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Idiopathic Pelvic Girdle Pain as it Relates to the Sacroiliac Joint

Sacroiliac Joint Hypermobility Biomechanics and What it Means for Health Care Providers and Patients

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Abstract

Sacroiliac joint dysfunction is complex with numerous etiologies. Proper stabilization of the sacroiliac joint allows for effective transfer of loads between the trunk and the lower extremities during static and dynamic activities, while maintaining a freely nutating motion. A loss of integrity of the stabilizing soft-tissue structures inhibits the ability to transmit axial loads and creates uneven stresses on the joint and surrounding tissues. Hypermobility of the sacroiliac joint can be caused by ligamentous instability or secondary to adaptive biomechanical changes and increased stresses affecting the joints of the pelvis. This article examines the current evidence related to the loss of stability on sacroiliac joint pain and dysfunction. A review of exercise goals for the hypermobile joint is included.

Introduction

As a global health condition, musculoskeletal-related low back pain (LBP) is the leading cause of disability and years lived with disability worldwide, with an estimated global point prevalence of 9.4% to 35% and a lifetime prevalence of between 50% and 85%.[1,2] In the United States, LBP has an estimated point prevalence of 20% to 30% in the general population, with 20% to 40% being sacroiliac joint and pelvic girdle pain.[2] This article examines the biomechanics of sacroiliac joint hypermobility and reviews the current literature on treatments.

Hypermobility of the sacroiliac joint is difficult to quantify in patients with sacroiliac joint pain. Whether due to adaptive biomechanical changes or actual ligamentous laxity, uneven stresses are created on the joint and surrounding stabilizing tissues.[3,4] Lumbopelvic pain due to ligament hyperlaxity can be a congenital or an acquired condition. The European Guidelines for the Diagnosis and Treatment of Pelvic Girdle Pain Pelvic Girdle Pain defined this as pain experienced between the posterior iliac crest and the gluteal fold, particularly near the sacroiliac joints, with or with radiation in the posterior thigh.[5] The natural ligamentous laxity during pregnancy can result in pelvic girdle pain.[5,6] Genetic conditions such as Marfan syndrome and Ehlers-Danlos syndrome cause systemic tissue hyperlaxity and joint hypermobility, potentially destabilizing the sacroiliac joint.[7,8]

Biomechanics of Sacroiliac Joint Stability

The sacroiliac joint is part of a complex lumbopelvic system that provides stability and motion, while allowing for nutation and counternutating motions and the transfer of loads though this system.[9] The self-bracing model of sacroiliac joint biomechanics describes the mechanism of efficient transmission of compressive loads from the lumbar spine to the lower extremity and vice versa, while freely nutating motion is maintained in the sacroiliac joint.[9,10] Effective transfer of loads and shearing forces through the sacroiliac joint are dependent on proper neuromuscular control of lumbopelvic muscles that stabilize and react to loads, plus ligaments and fascia (Figure 1).[9-11] Three pelvic slings comprising a series of muscles, ligaments, and fascia create the forced closure stabilization of the pelvis: Specifically, the longitudinal sling, consisting of the multifidus, erector spinae, and long head of the biceps femoris muscle; the posterior oblique sling made up of the latissimus dorsi and gluteus maximus muscles; and the anterior oblique sling

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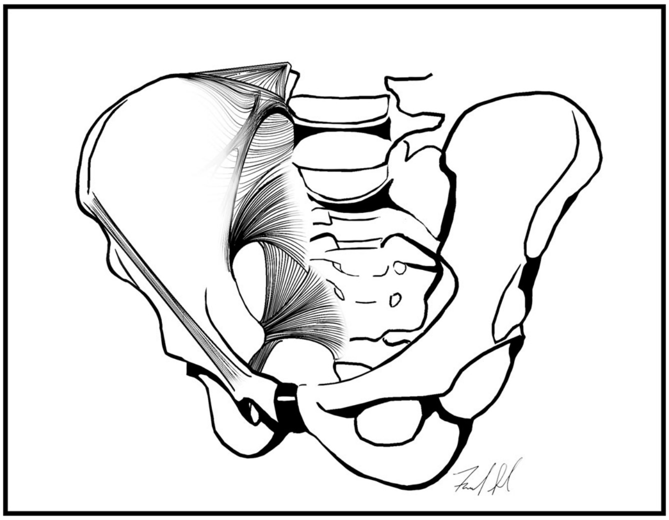

Figure 1. The anterior view of the pelvis, shown with and without sacroiliac joint ligaments. (Original Artwork by Frank Scali, MD, DC, used with permission.)

consisting of the internal and external abdominal muscles and the transversus abdominis muscle.[9,10,12]

Weak, inhibited, or overactive lumbopelvic stabilizing muscles can alter tension on ligaments and tendons that stabilize the sacroiliac joint, including the sacrotuberous ligament, which inhibits sacral nutation, and the long dorsal sacral ligament, which inhibits counternutation.[9,13] Asymmetry of ligament laxity, more than the amount of laxity is responsible for the severity of sacroiliac joint pain. Imbalances in hip flexors, extensors, and gluteal muscles can also affect pelvic inclination and sacral nutation.[12,13] The relative static malposition that may accompany sacroiliac joint dysfunction does not appear to influence the stabilizing compressive force closure mechanisms.[3,9,14-16]

Causes of Sacroiliac Joint Hypermobility

Functional joint stability is a combination of resistance to shearing forces, the capacity for load transfer, joint movement, and control of that motion.[10] The European Guidelines for the Diagnosis and Treatment of Pelvic Girdle Pain define functional joint stability as: "The effective accommodation of the joints to each specific load demand through an adequately tailored joint compression, as a function of gravity, coordinated muscle and ligament forces, to produce effective joint reaction forces under changing conditions."[5]

Sacroiliac joint instability can be a result of sprained ligaments, systemic conditions, or the eventual consequence of microtrauma-induced injury from congenital variations, arthritic changes to the sacroiliac intraarticular surfaces, progressive muscular imbalances, or adaptive pelvic obliquity.[9,11]

Altered movement patterns in the lumbar spine can contribute to the lack of symmetry of lumbopelvic motion.[3,14] Asymmetrical lumbar spine movements are strongly associated with pelvic asymmetry in patients with LBP and individuals without pain.[3,14] Static pelvic asymmetry or absolute ranges of motion do not correlate positively with chronic LBP; however, asymmetrical motion is strongly associated with LBP.[3,11,14-16] Bilateral pelvic asymmetry also correlates with reduced hip motion and bilateral asymmetrical hip rotation in patients with chronic LBP.[16] Therefore, a more accurate gauge of functional deficits in individuals with LBP relates to asymmetry of motion, rather than the range of motion in the lumbar spine.[16,17] Lumbopelvic kinematics and movement symmetry are important factors in the evaluation of patients with LBP.[17] Therefore, a primary goal in treating sacroiliac joint dysfunction involves restoring normal neuromuscular lumbopelvic control, joint stability, and motion.

Lower Extremity Amputation

Lower extremity amputation is a potential cause of sacroiliac hypermobility and related pain syndromes. Although not specifically focused on sacroiliac joint abnormalities, a systematic review noted that: (1) the occurrence of LBP increases following lower extremity amputation; (2) the level of amputation affects LBP; (3) leg length discrepancy is associated with LBP in people with lower extremity amputation; (4) postural imbalances and control issues are associated with LBP in people with lower extremity amputation; and (5) spinal and pelvic kinematics are altered by LBP in people with lower extremity amputation.[18]

A case study on lumbopelvic movement during posterior chain exercises found altered movement strategies in a person with a lower extremity amputation compared to an able-bodied person, such as asymmetrical movements in the residual limb and posture noted during certain exercises and altered activation patterns of the posterior chain muscles.[19]

Ligament Hyperlaxity

As part of the stabilizing force closure system of the sacroiliac joint, the integrity of the surrounding ligaments is crucial to maintain a normal transmission of forces from the torso to the lower extremities.[10,12,13] Studies examining the role of ligamentous laxity on pelvic symmetry have demonstrated a relationship between asymmetrical of pelvic ligaments and the levels of pain.[3,20,21] Ligamentous laxity affecting sacroiliac joint stability can be a congenital or acquired condition. Familial conditions that cause hyperlaxity are often accompanied by other systemic issues affecting multiple systems.[8,22] Hyperlaxity of ligaments results in a loss in integrity of the force closure mechanism. Special attention should be given to patients who present with multiple system involvement or vague complaints without a specific history of injury.[22,23] Evidence of familial connective tissue disorders or similar familial history of complaints may indicate a genetic rather than acquired condition.[23]

Pregnancy Related Ligament Hyperlaxity

Increased ligament laxity due to normal elevated levels of the hormone, relaxin, during the third trimester of pregnancy results in transient joint hypermobility and increased pelvic movement.[6,17] Low back and pelvic pain due to joint hypermobility is a common musculoskeletal problem affecting between 20% and 49% of all pregnancies, and may extend well after delivery, with up to 40% of women reporting continued postpartum pelvic pain for up to 18 months.[6,17] Asymmetric laxity of the sacroiliac joint is associated with moderate or severe pregnancy-related pelvic pain and correlates with severity levels and positive clinical tests for sacroiliac joint dysfunction, and may correspond with high body weight during pregnancy, early onset of pain, and a previous history of pregnancy-related pelvic pain.[24] Asymmetry of load and shear across the pelvis during this transient period of increased joint laxity can lead to asymmetries in joint stiffness, especially in the setting of inhibited or weak trunk and pelvic girdle muscles or poor neuromotor control. Moderate to severe pelvic pain during pregnancy from asymmetrical sacroiliac joint stiffness measured by Doppler imaging of vibration across the joint is predictive of moderate to severe postpartum pelvic pain.[17]

Genetic Joint Hypermobility Syndromes

Inherited hypermobility syndromes involve congenital connective tissue alterations due to autosomal dominant chromosomal changes affecting collagen fibers.[22,25] These disorders vary in clinical presentation and severity and include conditions such as Ehlers-Danlos syndrome, Marfan syndrome, and other conditions.[8,22] Marfan syndrome has a prevalence of from 1.5 to 17.2 per 100 000 individuals and Ehlers-Danlos syndrome has an estimated prevalence of between 1:5000 to 1:25 000.[7,8] Several classifications such as the Brighton Criteria have sought to categorize inherited generalized joint hypermobility according to clinical traits.[7] A recent change in terminology by the 2017 International Criteria for Ehlers-Danlos syndrome favors the terms Hypermobility Spectrum Disorder (HSD) and Hypermobile Ehlers-Danlos syndrome (hEDS) over the traditional term Joint Hypermobility Syndrome.[7] Consultation with a rheumatologist or medical geneticist to determine the specific phenotypes in this spectrum of disorders may be warranted in certain cases.[7]

Hypermobility syndromes are often marked by pain, nondermatomal paresthesia, decreased proprioception, impaired autonomic reflexes, and a predisposition toward neuropathies.[7,26] In addition to joint hypermobility, other changes in connective tissue can involve other areas including the mitral valve, aorta, lens in the eye, and spinal dural ligaments.[22,26] These familial conditions are typically more common in females, becoming symptomatic in late childhood and adolescence with symptoms of joint-related pain and stiffness, especially during long periods of standing or sitting.[7,22] Affected individuals are prone to repetitive-motion overuse injuries due to their increased flexibility. Because of the nature of this connective tissue disease, many individuals bruise easily, are prone to ligament or tendon rupture, have congenital hip dysplasia and temporomandibular joint dysfunction, and experience joint or bursa inflammation or fibromyalgia-like symptoms.[4,7,23] Other nonmusculoskeletal conditions associated with ligament hypermobility include generalized anxiety disorders, orthostatic tachycardia, gastrointestinal disorders, and pelvic and bladder dysfunction.[23]

Secondary Causes of Sacroiliac Joint Hypermobility

Sacroiliac joint dysfunction is typically due to an asymmetry in the ligamentous and muscular forces that support the sacroiliac joint, causing altered compressive force closure.[10,11] Functional changes that affect the sacroiliac joint involve a loss of symmetry in structure, stability, or neuromuscular control. Skeletal asymmetry and postural changes affect lumbopelvic kinematics and are an important consideration in evaluating the biomechanics of adaptive overload syndrome (Figure 2).[9,10] A common source of adaptive overload syndrome is an anatomical or functional leg length inequality, which increases stress across the sacroiliac joint creating uneven ligament strain.[14,27] As the leg length inequality increases and mechanical alignment decreases, loads and peak stresses increase rotational shearing forces on the side of long leg, and by a lesser amount, increased compressive forces on the short leg side.[14,27] The peak stresses across the sacroiliac joint increase with each centimeter of leg length inequality. A leg length inequality of 1 cm for example, will increase stresses on the long leg side of the sacroiliac joint 5-fold, while a 3-cm leg length inequality will cause a 12-fold increase[27] (Figure 3).

Both myofascial and skeletal structures are subject to adaptive changes from tissue overload and increased stress.[4] When sustained stresses create tissue creep they lose their elastic properties and deform plastically to the point of material failure and rupture of collagen fibers.[9,25] As an anisotropic material, ligaments respond differently to forces depending on the direction of the load.[25] Excessive tissue creep from continuous or repetitive stretching, especially from irregular loading, can create joint laxity leading to future injury.[25]

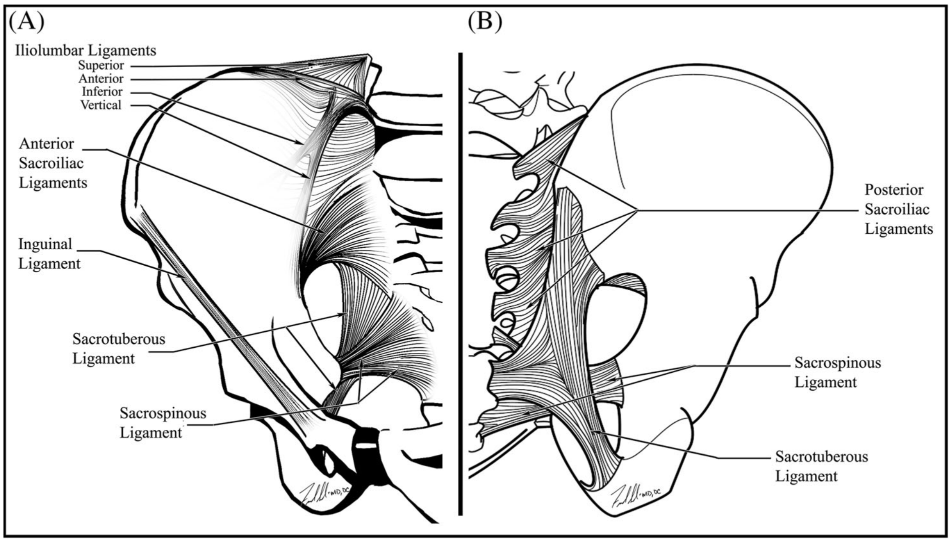

Figure 2. The anterior (A) and posterior (B) views of the pelvis with the ligaments that support the sacroiliac joint. (Original Artwork by Frank Scali, MD, DC, used with permission.)

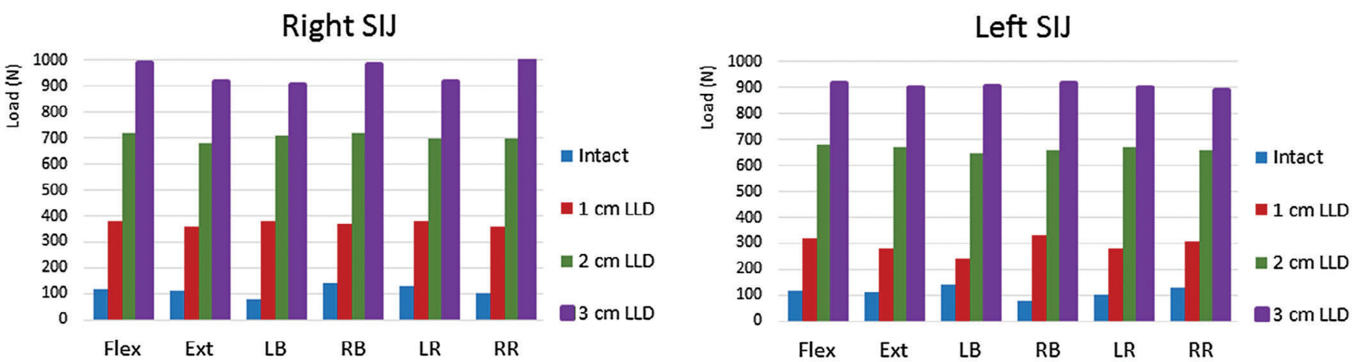

Figure 3. The predicted loads (N) across the left and right sacroiliac joints for different amounts of leg length discrepancies (LLDs) for different physiological motions. The intact sacroiliac loads are shown for comparison. The data are for a 400 N follower load and a 10 Nm moment. (Used with permission. From: Kiapour A et al. J Orthop Res 2012, 30:1577-1580.)

Biomechanics of the Hypermobile Sacroiliac Joint

Sacroiliac joint dysfunction often presents with altered lumbopelvic movement patterns as well as ligament and muscular asymmetry. The intrinsic motion and stability of the sacroiliac joint are dependent on the multiple structures that contribute to the form/force closure mechanism. In addition to the osseous structures of the spine and pelvis, spinal stiffness, lumbopelvic symmetry of motion, asymmetrical laxity of lumbopelvic stabilizing soft tissues, and spinal disk hydration status influence lumbopelvic biomechanics.[9,10]

Increases in ligament laxity result in a loss of normal compressive forces of these structures that stabilize and allow for effective transfer of load through the sacroiliac joint.[9,10] The loss of lumbopelvic stability from asymmetrical tissue overload or ligament laxity can predisposes the joint to further injury from excessive joint movement.[7] Abnormal repetitive motion creates recurring microtrauma to muscle, ligament, tendons, and cartilage causing acute pain, inflammation, functional deficits, and further joint instability.[7,10] As the self-bracing mechanism of the pelvis decreases, load transfer through the joint changes, thereby placing ligaments, such as the long dorsal sacral ligament, under increased tension. This imbalance in tissue stresses and strains can cause LBP and pelvic pain syndromes.[9,10]

Clinical Presentation and Assessment of the Hypermobile Joint

The clinical presentation of the hypermobile joint is multifactorial and requires a detailed assessment to guide clinical decision-making.[28,29] A comprehensive evaluation should assess for factors contributing to hypermobility related to a systemic disorder or several conditions with overlapping symptoms.[30] With a widely heterogeneous etiology, a classification system for identifying categories of joint hypermobility has been proposed to improve treatment group assignments, prognosis, and outcomes.[7] Summary recommendations for assessment of the hypermobile joint are outlined in this section.

Pain Distribution/Orthopedic Examination/Diagnostic Imaging

For clinical assessment of pelvic girdle pain syndromes, the 2008 European Guidelines for the Diagnosis and Treatment of Pelvic Girdle Pain recommend an extensive pain history, palpation of the sacroiliac joints and symphysis, manual diagnostic tests, Posterior Pelvic Pain Provocation Test, Patrick's (FABER) test, Gaenslen's test, the modified Trendelenburg's test, and the Long Dorsal Sacroiliac Ligament test.[5] The guidelines do not recommend routine use of imaging for nonankylosing spondylitis pelvic girdle pain or use of scintigraphy and sacroiliac joint injections for diagnostic purposes.[5]

Kinematics, Gait, Motor Control, and Muscular Function

Successful management of lumbopelvic pain syndromes should include both anatomical and functional assessments of strength, endurance, flexibility, motor control, gait, and lumbopelvic kinematics. Various options are available for assessment, such as the Sorenson test,[31] Prone Plank test,[32] Functional Movement Screen,[33] other movement control tests,[34] and laboratory-based gait analyses.[35] The Lumbar Spine Instability Questionnaire is a 15-item questionnaire that may be useful in assessing instability and guiding treatment approaches.[36,37] A thorough kinematic evaluation of bilateral lumbopelvic movement symmetry can provide important information for the management of patients with LBP.[15]

Treatment Approaches for Joint Stabilization

No recent clinical practice guidelines (CPGs) or systematic reviews are available on treatment approaches exclusively for sacroiliac joint syndromes. Thus, as appropriate, we relied on the literature for management of nonspecific LBP to help guide clinical decision-making. Treatment goals for the hypermobile sacroiliac joint should address strength, flexibility, stabilization, restoration of normal neuromuscular lumbopelvic control, and correction of functional adaptive changes as well as pain reduction. These goals are best accomplished with multiple and integrative therapies.[1,4,23,28]

Patients with sacroiliac joint hypermobility can benefit from a combination of active, passive, and self-care therapies, which may include manipulation or mobilization, sacral bracing, orthotics, and therapeutic exercises.[1,5,28] Used selectively, manipulation is an effective treatment for restoring normal pelvic symmetry and decreasing the resultant rotational and compressive forces on the sacroiliac joint, creating immediate changes gait and postural control.[5,30] Normalization of sacral nutation and counternutation as well as restoration of pelvic symmetry can be accomplished with muscle energy techniques, joint manipulation, or mobilization.[6,30] The restoration of normal spinal kinematics through selective rehabilitative exercises targeting specific muscle groups should be introduced after the postacute phase of care.[6,27] Developing an effective treatment protocol depends on identifying nonspecific musculoskeletal disorders from serious or systemic diseases that may present with associated spinal pain.[1]

Manual Therapies

We did not find a recent systematic review or CPG specific to sacroiliac hypermobility only; however, several recent guidelines on the management of acute and chronic low back pain including sacroiliac joint pain, recommend conservative management including manual therapies.[38–41] The 2008 European Guidelines for the Diagnosis and Treatment of Pelvic Girdle Pain did not identify any randomized controlled trials (RCTs) on manipulation and joint mobilization for pelvic girdle pain.[5] A recent RCT reported that both manipulation and stability exercises resulted in improvement in pain and disability in patients with subacute and chronic LBP, although no differences were observed between the groups.[42] Another RCT found that manual therapy resulted in higher success rates than traditional physiotherapy in patients with sacroiliac joint–related leg pain.[43] An RCT on management of low back and pelvic pain during pregnancy found that a multimodal intervention consisting of manual therapy, stabilization exercises, and brief education was superior to standard obstetric care in terms of alleviating pain and disability.[6] A pragmatic comparative study found that the addition of chiropractic care to usual medical care resulted in moderate short-term improvements in low back pain intensity and disability compared to usual care.[44]

Manual therapies for nonspecific LBP is well-studied and the CPGs on management of LBP generally recognize manual therapy (manipulation, mobilization) as safe and effective for short-term pain relief and disability reduction.[40] A recent summary of the CPGs recommends spinal manipulation as an intervention for management of acute and chronic LBP.[41] Like other therapies for LBP (eg, exercise, physical therapy), the literature is unclear on which mode of manual therapy or specific technique (eg, manipulation, mobilization) is superior for subgroups of patients. Thus providers are encouraged to base their clinical decision-making for use of manual therapy on safety, cost, clinical expertise, and patient preferences. In theory, manual techniques may be beneficial at the time of the initial presentation and can be utilized to reduce pain and pelvic asymmetries and allow for the progression of necessary strengthening and neuromotor control across the lumbopelvic region, reducing chances of further adaptive consequences. Manipulation of the sacroiliac joint may focus on addressing restrictions in the contralateral side of hypermobility, with the goal of restoring symmetry of motion. Sacroiliac joint manipulation has been shown to improve asymmetrical tension in the pelvis, equalizing force distribution to the lower extremities.[45] Patients with acute LBP respond differently to manipulation than asymptomatic individuals.[46] Therefore, caution should be enlisted in utilizing manual techniques repetitively for several reasons. First, the goal is to get the patient to a state of self-management and not to rely on a passive treatment for relief of pain. Second, there is theoretical concern for developing laxity in the soft tissue structures that provide force closure for the sacroiliac joint. Finally, avoiding the repetitive "quick fix" and providing education to the patient as to why strengthening and neuromotor control education is the end goal for long-term relief.

Back, Core, and Motor Control Exercises

The theoretical underpinnings of applying exercise to stabilize the pelvis by improving motor control, strength, and endurance of the lumbopelvic and other posterior chain muscles is compelling. However, similar to manual therapies, we did not uncover a recent systematic review or CPG on management of sacroiliac dysfunction with exercise. Therapeutic exercises targeted at improving the force closure mechanism to improve sacroiliac joint stability are often used. A systematic review assessing external pelvic compression on the sacroiliac joint aimed to improve force closure, found moderate evidence that external pelvic compression helped to decrease joint laxity, alter lumbopelvic kinematics, and thereby changing recruitment of stabilizing muscles and reducing pain.[20] Although there is limited evidence that external compression decreases mobility of the sacrum or improved muscle strength of the muscles surrounding the sacroiliac joint, the 2008 European Guidelines recommend individualized exercise therapy for pelvic girdle pain during pregnancy and exercise as part of a multi-modal program for postpartum pelvic girdle pain.[5] Providers should assess the patient's individual impairment and movement patterns to develop the best therapeutic exercise plan to improve the impairments, with the intent that amelioration of pain is to follow.

Exercise therapy for nonspecific LBP is well studied and the CPGs generally recognize exercise therapy as safe and effective for improving function and reducing disability in patients with LBP.[47] A recent summary of the CPGs recommends exercise as an intervention for primary management of patients with chronic LBP and for use in selected patients with acute LBP.[41] Numerous forms of exercise are available for management of LBP, ranging from general physical activity (eg, walking) to core-specific exercises (eg, motor control).[37] A Cochrane review reported that motor control exercises are not superior to other forms of exercise.[37] Likewise, a systematic review found that back strengthening exercises are not superior to other forms of exercise.[47] Therefore, selection of specific exercises may depend on patient preferences as well as implementing exercises that foster adherence to achieve long-term muscular and functional gains.[37,47]

Pelvic Compression Belts

Compression belts are a common conservative method for managing sacroiliac joint and pelvic pain from sprain/strains and other ligamentous laxity such as is commonly seen in peripartum females.[48,49] Sacroiliac belts have been used during pregnancy to improve proprioception and balance and to increase force closure in the sacroiliac joint.[49,50]

The success of this type of support for hypermobilityrelated peripartum pain depends on several factors, such as proper belt positioning and patient compliance.[17,49] The sacroiliac joint belt is intended to improve pelvic stability through actions similar to the lumbopelvic stabilizing function of the transversus abdominis and obliquus internus abdominis and multifidus muscles.[11,21,49,50] The most import factor in determining the efficacy of the sacroiliac belt is the belt location rather than the amount of compressive force created by the belt.[20,48,49] The optimal position for a lumbosacral belt to improve sacral laxity is just below the anterior superior iliac spines rather than a lower positioning around the symphysis.[20,49,50] Compression belts should be worn only for short periods and only after being fitted properly and verified that they provide relief.[50]

A 2012 systematic review of sacroiliac compression belts for lumbopelvic pain reported moderate evidence for pain relief, improved form closure and motor control by decreasing the recruitment of certain lumbopelvic stabilizing muscles.[20] However, there is limited evidence for the use of compression belts to decrease lumbosacral motion and increase muscular strength.[20] Another guideline however, does not recommend the use of sacroiliac joint compression belts as a sole treatment but favors its use in combination with other therapies as part of a comprehensive treatment pain.[5]

Patient Expectations

The CPGs on management of nonspecific LBP recommend brief education as a primary intervention,[41] which can align patient expectations with prognosis and treatment approaches. These recommendations should apply to patients with sacroiliac joint pain and suspected joint laxity or joint hypermobility. Components of brief education should include[38]: (1) evidence-based information on LBP, specifically about the patient's prognosis; (2) advice to remain active and to resume usually activities as soon as possible; and (3) information about options for self-care.

Engaging the patient in a program of self-care will enhance compliance and improve outcomes. A thorough review of the treatment goals of strength, flexibility, and stabilization should be reviewed carefully with patients. A structured plan of care that engages the patient as they move through each phase of injury recovery and maintenance care, mapping out a successive set of therapeutic exercises and stretching will improve patient compliance. Follow-up office visits for evaluation and monitoring of patient progress along with continuing prescribed therapies such manipulation or myofascial therapies will keep patients engaged in their recovery.

Conclusion

Sacroiliac joint hypermobility can result from multiple causes including postural adaptive changes and inherited or acquired conditions related to systematic ligament laxity. The loss of stabilizing force closure is a primary cause of sacroiliac dysfunction. Asymmetry in ligament laxity or lumbopelvic kinematics, rather than an absolute loss of motion, is a greater contributor to sacroiliac joint pain.

Treatment goals for sacroiliac joint hypermobility involve decreasing pain, correcting functional adaptive changes, removing factors that inhibit neuromuscular control, and improving joint stabilization by increasing force closure mechanisms. Selective use of manipulation to reduce pelvic asymmetries, improve neuromotor control, and decrease pain may be part of an initial treatment plan but should not be a long-term plan of care. A plan of care that includes active and passive strategies and engages patients in their recovery will improve compliance and treatment outcomes. Furthermore, repetitive manual medicine treatments applied to a sacroiliac joint with reduced stiffness theoretically defeats the intent of treatment to improve stability at the joint and thereby improve the ability of the pelvic girdle to distribute load and shear forces effectively. Additional research into the contribution of adaptive overload syndromes to altered lumbopelvic movement patterns and pelvic asymmetry will ultimately improve best practice guidelines for care of sacroiliac joint pain.

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Disclosure

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