Effect of right sidelying respiratory left adductor pull back exercise in subjects with iliotibial band tightness

Gaurav Shori[1,A,D-F], Ajay Joshi[2,B]

[1] Department of Physiotherapy, Chitkara School of Health Sciences, Chitkara University, Punjab, India

[2] Senior Physiotherapist, Max Home Health Care, New Delhi, India

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Aims: Many of the impairments associated with lumbo-pelvic-femoral conditions like tightness of iliotibial band may be associated with postural asymmetry, abnormal chain pattern and restriction of range of motion. Although physical therapists currently utilize the RSRLAPB technique for a myriad of musculoskeletal conditions, there is little research published on the efficacy of the technique. Therefore, this study explored the effect of RSRLAPB exercise on hip adduction angle in subjects with IT Band tightness.

Methods: 30 participants (16 males, 14 females) were recruited based on inclusion and exclusion criteria and randomized into two groups. Group I (experimental group) received moist heat pack, stretching and RSRLAPB exercise for three weeks while, group II (control group) received moist heat pack and stretching for three weeks. Both the groups were tested at baseline and post intervention for hip adduction angle.

Results: Statistically significant differences in hip adduction angle was observed between group I and II ($p < 0.001$) as well as within group I ($p < 0.001$) and group II ($p < 0.001$).

Conclusion: The results concludes that RSRLAPB exercise not only improves limited hip adduction in subjects with iliotibial band tightness but also rectifies postural asymmetry and establishes normal respiratory pattern.

Key words: Anterior Interior Chain Pattern, Non Manual Technique, ITB Tightness

Introduction

The Iliotibial band (ITB), also referred to as iliotibial tract, Maissiat's band, is a long, non-elastic collagen structure which crosses both the hip and knee joints on the lateral side. The fascia originates proximally from the iliac crest and blend into one structure after converging

from the gluteus maximus posteriorly and the tensor fascia lata muscle anterolaterally. Deep fibers of iliotibial tract attach to the linea aspera of the femur, whereas superficial fibers attach to the lateral femoral condyle as well as into the lateral patella as a part of the lateral retinaculum. The most distal insertion of the tract is into Gerdy's tubercle on the anterolateral tibial condyle [1].

Literature refers ITB as polyarticular muscle, which forms a polyarticular muscle chain, means muscle that overlap without a break in continuity and crosses more than one joint. This may be one of the reasons why many of the impairments associated with lumbo-pelvic-femoral conditions like tightness of ITB were suggested to be associated with postural asymmetry, abnormal chain pattern and restriction of adduction range of motion in hip joint. Many associated linked patterns of postural asymmetry like left anterior interior chain (LAIC) and right anterior interior chain (RAIC) have been identified and reported in studies. Moreover, these patterns not only causes asymmetry of bone or joint position, muscle imbalance but also lead to possible patterns of compensation which may further result in ligamentous laxity [2–4].

Screening of individuals with ITB tightness can be done through Ober's test or modification of Ober's test [5], the results of which can be quantified through various measures ranging from observation [6,7], to the use of a goniometer [8], tape measure [9], and inclinometer [10].

With regard to its management, numerous treatment strategies have been documented and employed by physical therapist including cryotherapy, high voltage pulsed galvanic stimulation or iontophoresis, rest or modification of the activities [6], stretching [5, 11, 12, 13], moist heat pack [14–16], ultrasound [17], range of motion exercises [5, 7, 13]. Majority of the protocol utilized for the treatment of ITB tightness till now managing it as a local problem focusing largely on tightness only, without visualizing its allied consequences. In the contemporary clinical reasoning the positive Ober's test indicates shortened iliotibial band and should be managed with stretching, is thus called into question. An active therapeutic exercise technique that also addresses postural asymmetry and abnormal chain pattern associated with it would seem to be desirable for patients.

Postural Restoration Institute^{R}, has recently suggested a new exercise, RSRLAPB, which not only facilitates isolated muscle activation for muscle inhibition, but also integrates desired neuromuscular function as well as preventing compensation and is beneficial in improving Ober's test measurement. Although physical therapists currently utilize the RSRLAPB technique

for a myriad of musculoskeletal conditions, there is little research published on the efficacy of the technique.

Subjects and methods

30 participants (16 males, 14 females) with a mean age (29.16 + 3.11 years), mean weight (57.97 + 4.86 kgs), mean height (161.3 + 5.39 cms) were selected in a randomized control trial. The inclusion criteria was subjects with left ITB tightness and exclusion criteria were participants with any other musculoskeletal impairment, neurological complications, systemic illness as well as bilateral iliotibial band tightness and those receiving any other treatment interventions. The participants were instructed to avoid any physical activity on the day of assessment, to wear comfortable attire and to take the necessary care with feeding and hydration. Written consent was obtained from all the participants before start of experimental procedure. The ethical clearance was obtained from institutional ethical committee in accordance with the guidelines laid by Helsinki Declaration (Revised 2013).

Screening for ITB tightness

Modified Obers Test like previously in the text, patient was asked to lay on the right side lying position, before the examiner maintained the subject's knee in full extension, and then placed the right hand on the ipsilateral pelvis to stabilize it by pushing in a downward direction (towards the floor). Examiner then used the left hand to, first, passively abduct the hip, and second, to extend the subject's left hip in line with the trunk. Subjects were asked to relax all muscles of the lower extremity while allowing the uppermost limb to drop into adduction towards the table through the available hip adduction range of motion. As the limb dropped towards the table, examiner supported the limb at the medial joint in order to lower the limb with greater control. In addition, examiner hand also prevented flexion and internal rotation of the hip. The end position of hip adduction was defined as the point at which lateral tilting of the pelvis was palpated, when the hip adduction movement stopped, or both. If above horizontal (abducted), it was recorded as a positive number. If below horizontal (adducted), it was recorded as a negative number [18].

Subjects were randomly divided into two equal groups, Group I, $n = 15$ regarded as experimental group and Group II, $n = 15$ as control group. Pre-test measurement of left hip adduction angle was taken by inclinometer.

Procedure for measuring hip adduction angle

The examiner 1 maintained the subject's knee in full extension, while, examiner 2 placed the inclinometer over the lateral epicondyle. Examiner 2 then positioned the inclinometer so that the measurement scale was facing away from examiners 1 and 2. Examiner 3 read the scale of the inclinometer. If the limb was horizontal, it was considered 0°; if below horizontal (adducted), it was recorded as a positive number; and if above horizontal (abducted), it was recorded as a negative number [18].

Group 1 (experimental group) received moist heat pack, stretching and RSRLAPB exercise for three weeks, while, Group 2 (control group) received moist heat pack and stretching.

Method of application of moist heat pack

Superficial heat was administered by moist heat pack consisting of silica gel encased in a canvas cover. The moist heat pack were heated and maintained at 73.88°C (165°F). Nine layers of terry cloth padding were placed between the hot pack and the subject. Moist heat pack was applied in side lying on the tight left iliotibial band (lateral aspect of thigh) for 20 minutes, twice a day for three weeks before stretching [14–16].

Method of stretching of ITB

The stretch began with the subject in standing upright. The left leg (being stretched) was extended and adducted across the right leg. The subject exhaled while slowly flexing the trunk in a direction lateral to the opposite side. The hands were clasped overhead and the arm on the same side of the leg being stretched in same direction. This motion continued until a stretch was felt on the left side of hip around the greater trochanter. The stretch held for 15 to 20 seconds, repeated 3–5 times for 3 weeks [11].

Procedure for RSRLAPB exercise

Subject was asked to lay on the right side with feet on a wall and hips and knees at a 90-degree angle, ankles and knees together and back rounded. A towel was placed under the head of the subject in order to keep back and neck relaxed. An appropriate size bolster was then placed between the feet and a towel between the knees, such that the subject's left knee got lower than the left hip and ankle. Subject was then asked to push from right foot into wall and asked to inhale through the nose as he pulled back his left leg. Subject exhaled through the mouth as he squeezed the left knee down into the towel for 3 seconds. Subject was then asked to repeat the same sequence of pulling back from left leg in inhalation and squeezing down from the left knee after exhalation. The exercise was continued in sequence until the subject had completed 4–5 breaths in and out. This exercise was done twice daily and repeated five times (three inhalation and three exhalation equals one repetitions) for 3 weeks. One set was done in one session [19].

Post-test measurement of left hip adduction angle was documented again following three weeks of treatment intervention.

Data was analyzed for statistical significance by using the statistical package for social sciences (SPSS 16.0) software. The dependent variable hip adduction ROM was analyzed using independent t-test and level of significance was kept at $p < 0.001$.

Results

Demographic Data

Independent t-test was applied to analyze the differences between the age, weight, and height of Group I & Group II. Insignificant differences were observed between age ($t = 0.758$, $p = 0.455$), height ($t = 0.634$, $p = 0.531$), weight ($t = 0.441$, $p = 0.663$) respectively (Table 1).

Between Group Analysis

Since the base line values of the subjects in both groups were comparable, the outcome variable i.e. difference of hip adduction ROM was compared using independent *t*-test.

The mean values of left hip adduction angle for group I and group II were 44.67 ± 1.05 degrees, 37.80 ± 1.66 degrees respectively. Statistically significant difference was observed between group I and group II (t = 13.575, $p = 0.001$) (Table 2).

Within Group Analysis

To analyze the difference within group I and group II, paired t-test was used.

The mean values of pre and post left hip adduction angle within group I & group II were – 18.46 ± 1.46 degrees, 26.20 ± 1.20 degrees and 18.46 ± 1.18 degrees,19.33 ± 0.81 degrees respectively. Statistically significant difference was observed within pre and post readings of left hip adduction angle in group I (t = 165.301, $p = 0.001$) and group II (t = 88.39, $p = 0.001$) (Table 3)

Discussion

Present study findings demonstrated how an active therapeutic exercise or non manual technique that addresses postural asymmetry and abnormal chain patterns can influence Ober's test measurement. Literature advocates this exercise as, specific process incorporating muscle position, the two respiration phases, and appropriate concomitant muscle activity [20]. During a positive Ober's test, when the tested leg is brought into neutral hip extension and then adducted, if the pelvis is anteriorly tilted and forward rotated, the neck of the femur may impinge on the cotyloid rim of the acetabulum, preventing normal adduction ROM as a result of bony abutment, leading to hard end feel [21]. The RSRLAPB exercise moves the acetabulum to an anatomically neutral position such that femoral motion can occur without any interference.

Positioning of the patient (in right side lying with his hips and knees in approximately 90º of flexion and the lumbar spine in flexion) itself, allows the paraspinals to be relaxed and lengthened and do not pull to anterior pelvic tilt but further causes passive left hip femoral acetabular internal rotation (FAIR) once a large pillow or blanket is placed between ankle or foot. As the left hip moves into internal rotation and adduction, it pushes the left posterior hip

capsule and ischio-femoral ligament in a lengthened position [19]. The left hip motion should also lengthen or inhibit muscles of the right anterior outlet (adductors, levator ani, obturator internus) and muscles of the left anterior inlet (rectus femoris, sartorius) [22]. This position further encourages neuromuscular re-education to maintain an increased left diaphragm zone of apposition via rib or spine or pelvis position being maintained during inhalation without allowing lumbar lordosis, anterior pelvic tilt and rib elevation or external rotation to occur. During the inhalation, the diaphragm contracts, which forces the left pelvic floor fulcrum (levator ani muscle group and coccygeus) to open the left posterior pelvic outlet so that upright left hip will be more easily obtained and not be limited by the pelvis.

Our findings were in agreement with the study, which used one similar technique (a 90/90 Left Hemibridge with Balloon) to address 13 subjects with lumbo-pelvic-femoral pain and a common LAIC impairment (defined by a positive Ober's Test). The participants reported a significant and clinically meaningful reduction in pain after one session of five repetitions. This study suggested Ober's Test as a reflection of triplanar position of the pelvis and hip joints, bring about activation of hamstrings and abdominals (five repetitions) for individuals with a positive Ober's Test, which seemed to immediately change the pelvic and hip position and therefore resulted in a negative Ober's Test (greater hip adduction range) [21].

Results of present study were also in agreement with a case study on a female patient with left low back pain and sacroiliac joint pain. The patient was 65 year old woman with a 10 month history of constant left low back pain and sacroiliac joint pain and leg pain. She was treated 6 times using unique unilateral exercises (90-90 left hemibridge with left hip shift or blowing up balloon, Left side lying scissor slides with ball, Left side-lying knee to knee, Right side lying left anterior gluteus medius with weighted femoral acetabular internal rotation and abduction) developed by the Postural Restoration Institute, to address pelvic asymmetry and left hip capsule restriction. Left Ober's test was found negative at discharge and patient was pain free and no longer had numbness in her left leg [3].

Findings of present study were also in accordance with a case study reported on 61 year old female patient with chronic sciatica and low back pain. On initial examination she reported pain at 9 on a scale of 10, demonstrated a straight leg raise (SLR) limited to 45 degrees, and a positive Ober's test. The Oswestry Disability Index (ODI) was 40%. For the first six weeks (five visits) the patient was instructed to stabilization and spinal flexion exercises. After documenting limited

improvement, the intervention plan was revised for 13 addition weeks (10 visits), to include the following exercises to reposition and stabilize the pelvis: muscle activation of the left hamstrings, adductors, gluteus medius, abdominals, and right gluteus maximus; stretching the left posterior hip capsule; and muscle inhibition for the paraspinals. After five visits, the patient reported 6/10 pain and leg pain. At discharge, patient reported 0/10 pain, SLR was 70 degrees, the ober's test was negative, and the ODI was 0% [20].

Similar findings were revealed by another case report on college football player with bilateral thoracic outlet syndrome. The athlete reported 100% decrease in pain on the numeric pain scale (e.g. 8-9/10 to a 0/10) by discharge and a 100% improvement in function on the Oswestry Disability Index (ODI) (e.g. 20-40% to 0%) or the Northwick Park Neck Pain Questionnaire (NPNPQ) (55.5% to 0%) by discharge when treated with RSRLAPB exercise for six weeks [22].

Limitations

In present study only left hip adduction angle as an outcome measure was taken. Measures, for instance pain, functional disability, and quality of life could have also been included in the study to further support the efficacy of this novel technique. Moreover, follow up measurement of hip adduction angle was also not done in order to validate present study findings that the hip adduction ROM was maintained.

Conclusion

The findings of present study concludes that RSRLAPB exercise is a technique which not only releases ITB tightness but also corrects associated postural asymmetry, and further aid in establishing normal respiratory pattern. Thus it is recommended to include this exercise in the current physical therapy protocols managing lumbo-pelvic-femoral conditions and associated musculoskeletal, respiratory and postural impairments to achieve best of results.

Conflict of Interest Statement

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Author's correspondence address:

Gaurav Shori
Department of Physiotherapy
Chitkara School of Health Sciences
Chitkara University
Chandigarh-Patiala National Highway (NH-64)
Village Jhansla
140401 Patiala, Punjab India
e-mail: gaurav.shori@chitkara.edu.in