

# **Pubic Joint Dysfunction and Symphyseal Diastasis: A Novel Biomechanical and Treatment Model**

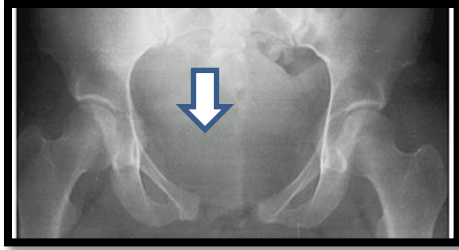
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## **INTRODUCTION**

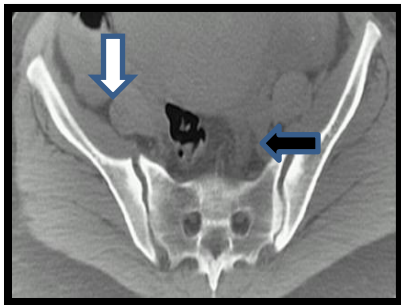
The purpose of this article is to bridge research from orthopedic trauma to obstetric symphyseal diastasis (SD) also to discuss pubic joint dysfunction (PJD), introducing new models (NM) of both. Pubic joint dysfunction presents with pain and purported hypermobility (at times subjectively defined, other times objectively shown with x-rays etc.). In contrast, symphyseal diastasis (SD) is severe pain and complete rupture with separation of the symphysis pubis (SyP), objectively identified on x-ray, (fig. 1, 4) CT scan (figs. 2, 3), MRI and ultrasound. When chronic, both PJD and SD are poorly understood painful disabilities in women, which are inadequately treated. To quote, “The persistence of symptoms in our patients emphasizes the need for careful examination and follow-up of these rare injuries... the outcome in our patients was poor (diastasis) and results in the literature are equivocal...”<sup>1</sup>

This article is a beginning point which describes a novel theory suggesting that obstetric SD is distinctly different from normative pregnancy and birth mechanics. Pregnancy and birth create widening of pelvic joints and the birth canal in response to ligamentous softening and fetal growth. Whereas SD is a significantly different mechanism, it is not just a continuation of pelvic outlet widening. A lack of understanding – if this theory is correct – may contribute to chronicity. The unique pathomechanics can be visualized by utilizing imaging, and with manual stress tests, or both. Novel treatment utilizes manual mobilization or passive fulcrums to restore correct position of the ilia in relation to the sacrum and of the paired pubic bones. This is coupled with application of a SIJ belt placed lower than the typical placement (below the waist), placed at the trochanters, to optimize joint closure. Only one older study was found, that specifically addressed the application of the support at the trochanters.<sup>2</sup> As noted in Depledge’s thorough review and research, there is a paucity of research on the use of pelvic belts for pubic pain. She stated; “However, a search of MEDLINE, the Cumulative Index to Nursing and Allied Health (CINAHL), Allied and Complementary Medicine (AMED), and the Cochrane Library indicated that no experimental clinical studies have investigated the effect of wearing a pelvic belt to treat symphysis pubis pain, and few studies have investigated the effect of wearing a belt on posterior pelvic pain.”<sup>3</sup>

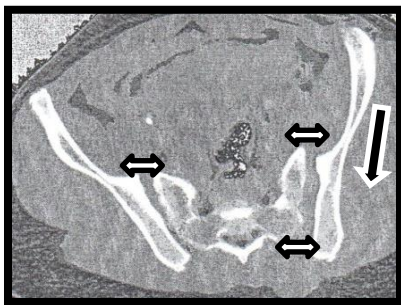
This article presents a general overview, the purpose being to inform clinicians and patients that there is more beyond the traditional model (TM), and provide hope. The actual movements involved in PJD, SIJ dysfunction (SIJD), and SD can be difficult to describe linguistically, and a few bi-plane images do not readily convey the dynamic 3-D joint position and movement. Therefore the reader is encouraged to view You Tube videos typing the author’s name (no spaces) and then “pubic joint dysfunction and symphyseal diastasis” and “sacroiliac joint dysfunction.”



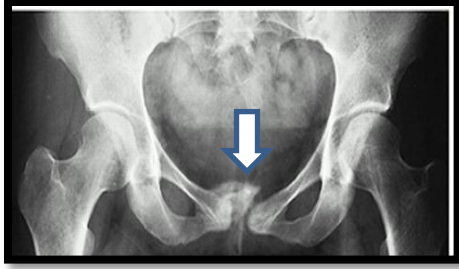
**Figure 1.** This is an A-P radiograph which shows a functionally unstable 4.7cm symphyseal diastasis (white arrow). This was reduced to 2.6 cm after wearing a pelvic binder for four days. Image is from Kowalk 1996.



**Figure 2.** This is the same patient as in figure 1. Note that there is gapping at both SIJ's (white arrow). The posterior glide and approximation of the retro-articular joint complex is readily apparent, seeming to form a “new SIJ” (black arrow). This CT scan image was taken on the second day post- partum when there was considerable SD. Image is from Kowalk 1996.



**Figure 3.** This is a CT scan of another patient. Observe that the posteromedial glide displacement of the right ilium is apparent (long arrow), as is bilateral SIJ joint widening, greater on the right (horizontal arrows). Image from Thornton 2011.



**Figure 4.** This is a pelvic radiograph of the same patient as shown in figs. 1-2, though 6 months later. Note that within and around the SyP there is callous formation (white arrow) and therefore, greater stability. The diastasis has reduced to from 4.7 to 1.5 cm. This validates the possibility of healing without surgical stabilization in a sub-set of patients. This was accomplished with the appropriate application of a pelvic binder at the trochanters. As closure is not complete, one can only wonder if the ilia remain in some degree of posterior glide fixation. Because the symphysis healed with a 15mm gap, (2-6mm norm) the degree of stability of the SIJ may be impacted bilaterally, though long-term follow up is unreported. Image is from Kowalk (1996).

#### PELVIC ALIGNMENT

There is very little coverage in the manual therapy literature on treatment for chronic pubic joint dysfunction SD, yet an abundance of treatment techniques for every other joint in the body. While this article focuses primarily on PJD and SD, it is relevant to interject that any instability or dysfunction, will also be reflected in one or both sacroiliac joints (SIJ) and treatment therefore must always address all three pelvic joints. A future article will elaborate on this important link and focus more on the SIJ, otherwise only brief mention of the SIJ is included. Physiotherapists/ Physical Therapists (PT) especially the sub-specialty of Women's Health PT treat obstetric PJD, SD, and SIJD with numerous approaches. This includes, but is not limited to: pelvic floor rehab, stabilization exercises, use of a SIJ support, pelvic floor rehabilitation, education in proper body mechanics, pain relieving modalities, effort to achieve lasting "pelvic symmetry AKA alignment," soft tissue treatment, etc.<sup>4,5,6</sup> This can be very helpful in acute stages, though PT intervention brings limited success in those with chronic, severe PJD, SIJD, and SD. Part of the limitations of the current treatment might be due to the tenacious focus on alignment.

There is a belief that pelvic bone asymmetry in static and dynamic contexts are the same as actual position and mobility dysfunction *in the actual pelvic joints*. The former best described as macromotion of the pelvis, not the SIJ, and is measured in double-digit millimeters or centimeters, or double digits of degrees of rotation. True joint motion in the SyP and SIJ is measured in single-digits in millimeters and single-digit degrees of rotation, except in very extreme and profoundly cases of surgical instability, with a profound loss of function. The very language is problematic in which a pelvic asymmetry is described as a "joint malposition" unlike any other region in the body. For example, in cases of knee joint dysfunction with an ACL insufficiency, it is not asymmetry of observed motion or of gross motion that is diagnostic, but rather isolated ligament and joint micromotion tested, that may precede additional testing such with an MRI of KT-2000™.

Pelvic "alignment" theory, which pervades many professions, and many PT practitioners, it is not just limited to women's health PT clinicians. It is a very relevant topic for women's health PT's as there are most likely to work with the population with PJD and SD. Alignment

theory is a problematic concept for the following reasons:<sup>1</sup> Alignment theory does not necessarily restore tri-plane compressive approximation of the joints, nor can it evaluate such.<sup>2</sup> Alignment does not (in spite of belief) resolve adverse articular position nor can it evaluate it.<sup>3</sup> Alignment does not restore normative physiological micro motion mobility and stability nor can it evaluate such.<sup>4</sup> Alignment does not and cannot evaluate and treat unilateral hypo- and hypermobility via joint stress/spring tests, and viscoelastic creep mobilization.<sup>5</sup> Alignment theory does not recognize, evaluate for, or treat symmetrical SIJ motion dysfunction, nor symmetrical hypo- or hypermobility.<sup>6</sup> The concept is based on a 50-year old static paradigm.<sup>7</sup> Soft tissue asymmetry overlying the sacrum and asymmetrical motion of the pelvis moving in 3-D space on the femoral heads, does not equate with a mal-positioned ilium on a sacrum, etc. This has been detailed elsewhere.<sup>7</sup>

## EVALUATION & TREATMENT

There are in fact several types of *symmetrical/aligned*, pelvic *joint* dysfunctions, which typically fall off the clinical radar. So pelvic bone symmetry is only part of true SIJD treatment goals, and elaboration will be given on passive motion testing (spring tests/stress tests) as a very necessary, albeit neglected evaluation tool that can discern bona fide joint dysfunction in the presence of apparent “symmetry”. Several important landmarks are not evaluated in the erroneous traditional paradigm of which *alignment is perceived to equate with joint integrity*. The more common muscle energy technique (MET) which PT’s often study as the technique of choice for restoring “SIJ alignment” does not typically screen several important pelvic landmarks. The additional necessary landmarks include the posterior and the medial portion of the ischia, middle and lower 1/3 of the pubic bones, depth, height and width of the symphyseal fibrocartilage, mid portion of sacrum, sacrotuberous and sacrospinous ligaments. Traditionally, landmark palpation is performed in standing, sitting, prone and supine. The expanded palpation screen adds a very important but often neglected posture; yoga child pose. Oftentimes occult dysfunctions are encountered in this position only. By palpating these additional landmarks and developing specific micromotion spring tests, several novel and relevant, recently described dysfunctions were encountered.

The MET model taught by Greenman<sup>8</sup> and other osteopaths does encourage ligament palpation within the context of a thorough screen. This author is very appreciated for the depth of knowledge regarding osteopathic manual medicine, of which MET is one method of evaluation and treatment. Unfortunately, in many clinical scenarios an abbreviated evaluation is performed. There are several different methods of treatment within the MET model, however it appears that in the physical therapy profession, isometric contract-relax against a soft tissue barrier, not an articular barrier is the one method that is most frequently utilized. The rhythmic-impulse MET technique seems promising in treating joints,<sup>9</sup> perhaps even non-synovial joints with dense connective tissue, such as the SyP and SIJ. Research is needed in order to compare and contrast various methods.

The micromotion spring tests are important in determining (with some subjectivity) if conservative treatment is appropriate, and helps evaluate treatment changes. If severe instability is present, as identified with passive orthopedic stress tests<sup>1</sup> (AKA spring tests), surgical referral may be mandated. What can seem to be paradoxical, and perhaps counter-intuitive is that some patients with instability can and do gain stability by restoring position and movement in the

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<sup>1</sup> Tests performed manually by orthopedic surgeons and orthopedic manual physical therapists to evaluate joint function, varying from normal to grades of hypermobility/instability and of hypomobility.

*opposite* direction(s) of the instability; in the direction of blocked motion. So hyper- and hypomobility frequently co-exist much more frequently than the TM can predict. The spring tests are not esoteric and belong in the hands of all PT's. Addressing the blocked motion first is far easier than treatment initially focused on the hypermobility, as both improve with this sequence of manual intervention. As this chronic population continues to suffer, it is timely that the system of evaluation and treatment evolve.

The majority of obstetric PJD and SD cases recover within six months of delivery, yet some suffer from a severe, perplexing, debilitating chronicity. Research is needed to discern whether or not they can be helped with a novel understanding of the injury mechanics, and novel treatment. This is relevant to both acute and chronic cases, and may be relevant to those who have suffered for many years. A common misconception is that chronicity equates with untreatable instability. There actually is a strong possibility that true 3-D joint approximation maintained for a period of time, can facilitate scar tissue development and reduction of reflexive muscular inhibition. An increase in muscle tone reflexively enhances tone in ligaments, through partial insertion or fascial expansions. As part of the sum-total of neural inputs and outputs modulating muscle tone, the joint mechanoreceptors have a remarkably strong, direct influence. The body is designed to recover from injury, if given the right input.

## A CHANGING PARADIGM

The TM of manual therapy for PJD can easily be traced to the Osteopathic biomechanical model, established in the 1940's and fully articulated in Mitchell's 1958 landmark article.<sup>10</sup> Among other things, the model describes specific types of pelvic joint movement dysfunction such as anterior ilium, sacral torsion, pubic rotation, etc. The biomechanical and treatment model of nearly every other joint in the body has evolved since then. Why is it that the biomechanical and treatment model of the pelvic joints (for specific dysfunctions such as pubic bone superior/inferior shear and rotation) has essentially remained static for more than half a century? Why is it that there remains a common misperception that asymmetry is a necessary prerequisite for SIJD, when in truth the osteopathic model does acknowledge symmetrical and asymmetrical dysfunctions (Mitchell 1958), as does the NM? The model of specific dysfunctions remains essentially unchanged, regardless of various terminologies and techniques. It is encouraging to note that there are exceptions with a small number of osteopathic and physical therapy clinicians who do question the fundamental pelvic joint model of specific-named dysfunctions (anterior ilium, pubic shear, etc.).<sup>11,12,13,14 15,16</sup>

A fairly recent paradigm encourages pain evaluation as a form of permission granting to initiate treatment to the pelvic joints.<sup>17</sup> Of course, pain cannot explain biomechanical phenomenon as well as imaging tests and manual therapy examination can. Other models negate the value of manual intervention for specifically named patterns of pelvic joint dysfunction (pubic bone upslip, anterior ilium, etc.), instead treating the joints in a general manner, or not at all, such as focusing on the low back, trunk and hip.<sup>18,19</sup> However, if MET, mobilization, or manipulation is performed for chronic conditions, it is typically very brief, which often times does not provide lasting results, even if combined with exercise, SIJ support, etc. When treating PJD, the joint requires a minimum of 5 minutes or more in a single direction to truly reposition one pubic bone in relation to the other. This is due to the large mass of fibrocartilage and ligament in the SyP, which may not be adequately represented in typical anatomical texts. The SyP joint requires time-dependent viscoelastic creep, in order to induce corrective movement, unlike synovial joints that are very abruptly manipulated or adjusted with MET.<sup>20</sup> There is an

extensive lateral expansion of the ligaments, and the average female symphyseal fibrocartilage dimensions of 2-6mm width, 25-35mm height, and 10mm anterior to posterior at mid joint. For very detailed reviews see Becker<sup>21</sup> and Alicioglu.<sup>22</sup> True pubic joint motion and SIJ motion always occur together, never independently. However, either the SyP or the SIJ can in fact, be furtherer from the axis and therefore show greater excursion, and greater motion dysfunction. Caution is advised against over-interpreting asymmetry of soft tissue tone as indicative of an asymmetrical joint fixation, or of hypermobility. The term joint is much too general and imprecise when observing the *pelvis* moving asymmetrically on the hips, for example.

MET is particularly ineffective at the pubic joint, except for mild cases of PJD. MET is very effective for balancing asymmetrical muscle length/tone which can create the illusion of unilateral pubic bone asymmetry. Treatment with MET can create the illusion of joint mobilization by reducing (perhaps temporarily) asymmetry of muscle tone and create a “therapeutic joint pop”, which in truth; is most likely simply just a release of negative pressure in the adductor tendon sheath. Non-synovial fibrocartilagenous joints like the SyP do not “pop” when manipulated, whereas other proximal structures do. Decrease in pain can be noted due to the afferent barrage in the spinal cord. Unfortunately, the belief that a popping sound indicates a SyP joint correction/adjustment is best described as pervasive clinical mythology. Worse than that is the belief that if it “does not hold correction” more frequent popping/adjustment will then be required in order to create “stability.” Evaluation before and after treatment with more palpation and spring tests can be very informative regarding the success of any intervention. It is suggested that the traditional model can be greatly enhanced to the patient’s benefit.

For PJD and SD the TM utilizes palpation of the top of pubic bones (height) named the crest, and the bump named the tubercle at the upper 1/3rd. Palpation at the pubic crest and tubercles must be carefully performed with the abdominal and adductors placed in a position of slack. These pubic structures are curved, and have tendon insertions on the crest and on the tubercle. Therefore the clinician must be very careful and not rush the palpatory screen. The NM adds several additional landmarks, the middle and lower 1/3 of the pubic bones, and palpation across the pubic bones for depth of cartilage, across the top to check verticality of fibrocartilage, and inter pubic width at mid-joint (as able to).<sup>23,24</sup> Gently pushing with thumb pads using small forces on pubic bones and fibrocartilage evaluates mobility, stability and pain. The TM describes up and down malposition of a pubic bone and an upper joint rotation. The NM negates the upper rotation fixation, having discerned it to actually be a pure posterior glide fixation along the entire length, and presents 4 more common movement dysfunctions, and 2 others that occur infrequently. This may seem difficult to image, given the appearance of simplicity of this remarkably important articulation, and is certainly worth inquiry. The PJD patterns nearly always resolve with brief intervention, without lasting hypermobility, by using a low load with a fulcrum and a long duration correction, applied in a specific direction, and by focusing on all biomechanical influences to the pelvic girdle, be they proximal or distal. Chronic PJD and SD are challenging conditions and novel treatment is timely.<sup>25</sup>



## STRESS TESTS FOR OCCULT INSTABILITY

Passively stressing the ilium manually in a posterior direction, and then a lateral direction while palpating the inter-pubic width, is a very important manual screen for occult instability. This oftentimes is neglected and unfortunately, is not a standard of PT practice. This orthopedic joint test has been shown to have significant utility in the acute phase, because there is some recoil that occurs very soon after traumatic or obstetric SD.<sup>26,27,28</sup> Thus the actual damage can be occulted even with imaging, unless manual stress testing is performed. When pelvic stress tests are combined with radiographs, much greater symphyseal separation is sometimes encountered, upping the joint status to one of surgical instability.<sup>29,30,31</sup> One of the roles of manual therapists in the chronic population would be to perform stress tests and discern if significant, palpable widening occurs, even in the presence of “aligned” or symmetrical structures.

This stress test is typically performed by a single clinician, though there could be some merit in contralateral pelvic stabilization from a co-worker. Some cases of occult instability may come to light, facilitating medical referral. It appears that stress x-rays are not yet a standard of care for this population, though the argument for taking them is compelling. By incorporating the stress tests as an initial screen (without x-ray) we can help these acute and chronic cases diagnostically and we should never assume that the test has already been performed. If instability is identified, referral for stress imaging is indicated. It is important to acknowledge the limitations of stress x-rays and of the manual stress tests. These methods as described do not take into account anterior to posterior instability. Transverse plane images during stress tests are essentially unfeasible with current technological limitations of space, design, etc. In addition to the above described stress tests the author recommends an AP spring, a superior-inferior, an inferior-superior, a PA at the posterior flat portion of the ilium, an AP at the symphyseal fibrocartilage, an upper and a lower pubic spring test to screen for rotational instability.

## BIRTH AND SYMPHYSEAL DIASTASIS JOINT MECHANICS

There are no contemporary imaging studies to validate specific pelvic joint mechanics of labor and parturition. The traditional belief is that the pelvic outlet widens circumferentially which is accomplished via sacral nutation, in which the top of the sacrum moves down and forward and the sacral apex (bottom) goes back and up, allowing increase in anterior - posterior pelvic outlet dimension. There is also medial in-folding of the ilia coupled with upper SyP compression and lower SyP widening, with spreading of the sit bones (ischia) increasing medial to lateral dimension. This normative birth model is supported with bench top pelvic modeling, affirming it to be the most efficient way to increase the outlet, yet minimize damage. As the saying goes “form follows function” and “function influences form”.

Several case studies from the orthopedic and obstetric trauma literature on SD consistently present a rather remarkable CT scan pelvic image. These studies use x-ray and CT images to show SD and subsequent recoil. The unique and surprising images show a posterior glide fixation of the ilium/ilia, in addition to widening of the SIJ (fig. 2, 3). The ilia make contact with the sacrum behind the true SIJ, literally forming a new joint, in the area that contains the interosseous ligament (fig. 2). This novel behavior can be replicated with bench top modeling on a ligamented anatomical model. This can be unilateral or bilateral and may maintain the SD, if this particular aspect is not reversed (Figs. 1, 2, 3). The authors report a small amount of pathological anterior SIJ widening (millimeters), and an extreme separation at the SyP (centimeters)<sup>32,33,34,35</sup> (Figs. 1-4).



As previously stated, the articles do not elaborate on the repositioning of the ilium and sacrum, other than to describe the SIJ joint widening and the severe diastasis. They do not state the possibility that mechanics of SD differ significantly from normative birth joint widening. This affirms the novelty of the proposed theory. It appears that after the usual/normative spreading of the pelvic joints in preparation for non-traumatic birth, there is a limit to the degree in which the pelvic outlet can be further increased. Prior to SD the upper pubic joint and anterosuperior SIJ's are maximally compressed, restricting any further motion. When the SyP ruptures, motion is primarily constrained to the transverse plane, with the pubic bones initially swinging out slightly anterior, and also laterally in a cam-like manner. This cam-like motion is necessary to then allow the ilia to glide posteromedially, allowing a true or apparent anterior sacral glide and/or a sacral nutation. The ilia compress against the retro-articular portion of the sacrum, creating novel stability via a novel articulation. It is not difficult to image the posterior glide of the ilia based on the shape and angulation of the joint, which as a reasonable generalization, tapers anteriorly to posteriorly in the transverse plane throughout much of the joint. This literally eliminates the previous ilium on sacrum apposition on the articular surfaces, again stated; creating a very remarkable *new articulation* posterior to the normal articulation. *This is the key concept.*

This is a very fundamental discovery that may lead to better treatment. It may be the case that the axial ligament, which is very unique, participates in this process. It is within the interosseous ligament complex, is short, stout and has less elastin than all the other SIJ ligaments. The axial ligament may act initially as a primary strut to draw the ilia posterior and medial with or without assist of the other ligaments. As the axial ligament compresses, it might then act as a stop to constrain further excursion. This ligament traverses medial to lateral and lies right behind the SIJ at the mid joint level. This may be maintained in order to maximize pelvic outlet dimension until the birth process is completed, and then over time recoil to initialize healing. In pathological cases, the recoil may be absent or insufficient, and restoring the recoil might be a missing key to restoring stability, decreasing pain and restoring function. It has been extensively described in Bechtel's landmark study.<sup>36</sup> The proposed biomechanical model may actually be simplistic, and the true mechanics more complex than the above description. Because imaging during parturition is untenable, computer generated joint modeling may be a reasonable alternative. Hopefully, treatment will be straight-forward, regardless of injury complexity.

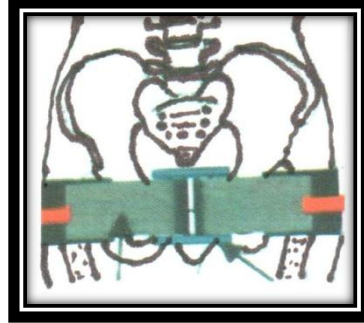
In order for the SyP joint to approximate and heal after traumatic SD, it is necessary for the ilia glide forward and lateral relative to the sacrum, reversing the traumatic SD trajectory, if the proposed model is valid. Otherwise it appears to be physically impossible for the pubic joint and the SIJ joints to fully approximate and heal. A small amount of anterior glide and medial compression at the SIJ joints is sufficient for SIJ stability. A significantly greater 3-D excursion must happen at the pubic bones, much like elongated cork-screw motion. The axis appears to be posterior, perhaps at or near the axial ligaments. This process effectively reverses the mechanics of SD and progresses on to seamlessly reverse the joint mechanics of birth. To better appreciate this reversal, review fig. 3 and try this visual and kinesthetic exercise. Hold your cupped hands 3" apart facing each other with thumbs up. Digits 1-4 in each hand represent the ilia. Now glide your hands forward and laterally to represent the glide of the ilia. Then roll the palms up as though holding a large bowl and allow the 5<sup>th</sup> fingers (representing pubic bones) to touch. This grossly approximates the reversal of the SD, and the initial birth mechanics prior to SD. It is theorized that a symphyseal gap may persist in those cases that fail to fully recoil and adequately restore the initial anterior glide of the ilia. If this NM is valid, the question of why it reduces and

allows full recovery in some, and not in others, is a research-worthy topic. The following theory is proposed: *In the chronic population of SD and PJD, perhaps manual therapy can evaluate and identify a lack of anterolateral glide of the ilia, and then restore this motion so that the SIJ and SyP can fully compress and heal, with the assistance of a fulcrum and trochanter belt. Hands-on stress/spring testing may conceivably identify cases of occult surgical instability.* For the non-surgical instabilities with posterior glide ilia fixation, a manually applied force or a fulcrum, such as an appropriately sized and positioned dense foam roll can be used to slowly restore anterolateral glide of the ilia applied before, or during circumferential belt compression.

#### TROCHANTER BINDER REPLACING SACROILIAC SUPPORT

The trochanter binder is an orthopedic standard of care for acute SD.<sup>37,38,39,40,41</sup> Note that significant reduction (4.7cm to 1.5cm)<sup>42</sup> has been reported to occur in the acute phase in a very short time frame of 4 days. Hypermobility joints typically respond readily to mild forces directed in appropriate directions, if sustained. Also, mild forces do not provoke painful reflex guarding. Next we will explore why the typical location where SI supports are applied in some populations is sometimes counter-productive and surprisingly; may actually perpetuate SD and PJD.

Research indicates that the typical application of pelvic/SIJ belts *above* the trochanters (fig. 5) is not as effective as application directly at the level of the trochanters (fig. 6).<sup>43,44,45,46</sup> This trochanter application is an accepted principle in orthopedic trauma care, and when placed higher is described as “inappropriate placement.” The orthopedic literature seems to be the only place where the trochanter placement is promoted, and validated with research. In physical therapy and rehabilitation placement is not specifically reported,<sup>47,48</sup> but the support being named a sacroiliac support implies placement below the waist, above the trochanters. Also, much of the advertising for various SIJ supports advocates the higher “inappropriate placement.”<sup>49</sup> Placing the support at the trochanters is superior regarding biomechanics and amount of therapeutic force. Studies using force transducers validates that up to 40% more compression is applied to the pelvic joints and the force is certainly much more directly in-line with the pubic joints (fig. 6).<sup>50,51,52,53</sup> This allows perhaps more comfortable application using less pressure yet receiving greater compression. This can provide hope for those who find wearing the support below the waist to be uncomfortable. The typical application below the waist actually replicates the joint forces of pregnancy and birth, specifically; the sacral nutation, in-folding of the ilia, the upper pubic joint compression, and the lower pubic bone separation. The trochanter application is optimal for pubic and SIJ compression, yet this can be a difficult sell as this author has noted. This reluctance may be based perhaps on habit, unerring trust in prior methods, marketing of traditional placement, human nature, with its inherent resistance to novelty, etc. Hopefully, educated patients and informed clinicians will increasingly promote appropriate placement of sacroiliac supports.



**Figure 5.** This is a suboptimal location for the application of an SI belt for SIJD, and especially for primary PJD, or SD. First image from [www.OPTP.com](http://www.OPTP.com), second from Bottlang 2002.

**Figure 6.** This is the optimal trochanter location for SI belt application for SIJD, and especially for primary PJD, and for SD. Image from Bottlang 2002.

## CONCLUSION

Reinterpretation of PJD and SD is timely, expanding the TM to include additional palpatory landmarks, passive stress/spring tests, evaluating and treating the recently described types of dysfunction (NM) and the use of trochanter supports. The basic science and orthopedic trauma research enhances our understanding of relevant clinical application, in addition to case studies such as in the obstetric literature. It is a minority of cases that go on to become chronic and severe, and this minority is especially in need of improved care. Ideally, improved early intervention for PJD and for non-surgical SD may facilitate successful rehabilitation for this vexatious condition. Perhaps the chronic cases can still be treated and achieve significant improvement; if there is a posterior glide fixation preventing pubic joint closure, and it is appropriately treated.

This theory seems promising and clinical research is needed to determine if this model has clinical validity, and utility. Improved understanding may facilitate early identification, optimal frequency and duration of intervention, and determine the ideal type of trochanter support, etc. The author gratefully acknowledges Dr. Kowalk's article<sup>54</sup> provided inspiration, especially his statement paraphrased, "The orthopedic trauma SD occurs from extrinsic force, and being from the outside; is very different from obstetric diastasis in which the force of trauma is from within. Thus the injuries are nearly opposite and their treatment must therefore be very different." The other studies from the orthopedic trauma literature were also very enlightening.

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<sup>4</sup> Depledge

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