Section: Miscellaneous

Original Research Article

ROLE OF MUSCLE ENERGY TECHNIQUES IN IMPROVEMENT OF STRENGTH OF HAMSTRING MUSCLE AND QUALITY OF LIFE IN FEMALES

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ABSTRACT

Background: Hamstring tightness is a common musculoskeletal issue that can lead to reduced strength, flexibility, and impaired quality of life, particularly among females. Muscle Energy Technique (MET) is frequently used to enhance flexibility and muscle performance; however, its impact on quality of life remains unclear. The aim is to evaluate the role of Muscle Energy Technique in improving hamstring muscle strength and quality of life among females with hamstring tightness.

Materials and Methods: A total of 90 female college students aged 25 to 50 years with clinically diagnosed hamstring tightness were randomly assigned to two groups. Group A (n=45) received MET, while Group B (n=45) received conventional physiotherapy consisting of moist heat application and passive stretching. Hamstring flexibility was assessed using the Active Knee Extension Test (AKET), muscle strength through standard strength testing, and quality of life using validated questionnaires. The intervention lasted four weeks, and pre- and post-test comparisons were analyzed statistically.

Results: Group A demonstrated a significant improvement in muscle strength post-intervention (p=0.012) compared to Group B. However, changes in quality of life within and between groups were minimal and not statistically significant (p=0.978). Flexibility (AKET scores) improved significantly in both groups, with Group B showing greater gains (p<0.001).

Conclusion: Muscle Energy Technique significantly improved hamstring strength; however, neither MET nor conventional interventions produced meaningful short-term improvements in quality of life. This suggests that isolated muscle-focused interventions may not be sufficient to enhance overall well-being, highlighting the need for long-term, comprehensive rehabilitation approaches.

Keywords: Muscle Energy Technique, Hamstring Tightness, Muscle Strength, Quality of Life, Flexibility.

INTRODUCTION

Flexibility is an essential component of musculoskeletal health, defined as the ability to move a joint through its complete physiological range of motion. It is determined by the extensibility of both contractile structures, such as muscles, and non-contractile tissues, including tendons, ligaments, and the joint capsule.[1] Among the muscle groups that significantly influence flexibility, the hamstring muscles—comprising the biceps femoris, semitendinosus, and semimembranosus—play a critical role in maintaining proper posture, facilitating athletic performance, and preventing musculoskeletal dysfunction. Hamstring flexibility is particularly important as tightness or shortening in these muscles has been closely associated with a wide range of musculoskeletal conditions. These include patellofemoral joint dysfunction, lower back pain, pubic pain, and various postural deviations.[2-6] Such conditions are prevalent in both the general and athletic populations and can significantly impair quality of life, daily activities, and sports performance. Restricted hamstring flexibility is often implicated as a contributing factor to altered pelvic tilt, lumbar spine mechanics, and lower limb kinematics, which may increase the risk of injury and discomfort.[2-6]

In the female population, these musculoskeletal challenges are further compounded by anatomical, biomechanical, and hormonal differences compared to males. Women often experience unique postural demands and musculoskeletal stressors due to factors such as pregnancy, wider pelvic structure, and differences in ligamentous laxity. As a result, females may be more prone to developing hamstring tightness, reduced flexibility, and associated conditions, all of which can negatively impact their physical function and overall quality of life. Flexibility, specifically the ability of the musculotendinous unit to elongate during joint movement, plays a vital role not only in injury prevention but also in enhancing relaxation, postural control, and muscular recovery.[7] Adequate flexibility allows the body to maintain proper alignment, perform activities with ease, and reduce the likelihood of compensatory movement patterns that can result in pain and dysfunction. Conversely, decreased flexibility can limit joint mobility, increase tissue stiffness, and contribute to a cycle of muscular imbalance and chronic discomfort. Numerous studies have emphasized the importance of maintaining hamstring flexibility to reduce the risk of lower extremity injuries, particularly in physically active individuals.[4,5] Athletes, in particular, are susceptible to hamstring strains, tears, and overuse injuries, which are often exacerbated by inadequate flexibility. Furthermore, research suggests that interventions aimed at improving hamstring extensibility may also contribute to alleviating symptoms of lower back pain, a condition frequently associated with shortened hamstrings and altered pelvic mechanics[3].

One of the therapeutic approaches gaining significant attention in recent years for improving hamstring flexibility and muscle function is Muscle Energy Technique (MET). MET is a form of manual therapy that involves the voluntary contraction of a muscle or muscle group in a controlled and specific direction, followed by a period of relaxation and passive stretching. This technique leverages the principles of neurophysiological mechanisms such as autogenic and reciprocal inhibition, which facilitate muscle relaxation, elongation, and overall flexibility improvement.[7] Several studies have demonstrated the efficacy of MET in enhancing the flexibility of shortened muscles, particularly in the hamstrings.[7] MET not only aids in increasing muscle length but also contributes to improved joint range of motion, reduced muscle stiffness, and decreased risk of injury. Unlike aggressive stretching techniques that may lead to discomfort or muscle guarding, MET provides a gentle, patient-controlled approach to improving flexibility, making it suitable for both athletic and non-athletic populations, including females with musculoskeletal restrictions. In addition to enhancing muscle extensibility, MET has been shown to play a role in addressing muscular pain and improving the overall sense of well-being[7]. Chronic muscle tightness and reduced flexibility are often accompanied by discomfort, fatigue, and functional limitations, all of which can detract from an individual's quality of life. By promoting muscle relaxation, restoring tissue elasticity, and improving neuromuscular control, MET contributes to pain reduction and functional restoration, thereby enhancing the overall quality of life, especially in females dealing with musculoskeletal complaints. Furthermore, improvements in hamstring flexibility achieved through MET may have a cascading positive effect on other aspects of musculoskeletal health. Enhanced flexibility in the posterior chain can lead to better postural alignment, improved movement patterns, and a reduced risk of compensatory strain on adjacent structures such as the lower back and pelvis. This is particularly relevant for females, who often face postural challenges due to factors such as pregnancy, occupational demands, or lifestyle-related physical inactivity.

MATERIALS AND METHODS

The present study was designed as an experimental, interventional, comparative investigation to assess the role of Muscle Energy Technique (MET) in improving hamstring muscle strength and enhancing the quality of life among females experiencing hamstring tightness. The study adopted a randomized approach to ensure unbiased group allocation and outcome evaluation. Participants were selected through a random sampling method. Eligible participants were identified based on predefined inclusion and exclusion criteria. All individuals were briefed regarding the study's objectives, procedures, and potential benefits. Written informed consent was obtained from each participant prior to enrollment in the study to ensure voluntary participation. The total sample size consisted of 90 female subjects, all of whom were recruited from a college student population. Participants were randomly divided into two groups to facilitate comparative analysis.

- Group A (Experimental Group): Comprised of 45 subjects who underwent Muscle Energy Technique (MET) for hamstring flexibility and strength enhancement.
- Group B (Control Group): Consisted of 45 subjects who received conventional physiotherapy

interventions, including moist heat application and passive stretching.

The age range of the participants was 25 to 50 years, targeting females prone to musculoskeletal flexibility impairments within this demographic.

Methodology

All subjects were recruited from among female college students, ensuring uniformity in lifestyle factors such as physical activity patterns and accessibility for follow-ups.

Inclusion Criteria

Participants were included if they exhibited clinical signs of hamstring tightness, defined by a knee extension of less than 160 degrees with the hip positioned at 90 degrees of flexion, accompanied by a decreased range of motion at the knee joint, reduced straight leg raise, and pain localized to the posterior compartment of the thigh. Eligible participants were females between 25 to 50 years of age.

Exclusion Criteria

Participants were excluded from the study if they presented with any condition that could interfere with the assessment or treatment outcomes. Specifically, individuals with a history of low back pain or intervertebral disc prolapse, whether acute or chronic, were excluded. Similarly, those with previous or current hamstring injuries, either acute or chronic in nature, were not considered eligible. Participants exhibiting visible acute swelling in the hamstring muscle region were also excluded.

Methodology

Hamstring flexibility was objectively assessed using the Active Knee Extension Test (AKET). For this test, each participant was positioned in a supine posture with the hip flexed to 90 degrees, supported by a sling apparatus to stabilize the hip joint. Participants were instructed to actively extend the knee as far as possible, and the angle formed at the popliteal region was measured using a goniometer to determine hamstring flexibility.

Prior to data collection, the entire procedure was explained to each participant to ensure understanding and cooperation. Testing commenced only after securing written informed consent. Eligible participants were then randomly assigned into two groups as follows:

- Group A received Muscle Energy Technique (MET) intervention.
- Group B received conventional physiotherapy interventions, including moist heat application and passive stretching.

Treatment Protocol

Muscle Energy Technique (MET) – Group A

The Post-Isometric Relaxation technique, as described by Lewit, was utilized to improve hamstring flexibility and muscle function in Group A. The intervention was performed as follows: Participants were placed in a supine position with their hip joint flexed to 90 degrees. The therapist passively extended the participant's knee joint to the restrictive barrier, defined as the limit of available motion before encountering resistance. The participant was then instructed to perform an isometric contraction of the hamstring muscle at approximately 75% of their maximum voluntary contraction, resisting the therapist's applied force directed towards knee flexion. This contraction was maintained for 7 to 10 seconds, after which the participant relaxed, and the therapist passively extended the knee to the new available range of motion, holding the stretch for 10 seconds.

Conventional Intervention – Group B

Participants assigned to the control group received conventional physiotherapy intervention aimed at improving hamstring flexibility. The intervention consisted of moist heat application directed over the hamstring muscle region to promote muscle relaxation and enhance local blood circulation. In addition to the heat therapy, participants performed passive stretching exercises specifically targeting the hamstring muscles. Each stretching session included three repetitions, with each stretch held for a duration of 30 seconds. The stretching protocol was performed daily for a period of four weeks. The duration and frequency of the stretching program were based on established guidelines from previous studies, which have demonstrated the effectiveness of stretching interventions ranging from two to eight weeks in improving muscle flexibility.

Outcome Measures

The primary outcomes assessed during the study included hamstring muscle strength, quality of life, and hamstring flexibility. Hamstring muscle strength was evaluated using standardized muscle strength testing protocols to ensure objective and reliable measurement of improvements. Quality of Life (QOL) was assessed through the use of validated questionnaires specifically designed for musculoskeletal conditions, providing insight into the participants' overall well-being and functional status. Hamstring flexibility was objectively measured using the Active Knee Extension Test (AKET), which provided quantitative data on hamstring extensibility and range of motion. Upon completion of the intervention period, all collected data were subjected to statistical analysis to determine the effectiveness of Muscle Energy Technique (MET) compared to conventional interventions in enhancing hamstring muscle strength, flexibility, and overall quality of life among the female participants.

RESULTS

Strength (Muscle Power) Comparison [Table 1]

The comparison of strength (muscle power) between Group A and Group B was conducted at both pre-test and post-test stages. At the pre-test stage, Group A demonstrated a mean strength score of 4.37 (SD = 0.49), while Group B had a slightly lower mean of 4.21 (SD = 0.41). The unpaired t-test resulted in a t-value of 1.67 with a p-value of 0.098, indicating that the difference between the two groups at baseline was not statistically significant.

Following the intervention, both groups showed an improvement in strength scores. Group A achieved a mean score of 4.51 (SD = 0.51), whereas Group B showed a mean of 4.26 (SD = 0.44). The between-group comparison at post-test revealed a statistically significant difference, with a t-value of 2.57 and a p-value of 0.012. This suggests that the intervention had a notable impact on improving strength, particularly favoring Group A.

However, when analyzing the intragroup (within-group) differences from pre-test to post-test, both groups did not show statistically significant improvements individually. Group A had a t-value of 1.29 (p = 0.204), and Group B had a t-value of 1.43 (p = 0.160). These findings indicate that although there was a slight improvement within each group, the change was not statistically significant on its own. Nonetheless, the significant difference in post-test scores between groups suggests the intervention was more effective in improving strength for Group A relative to Group B.

Quality of Life Comparison [Table 2]

The assessment of quality of life (QOL) between the groups revealed minimal differences both before and after the intervention. At baseline, Group A reported a mean QOL score of 18.93 (SD = 0.70), while Group B reported a slightly higher mean of 19.00 (SD = 0.69). The unpaired t-test resulted in a t-value of -0.47 with a p-value of 0.637, indicating no significant difference between the groups at pre-test.

Post-intervention, Group A's mean QOL score slightly increased to 19.05 (SD = 0.65), and Group B's mean score remained relatively stable at 19.04 (SD = 0.69). The post-test comparison between groups produced a t-value of 0.03 with a p-value of 0.978, confirming no statistically significant difference.

Furthermore, intragroup analysis from pre-test to post-test also revealed no significant improvements. In Group A, the t-value was 0.82 (p = 0.418), and in Group B, it was 0.29 (p = 0.776). These results suggest that the intervention had no meaningful impact on the participants' reported quality of life, with both groups showing negligible changes.

Changes in Study Parameters [Table 3]

Motor Learning (ML) Change: Group A exhibited a mean reduction of -1.14 units (SD = 1.04), whereas Group B showed a more substantial reduction of -2.43 units (SD = 1.14). The unpaired t-test revealed a highly significant difference between the groups, with a t-value of 5.59 and a p-value of <0.001. This suggests that the intervention effectively reduced motor learning limitations, with Group B showing more pronounced improvement.

AKET (Attention, Knowledge, Education, Training) Change: Group A showed a mean increase of 7.23 units (SD = 5.44), while Group B demonstrated a significantly larger improvement of 17.57 units (SD = 5.01). The between-group comparison yielded a t-value of -9.39 and a p-value of <0.001, indicating a statistically significant difference in favor of Group B. This reflects that the intervention was highly effective in enhancing AKET scores, particularly in Group B.

Strength (ST) Change: The change in muscle strength within groups was minimal. Group A exhibited a mean increase of 0.14 units (SD = 0.71), and Group B had a slight increase of 0.04 units (SD = 0.20). The t-value was 0.90 with a p-value of 0.372, showing no statistically significant difference between groups regarding strength change over time. This aligns with earlier findings that while post-test strength differed between groups, within-group changes were not statistically significant.

Quality of Life (QOL) Change: Both groups reported negligible improvements in quality of life, with Group A's mean change being 0.12 units (SD = 0.93) and Group B's mean change being 0.04 units (SD = 1.02). The t-value was 0.36, and the p-value was 0.722, indicating no significant difference between groups.

Table 1: Intergroup & Intragroup Comparison of Strength (Muscle Power) Parameter

Strength (Muscle Power)	Group A		Group B		unpaired t test	
	Mean	SD	Mean	SD	t-value	p-value
Pre test	4.37	0.49	4.21	0.41	1.67	0.098
Post test	4.51	0.51	4.26	0.44	2.57	0.012
Pre to post sig	t=1.29, p=0.204		t=1.43, p=0.160			

Table 2: Intergroup & Intragroup Comparison of Quality of Life Parameter

Quality of life	Group A		Group B		unpaired t test	
	Mean	SD	Mean	SD	t-value	p-value
Pre test	18.93	0.70	19.00	0.69	-0.47	0.637
Post test	19.05	0.65	19.04	0.69	0.03	0.978
Pre to post sig	t=0.82, p=0.418		t=0.29, p=0.776			

Table 3: Intergroup & Intragroup Comparison of Changes in Study Parameters

Parameter (Pre to post change)	Group A		Group B		unpaired t test	
	Mean	SD	Mean	SD	t-value	p-value
ML change	-1.14	1.04	-2.43	1.14	5.59	<0.001
AKET change	7.23	5.44	17.57	5.01	-9.39	<0.001
ST change	0.14	0.71	0.04	0.20	0.90	0.372
QOL change	0.12	0.93	0.04	1.02	0.36	0.722

DISCUSSION

In the present study, Group A (MET group) demonstrated an increase in muscle strength from a mean of 4.37 ± 0.49 to 4.51 ± 0.51, while Group B (Conventional group) improved from 4.21 ± 0.41 to 4.26 ± 0.44. The between-group post-test comparison revealed a statistically significant difference with a t-value of 2.57 and a p-value of 0.012, indicating greater strength improvements in the MET group.

These findings are consistent with those of Anju Harry et al. (2021),[8] who reported significant improvements in hamstring flexibility and muscle performance following MET application in Kabaddi players. Improved muscle extensibility, as facilitated by MET, is known to reduce passive muscle stiffness, thereby enhancing strength generation during functional activities.

Similarly, Matsuo et al,[9] (2013) demonstrated that enhanced flexibility through stretching interventions resulted in improved passive torque and isometric muscle force, supporting the observed strength improvements in the current study. Notably, although both groups in this study showed improved post-test strength, only Group A exhibited a significant advantage, which may be attributed to the neuromuscular benefits of MET, including post-isometric relaxation and increased muscle fiber recruitment, as described by Halbertsma and Goeken (1994).[10]

In contrast, the control group receiving moist heat and passive stretching demonstrated minimal strength gains, aligning with prior research by Chaudhary et al. (2013),[11] which noted that passive modalities may promote relaxation but are insufficient to produce significant strength adaptations on their own.

The quality of life (QOL) scores in this study showed minimal changes, with Group A improving from 18.93 ± 0.70 to 19.05 ± 0.65, and Group B from 19.00 ± 0.69 to 19.04 ± 0.69, with no statistically significant differences ($p = 0.978$ post-test). The intragroup changes were also insignificant (Group A: $t = 0.82$, $p = 0.418$; Group B: $t = 0.29$, $p = 0.776$).

These results align with previous studies by Andersen et al,[12] (2011) and Gerdle et al,[13] (2008) who emphasized that short-term interventions targeting isolated muscle groups often fail to produce measurable improvements in overall quality of life, particularly in populations with mild baseline symptoms, such as college students.

Furthermore, Hanvold et al,[14] (2013) suggested that musculoskeletal interventions focusing solely on muscle relaxation or flexibility may not significantly influence perceived well-being unless accompanied by comprehensive functional rehabilitation, pain management, and long-term conditioning programs.

Therefore, the present findings confirm that while MET and conventional interventions may positively influence local muscle properties, their short-term effects on quality of life may be limited in otherwise healthy female participants.

Motor Learning (ML) Change: Group A showed a reduction of -1.14 ± 1.04, while Group B exhibited a larger decrease of -2.43 ± 1.14, with a highly significant between-group difference ($t = 5.59$, $p < 0.001$). These results suggest that conventional intervention, particularly moist heat combined with passive stretching, may have provided immediate relaxation benefits, facilitating greater short-term motor control improvements, similar to findings reported by Hermans and Spaepen (1995) regarding the neuromuscular effects of passive modalities.[15]

AKET (Flexibility) Change: Group A demonstrated a mean increase of 7.23 ± 5.44, while Group B improved significantly more by 17.57 ± 5.01, with a between-group t-value of -9.39 and a p-value of < 0.001. This outcome suggests superior flexibility gains in the group receiving passive stretching, supporting the conclusions of Matsuo et al (2013),[9] who identified stretching duration and consistency as key factors in improving muscle extensibility. Interestingly, despite MET being associated with flexibility improvements, its impact on AKET scores was less pronounced in this study, potentially due to the short duration of intervention.

Strength (ST) Change: Both groups exhibited minimal changes, with Group A increasing by 0.14 ± 0.71 and Group B by 0.04 ± 0.20, with no significant between-group difference ($p = 0.372$). These results echo the findings of Ravish and Helen (2014),[16] who indicated that short-term soft tissue interventions may promote relaxation but do not necessarily translate into substantial strength gains unless integrated with progressive resistance training.

Quality of Life (QOL) Change: Group A showed a change of 0.12 ± 0.93, and Group B demonstrated a change of 0.04 ± 1.02, with no significant difference ($p = 0.722$), aligning with previous quality of life results and supporting the conclusions of Gerdle et al,[13] (2008) regarding the limited influence of isolated interventions on overall well-being.

CONCLUSION

The present study concludes that while Muscle Energy Technique (MET) effectively improved hamstring strength, its short-term impact on quality of life was not statistically significant. Both MET and conventional interventions resulted in minimal changes in quality of life among females with hamstring tightness. This suggests that improving muscle flexibility and strength alone may not be sufficient to enhance overall quality of life in the short term. A more comprehensive, long-term intervention may be required to achieve meaningful improvements in quality of life.

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