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

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Abstract

Introduction. Many of the impairments associated with lumbo-pelvic-femoral conditions, like tightness of the iliotibial band, may be bound with postural asymmetry, abnormal chain pattern, and restriction of the range of motion. Although physical therapists currently utilize the right sidelying respiratory left adductor pull back (RSRLAPB) technique for numerous 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 iliotibial band tightness.

Methods. The total of 30 participants (16 males, 14 females) were recruited on the basis of the inclusion and exclusion criteria, and randomized into two groups. Group 1 (experimental group) received moist heat pack, stretching, and RSRLAPB exercise for 3 weeks, while in group 2 (control group), moist heat pack and stretching were applied for 3 weeks. Both groups were tested at baseline and post-intervention for hip adduction angle.

Results. Statistically significant differences in hip adduction angle were observed between groups 1 and 2 ($p < 0.001$), as well as within group 1 ($p < 0.001$) and within group 2 ($p < 0.001$).

Conclusions. The results revealed 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, iliotibial band tightness

Introduction

The iliotibial band (ITB), also referred to as iliotibial tract or 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 blends into one structure after converging from the gluteus maximus posteriorly and the tensor fascia lata muscle anterolaterally. Deep fibres of ITB attach to the linea aspera of the femur, whereas superficial fibres 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 describes ITB as a polyarticular muscle, which forms a polyarticular muscle chain, i.e. a muscle that overlaps 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 ITB tightness, were suggested to be bound with postural asymmetry, abnormal chain pattern, and restriction of the adduction range of motion (ROM) in the hip joint. Many associated linked patterns of postural asymmetry, like left anterior interior chain (LAIC) or right anterior interior chain (RAIC), have been identified and reported in studies. Moreover, these patterns not only cause asymmetry of bone or joint position and 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 performed with the Ober's test or a modification of the 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, 11–13], moist heat pack [14–16], ultrasound [17], and ROM motion exercises [5, 7, 13]. The majority of the protocols utilized for the treatment of ITB tightness till now manage it as a local problem and focus largely on the tightness only, without visualizing its allied consequences. In the contemporary clinical reasoning, the assumption that positive Ober's test indicates shortened ITB, which 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.

The Postural Restoration Institute® has recently suggested a new exercise, right sidelying respiratory left adductor pull back (RSRLAPB), which not only facilitates isolated muscle activation for muscle inhibition, but also integrates desired neuromuscular function, as well as prevents compensation and is beneficial in improving the Ober's test measurement. Although physical therapists currently utilize the RSRLAPB technique for numerous musculoskeletal conditions, there is little research published on the efficacy of the technique.

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Subjects and methods

The total of 30 participants (16 males, 14 females) with the mean age of 29.16 + 3.11 years, mean weight of 57.97 + 4.86 kg, mean height of 161.3 + 5.39 cm were selected to a randomized control trial. The inclusion criterion was the presence of left ITB tightness; the exclusion criteria involved any other musculoskeletal impairment, neurological complications, systemic illness, as well as bilateral ITB tightness and 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 subjects before the experimental procedure. The ethical clearance was obtained from the institutional ethical committee in accordance with the guidelines laid by the Declaration of Helsinki (revised 2013).

Screening for ITB tightness

Modified Ober's test was applied. The patient was asked to lie on the right side before the examiner maintained their 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). The 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. The 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 ROM. As the limb dropped towards the table, the examiner supported the limb at the medial joint in order to lower the limb with greater control. In addition, the examiner's 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 the position was above horizontal (abducted), it was recorded as positive; if below horizontal (adducted), it was recorded as negative [18].

The subjects were randomly divided into 2 equal groups: group 1 (n = 15), regarded as the experimental group, and group 2 (n = 15), as the control group. A pre-test measurement of the left hip adduction angle was taken by an inclinometer.

Measuring the hip adduction angle

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) received moist heat pack, stretching, and RSRLAPB exercise for 3 weeks, while in group 2 (control), moist heat pack and stretching were applied.

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 was heated and maintained at 73.88°C. 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 ITB (lateral aspect of thigh) for 20 minutes, twice a day for 3 weeks before stretching [14–16].

ITB stretching

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

RSRLAPB exercise

The participant was asked to lie on the right side with the 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 subject's head in order to keep back and neck relaxed. An appropriate size bolster was then positioned between the feet and a towel between the knees, so that the subject's left knee got lower than the left hip and ankle. The patient was then asked to push from the right foot into the wall and to inhale through the nose as they pulled back their left leg. The subject exhaled through the mouth as they squeezed the left knee down into the towel for 3 seconds. They were then asked to repeat the same sequence of pulling back from the 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 performed twice daily and repeated 5 times (3 inhalations and 3 exhalations equalled 1 repetition) for 3 weeks. One set was carried out in 1 session [19].

The post-test measurement of the left hip adduction angle was documented again following 3 weeks of the treatment intervention.

Data were analysed for statistical significance with the Statistical Package for the Social Sciences (SPSS 16.0) software. The dependent variable of hip adduction ROM was analysed with the independent t-test and the level of significance was kept at $p < 0.001$.

Results

Demographic data

The independent t-test was applied to analyse the differences between the age, weight, and height in group 1 and group 2. Insignificant differences were observed with regard to all the 3 measures (Table 1).

Table 1. Demographic description of the subjects

	Group 1 (mean ± *SD*)	Group 2 (mean ± *SD*)	t Value	*p* Value
Age (years)	28.73 ± 2.81	29.60 ± 3.42	0.758	0.455
Height (cm)	160.87 ± 5.28	161.73 ± 5.49	0.634	0.531
Weight (kg)	57.40 ± 4.32	58.53 ± 5.41	0.441	0.663

Between group analysis

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

The mean values of the left hip adduction angle for the groups, as well as the statistically significant difference observed between them are depicted in Table 2.

Table 2. Comparison of the pre and post hip adduction angle between groups 1 and 2

	Group 1 (mean ± *SD*)	Group 2 (mean ± *SD*)	t Value	*p* Value
Hip adduction angle (°)	44.67 ± 1.05	37.80 ± 1.66	13.575	0.001

Within group analysis

To analyse the differences within group 1 and group 2, the paired t-test was used.

The mean values of pre and post left hip adduction angle within group 1 and group 2 are presented in Table 3. As depicted in the Table, a statistically significant difference was observed within pre and post readings of the left hip adduction angle in both groups.

Table 3. Comparison of the pre and post hip adduction angle within group 1 and within group 2

	Pre hip adduction angle (mean ± *SD*)	Post hip adduction angle (mean ± *SD*)	t Value	*p* Value
Group 1	–18.46 ± 1.45	26.20 ± 1.20	–165.301	0.001
Group 2	–18.46 ± 1.187	19.33 ± 0.816	–88.39	0.001

Discussion

The present study findings demonstrated how an active therapeutic exercise or non-manual technique that addressed postural asymmetry and abnormal chain patterns could influence the Ober's test measurement. Literature advocates this exercise as a specific process incorporating muscle position, 2 respiration phases, and appropriate concomitant muscle activity [20]. During the positive Ober's test, when the tested leg is brought into neutral hip extension and then adducted, if the pelvis is anteriorly tilted and rotated forward, 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 so that femoral motion can occur without any interference.

The positioning of the patient (in right sidelying with their hips and knees in approximately 90º of flexion and the lumbar spine in flexion) itself allows the paraspinals to be relaxed and lengthened and not to 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 the ankles. As the left hip moves into internal rotation and adduction, it pushes the left posterior hip capsule and ischiofemoral 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 those 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 a rib or spine or pelvis position being preserved 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 the upright left hip becomes more easily obtained and not limited by the pelvis.

Our findings remain in agreement with a study which used a 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 5 repetitions. This study suggested the Ober's test as a reflection of a triplanar position of the pelvis and hip joints, bringing about activation of hamstrings and abdominals (5 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].

The results of present study are also in agreement with a case study of a female patient with left low back pain and sacroiliac joint pain. The patient was a 65-year-old woman with a 10-month history of constant left low back pain, sacroiliac joint pain, and leg pain. She was treated 6 times with unique unilateral exercises (90/90 left hemibridge with left hip shift or blowing up balloon, left sidelying scissor slides with ball, left sidelying knee to knee, right sidelying 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 the patient was pain-free and no longer had numbness in her left leg [3].

The present study findings also support the results of a case study reported for a 61-year-old female patient with chronic sciatica and low back pain. On the initial examination, she reported pain of the level of 9 on a scale of 10, as well as demonstrated a straight leg raise (SLR) limited to 45° and a positive Ober's test. The Oswestry Disability Index (ODI) was 40%. For the first 6 weeks (5 visits), the patient was instructed to apply 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 5 visits, the patient reported 6/10 pain and leg pain. At discharge, the patient declared 0/10 pain, SLR was 70°, the Ober's test was negative, and the ODI equalled 0% [20].

Similar findings were revealed by another case report on a college football player with bilateral thoracic outlet syndrome. By discharge, after a 6-week treatment with the RSRLAPB exercise, the athlete declared 100% decrease in pain on the numeric pain scale (8–9/10 to 0/10) and 100%

improvement in function on the ODI (20–40% to 0%) or the Northwick Park Neck Pain Questionnaire (NPNPQ) (55.5% to 0%) [22].

Limitations

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

Conclusions

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

Conflict of interest statement

This research did not receive any kind of grant or funding from any funding agency. The authors also declare that they have no conflict of interest or any kind of financial benefits arising from the direct applications of the presented research.

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