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**A STUDY TO COMPARE IMMEDIATE EFFECT OF SOFT TISSUE
FLOSSING TECHNIQUE VERSUS DYNAMIC SOFT TISSUE
MOBILISATION (DSTM) TECHNIQUE ON HAMSTRING
FLEXIBILITY IN DESK JOB WORKERS**

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ABSTRACT

Objective: This research aims to investigate the immediate effectiveness of Soft tissue flossing technique versus DSTM technique on hamstring flexibility in male desk job workers.

Method: A total number of 66 male desk-job workers were selected for the study. Participants with Popliteal angle < 125° and SLR of between 40° - 70° were included. They were divided into two groups of 33 each. Group-A was given Soft tissue flossing technique for 5-7 minutes and Group-B was given DSTM technique for 8 minutes. Pre and Post Hamstring flexibility was assessed by Popliteal angle test (Right and Left), SLR test (Right and Left) and Sit and reach flexibility test.

Results: The Shapiro-Wilkinson test assessed data normality. Within-group comparison utilized the Wilcoxon sign rank test, while between-group comparison employed the Mann-Whitney U test for both Group-A and Group-B. The Mann-Whitney U test did not reveal statistically significant differences at the pre/post interval (P>0.05) for the Popliteal angle test, SLR test, and Sit and reach flexibility test. However, the Wilcoxon sign rank test indicated significant differences within both groups (P<0.05).

Notably, the DSTM Technique group showed higher mean difference (pre-post) values compared to the Soft tissue flossing technique group across all three outcomes.

Conclusion: This study concludes that both Soft tissue flossing technique and DSTM technique was found to improve hamstring flexibility, but DSTM technique was found superior to Soft tissue flossing technique for hamstring flexibility in male desk-job workers.

Keywords: Hamstring Flexibility, Soft tissue flossing, Dynamic soft tissue mobilisation (DSTM) Technique, Desk job workers

INTRODUCTION

Flexibility is crucial for smooth movement, but alterations can increase injury risk and diminish physical capabilities [1, 2].

Tightness in specific muscle groups, like the hamstrings, is common and can result from adaptive changes in soft tissue [3].

Biarticular muscles like the hamstrings are especially susceptible due to their structure, often experiencing strain across two joints simultaneously [4].

The hamstring muscle group is the collective word for the main musculature that form thigh's posterior portion [5]. The semimembranosus, semitendinosus, and both the short and long heads that constitute the biceps femoris are among these four particular muscles. These muscles combine to form the biarticular muscle complex known as the hamstring [3].

Most hamstring muscles span both the knee and hip joints, originating from the pelvis and extending along the back of the thigh. They control the posterior movement of the femur during hip extension and the posterior movement of the tibia and fibula during knee flexion [6]. Hamstring muscles

performs a crucial part into exercises like walking, running, jumping as well as cycling [3].

The presence of tightness of hamstring group of muscles leading to restricted flexibility initiates neuromusculoskeletal symptoms, ultimately reducing factors such as strength, stability, endurance, and other interconnected elements [7].

Tight hamstrings are associated with various problems including patellar tendinopathy, plantar fasciitis, and LBP [8, 9, 10]. They can limit knee extension, ankle dorsiflexion, and spine curvature, affecting posture and gait. Hamstring tightness can increase risk of hamstring strains and make bending forward difficult [6].

Individuals who spend extended hours at a desk, for instance, undergo adaptive changes that can lead to the shortening of their hamstring muscles. Sitting for longer durations induces a posterior pelvic tilt, causing the hamstrings to contract into a shortened position [11].

Based on the study, an incidence rate - 96.7% was observed for tight hamstrings

among Indian men in their Middle Ages who work longer with desk jobs [12]. Furthermore, among individuals with lower flexibility, especially inactive males, tightness of the hamstrings was shown to be as common as 54% of the time [10].

Various diagnostic tests such as knee extension angle, sacral angle, SLR and sit and reach can be utilized to assess Extensibility of hamstrings [13]. Numerous methods are available to alleviate tightness and enhance flexibility. These include static-dynamic stretching, proprioceptive neuromuscular facilitation, Cross-fibre massage, Transverse massage, and MFR using tools such as foam rollers or roller massagers [12].

A recent research investigation revealed that engaging in a soft tissue flossing intervention led to enhanced flexibility in the hamstrings [14]. Tissue flossing represents a novel approach designed to enhance athletes' ROM, alleviate discomfort, lower the risk of injuries, or expedite their return to competition [15].

Subsequent studies aimed to assess efficiency of DSTM technique with relation to improving extensibility of the hamstrings [8, 16]. DSTM serves as an intervention for mobilizing soft tissues, applied to address tight spasms through a gradual activation of muscles [17].

Previous studies have shown effectiveness for both the soft tissue flossing technique and dynamic soft tissue mobilisation (DSTM) technique beneficial in managing hamstring tightness but none of the studies compared these two techniques. Therefore, this study is to compare between these two techniques.

METHODOLOGY

Materials: This study utilized a variety of materials including a plinth, paper, pen, assessment and consent forms, a goniometer, inch tape, flossing band, and sit & reach box.

Study Design: Experimental Study

Source of data: 66 male desk-job workers with the presence of bilateral hamstring tightness were recruited from 2 different companies of Ahmedabad for the study.

Ethical consideration: Institutional ethical clearance (IECHR-SAINATH HOSPITAL/AHMC/80) was obtained, and people that fulfilling eligibility criteria had been chosen and given on the research protocol.

Diagnosing Criteria's: The hamstring was considered tight if the popliteal angle was less than 125 degrees [18] or the SLR angle was between 40°-70° [8].

Sampling Method: 66 Male desk-job workers with bilateral hamstring tightness were randomly distributed to two groups, Group -A and Group- B, using a simple

random sample approach called chit-method.

GROUP A (n=33) received the Soft tissue flossing technique.

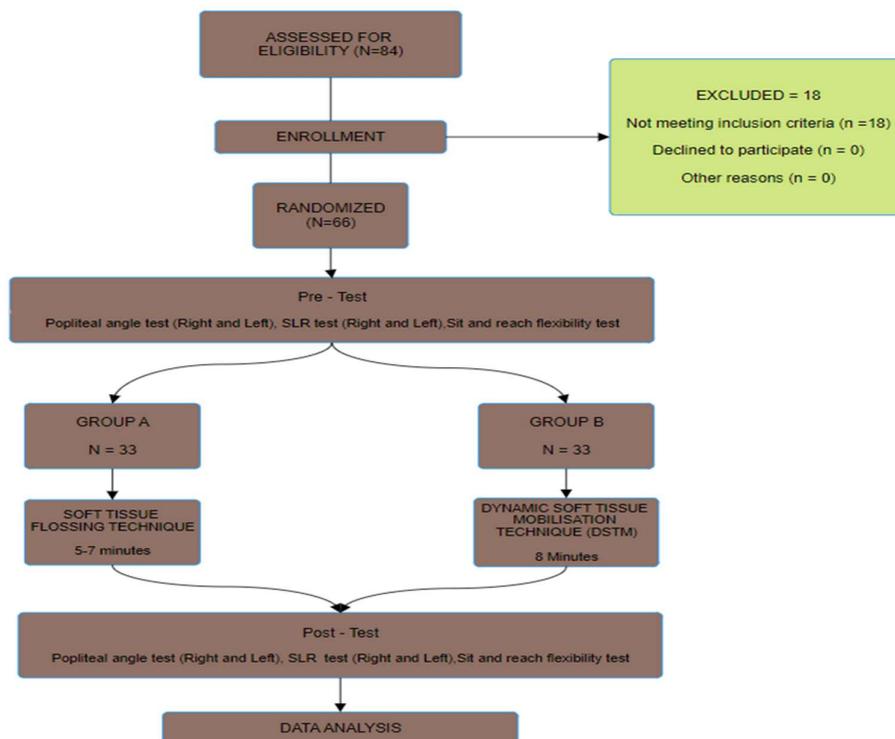
GROUP B (n=33) received the Dynamic soft tissue mobilisation (DSTM) approach.

Inclusion criteria: The inclusion criteria for research participants included those who provided informed consent, Male desk-job workers aged between 35 and 55 years, engaged in desk-based occupations for at least 7 years continuously, spending a minimum of 5 hours daily at their desks. Additionally, participants were required to demonstrate a SLR test between 40°-70° and a popliteal angle measurement < 125° [8, 12, 18].

Exclusion criteria: The exclusion criteria included individuals who worked remotely

(WFH), significant lower limb musculoskeletal disorders in the past 6 months such as fractures or tears, acute or recent hamstring injuries or strains, discomfort or issues in the spine, knees, or hips, knee stiffness, recent LBP within 2 months, compromised neurological function in the lower back or lower limbs, and recent lower limb surgeries affecting participation [8, 14, 16, 19].

Outcome measures: Before and after the intervention (single-session, immediate effect), participants in both groups underwent evaluations using the Popliteal angle test [19] (for both right & left sides) - ICC=0.8525, SLR test [20] (for both right & left sides) - ICC= 0.94-0.96, and Sit-and-Reach flexibility test [21] - ICC=0.92.



Group - A - Soft tissue flossing technique:

The soft tissue flossing treatment begins by placing a 4-inch rubber band around the upper leg, starting from the bottom and moving upward, stretching it to about half of its maximum capacity. This band applies pressure on the hamstrings, after which the therapist reduces the stretch to about 25% percent of the band's maximum capacity while focusing on the quadriceps femoris muscle. The process involves wrapping the floss band around the upper, middle, and lower thighs and swiftly removing it at the end of each treatment session [10, 14].

Participants completed an exercise protocol: One set of 10 squats with quads parallel to the ground, 10 lunges per leg, 20 upright hamstring curls on both legs without resistance. Therapist provided a demonstration for accuracy [14].

After finishing all exercise protocol, the floss band had been taken off. Afterwards, subjects asked to proceed walking for approximate duration of 1-min [14]. Overall, this intervention took approximately 5-7 minutes.



Figure 1: Application of Floss Band

Group-B – DSTM Approach:

Before administering dynamic intervention, all participants received traditional massage techniques lasting about 5 minutes [8].

During classical technique, everyone participating was in prone-position, having their knees and hips assuming neutral and comfortable positions. The hamstrings were treated with a standard Swedish massage,

which included techniques including picking-up, effleurage, kneading. Total massaging session consisted of 5 applications for every method, which was completed in 5-minutes timeframe [8].

The DSTM technique involved three stages. The patient lied supine with knees and hips bent at 90 degrees. In each stage, the therapist performed 5 deep strokes along the

tight hamstring area (distal to proximal). Stage 1 included passive hamstring stretching, stage 2 added active leg extension, and stage 3 involved eccentric hamstring contraction with pressure against the therapist's hand while administrating 5 deep longitudinal strokes in all three stage from distal to proximal. [17] In total, it took approximately 8 minutes to perform both the classical and dynamic procedures combined.

RESULTS

A statistical evaluation of pre-post data was performed using Statistical Package for the Social Sciences (SPSS) program version-26.0 -SPSS Inc., Chicago- IL. The Wilcoxon Sign Rank test was employed for Within group analysis (Group A and Group B). Between group analysis (GROUP A VS. GROUP B) was done using Mann-Whitney U test.

Non-parametric tests were employed due to non-normal data distribution (Shapiro-Wilk, $p < 0.05$). Popliteal angle assessment revealed no significant inter-group

differences (Mann-Whitney U, $p > 0.05$). However, within-group analyses (Wilcoxon Sign Rank, $p < 0.05$) demonstrated improvements in both interventions. Notably, the DSTM group exhibited greater improvement (**Tables 2 & 3**).

Non-parametric tests were employed due to non-normal data distribution (Shapiro-Wilk, $p < 0.05$). SLR test revealed no significant inter-group differences (Mann-Whitney U, $p > 0.05$). However, within-group analyses (Wilcoxon Sign Rank, $p < 0.05$) showed improvements in both interventions. Notably, the DSTM group exhibited greater improvement (**Table 4 & 5**).

Non-parametric tests were employed due to non-normal data distribution (Shapiro-Wilk, $p < 0.05$). Sit & reach flexibility test revealed no significant inter-group differences (Mann-Whitney U, $p > 0.05$). However, within-group analyses (Wilcoxon Sign Rank, $p < 0.05$) showed improvements in both interventions. Notably, the DSTM group exhibited greater improvement (**Table 6**).

Table 1: Mean Age

	GROUP A	GROUP B	Z VALUE	P VALUE
MEAN	43	45	1.46	0.14
SD	4.89	6.17		

$P < 0.05$ is statistically significant

Table 2: Comparison of popliteal angle test- RIGHT

	PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
GROUP A- Soft tissue Flossing	109.06±7.99	117.64±8.26	4.28	0.0001*	8.4±8.16
GROUP B- DSTM Technique	108.27±8.35	117.54±7.01	5.21	0.0001*	9.27±8.24
Mann Whitney U TEST	0.23	0.08			
P VALUE	0.78	0.91			

* $P < 0.05$ is statistically significant

Table 3: Comparison of popliteal angle test- LEFT

	PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
GROUP A- Soft tissue Flossing	111.58±8.79	119.37±8.87	3.89	0.0001*	7.79±8.81
GROUP B- DSTM Technique	108.31±8.42	117.94±8.44	4.43	0.0001*	9.63±8.42
Mann Whitney U TEST	0.67	0.44			
P VALUE	0.31	0.59			

*P<0.05 is statistically significant

Table 4: Comparison of SLR test- RIGHT

	PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
GROUP A- Soft tissue Flossing	54.33±9.14	62.06±9.78	3.68	0.0001*	7.73±9.44
GROUP B- DSTM Technique	52.54±8.31	61.81±9.01	4.24	0.0001*	9.27±8.88
Mann Whitney U TEST	0.56	0.24			
P VALUE	0.34	0.77			

*P<0.05 is statistically significant

Table 5: Comparison of SLR test- LEFT

	PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
GROUP A- Soft tissue Flossing	55.75±9.51	63.91±11.09	3.94	0.0001*	8.16±10.23
GROUP B- DSTM Technique	55.15±7.87	65.45±9.04	4.68	0.0001*	10.3±8.44
Mann Whitney U TEST	0.10	0.68			
P VALUE	0.89	0.29			

*P<0.05 is statistically significant

Table 6: Comparison of sit & reach flexibility test

	PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
GROUP A- Soft tissue Flossing	15.45±6.15	19.69±6.63	2.64	0.01*	4.14±6.23
GROUP B- DSTM Technique	14.63±5.72	18.93±6.18	2.85	0.001*	4.3±6.05
Mann Whitney U TEST	0.35	0.24			
P VALUE	0.68	0.77			

*P<0.05 is statistically significant

DISCUSSION

Current research contrast effects related to Soft Tissue Flossing intervention and DSTM intervention on Hamstring Flexibility of Desk-job workers. Extensibility of hamstrings into all individuals from both the groups was analysed by applying Popliteal Angle Test, SLR test and Sit and Reach Flexibility test Pre & Post intervention.

Participants in Group A underwent soft tissue flossing, which demonstrated a

noticeable beneficial impact on hamstring flexibility. This technique involves tightly wrapping elastic bands around muscles to induce fascial shearing and disrupt adhesion points, facilitating myofascial sliding [19]. By partly limiting blood flow circulation, soft tissue flossing allows for passive twisting and active movement during 1-3-minute range of motion drills [14, 15]. This compression reduces local blood flow, potentially decreasing inflammation and

sensitivity to pain while activating mechanoreceptors for pain relief [19, 22].

Research by Thanawat Kitsuksan *et al.* (2022) showed significant improvement in hamstring flexibility with tissue flossing during active isolated stretching [10]. Similarly, Zachary Maust *et al.* (2021) found that flossing improved hamstring extensibility without compromising power, beneficial for performance enhancement and injury rehabilitation [14].

Participants in Group B received DSTM intervention, resulting in a significant increase in hamstring flexibility. DSTM involves therapist-administered manual treatment combined with movement execution, targeting regions of hamstring stiffness using end-range methods [8]. This pain-free and efficient technique aims to reduce tissue tension within the functional range of motion, potentially increasing muscle circulation and decreasing rigidity [23, 24]. Additionally, DSTM is theorized to break down scar tissues, facilitating the remobilization of fascia into a pliable condition, thereby increasing connective tissue compliance and ROM [24].

Study by Hopper *et al.* (2005), demonstrated the effectiveness of DSTM in improving hamstring flexibility across various populations. [8] Additionally, research by Imtiaz *et al.* (2018) and Maghade *et al.* (2018) supported the convenience and efficacy of DSTM for this purpose [22, 25].

However, contrasting studies by Yadav *et al.* (2013) and Aroona *et al.* (2016) suggested that alternative techniques like the Bowen technique or Mulligan – BLR technique might be more effective in certain scenarios [18, 23].

In summary, Soft tissue flossing and DSTM both significantly improved hamstring flexibility in male desk-job workers. However, DSTM showed greater improvement compared to flossing, suggesting its superiority in addressing hamstring tightness in this population.

CONCLUSION

The research concluded that both soft tissue flossing and DSTM interventions significantly improved hamstring flexibility in male desk-job workers. Group-B, receiving the DSTM technique, showed greater improvements in all three outcomes compared to Group A, which received soft tissue flossing. In summary, while both interventions were effective, DSTM emerged as superior, indicating its preference for addressing hamstring flexibility issues in desk-job workers. Future research can explore these techniques in different populations and with larger samples, while also investigating long-term effects and comparing different interventions.

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