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Effects of Dynamic Soft Tissue Mobilization Versus Mulligan's Bent Leg Raise Technique on Hamstring Flexibility in College Students with Hamstring Tightness: A Comparative Study

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Abstract

Background: Hamstring tightness is a common musculoskeletal problem among college students, mainly due to prolonged sitting, poor posture, and reduced physical activity. Reduced hamstring flexibility may impair pelvic alignment, alter lower-limb biomechanics, and increase the risk of low back pain and lower-extremity injuries. Dynamic Soft Tissue Mobilization (DSTM) and Mulligan's Bent Leg Raise (BLR) technique are used to improve hamstring flexibility; however, evidence directly comparing their effectiveness remains limited.

Objective: To compare the effectiveness of Dynamic Soft Tissue Mobilization and Mulligan's Bent Leg Raise technique in improving hamstring flexibility among college students with hamstring tightness.

Methods: A comparative study was conducted among 30 college students aged 17–25 years with hamstring tightness. Participants were allocated into two groups of 15 using convenience sampling. Group A received Dynamic Soft Tissue Mobilization, while Group B received Mulligan's Bent Leg Raise technique. Both groups underwent three sessions per week for four weeks. Hamstring flexibility was assessed before and after treatment using the Active Knee Extension Test (AKET). Statistical analysis used paired and independent t-tests, with significance set at $p<0.05$.

Results: Both groups demonstrated statistically significant improvements in hamstring flexibility after the intervention ($p \leq 0.05$). Between-group comparison showed no statistically significant difference in post-intervention outcomes for the right limb ($p = 0.746$) or left limb ($p = 0.478$), indicating comparable effectiveness.

Conclusion: Within the limitations of this study, both Dynamic Soft Tissue Mobilization and Mulligan's Bent Leg Raise technique significantly improved hamstring flexibility, with no statistically significant difference between interventions.

Keywords: Hamstring tightness; Dynamic Soft Tissue Mobilization; Mulligan's Bent Leg Raise technique; Hamstring flexibility; Active Knee Extension Test.

INTRODUCTION

Hamstring tightness is a common musculoskeletal problem among young adults and college students, largely attributed to prolonged sitting, poor posture, reduced physical activity, and sedentary lifestyles [6]. Decreased hamstring flexibility can alter pelvic alignment, reduce lumbar lordosis, impair lower-limb biomechanics, and increase the risk of low back pain, muscle strain, and functional limitations [1,5].

Maintaining adequate hamstring flexibility is important for normal movement, physical performance, and injury prevention [2].

The Active Knee Extension Test (AKET) is a clinical measure used to assess hamstring flexibility and muscle extensibility [8,9,7]. Physiotherapy interventions including stretching, proprioceptive neuromuscular facilitation, manual therapy, neuromuscular techniques, and soft tissue mobilization have been reported to improve hamstring flexibility [4,3].

Dynamic Soft Tissue Mobilization (DSTM) combines targeted soft-tissue techniques with active and passive limb movements to improve muscle extensibility, reduce tissue stiffness, and enhance functional mobility [10]. Mulligan's Bent Leg Raise (BLR) technique uses pain-free mobilization with movement and may improve stretch tolerance and hamstring flexibility [13,12,3]. Although both techniques have demonstrated beneficial effects individually, direct comparisons among college students with hamstring tightness remain limited. Therefore, this study compared the effectiveness of DSTM and Mulligan's BLR technique in improving hamstring flexibility.

METHODS

STUDY DESIGN AND PARTICIPANTS

A comparative experimental study was conducted at the Exercise Therapy Laboratory, Revathi Institute of Physiotherapy, over a period of eight months. Thirty college students aged 17–25 years with hamstring tightness were recruited using convenience sampling based on predefined inclusion and exclusion criteria. Ethical approval was obtained from the Institutional Ethics Committee of Revathi Institute of Physiotherapy and Research (Approval No.: RIPR/DT/21/4526). Written informed consent was obtained from all participants before enrolment.

INCLUSION AND EXCLUSION CRITERIA

Participants aged 17–25 years who were enrolled as college students and had hamstring tightness were included. Eligible participants demonstrated a minimum reduction of 15° in Active Knee Extension with the hip flexed to 90°, a minimum limitation of 20° on the unilateral Straight Leg Raise test, and a history of low back pain. Participants had to provide written informed consent and complete the four-week intervention.

Individuals were excluded if they had a lower-extremity injury within the previous three months, previous spine or lower-limb surgery, acute traumatic injury, red-flag conditions (fracture, malignancy, infection, or cauda equina syndrome), severe neurological deficits or disorders affecting the lower limb, severe cardiac disease, systemic inflammatory or metabolic disorders, connective tissue disorders, recent use of analgesic or general anaesthetic medication, or were unwilling to participate.

INTERVENTION

Thirty participants were allocated into two groups of 15. Group A received Dynamic Soft Tissue Mobilization (DSTM), while Group B received Mulligan's Bent Leg Raise (BLR) technique. Both interventions were administered three sessions per week for four weeks, with each session consisting of three sets of 10 repetitions. Interventions were performed by a qualified physiotherapist using standardized treatment protocols. Participants were informed of their right to withdraw at any stage.

OUTCOME MEASURE

Hamstring flexibility was assessed using the Active Knee Extension Test (AKET) with a universal goniometer before and after the four-week intervention. The test was used to determine changes in hamstring flexibility in both lower limbs.

STATISTICAL ANALYSIS

Data were analysed using SPSS version 24.0. Statistical significance was set at $p < 0.05$, with a 95% confidence interval. The Shapiro–Wilk test was used to assess normality. As the data were normally distributed ($p > 0.05$), parametric tests were adopted. Paired t-tests were used to compare pre- and post-intervention scores within groups, and independent t-tests were used for between-group comparisons.

RESULTS

Thirty participants with hamstring tightness were included and allocated equally to Group A (DSTM) and Group B (Mulligan's BLR), with 15 participants in each group. Both groups demonstrated statistically

significant improvements in right and left AKET scores following the intervention ($p \leq 0.05$). Between-group comparisons of post-intervention AKET scores showed no statistically significant difference for the right limb ($p = 0.746$) or left limb ($p = 0.478$).

Table 1. Within-Group Comparison of Active Knee Extension Test (AKET)

Group / Limb	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	p-value
DSTM – Right	42.66 ± 7.28	51.80 ± 7.45	0.001
DSTM – Left	40.00 ± 0.12	46.53 ± 4.85	0.001
BLR – Right	38.26 ± 8.11	50.80 ± 9.21	0.001
BLR – Left	38.13 ± 9.84	48.46 ± 9.20	0.001

*$p \leq 0.05$ indicates statistical significance.

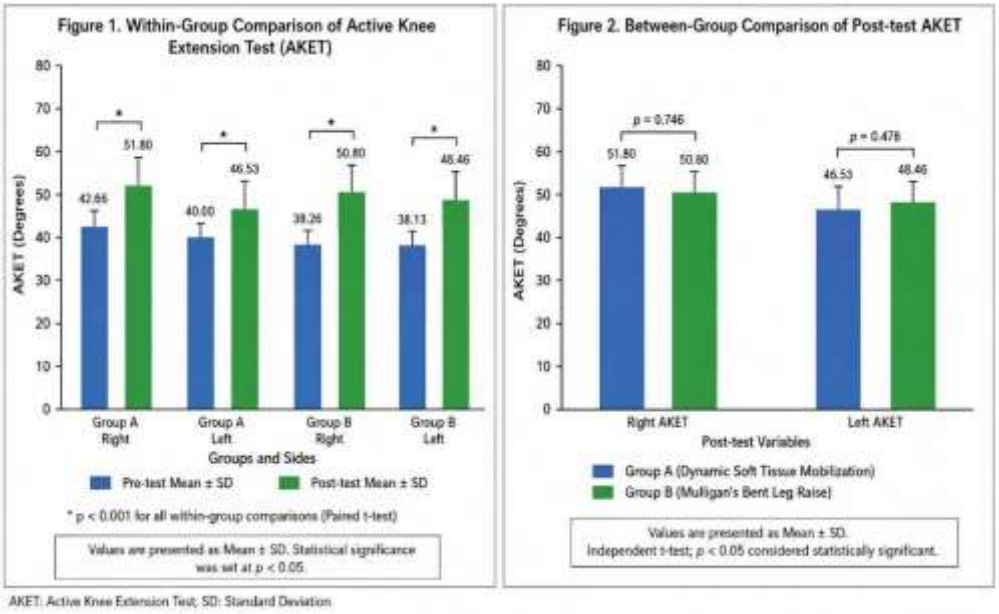
Table 2. Between-Group Comparison of Post-test AKET

Outcome	Group A: DSTM	Group B: BLR	p-value	Interpretation
Right limb	51.80 ± 7.45	50.80 ± 9.21	0.746	No statistically significant
Left limb	46.53 ± 4.85	48.46 ± 9.20	0.478	No statistically significant

The post-intervention comparison did not show a statistically significant difference between the two groups ($p > 0.05$).

These findings indicate comparable effectiveness of DSTM and Mulligan's BLR technique in improving hamstring.

GRAPH



DISCUSSION

The present study compared Dynamic Soft Tissue Mobilization and Mulligan's Bent Leg Raise technique for improving hamstring flexibility among college students with hamstring tightness. Both interventions produced statistically significant improvements in right and left AKET scores after four weeks. The between-group analysis did not identify statistically significant differences for either limb, suggesting that both techniques were similarly effective within the limitations of this study.

DSTM may improve tissue mobility and muscle extensibility by combining soft-tissue mobilization with active movement. Mulligan's BLR technique combines mobilization with movement and neuromuscular relaxation, potentially improving stretch tolerance and active knee-extension range. Although the amount of improvement differed across limbs and groups, the post-intervention comparisons did not demonstrate a statistically significant difference.

Clinically, both techniques may be considered conservative physiotherapy options for college students with hamstring tightness. The findings should be interpreted cautiously because of the relatively small sample, limited intervention period, and use of AKET as the principal outcome measure.

CONCLUSION

Within the limitations of this study, both Dynamic Soft Tissue Mobilization and Mulligan's Bent Leg Raise technique significantly improved hamstring flexibility among college students with hamstring tightness. No statistically significant difference was observed between the two interventions in post-intervention AKET scores.

LIMITATIONS

The study included a relatively small sample of college students aged 17–25 years, which may limit generalizability. The intervention period was limited to four weeks, and no long-term follow-up was performed. Hamstring flexibility was assessed using the Active Knee Extension Test; other functional and patient-reported outcome measures were not included. Physical activity levels and therapist-related variations may also have influenced outcomes.

RECOMMENDATIONS

Future studies should include larger samples and participants from different age groups to improve generalizability. Longer follow-up periods are recommended to assess the sustainability of treatment effects. Additional outcome measures, including functional performance, pain, and patient-reported outcomes, may provide a more comprehensive assessment. Further randomized controlled trials comparing DSTM and Mulligan's BLR technique with other physiotherapy interventions are also recommended.

INFORMED CONSENT

Written informed consent was obtained from all participants before enrolment. Participants were informed about the study objectives, procedures, potential benefits, and their right to withdraw at any time without consequences.

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AUTHOR CONTRIBUTIONS

Pavithra R: Conceptualization, methodology, participant recruitment, data collection, and manuscript drafting. **Dr. Nithya V:** Study supervision, methodology validation, critical review of the manuscript, and final approval. **Dr. P. Bright Alwin Victor:** Research guidance, manuscript review, administrative support, and final approval.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest regarding the publication of this study.

DATA AVAILABILITY STATEMENT

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

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