

Short Term Effects of Instrument Assisted Soft Tissue Mobilisation Technique Versus Mulligan's Bent Leg Raise Technique in Asymptomatic Subjects with Hamstring Tightness- A Randomised Clinical Trial

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ABSTRACT

Background: Hamstring a two joint muscle, its flexibility is an important variable; reduced flexibility has been proposed as a predisposing factor for non-specific low back pain and changes in lumbopelvic rhythm. Evidence suggests that Instrument Assisted Soft Tissue Mobilisation Technique (M²T blade) is underreported and also paucity of literature is seen against between IASTM (M²T blade) and Mulligan's Bent Leg Raise technique.

Objective: To study short term effect of IASTM (M²T blade) versus Mulligan's BLR technique in asymptomatic subjects with hamstring tightness.

Methodology: This is a randomised clinical study conducted on 212 asymptomatic subjects with hamstring tightness. The study compared two groups IASTM (M²T blade) and Mulligan's BLR technique. Both group had passive static stretching in adjunct. One-time intervention was delivered for each group. Patients were assessed at baseline and after one day of therapy.

Results: There were statistically significant changes in the all of the outcome measures in both the groups with p value <0.0001 except lumbar lordosis index which was significant only in BLR group with p value < 0.05.

Conclusion: Both IASTM (M²T blade) and Mulligan's BLR technique are effective in reducing the tightness of hamstring muscle which was maintained for 24 hours post-treatment. Mulligan's BLR technique also was effective in reducing lumbar lordosis index.

Keywords: IASTM (M²T blade), Mulligan's BLR, Asymptomatic, Hamstring tightness.

INTRODUCTION

The hamstring muscle is a two joint muscles and is easily subjected to large length changes when compared to muscles crossing only one joint, hence hamstring is a frequent group of muscle to get injured. [1] Flexibility has been defined as the ability of a muscle to lengthen and allow one joint (or more than one joint in a series) to move through a range of motion. [2,3] A theorized

cause of apparent muscle tightness is tissue extensibility dysfunction (TED). [3]

Hamstring flexibility is an important variable because; reduced extensibility has been proposed as a predisposing factor for injuries, non-specific low back pain, and changes in lumbopelvic rhythm [11] Inability to achieve greater than 160° of knee extension with hip at 90° of flexion is considered as hamstring tightness. [4,5]

Anatomically hamstring muscle originates from the inferomedial impression on the upper part on the ischial tuberosity, except short head of bicep femoris and inserted on the upper part of the posterior surface of tibia. [1] Because of the origin point in the pelvis, the tension within muscle is influenced by the posture of the pelvis. [6] Considering the pelvis to be base of the spine. Its orientation in anteroposterior direction affects the sagittal curves of the spine that is lumbar lordosis. [7] Hence, it can be attributed that hamstring flexibility is being influenced by the pelvic posture, subjected to high or moderate tension. [8] Instrument Assisted Soft Tissue Mobilization (IASTM) is a technique of mobilizing soft tissue with a rigid devices that can be made of different materials (e.g. wood, stone, jade, steel, ceramic, resin) to examine and treat the soft tissue. [9] Regardless of the type of method, approach, instrument or design; IASTM interventions are various forms of mechanotherapy which induce a mechanical stimulus to the tissue with a goal of improved healing which includes treatment of affected soft tissues to heal and regenerate at a cellular level. [9-11] It is based upon the rationale given by Dr. James Cyriax. [10] M²T blade is a latest invention, by Mr. Adam Bogar. M²T blade is used to reduce myofascial pain and increase range of motion of a particular joint. [12,13] The blade is made up of stainless surgical steel; it is the only double bevelled tool with 35⁰ and 55⁰ sides and 8 different treatment planes with 14 edges. It can be easily used by both left and right hand. Treatment plane number 2 is used under this study.. Musculoskeletal pain treatment protocol followed by manual therapists generally includes MWM concept in order to give immediate effect of increasing range of motion, reducing pain, and improving function. [14] It is both joint and muscle based concept. [15] BLR consists of gentle stretching of Hamstrings in a specific direction, gradually increasing the degree of hip flexion and knee extension post treatment. [2] Mulligan's BLR technique also

is known to alter the lumbar lordosis as the traction applied unilaterally is theorized to reach the pelvis through hip joint, further to sacrum and also lumbo-sacral junction. [15,16] Mulligan bent leg has been proved individually to be effective in improving hamstring flexibility in previous studies. [16] But there is paucity in literature stating the efficacy of IASTM technique using M²T blade in improving the hamstring flexibility and also limited studies are done comparing these two techniques i.e. IASTM using M²T blade and Mulligan Bent Leg Raise technique on hamstring muscle tightness. Hence, the aim of present study is to compare the effectiveness of IASTM technique using M²T blade and Mulligan Bent Leg Raise technique in asymptomatic subjects with hamstring tightness. We hypothesized that there will be difference in the effect of Instrument Assisted Soft Tissue Mobilization technique (M²T blade) and Mulligan's Bent Leg Raise technique on the hamstring muscle.

METHODOLOGY

Sample: The study sample consisted of 212 asymptomatic subjects both male and female of Kaher University, Belagavi, Karnataka. Ethical clearance was obtained from the Institutional Review Board. Sample size was estimated using SPSS software 21 at 95 percent power and effect size of 1.01 at significance level of 0.05 (α) came out to be 212 i.e. minimum 106 in each group. [17]

Inclusion Criteria: Subjects were included with age group between 18 to 25 years, Both and male and female subjects, asymptomatic subjects with hamstring tightness, Subjects willing to participate, Minimum 20 degrees of flexion at knee while performing active knee extension test (AKT) unilaterally.

Exclusion criteria: Hypersensitive skin, Diagnosed subjects with neurological deficits, Diagnosed subjects with malignancy, Diagnosed subjects with skin disease, Subjects diagnosed with systemic illness, Traumatic injury to the knee joint

and lumbar spine less than 6 months, Co-morbid conditions.

Study design: Randomised Clinical Trial design with random allocation into two study groups using envelope method. 225 subjects screened, out of which 212 subjects were included in the study.

Procedure: Institutional Ethical Committee approved the study. Subjects were screened for inclusion & exclusion criteria. Informed consent was taken before commencement of the study. Demographic data and Outcome measures were noted down pre-intervention. Subjects were randomly allocated into the two groups by envelope method. The treatment assigned to that particular group was delivered. Post treatment outcome measures were noted down after one day.

Intervention:

Group A: IASTM (M²T Blade) with conventional physical therapy: The patient was made to lie prone with foot outside the couch and in the center of the bed. The therapist stood on same side of the extremity to be treated beside the thigh and placed the treatment plane number 2 of M²T blade on posterior aspect of thigh. Vaseline was applied to the posterior aspect of thigh with the blade. Adhesions were assessed with the blade in both upward and downward direction, whichever felt better was used for the treatment. 30 strokes were given for the area consisting of maximum adhesions. The plane was held in 45⁰ position on the treatment area. [18] After IASTM treatment, static passive stretching was delivered to the patient with hold time of 90 seconds and rest time of 30 seconds for 5 repetitions. [19]

Group B: Mulligan's Bent Leg Raise Technique with conventional physical therapy: Patient was made to lie in supine position at the edge of the couch. Therapist stood at the side to be treated. The therapist grasped the lower extremity of the subject and placed it on his/her shoulder such that subject's flexed knee (Popliteal fossa) must be resting on therapists shoulder. The other lower extremity was resting on the couch.

Therapist flexed the lower extremity at the hip undergoing treatment in the direction of the same sided shoulder, gradually increasing the flexion range until pain is experienced by the subject. Once the subject starts experiencing pain, he/she was asked to push the therapist away with the same leg while the therapist is matching the subjects force, resisting it (hold for five seconds). Taking the lower extremity further into hip flexion, the therapist repeated the entire procedure until the subject experienced no pain. At the end, therapist held the end range (possible range attained where subject experienced no pain at all) for twenty seconds, and then the lower extremity was lowered down to the couch. [20] With the bent knee over the therapist's shoulder, therapist included a traction component with this technique. [21] After BLR technique, static passive stretching was delivered to the patient with hold time of 90 seconds and rest time of 30 seconds for 5 repetitions. [19]

FREQUENCY:

IASTM group: one time IASTM intervention (30 strokes) + conventional stretching of 5 repetitions (of hold time 90 seconds and rest time 30 seconds)

BLR group: one time intervention (20 seconds hold of end position) + conventional stretching of 5 repetitions (of hold time 90 seconds and rest time 30 seconds)

DURATION:

Duration of the IASTM group for each subject was 10 minutes.

Duration of BLR group for each subject was 9minutes 8 seconds.

TREATMENT DOSAGE: One time intervention was delivered to the subjects under the study.

OUTCOME MEASURES:

Popliteal angle: Popliteal angle measurements were recorded by goniometer. The hip and knee joints were kept at 90-90 position. From this angle of

knee, the knee was passively extended as far as resistance was felt. The angle was noted down. On subtracting the attained angle from 90 degrees, the popliteal angle was noted down. The measurement was taken pre intervention and also after one day, to observe the maintained effects of the treatment. [22]

Active Knee Extension test: same method was followed to perform active knee extension test as popliteal angle. Only difference in this test was, the subject is asked to actively extend the knee and the angle was noted down between thigh and leg. The attained angle was subtracted from 90 degrees and the angle was noted down. [23]

Sit and Reach test: In this test subject was asked to sit on the floor with legs stretched, straight ahead. The soles of the feet were placed flat against a wooden box. Subject was advised to lock both the knees and to press knees towards the floor. With the palm facing downward, and the hands being parallel to each other, the subject reached forward along the measuring line as far as possible, without involving his trunk. The subject held the reach position for one-two seconds while distance was recorded. The readings were taken pre and after one day to observe the maintained effects of the intervention. [24]

Lumbar lordosis index: Flexible ruler is a device measuring the curvature of spine; it can also be used to measure curvature of any body part. For measurement of lumbar lordosis, the flexible ruler was placed on the lumbar spine first, and then therapist carefully moulded the flexible ruler to get the ruler in the shape of the subject's lumbar

spine. Then the ruler was placed on a paper. The spinal curvature was copied on the paper using pencil, running at the border of the flexible ruler. Also a vertical line was drawn from T12 to S2 on the lumbar spine. [25]

To measure the lumbar lordosis using flexible ruler, deepest method is by an equation

$$(\text{Theta}) \text{ degree of lumbar lordosis} = 4 [\arctan^0(2H\text{cm}/L\text{cm})]$$

L line is the vertical line joining the T12 and S2 vertebrae in centimetres.

H line is the measurement of the first maximum width, which is deepest part of the curvature. [26]

RESULTS

For this study Two hundred and twelve (n=212) subjects were selected to compare the effects of IASTM (M²T blade) against Mulligan BLR technique. The demographic data is shown in Table 1. Except age no significant difference for the demographic characteristics between the groups was seen. Both the groups were comparable in terms of height, weight and BMI which (Table 1). In the present study, data were assessed by a Kolmogorov Smirnov test for the normality of the distribution of the scores, which was found to be non-normal distribution. Hence, non-parametric test were used. Comparison of baseline criterion measurement between the two experimental groups was done using Mann Whitney U test and measurement of within experimental groups was done using Wilcoxon test. As shown in the tables significant difference was found in both the groups with respect to popliteal angle, AKT, sit and reach test except lumbar lordosis index (which was significant only in Group B).

DEMOGRAPHIC DATA

Table 1: Distribution of male and females in the two groups

| Gender | Group A (M ² T group) | % | Group B (BLR group) | % | Total | % |
|------------------------------|----------------------------------|--------|---------------------|--------|-------|--------|
| Male | 30 | 28.30 | 22 | 20.75 | 52 | 24.53 |
| Female | 76 | 71.70 | 84 | 79.25 | 160 | 75.47 |
| Total | 106 | 100.00 | 106 | 100.00 | 212 | 100.00 |
| Chi-square=1.3432 p = 0.2471 | | | | | | |

Table 2: Distribution of respondents in two study groups (M²T and BLR) by age groups

| Age in yrs | Group A (M ² T group) | % | Group B (BLR group) | % | Total | % |
|-----------------------------------|----------------------------------|--------|---------------------|--------|-------|--------|
| 18 yrs | 4 | 3.77 | 1 | 0.94 | 5 | 2.36 |
| 19 yrs | 23 | 21.70 | 5 | 4.72 | 28 | 13.21 |
| 20 yrs | 10 | 9.43 | 8 | 7.55 | 18 | 8.49 |
| 21 yrs | 15 | 14.15 | 13 | 12.26 | 28 | 13.21 |
| 22 yrs | 7 | 6.60 | 20 | 18.87 | 27 | 12.74 |
| 23 yrs | 19 | 17.92 | 29 | 27.36 | 48 | 22.64 |
| 24 yrs | 22 | 20.75 | 21 | 19.81 | 43 | 20.28 |
| 25 yrs | 6 | 5.66 | 9 | 8.49 | 15 | 7.08 |
| Total | 106 | 100.00 | 106 | 100.00 | 212 | 100.00 |
| Chi-square=22.7022 $p = 0.0023^*$ | | | | | | |
| Mean age | 21.63 | | 22.47 | | 22.05 | |
| SD age | 2.12 | | 1.62 | | 1.93 | |

Table No. 3: Comparison of two study groups A and B (M²T and BLR) with mean age and BMI scores by independent t test

| Variable | Groups | Mean±SD | SE | t-value | p-value |
|----------|---------|-------------|------|---------|---------|
| Age | Group A | 21.63±2.12 | 0.21 | -3.2365 | 0.0014* |
| | Group B | 22.47±1.62 | 0.16 | | |
| Weight | Group A | 56.30±9.85 | 0.96 | 1.2110 | 0.2272 |
| | Group B | 54.75±8.71 | 0.85 | | |
| Height | Group A | 163.10±7.35 | 0.71 | 0.9089 | 0.3645 |
| | Group B | 162.17±7.49 | 0.73 | | |
| BMI | Group A | 21.80±2.97 | 0.29 | -1.4278 | 0.1548 |
| | Group B | 22.32±2.37 | 0.23 | | |

$p^* < 0.05$

Table No. 4: Distribution of respondents in two study groups A and B (M²T and BLR) by Occupations:

| Occupations | Group A | % | Group B | % | Total | % |
|------------------|---------|--------|---------|--------|-------|--------|
| Allied health | 21 | 19.81 | 6 | 5.66 | 27 | 12.74 |
| Ayurvedic Intern | 0 | 0.00 | 3 | 2.83 | 3 | 1.42 |
| B.Pharm | 8 | 7.54 | 5 | 4.71 | 13 | 6.13 |
| BPT | 15 | 14.15 | 32 | 30.19 | 47 | 22.17 |
| M. Ph. Student | 20 | 18.87 | 13 | 12.26 | 33 | 15.57 |
| MBBS | 5 | 4.72 | 8 | 7.55 | 13 | 6.13 |
| MPT | 16 | 15.09 | 32 | 30.19 | 48 | 22.64 |
| Nursing staff | 5 | 4.72 | 3 | 2.83 | 8 | 3.77 |
| Nursing student | 11 | 10.38 | 4 | 3.77 | 15 | 7.08 |
| Others | 2 | 1.89 | 3 | 2.83 | 5 | 2.36 |
| Total | 106 | 100.00 | 106 | 100.00 | 212 | 100.00 |

Table No. 5: Normality of pre-test and post-test scores of various parameters in Group A (M²T) and Group B (BLR) by Kolmogorov Smirnov test

| Parameters | Time points | Group A | | Group B | |
|-----------------------------------|-------------|---------|---------|---------|---------|
| | | Z-value | p-value | Z-value | p-value |
| Popliteal angle (degree) in right | Pretest | 2.2120 | 0.0001* | 1.5320 | 0.0180* |
| | Posttest | 2.3510 | 0.0001* | 1.5860 | 0.0130* |
| | Difference | 1.7510 | 0.0040* | 2.1480 | 0.0000* |
| Popliteal angle (degree) in left | Pretest | 1.7520 | 0.0040* | 1.2280 | 0.0980 |
| | Posttest | 1.7640 | 0.0040* | 0.9960 | 0.2750 |
| | Difference | 1.3680 | 0.0470* | 1.4700 | 0.0260* |
| AKT(degree) in right | Pretest | 2.5360 | 0.0001* | 2.0660 | 0.0001* |
| | Posttest | 2.1650 | 0.0001* | 1.5470 | 0.0170* |
| | Difference | 1.5060 | 0.0210* | 3.6000 | 0.0001* |
| AKT(degree) in left | Pretest | 2.0000 | 0.0010* | 1.2600 | 0.0840 |
| | Posttest | 2.0170 | 0.0010* | 1.2740 | 0.0780 |
| | Difference | 1.2680 | 0.0800 | 2.3410 | 0.0001* |
| Sit and reach test (centimeters) | Pretest | 3.3980 | 0.0001* | 1.7260 | 0.0050* |
| | Posttest | 1.7910 | 0.0030* | 1.3080 | 0.0650 |
| | Difference | 2.2330 | 0.0001* | 1.5960 | 0.0120* |
| Lumbar lordosis index (degree) | Pretest | 1.3550 | 0.0500* | 1.7790 | 0.0040* |
| | Posttest | 1.1120 | 0.1680 | 0.6810 | 0.7420 |
| | Difference | 1.5730 | 0.0140* | 0.6710 | 0.7590 |

* $p < 0.05$ indicates normality assumption not met

Table No. 6: Comparison of Groups A (M²T) and B (BLR) of right knee with pre-test and post-test popliteal angle (degree) by Mann-Whitney U test

| Time | Groups | Mean±SD | Sum of ranks | U-value | Z-value | p-value |
|------------|---------|---------|--------------|---------|---------|---------|
| Pretest | Group A | 34±4.36 | 10562.00 | | | |
| | Group B | 32±6.34 | 12016.00 | 4891.00 | -1.6279 | 0.1036 |
| Posttest | Group A | 28±3.30 | 9139.00 | | | |
| | Group B | 22±2.51 | 13439.00 | 3468.00 | -4.8143 | 0.0001* |
| Difference | Group A | 6±1.06 | 7984.50 | | | |
| | Group B | 10±3.83 | 14593.50 | 2313.50 | -7.3995 | 0.0001* |

*p<0.05

Table No. 7: Comparison of pre-test and post-test popliteal angle (degree) in right in Group A (M²T) and Group B (BLR) groups by Wilcoxon matched pairs test:

| | Group A | Group B |
|-----------------------|---------|---------|
| Pre-test (Mean ± SD) | 34±4.36 | 32±6.34 |
| Post-test (Mean ± SD) | 28±3.30 | 22±2.51 |
| % Difference | -4.3 | -6.17 |
| p value | 0.0001* | 0.0001* |

*p<0.05

Table No.8: Comparison of Groups A (M²T) and Group B (BLR) with pretest and posttest popliteal angle (degree) in left by Mann-Whitney U test:

| Time | Groups | Mean±SD | Sum of ranks | U-value | Z-value | p-value |
|------------|--------|------------|--------------|---------|---------|---------|
| Pre-test | A | 34±3.32 | 10974.00 | | | |
| | B | 32.4±3.03 | 11604.00 | 5303.00 | -0.7054 | 0.4806 |
| Post-test | A | 29.6±5.64 | 8878.50 | | | |
| | B | 23.21±6.58 | 13699.50 | 3207.50 | -5.3976 | 0.0001* |
| Difference | A | 6.56±2.32 | 7266.00 | | | |
| | B | 12.49±3.55 | 15312.00 | 1595.00 | -9.0083 | 0.0001* |

*p<0.05

Table. No. 9: Comparison of pretest and posttest popliteal angle (degree) in left in Groups A (M²T) and Group B (BLR) by Wilcoxon matched pairs test:

| | Group A | Group B |
|----------------------|-----------|-------------|
| Pre-test(Mean ± SD) | 34 ±3.32 | 32.4±3.30 |
| Post-test(Mean ± SD) | 29.6±5.64 | 23.21 ±6.58 |
| % of difference | -2.32 | -3.55 |
| p value | 0.0001* | 0.0001* |

*p<0.05

Table. No. 10.: Comparison of Groups A (M²T) and Group B (BLR) with pretest and posttest AKT (degree) in right by Mann-Whitney U test

| Time | Groups | Mean±SD | Sum of ranks | U-value | Z-value | p-value |
|------------|--------|------------|--------------|---------|---------|---------|
| Pre-test | A | 36.75±5.60 | 10414.50 | | | |
| | B | 35.45±2.30 | 12163.50 | 4743.50 | -1.9582 | 0.0502 |
| Post-test | A | 30.83±3.30 | 9206.00 | | | |
| | B | 28.64±1.56 | 13372.00 | 3535.00 | -4.6643 | 0.0001* |
| Difference | A | 5.92±2.57 | 8273.00 | | | |
| | B | 6.81±0.74 | 14305.00 | 2602.00 | -6.7535 | 0.0001* |

*p<0.05

Table. No. 11: Comparison of pretest and posttest AKT (degree) in right in Groups A (M²T) and Group B (BLR) by Wilcoxon matched pairs test

| | Group A | Group B |
|-----------------------|------------|------------|
| Pre-test (Mean ± SD) | 36.75±5.70 | 35.45±2.30 |
| Post-test (Mean ± SD) | 30.83±3.30 | 28.64±1.56 |
| % difference | -4.58 | -6.16 |
| p value | 0.0001* | 0.0001* |

*p<0.05

Table. No. 12: Comparison of Groups A (M²T) and Group B (BLR) with pretest and posttest AKT (degree) in left by Mann-Whitney U test:

| Time | Groups | Mean±SD | Sum of ranks | U-value | Z-value | p-value |
|------------|--------|------------|--------------|---------|---------|---------|
| Pre-test | A | 36.52±6.32 | 10507.00 | | | |
| | B | 34.92±6.88 | 12071.00 | 4836.00 | -1.7511 | 0.0799 |
| Post-test | A | 31.50±3.99 | 9093.50 | | | |
| | B | 28.71±3.07 | 13484.50 | 3422.50 | -4.9162 | 0.0001* |
| Difference | A | 5.02±2.33 | 7878.50 | | | |
| | B | 6.27±3.81 | 14699.50 | 2207.50 | -7.6368 | 0.0001* |

*p<0.05

Table. No. 13: Comparison of pretest and posttest AKT (degree) in left in Groups A (M²T) and Group B (BLR) by Wilcoxon matched pairs test:

| | Group A | Group B |
|----------------------|------------|------------|
| Pre-test(Mean ± SD) | 36.52±6.32 | 34.98±6.88 |
| Post-test(Mean ± SD) | 31.50±3.99 | 28.71±1.07 |
| % difference | -3.85 | -4.57 |
| p value | 0.0001* | 0.0001* |

*p<0.05

Table. No. 14: Comparison of Groups A (M²T) and Group B (BLR) with pretest and posttest Sit and reach test (cms) by Mann-Whitney U test

| Time | Groups | Mean±SD | Sum of ranks | U-value | Z-value | p-value |
|------------|--------|------------|--------------|---------|---------|---------|
| Pretest | A | 16.39±1.16 | 10990.50 | | | |
| | B | 16.41±1.68 | 11587.50 | 5319.50 | -0.6684 | 0.5039 |
| Posttest | A | 18.56±1.89 | 7063.50 | | | |
| | B | 21.86±2.07 | 15514.50 | 1392.50 | -9.4618 | 0.0001* |
| Difference | A | 2.17±1.44 | 6421.50 | | | |
| | B | 5.45±1.48 | 16156.50 | 750.50 | -10.899 | 0.0001* |

*p<0.05

Table. No. 15: Comparison of pretest and posttest Sit and reach test (cms) in Groups A (M²T) and Group B (BLR) by Wilcoxon matched pairs test:

| | Group A | Group B |
|----------------------|-------------|------------|
| Pre-test(Mean ± SD) | 16.39±1.16 | 16.41±1.68 |
| Post-test(Mean ± SD) | 18.56± 1.89 | 21.86±2.07 |
| % difference | -13.24 | -33.20 |
| p value | 0.05* | 0.0001* |

*p<0.05

Table. No. 16: Comparison of Groups A (M²T) and Group B (BLR) with pretest and posttest lumbar lordosis index (in degree) by Mann-Whitney U test:

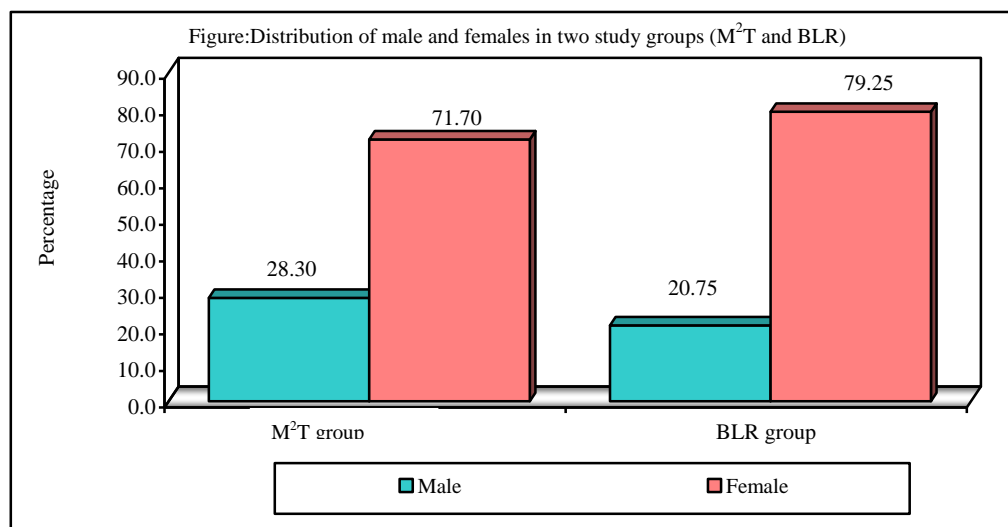
| Time | Groups | Mean±SD | Sum of ranks | U-value | Z-value | p-value |
|------------|--------|------------|--------------|---------|----------|---------|
| Pre-test | A | 35.76±1.05 | 8354.50 | | | |
| | B | 37.36±1.36 | 14223.50 | 2683.50 | -3.5710 | 0.2378 |
| Post-test | A | 34.80±1.89 | 14140.50 | | | |
| | B | 32.99±1.56 | 8437.50 | 2766.50 | -6.3851 | 0.0001* |
| Difference | A | 0.96±0.70 | 1896.00 | | | |
| | B | 4.37±1.56 | 16682.00 | 225.00 | -12.0761 | 0.0001* |

*p<0.05

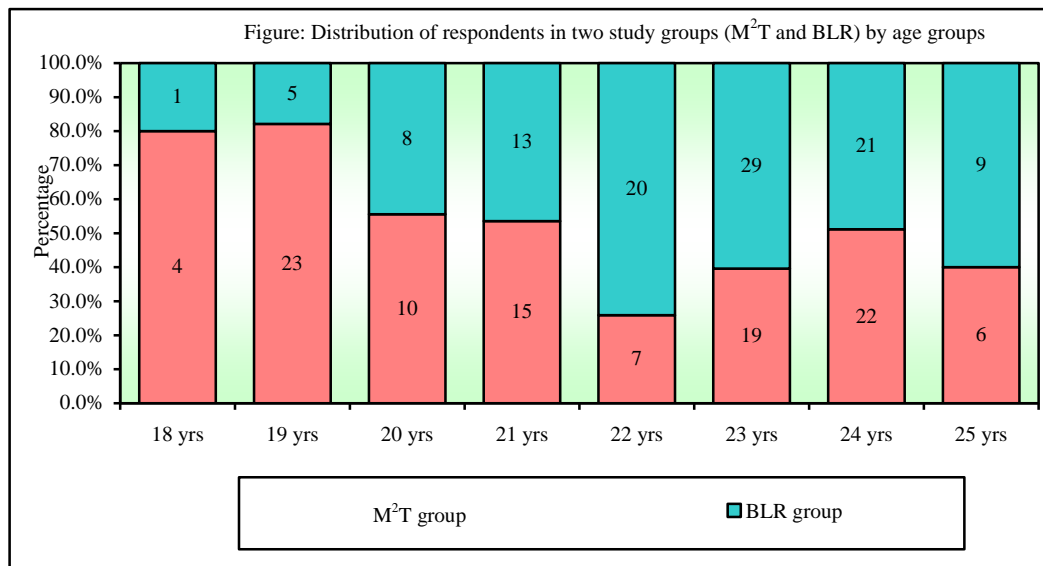
Table. No. 17: Comparison of pretest and posttest flexible ruler (in degree) in Groups A (M²T) and Group B (BLR) by Wilcoxon matched pairs test:

| | Group A | Group B |
|----------------------|------------|------------|
| Pre-test (Mean ±SD) | 35.76±1.85 | 37.36±1.36 |
| Post-test (Mean ±SD) | 34.80±1.89 | 32.99±1.56 |
| % of change | 2.68 | 11.71 |
| p value | 0.2021 | 0.0001 |

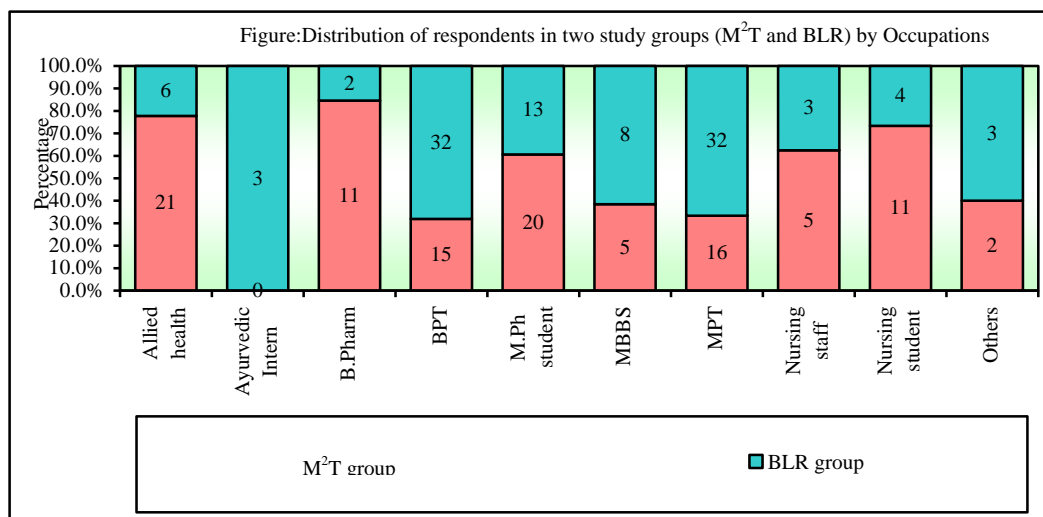
*p<0.05



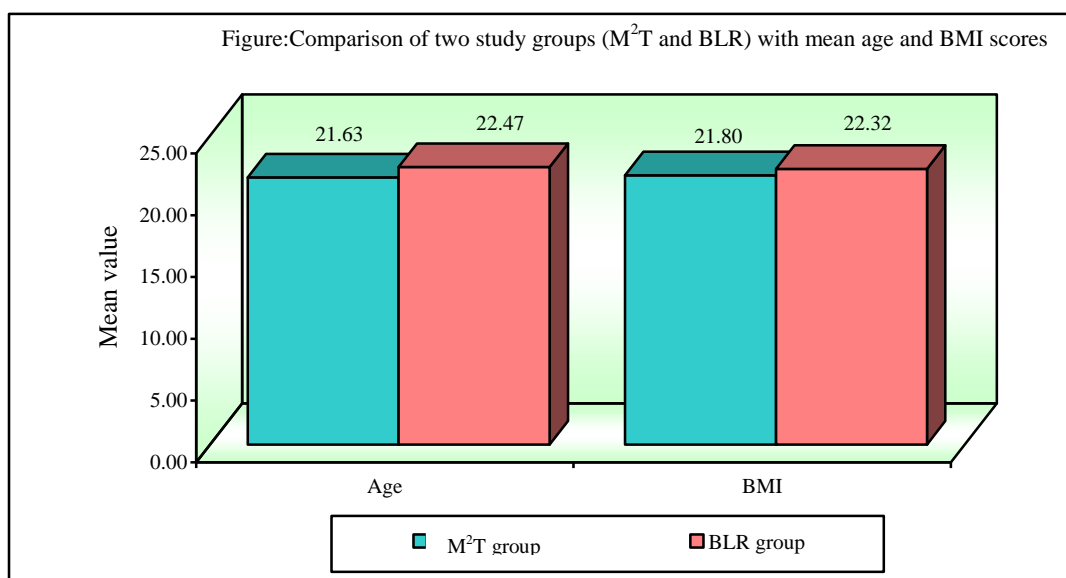
Graph. No. 1: Distribution of male and females in two study groups (M²T and BLR)



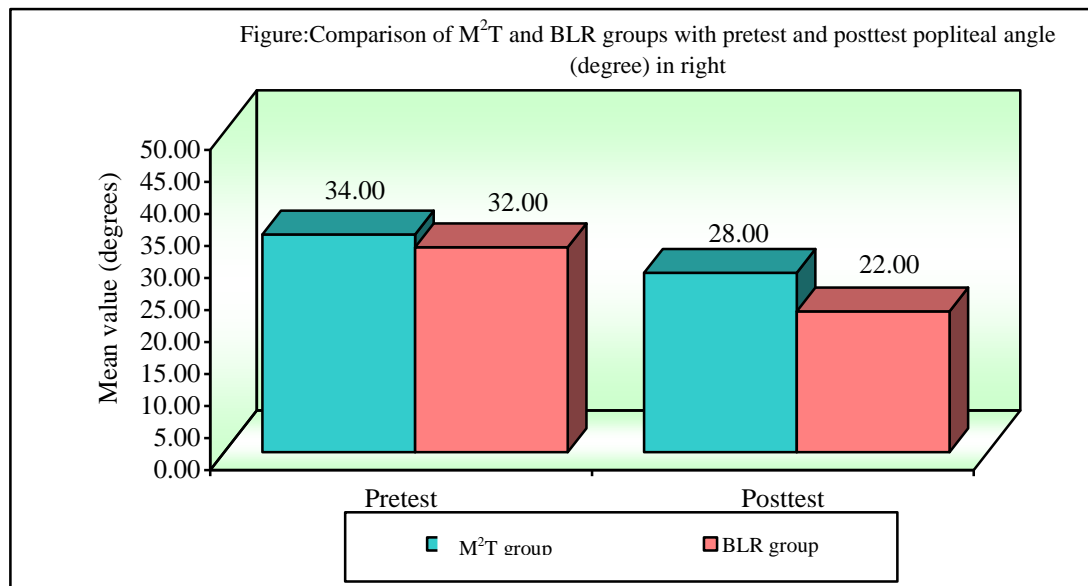
Graph 2: Distribution of respondents in two study groups (M²T and BLR) by age groups



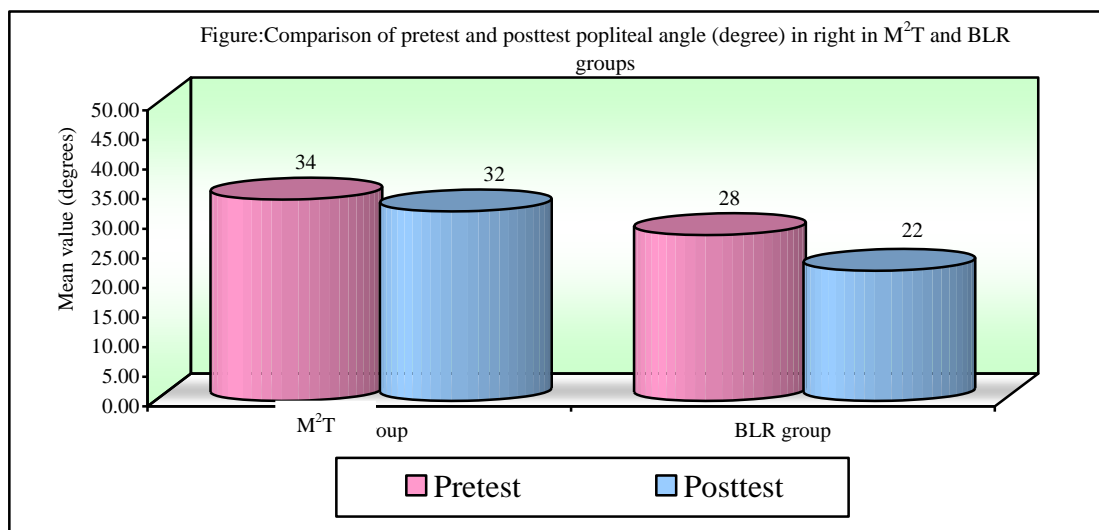
Graph 3: Distribution of respondents in two study groups (M²T and BLR) by Occupations



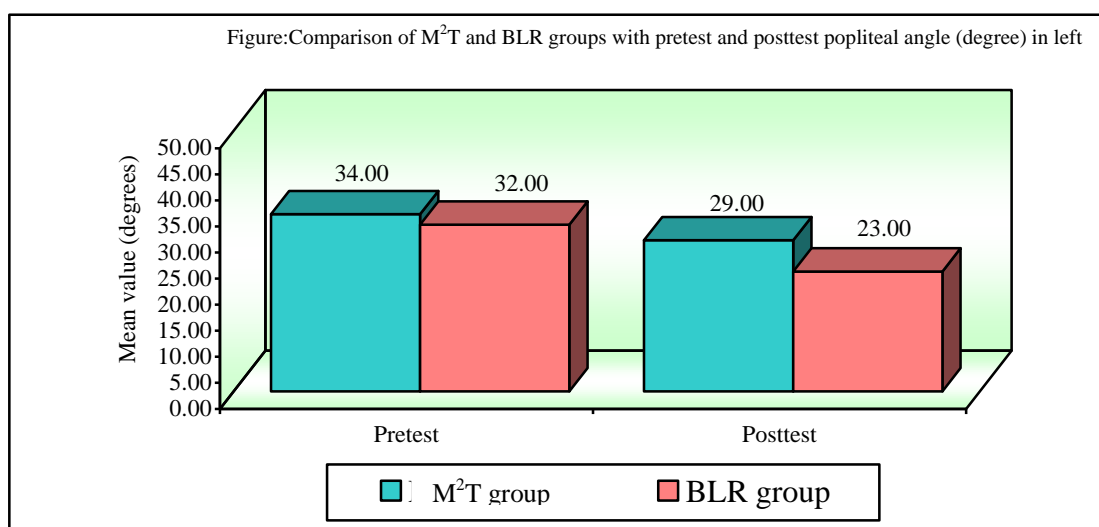
Graph 4: Comparison of two study groups (M²T and BLR) with mean age and BMI scores by independent t test



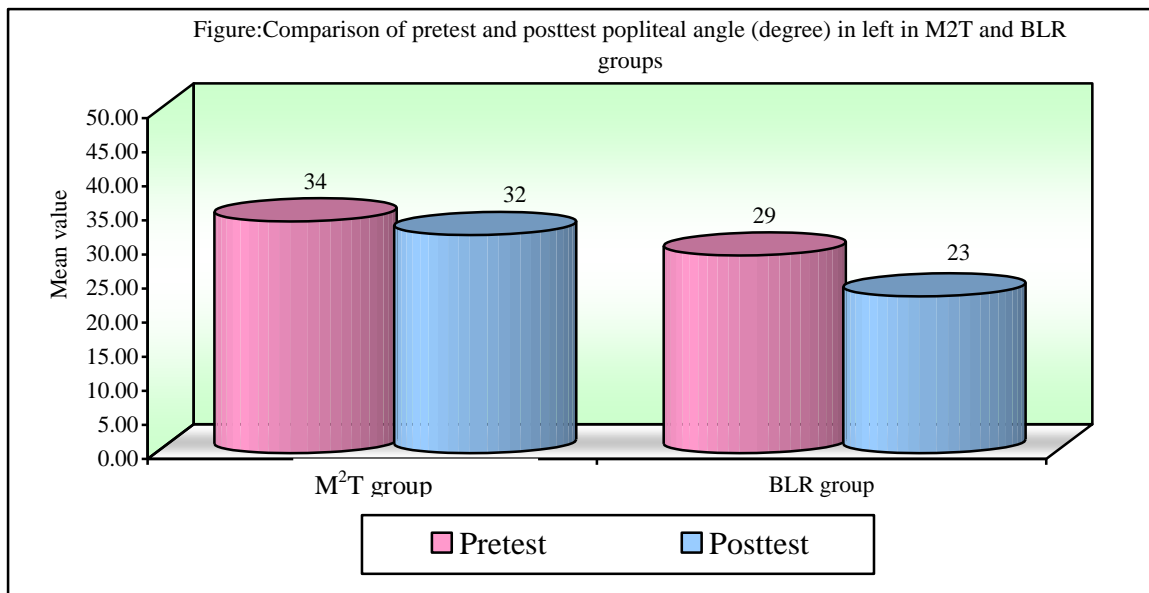
Graph 5: Comparison of M²T and BLR groups with pretest and posttest popliteal angle (degree) in right by Mann-Whitney U test



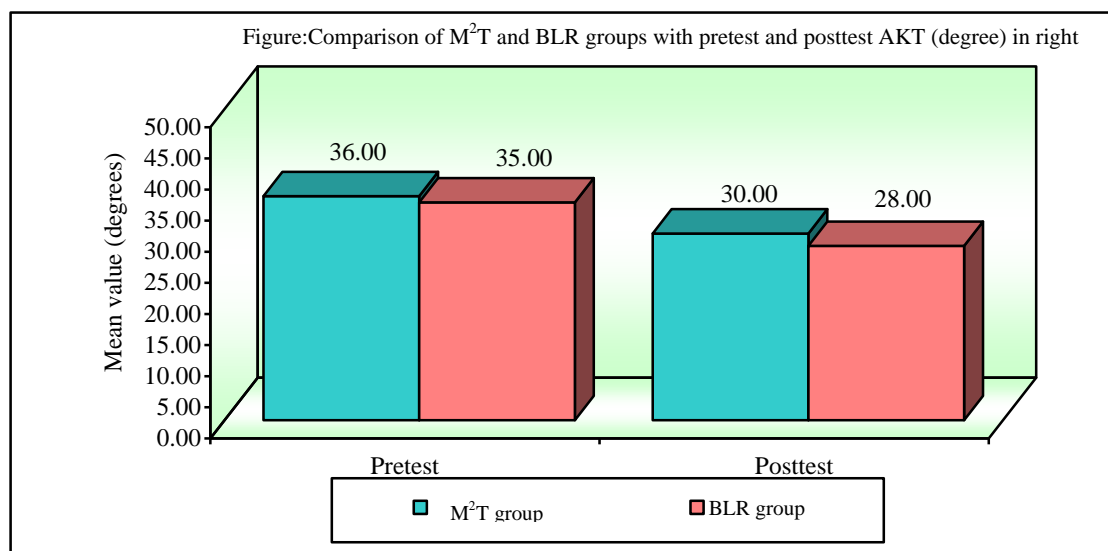
Graph 6: Comparison of pretest and posttest popliteal angle (degree) in right in M²T and BLR groups by Wilcoxon matched pairs test



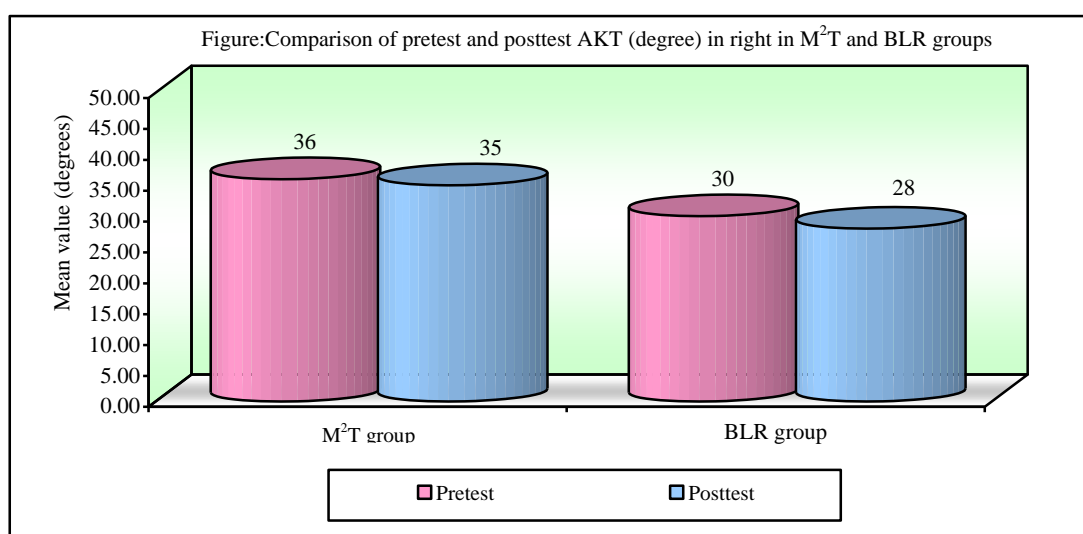
Graph 7: Comparison of M²T and BLR groups with pretest and posttest popliteal angle (degree) in left by Mann-Whitney U test



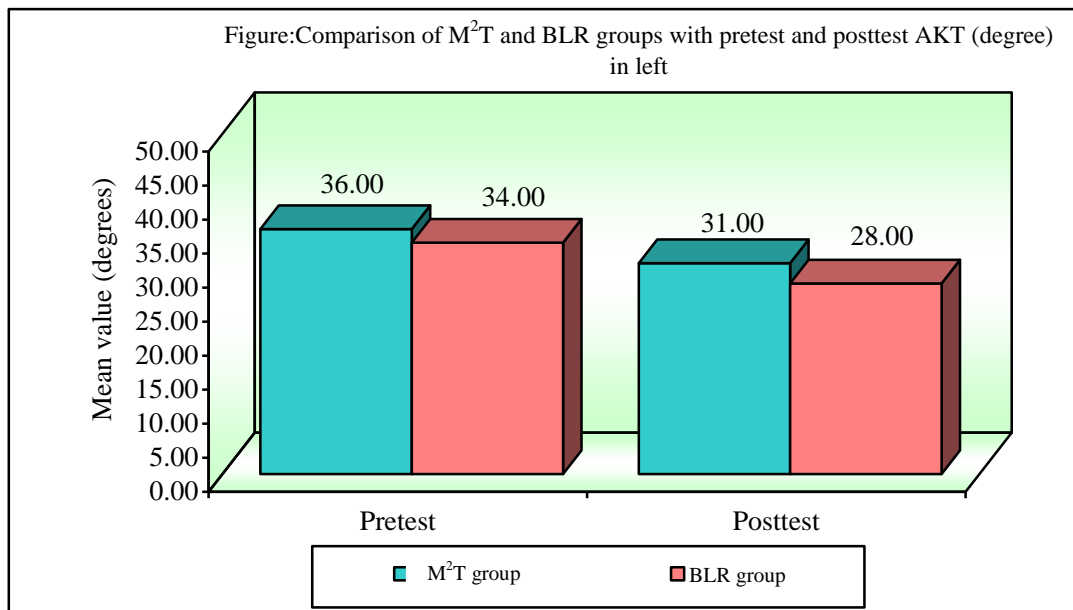
Graph 8: Comparison of pretest and posttest popliteal angle (degree) in left in M²T and BLR groups by Wilcoxon matched pairs test



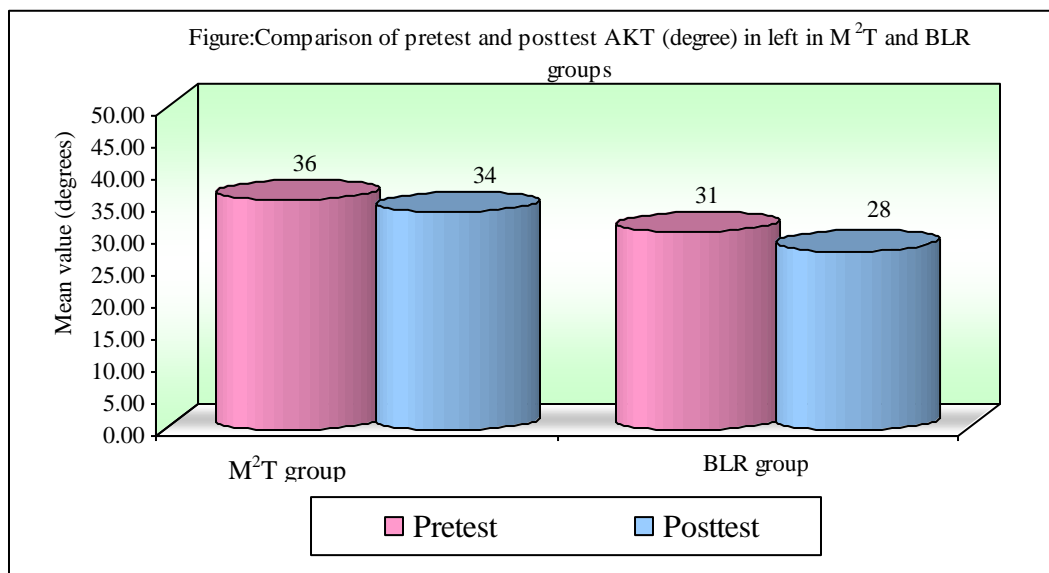
Graph 9: Comparison of M²T and BLR groups with pretest and posttest AKT (degree) in right by Mann-Whitney U test



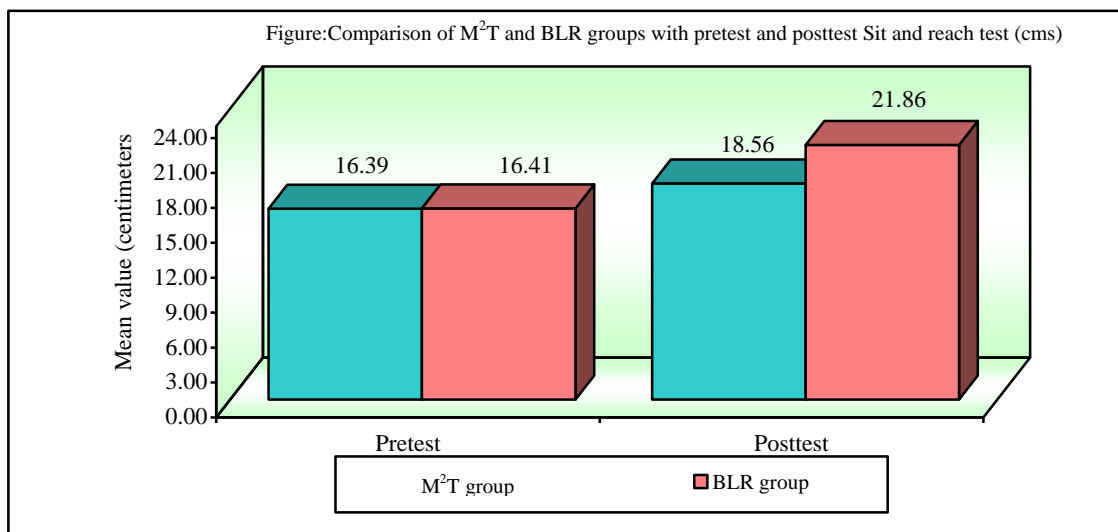
Graph 10: Comparison of pretest and posttest AKT (degree) in right in M²T and BLR groups by Wilcoxon matched pairs test



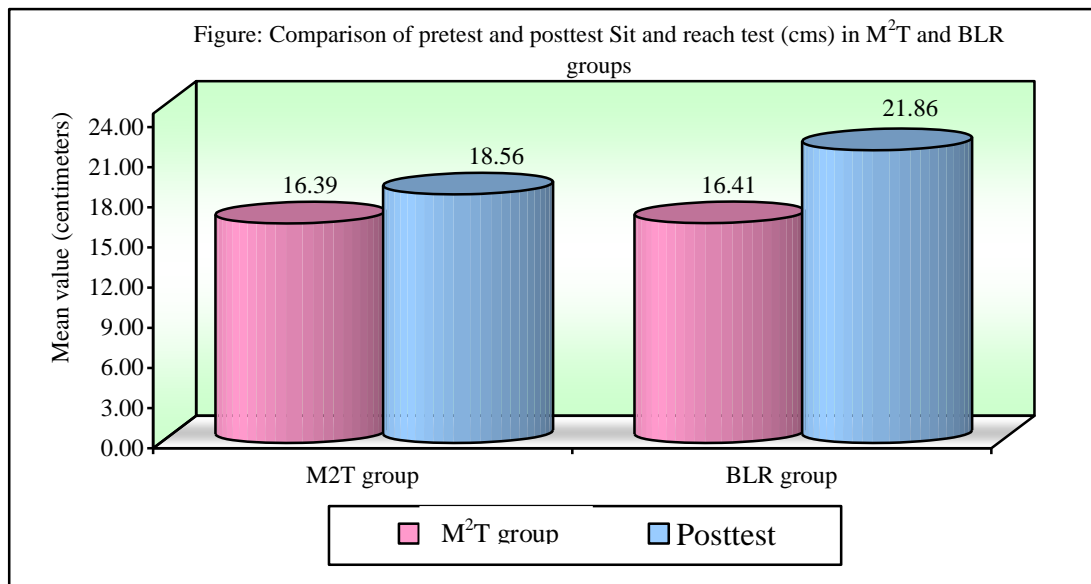
Graph 11: Comparison of M²T and BLR groups with pretest and posttest AKT (degree) in left by Mann-Whitney U test



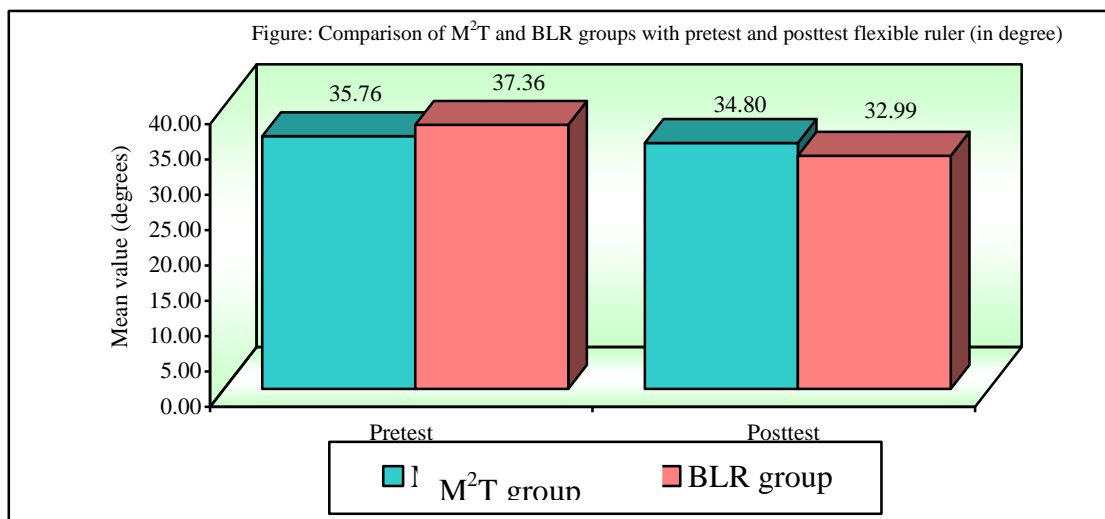
Graph 12: Comparison of pretest and posttest AKT (degree) in left in M²T and BLR groups by Wilcoxon matched pairs test



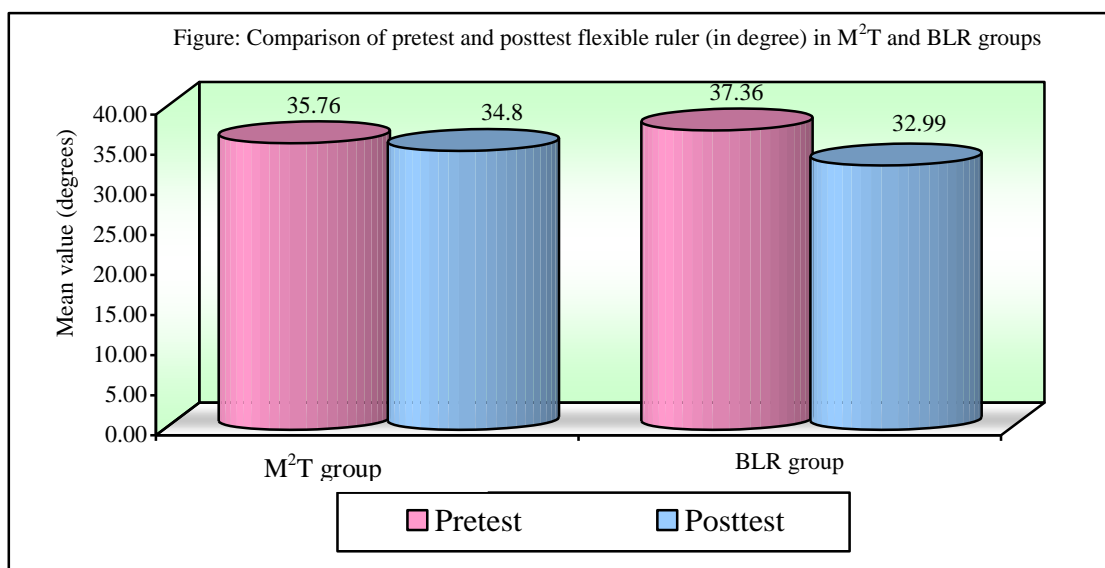
Graph 13: Comparison of M²T and BLR groups with pretest and posttest Sit and reach test (cms) by Mann-Whitney U test



Graph 14: Comparison of pretest and posttest Sit and reach test (cms) in M²T and BLR groups by Wilcoxon matched pairs test



Graph 15: Comparison of M²T and BLR groups with pretest and posttest flexible ruler (in degree) by Mann-Whitney U test



Graph 16: Comparison of pretest and posttest flexible ruler (in degree) in M²T and BLR groups by Wilcoxon matched pairs test

DISCUSSION

Significant increase in hamstring flexibility was noted in both groups over a single intervention which was maintained for one day. In adjunct to therapy allotted to both the groups, subjects also received passive static stretching of hamstring. Passive static stretching improved the hamstring flexibility in addition to the primary treatment. The conventional treatment was added in order to nullify the effect of the single area of treatment in the groups. IASTM was given only to the area of maximum adhesions and also BLR only stretches the origin part of hamstring. To nullify the effect of stretching only single area of hamstring static stretching was added to both the groups. It is proved to improve the hamstring flexibility as demonstrated by Magnusson et al. [27]

In the present study, age group of the subjects was between 18 to 25 years. Subjects within 20-25 years of age were prone for hamstring tightness because of increase physical stress, decreased concentration on muscle flexibility during work-out etc. Aging factor plays a role to provable decrease in muscular flexibility, which sets the platform for myofibrillogenesis inducing muscular tightness. It has been reported that hamstring tightness attains as schooling starts. It increases till 25 years. Once physical stress reduces tightness within hamstring decreases. After attainment of old age further the tightness increases. [28]

In the present study reduction in hamstring tightness, as quantified by the Popliteal angle and AKT, in both IASTM (M²T blade) and Mulligan's BLR technique is consistent with the findings of previous studies indicating both treatment were effective in reducing popliteal angle and AKT thus increasing hamstring flexibility.

According to Kage et al, Mulligan's BLR technique would stretch entire posterior muscular sling from hamstring till thoracolumbar fascia. This has a positive effect on reduction in lumbar lordosis index,

thus having changes in lumbo-pelvic rhythm. In correspondence to the present study Group B alone showed significant reduction in lumbar lordosis index. [3]

Also, a study conducted on 50 subjects diagnosed with trapezitis using IASTM approach with M²T blade with outcome measures being VAS, demonstrated that mean VAS on pre session was 7.18, which was decreased to mean of 1.18 after one time intervention which resulted in reduced spasm of trapezius. This spasm reduction may be co-related with increased trapezius muscle flexibility and also smooth gliding between the fascia and the muscle thus reducing adhesions. Similar effects must have occurred in the present study in Group A that decreased the popliteal angle, AKT and increased the distance in sit and reach test.

In group A only the part which had maximum number of adhesions was treated, compared to group B which had its effects till the lumbar spine. This may be one of the reasons for attaining positive result in reduction of lumbar lordosis index only in Group A. Also, Mulligan's BLR technique is postulated to reach till the lumbar spine stretching the thoracolumbar fascia thus reducing the degree of lumbar lordosis. In addition to that the group also had the effect of convention physical therapy (passive static stretching) which also demonstrated to induce change sagittal curvature of the spine.

Limitation:

No control group was used in the present study, and also variation of the level of treatment area in both the groups might have affected the result showing bias towards the BLR group in increasing the Sit and Reach test and reducing lumbar lordosis index.

Future Scope:

Long term effects of the interventions can be studied including the control group along with the effects on chronic back ache patients. Also detailed analysis of IASTM

(M²T blade) intervention can be studied alone along with exercises to check its effects on hamstring flexibility.

CONCLUSION

The findings of this study clearly demonstrate that both the techniques along with conventional physiotherapy have a great impact on popliteal angle, AKT, sit and reach test except lumbar lordosis index which was significant only in group B. The between group analyses was done using Mann Whitney U test and the result of the study confirm the hypothesis that there was a significant difference between the two groups. The results prove that there was difference in the effect of Instrument Assisted Soft Tissue Mobilization technique (M²T blade) and Mulligan's Bent Leg Raise technique on the hamstring muscle flexibility. Subjects in both groups showed pronounced effects in improving hamstring flexibility but the magnitude of response was more in group B, also Lumbar lordosis index was seen significantly reduced only in group B.

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