

Muscle Energy Techniques Following Low Back Pain and Sacroiliac Joint (SIJ)
Dysfunction: A Case Report.

A Capstone Project for PTY 768
Presented to the Faculty of the Department of Physical Therapy
Sage Graduate School

In Partial Fulfillment
of the Requirements for the Degree of
Doctor of Physical Therapy

James M. Mielewski

May, 2009

Approved:

Laura Gras PT, DSc ,GCS

Research Advisor

Marjane Selleck, PT, DPT, MS, PCS

Program Director, Doctor of Physical Therapy Program

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Abstract

Background and Purpose: Sacroiliac joint (SIJ) dysfunction is common in between 10 to 26% of patients with low back pain. The purpose of this case report is to describe the use of

muscle energy techniques (MET) used to treat SIJ dysfunction. **Case Description:** The patient is a 56 year old male with a history of back pain located across his lower back and radiating down his left lower extremity. **Intervention:** MET techniques were used to

realign the patient's pelvis and reduce his pain. **Outcome:** Following 8 treatments using MET techniques the patient's pelvis remained level on multiple visits. **Discussion:**

Management of patients with low back pain need to be examined thoroughly for the detection of SIJ dysfunction. Further research is needed to determine the effectiveness of MET on SIJ dysfunction.

Key Words: muscle energy techniques, sacroiliac joint dysfunction, sacroiliac joint pain, low back pain, diagnostic tests, treatment, muscle strengthening, therapeutic exercise, pelvic disorder, muscle weakness

Introduction

Low back pain is very common, and affects 70–85% of adults at least once during their lifetime.¹ Low back pain can be very severe causing sharp shooting pain or it can be a mild pain such as a dull ache. In most cases a person can recover without needing to seek medical attention, recovering within a couple of days up to 6 weeks.^{2,3} In the past it was widely believed that bed rest was the best cure for acute low back pain.⁴ Trends are now moving away from that old way of thinking and exercise is now being prescribed for treatment.⁴ SIJ dysfunction is common in between 10 to 26% of patients with low back pain.^{5,6} Misalignment of this joint can cause the pain associated with SIJ dysfunction. Referral of SIJ pain has been noted to be located in the following areas: lower lumbar spine, buttock, groin, medial, lateral, posterior thigh, and sometime the calf.⁷ According to Hungerford et al. those who have SIJ dysfunction show a reduced ability to initiate the recruitment of the Internal oblique, multifidus, and gluteus maximus muscles during gait.⁸ This delay may cause a change in the lumbopelvic stabilization needed during the load transfer of normal gait.⁸

The pelvis is made of 3 bones, 2 paired ilia and a sacrum and 3 joints (2 SIJs and 1 pubic symphysis)^{9,10}, this occurs where the sacrum is joined with the ilium. The surfaces of these joints have been found to be irregular between men and women, and increase in irregularities as one progresses with age.⁹ The SIJs connect the vertebral column to the pelvis, and are held together by several strong ligaments, which does not allow for much movement.⁹ Although movement is small, motion occurs passively from above or below the SIJ.¹¹ Internal oblique, external oblique, transversus abdominis, and rectus abdominis attach superiorly on the pelvis, and quadratus lumborum, thoracolumbar fascia, multifidus, and erector spinae muscles attach posteriorly.^{6,9,11} Hip and thigh muscles such as gluteus maximus attach laterally, latissimus dorsi

inferiorly, psoas, and piriformis muscles cross anteriorly to the SIJ.^{6,9,11} Change in the length of the piriformis can be seen with SIJ dysfunction.¹¹ The SIJs allow large forces coming from the lower limbs to be displaced to the vertebral column.¹⁰ These forces come from the ground up, and from gravity pulling down.⁹ The gluteus maximus, latissimus dorsi, and sacroiliac ligament effect the lumbopelvic stabilization during gait.^{6,11}

There are several tests to determine the presence of SIJ dysfunction such as the Standing Flexion Test , the Spine Test, the Iliac Compression Test in supine, and the Iliac Springing Test.¹² Standing Flexion Test is performed with the patient standing while the therapist placed their thumbs inferiorly to the posterior superior iliac spine (PSIS). The patient is asked to bend forward into full lumbar flexion while keeping their knees extended. The therapists notes if one thumb moves superiorly during flexion it indicates SIJ dysfunction.^{13,14} Seated Flexion Test uses the same hand placements as the Standing Flexion Test , and the person is seated on a mat with their legs hanging over the edge. The findings are also similar to the Standing Flexion Test, if one thumb moves there is an indication the sacrum is fixed on the ilium indicating SIJ dysfunction.^{13,14} The Gilet Test can show abnormal movement of the SIJ. The examiner places their thumbs on the PSIS's while in a standing position and asks the person to flex their hip and knee on the indicated side. If the PSIS does not drop lower than the opposite side it is an indication of SIJ dysfunction.¹⁴ The Squish Test is performed with the person in supine, therapist's hands are on the anterior superior iliac spine (ASIS) and iliac crests. The therapist applies pressure looking for a reproduction of pain caused a dysfunction of the SIJ ligament.¹⁴ Sacral Apex (Spring) Test is performed with the person lying prone, and the therapist's hands apply pressure to the apex of the sacrum. A positive Spring Test may indicate a SIJ dysfunction.¹⁴ While performing the tests, the PT is looking for the patient to have pain from the

movements. If there is no other cause of pain, such as a disc herniation, the SIJ may be the cause of pain.

Muscle Energy Techniques (MET) came from early work done by an osteopathic practitioner named T. J. Ruddy and Fred Mitchell Sr.^{11, 13, 15} In 1961 Ruddy developed a method of using low amplitude muscle contractions against resistance thinking that it would improve vascular circulation, and have a positive influence on static and dynamic posture.¹³ Mitchell borrowed principles from Ruddy¹¹, by having patients use their muscles in a controlled position against a counterforce.¹³ Mitchell used of muscle contraction to restore motion to areas of dysfunction in extremities and vertebral column.¹¹ Edward Stiles stated in 1984 he believed that the musculoskeletal system has an important role in other systems.¹⁶ Segmental dysfunctions in one area can be corrected by using MET to free up that segment, and may release other involved areas.¹⁶ MET aims to normalize soft tissue structures, such as shortened or tight muscles with no direct implication to the joint associated with these soft tissues. MET can be used to improve joint mobility by influencing the dysfunctional soft tissues.¹³ MET can be used to relax tight tense musculature, spasms, or fibrotic changes due to chronic soft tissue problems.^{11,13} MET has several uses that can help increase muscle strength, increase range of motion (ROM), and decrease edema. In 2003 Wilson found using MET and resistance exercises may benefit a patient greater than using neuromuscular re-education and resistance exercises to reduce low back pain and improve function.¹⁷

MET has been defined when the patient uses their force against the therapist's counterforce.¹³ The therapist brings the area of treatment to a pain free end range barrier by taking up the slack of the available soft tissue.¹³ Once the patient is brought to the pain free end range barrier the therapist will request the patient to use his/her muscles to resist or push back

against the therapist. By knowing the anatomy, MET is used by placing the patient in a controlled and exact position, to allow a counterforce to be applied by the therapist, and the patient is responsible for the amount of force applied.¹¹ The force generated by the patient can be a muscle twitch, or a maximum muscle contraction.¹¹

Other modalities that can be used to treat LBP include; transcutaneous electrical nerve stimulation (TENS) unit, cold packs, hot pack, soft tissue mobilization, ultrasound (US), passive range of motion (PROM), and therapeutic exercises. TENS is used as a treatment modality because it offers a non-invasive procedure to reduce both acute and chronic pain by attaching two or more electrical pads to a person's skin.¹⁸ Electricity passes from one electrode to the other stimulating nerve endings that block pain signals to the brain. Cold packs are used to decrease inflammation, decrease pain, decrease muscle spasm, and provide vasoconstriction of blood vessels in and around the area.¹⁹ Hot packs are used to heat small areas, and allow for decrease pain, decrease muscle spasm, and provide vasodilatation of the blood vessels leading to the area.¹⁹ Soft tissue mobilization (STM) can be used on low back muscles to increase ROM, flexibility, and to decrease pain. STM can be used on the gluteus maximus muscle, external rotators muscles of the hip, and the sacrotuberous ligament. STM to these muscles required using cross-fiber strokes using fingers, knuckles, or elbows to penetrate deep into the tissue.²⁰ US can be used in a prone position, along the PSIS to increase ROM, flexibility, promote increased blood flow to the area and, decreased pain.¹⁹ PROM can help increase ROM, increase circulation, and decrease pain, by moving the limb in a passive motion without the assistance from the patient.¹⁹ Therapeutic exercise is used to restore and improve physical function by increasing balance, coordination, flexibility, muscle performance, neuromuscular control, and stability.¹⁹

The purpose of this study was to examine the effects of using METs on a 56 year old male who has SIJ dysfunction. This case study has been approved by the Institutional Review Board at the Sage Colleges in Troy, NY.

Case Description

The patient is a 56 year old male who is married with 2 children both in their 20s. He works as a government administrator, spending 80% of his day sitting at a desk using a computer, while the other 20% is spent filing and other clerical duties. He presented to outpatient physical therapy (PT) on 7/23/08 with exacerbation of low back pain with left radicular symptoms. The patient has a history of back pain dating to 1989, where he initially injured his back at work. During his most recent episode the patient reports he was lifting a bag of water balloons and is having difficulty sitting. He had increased back pain over the past week and saw a chiropractor on 7/18/08 and 7/21/08. The two visits that were made to the chiropractor resulted no changes in pain from the adjustments. His primary care physician suggested he see a physical therapist, and also recommended he see an orthopedic specialist. He went to see an orthopedic surgeon on 7/24/08 who wanted the patient to continue PT to see if he had any decrease in pain.

Examination

On 7/23/09 the patient had the following functional limitations: lying down and sitting up he feels his back is locking up and unable to move. His pain level was 7-8/10 on a Numeric Rating Pain Scale^{14,21} with all activities, pain located across lower back and radiating down his left lower extremity. The patient also had moderate tenderness to left L3-L5 and along the left iliac crest. He had increased radiating pain with prolonged standing, getting in and out the

bathub, sleeping, lifting object over 10 pounds, work activities, walking and driving. The patient showed postural deviations with a flexed forward trunk, shifting to the right, and decreased weight bearing with the left lower extremity. The patient's lumbar active range of motion (AROM) was measured using a plastic universal goniometer²² was: flexion 0-40°, extension 0-12°, right side bend 0-15°, and left side bend 0-5°. Hamstring flexibility was also measured using goniometer, with the axis at the greater trochanter of the femur.²² The patient was placed in a supine position, straight leg raise, opposite knee bent at 90°. His right hamstring measured 0-55°, and the left hamstring measured 0-50°. At this time the ASIS and PSIS were checked in supine and prone, both were determined to be equal. Trunk flexion was tested in supine, and was asked to perform a sit up and was given a 3/5.¹⁴ At the time of the initial examination the Squish Test was performed and determined to be negative, leading the original examiner to believe there was no SIJ dysfunction.

Evaluation

Patient has a chief concern of having his pain level at 7-8/10 on a numeric rating pain scale^{14,21} with all activities. He exhibited decreased AROM in all directions, exhibited strength deficit in core musculature, presented with postural impairments, and lacked a skilled home exercise program (HEP), such as prone on forearms, prone with knee flexion, and standing extension.

Diagnosis

The patient was given the guide to Physical Therapist's Practice Preferred Practice Pattern 4D impaired joint mobility, motor function, muscle performance, and ROM associated with connective tissue dysfunction.²³ The patient was given a diagnosis of low back pain, ICD-9

code 724.2 thoracic or lumbosacral neuritis or radiculitis unspecified. The patient showed signs of impaired joint mobility, inability to tolerate prolonged standing or sitting, and difficulty lying down without pain. The patient was having pain with all functional movements such as working at his desk, driving in his car, and walking up stairs.

Prognosis

The patient shows good overall potential to meet all goals. He is highly motivated to return to performing all activities of daily living (ADL) with decreased pain, increased ROM, and increased strength. PT was recommended 2-3 times per week for 4-6 weeks.

Plan of Care

Short Term Goals

1. Patient will be able to decrease his subjective low back pain by 50% will activities within 2 weeks.
2. Patient will be able to increase AROM by 25% in flexion, extension, and sides bending that comprise the lumbar restricted ranges within 2 weeks.
3. Patient will be able to improve strength by ½ grade in hamstrings, quadriceps, multifidus, internal oblique, external oblique, and transversus abdominis muscles within 2 weeks.
4. Patient will demonstrate improved posture in the sitting and standing positions without verbal cueing within 2 weeks.
5. Patient will be issued and has understanding of the HEP.

Long Term Goals

1. Patient will decrease subjective low back pain by 0-1/10 will activities by discharge.

2. Patient will have increase in flexion, extension, and side bending lumbar ROM to within normal limits to allow patient to perform daily functional activities by discharge.
3. Patient will have increase in hamstrings, quadriceps, multifidus, internal oblique, external oblique, transversus abdominis muscles to 5/5 allowing patient to perform daily activities by discharge.
4. Patient will return to all functional and daily activities by discharge.
5. Patient will be able to demonstrate knowledge and independence with a complete HEP appropriate for discharge.

Intervention

The patient began PT on 7/23/08 and received therapeutic exercises to increase his ROM and flexibility. While the pelvis is unstable, only double-legged exercises are done, as single legged exercises can make the pelvis uneven. The double-legged exercises that were used during treatment from 7/23/08 to 7/28/08 are as follows: prone on forearms, prone with knee flexion, standing extension (Table 1). Prone on forearms: patient lies on their stomach, legs straight, arms at their side, elbows bent with palms on the mat . Patient presses into the mat using their forearms while simultaneously arching their low back. Prone with knee flexion: patient is on all fours, and sits back until they are resting on the heels of their feet. Standing extension: patient stands with their hands on their hips and arches backwards. These 3 therapeutic exercises were also given to the patient as a home exercise program. The following modalities were used between 7/23/08 to 7/28/08 are: TENS, cold pack, soft tissue mobilization, and ultrasound (Table 1). TENS was discontinued after two treatments at the request of the patient and replaced with ultrasound. The patient reports having previously had good results when ultrasound was use while having PT for a shoulder injury.

Other modalities were used during the treatment at this time included; transcutaneous electrical nerve stimulation (TENS) unit, cold packs, hot pack, soft tissue mobilization, ultrasound (US), PROM, and therapeutic exercises. A TENS unit was used along with a cold pack was used for 10 minutes in a prone position to decrease his pain. A hot pack was used for 15 minutes in a prone position to help decrease pain. STM was performed while the patient was lying in the prone position. US was used in a prone position, along the left PSIS for 8 minutes. PROM and therapeutic exercises were used as part of the treatment session.

The patient was seen on 7/28/08 by a different therapist and mentioned he was still having difficulty sitting and standing. The therapist checked the alignment of his ASIS and PSIS using Standing Flexion Test, Seated Flexion Test, and Sacral Apex (Spring) Test. After performing these tests it was noted his right ASIS was superior and closer to the umbilicus showing a right iliac inflare.^{11, 13} The right ASIS was superior and his right PSIS was inferior causing a posterior sacral rotation. To try and correct this dysfunction the therapist began using METs commonly referred to as the Scissor and Shotgun techniques. The Scissor technique is a MET, and was performed because his right ASIS was superior and his right PSIS was inferior. The Scissor technique was used to his right hip extensor and left hip flexor. To perform the scissor technique (Figures 1&2), the therapist put their arm through the patient's legs with my arm over his right lower extremity and under his left lower extremity and had him push up with his right lower extremity and down with the his left lower extremity. This allowed the hip extensor on the right to pull down on his hip with contraction while the flexors on the left pulled up on the other side. The Shotgun technique was also used on this date, and was used when determining that the right ASIS was closer to the umbilicus showing a right iliac inflare. The Shotgun technique (Figure 3) is when the therapist put their arm between the patient's knees (a

hand on one knee, and an elbow on the other knee) and has them adduct against resistance for 10 seconds.^{11, 13} The patient's pelvic alignment was checked 9 times over a 3 week period.

Generally the technique works temporarily until the muscles are strong enough to keep the pelvis stabilized by themselves. At each subsequent visit, and the MET was continued from 7/28/08 through 8/22/08 until his pelvis was equal at the beginning of the treatment session for a few sessions in a row.

From 7/29/08 to 8/29/08 the following therapeutic exercises were added: pelvic tilt, maintained bridge, prone pressups, prone knee bend, and ball pass (Table 1). Pelvic tilt: patient laid on his back with both knees bent, flattened his low back into the mat and simultaneously rolls their hips slightly posterior. Maintained bridge: patient laid on their back with both knees bent, and lifts their hips off the mat. Prone pressups is similar to prone on forearms, but patient pushed on their hands instead of their forearms. Prone knee bend: patient laid on a mat with one leg straight while the other knee is flexed using a gait belt to elicit a stretch on the front the leg. Ball pass: patient laid on their back with an exercise ball between their feet, they raised their feet and ball into the air while passing the ball to their hands. Modalities remained the same during this time (Table 1) with the addition of PROM to hamstrings and piriformis muscles, and cold packs were discontinued on 8/9/08 and replaced with hot packs. There is no indication why a change was made from cold to hot packs at this time, but it is assumed it was because of patient discomfort to cold packs.

Outcomes

The patient completed PT by meeting most of his goals, his pelvis has remained stabilized and he reported feeling about 85-90% better since beginning treatment. He reported

having some low back and left leg radiating pain 2-3/10 on the Numeric Pain Scale. He also had increased ROM in lumbar flexion, extension, side bending, and hamstrings bilaterally (Table 2).

Discussion

Low back pain is common ailment that affects 70 to 80% adults during their life time, and 5 to 10% of adults annually.^{1,24} It is a huge expense for the health care profession, and cost employers billions of dollars per year when employees miss work or are unable to perform to their highest potential.^{1,3} Common sources for low back pain are injury or overuse of muscles, ligaments, facet joints, herniated discs and SIJ dysfunction.^{3, 25} It is estimated that between 10 and 30% of all those reporting low back pain is caused by a SIJ dysfunction.²⁶ SIJ dysfunction can be difficult to identify in people with low back pain, and can often go undiagnosed and prolong the patient's symptoms.²⁷ While there is some research on the cause of SIJ dysfunction²⁶ there is even less on how MET can help to restore the SIJs. Typically SIJs are known to be a very stable and do not allow for much movement.²⁵ Performing functional tests such as Standing Flexion, Seated Flexion, and the Sacral Spring Tests can help physical therapists detect SIJ dysfunction.²⁵

PT can be used to increase muscular strength, ROM, postural education, and aerobic conditioning.^{24,26} MET was used to reduce the restrictions around the SIJs by having the patient apply a force to the therapist's counterforce. As this imbalance is corrected the therapist also worked to strengthen the patient's transverse abdominal muscles, low back muscles, along with the hip flexor and extensor muscles. These same muscles are also being stretched by the therapist. The exercises used with this patient were similar to the ones used in a study by Wilson et al.²⁴ This patient has had a history of low back pain dating back to 1989, and has several episodes over the years. Once the MET was started he had increased ROM, increased, and

decreased pain after only a few visits. He was able to transfer in and out of bed, and increase his ADLs with less discomfort.

The patient had been seeing a chiropractor just prior to starting PT, which seemed to exasperate his low back symptoms. He also stopped PT for 1 week and went back to a chiropractor, and once again this exasperated his symptoms. The chiropractor was not able to address the soft tissue imbalance and he continued to have low back pain. In 1991 Herzog found using PT verses chiropractic spinal manipulation was a better treatment for chronic SIJs dysfunction²⁷. In a study done by Cherkin, he stated there was very little difference between individuals who went to see physical therapist verses seeing a chiropractor for low back pain²⁸.

While attending PT, MET was not the only intervention used. He was also strengthening transverses abdominal muscles, low back muscles, and thigh muscles to strengthen the imbalance around the SIJs. Different therapeutic exercises could have been used such as seated leg adduction, seated leg abduction, postural re-education, standing latissimus dorsi pull-down, supine dumbbell overhead extension and standing shoulder extension.^{13,24} These therapeutic excises have used in other studies while performing MET for SIJ dysfunction. There were other modalities used during his treatment such as TENS, ultrasound, soft tissue mobilization, hot packs and cold packs. These other modalities may have caused improvement without the use of MET.

The therapists could also have checked to see if there was a leg length discrepancy. A leg length discrepancy would have produced the raising or lowering of ASIS, PSIS, and iliac crests.²⁹ Leg length discrepancy can be assessed by comparing bilateral levels of the greater trochanter, medial maleolus, distance of the umbilicus to the ASIS.^{13, 14}

Another possible limitation to this case report was that there were several physical therapists and PT assistances treating this patient. During his entire treatment of care he was seen by a total of 6 different therapists, 4 different therapists came within his first 4 visits. By not being able to stay with one therapist he was subjected to therapists having different educational levels, years of experience, and using the interventions differently. By using one therapist per patient will decrease any variability in their treatment techniques. In 2008 Holmgren found that low inter-rater reliability may be due to different palpation techniques and skills between therapists.³⁰ There is also may be a difference between physical therapist when looking at the inter-rater reliability when performing functional tests such as Standing Flexion, Seated Flexion, and the Sacral Spring Tests.³¹ During the initial evaluation the original therapist noted that his pelvic landmarks were equal in prone and supine, while a subsequent therapist discovered there to a SIJ dysfunction.

Further research is needed to determine the effectiveness of MET on SIJ dysfunction. Large scale randomized controlled trails could be used to establish a greater amount of literature as they provide the greatest evidence to determine if the intervention has been successful.³² Research questions for a reliability study could be, will similar years of experience treating patients using MET increase inter-rater reliability? Future studies can be done using physical therapists with similar years of experience and skill level. By using one therapist per patient will decrease any variability in their treatment techniques. Research can limit patients to use only PT treatments and not seek other treatments during the study.

Conclusion

The patient was a 56 year old male who presented to PT with low back pain showing signs and symptoms of left radicular pain, decreased strength, ROM and ADL's. The combined

use of METs, therapeutic exercises, TENS, hot packs, cold packs, and soft tissue mobilization appeared to decrease pain, increase strength and ROM, and improve overall function following SIJ dysfunction. Although the patient chose to discontinue PT early, did appear to have significantly reduced pain by 85 to 90% and increased ADLs. METs used on this patient may have favorable outcomes on other patients who present with SIJ dysfunction. At this time there is very little research done to show the effects of METs when used with patients who have SIJ dysfunction.

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Table 1. Therapeutic Exercises and Modalities

Session and Date	Therapeutic Exercise	Modalities
Session 1-3 7/23-7/25/08	Prone on Forearms	TENS d/c 7/25/08
	Prone with Knee Flexion	Cold Pack
	Standing Extension	Soft Tissue Mobilization
		Ultrasound added 7/25/08
Session 4 7/28/08	Same as above	Scissor
		Shotgun
Session 5-13 7/29-8/29/08	Pelvic Tilt	Cold Pack d/c 8/9/08
	Maintained Bridge	PROM Hamstring Stretch
	Prone Knee Bend	PROM Piriformis Stretch
	Prone Pressups	Hot Pack added 8/8/08
	Ball Pass	

Table 2. Active Range of Motion

ROM	7/23/2008	7/28/2008	8/15/2008
Lumbar Flexion	40°	65°	75°
Lumbar Extension	12°	15°	20°
Lumbar Rt Side Bend	15°	18°	25°
Lumbar Lt Side Bend	5°	10°	20°
Hamstring Rt	55°		62°
Hamstring Lt	50°		68°



Figure 1. MET: Scissor method for posterior sacral rotation



Figure 2. MET: Scissor method for posterior sacral rotation



Figure 3. MET: Shotgun method for right iliac inflare