Review of the Examination and Treatment of Back and Pelvic Disorders

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Take Home Message

The spine and sacroiliac joint continue to be an area of controversy for most practitioners due to its deep location, unique anatomic features and the limited biomechanical investigations into its functional significance. The definitive diagnosis of spinal and sacroiliac joint injuries provides individual tailoring of specific treatment modalities and recommendations for rehabilitation.

Introduction

The prevalence of back problems in horses varies greatly (from 0.9% to 94%), depending on the specialization or type of practice surveyed: general practice (0.9%); Thoroughbred racehorse practice (2%); veterinary school referrals (5%); mixed equine practice (dressage, show-jumpers, eventing) (13%); spinal research clinic (47%); or equine chiropractic clinic (94%).[1] Veterinarians often have difficulties when dealing with horses that have no obvious localized pain or have vague, unspecified lameness. Neck or back problems and limb lameness are often interrelated.[2] Distal limb injuries can cause an alteration in carriage of the affected limb and altered gait, which can subsequently overwork or injure proximal limb musculature and the paraspinal musculature. Similarly, vertebral column or sacroiliac joint injuries can produce gait abnormalities, increased concussive forces, and distal limb lameness.[3] The diagnostic dilemma facing veterinarians is to decide whether the limb or the vertebral column is the primary or initial cause of the horse's clinical problem. Unless the primary cause of the back or pelvic pain is identified and treated, most horses will have recurrent back or sacroiliac joint pain when returned to work after a period of rest or a trial of anti-inflammatory medications. Nonspecific back pain is most likely related to a functional impairment and not a structural disorder. Therefore, many back problems may be related to muscle or joint dysfunction with secondary soft tissue irritation and pain generation.[4]

Physical examination of the back and pelvis

The principle goal of the physical examination of the vertebral column and pelvis is to identify if a back or pelvic problem exists and to localize the injury to either soft tissue, osseous, or neurologic structures. Traditional orthopedic and neurologic evaluations are important adjunctive assessments used to rule out other, more common, causes of lameness and neurological disorders. The spinal examination also helps to determine if the back problem is acute or chronic and if the vertebral dysfunction is segmental and

localized or regional and diffuse.

Subjective assessment and grading of back problems

Vertebral dysfunction is most often characterized by localized pain, muscle hypertonicity, reduced joint motion, and subsequent functional disability. The challenge, as with any musculoskeletal injury, is to identify the specific musculoskeletal structures affected and quantify the associated disability or altered function. The most common categorization of musculoskeletal injury consists of mild, moderate, or severe degrees. Further quantification may involve the use of a 0-10 scale in an attempt to objectively monitor changes in pain, muscle hypertonicity, reduced joint motion, or functional disability. Subjective parameters can then be assigned a numerical value that can be assessed pre- and post-treatment. The progression or regression of the individual parameters can be recorded over time since most clinical back and sacroiliac problems tend to be chronic and recurrent in nature.

Regional joint motion

Joint range of motion can be assessed either regionally via induced vertebral movements, or segmentally via motion palpation of individual vertebral motion segments. Vertebral range of motion is evaluated to detect whether a particular movement is normal, restricted or hypermobile. Regional causes of vertebral movement restrictions may include intra-articular pathology (i.e., osteoarthritis), periarticular soft tissue adhesions, musculotendinous contractures, or protective muscle spasms.

Active range of motion

The diagnostic evaluation of regional active range of motion (AROM) involves using a carrot or other treat to induce flexion, extension, and lateral bending of the neck and trunk. The willingness, coordination and amount of vertebral motion is compared bilaterally. Resistance, struggling to grasp the treat and left-to-right range of motion asymmetries are documented. Similar procedures can be used therapeutically as stretching exercises to increase neck or trunk range of motion.

Active lateral bending range of motion

The horse is positioned parallel against the stall wall to stabilize the trunk and pelvis and to provide a surface for the horse to lean against if needed during the active stretches. The positioning also helps to prevent the horse from chasing the treat holder around the stall during the evaluation. The treat is directed towards the elbow and held against the lateral girth region. The treat is then advanced along the ribs towards the stifle or point of the hip (i.e., tuber coxae). This motion assesses trunk flexibility in lateral bending. Normally, horses should be able to readily touch their nose to their stifle and hold the stretch for 5 seconds. Horses with back pain or stiffness will not be able to reach their nose pass their elbow, and notable left-to-right asymmetries in range of motion will be seen if a back problem only affects structures on one side of the body. The distance of

the nose from the stifle can be measured (e.g., 10 inches or able to reach the 15th rib) and changes assessed over time.

Active flexion range of motion

A treat is directed cranially between the forelimbs and towards the front feet. This motion assesses flexion flexibility of the mid to lower neck and withers. The broad attachment of the nuchal ligament to the dorsal spinous processes of the withers and the caudal continuation as the supraspinous ligament induces elevation of the withers and trunk when the head and neck is lowered.[5] The clinician needs to place a hand on the ipsilateral carpus to prevent knee flexion during the range of motion assessment. Normally, horses should be able to readily touch their nose between the front feet and hold the stretch for 5 seconds. Horses with pain or stiffness in the withers or back will not be able to reach their nose to their front feet and will flex one or both of their knees to compensate while reaching for the treat.

Passive range of motion

Passive range of motion (PROM) is assessed by measuring the amount and characteristics of joint motion beyond the active joint ranges of motion. These procedures require muscle relaxation so that passive joint motion can be induced and evaluated. However, there may be a high risk of injury if the excessive forces are applied to the body regions, without protective muscle tone. This is especially true when evaluating joint range of motion while under sedation or anesthesia. Most passive joint range of motions are assessed segmentally in nonsedated horses with more refined and detailed motion palpation techniques (see later section).

Active assisted range of motion

Active assisted range of motion (AAROM) or spinal reflexes are often assessed with firm pressure applied to specific body regions that secondarily induce characteristic vertebral column movements. Diagnostically, the induced movements are graded as reduced, normal, and exaggerated. Therapeutically, the induced movements are often held for a set period of time to induce stretch of hypertonic muscles and creep relaxation of shortened connective tissue (i.e., fascia or ligaments), or to strengthen weak or uncoordinated agonist muscles via isometric or concentric contractions.

Wither elevation

Firm pressure applied along the ventral midline at the level of the sternum and cranial linea alba will induce elevation of the withers via isometric contraction of the thoracic portion of the serratus ventralis muscle. Pressure is applied with the fingertips or fingernails of one or both hands. Normally, horses will readily elevate the withers and mid-thoracic vertebrae (T7-T17) approximately 3-4 cm and hold the position for 5-10 seconds. Horses with cranial thoracic pain or stiffness will not be able to elevate the withers and will resent the applied pressure. Caution needs to be applied to horses with

girth sensitivity or pain, since they often resent the applied pressure and may kick out with a hind limb. This exercise is often indicated therapeutically to induce relaxation of a hypertonic spinalis muscle associated with poor saddle fit (i.e., too narrow of a tree).

Trunk elevation

Firm pressure applied bilaterally along the muscular groove between the biceps femoris and semitendinosus muscles induces elevation of the back via isometric contraction of the rectus abdominis and iliopsoas muscles. The muscular groove is located approximately 10 cm lateral to the base of the tail. Pressure is applied bilaterally with equal pressure from the fingernail of the index fingers (or needle caps if needed). A variation of the technique involves the application of firm manual compression at the sacrocaudal junction; however, the response is often less consistent or dramatic. Normally, horses should readily elevate the thoracolumbar spine (T12-L5) approximately 10-12 cm. The induced movement should be controlled and coordinated, and easily held for 20-30 seconds. Horses with back pain or stiffness will not be able to elevate the trunk and will resent the applied pressure. Other horses may immediately flex their pelvis and slightly hop upwards on the hind limbs or step away from the applied pressure. This exercise is similar to muscular efforts required during collection while performing certain dressage movements. This exercise is often indicated therapeutically to induce relaxation of the thoracic or lumbar longissimus muscle hypertonicity associated with back pain, poor collection and coupling of the lumbosacral region, and lack of impulsion from the hind limbs.

Spinal reflexes

Firm pressure applied unilaterally along the length of the longissimus muscles will induce localized contraction of the stimulated back or croup musculature. Light pressure with a needle cap or ballpoint pen is applied either along the long axis of the spine or transversely across the longissimus or middle gluteal muscles. There seems to be some confusion as to the clinical significance of the observed response to the applied stimuli. Some clinicians place significance on exaggerated or rapid movement away from the applied pressure, which is believed to be indicative of muscle pain. However, horses often have differing amounts of skin sensitivity or inconsistent responses to various stimuli, which may not be reliable indicators of back pain.[6] Some clinicians believe that resistance or lack or movement away from the applied pressure is clinically significant and indicative of severe muscle guarding or pain and the horse is unable or unwilling to move its back despite the applied pressure. In the author's opinion, the procedure often appears to be an unnecessary and noxious stimulus for most horses with back pain. Other, less noxious, means of assessment are more informative in most horses with back pain. The procedure should be reserved for very stoic horses, where a question exists about the ability to actively lateral bend or flex and extend the trunk.

Blunt pressure applied unilaterally to the epaxial musculature will induce three characteristic and repeatable spinal reflexes. The first portion of the reflex occurs as a stimulus is applied to the saddle region (T10-L3). Normally, the horse will respond with

an induced contralateral lateral bending and extension of the trunk away from the applied stimuli. Horses with back pain may have an exaggerated response and will rapidly and dramatically move away from the applied stimuli. Other horses, presumably due to excessive muscle guarding or nervousness, will not move away from the applied stimuli and will resist moving their trunk in the characteristic pattern of contralateral lateral bending and extension. The second portion of the reflex occurs as a stimulus is continued along the cranial croup region (L4-S3). Normally, the horse will respond with an induced extension of the lumbosacral joint. Horses with back pain may have an exaggerated response and will rapidly and dramatically move away from the applied stimuli. Horses with hypertonic or injured iliopsoas muscles would theoretically resent any induced extension of the lumbosacral junction due to secondary stretching of the iliopsoas muscles. The third portion of the reflex occurs as a stimulus is continued along the caudal croup region (S4-tuber ischii) along the muscular groove between the biceps femoris and semitendinosus muscles. Normally, horses will respond with an induced flexion of the lumbosacral joint and ipsilateral lateral bending of the trunk towards the applied stimuli. Horses with back pain may have an exaggerated response to the applied stimuli and will rapidly and dramatically immediately flex the pelvis and step away from the applied pressure. Bilateral application of pressure in the same location will induce flexion of the lumbosacral joint without lateral bending, as described above.

Soft tissue palpation

Any palpation of the musculoskeletal system requires a quiet and cooperative patient. Horses that are moving around and not willing to stand quietly are difficult to fully assess for back problems. The horse's response to being approached and its anticipation of palpation is often used as an indication of potential back pain or hypersensitivity. Many owners will report a change in behavior (i.e., pinned ears, swishing tail) as a horse with back pain anticipates being touched or having the saddle placed on the back. Other complaints include a newly developed sensitivity to being groomed in one particular location on the trunk. The hallmarks of vertebral segment dysfunction include localized pain, stiffness and abnormal paraspinal muscle tonicity.[7]

Palpation is often a reliable technique used to localize and identify soft tissue and osseous structures for changes in texture, tissue mobility, or resistance to pressure.[8,9] The soft tissue layers are evaluated from superficial to deep without simply increasing digital pressure but also shifting attention with discrete palpatory movements. Shapes of structures, transitions between structures and attachment sites may also be palpated.[4] Soft tissue texture and mobility can be compared between the skin, subcutaneous tissues, thoracolumbar fascia, and muscle.

Skin and subcutis

Acute back pain and inflammation will produce local areas of palpable heat, whereas chronic back problems can be identified by focal regions of colder temperatures, relative to the surrounding or contralateral tissues. Thermography provides an objective measure of temperature variations within the superficial tissues of horses with back problems.

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The hair, epidermis, dermis and subcutaneous tissues should be evaluated systematically with detailed palpation and observation for potential contributing factors to back pain or discomfort. The hair coat is evaluated for changes in hair texture or alopecia, which are often indicative of abnormal saddle or blanket wear. Asymmetric dirt or sweat patterns after removal of the saddle pad are also important indicators of poor saddle fit. A common presenting complaint for horses with back problems include localized sensitivity to routine grooming or brushing. The skin around the withers should be evaluated for evidence of acute injuries associated with poor saddle fit or improper blanket wear, which are characterized by localized hair loss, open skin lesions (saddle galls) and signs of inflammation. Chronic saddle fit or blanket wear lesions are identified by the presence of white hairs and scar tissue over the dorsal or lateral aspects of the withers. In some horses, localized sites of edema or hives may occur after riding with a poor fitting saddle or pad.[6] The epidermis should be evaluated for scabs, scrapes, lacerations, fly bites (ventral dermatitis), sarcoids, and dermatophilus (rain scald), which may be primary causes of back pain or are irritated with saddle or girth placement. The dermis is palpated over the trunk region for eosinophilic granulomas or melanomas. Eosinophilic granulomas may regress spontaneously, or enlarge and become ulcerated with continued friction in the saddle region. The subcutaneous tissues are palpated for edema or cellulitis, masses, fat deposits, and the mobility of the skin over the underlying loose connective tissue. Chronic scar tissue, adhesions, and fibrosis may produce back pain if the affected tissues are restricted or pulled on during locomotion or trunk movements. Blood vessels, nerves, and lymph nodes are important structures that reside within the subcutaneous tissues.

Connective tissue palpation

Connective tissue structures, such as the fascia and ligaments, are systematically evaluated for clinical signs of acute or chronic injury. The dense connective tissue that forms the superficial and deep fascia is systematically evaluated for masses, rents, scar tissue, and tonicity. The overlying skin and subcutaneous tissues are gently mobilized by a firm, broad contact. The superficial fascia is assessed for smoothness and uniform tonicity or compliance. The superficial fascia typically forms a superficial covering over muscles, whereas the deep fascia forms folds of connective tissue between muscle bellies and anchors to deeper osseous structures. Severe or deep trauma to the myofascial tissues (e.g., kicks, deep lacerations, or abscesses) can produce residual fibrosis that limits adjacent muscular movements and fascial extensibility. The thoracolumbar fascia is the most prominent fascia of the trunk and is particularly evident at the thoracolumbar junction as it blends medially with the supraspinous ligament. In the lumbar region, the thoracolumbar fascia attaches to the cranial aspects of the tuber sacral and iliac wing, deep to the overlying middle gluteal muscle.

Spinal ligaments

The spinal ligaments are systematically palpated for masses, fiber disruption, fibrosis, and signs of desmitis (i.e., swelling or pain). The nuchal ligament forms a broad attachment to the dorsal apexes of the spinous processes of the withers, and continues

caudally as the supraspinous ligament. The supraspinous bursa lies between the nuchal ligament and the T3-T5 dorsal spinous processes. The supraspinous bursa is not normally palpable, unless distended or possibly infected (i.e., fistulous withers). Firm digital pressure is applied dorsally and laterally to the nuchal and supraspinous ligaments and ligamentous attachments at the dorsal spinous processes. The entire length of the supraspinous ligament is palpated by lateral compression between the index finger and thumb. The induction of spinal flexion will cause the supraspinous ligament to be more prominent and readily palpable.

Pelvic ligaments

Unfortunately, most of the pelvic ligaments are inaccessible due to their location deep to the gluteal musculature or within the acetabular region of the hip. The dorsal portion of the dorsal sacroiliac ligament and the caudal portion of the sacrosciatic ligaments are the only palpable ligaments of the pelvic region. The dorsal sacroiliac ligaments are palpable in the croup region as two large round ligaments that originate on the caudal aspect of the tuber sacrale and converge caudally on the sacral spinous processes. Firm digital pressure is applied dorsally and laterally to the dorsal sacroiliac ligaments, bilaterally and individually to lateralize any localized pain or swelling, indicative of desmitis. The caudal attachment of the sacrosciatic ligament at the tuber ischii is palpable and should be evaluated for pain and symmetry in tonicity. Horses that consistently carry their tail off to one side or have a history of sacral fractures may have palpable difference in sacrosciatic ligament tonicity. The trochanteric bursa is located between the tendon of the accessory gluteal muscle and the greater trochanter of the femur. Like other bursae, the trochanteric bursa is not palpable unless inflamed or distended. Trochanteric bursitis often presents as upper hind limb lameness and not as a back problem.

Muscle palpation

The trunk and pelvic musculature is evaluated systematically from superficial to deep with detailed palpation of abnormal muscle tonicity, pain, or fasciculations. Muscle palpation is done with light but firm pressure applied by a broad contact with the entire hand, not only the finger tips, which may unduly localize the applied pressure and precipitate a pain response (i.e., false positive). Regional muscle tone and development of the neck, trunk and proximal limb musculature is assessed and compared left-to-right. Muscles are then individually identified and evaluated for masses, fibrosis, swellings, or depressions. Individual muscles and their attachments are assessed unilaterally and then compared bilaterally for tonicity and the response to manual palpation (i.e., sensitivity). Local or regional alterations in temperature or texture are carefully palpated for signs of active inflammation.

Muscle development

Muscle evaluation begins with observation and palpation of the neck, shoulder, pectoral, wither, trunk, gluteal, and thigh muscle development and symmetry. Muscle atrophy can be due to partial or complete denervation, disuse, malnutrition, or immune-mediated

disorders.[10] Obese horses are often difficult to palpate due to poor muscle development and indistinct myofascial borders. Epaxial muscle development is assessed by laying a hand transversely across the longissimus and middle gluteal muscles. Horses with exceptional back muscle development should have a palpable convexity or outward curvature of the muscles along the entire distance from the withers to the croup. Deconditioning or poor flexibility may contribute to epaxial muscles that are palpably flat between the dorsal spinous processes and the ribs laterally. Horses with chronic back problems or poor saddle fit will have a palpable concavity or inward curvature of the epaxial muscles at the withers or along trunk. Asymmetries in muscle development may be palpable cranial-to-caudal, medial-to-lateral, or left-to-right. The thoracic portion of the spinalis muscle is the most commonly affected muscle in the wither region. The longissimus muscle is the most commonly affected trunk muscle. The middle gluteal and the vertebral portions of the biceps femoris, semitendinosus, and semimembranosus muscle are common areas to visualize or palpate muscle asymmetries in the pelvic region.

Muscle tonicity

The general muscle tone varies between horses and breeds. Nervous or excited horses will have overall increased muscle tone, whereas stoic, depressed, or systemically ill horses will have reduced or sometimes flaccid muscle tone. Arabians tend to carry more muscle tone, whereas, most Warmbloods or draft breeds will allow deep palpation of their generally relaxed muscles. Muscle tonicity is an indirect measure of muscle activity or contraction. Electromyography (EMG) provides a direct assessment of muscle activity; however, it is not readily available in most clinical situations and it is often difficult to perform and interpret.[10]

Muscle tonicity is categorized as hypotonicity, normal tonicity and hypertonicity. Normal epaxial muscles are not contracted in a quietly standing horse, but are relaxed and quite malleable. Muscle hypotonicity or flaccidity is indicative of neuropathies, such as disuse or denervation atrophy. Muscle hypertonicity is the most commonly palpable abnormality in horses with acute or chronic back problems. Muscle hypertonicity can have either neural or myopathic origins.[10] Generalized muscle hypertonicity may effect a small portion of a muscle (i.e., trigger point), an entire muscle belly, or a regional group of muscles. Muscle spasms are an acute, severe form of muscle hypertonicity, with substantial pain and loss of muscle function. Detailed palpation and a thorough knowledge of muscular anatomy will help to identify which muscle or muscles are primarily affected, and which adjacent muscles are likely to have secondary guarding due to common biomechanical or neurologic factors. In general, localized muscle hypertonicity is considered an acute or primary back problem whereas, regional longissimus muscle hypertonicity is often associated with a chronic hind limb lameness or systemic disease.

Trigger points are characterized as localized bands or foci of muscle contracture and pain within a muscle belly.[11,12] Muscle contractures are not associated with normal neural firing and subsequent depolarization of the muscle membrane.[10] Trigger points occur in

consistent and predicable locations, presumably due to alterations in local muscle function due to changes in posture or biomechanics. In horses with back or pelvic problems, focal hypertonic muscle bands with a lower pain pressure threshold (i.e., increased sensitivity) can often be found in the middle gluteal muscle. The clinical significance of trigger points in the middle gluteal muscle is difficult to determine since they do not always correlate with the presence or severity of lameness or back problems.

Muscle spasms or splinting is characterized as involuntary, pronounced and unremitting muscle contractions in response to severe and unrelenting pain (e.g., colic) or metabolic disturbances (e.g., electrolyte imbalances or exertional rhabdomyolysis). Horses with acute or severe back pain may present with muscle splinting; however, other underlying medical conditions that may be more life threatening or critical need to be ruled out immediately. Muscle splinting severely restricts the ability to evaluate trunk mobility and the palpation of underlying soft tissue structures. Therefore, medical treatment of the primary problem or the administration of muscle relaxants is often required before a complete evaluation of the vertebral column can be accomplished.

Muscle pain

The assessment of muscle pain is often subjective and is dependent on the evaluator's tactile skills and interpretation of clinical significance. The clinical assessment of acute versus chronic pain is relatively straightforward; however, determination of the exact etiology and appropriate treatment regime are diagnostically challenging. Acute muscle pain is characterized by heat, firm swelling or edema, substantial hypertonicity and pain, and dysfunction of the affected muscle region. Acute muscle pain may be due to direct trauma (e.g., kick or other blunt trauma) or metabolic disorders (i.e., exertional rhabdomyolysis). The thoracic portion of the spinalis muscle is a common site of muscle pain; associated with a poor fitting saddle (i.e., too narrow of a tree). Chronic muscle pain has a more neurogenic basis and is due less to direct inflammatory mediators.

Horses with acute sacroiliac joint injuries may have localized sensitivity to palpation of the gluteal musculature and surrounding soft tissues in the dorsal croup region.[13] Protective muscle spasms may be palpated in the adjacent middle gluteal musculature and the vertebral portions of the biceps femoris, semitendinosus, and semimembranosus muscles. A localized region of edema may occasionally be palpated over the lumbosacral junction;[14] however, this is not a specific finding related to sacroiliac joint injury.

Muscle fasciculation

Muscle fasciculations are usually indicative of profound muscle weakness, electrolyte imbalances, or primary muscle pathology. Although, muscles may fasciculate at characteristic locations distant to an area of palpation.[6] In humans, this is indicative of referred pain, which is difficult to truly assess in horses due to the lack of verbal feedback. In horses with back or gluteal muscle pain, it is common to find areas of muscle fasciculations in the mid-lumbar longissimus muscles when firm, localized pressure is applied to hypertonic or painful areas (i.e., trigger points) within the middle

gluteal muscles. This is an intriguing response since the motor innervation of the reactive lumbar longissimus muscles is provided segmentally by dorsal branches of the spinal nerves of L2 to L4; and the middle gluteal muscle is innervated by ventral branches of the spinal nerves that contribute to the cranial gluteal nerve (L6-S2).

Osseous palpation

Osseous palpation involves evaluating osseous structures for pain, morphology, asymmetries and alignment. Individual thoracic, lumbar and sacral spinous processes are palpated for a painful response with firm digital pressure applied to the osseous structures of the dorsal midline.[15] Typical signs of discomfort include tossing the head upwards, extension of the back or withers away from the applied pressure, or localized secondary muscle spasms. Algometry (pain pressure thresholds) of osseous landmarks provides an objective measure of bony pain and allows monitoring of the effectiveness of treatment protocols. Normal algometry values for osseous landmarks are higher than soft tissue values, and typically exceed 30-40 pounds/cm^2. Horses with bone pain often have osseous algometry values less than 10 pounds/cm^2.

Dorsal spinous processes

The morphology of individual dorsal spinous processes are compared to adjacent spinous processes. It is common to palpate seemingly higher, wider, or laterally displaced dorsal spinous processes. However, unless there is also localized pain or muscle hypertonicity adjacent to the affected dorsal process, then the spinous process deviation is probably not clinically significant. Individual spinous process deviation is common, but it is not often associated with spinous process fracture or vertebral malposition (i.e., bone out of place), as is commonly thought. Overlapping or malaligned dorsal spinous processes are often caused by spinous process impingement, developmental asymmetries in the neural arch, or isolated dorsal spinous process deviation of unknown etiology.[16,17] Palpably taller or wider dorsal spinous processes occur presumably due to avulsion fractures or osseous proliferation within or at supraspinous ligament insertion sites (i.e., enthesiopathies). Radiographs, ultrasonography, and scintigraphy are useful modalities to document the cause of palpable differences in dorsal spinous processes.

Tubera sacrale

The tubera sacrale of the pelvis are palpated for height asymmetries and pain response to manual compression. Unilateral or bilateral prominence of the tuber sacrale may be noted, but are not usually clinically significant unless associated with clinical signs of localized pain or inflammation or positive findings on diagnostic imaging (e.g., scintigraphy). In acute sacroiliac injuries, asymmetry in gluteal muscle development is uncommon, unless pronounced osseous pelvic asymmetry is also present. Firm digital pressure applied to the dorsal aspect of the tuber sacrale has been reported to produce a variable and inconsistent pain response.[18] In the author's opinion, dramatic and consistent pain responses have been produced in affected horses with specific

provocation tests that are useful to establish a presumptive diagnosis of sacroiliac joint injury or pelvic stress fractures. The procedure involves simultaneous manual compression of the dorsal aspects of both tuber sacrale, which induces a bending moment on the iliac wing and presumably compresses the sacroiliac articulations (Fig. 8). Normally, horses will not have any response or only a mild response to the applied pressure. Mild contraction of the lumbar longissimus muscles and slight extension of the lumbosacral joint is normal for most horses. Acutely affected horses may have a dramatic reaction to this manipulation and will demonstrate severe longissimus muscle contractions and sudden collapse of the hind limbs which is indicative of pelvic injury or sacroiliac joint pain.[6] Practitioners should gradually apply increasing pressure since affected horses may actually collapse in the hind limbs and fall to the ground if excess force is applied to the painful tubera sacrale. This test is not specific for sacroiliac joint pathology, as horses with incomplete or stress fractures of the ilial wing may respond even more dramatically to the applied pressure.

The apex of the second sacral spinous process is a reliable landmark used to evaluate relative tuber sacrale displacement. Normally, the dorsal apices of the tubera sacrale and the second sacral spinous process lie in close apposition and follow the contour of the croup. Using palpation, ultrasound, or radiographs, a physical discrepancy in height can often be identified between the dorsal profile of the sacral spinous processes (which should remain constant, unless fractured) and the potentially ventrally or dorsally displaced unilateral or bilateral tubera sacrale. In this manner, either unilateral (i.e., tuber sacrale height asymmetry) or bilateral tuber sacrale displacement (i.e., hunters' or jumpers' bumps) can be diagnosed, depending on if one or both tuber sacrale are elevated relative to the apices of the sacral spinous processes. Tuber sacrale height asymmetry is evident in sacroiliac joint subluxation (the higher side is affected) and complete ilial wing fractures (the lower side is affected). Bilateral tuber sacrale displacement has an unknown clinical significance and may be present in many high-level competition horses.[14] Theoretically, the hunters' or jumpers' bumps may provide a longer lever arm for the strong longissimus and thoracolumbar fascia to produce extension at the lumbosacral joint, resulting in increased impulsion and range of hind limb motion with subsequent improved performance.

Pelvis

Lateral compression of the tuber coxae and tuber ischii is indicated in horses with acute pelvic lameness to help rule out complete pelvic fractures. Palpation or auscultation of the dorsal pelvic region during repetitive side-to-side movements also assist in the diagnosis of pelvic crepitus. Normally, the tubera sacrale move in unison during locomotion. A palpable or visible independent movement of the tuber sacrale at a walk or during treadmill locomotion is indicative of sacroiliac joint luxation or a complete pelvic fracture. Horses with acute sacroiliac joint injuries may also resent flexion of the contralateral hind limb. Rectal palpation is also indicated to assess osseous morphology (e.g., displaced fracture fragments or callous) and soft tissue pain or swelling (i.e., hemorrhage) in horses with suspected pelvic fractures.

Segmental joint motion

A vertebral motion segment is the functional unit of the spine and includes two adjacent vertebrae and the associated soft tissues that bind them together. To utilize palpation in the evaluation of the musculoskeletal system fully, an understanding of how joint motion is assessed is required.[4] Joint motion can be categorized into three zones of movement: physiologic, paraphysiologic and pathologic. The physiological zone of movement includes both active and passive ranges of motion and is the site where joint mobilization is applied. Moving an articulation from a neutral position first involves evaluating a range of motion that has minimal, uniform resistance. As the articulation is moved toward the end of that range of motion, there is a gradual increase in the resistance to movement (i.e., joint end feel). End range of motion starts when any change in resistance to passive joint manipulation is palpable. Joint end feel is evaluated by bringing the articulation to tension and applying rhythmic oscillations to the joint to qualify the resistance to movement. The normal joint end feel is initially soft and resilient and gradually becomes more restrictive as maximal joint range of motion is reached. A pathologic or restrictive end range of motion is palpable earlier in passive joint movement and has an abrupt, restrictive end feel when compared with normal joint end feel. The paraphysiological zone of movement occurs outside the joint's normal elastic barrier and is the site of joint cavitation and manipulation. The anatomical barrier of the joint marks the junction of the paraphysiologic and pathologic zones of movement. The pathological zone of movement lies outside the limits of normal anatomic joint integrity and is characterized by joint injury (e.g., sprain, subluxation, or luxation).

Combining the evaluation of segmental joint range of motion and the presence or absence of pain at the extremes of motion, diagnostic interpretations can be implied.[19] Normal joint motion is painless, suggesting that articular structures are intact and functional. Normal joint mobility that has a painful end range suggests that a minor sprain of the associated articular tissues is present. Painless joint hypomobility suggests that a contracture or adhesion is present. Painful hypomobility suggests an acute strain with secondary muscle guarding. Painless hypermobility may indicate a complete rupture and a painful hypermobility suggests a partial tear of the evaluated structure.

Motion palpation

Motion palpation is used to evaluate each individual vertebral and pelvic articulation for loss of normal joint motion and overall resistance to induced motion. The goal of palpating joint movement is to evaluate the initiation of motion resistance, the quality of joint motion and end feel, and the overall joint range of motion (ROM). Similar palpatory findings can be noted in other soft tissues such as skin, connective tissue, muscles or ligaments.[8] Each vertebral segment is evaluated for altered motion palpation findings in flexion and extension; right and left lateral flexion and right and left rotation. Segmental causes of vertebral movement restrictions include soft tissue (e.g., capsular fibrosis, muscle spasms or contractures) and osseous (e.g., malformations, osteoarthritis, ankylosis) pathologies. Vertebral segments with altered motion palpation findings (i.e., joint stiffness) can occur with or without localized muscle hypertonicity and pain.

Comparisons of motion palpation findings pre- and post-manipulation or stretching exercises are made to evaluate the vertebral motion segment response to treatment.

Wither motion palpation

Lateral forces are applied to individual dorsal spinous processes of the withers (T3-T12) to assess lateral bending and rotation of individual thoracic vertebral motion segments. The practitioner stands facing the withers. To stabilize the cranial and caudal vertebral segments, the base of both hands are applied to the ipsilateral surface of the adjacent spinous processes to the vertebra evaluated. The index fingers contact the contralateral surface of the dorsal spinous process to be assessed. A compressive force is applied between the index fingers and base of the hands to induce slight rotation of an individual thoracic spinous process. Normally, 3-4 mm of spinous process movement is palpable, without any evidence of pain or muscle spasms in response to the applied force. In horses with wither discomfort due to poor saddle fit, an obvious pain response (e.g., a rapid elevation of the head, depression of the withers) and local muscle hypertonicity will be precipitated with the applied pressure. In chronic forelimb lameness (e.g., laminitis), individual spinous process motion will not be detectable, and the entire withers will move as a unit due to presumed chronic fibrosis and muscle guarding.

Trunk lateral bending motion palpation

Lateral forces are applied to individual dorsal spinous processes of the trunk (T13-L6) to assess lateral bending and rotation of individual thoracolumbar vertebral motion segments. The practitioner stands facing the trunk. The base of the tail is grasped in the caudal hand, which provides side-to-side motion during the procedure. The base of the cranial hand is positioned against or between the spinous processes of interest. A lateral bending moment (i.e., wiggle) is induced as the cranial hand rhythmically pushes laterally and the caudal hand pulls laterally. The cranial hand is repositioned at the sequential dorsal spinous processes from cranial to caudal in order to assess lateral bending and rotation at individual thoracolumbar vertebral segments. Normally, a slight springy end feel of joint motion is palpable at each motion segment, without any evidence of pain or muscles spasms in response to the applied force. In horses with back problems, restricted vertebral motion or stiffness is palpable and there is evidence of local pain and muscle spasms in response to the applied pressure. In general, acute or primary back problems produce segmental stiffness, pain, and muscle hypertonicity. Chronic or secondary back problems produce regional stiffness, pain, and muscle hypertonicity or atrophy.

Trunk flexion-extension motion palpation

While standing on an elevated surface, ventrally directed forces are applied rhythmically over individual dorsal spinous processes to assess flexion and extension of individual thoracolumbar (T13-L6) vertebral motion segments. The palm of one hand is placed over the dorsal aspect of the spinous process of interest. The other hand grasps the wrist and both hands apply a ventral force equally. An extension moment and rebound flexion (i.e.,

bounce) is induced as the hands rhythmically push ventrally. The hands are repositioned at sequential dorsal spinous processes from cranial to caudal. Normally, a slight springy end feel of joint motion is palpable at each motion segment, without any evidence of pain or muscles spasms. In horses with back problems, restricted motion or stiffness is palpable and there is evidence of local pain and muscle spasms in response to the applied pressure.

Lumbosacral flexion-extension motion palpation

Ventrally directed forces are also applied rhythmically over the tuber coxae to induce extension of the sacroiliac and lumbosacral articulations. The practitioner stands facing the pelvis. The fingers are placed over the dorsal aspect of the tuber coxae to induce the ventral motion. A normal response to the induced movement is fluid vertical motion of the lumbosacral region with 1-2 cm of dorsoventral displacement over the lumbar dorsal spinous processes. Horses with pelvic or lumbar dysfunction will have a noticeable pain response, resent the induced movement, or will have protective gluteal or sublumbar muscle spasms that limit the induced movement. The vertically directed force primarily induces movement at the lumbosacral junction, but sacroiliac joint motion and potential injury must also be differentiated with this procedure.

Sacroiliac ligament stress tests

The sacroiliac ligaments are not readily palpable in horses; however, specific applied forces to the pelvic prominences (i.e., tuber sacrale, tuber coxae, or tuber ischii) or the sacral apex can provide an indirect method to assess the structural and functional status of the supporting ligaments.

Dorsoventral sacroiliac ligament stress tests

Sacroiliac ligament injury can be identified by rhythmically applying a ventrally directed force over the lumbosacral dorsal spinous processes in an effort to stress the supporting sacroiliac ligaments. This procedure requires the practitioner to get up on an elevated surface (i.e., mounting block) so that the two separately applied forces can be directed vertically over the L6 and S2 dorsal spinous processes, respectively. Horses with sacroiliac ligament injuries would be expected to resent the induced movement over the L6 dorsal spinous process since it specifically stresses the interosseous sacroiliac ligament (i.e., ligamentous sling of the sacropelvic junction). Horses with lumbosacral vertebral joint dysfunction (i.e., localized pain, reduced joint motion and muscle hypertonicity without structural pathology) may also resent this procedure. Rhythmically applied ventrally directed forces over the dorsal spinous processes at the sacrocaudal junction would be expected to specifically stress the dorsal portion of the dorsal sacroiliac ligament. A positive response to this test combined with positive ultrasound findings of desmitis of the dorsal sacroiliac ligament would be highly suggestive of clinically significant dorsal sacroiliac ligament injury.

Lateral sacroiliac ligament stress test

Sacral apex deviation can be assessed by applying simultaneous, but opposite directed, lateral forces to the tubera sacrale and the sacrocaudal junction. Sacroiliac joint or ligament injuries can be also localized by evaluating pain and ligamentous laxity in the sacroiliac joint. These procedures are similar to valgus-varus stress tests used to evaluate the collateral ligaments of the distal limb articulations. Caution should be taken to not apply excessive force due to the long lever arm action of the sacral apex on the sacroiliac ligaments, which can unduly stress unstable or partially torn ligaments or aggravate an acutely inflamed sacroiliac joint. The proposed mechanism of action of these tests are to use the base of the tail and sacrum as a handle to apply a lateral (horizontal plane) stress to the sacroiliac joint as the wing of the ilium is stabilized.

The technique involves two parts. First, the base of the hand closest to the horse's head is placed over the lateral aspect of the tuber sacrale. The hand closest to the tail grasps the base of the tail head (Cd2-3). The sacroiliac joints are then evaluated as firm pressure is simultaneously applied by both hands; pushing with the hand at the tuber sacrale away from the examiner and pulling with the hand at the tail head toward the examiner. Theoretically, this maneuver produces compression of contralateral sacroiliac articular surfaces and distraction of the ipsilateral sacroiliac articular surfaces.

The second portion of the technique involves repeating the procedure and reversing the direction of the applied forces. The fingers of the hand closest to the horse's head are placed over the contralateral tuber sacrale and the base of the hand closest to the tail is placed against the ipsilateral base of the tail head (Cd2-3). The sacroiliac joints are again evaluated as firm pressure is applied by both hands; pulling with the hand at the tuber sacrale toward the examiner and pushing with the hand at the tail head away from the examiner. Theoretically, the contralateral sacroiliac articular surfaces are distracted and the ipsilateral sacroiliac articular surfaces are compressed. A pain response to the induced movements may be identified either unilaterally or bilaterally, depending on the extent of inflammation or injury present. In general, sacroiliac joint compression would be expected to aggravate osteoarthritic changes, whereas joint distraction would be expected to stress any injured or inflamed sacroiliac ligaments.

General treatment recommendations

The proposed treatment of back and sacroiliac joint injuries is only as good as the diagnosis. Since definitive diagnosis of back and sacroiliac joint pathology remains difficult at times, treatment recommendations are usually supportive and non-specific. Treatment regimes are often extrapolated from treatment recommendations for similar acute or chronic disease processes in other articular locations. Very few studies have investigated the efficacy of specific treatment recommendations for back or sacroiliac joint injuries.[3,20] In addition, there are no prospective, case-controlled studies on back or sacroiliac joint disease management. Most acute spinal injuries involve soft tissue injuries or osseous pathology associated with a traumatic incident. Chronic spinal problems are usually insidious and difficult to definitively diagnose without advanced imaging modalities and extensive lameness evaluation. Since many back and sacroiliac joint

problems are chronic in nature, multiple treatments may have been applied. It is always important to know what type of medications or therapy has been tried in the past and whether or not it has provided any improvement in the condition.

A clinical trial of phenylbutazone (2 g, p.o., b.i.d. for 4-5 days) is often used to assess the inflammatory component of any musculoskeletal problem. The use of nonsteroidal anti-inflammatory drugs (NSAIDs) will often produce an improvement in osseous or articular pathologies although this may be incomplete and short-lived. Other NSAIDs include ketoprofen (2.2 mg/kg (1 ml/100 lbs), i.v., s.i.d. for up to 5 days) or naproxen (5-10 mg/kg, p.o., b.i.d. for up to 14 days). Long-term use of phenylbutazone at low doses (1 g, p.o., s.i.d.) for mild aches and stiffness can be beneficial, but may mask the signs of other musculoskeletal injuries or compensation.[21] The additional use of glucosamine, chondroitin sulfate, or methylsulfonylmethane (MSM) has been reported to help reduce inflammation and improve the clinical signs of osteoarthritis in some horses.[22]

Muscle relaxants have been advocated for back and gluteal muscle hypertonicity, but their effectiveness seems to be inconsistent and varies between horses.[14] A clinical trial of methocarbamol (15-44 mg/kg, p.o., s.i.d.) or dantrolene sodium (2 mg/kg, p.o., s.i.d.) will help some horses with back or gluteal muscle-related soreness or hypertonicity. These drugs may not have any specific effects other than reducing muscle tension or spasm in order to allow the normal healing process to occur.

Soft tissue and articular motion restrictions (i.e., stiffness) can be directly addressed with specific stretching exercises to induce creep and stress relaxation within fibrotic or shortened periarticular soft tissues. With minimal training, horses and their owners can be taught how to do simple but effective passive joint mobilization and active stretching exercises (i.e., carrot stretches) to improve both axial skeleton and limb flexibility. These concurrent therapies also help to encourage owner participation in the healing process and provide close monitoring of the patient's progress. Cryotherapy (i.e., ice packs or ice massage) is indicated in the first 24-48 hours post-injury to reduce pain, induce muscle relaxation, and reduce inflammation. The application of heat or electrical stimulation can provide increased soft tissue extensibility, reduced inflammation and adhesion formation, and pain control to help facilitate the restoration of normal joint motion.[23]

Treatment of chronic back and sacroiliac joint injuries typically focuses on a gradual return to a low level of exercise to maintain muscle development of the back and gluteal regions in order to counteract the clinical signs of poor performance and reduced hind limb impulsion.[24] In acute spinal injuries, cantering or galloping is contraindicated due to high stresses on the back or sacroiliac joint, which may exacerbate pre-existing pathology. The high musculoskeletal demands required during these activities may also cause horses to decompensate and injure muscles or other soft tissues. Many repetitive-use disorders benefit from cross-training activities (i.e., alternating dressage, hacks, and cavelletti work) are often helpful in rehabilitation of the sacroiliac joint problems. Modifications in exercise or training program duration, frequency or intensity need to be tailored to individual horses and their ability to compensate and increase the workload. Recommendations for a reduction in jumping, turning in tight circles or abrupt transitions

(e.g., canter-halt-canter) or changes in direction (e.g., barrel racing or reining) or other high impact maneuvers are also important. Query into the size and the time spent in stalls, paddocks, or turnout in pasture is indicated for any horse with back problems. In addition, horses that are turned out in paddocks with deep mud, large rocks, poor footing, or steep hills may aggravate back or sacroiliac joint problems.

Treatment of spinal and sacroiliac osteoarthritis

The basic principles of conservative management of spinal and sacroiliac osteoarthritis are to reduce pain and inflammation in order to improve healing, followed by a program of rehabilitation and exercises to prevent further injury or stress to the dorsal articular facets or sacroiliac joints. Therefore, it is necessary in many cases to use a combination of medications (e.g., NSAIDs, corticosteroids, or muscle relaxants) and physical or manipulative therapies.

The deep overlying croup musculature and seemingly inaccessible anatomic location of the spinal articulations and sacroiliac joint has limited the clinical application of intra-articular injections in horses.[13,18] Regional perfusion of the dorsal spinous processes, articular facets or sacroiliac joint region with local anesthetics or anti-inflammatories for diagnostic or therapeutic purposes is a viable alternative, but inappropriate needle placement or the use of too short of needles are why most techniques have had suboptimal diagnostic or therapeutic effects.[14,25,26] A medial approach to the sacroiliac joint provides the most direct, safe and consistent periarticular injection technique.[27] Periarticular injections are made as close as possible to the caudomedial sacroiliac joint margin due to the high prevalence of degenerative changes affecting the caudomedial sacroiliac joint margin.[28,29] The injection mixture typically includes combinations of methylprednisolone acetate, isoflupredone acetate, and hyaluronic acid. Improvement usually takes 2 to 6 days and repeated treatment is sometimes necessary at six or 9-month intervals, similar to intra-articular injections at other sites. Injections of corticosteroids in the sacroiliac joint region have been used quite extensively; however, there are not any well designed or controlled trials currently reported in the literature.[21]

Musculoskeletal health depends on movement and use. Scientific evidence suggests that long-term rest or inactivity is contraindicated for osteoarthritis in humans.[4] Similar recommendations are appropriate for horses with spinal or sacroiliac osteoarthritis. Horses that are stalled for the majority of the day or large portions of the year do not have the opportunity to maintain back or pelvic flexibility, which may contribute to sacroiliac joint stiffness and dysfunction. In-hand on the lunge line or round pen without a rider is indicated for several weeks to allow movement of the back or sacroiliac region without the excessive stress associated with the weight of a rider.[30] In chronic, low-grade spinal osteoarthritis, a progressive exercise program can be used to help build up and supple the gluteal and hind limb muscles. A tapering dose of oral phenylbutazone can be given as the exercise is gradually increased. Once comfortable in-hand or on the lunge line, light riding at a walk, then trot may begin as long as the horse is monitored daily for willingness and ability to do the work.

Chiropractic

Chiropractic evaluation focuses on evaluating and localizing segmental vertebral dysfunction (i.e., chiropractically defined 'subluxation') which is characterized by localized pain, muscle hypertonicity, and reduced joint motion.[31] A thorough knowledge of vertebral anatomy, joint physiology and biomechanics is required for proper chiropractic evaluation and treatment. Alterations in articular neurophysiology from mechanical or chemical injuries can affect both mechanoreceptor and nociceptor function via increased joint capsule tension and nerve ending hypersensitivity.[23] Mechanoreceptor stimulation induces reflex paraspinal musculature hypertonicity and altered local and systemic neurologic reflexes. Nociceptor stimulation results in a lowered pain threshold, sustained afferent stimulation (i.e., facilitation), reflex paraspinal musculature hypertonicity, and abnormal neurologic reflexes. The goal of chiropractic treatment is to restore normal joint motion, stimulate neurologic reflexes, and to reduce pain and muscle hypertonicity. Multiple theories have been proposed and tested over the years to explain the pathophysiology of vertebral segment dysfunction and its interactions and influences on the neuromusculoskeletal system.[31,32] Chiropractic treatment is thought to affect mechanoreceptors (i.e., Golgi tendon organ and muscle spindles) to induce reflex inhibition of pain, reflex muscle relaxation, and to correct abnormal movement patterns.[7,33,34] Anecdotal evidence and clinical experience suggest that chiropractic is an effective adjunctive modality for the diagnosis and conservative treatment of select musculoskeletal-related disorders in horses. However, therapeutic trials of chiropractic manipulations are often used since we currently have limited formal research available about the effectiveness of chiropractic procedures in equine practice.

During treatment, a 'release' or movement of the restricted articulation is often palpable. An audible 'cracking' or 'popping' sound may also be heard during chiropractic treatment as the applied force overcomes the elastic barrier of joint resistance.[35,36] The rapid articular separation produces a cavitation of the synovial fluid.[37] In humans, radiographic studies of synovial articulations after manipulation have shown a radiolucent cavity within the joint space (i.e., vacuum phenomenon) that contains 80% carbon dioxide and lasts for 15-20 minutes. A second attempt to recavitate the joint will be unsuccessful and potentially painful until the intraarticular gas has been reabsorbed (i.e., refractory period). The static position of the vertebral or sacroiliac joints in humans has been studied per and post-manipulation by roentgen stereophotogrammetric analysis, which allows precise measurements of three-dimensional articular movement.[38] Static palpation changes were noted pre and post-manipulation; however, no changes were seen with the roentgen stereophotogrammetric analysis. Therefore, soft tissue responses such as joint capsules, muscles, ligaments, tendons and postural neuromuscular reflex patterns should be the focus of future spinal manipulative studies and not articular malpositioning (i.e., bone out of place).[38]

The principal indications for equine chiropractic evaluation are back or neck pain, localized or regional joint stiffness, poor performance and an altered gait that is not associated with overt lameness. A thorough diagnostic workup is required to identify soft tissue and osseous pathology, neurologic disorders, or other lameness conditions that may

not be responsive to chiropractic care. The primary clinical signs that equine chiropractors look for are localized musculoskeletal pain, muscle hypertonicity and restricted joint motion. This triad of clinical signs can be found in a variety of lower limb disorders, but is most evident in neck or back problems. Chiropractic care can help manage the muscular, articular and neurologic components of select musculoskeletal injuries in performance horses. Musculoskeletal conditions that are chronic or recurring, not readily diagnosed, or are not responding to conventional veterinary care may be indicators that chiropractic consultation is needed. Chiropractic care is usually contraindicated in the acute stages of soft tissue injury. However, as the soft tissue injury heals, chiropractic has the potential to help restore normal joint motion, thus limiting the risk for future reinjury.[4] Chiropractic care may provide symptomatic relief in early degenerative joint disease if related to joint hypomobility and subsequent joint degeneration. Chiropractic is usually much more effective in the early clinical stages of disease versus end-stage disease where reparative processes have been exhausted.

Chiropractic is not a 'cure all' for all back problems and is not suggested for treatment of fractures, infections, neoplasia, metabolic disorders or nonmechanically-related joint disorders. Acute episodes of sprains or strains, degenerative joint disease or impinged spinous processes are also relative contraindications for chiropractic treatment. All neurologic diseases should be fully worked up to assess the potential risks or benefits of chiropractic treatment. Serious diseases requiring immediate medical or surgical care need to be ruled out and treated by conventional veterinary medicine before routine chiropractic treatment is begun. However, chiropractic care may contribute to the rehabilitation of most post-surgical cases or severe medical conditions by helping in the restoration of normal musculoskeletal function. Chiropractic care cannot reverse severe degenerative processes or overt pathology.

Acupuncture

Acupuncture involves the insertion of fine needles into specific predetermined locations (i.e., acupuncture points) to produce therapeutic effects.[39] Acupuncture points are often chosen within the same dermatome as the lesion or condition being treated, as well as, local tender or painful sites, points cranial or caudal, or proximal or distal to the localized lesion.[40] Additional methods of stimulation include acupressure, aquapuncture, electrostimulation, and low-level laser therapy. Theoretically, each acupuncture point, or combination of points, has specific therapeutic actions when stimulated. The primary benefit of acupuncture for back problems is pain management via opioid (i.e., enkephalin and beta-endorphin) and non-opioid (e.g., serotonin) pathways.[40] Pain relief is often immediate, but may have variable durations of effectiveness, depending on the type and severity of musculoskeletal dysfunction. Acute injuries often respond rapidly and require fewer treatment sessions, whereas chronic musculoskeletal conditions may require periodic or long-term treatment. Acupuncture is often the treatment of choice for trigger points, which are characterized by localized tight, painful bands of muscle at characteristic locations within large muscle groups, particularly the middle gluteal muscle.

Clinical studies and experimental reports indicate that acupuncture is a safe and effective modality for specific musculoskeletal conditions if used properly.[39]   Disease conditions managed by acupuncture include trauma, osteoarthritis, and muscle hypertonicity. Pain is the primary indication for acupuncture in horses with back problems.[41,42]   Acupuncture does not have any known direct effects on reducing joint stiffness, as do manual therapies. Therefore, synergistic effects are often obtained with combined chiropractic and acupuncture treatment that cannot be obtained consistently with either modality by itself. The immediate pre-race use of acupuncture is banned by many racing jurisdictions and athletic organization regulations due to its potential misuse or analgesic properties.

There are few specific contraindications for acupuncture since the majority of medical and surgical conditions have associated indications for acupuncture. Fractures, active infections, and bleeding tendencies are relative contraindications for acupuncture. Risks and complications associated with needle placement include infection, puncture of organs, or pneumothorax. Solid needles or aquapuncture are often recommended over the thoracolumbar region due the risk of breaking off a portion of the needle within the epaxial muscles from the action of the thoracolumbar fascia on the needle.

Physical therapy

Physical therapy modalities that may have direct application to back problems in horses include devices that apply electrical currents for pain control or neuromuscular rehabilitation; thermal modalities (i.e., superficial and deep heat or cold applications) for influencing inflammatory mediators, collagen extensibility and altering nerve conduction; and mechanical approaches (e.g., massage, vibration, stretching, and training exercises) for maximizing musculoskeletal rehabilitation.

In the absence of trauma or documented pathologic findings, the primary goal of treatment should address restoration of function and prevention of future disability.[4] Management should be systematically and methodically directed toward developing coordination and proprioception, flexibility strength, and endurance. The negative effects of immobilization and deconditioning should be minimized with early mobilization and controlled activity. Increased mobility is addressed with joint mobilization and muscle stretching.[43]   Altered movement patterns are addressed with coordination via proprioceptive retraining, postural reeducation, muscle strengthening, and endurance training.[4]

The primary indications of physical therapy for back or pelvic problems include localized or generalized pain, joint motion restrictions, and altered back muscle tonicity.[44] Pain modulation can be provided by influencing inflammatory mediators, altering pain perception and transmission, and increasing beta-endorphin levels. Physical therapy modalities involved in pain control include electrical stimulation (i.e., muscle stimulation, transcutaneous electrical nerve stimulation (TENS)), the application of hot or cold, mechanical vibration, and electromagnetic modalities. Soft tissue and articular motion restrictions (i.e., stiffness) can be directly addressed with specific stretching exercises to induce creep and stress relaxation within fibrotic or shortened periarticular soft tissues.

With minimal training, horses and their owners can be taught how to do simple but effective passive joint mobilization and active stretching exercises (i.e., carrot stretches) to improve both axial skeleton and limb flexibility. Cryotherapy (i.e., ice packs or ice massage) is indicated in the first 24-48 hours post-injury to reduce pain, induce muscle relaxation, and reduce inflammation. The application of heat or electrical stimulation can provide increased soft tissue extensibility, reduced inflammation and adhesion formation, and pain control to help facilitate the restoration of normal joint motion.[23] Abnormal muscle tone can be addressed with modalities that increase or decrease muscle contractility or coactivation and nerve conduction or inhibition. Some of these modalities include hydrotherapy, electrical stimulation, and rehabilitative exercises that specifically address issues of reduced flexibility, coordination, strength, and endurance. In humans, anti-inflammatories and other drugs can be delivered into superficial soft tissues via electrical currents (i.e., iontophoresis) or via mechanical sound waves (i.e., phonophoresis). However, preliminary equine research indicates that a heavy hair coat, thick skin, and deep articular structures may limit the overall effectiveness of these novel drug delivery systems for back problems.

Contraindications for massage include active skin lesions, open wounds, acute inflammation, or persistent muscle hypertonicity (i.e., exertional rhabdomyolysis).[45] Contraindications for electrical modalities include active skin lesions, open wounds, pain of unknown origin or pain conditions where masking the pain may be detrimental (e.g., pre-race).[46] Contraindications for superficial or deep heating modalities include acute injury or inflammation, open wounds, recent or potential hemorrhage, neoplasms, or impaired sensation.[23] Precautions or contraindications for cryotherapy include open wounds, vascular compromise or peripheral vascular disease due to the induced vasoconstriction produced by the ice.[23]

Future areas of research

In horses with back pain, specific functional pathologies that need to be addressed in addition to initial pain relief include trigger points, hypertonic muscles, weak muscles, abnormal movement patterns, and joint dysfunction. Compared to our human counterparts, veterinarians and equine athletes often have a very limited selection of options for the treatment of musculoskeletal disorders. Currently, we do not have objective measurement or rehabilitation tools to specifically assess soft tissue or articular pain, reduced flexibility and joint stiffness, muscle hypertonicity, trigger points, or alterations in proprioception or coordination associated with musculoskeletal or nerve dysfunction. Normal kinematics of the thoracolumbar spine have been investigated,[47-51] but continued work needs to be done to assess segmental vertebral motion and its response to specific and defined articular and soft tissue injuries. Objective measures of spinal stiffness have been investigated,[52] but the effects of pain, muscle hypertonicity, articular process osteoarthritis and concurrent lameness have not been explored. Functional outcome measures assess how well a horse is able to do the job asked of it (e.g., speed, flexibility, coordination, strength, and endurance). Quantitative assessments of pain include the use of a 0-10 pain scale, algometry or pain pressure threshold measurements, and mapping areas of pain. A 0-10 visual analog scale or pain scale is

easy to use and provides a semi-objective means of following pain, dysfunction, performance, or any other musculoskeletal parameter either immediately before and after treatment, or over several days or weeks of treatment. Measurements can be complied independently by both the owner and the veterinarian, with similarities or differences evaluated. Other areas of musculoskeletal treatment that need further scientific investigation include well-defined, scientifically validated strength and endurance training programs tailored for the unique athletic demands of the various equestrian events. It is hoped that new insights into measuring musculoskeletal dysfunction and the pathophysiology of chronic pain syndromes will assist in assessing the effectiveness of many of the traditional and complementary modalities currently applied to horses with the rationale of reducing morbidity and improving overall performance in our elite equine athletes.

Conclusion

The spine and sacroiliac joint continue to be an area of controversy for most practitioners due to its deep location, unique anatomic features and the limited biomechanical investigations into its functional significance. The definitive diagnosis of spinal and sacroiliac joint injuries provides individual tailoring of specific treatment modalities and recommendations for rehabilitation. Unfortunately, to date, few clinical controlled studies have evaluated the effectiveness of most therapeutic modalities for back and sacroiliac joint injuries. Further research is needed to assess the effectiveness of specific treatment recommendations or combined treatments for back problems and pelvic injuries.

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Back pain can result from injury, disease, or simply aging. Learn more, including what treatments may help with your condition. If your doctor suspects a referred source of back pain, a pelvic or abdominal exam may be performed, as well as various blood or urine tests. Treatment. The most frustrating aspect of the treatment of back pain is that it often takes time for symptoms to resolve. Most individuals recover completely by simply avoiding stress to the back. Keep in mind, though, that this does not mean prolonged bed rest. Pelvic Floor Disorders: Surgical Approach. 26. Management of Concomitant Pelvic Disorders: The Urologic Perspective. An overactive pelvic floor is frequently associated with voiding difficulties of the bladder, and constipation, dyspareunia, and chronic pelvic pain. A reduced tone of the pelvic floor is associated with urinary stress incontinence and/or fecal incontinence, vaginal prolapse, and sexual problems. However, a recent systematic review underlines the fact that specific randomized controlled trials of tapes with a long-term follow-up are needed in order to demonstrate the efficacy of retropubic and TOT techniques in women with urodynamically proven and symptomatic MUI [33]. 26.3.1.3 Midurethral Sling and Voiding Dysfunction.