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# Effectiveness of dynamic soft tissue mobilization vs passive stretching to improve hamstring flexibility in stroke patients – A comparative study

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**Abstract**
**Background:** Flexibility is considered as an essential element of normal biomechanical functioning. The progressive decline in flexibility with age has been attributed to change in elasticity and decreased level of physical activities. Hamstrings extensibility is a physical fitness component widely recognized as an important marker of health and quality of life. The tightness of hamstring muscles is one of the main factor hindering performance in daily and sporting activities.
**Objective:** To compare the effect of dynamic soft tissue mobilization & passive stretching to improve hamstring flexibility in stoke patients.
**Method:** A sample of 80, with > 20 degree hamstring tightness in stroke patients were selected by simple random method and equally divided into 2 groups. Group A And group B were given DSTM & PS respectively for 4 weeks.
**Result:** Statistical analysis was done using instant software. Intergroup analysis was done using paired t-test within the groups and unpaired t-test for comparison between the group. The values when compared between the groups were p=0.0092 t=2.670 in post DSTM v/s PS on Rt limb and p=0.0013 t=3.358 was in post DSTM v/s PS on left limb respectively using t-test, hence considered extremely significant.
**Conclusion:** Based on the result the present study it can be concluded that DSTM technique is more effective to improve hamstring flexibility than PS technique in stroke patients with hamstring tightness.

**Keywords:** stroke, flexibility, passive stretching, dynamic soft tissue mobilization etc

## Introduction
Flexibility is considered as an essential element of normal biomechanical functioning [1]. The progressive decline in flexibility with age has been attributed to change in elasticity and decreased level of physical activities. Hamstrings extensibility is a physical fitness component widely recognized as an important marker of health and quality of life [2].
The tightness of hamstring muscles is one of the main factor hindering performance in daily and sporting activities. Reduction in the flexibility of hamstring has been reported to be associated with occurrence of back pain in adolescents and adults in cross-sectional studies.
Furthermore, reduction in the flexibility of hamstring has been reported to increase the risk of damage to the musculoskeletal system. Thus, flexibility of hamstrings is important for general health and physical fitness [3]. Hamstring tightness are associated with a posterior rotation of pelvis in standing due to the attachment of hamstring muscle is on ischial tuberosity.
Tightness in hamstring causes posterior pelvic tilt which leads to decrease in lumbar lordosis result in low back pain [4]. American Stroke Association explains that after stroke, muscles become tight up and resist stretching. Stroke may cause an abnormal increase in muscle tone, leading to spasticity. When muscle tone is abnormally tight it causes muscles to shrink and shorten. Joint s can become stuck in one position and quite hard to move and most common affected is the knee joint due to hamstring tightness. Hamstring muscle flexibility can be improved by various techniques such as PNF stretching, MET (Muscle Energy Technique), neurodynamic sliding technique, active stretching technique, mulligan bent leg raise, myofascial release etc [5-7]. But the treatment options used in this study are the DSTM and PS techniques. In Dynamic Soft Tissue Mobilization, few deep longitudinal strokes are applied to the entire muscle group and then the part is passively moved to a position in which it is

Lengthened [8]. In Passive Stretching, subjects had their knees extended by one examiner while lying supine with 90 degrees of hip flexion stretches were performed times in 3 sets of assigned stretch [3].

Several studies have indicated that flexibility of hamstring is improved by stretching. Among stretching methods, passive and active stretching techniques are easy to implement and useful as home exercises. Active stretching increases the flexibility of tight muscles while concomitantly improving the function of antagonistic muscle. In contrast, passive stretching is characterized by addition of stretch stimulation on muscle contraction independent of the subject. However passive stretching may elicit greater improvements in hamstring flexibility than active stretching [3].

Several studies have investigated the use of massage as a treatment option for delayed onset muscle soreness. Two massage interventions were compared (classic and dynamic). Study found that subjects who received dynamic soft tissue mobilization achieved significantly greater increase in hamstring flexibility [1]. Another comparative study of dynamic soft tissue mobilization vs passive stretching technique was done to improve the flexibility of hamstrings in cricket players and the study concluded that dynamic soft tissue mobilization produces better results than passive stretching to improve hamstring flexibility in cricket players [8]. But there is no study comparing the effect of dynamic soft tissue mobilization and passive stretching to improve hamstring flexibility in stroke patients. Hence our study aims to see the effect of dynamic soft tissue mobilization vs passive stretching to improve hamstring flexibility in stroke patients.

## Methodology

### Design

The design of the study is a comparative using clinical examination (Active knee extension test and range of motion). The Research Proposal of the study was approved by Institutional Clinical Ethical Committee (I.C.E.C) of City college, Mangalore.

### Sampling

The nature of sampling for the present study is simple random sampling using odd & even technique, 80 subjects were equally divided into two groups group A & group B. odd subjects were included in the group A & even subjects were included into the group B. group A were given dynamic soft tissue mobilization & passive stretching were given to group B.

### Procedure

**Inclusion criteria:** Male & female both gender, B/L hamstring tightness & subjects with >20 degrees of hamstring tightness.

**Exclusion criteria:** Lower extremities surgeries and fracture past 6 months, spine surgeries and fracture past 6 months.

### Outcome measures

### Universal goniometer

The universal goniometer was used for the measurement of hip and knee joint range of motion.

### Active knee extension test

The Active Knee Extension Test is used to assess hamstring muscle length and the range of active knee extension in the position of hip flexion. The hamstrings length has been associated with altered lordotic posture and increased incidence of lower limb injuries. This test is highly reliable if the body positions are stabilised adequately. This test has also been effective when administered by self, which is a self-monitored version of the active knee extension test. The interrater and intrarater reliability has been established among healthy adults.

### Dynamic Soft Tissue Mobilization

The DSTM is divided into hierarchical progression and here the subject is in prone lying position and few longitudinal strokes are applied to the entire muscle group and the area of tightness is located. When the specific area of tightness of hamstring muscle is located, the further treatment is located to this target area. For dynamic intervention, the subject is in supine lying with knee and hip flexed to 90 degrees and all the dynamic techniques are applied in a distal to proximal direction. Deep longitudinal strokes are applied to the area of hamstring tightness and the leg is passively moved to a position in which the hamstring is in lengthened position. Five strokes are applied to the area and shaking of the limb is performed for 20 seconds at the completion of this technique. Then the area of hamstring tightness is reassessed for reduction in muscle tightness. If there is no reduction in the area of tightness then treatment is stopped. The same sequence is applied for the next dynamic technique in which the subject is asked to actively extend his leg, so that reciprocal inhibition of hamstring can be achieved. In the final technique the subject is asked to eccentrically work the hamstring muscle group to the end ROM and the therapist performs five deep distal to proximal strokes over the area of muscle tightness at hamstring [8].

**Fig 1.1:** Application of DSTM

### Passive Stretching

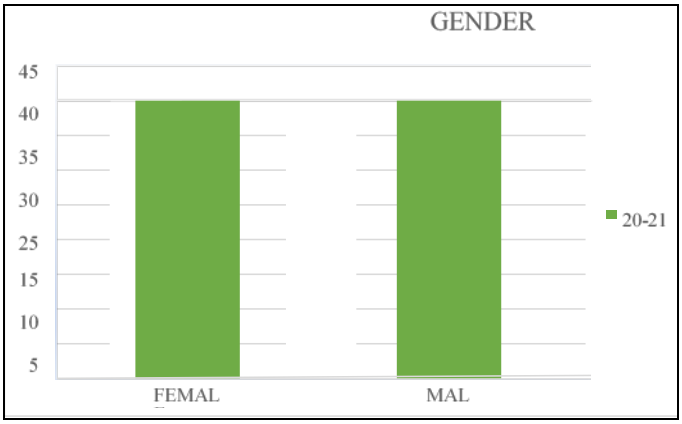
In passive stretching, subjects will be positioned supine with their hip at 90 degrees of flexion and their lumbar lordosis was supported with a lumbar roll. From that position, extension of knee was performed. The knee will be extended to the point of mild resistance or just below the threshold of myoclonus. Subjects in passive stretching group have their knees extended by one examiner while lying supine with 90 degrees of hip flexion. Stretches will be performed times in 3 sets of assigned stretch. Each stretch will be held for 10 seconds at the point where tightness in the hamstring muscle is felt and then the leg is lowered.

**Fig 1.2:** Application of Passive stretching

### Statistical Analysis

Mean, standard deviation, standard error, and percentage were used to prepare summary statistics. T test were used to compare the parameters. Data was analyzed using Microsoft Excel and SPSS version 20.

### Results



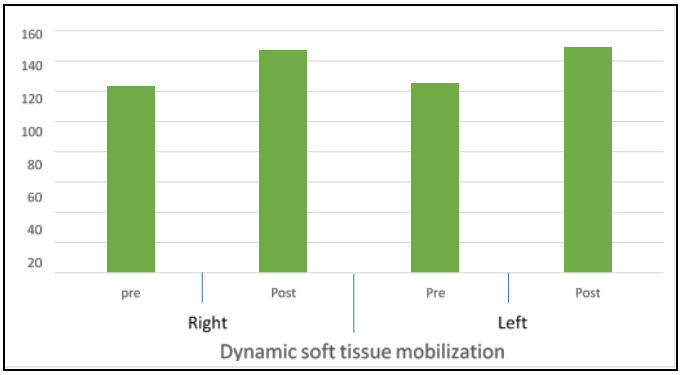

**Graph 1.1:** Gender distribution

**Table 1.1:** Gender distribution

| Female | Male |
|---|---|
| 40 | 40 |

### Intra Group Comparisions

Graph showing pre and post values of Dynamic soft tissue mobilization on both right and left side.

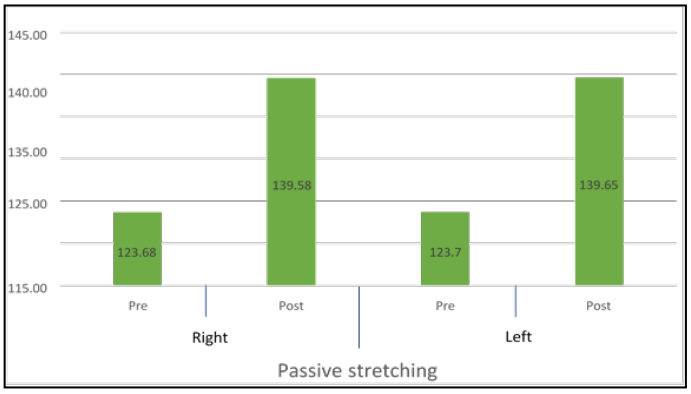



**Graph 1.2:** Mean of pre & post of Dynamic soft tissue mobilization

**Table 1.2:** Mean of pre & post of Dynamic soft tissue mobilization

| Dynamic soft tissue mobilization | | | | |
|---|---|---|---|---|
| | Right | | Left | |
| | Pre | Post | Pre | Post |
| Mean + Std Dev. | 123.53 ± 11.34 | 146.90 ± 12.148 | 125.53 ± 11.266 | 148.98 ± 12.234 |
| P | <0.0001 | | <0.0001 | |
| T | 68.553 | | 68.299 | |

Graph showing pre and post values of Passive stretching on both right and left side.

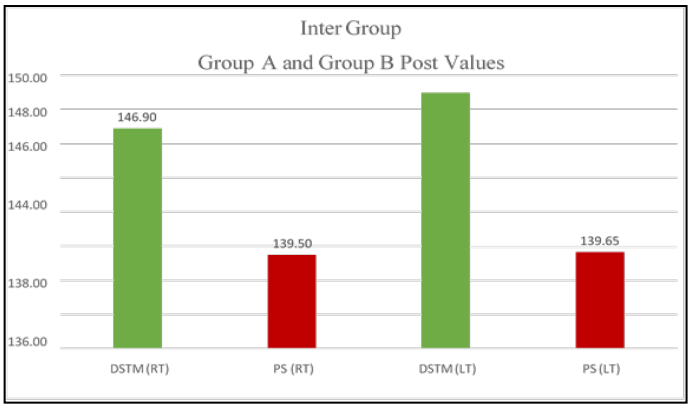



**Graph 1.3:** Mean of pre & post of passive stretching

**Table 1.3:** Mean of pre & post of passive stretching

| Passive Stretching | | | | |
|---|---|---|---|---|
| | Right | | Left | |
| | Pre | Post | Pre | Post |
| Mean + Std Dev. | 123.68 ± 11.28 | 139.58 ± 12.385 | 123.70 ± 11.507 | 139.65 ± 12.601 |
| P | <0.0001 | | <0.0001 | |
| T | 28.918 | | 29.635 | |

Graph showing comparison of Dynamic soft tissue mobilization and Passive stretching on right and left side




**Graph 1.4:** Comparison between the groups for DSTM & PS

**Table 1.4:** Comparison between the groups for DSTM & PS

| Intergroup post intervention values | | | | |
|---|---|---|---|---|
| | Right | | Left | |
| | Pre | Post | Pre | Post |
| Mean + Std Dev. | 146.9 ± 12.148 | 139.57 ± 12.385 | 148.98 ± 12.234 | 139.65 ± 12.601 |
| P | 0.0092 | | 0.0012 | |
| T | 2.670 | | 3.358 | |

Study was conducted to compare the effect of DSTM v/s PS on hamstring tightness. Statistical analysis was done using instant software. Intergroup analysis was done using paired t-test within the groups and unpaired t-test for comparison between the group. The values p=0.0001 and t=68.553 was found pre and post DSTM on Rt limb, p=0.0001 and t=68.299 on Left limb using paired t-test within the group. The values p=0.0001 and t=28.918 was found pre and post PS on Rt limb p=0.0001 and t=29.635 on left limb using paired t-test within the group.

The values when compared between the groups were p=0.0092 t=2.670 in post DSTM v/s PS on Rt limb and p=0.0013 t=3.358 was in post DSTM v/s PS on left limb respectively using t-test, hence considered extremely significant.

## Discussion

The primary purpose of this study was to compare the effect of DSTM and PS on hamstring flexibility in undergraduate physiotherapy students. 80 subjects were selected among which 40 were male and 40 were female. Subjects were based on inclusion criteria, subjects having bilateral hamstring tightness with AKE more than 20 degrees with no history of lower extremities surgeries and spine surgeries and fracture past 6 months were included. Measurement active knee extension test was obtained before and after treatment session. Measurement of hamstring flexibility was taken using Acute knee extension test as it has high reliability and validity. DSTM and PS was given to the participants after dividing them using simple random sampling into 2 groups. The aim of the study was to compare the effect of DSTM v/s PS on hamstring tightness. The result showed that there is significant difference between both the groups.

There was statistical difference in the pre and post values of DSTM in right and left limb as well as in the values of PS in right and left limb which showed that DSTM and PS both are effective. Various research over DSTM methods suggests that DSTM model consisted of a series of progression from traditional to dynamic techniques which concentrated on one specific area of muscle tightness. It is hypothesized that incoperating active contractions into a massage protocol may increase muscle perfusion and decrease muscle stiffness. Clinical experience suggests that DSTM model is efficient pain free intervention that appears to have an immediate effect on improving hamstring flexibility.

In two recent studies, hamstring massage was applied using typical Swedish massage protocols for 15–20 min. The outcomes of these studies demonstrated that massaging the hamstring showed no improvement in the sit and reach test[9] and no measurable physiological effect after a 20 min post-recovery leg massage [10]. Our study demonstrated that a significant increase in hamstring length could be achieved by identifying a specific area of hamstring tightness and targeting treatment to this area using dynamic techniques. The classic component of dynamic STM exactly replicated the classic protocol and was comprised of the traditional Swedish soft tissue techniques used in previous studies [11]. This suggests that the unique features of dynamic STM resulted in the significant difference in HFA measurements between this intervention and the control and the classic STM groups. Most of the current literature describes general techniques applied to non-specific areas delivered when muscles were placed in a shortened, resting, or neutral position [11] Unlike these generalised techniques, dynamic STM is a specific structured technique in which the therapist identifies a target area of muscle tightness and focuses the treatment on that specific area whilst moving it longitudinally under different muscle contraction parameters.

Winter *et al*. reported that passive stretching is characterized by the external addition of stretch stimulation on muscle contraction, while active stretching is characterized by a reciprocal innervation mechanism used to relax antagonist muscle contraction [12].

The results of the current study show that passive stretching was useful for increasing the flexibility of the hamstring muscles. Previous studies reported improvements in flexibility were elicited by passive stretching conducted for patients with contracture and limited flexibility [13]. The values when compared between the groups were p=0.0092 t=2.670 found in post DSTM v/s PS on right limb and p=0.0012 t=2.632 was in post DSTM vs PS on left limb respectively using unpaired t-test.

The alternate hypothesis has been accepted that DSTM is more effective than PS in stroke patients.

The beneficial increase in hamstring flexibility post intervention in DSTM might be due to dynamic technique which concentrated on one specific area of muscle tightness and it incorporates active contractions into a massage protocol which may increase muscle perfusion and decrease muscle stiffness.

The findings of this study corelates with the previous study i.e. "A comparative study of dynamic soft tissue mobilization vs passive stretching to improve flexibility of hamstring in cricket players. And DSTM can be the first option to improve hamstring flexibility in stroke patients.

## Conclusion

The present study proves that both DSTM and PS techniques are effective in improving flexibility. The study has shown a significant difference in DSTM and PS techniques.

Hence based on the result the present study it can be concluded that DSTM technique is more effective to improve hamstring flexibility than PS technique in stroke patients with hamstring tightness.

**Conflict of interest**: There is no conflict of interest

**Funding:** There is no sources of funding, it is self-funding.

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