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Immediate Effects of Kinesiotaping Versus Instrument-Assisted Soft Tissue Mobilization on Fascial Line over Hamstring Area for Superficial Back Line Flexibility in Young Adults - A Single-Blinded Randomized Control Trial

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Abstract:

➢ ***Purpose***

Hamstring tightness, a prevalent problem, affects Fascia and hence the whole Superficial Back line. This affects the whole Fascia line Flexibility and can cause problems distally. Hence, there is a need for effective treatment for Fascial disorders. Kinesiotaping and Instrument Assisted Soft Tissue Mobilization (IASTM) are commonly used for the treatment.

➢ ***Methods***

A single-blinded randomized control trial with a total of 90 healthy participants was included into two groups, IASTM (n=45) and Kinesiotaping (n=45). Each group was given a treatment of 15 minutes and all participants were assessed with the Fingertip to Floor test, Passive Straight Leg Raise and the Active Knee Extension test pre and immediately post-treatment.

➢ ***Results***

Using a paired t-test, inter-group analysis was done where both groups, IASTM and Kinesiotaping, showed a significant difference ($p \leq 0.05$) in all the outcome measures, while intra-group analysis showed that the group treated with IASTM showed a significant difference only in the Passive Straight leg Raise and Active Knee Extension ($p \leq 0.05$).

➢ ***Conclusion***

Instrument-assisted soft Tissue Mobilization was superior to Kinesiotaping in young adults. It showed a significant difference in improving the passive Straight Leg Raise and Active knee extension test, but not for the Fingertip to Floor test. Both Kinesiotaping and Instrument Assisted Soft Tissue Mobilization were effective in improving Superficial Back Line Flexibility when applied over the Hamstring area.

Keywords: *Fascial Disorders, Fascial Manipulation, Hamstring Tightness, IASTM, Kinesiotaping, Superficial Back Line.*

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I. INTRODUCTION

Flexibility is essential for both injury prevention and rehabilitation. Limited range of motion, influenced by various factors, often contributes to musculoskeletal issues. Research indicates that hamstring tightness, particularly in the dominant leg, is common among young individuals (M: 27.5%, F: 45%) [1][2].

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Hamstring strains, muscle imbalances, and lower extremity misalignments, along with issues such as sacroiliac joint dysfunction and loss of lumbar lordosis, can impair stress absorption and posture. Many individuals with reduced flexibility remain asymptomatic for years until progressive muscle imbalances alter biomechanics [3].

Research suggests a link between foot posture and hamstring tightness, indicating that distal segment abnormalities can lead to compensations in proximal segments. Over time, hamstrings may act more as stabilizers rather than primary movers, contributing to inefficient motor control and increased tension. This dysfunction can also result from blood vessel constriction due to muscle tightness [4]. Since the hamstrings and plantar muscles are part of the superficial backline, weakness in the proximal segment can disrupt muscle activation patterns, causing movement compensations, tissue overload, and foot posture alterations also leading to an impact in dynamic.

Fascia plays a crucial yet underexplored role in musculoskeletal function. Research indicates that connective tissues link the contractile components of muscles, forming an extensive myofascial network [3]. As a continuous structure, fascia encases muscles, organs, and vessels, both compartmentalizing and interconnecting different body segments [5]. Fascial tension, whether from strain, trauma, or stress, can transfer along connected segments of the body. The fascia, particularly the epimysium and aponeuroses, contains numerous nociceptors, making it sensitive to pain, especially when inflamed [6][7]. As a viscoelastic tissue, fascia adapts to slow forces but can become stiff due to micro-injuries that activate fibroblasts and myofibroblasts, leading to fibrosis [6][7][8]. The central and autonomic nervous systems also regulate fascial tone, influencing pain and movement. It varies in thickness, being more prominent in the upper body, posterior regions, and in females [9]. T. Myers identified 12 interconnected myofascial lines, with the Superficial Backline (SBL) being the most researched. The SBL links the body from the feet to the head in two sections, incorporating key structures like the hamstrings [5].

The Superficial Backline (SBL) helps maintain an upright posture and prevents the body from collapsing into flexion. Due to this role, its segments are often overworked, making them susceptible to micro-injuries and biomechanical imbalances. Dysfunction in this fascial line can contribute to musculoskeletal issues like muscle spasms, hamstring strains, and lower back pain[5]. Leon Chaitow's work on fascial dysfunction highlights how hamstring tension distributes along the line during stretching, with dysfunction potentially originating elsewhere [10].

Two key fascial changes are fibrosis and densification [11]. Fibrosis results from excess collagen deposition, altering the extracellular matrix and function, often due to stress, immobilization, or inflammation. Initially, pain is the primary symptom, but as fibrosis progresses, it leads to stiffness, reduced flexibility, and limited range of motion [8][9].

Densification refers to the thickening of loose connective tissue between fascial layers, which can be reversed with manual therapy [11]. Common SBL dysfunction patterns include limited ankle dorsiflexion, knee hyperextension, and anterior pelvic shift, all of which affect fascial sliding. Myofascial pain can result from densification, as hyperactive nerve endings trigger inflammation and sensitivity, disrupting force transmission and reducing mobility.

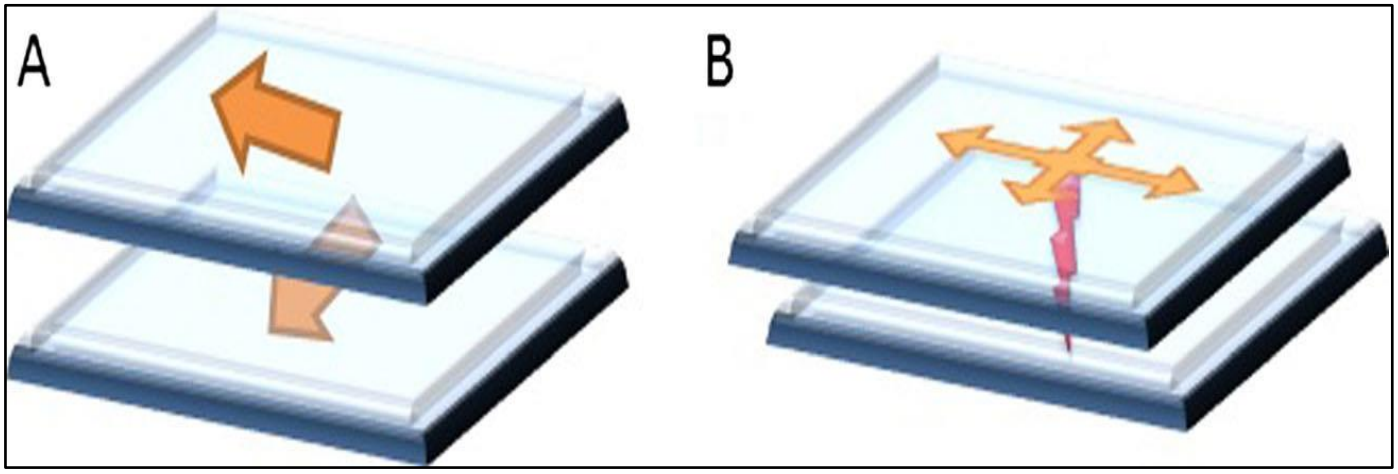

Fig 1 The Difference in Force Transmission between Normal and Abnormal Tissue

The two fibrous layers are free to glide thanks to the presence of low-viscosity loose connective tissue. This permits these layers to transmit the forces (orange arrow) independently and in different directions.

The densification of the loose connective tissue, represented with a red flash, alters the gliding between the two fibrous layers. The transmission of the forces can be altered in a way that is not easily defined. The tissue around the densification point can be subjected to intense mechanical stress.

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T. Myers, in *Anatomy Trains*, demonstrated how releasing the plantar foot can improve hamstring flexibility, highlighting the interconnected nature of the SBL [5][12]. Fascial Manipulation (FM) is a soft tissue technique involving repetitive release at focal points to generate heat and mechanical stress. Leon Chaitow describes two approaches: the direct method applies sustained pressure to restricted tissue, while the indirect method guides tissue into its natural position to relieve tension [10].

Emerging treatments like Kinesiotaping and Instrument-Assisted Soft Tissue Mobilization have gained popularity in fascia therapy. Assessing SBL function is crucial for addressing issues such as reduced flexibility, hamstring strains, low back pain, and plantar fasciitis. The standing forward bend test (Fingertip-to-Floor Test) helps evaluate SBL integrity by stretching and challenging its entire length [5].

Both Instrument-Assisted Soft Tissue Mobilization (IASTM) and Kinesiotaping are widely used for treating fascial disorders, but no clear evidence determines which technique is superior. Since fascia plays a crucial role in both symptomatic and asymptomatic conditions, it is essential to evaluate the effectiveness of different fascial manipulation methods.

Hamstring tightness, being highly prevalent, highlights the need for targeted treatment. Addressing a single fascial segment may have widespread effects, potentially reducing therapists' workload while effectively improving flexibility. A quick and efficient approach is especially beneficial for managing chronic fascial pain, trigger points, and muscle spasms, as well as enhancing athletic performance. Understanding and refining fascial release techniques are integral to optimizing rehabilitation protocols.

II. METHODOLOGY

The study was designed as a single-blinded randomized controlled trial with a sample size of 90 participants, 45 in each group. The Inclusion criteria was young adults belonging to all genders with hamstring tightness (>20 degrees from full extension on active knee extension test and <80 degrees on passive straight leg raise) in the age group of 18 to 25 years and willing to participate in the study. Individuals with lower limb radicular symptoms, any form of musculoskeletal, neurologic, or cardiovascular disease, participation in a flexibility exercise or physiotherapy program within the last three months, an injury or surgery within the last six months were excluded. Contraindications specific to IASTM include individuals who tend to bleed and those with immunocompromised conditions. For Kinesiotaping, contraindications include sensitive skin, exposed lesions, and skin allergies.

After taking informed written consent and testing for leg dominance using the Ball Kick Test, leg dominance was decided. Subjects were divided into Group A and Group B using a computer based random allocation method. Group A was IASTM and Group B was Kinesiotaping. A pre and immediate post-assessment which included Toe touch test, Passive Straight Leg Raise (PSLR) and Active Knee Extension Test was taken as an outcome measure to see the effects [13].

➢ *Procedure for IASTM*

A lubricant was applied to the patient's posterior thigh, and the blade was held at a 45-degree angle. Two positions were used: neutral and stretched. The neutral position was relaxed, while the stretched position involved side-lying Straight Leg Raise. The goal was to manipulate the fascia in both relaxed and strained positions to reduce restrictions and realign the fascia. A post-assessment was taken after 15 minutes of treatment.

Fig 2 Procedure for Treatment by IASTM

➢ *Procedure for Kinesiotaping*

A reference line was drawn to divide medial and lateral hamstring segments, and the tape was cut proportionately. The superficial back line was relaxed or neutral. The dominant leg underwent Kinesiotaping application to evaluate fascial system continuity. Anchors were applied to the medial and lateral borders, and Y-shaped strips were applied using a fascia correction technique that preserved 45-55% tension and maintained an angle of 15 - 30 degrees with the skin. The goal was to manipulate the medial and lateral hamstring fascia. A reassessment was conducted 15 minutes post-application.

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Fig 3 Procedure for Treatment by Kinesiotaping

III. RESULT

This study explored the immediate effects of instrument-assisted soft tissue Mobilization and Kinesiotaping for Superficial backline flexibility. The mean age of the population was 22.03 ± 1.69 years. The Total number of Participants included in the study was 90, which included 69 females (76.6%) and 21 Males (23.3%). The leg dominance for 98.89% of the population was right and for 1.11% left. The mean BMI of the population was 21.37 ± 2.01 kg/m^2, indicating that the individuals' weight was appropriate according to their height.

Post-intervention of IASTM on the Active Knee Extension Test (Mean ± SD = 32.58 ± 8.05)(Z = 19.08, p < 0.001), Passive Straight Leg Raise Test (Mean ± SD = 74.84 ± 10.23)(Z = 22.90, p < 0.001) and the Fingertip to Floor Distance (Mean ± SD = 12.12 ± 6.61)(Z = 16.23, p < 0.001) was statistically significantly higher than that of pre-intervention. It can be stated that the IASTM intervention significantly reduced the Active Knee Extension Score and significantly increased the Passive Straight Leg Raise Test and significantly reduced the Fingertip to Floor Distance.

Post-intervention of Kinesiotaping on the Active Knee Extension Test (Mean ± SD = 42.64 ± 9.40) (Z = 16.43, p < 0.001), the Passive Straight Leg Raise Test (Mean ± SD = 61.07 ± 9.20)(Z = 14.60, p < 0.001) and the Fingertip to Floor Distance (Mean ± SD = 18.28 ± 6.10)) (Z = 13.03, p < 0.001) was statistically significantly higher than that of pre-intervention. It can be stated that the Kinesiotaping intervention significantly reduced the Active Knee Extension Score, significantly increased the Passive Straight Leg Raise Test and significantly reduced the Fingertip to Floor Distance.

For Intra group analysis, according to the Mann-Whitney U test; mean difference of IASTM on Active Knee Extension Test (Mean ± SD = 12.42 ± 4.37) and Passive Straight Leg Raise test (Mean ± SD = 13.89 ± 4.07) was statistically significantly higher than the mean difference of Kinesiotaping on Active Knee Extension Test (Mean ± SD = 10.49 ± 4.28) and Passive Straight Leg Raise test (Mean ± SD = 12.69 ± 5.83) (Z= 733 and 768, p < 0.05). IASTM for and Fingertip to Floor Distance (Mean ± SD = 7.22 ± 2.99) was better than Kinesiotaping (Mean ± SD = 6.83 ± 3.52) but was not statistically significant. It can be stated that the IASTM intervention was significantly better in improving Active Knee Extension test and Passive Straight Leg Raise than Kinesiotaping but not the Fingertip to Floor Distance. (Table 1)

The Effect size is Small for the Active knee extension test and Very Small for Passive Straight leg Raise and Fingertip to Floor Distance.

Table 1 Intra Group Analysis and Effect Size

Mean Difference	AKE	PSLR	FTD
IASTM	12.42 ± 4.37	13.89 ± 4.07	7.22 ± 2.99
KTAPE	10.49 ± 4.28	12.69 ± 5.83	6.83 ± 3.52
Statistical Analysis (Mann-Whitney U) Z value	733	768	852
Significance (p-value)	**0.023**	**0.046**	0.192
Effect size – Cohen's *d*	0.446	0.238	0.119

IV. DISCUSSION

To the best of our knowledge, this is the first study to explore the immediate effects of fascial techniques between IASTM and Kinesiotaping for Hamstring and Superficial Back Line flexibility.

IASTM showed a significant difference in the Active knee extension test, Passive Straight Leg Raise, and Fingertip to Floor distance. These results are in line with the study done by Konstantinos F, et al which concluded that IASTM given in the upper area or the lower area of

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Superficial Back Line improved the Hamstring flexibility irrespective of the site [14]. Another study conducted by Simatou M, et al. stated that IASTM was superior to Foam rolling and Static stretching, irrespective of the application site in improving Hip Joint flexibility when targeting the myofascial lateral line [15]. The difference can be attributed to the IASTM instrument's ability to target the adhesions in the fascia, as well as triggering an inflammatory process via stimulation of fibroblastic activity, which promotes healing. It also increases muscular blood supply, reduces tissue viscosity, and promotes collagen tissue repair [16].

The group given Kinesiotape in the form of fascial alignment correction also showed an improvement in the Active knee extension test, Passive Straight Leg Raise, and Fingertip to Floor distance. A study done by Swapnil Mate suggested the effectiveness of Kinesiotaping in realigning the fascia fibers to improve the range of motion thereby improving flexibility [6]. Another study was done in Maria Penalver-Barrios et. Al to use various techniques of Kinesiotape for Chronic Low Back Pain patients compared with Placebo, out of which one is the "Fascia Technique" of application; which showed an improvement in pain and range of motion [17]. Many believed Kinesiotape worked due to the central nervous system receiving a neuromuscular input that originates from mechanoreceptors which are present on the fascia. The Kinesiotape applied to transversely align the fascia sends neural feedback providing a modified "correct" pattern of movement [17]. By correcting the fascia to its original position, the space between the fibers is increased and allows more force transmission through muscular fibers, and along with that the sensory mechanoreceptors lead to a reduction in the sympathetic tonus causing a change in the tissue viscosity [6]. A study was done on swimmers by Jasmine H. Hanson, Joseph D. Ostrem, and Brenda Davies for fascial taping to improve Shoulder pain and functional movements of the upper limb showed a significant improvement in pain and functional scores after 30 minutes of application of Kinesiotape. They attributed this to the ability of Kinesiotape to increase muscle extensibility and decrease tone, this affects the fascial adhesions by facilitating muscle spindle stretch thereby improving functional movement by enhancing muscle activation [18]. This study also stated its unique property of enhancing proprioception by mechanoreceptor stimulation which improves balance and posture [18].

Many kinds of research have found that remote application on a fascial line shows a similar effect to that of the local application. Research done by William W, et al on the self-myofascial Release group of the superficial backline to improve Sit and Reach in the hamstring group and plantar release in another was carried out, which concluded that Self Myofascial release did indeed improve Sit and Reach but neither was superior to other, implying that fascial release on local or remote areas does improve the overall flexibility of Superficial Back Line [12].

Another study conducted by Fauris P et. al, explored the effect of Self-myofascial release carried out at multiple levels on Hamstring flexibility and concluded that hamstring flexibility and ankle dorsiflexion improved irrespective of the area of application of self-myofascial release in the superficial Backline and showed a 50% gain in flexibility in the first 2 mins of application [3]. These results fall in line with the study which also demonstrated an improvement in Fingertip to floor distance which tested the flexibility of the Superficial Back line and the application of Kinesiotape and IASTM on the Fascial line and the improved flexibility as seen by improvement in Active knee extension and Passive straight leg raise.

When comparing Kinesiotape with IASTM, IASTM was superior to Kinesiotaping in terms of Straight Leg Raise, Active Knee Test but no significant difference was found for Fingertip to Floor test. This could be attributed to IASTM breaking adhesions and raising the skin temperature [19]. While IASTM is applied, Fascia's unique property adapts to mechanical stress and it also remodels the collagen fibers according to the direction of the stress, thereby correcting the Fascia and promoting healing which explains the significant difference in AKE and PSLR [20]. Whereas in Kinesiotape there is realigning of Fascia Lines, working on the "creep" effect for deformation of the displaced fascia which changes due to the tightness of the muscle and also, there is a neural feedback taking place that reduces the tension on the Fascia Line which is demonstrated when the difference between the two groups for FTD was not significant. Although Kinesiotaping has been known to help decrease pain by lifting the space enclosing the site of inflammation, this enhances the blood flow facilitating healing as this creates space and decreases the pressure [18]. According to a quasi-experimental study by Brandl A, the effect of IASTM on the water content of the lumbar myofascial tissues was explored via lumbar bioimpedance. They concluded that there was an increase in the bioimpedance of Lumbar tissue initially and an increase in the temperature which implied that there was a reduction in the water content but returned to baseline soon and they also detected an increase in the water content as a way of overcompensation after a brief recovery period [21]. This also supports the fact that IASTM reduces stiffness by working at the cellular levels of fascia. A systematic review suggested that when compared, IASTM is superior to Foam roller self-myofascial release in various sports athletic performance due to its ability to moderate hydration content and thereby reduce the stiffness of the joints and improve the range of motion and muscle flexibility and proprioception thereby enhancing the sports performance [22].

The effect size for the Active Knee Extension test is Small, indicating that though IASTM is superior to Kinesiotape, its effects cannot be generalizable to a large population. Similarly for the Passive Straight Leg Raise and the Fingertip to Floor Distance test, the effect size was very small, indicating that the results of the study is applicable to a small population similar to the study.

Hence, both IASTM and Kinesiotaping can be used as fascial release techniques for the Superficial Back Line. For a local release, IASTM is a preferred choice of treatment. It is recommended to consider fascial adhesions in many

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disorders and to use IASTM or Kinesiotape for improving Superficial backline flexibility and also to improve the flexibility of local areas for sports persons and normal individuals. To improve work efficiency and also reduce therapists' physical stress, it is advised to use such adjuncts for immediate results and to build strength and long-term flexibility. This study has no limitations.

Future similar studies can be conducted to observe the effects of fascial manipulation in other populations and age groups and long-term effects or lasting effects could be explored.

V. CONCLUSION

The findings of the study concluded that Instrument Assisted Soft Tissue Mobilization was superior to Kinesiotaping in young adults. It showed a significant difference in improving passive Straight Leg Raise, and Active knee extension test but not for the Fingertip to Floor test. Both Kinesiotaping and Instrument Assisted Soft Tissue Mobilization were effective in improving Superficial Back Line Flexibility when applied over the Hamstring area.

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