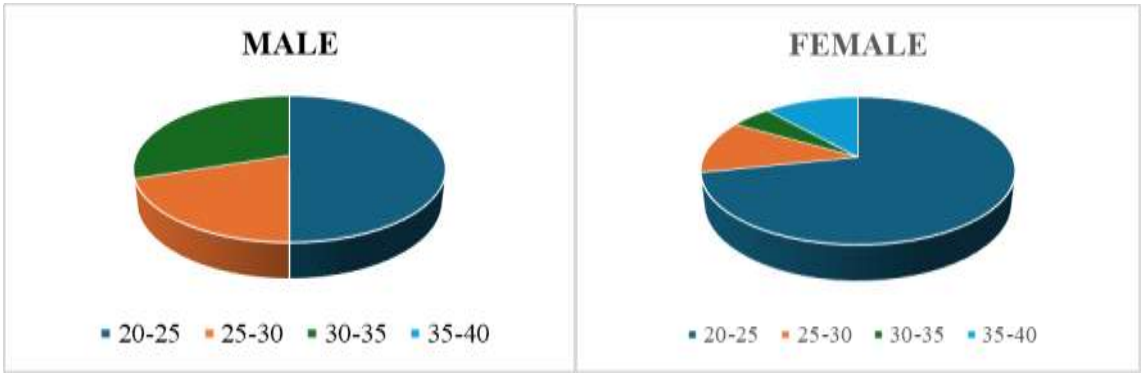
All statistical analyses were performed using Microsoft Excel 2007. Descriptive statistics including means and standard deviations were calculated for all quantitative variables. Intragroup comparison of pre- and post-intervention popliteal angle values was performed using the paired t-test for each group. Intergroup comparison of post-intervention popliteal angle values between Group A and Group B was performed using the unpaired t-test. A p-value of less than 0.05 was considered statistically significant.

RESULT

A total of 68 participants (34 in each group) were enrolled and completed the study. The sample comprised predominantly female participants (85%, n = 58) and male participants (15%, n = 10). The majority of participants fell within the 20–25 years age group (n = 48), followed by 25–35 years (n = 15), and 35–40 years (n = 7). The demographic distribution is presented in Table 1.

Table 1: Demographic Distribution

Gender / Age Group	20–25 years	25–35 years	35–40 years
Male	**5**	**5**	**0**
Female	**43**	**10**	**7**
Total	**48**	**15**	**7**



Graph 1: Demographic Distribution

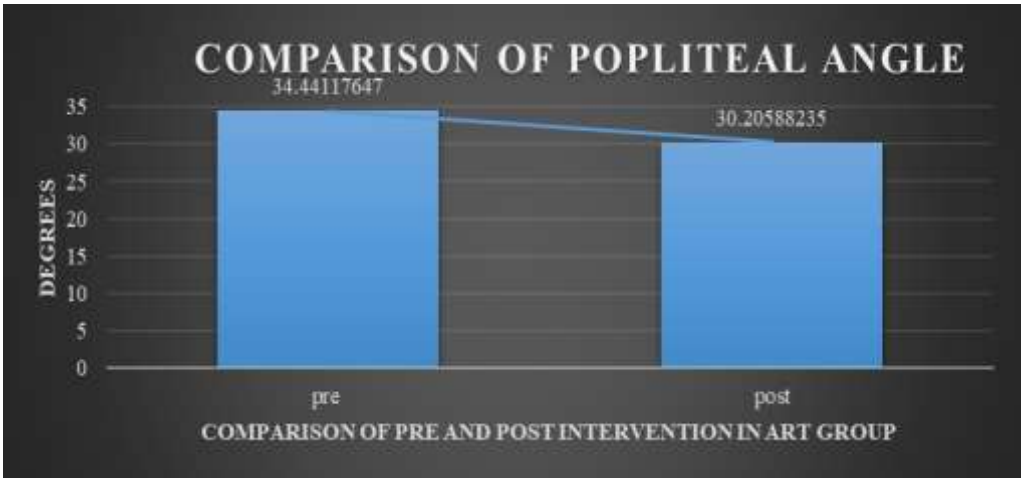
Interpretation: Above pie chart shows that 85% were female and remaining 15% were male participants in the study.

Intragroup Analysis – Group A (Active Release Technique)

Participants in Group A demonstrated a statistically significant improvement in hamstring flexibility following a single session of ART. The mean popliteal angle decreased from 34.44° (SD ± 4.24) pre-intervention to 30.21° (SD ± 4.19) post-intervention, reflecting a mean reduction of 4.23° in popliteal angle. The paired t-test yielded a t-value of 20.45 and a p-value of less than 0.0001, confirming that the improvement was highly statistically significant. These results are presented in Table 2.

Table 2: Pre- and Post-Intervention of Popliteal Angle Values in Group A (ART)

Group (ART)	Mean (°)	SD	T value	t / p value
Pre-Intervention	34.44	4.24	20.45	$p < 0.0001$
Post-Intervention	30.21	4.19		



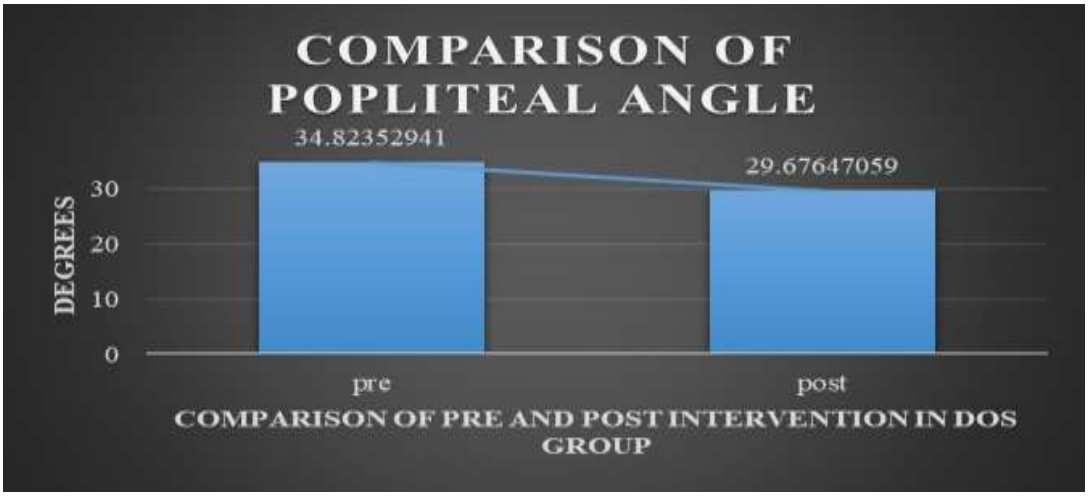
Graph no.2: Bar graph representation of comparison of pre and post intervention in Active release technique

Interpretation: Above bar graph shows that on Comparison of Pre and Post Popliteal angle values in ART (Group 1) group using paired t test t value is 20.45and p value is < 0.0001 it indicated statistically significant (Graph 2).

Intragroup Analysis – Group B (Dynamic Oscillating Stretching Technique)

Table 3: Pre- and Post-Intervention of Popliteal Angle Values in Group B (DOS)

Group (DOS)	Mean (°)	SD	T value	t / p value
Pre-Intervention	34.82	4.73	12.24	p < 0.0001
Post-Intervention	29.68	4.18		



Graph No.3: Comparison Of Pre and Post Intervention Using Popliteal Angle in Dynamic oscillating stretching technique group

Interpretation: Above bar graph shows that on Comparison of Pre and Post Popliteal angle values in DOS group (Group 2) using paired t test value is 12.24 and p value is <0001 it indicated statistically significant (Graph3).

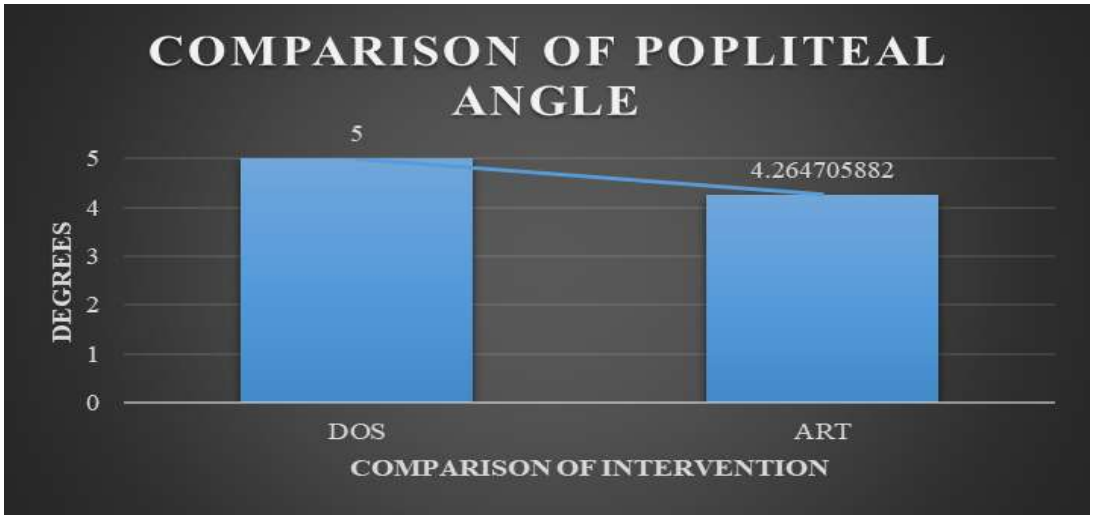
Intergroup Comparison of Post-Intervention Values

When comparing the post-intervention popliteal angle values between Group A (ART) and Group B (DOS) using the unpaired t-test, the t-value was 0.52 and the p-value was 0.60. This result was not statistically significant (p > 0.05), indicating

that there was no significant difference in the immediate effect of ART and DOS on hamstring flexibility in young adults. Both techniques produced comparable improvements. These results are presented in Table 4.

Table 4: Intergroup Comparison of Post-Intervention Popliteal Angle Values

Group	Mean Difference (°)	SD	T value	t / p value
Post ART (Group A)	4.3	4.19	0.52	p = 0.60
Post DOS (Group B)	5.14	4.18		(Not Significant)



Graph no.4: Comparison between post intervention in both groups (Active release technique and Dynamic oscillating stretching technique)

Interpretation: Above bar graph shows Comparison of Post value of Popliteal angle after ART and DOS using unpaired t test the t value is 0.52.The p value is 0.60.The result is not significant at p<0.05.(Graph no.4) .

DISCUSSION

The present study compared the effectiveness of Active release technique & Dynamic oscillating stretching technique on hamstring tightness.

On reviewing the literature relating to hamstring tightness occurring in asymptomatic healthy individuals the incidence of hamstring tightness has been shown to be high in individuals with either long standing professions and also students and workers who have long extended sitting posture , hence the age group of 20 – 40 years was taken to be relevant. Flexibility of the hamstring muscles was tested by Davis DS Quinn RO et al on the concurrent validity of four clinical tests which included knee extension angle, the straight leg raise test, the sacral angle and the sit to reach test. In this the reliability of the classic knee extension angle (popliteal angle) was reported to be 0.98.

Both groups demonstrated statistically significant improvements in popliteal angle following a single intervention session. Group A (ART) showed a mean reduction of 4.23° (34.44° to 30.21°; t = 20.45, p < 0.0001), while Group B (DOS) showed a mean reduction of 5.14° (34.82° to 29.68°; t = 12.24, p < 0.0001). The intergroup comparison revealed no statistically significant difference between the two techniques (t = 0.52, p = 0.60), indicating that both are equally effective in producing immediate improvements in hamstring flexibility.

The improvement in Group A is consistent with existing literature. Borkar et al. (2020) and Kage & Ratnam (2014) both reported significant hamstring flexibility gains following a single ART session. ART works by mechanically disrupting inter- and intra-muscular adhesions formed due to microtrauma or sustained postural loading,

restoring normal fascial gliding and reducing tissue tension. The active movement component may additionally facilitate neurological inhibition via Golgi tendon organ stimulation, further reducing muscle tone.[25,27]

The improvement in Group B aligns with findings by Arie Michaeli et al. (2017) and Kanza Masood et al. (2020), who demonstrated DOS to be superior to static stretching in producing immediate hamstring extensibility gains. DOS achieves its effect through two mechanisms: reciprocal inhibition, whereby active quadriceps contraction reflexively relaxes the hamstrings; and oscillatory pain modulation via the descending noradrenergic inhibitory system, which raises stretch tolerance and allows the muscle to be taken beyond its habitual end-range.googl

The study has several limitations. The sample size was small, limiting generalizability. Only immediate post-intervention effects were measured, with no follow-up to assess the sustainability of gains. Intervention parameters such as repetitions, contraction duration, and oscillation frequency were not fully standardised, potentially introducing dose variability. Limb dominance and quadriceps lag were not accounted for as confounding variables. As a quasi-experimental study with convenient sampling, the absence of randomization and a control group limits causal inference. Future research should include randomized controlled trials with larger samples, long-term follow-up, and investigation of dose-response relationships across specific sub-populations such as athletes, desk workers, and older adults.

CONCLUSION

Our study leads to following conclusions that both active release technique and dynamic oscillating stretching technique were effective in the treatment of hamstring tightness but statistically no significant difference was found between these two techniques. Although both techniques are effective clinically in alleviation of symptoms and associated disability in hamstring tightness but DOS showed more immediate results as compared to ART.

Declaration by Authors

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