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Osteopathic Manipulative Treatment: Muscle Energy Procedure - Sacral Dysfunctions

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Continuing Education Activity

Osteopathic manipulative treatment particularly focuses on muscle energy techniques (METs) and is utilized to address sacral dysfunctions in patients experiencing low back pain, aiming to alleviate symptoms. The sacrum is a triangular-shaped, weight-transferring bone at the bottom of the vertebral column, which is highlighted as a crucial element in treating back pain and correcting abnormal gait. Recent studies underscore the effectiveness of osteopathic manipulative medicine, which involves various manual techniques and is used by healthcare providers to diagnose and address structural causes of back pain.

MET has been essential in correcting structural restrictions leading to low back pain, especially when related to sacral dysfunction. METs, particularly post-isometric isolation, offer a targeted approach for addressing soft tissue restrictive barriers and joint mobilization associated with sacral dysfunctions in cases where a significant percentage of back pain lacks precise diagnosis. This activity focuses on the physiological principles of MET, the diagnosis of sacral dysfunctions, patient positioning, potential complications, and the broader implications of sacral dysfunction on gait, musculoskeletal health, and neurological function. This activity also emphasizes the significance of addressing dysfunctions elsewhere in the body that may impact sacral positioning. In addition, this activity provides healthcare professionals with the skills and tools to evaluate, diagnose, and treat patients with sacral dysfunctions using METs for effective correction, thus enhancing patient outcomes and quality of life.

Objectives:

- Identify sacral dysfunctions as potential contributors to patients' low back pain through comprehensive examination and assessment techniques.
- Implement muscle energy techniques effectively to address sacral dysfunctions in patients experiencing low back pain, ensuring safe and appropriate treatment delivery.
- Apply appropriate patient positioning techniques to optimize the effectiveness of muscle energy techniques in treating sacral dysfunctions.
- Collaborate with interdisciplinary healthcare teams to ensure comprehensive care for patients with sacral dysfunctions, incorporating input from various specialties as needed.

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Introduction

Osteopathic manipulative treatment particularly focuses on various manual techniques, such as muscle energy techniques (METs), and is used by healthcare providers to diagnose and

address structural causes of back pain. These techniques address sacral dysfunctions in patients experiencing low back pain, aiming to alleviate symptoms. The sacrum is a triangular-shaped, weight-transferring bone at the bottom of the vertebral column, which is highlighted as a crucial element in treating back pain and correcting abnormal gait. Low back pain is a common complaint and is a challenge to diagnose and treat.[1][2] Studies indicate that approximately 85% of patients suffering from low back pain cannot receive a precise diagnosis for their symptoms.[3] Medical schools often instruct that a significant portion of back pain originates from musculoskeletal issues. However, as specific etiologies are less commonly identified, persistent pain leading to restricted activities can substantially diminish patients' quality of life.[3][4] METs have been essential in correcting structural restrictions leading to low back pain, especially when related to sacral dysfunction.[5]

Dr Fred Mitchell, Sr initially developed these techniques in the 1950s after deducing the kinematic motion of the pelvis. MET is largely considered a direct, active treatment, as patients are often positioned toward a barrier, prompting them to move to generate an activating force. There are 9 physiological principles in muscle energy, including post-isometric relaxation, respiratory assist, joint mobilization using muscle force, oculocephalic reflex, reciprocal inhibition, crossed extensor reflex, isokinetic strengthening, isolytic lengthening, and muscle force in one region of the body to achieve movement in another. Among the 9 types of METs, post-isometric isolation stands out as the most commonly used technique. In this approach, the patient is positioned toward a barrier and applies an activating force toward freedom. The isometric contraction induced by this method leads to reciprocal inhibition and relaxation of the antagonistic muscle, effectively addressing soft tissue restrictive barriers and mobilizing joints. This process contributes to pain reduction and improved circulation.[6][7] Furthermore, sacral motion within the sacroiliac joint can result in 10 somatic dysfunctions, including left-on-right torsion, right-on-left torsion, left-on-left torsions, right-on-right torsions, left or right unilateral flexion or extension, and bilateral flexion or extensions. This article elaborates on diagnosing such sacral dysfunctions and describes the METs used for their correction.

Anatomy and Physiology

Understanding muscle physiology is crucial for grasping METs. There are 4 types of muscle contraction—isolytic, concentric, isometric, and eccentric. Isolytic contraction occurs when an external force lengthens muscle contraction, whereas concentric contraction involves muscles shortening during contraction. Isometric contraction happens when muscles contract, but the origin and insertion do not draw closer to each other. Lastly, eccentric contraction occurs when the muscle lengthens during contraction.[8]

A muscle is made up of many spindles. Each spindle comprises a large extrafusal muscle fiber surrounding 3 to 12 intrafusal fibers. The extrafusal fibers are innervated by alpha (α) motor neurons, and the intrafusal fibers by gamma (γ) motor neurons. The sensory fibers include the Ia and II fibers, which innervate muscle spindles, and the Ib fingers, which innervate the Golgi tendon organs at the myotendinous junction.[9] A Golgi tendon organ is stimulated with increased muscle tension and provides a negative feedback loop to prevent the Ia fibers from contracting the muscle. Therefore, activating a Golgi tendon organ with a post-isometric relaxation mechanism is crucial during MET.[10]

MET with post-isometric relaxation is the most commonly used form of the technique. One hypothesis suggests that after an isometric contraction, the muscle is in a refractory state where it

may be passively stretched without a reflexive contraction. Therefore, placing the patient against a barrier is essential and puts more tension on the muscle fibers. When the patient contracts against the physician's counterforce, it allows activation of the Golgi tendon organ. When activated, the muscle will relax via the Ia fibers, and the physician may passively stretch the muscle further during this refractory state.[10]

The sacrum is a triangular-shaped bone at the bottom of the vertebral column. The sacrum originates from 5 vertebrae fusing by ossification in the first year of life.[11] The sacrum articulates with the fifth lumbar vertebra at its superior surface, inferiorly with the coccyx, and lateral articulations with the ilium. This anatomical relationship is crucial for palpation and locating sacral landmarks. One of its primary functions is believed to be as a load-transferring bone, facilitating smooth gait.[12]

The sacrum and its function relative to the sacroiliac joint have been identified as a source of lower back pain since the early 20th century. The sacroiliac joint is an L-shaped diarthrodial joint containing synovial fluid encompassed by a fibrous capsule. The stabilization of the sacroiliac joint is provided by ligamentous attachments, tendinous attachments from the gluteus maximus and piriformis muscles, and the thoracolumbar fascia extending from the latissimus dorsi.[13]

The sacrum has an inverted triangle wedge shape, with the broadest portion forming the sacral base superiorly and the apex inferiorly toward the coccyx.[11] The sacral base can be located by palpating just inferiomedial to the posterior superior iliac spines (PSIS). The most inferior aspect of the sacrum forms projections known as the inferior lateral angle (ILA). This structure is identifiable by following the convex dorsal surface of the sacrum with the palm or pads of the fingers until there is a drop-off superior to the coccyx. These landmarks help test sacral motion and identify dysfunctions.[5]

Initially, it was believed that the sacroiliac joint was immobile. However, recent studies have unveiled complex motions occurring at this joint.[2][13][14] The sacrum has 3 transverse axes—the superior, middle, and inferior transverse axes. The superior transverse axis is located at the level of S1, and its motion depends on respiratory and craniosacral motion. The middle transverse axis, situated at the level of S2, is dependent on postural motion, serving as the point where the sacrum rotates about the innominate bones. Lastly, the inferior transverse axis is at the level of S3, where the innominate bones move about the sacrum. To accommodate weight transfer and innominate motion during gait, the middle transverse axis tilts to become either the right oblique or left oblique axis, which can cause sacral somatic dysfunctions.[2] The right oblique axis runs diagonally through the left ILA from the right sacral base, whereas the left oblique axis runs through the right ILA. Due to these 5 different axes co-occurring, the sacrum has a gyroscopic effect where it appears to have little motion relative to other bones.

Nutation refers to the anteroinferior movement of the sacral base along a transverse axis, while counternutation involves its posterosuperior movement.[13] Nutation typically occurs during exhalation and extension of the lumbar spine, whereas counternutation happens during inhalation or lumbar flexion. Clinicians can palpate these motions by directly palpating medial and inferior to the PSIS over the sacral base and monitoring for anterior or posterior translation of the sacral base during truncal extension or flexion, respectively.[14][15]

With the extensive network of fasciae, muscles, and ligaments supporting and interconnecting skeletal structures, the sacrum's movement about these axes is strongly related to the lumbar spine.[2][15] The rotation of the fifth lumbar vertebra, which sits directly superior over the sacral

base, causes rotation of the sacrum as a unit in the opposite direction over one of the oblique axes. Side-bending of the fifth vertebrae engages the oblique axis on the same side, indicating the oblique axis on which the sacrum is rotating. The opposite relationship between the L5 and the sacrum is important as the body's compensatory mechanism keeps the patient's eyes level while walking. Understanding the anatomical relationships between structures of the sacrum and sacroiliac joint makes it possible to diagnose sacral dysfunctions and treat them accordingly.

Indications

MET is most commonly used for treating low back pain complaints associated with sacral dysfunction. However, due to the close relationship between the sacral plexus innervation in the pelvis, the sacrum, and surrounding structures, dysfunction may also lead to changes in parasympathetic tone, affecting the large intestine and genitourinary systems. Therefore, conditions such as constipation and dysmenorrhea may also benefit from treating sacral dysfunction.[16]

Contraindications

METs are generally considered safe procedures with minimal complications. MET uses a controlled, equal, and opposite force to lengthen a contracted muscle, posing few risks and proving tolerable for patients experiencing acute pain.[17][18] However, METs should be approached with caution or avoided altogether if there are concerns regarding muscle ruptures or tears, fractures in the treated area, or spinal or vertebral joint ligament rupture.[19] In addition, as METs require patient cooperation, individuals should be able to follow instructions effectively.

Equipment

A flat surface, such as a hospital bed or massage table with padding, is adequate for performing MET. Adjustable table height facilitates easy patient positioning and reduces strain on the clinician administering the treatment.

Preparation

Diagnosing sacral somatic dysfunction involves multiple steps and differs significantly from diagnosing other vertebral segments, given the existence of 10 potential somatic dysfunctions. As a result, diagnostic efforts encompass both static and dynamic tests.[20]

A crucial dynamic test for sacral dysfunction is the seated flexion test. With the patient seated, this stabilizes the innominate, allowing the assessment of sacral motion without the influence of the innominate bones. The seated flexion test is performed with the patient sitting flat on the floor. The clinician monitors the movement with thumbs inferior to the patient's PSIS as the patient flexes forward. The side of the dysfunction that moves the most superior or cranial is observed by the PSIS movement, indicating a positive seated flexion test.[21] The side of the sacrum in the dysfunction is unable to articulate against the innominate efficiently; therefore, during flexion, the sacrum will "catch" the innominate and pull it more cephalad. If a sacral dysfunction occurs along an oblique axis, it is considered a torsion, with the oblique axis located at the sacral base opposite the "stuck" side of the sacrum. In other words, the oblique axis aligns with the opposite direction of the seated flexion test. Therefore, if the test yields a positive result with the left PSIS moving more cranially, the sacrum rotates on the right oblique axis. In cases of unilateral sacral dysfunction (unilateral extension or flexion), the side of the positive seated

flexion test corresponds to the side of the sacral dysfunction. Conversely, if the seated flexion test is negative, the patient may not have a sacral dysfunction or may have bilateral dysfunction (bilateral sacral flexion or extension).

Other crucial dynamic tests include the spring test and the sphinx test. During the spring test, the patient assumes a prone position, and the physician applies a slow downward force through the lumbosacral junction. A negative result is characterized by a soft, regular, and bouncy return, whereas a positive outcome indicates a hard end point. A positive result typically suggests a restriction in the anterior motion of the sacral base against L5, most likely indicative of bilateral sacral extension or a backward sacral torsion.

The sphinx test aims to identify findings similar to those observed in the spring test. Initially, the patient assumes a prone position while the physician observes the sulcus or ILAs. Next, the patient raises their torso to a position supported on their elbow (the sphinx position), inducing lumbar extension, which flexes the sacrum. If the asymmetrical ILA or sacral sulcus becomes symmetrical during lumbar extension, the patient likely has a forward sacral torsion or flexed sacral dysfunction. Conversely, if the landmark findings become asymmetrical or cause increased pain, the patient likely has a backward sacral torsion or extension dysfunction.

For static tests of the sacrum, clinicians must be able to palpate the sacral sulcus (base of the sacrum) located at a finger-width medial and inferior of the PSIS and the ILA. Depending on the dysfunction, the sacrum may exhibit a unilateral deep sulcus and a unilateral posterior ILA.

Unilateral Sacral Dysfunctions

There are 2 types of unilateral sacral dysfunctions—flexion or extension, depending on the relative depth of the sacral sulcus (or position of the sacral base) and the direction of the seated flexion test. The dysfunction is named for the side of the positive seated flexion test. A unilateral sacral flexion has a positive seated flexion test, a deep sacral sulcus (sacral base is anterior), and a posterior ILA is posterior on the same side. If the positive seated flexion test corresponds with a shallow sacral sulcus (posterior sacral base) and an anterior ILA, it is diagnosed as a unilateral extension to the side of the positive seated flexion test.

Anterior Sacral Torsion

The patient exhibits a sacral torsion dysfunction when the deep sulcus and the posterior ILA are on opposite sides. The sacrum may have an anterior or a posterior torsion. The physician may do either the sphinx or the spring test to determine whether it is an anterior torsion. A torsion dysfunction is along an oblique axis on the opposite side of the seated flexion test. If a patient exhibits a positive right seated flexion test, indicating a dysfunction, their oblique axis will be on the left side. Consequently, the sacrum will rotate toward the left, indicating an anterior sacral torsion. The appropriate terminology in this case is that the sacrum has a left rotation on a left axis, denoted as a left-on-left sacrum.

Posterior Sacral Torsion

The patient exhibits a sacral torsion dysfunction when the deep sulcus and the posterior ILA are on opposite sides. The sacrum may have an anterior or a posterior torsion. The physician may do either the sphinx or the spring test to determine whether it is a posterior torsion. A torsion dysfunction is along an oblique axis on the opposite side of the seated flexion test. If a patient demonstrates a positive right seated flexion test, indicating dysfunction, their oblique axis will be on the left side. Consequently, the sacrum will rotate toward the right, indicating a posterior

sacral torsion. The correct terminology in this scenario is that the sacrum has a right rotation on a left axis, referred to as a right-on-left sacrum.

Bilateral Sacral Dysfunctions

Bilateral sacral dysfunctions are rare and commonly missed. The patient usually presents with pain in the lumbosacral junction and the sacroiliac joint. They will exhibit a negative seated flexion test, equal sulci, and equal ILA. The sphinx and the spring tests will be positive in the case of bilateral sacral extension and negative in bilateral sacral flexion.

Technique or Treatment

Several manual approaches exist for treating the sacrum and the sacroiliac joint.[22] [23] However, this article focuses on METs with post-isometric relaxation, as initially taught by Dr Fred Mitchell Sr and modern American Osteopathic Medical Schools. Treating the sacrum with MET can be challenging due to patient positioning. When positioning the patient, keeping the lumbosacral junction free to move is important. Therefore, part of the MET is directed at L5 to reciprocate the changes to the sacrum. As mentioned earlier, the oblique axis aligns with the same side as the L5 side-bending, and the rotation along the axis opposes the L5 rotation.

Anterior Torsion

The patient is placed in a Sims position where the chest and torso are prone while the lower body is flexed on the side so that the side of the axis faces the table (ie, if the patient has left-on-left dysfunction, they are laid down on the left). Next, the upper body is further rotated to restrict motion in all segments above the L5. Subsequently, the hips and legs are flexed until movement is localized at S2 (the level where the sacrum moves against the ilia). The physician then takes the bilateral leg and pushes it down toward the table to further engage the barrier. The patient is then instructed to lift both feet to the ceiling as the clinician applies an equal and opposite resistance, holding for approximately 5 seconds or until a change in tissue texture is noted, and then they are asked to relax. After relaxing, the hip flexion increases, and the feet are dropped toward the ground to engage the next barrier. Each cycle is repeated 3 to 5 times, and the correction of the dysfunction is rechecked after completing the treatment.

Posterior Torsion

The patient is positioned in a lateral recumbent position with the side of the oblique axis facing the table and flexing their knees. While monitoring the lumbosacral junction, the physician rotates the patient's upper body towards the back to immobilize the motion of all segments above L5. The superior knee is then flexed until movement can be sensed at the level of S2. Subsequently, the inferior lower extremity is extended while the superior leg is dropped off the table. The physician lowers the upper leg until motion is detected under the monitoring hand. The patient is instructed to lift their leg toward the ceiling as the clinician exerts the opposing force, creating an isometric contraction. This position is held for 5 seconds or until a change in tissue texture is observed. To engage the next barrier, the physician increases hip extension, drops the leg toward the floor between each effort, and repeats the process 3 to 5 times. The resolution of the dysfunction is continually reassessed after completing the treatment.

Unilateral Flexion

The patient is positioned prone, with the leg on the side of the seated flexion test slightly abducted and internally rotated. This abduction and internal rotation permit motion at the

sacroiliac joint while immobilizing the hip joint. Next, the physician places the heel of the hand on the ipsilateral ILA (the most posterior ILA) and detects sacral motion throughout the patient's respiratory cycle. As the patient inhales, causing counternutation of the sacrum, the ILA is followed anteriorly and cephalad. Resistance is maintained at this point to prevent the ILA from moving posteriorly as the patient exhales. This motion is repeated 3 to 5 times, after which sacral mobility is reassessed, and any other dysfunctions are identified.

Unilateral Extension

The patient is positioned prone, with the leg on the side of the seated flexion test slightly abducted and internally rotated, allowing motion at the sacroiliac joint while immobilizing the hip joint. The clinician is situated at the head of the patient, with the base of one hand on the dysfunctional sacral base. Lumbar extension is added by instructing the patient to come up onto their elbows. The patient is then asked to take a deep breath and follow the sacral base anterior and caudad upon exhalation. Resistance is maintained in this position as the patient inhales again, preventing posterior motion of the sacral base. This cycle is repeated 3 to 5 times, after which any residual asymmetry is reassessed.

Bilateral Flexion and Extension

Positioning for bilateral flexion and extension mirrors that of unilateral flexion and extension. The patient is placed prone, with both legs abducted and internally rotated. Depending on the diagnosis, the physician positions their hands on the center of the sacral base or the sacral apex. In the case of bilateral flexion, the physician applies force to the sacral apex during inhalation. Conversely, the physician applies force to the sacral base for bilateral extension during inhalation.

Complications

Patients undergoing treatment with MET should be informed that they may experience muscle soreness and fatigue afterward. The physician should recommend increasing water intake following treatment. Using excessive force can lead to inappropriate treatment, as the body may start recruiting larger muscles instead of engaging the targeted smaller muscles for specific adjustments. To minimize force during post-isometric relaxation, patients should be instructed to resist just enough to engage the treated segment.

Clinical Significance

Somatic dysfunction of the sacrum commonly leads to back pain and discomfort, prompting patients to seek medical attention. Osteopathic techniques, including MET, offer a conservative, non-pharmacological approach to relieving pain and correcting musculoskeletal somatic dysfunctions in the thoracic spine, thereby enhancing the range of motion in affected joints.[6] [24]

Proper sacral mechanics play a large role in normal gait; addressing somatic dysfunctions can improve gait and reduce potential injuries from instability.[25] Treating the sacrum can also help resolve pain in the sacroiliac joint, which can cause lower back pain in up to 25% of patients.[26] Addressing sacral and sacroiliac joint issues without resorting to surgery or medication can greatly benefit patient wellness and mobility.[27][28]

Beyond musculoskeletal pain, physicians should consider the potential neurological implications of sacral dysfunctions. The parasympathetic splanchnic nerves originate from the sacral

plexus. A hypothesis exists that addressing sacral dysfunctions could potentially improve conditions related to the lower gastrointestinal system, uterine, or bladder function.

If the physician determines that a high-velocity, low-amplitude technique would be more suitable for treating the sacrum, MET can be used beforehand to facilitate greater soft tissue relaxation and enhance the effectiveness of the treatment. Additionally, it can aid in resolving hypertonic tissue before applying myofascial release techniques.

Importantly, somatic dysfunctions in the sacrum are commonly caused by dysfunction elsewhere in the body. Other nearby regions should be examined and treated before treating the sacrum. Areas that may affect the positioning of the sacrum include the L5 and the innominate or anatomic leg-length discrepancies.

Enhancing Healthcare Team Outcomes

METs provide an efficient and relatively safe treatment approach for patients experiencing various complaints, ranging from lower back pain to constipation. Effective interprofessional communication among clinicians managing patients with persistent low back pain remains crucial, especially considering pharmacologic therapies such as spinal injections and narcotic analgesics. MET could serve as a treatment alternative the healthcare team may not have previously considered. By comprehending the principles underlying osteopathic medicine for diagnosing structural dysfunctions and understanding the potential for manual manipulation to successfully address such dysfunctions, clinicians can provide patients with less invasive and nonpharmacologic options to potentially restore their productivity and overall happiness despite persistent pain.[6][18]

In efforts to combat the opioid epidemic, coordinating care among healthcare professionals by referring patients for osteopathic evaluations and utilizing MET as treatment strategies can enhance patient-centered care. These approaches can potentially improve outcomes for patients experiencing conditions associated with sacral dysfunctions.

Review Questions

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