The Effect of Osteopathic Manual Therapy on Somatic Dysfunction in the Equine Sacropelvic Region

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The Effect of Osteopathic Manual Therapy on Somatic Dysfunction in the Equine Sacropelvic Region: Introduction

The pelvic limb of equines is a fundamental structure for locomotion, supporting weight, and carrying out various motor activities. It is made up of a series of bones, joints, muscles, tendons, and ligaments that work together to provide stability and movement. Unlike the thoracic limb, the pelvic limb is directly connected to the axial skeleton through the sacroiliac joint that joins the ilium to the sacrum of the spinal column (Mothé et al., 2024). According to Thorensen, when the horse is in motion, the pelvis is pivotal to the forward power, with its main source of propulsion being the coxofemoral joint (Thoresen, 2006). The muscles of the pelvic area move the body forward as well as stabilize the pelvis during stance. The function of the stifle joint is to stabilize the hindlimb during stance through flexion as the large extensor muscles of the knee act to resist gravity as opposed to power locomotion. The tendons and ligaments of the tarsal area behave elastically to store and return energy to be used in propulsion. The power from the proximal hindlimbs is transferred via the sacroiliac joints to the thoracolumbar vertebral column. The forelimbs act as a pivot that moves the body forward until the hindlimbs can take over again (Thoresen, 2006).

Given the critical importance and function of the equine pelvic limb, it is inevitably subject to a range of potential issues. However, for sake of brevity, this paper will concentrate specifically on the anatomy and function of the sacropelvic area, excluding a comprehensive examination of the entire limb.

According to Thorensen, traditional veterinary methods are limited in accessing the vertebral column and the sacroiliac joints (SIJ) in order to treat or diagnose some of the potential

concerns that can arise, and due to the fact that hip joint disorders are mostly related to the muscles, osteopathy is a superior means of detecting and treating injuries in these areas (Thorensen, 2006).

Osteopathic Manipulative Treatment (OMT) holds therapeutic potential for the management of somatic dysfunction of the equine pelvis, as this approach aims to enhance joint function and alleviate discomfort through targeted interventions addressing specific anatomical and biomechanical factors. For this paper, an overview of equine pelvis anatomy will be presented along with common clinical findings associated with somatic dysfunction in the sacropelvic region. In addition, the integration of clinical evidence and case studies demonstrating positive outcomes will be discussed to further support the efficacy of OMT in improving mobility and overall equine well-being.

Osteopathic Principles and Somatic Dysfunction

After starting his career as a doctor of medicine on the frontier in the 1850s, and disillusioned with the limitations and practices of modern medicine, Andrew Taylor Still founded osteopathy in rural America at the end of the 19th century (Tuscano et. al., 2024). Osteopathy is a discipline that informs a holistic approach to health and wellbeing by emphasizing the body's self-regulatory processes and structure-function relationships. It has historically involved mostly manual treatment.

Somatic dysfunction, and its predecessor term, the ‘osteopathic lesion’, has been considered a central concept of the theory and practice of osteopathy. Somatic dysfunction has been defined as “impaired or altered function of related components of the somatic (body framework) system: skeletal, arthrodial, and myofascial structures, and related vascular,

lymphatic, and neural elements. It is proposed to be a reversible, functional disturbance that predisposes the body to disease, where manipulation is the specific and effective treatment" (Fryer, 2016). Typical diagnostic indicators for somatic dysfunction are tissue texture abnormality, asymmetry, restriction of motion, and tenderness of affected tissues. Somatic dysfunction is commonly classified as being acute or chronic. Plausible causes for the clinical signs of somatic dysfunction may be acute tissue inflammation or long-term degenerative changes. Both causes can be accompanied by neurologic and functional changes, which may relate to the acute or chronic nature of somatic dysfunction (Liem, 2016).

Brooks and Pusey use a brilliant computer analogy to clearly illustrate somatic dysfunction. They state that tissue pathology is more of a software issue than a hardware issue. To extend the analogy, osteopathy may be regarded as a sort of reprogramming, which changes the balance of signals inside the neurological system (Brooks and Pusey, 2006).

This working definition will inform the clinical findings found pertaining to somatic dysfunction in the equine sacropelvic area, and the subsequent effect of OMT.

Anatomical Overview of the Equine Sacropelvic Region

Forty to forty-five percent of the horse's weight and most of the propulsion for movement is carried by the pelvic limb. Known together as the *os coxae*, the skeleton of the pelvic limb includes the bones of the pelvic girdle: the ilium, pubis, and ischium. The right and left hip bones are joined together in the pubic symphysis, which ossifies craniocaudally, and united dorsally by the sacrum (Burdas et. al., 2009). Palpable landmarks include the tuber coxae and the tuber sacrale; the tuber ischii are found under the hamstrings and more difficult to palpate. The

acetabulum, where the femur head articulates with the pelvis through a ball and socket joint, is formed when the ischium and ilium fuse together (Burdas et. al., 2009). The sciatic nerve can cross the medial surface of the ilium, the largest of the three bones, thanks to its size. The pelvis is connected to the axial skeleton at the sacral vertebrae. The five sacral vertebrae are fused together, which creates a stable structure for attachment (Burdas et. al., 2009). One of the hey joints of the pelvis include the sacroiliac joints, which are considered synovial joints as they sit within a small synovial capsule; however, it has a much smaller range of motion than a typical synovial joint. It is uncommon in that the ilial surface has a small layer of fibrocartilage, and the sacral articular surface is the only area with hyaline cartilage. It is encircled by several fascial connections via the gluteals and hamstrings, as well as the ventral, dorsal, and interosseous sacroiliac ligaments (VSIL, DSIL, and ISL ligaments). Transferring stresses from the hindlimbs to the thoracolumbar vertebral column, it serves as the link between the pelvis and axial skeleton (White Rose Physio, 2011).

In addition, the hip joint is a synovial ball and socket joint that connects the pelvis to the femur. It is composed of the acetabulum of the hip bone, “which is deepened by the fibrous labrum along its rim,” and the femoral head, whose ligament “extends from the depth of the acetabulum to the central part of the fovea” (Budras et. al., 2009). The accessory ligament, which is a part of the prepubic tendon, inserts into the peripheral part of the fovea (Budras et. al., 2009). The hip joint aids in flexion, extension, abduction, and adduction and plays a critical role in the movement and stability of the hindlimb.

Furthermore, the femorotibial joint of the stifle is an incongruent condylar joint composed of the femur and the medial and lateral condyles of the tibia. It is “incompletely

divided by the two menisci, which are tough, fibrocartilaginous structures that compensate for the incongruence of the articular surfaces and reduce concussion in the joint" (Budras et. al., 2009). It is held together by the anterior and posterior cruciate ligaments, lateral and medial collateral ligaments, and the meniscofemoral ligament.

In addition, the femoropatellar joint, which moves in unison with the femorotibial joint, is "anchored to the femur by medial and lateral femoropatellar ligaments, and to the tibia by three patellar ligaments: medial, lateral, and intermediate;" the medial and intermediate ligaments play a significant role in the locking mechanism of the stifle (Budras et. al., 2009). The tarsus and stifle joints are mechanically linked. When the horse flexes the stifle, the hock automatically extends, and vice versa.

Correspondingly, the pelvic limb has several muscle groups that are categorized by anatomical areas as opposed to function; the following section will provide a brief overview of muscles affecting the sacropelvic area:

First, key sublumbar muscles affecting hind limb movement include the psoas major muscle, which flexes the lumbar spine at the walk, protracts and rotates the hindlimb, and flexes the hip; the psoas minor muscle, which flexes the lumbar spine and pelvis in bilateral contraction, and inclines the pelvis to the side in unilateral contraction. In addition, the iliacus flexes the lumbar spine and hip (Lejeune).

Next, superficial muscles affecting the hip joint include the superficial gluteal muscle, which flexes the hip joint and abducts the leg; the tensor fascia latae, which flexes the hip, protracts the limb, and tenses the fascia latae, extending the stifle; and the middle gluteal muscle,

which extends and abducts the leg; the accessory gluteal muscle is considered part of the middle gluteal group as it is a deeper portion of the muscle (Lejeune).

The deep muscles affecting the hip joint include the deep gluteal muscle, which extends and abducts the hip joint as it is found deep to the accessory gluteal. Originating in the internal portion of the pelvis, the internal obturator muscles extend the hip, rotate it outward, and act as a hip stabilizer. Meanwhile, the external obturator aids in outward rotation, adduction, and stabilization. Additional deep muscles affecting the hip include the quadratus femoris muscle which extends the hip, and the gemelli muscle aiding in hip supination and stabilization (Lejeune).

Another important major muscle group affecting the hip includes the hamstrings which are composed of the semitendinosus muscle, which extends the hip, stifle, and hock during weight bearing and flexes the stifle and retracts the limb when non-weight bearing. Adjacent is the semimembranosus muscle, which extends the hip and stifle during weight bearing and retracts, adducts, and rotates the limb when non-weight bearing (Lejeune).

Finally, the hip adductors include the adductor muscle, which adducts and extends the hip, and the pectineus muscle, which adducts and flexes the hip. Additional medial muscles of the thigh that aid in adduction include the gracilis muscle, which also extends the hip, and the sartorius, which flexes the hip.

Clinical Findings of Somatic Dysfunction in the Equine Sacropelvic Region

Osteopathy is based on the idea of somatic dysfunction; something has gone wrong between the body and environment sending information to the central nervous system, which processes it, and the body then produces a motor response. When there is no discernible disease mechanism, this shows up as clinical symptoms in the horse, such as stiffness, poor performance, and gait asymmetry (Thorensen, 2006).

According to Thorensen's 2006-2007 study, "Case Reports: Effect of osteopathic manipulations on performance in 374 horses with suspected sacroiliac and/or hip joint dysfunction and back pain," "374 horses with poor performance were treated exclusively with osteopathic manipulations. The majority of the horses had been examined for lameness (92%) and many had also had intra-articular medical treatment without success (78%)" (Thorensen, 2006). Thorensen's findings conclude that:

> Sacroiliac dysfunction (SID) is an important cause of poor performance in horses. The most consistent clinical symptom of poor performance is a lack of impulsion from one or both hind limbs. Changes in performance also include back stiffness, resisting jumps, subtle gait asymmetries at slow speeds during groundwork or dressage movements and in harness horses at racing speeds. (Thorensen, 2006).

In the study, 282 horses had pain associated with the SI joint area just cranial to and on top of the sacral tubers and were diagnosed with restriction of mobility in one or both SI joints:

> All of them had restriction in moving the leg in extension and at the same time the sacral tuber towards cranial and ventral, in osteopathy called "Lesion ilium dorsal", the majority on the right side. 188 also had restriction in moving the leg in adduction, and at the same

> time the sacral tuber towards lateral, called “Lesion ilium medial or in-flair”, on the same side. The most common finding was restriction of the mobility in the hip joint, uni- or bilaterally. All of them had restrictions in extension, abduction and medial rotation of the femur; all horses had thoraco lumbar epaxial muscle discomfort and spasm during palpation. (Thorensen, 2006)

This denotes a dorsally displaced ilium, which is frequently linked to limitations in the SI joint. The SI joint, which joins the sacrum to the pelvis, is essential for maintaining the stability of the hindquarters. This lesion limits pelvic mobility and leg extension, making it more difficult for the horse to engage the hindlimb correctly during propulsion. The fact that this was frequently seen on the right side suggests that the horse is loading or using its body asymmetrically, which could be an attempt to make up for other deficiencies or injuries.

These findings can be apparent through an osteopathic assessment that includes a thorough case history and a visual assessment, walk and trot-up on various surfaces, as well as the horse performing in their respective discipline under saddle.

Another key clinical finding is what Thorensen describes as “gluteal syndrome:”

> Pain can be demonstrated with digital pressure along a line between the wing of ilium and the greater trochanter of the femur. The accessory head of *M. gluteus medius* was identified as the deep structure that best corresponds anatomically to the characteristic pattern of pain. The same horses also had pain in *M. gluteus medius* from ilium to the great trochanter of the femur and also in *M. biceps femoris* just dorsocaudal to the great femoral trochanter, unilaterally or bilaterally. (Thorensen, 2006)

It is possible that the biceps femoris and gluteus medius are overcompensating for underlying joint dysfunction based on the pain patterns in these muscles. The fact that these horses felt discomfort when their bodies were palpated further supports the possibility that persistent muscle tension and spasm are at work, which can further restrict the hindquarters' range of motion and flexibility.

Moreover, in his “Sacroiliac Joint Pain and Dysfunction Webinar,” Haussler provides an overview of clinical signs of sacropelvic dysfunction which include: poor performance, low-grade or intermittent pelvic limb lameness, sensitivity to lumbosacral palpation, prominent tuber sacrale (hunter’s bump), and inconsistent gluteal muscle atrophy (Haussler, 2024).

Additionally, according to Goff et. al., clinical signs of sacropelvic dysfunction include atrophy of pelvic limb musculature, tuber coxae and tuber sacrale asymmetry, pain on palpation of the dorsal SI ligament, pain on middle gluteal palpation, and pain on dorsoventral directed force over the tuber coxae (Goff et.al., 2008).

Efficacy of OMT in Treating Equine Sacropelvic Somatic Dysfunction

Osteopathic treatment is directed at changing the signals to the neural network to modify the way sensory information is processed and thus to correct the motor response generated in the central nervous system.

Equine osteopathy offers biomechanical techniques for testing and manipulation of the ilium and sacrum as well as for the vertebrae and coxofemoral joint.

According to Thorsensen:

> 222 (79%) of the 282 horses with restriction of one or both SIJ showed a positive result after osteopathic treatment. 15 did not show a positive result after treatment.
>
> In the group that had restrictions in one or both hip joints and/or back and neck, without restriction in the SIJ, 76 (83%) had a positive result to osteopathic treatment, 16 had one treatment with unknown outcome. (Thorensen, 2006)

OMT may be a useful treatment for sacroiliac joint (SIJ) constraints, as evidenced by the fact that 222 out of 282 horses with these limits responded well to treatment (about 79%). This high success rate suggests that OMT may be beneficial for a large number of horses, hence enhancing their general health and performance. The outcomes for the group of horses with hip, back, and/or neck constraints, where 76 out of 91 (or roughly 83%) also had excellent outcomes, support the efficacy of OMT. This comparison implies that OMT produces positive results even in the absence of SIJ constraints, demonstrating its wider application for musculoskeletal problems.

Likewise, in a 1995 study of 127 cases, horses presented with back pain, non-specific, changing lameness, and back stiffness. They were also unable to carry out the tasks that were expected of them (Pusey, Colles, Brooks, 1995). 30% of cases experienced these issues for more than two years, and 71% had them for more than six months. Owners and veterinary surgeons reported that following up at least a year after the last osteopathic treatment, 95 (75%) had maintained improvement and were functioning at or above the predicted level (Brooks and Pusey, 2006).

Moreover, in a 2022 Lithuanian study titled, “Effects of osteopathic manual therapy on the autonomic and immune systems and the hypothalamus-pituitary-adrenal axis in the horse,”

researchers evaluated the effect of OMT on the nervous and immune systems by measuring the following non-invasive biomarkers: heart rate (HR), respiratory rate (RR), temperature (T) as well as measurements of blood serum cortisol concentration (BSC) and white blood cell count (WBC). The study encompassed 30 thoroughbreds randomly split into two groups - an experimental and control group - and whose biomarkers were evaluated before (p0), after (p1) and one hour after (p2) the OMT treatment for the experimental group (Vokietyte-Vileniske et. al., 2022). Even if the horse's dynamic and behavioral alterations show results right away following OMT, it is imperative to understand what physiological elements influence the living body and its systems. In this study:

> A significant increase of BSC after OMG suggests a direct influence on the HPA Axis. Also a substantial decrease of WBC indicates the immune system's response to treatment. Moreover, an observed significant decrease in HR and RR shows that the autonomic nervous system was affected by activating the parasympathetic nervous system. Based on the results obtained, it is concluded that OMT has an effect on the HPA axis and on the nervous and immune systems. (Vokietyte-Vileniske et. al., 2022)

The substantial rise in BSC following OMT implies that the HPA Axis is directly impacted. This discovery is significant since the HPA Axis is fundamental to the body's stress response. Improved function of this axis by OMT may benefit horses' general wellbeing and stress management, which can be especially helpful in high-performance or competitive environments.

Furthermore, the significant reduction in the white blood cell (WBC) count suggests that the immune system is responding well to the treatment. This implies that OMT supports a more balanced immune response in addition to aiding in the reduction of stress or inflammation. For

healing and general health, especially in horses who are prone to infections or other health problems, a well-regulated immune system is essential to homeostasis. In addition, the parasympathetic nervous system appears to have been activated based on the observed drop in both heart rate (HR) and respiratory rate (RR). This study is noteworthy because it suggests that OMT can aid in recuperation and relaxation, hence mitigating the negative consequences of stress. The horse's total physiological resilience can be improved by influencing the autonomic nerve system, illustrating that OMT has a complex effect on equine health. The holistic approach emphasizes the interdependence of multiple bodily systems, which is in line with the principles of osteopathic medicine.

Moreover, the shift in sympathetic nervous system activity in response to a painful stimuli is another physiological sign of somatic dysfunction (Sato and Schmidt, 1973). This is shown by changes in surface temperature, which infrared thermography can measure. Most people agree that normal cutaneous heat transport patterns maintain surface temperatures within 10 C throughout the body (Brooks, 2003). Acute injuries are identified as "hot spots" due to changes in local inflammation, but they are also represented as colder areas because of the sympathetic nervous system's heightened activity in reaction to pain, which acts on the arterio-venous shunts to transport blood from the surface to the muscles (Brooks, 2003). In a 2003 study looking at thermal patterns in the gluteal regions, there was a significant increase in temperature following osteopathic treatment; initially, the gluteal area was found to be significantly cooler than expected ($p<0.02$) (Brooks, 2003).

Conclusion

In conclusion, when it comes to treating somatic dysfunction in the equine sacropelvic region, osteopathic manual therapy (OMT) has demonstrated remarkable efficacy. OMT aids in the restoration of appropriate motor responses and the reduction of biomechanical constraints in the sacroiliac joint, hips, and vertebrae by modulating the neural network. The advantages of the treatment go beyond simple realignment; they also affect the immune, neurological, and autonomic systems and encourage general stress relief, improved immunity, and relaxation.

The body functions as a whole, and a dysfunction anywhere in the organism affects all other parts of the whole. Thus, an interesting finding through this research is Thorensen's hypothesis, which is that a muscular problem in the pelvic- and hip area affects the proximal muscles of the shoulder and torso directly as well as indirectly, thereby diminishing these muscles' capacity to absorb shock. As long as we can find horses with back dysfunction or SID without fore- or hindlimb lameness, the logical conclusion is that SID and/or back dysfunction is an important cause to distal lameness, maybe even the primary cause (Thorensen, 2006).

Studies like this can contribute to the growing establishment of evidence-based protocols for the use of OMT in equine healthcare as interest in complementary therapies grows.

These findings imply that OMT is a beneficial, all-encompassing method that offers both immediate and long-term advantages for musculoskeletal health in horses by enhancing mobility, performance, and overall well-being.

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