Use of Muscle Energy and Tissue Mobilization Approach to the Treatment of Three Patients with Sacroiliac Joint Dysfunction

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ABSTRACT

The Purpose of this case report is to describe the treatment and the short outcome, for three cases of sacroiliac dysfunction, utilizing muscle energy and mobilization approach. Three athletic patients were referred to the Rehabilitation Center, Bloomington, Indiana, USA for sacroiliac relocation and stabilization approach using muscle energy technique by Physical Therapy. Muscle energy and mobilization technique was used depending on the objective findings enumerated within the evaluation. No neurological symptoms were associated with all 3 cases. Patients were given home exercise program. One patient required sacroiliac belt because of hyper mobility at sacroiliac joint. Pain was evaluated using visual analog scale (VAS). Pain was improved from 10 VAS to 1.5 VAS ($p<0.0001$). Gait was evaluated using temporal parameter and observational analysis of posture during walking. Gait was improved from antalgic *type to normal. Posture was improved to normal.*

Key words: Low back pain, sacroiliac joint dysfunction, soft tissue mobilization.

INTRODUCTION

Muscle energy is thought to reverse the changes that were produced by immobilization, through promoting movement between capsular fibers. This is belived to result in an increase in the interstitial water content and inter fiber distance. It is also belived that it promotes movement capsular fibers through the repetitive manipulation of joint structures. Synovial tissue will be stretched in a selective manner, causing gradual rearrangement of old collagen tissue with a reduction of cross link for motion and development of parallel fiber configuration in new tissue[3].

The lumbopelvic girdle and hip complex (LPGHC) represent one of the most important biomechanical links in the kinetic chain of the human body. Linking the upper trunk and torso to the lower quarter, the LPGHC acts as a shock absorber and, attenuator of force. LPGHC also serves as a shock transducer for forces that enter the LPGHC from cranio-caudal and, caudal- cranial directions. The sacroiliac articulation with LPGHC is complex in both anatomic design and, biomechanical function and continues to perplex those who would attempt define its arthrokinematics and, overall functions[5].

Motions and movement potentials may occur at sacroiliac joint (SIJ) include: flexion, extension, tilting, side bending, and rotation. To date, no definitive model exists to define motion about a single fixed axis, and controversy remains regarding the amount of motion present[3]. For descriptive purposes, several axes have been defined to describe the motion palpated during the clinical examination. The transverse axes include; 1- the superior axis; the axis that sacrum flexes and extends in response to respiration, 2- the mid transverse axis; the axis that sacrum flexes and extends in response to lumbar spine flexion and extension, 3- the inferior transverse axis; the axis that sacrum flexes and extends in response to lower extremity movement during ambulation. The oblique axes include; 1- left oblique axis; the axis that sacrum rotates about into forward or backward torsional movement (left/left forward sacral torsional movement, and right /left backward sacral torsional movement), 2- right oblique axis; the axis that the sacrum rotates about in forward and backward torsional movement (right/right forward sacral torsional movement, and left/right backward sacral torsional movement)[16].

Due to the anatomic location of the sacroiliac joint (SIJ) and its proximity to adjacent nociceptors bearing structures in the lumbar spine and hip, the posterior facet joints, intervertebral discs, ligamentous tissues, and nerve roots , so mobility testing this joint is difficult. Many of these tests intended to yield information regarding SIJ position, mobility and nociception, so it may provoke symptoms in the other areas[14].

Somatic dysfunction is the impaired or altered function of related components of the somatic system skeletal, arthrodial, myofascial structures, related vascular, lymphatic, and neural elements. The evaluation and management of somatic dysfunction of LPGHC requires understanding of the osteokinematics, arthrokinematics, and myokinematics of the area and their mechanical and neurophysiological relationships to adjacent structures. Evaluation scheme that embraces an algorithmic methodology of evaluating each structure as they relate to the overall kinetic chain. A clinician accomplishes this by: 1- obtaining an accurate history; 2- defining objective static and positional asymmetries; 3- challenging static findings by assessing dynamic and motion loss characteristics; 4- assessing myofascial structures for direct mechanical influence and/or neurovascular entrapment; 5-considering differential sources of diagnosis; and, 6- enumerating and prioritizing the key findings[17].

The biomechanical elements of injury may be useful in guiding the clinician to consider certain mechanical lesions of the pelvis or hip. Hyper-extension injuries of the lumbar spine and hip may create an anterior rotated innominate dysfunction or hyper-flexion may contribute to a posterior innominate dysfunction. In addition to biomechanical analysis, present injury, past and family history may reveal predisposition toward hormonal disturbance or certain types of arthritis[12].

The presence of type 1, (lumbar movement produces motion of sacrum on ilium) multi-segmental dysfunction in the lumbar spine should direct the clinician to consider the possibility of positional or motion dysfunction of sacroiliac joint. This is a common compensatory reaction rotational or un stability of the sacral base or torsional dysfunction of the innominate. Evaluation of body landmarks at the hip should include observation of pelvic obliquities due to leg discrepancy, muscle imbalance, abductor/ adductor contractures, sciosis or lumbar dysfunction. Hip flexion contractures indicates possible hip pathology and is best identified from the side as excessive anterior pelvic tilt[1].

Both SIJ and hip dysfunction, patients rarely manifest with correlative neurologic findings. As with any subjective complaints, the clinician should be careful to assess and differentiate between mechanical and non mechanical or systemic dysfunction. This requires a constitutional symptoms, patterns of symptoms, and associated signs and symptoms of systemic involvement that would necessitate a physician referral[15]. The purpose of this study was to investigate the effect of muscle energy and mobilization technique on SIJ dysfunction. The hypothesis of this study was: muscle energy and mobilization approach has no significant effect in improving SIJ function, reducing pain, or improving gait.

CASE DESCRIPTION

Patients: Their age was ranged from (17-27) years, the mean age was 21.6±5.3 years. They were admitted to (Rehabilitation Center) Rebound West, Bloomington, Indiana, with a diagnosis of SIJ dysfunction, for relocation and stabilization techniques of SIJ. Mechanical analysis of SIJ was carried at School of Health, Physical Education and Recreation, Indiana University, Bloomington. Moire Topography was used to assess asymmetries of bony landmarks. Patients signed a consent form and refused to publish their pictures.

Methodology

I- Marcher s test: To assess the mobility of iliosacral articulation. The patient assumes a standing posture, while the clinician palpates the caudal and inferior aspect of posterior superior iliac spine (PSIS) by one thumb. The other thumb palpates the median sacral crest, that the level to the PSIS approximately S 2. The clinician instruct the patient to flex the ipsilateral hip and knee above 90. The procedure is repeated on the contralateral side[8].

II- Standing flexion test: To assess the articular mobility of iliosacral joint. The patient stands in a comfortable balanced posture with equal weight bearing on both lower extremities. The therapist palpates the inferior slope of PSIS bilateral. The patient is instructed to sequentially forward bend beginning with the cranium and continuing down as far as possible in a smooth and regular fashion. Premature and excessive cranial movement or excessive excursion of one side represents possible dysfunction[8].

III- Physiologic enhanced mobility testing (PEMT): It is a combination of physiologic (osteokinematic) motion and passive, accessory mobility testing yields valuable information regarding excursion and end feel. It is utilized with the following motion in the LPGHC: 1-PEMT with combined lumbar flexion, side bending, and rotation. 2- PEMT with combined lumbar extension, side bending, and rotation. 3- PEMT with innominate rotation. 4-PEMT with pubic symphyseal inferior and superior translation. 5- PEMT with sacral base extension and flexion. 6- PEMT with sacral torsion[8].

IV- Pain was evaluated using visual analogue scale (0=no pain, 10 = severe pain, between 0 & 10 is the fluctuation of pain).

V- Gait was evaluated using temporal parameter of walking a distance of 30 feet in less than 30 seconds.

VI- Observational Analysis of posture was carried out during walking.

VII- Moire topography was used to assess the level of posterior superior iliac spine (PSIS), following the technique of Dillard et al., (1991)[2].

VIII- Descriptive statistics was used to analyze the results.

	Patient 1	Patient 2	Patient 3
Chief complaint	27 years old female softball player, one month post- partum, reported a four month history of (R) SIJ and inguinal pain sharp, shooting pain. Pain increased since giving birth and was severe during gait and sitting.	17 years old male basketball player presented with severe (R) SIJ pain unbearable when weight bearing on the affected side, with associated spasm in the (R) lumbar spine.	21 years old female softball player, presented with (L) SIJ pain, spasm of the (L) posterior thigh. Pain increased during ambulation, and sitting more than 10 min.
History	She had uneventful pregnancy until her six month. Patient stated that, during exercise on stairmaster, she had severe back pain, progressed to include (R) SIJ, pain was described as stabbing pain, radiated to the (R) buttock. Last 2 months pain was consistent and more severe and was unable to find pain free position. Following delivery, patient experienced (R) inguinal pain radiated to anterior thigh, increased with weight bearing. No family, past medical, or surgical history. No medication at this time.	He described being injured while playing basketball two days before the evaluation. The patient stated he was in the air while retrieving a rebound during a game and was clipped from behind, landing directly on his (R) buttock. Patient reported immediate and severe pain. No history of low back pain or other medical or surgical history. No medication at this time.	She described being injured while playing basketball one week before the evaluation. The patient stated she was running and got a shoulder push from front, landing directly on her (L) buttock. Patient reported immediate and severe pain. No history of low back pain or other medical or surgical history. No medication at this time.

Table (2) Asymmetries of bony landmarks, mobility testing, and tissue abnormalities

	Patient 1	Patient 2	Patient 3
Asymmetries of bony landmarks	1- (R) pubic symphysis inferior. 2- (R) ASIS inferior. 3- (R) PSIS superior.	1- PSIS, ASIS, iliac crest are superior on the (R) in sitting and standing. 2- (R) lower extremity shorter in supine 0.3 cm. 3- lumber spine type 1 rotroscliosis, convex left in the lumbar spine.	1- PSIS, ASIS, iliac crest are superior on the (L) in sitting and standing. 2- (L) lower extremity shorter in supine 0.2 cm. 3- lumber spine type 1 rotroscliosis, convex right in the lumbar spine.
Mobility testing	1- Diminished excursion of the (R) innominate during hip swing with decreased posterior rotation 2- Positive Marcher s test on right. 3- Stiff and painful end feel during mobility test.	1- Positive Marcher s test on right. 2- Positive standing flexion test.	1- Positive Marcher s test on left. 2- Positive standing flexion test.
Tissue abnormalities	Increased tone of (R) rectus femoris, iliopsoas, and adductor muscles.	Increased tone of (R) quadratus lumborum.	Increased tone of (L) quadratus lumborum and (L) lumbar sacrospinalis.

Table (3): Physiologic enhanced mobility testing.

	Patient 1	Patient 2	Patient 3
PEMT	Positive adverse neural tension on the (R) with combined hip flexion, adduction, internal rotation, as well as hip extension and external rotation.	Positive adverse neural tension on the (R) with combined hip flexion, adduction, internal rotation, as well as hip extension and external rotation.	Positive adverse neural tension on the (L) with combined hip flexion, adduction, internal rotation, as well as hip extension and external rotation.

Treatment Approach

I- Myofascial extensibility: Following the technique of Dorman et al., (1995)[4]:

1- Iliopsoas muscle; from supine, knee 90 degree flexed at the edge of the table. Patient is instructed to flex the contra lateral hip. Therapist stretches the iliopsoas muscle. B) From side lying on

stabilizes pelvis, right hand stretches iliopsoas. C) From prone, lower extremities flexed at the edge of the table, therapist left hand stabilizes the pelvis, right hand stretches iliopsoas.

2- Piriformis muscle: From long, patient instructed to adduct and cross the affected side with knee flexed, keeping the foot of the affected side flat on the table.

the table.

3- Quadratus lumborum: From side position on the contra lateral side, the therapist placed his hands in a cross position, right hand on the lower rib cage, the left hand on the iliac crest, therapist stretches the muscle.

II- Muscle energy technique: Following the technique of Edmond (1993)[6]:

1- Symphyseal joint dysfunction: Patient is supine with knee bent, feet flat. Clinician instructs the patient to perform isometric contraction of the adductors, the clinician brings the hips into more abduction until an increase in resistance is met. This procedure can be repeated several times.

2- Sacroiliac joint dysfunction: Patient is lying on the un affected side. The sacroiliac joint is approximating the restricted range into backward torsion. The manipulating hand on the ischium. The clinician glides the ischium ventrally, thus rotating the pelvis into backward torsion. The other hand glides the ASIS and the ventral surface of the iliac crest in a dorsal and cranial direction.

Table (4): Myofascial extensibility and muscle energy technique.

	Patient 1	patient 2	patient 3
Myofascial extensibility	1-Progressive stretching technique of iliopsoas muscle, starting from supine, side lying,and prone position. 2- Stretching priformis muscle from long sitting position	1-Progressive stretching technique of iliopsoas muscle, starting from supine, side lying,and prone position. 2- Myofascial release of (R) Quadratus lumborum and (R) paravertebral muscles	1-Progressive stretching technique of iliopsoas muscle, starting from supine, side lying,and prone position. 2- Myofascial release of (L) Quadratus lumborum and (L) paravertebral muscles
Muscle Energy Technique	1-Normalize position and movement dysfunction of symphyseal joint. 2- Normalize position and movement dysfunction of anterior SIJ	1- Normalize position and movement dysfunction of anterior SIJ. 2-Sacroiliac stabilization belt due to hyper mobility at (R) SIJ.	1- Normalize position and movement dysfunction of (L) anterior SIJ

RESULTS

Visual Analog Scale was used to measure pain and discomfort as well as the endurance to tolerate sitting position for a longer time. Before treatment patients reported that pain was 10/10 VAS. Pain evaluation was taken in a weekly basis every Wednesday, and at the end of every treatment Pain decreased significantly from 10/10 to 1.5±0.5 VAS as shown in fig (1).

Moire Topography was taken at a distance of 2 meters from the screen fram, before and after treatment, no displacement of PSIS and/or ASIS was recorded after 4 weeks of treatment.

In patient #2, two millimeters differences between the levels of PSIS was recorded. This difference produced hyper mobility of SIJ for patient 2, which was reduced by sacroiliac stabilization belt.

Using temporal parameters for gait evaluation, patients were able to walk 30 feet with normal step length, normal speed in <30 seconds, and gait was improved from antalgic type to normal sequences and no pain during ambulation.

Observational analysis of posture, revealed normal alignment of the body in standing position, and normal position of the spine during ambulation.

Table (5): Pain evaluation using visual analog scale.

	Pre treatment	Post treatment
Patient #1	10 VAS	2 VAS
Patient #2	10 VAS	3 VAS
Patient #3	10 VAS	0 VAS

DISCUSSION

In this study, muscle energy and mobilization technique were used to normalize the position and movement dysfunction of sacroiliac joint and symphyseal joint. It reduced joint pain and leg discrepancy of all the three patients. Knott and Voss reported that, muscle energy is an extremely valuable technique for correcting positional faults, increase extensibility of peri-articular tissue with methods to restore a length - tension relationship to muscles controlling joint motion and position consistent with maintaining that joint in a normally functioning state[10].

Similar results reported by Maigne that, muscle energy used to relieve pain of lumbo sacral joint, the mechanism is rather difficult to understand if the pain is considered to be due to peripheral nerve involvement. Electromyographic examination shows no clear changes[13].

Besides the painfull reactions, sometimes, there are sympathetic reactions. It is quite frequent that, following manipulation, the patient may show increased sweating of the axillary area or of the body[3].

Similar results reported by Greenman that, the clinical uses of muscle energtechnique are numerous and include: lengthening a shortened, contracted or spastic muscle, strengthening a weakened muscle or muscle group, reducing localized edema and reliving passive congestion, mobilize a restricted articulation and decreasing pain[9].

Muscle energy is a specific type of direct technique using voluntary contraction of the patient s muscles. The joint is placed in a specific position to facilitate optimal contraction of a particular muscle. The patient is asked to do isometric contraction, this causes the muscle to pull on the boy attachment that is not being stabilized by the clinician. Most of the isometric contractions are held for 3 to 7 seconds, the technique is repeated approximately three times before re-assessment[2].

In this study, there was a displacement of ASIS and PSIS that, lead to leg discrepancy in patients 2 and 3. Similar results reported by Ellis (1990) that, it is imperative to differentiate between an innominate up slip (UP) and a structural leg length discrepancy (SLLD). This process can be simplified through the use of an algorithmic approach. An UP is precipitated by a traumatic event, while SLLD is not accompanied with trauma. UP is almost debilitating and painful, while SLLD is typically painless. Mobility testing will reveal positive Marcher s test and forward bend test in an UP, while SLLD will present with negative findings. In seated position iliac crest will be superior with UP, while the crests are level in the SLLD. Finally, in supine posture, the SLLD continues to appear long with the malleolus caudal, while the UP side appears short as the malleolus moves cranially[7].

CONCLUSION

In this study, muscle energy and mobilization technique improved SIJ dysfunction, reduced back pain, and improved both sitting tolerance and gait. Further researches are needed to study the effect of muscle energy and mobilization techniques in a large population of SIJ dysfunction.

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الملخص العربي

استخدام الطاقة العضلية وتلين الأنسجة
في علاج ثلاث حالات من الخلل الوظيفي لمفصل الحرقفة

الغـــرض مـــن هذه الدراسة فحص اثر استخدام الطاقة العضلية وتلين الأنسجة في علاج ثلاث حالات من الخلل الوظيفي لمفصل الحـــرقفة. ثـــلاث لاعبين رياضيين تم تحويلهم بمركز العلاج الطبيعي بمدينة بلمنجتون ولاية انديانا – امريكا لإعادة الوظيفة الطبيعية لمفصل الحرقفة باستخدام الطاقة العضلية وتلين الأنسجة حيث اعتمدت النتائج على التقييم الأولى للحالات بمقياس الألم والمقياس الزمني / المسافة لتقييم المشي التقييم النظري لوضع الجسم وكذلك الرسم الطوبوغرافي لوصف مفصل الحرقفة .
تحســن الأداء الحركي للمشي وقل الألم لكلا من الحالات الثلاثة زادت مرونة الحركة في مفصل الحرقفة للمريض الثاني الأمر الذي أدى إلى وصف حزام الحرقفة لتقليل معدل الحركة الوظيفي .