FUNCTIONAL ASSESSMENT AND REHABILITATION OF THE EQUINE AXIAL SKELETON
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Key Points
• Temporomandibular joint motion asymmetries may indicate dental disease and be a cause of poor performance in sport horses.
• Cervical osteoarthritis can be a significant cause of pain and stiffness, without causing overt neurologic signs.
• Saddle fit issues are an important component of assessing causes of back pain.
• Rehabilitation of sacroiliac osteoarthritis is focused on pain management and core stability.

Injuries and performance-limiting issues in horses can often be localized to the axial skeleton. The majority of equine practitioners are well-versed in addressing lameness due to structural or functional issues within the thoracic or pelvic limbs. Unfortunately, the axial skeleton has been often overlooked as a significant cause or contributing factor to poor performance or pain-related issues in sport horses. Several factors likely contribute to this perceived short-coming in assessing the ridden horse within its entirety, especially in athletes that are often pushed to their structural and physiologic limits. In general, the large mass of the trunk and pelvis often prevents detailed physical examination or diagnostic imaging; many of the pain-generating structures of the axial skeleton are not readily known or accessible to local anesthetic injections; complex anatomical features and spinal biomechanics can become easily overwhelming; and we do not have a clear understanding of compensatory gait or lameness issues that must influence the axial skeleton as biomechanical forces and pain signals are transmitted within and through the trunk. In order for us to advance as a profession, we need to develop an increased understanding of the structural and functional components of the equine axial skeleton, especially as it relates to managing chronic lameness issues and the development of effective rehabilitation programs for affected sport horses. The functional assessment of spinal motion quality and quantity, muscular timing and activity, and neuromuscular control (i.e., core stability) are key components to assessing and maintaining optimal athletic performance.

Head and cervical region
Temporomandibular joint disorders may often be overlooked due to poorly defined or non-specific clinical signs and the need for differentiation from behavioral problems.1 The primary function of the temporomandibular joints are to support mastication; however, mandibular motion is also important during vocalization, self grooming, drinking, suckling in foals, athletic activities (e.g., bit placement and motion), head positioning, social interactions and defense (i.e., biting). Clinical signs of temporomandibular disease related to poor performance include: inability to open or close the mouth, avoiding or resisting pressure applied to the bit, reduced ability to flex at the poll and inability to hold a vertical head carriage, and head tossing or shaking. On physical examination, palpable heat, pain or swelling may be localized to the region of the temporomandibular joint. Resting lateral or rostral displacement of the mandible can be readily identified by changes in the alignment of the upper and lower incisors. Malocclusion may be due to localized muscle hypertonicity or articular derangement. Reduced mandibular range of motion may be evident during observations of opening and closing of the
moust. Passive mandibular motion can be induced with lateral excursion of the mandible, while the quantity, quality and asymmetry of mandibular motion is assessed. Movement on one side of the mandible must be accompanied by movement in the opposite temporomandibular joint. However, the induced motion may not necessarily be identical, since mediolateral mandibular movement induces opposite joint movements in the paired temporomandibular articulations. Using a diagnostic acupuncture examination, horses with temporomandibular joint pain will have exaggerated pain responses at specific masseter muscle sites or along the temporomandibular joint margins. Reduced mechanical nociceptive thresholds (MNTs) may be measured over the lateral temporomandibular joint margins, where normal MNTs are approximately 6 kg/cm².

Four general categories of temporomandibular joint disease include masticatory muscle disorders (e.g., masseter myositis); articular disorders (e.g., disc degeneration, osteoarthritis, fractures); dental disease (e.g., malocclusions) and bit-induced pain. Arthrosonography allows noninvasive visualization of the joint capsule, surrounding soft tissue structures, articular cartilage surface, subchondral bone surface, and the intraarticular disk. However, only the lateral aspect of the joint can be visualized. Abnormal ultrasound findings are highly suggestive of pathological lesions and include narrowed or absent articular disk space, fibrous thickening of the joint capsule, and irregular joint margins of the temporomandibular joint. The incidence of equine temporomandibular disease may be underreported due to the difficulty in obtaining diagnostic images of the region. Lateral and oblique skull radiographs are difficult to interpret due to complex anatomy and superimposition of bony structures in the region of the temporomandibular joint. Diagnostic local anesthesia is useful for localizing pain. The dorsal and ventral joint cavities need to be injected separately since they are separate synovial structures. Magnetic resonance imaging and computed tomography are considered the gold standard in imaging temporomandibular joints due to the ability to visualize three-dimensional and cross-sectional anatomy of deep structures and surrounding soft tissues.

Rehabilitation of temporomandibular joint disorders is focused on pain management and restoration of mandibular motion.

The hyoid apparatus consists of a series of six paired and unpaired bones that are located medially between the rami of the mandible. The hyoid is embedded within the root of the tongue rostrally, connected to the larynx caudally, and articulates dorsally at the base of the skull via the tympanohyoid cartilage. The articular configuration of the temporohyoid joint supports hinge-like movements, which primarily produces dorsoventral movements of the hyoid apparatus. In horses, the stylohyoid bones, which form a large portion of the hyoid, are visible along most of their length through a thin covering of mucous membrane during endoscopic examination of the guttural pouches. The basihyoid, lingual process and thyrohyoid bones are fused into a common osseous structure. The basihyoid bone is a palpable, transversely-oriented bone that provides a base of attachment for the lingual process, which extends rostrally and is embedded within the root of the tongue. The paired thyrohyoid bones extend caudally from the lateral extremities of the basihyoid bone and articulate with the thyroid cartilage of the larynx.

The hyoid apparatus moves in conjunction with tongue movements associated with chewing, swallowing, coughing, vocalization, or reaction to the bit while being ridden. Rostrodorsal excursion occurs during swallowing and with tongue movements associated with mastication. Restricted dorsoventral motion of the hyoid apparatus may be associated with degeneration or ankylosis of one or both temporohyoid articulations. Restricted hyoid motion has important effects on tongue and laryngeal function, as well as, neck and forelimb kinematics because of the muscular attachments of the sternothyrohyoid and omohyoid muscles.
respectively. Horses with abnormally increased or severely restricted dorsoventral basihyoid motion need immediate diagnostic imaging to rule out fractures of the stylohyoid bone or temporohyoid osteoarthropathy, respectively. It is important to identify affected horses prior to progression to petrous temporal bone fracture and severe neurologic compromise of the facial and vestibulocochlear nerves. Guttural pouch endoscopy provides direct visualization of pathology and is the most sensitive procedure to detect asymmetry, inflammation or osseous proliferation in the region of the temporohyoid joint or proximal portion of the stylohyoid bone on the affected side. Radiographic examination has poor lateralization due to superimposition of the stylohyoid bones, temporohyoid joints and other adjacent structures. Computed tomography provides superior image resolution, three-dimensional reconstruction of the hyoid apparatus and visualization of the temporohyoid articulation, tympanic bulla and petrous temporal bone.

Surgical management of temporohyoid osteoarthropathy is focused on restoring hyoid motion due to the risk for secondary cranial nerve deficits and associated morbidity. Postsurgical medical management and rehabilitation is focused on management of any facial or vestibulocochlear nerve deficits with possible electrical muscle stimulation of facial muscles and restoring vestibular function.

The cranial cervical region consists of the atlantooccipital and the atlantoaxial articulations, which form the primary junction between the skull and the caudal cervical spine. These joints are highly mobile and forms unique intervertebral articulations because of their altered morphology and the lack of an intervertebral disk. Flexion and extension are the primary joint motion of the atlantooccipital articulation; however, a large amount of lateral bending is also present. Restricted atlantooccipital flexion is often found in horses used for dressage or other activities that require pronounced vertical head carriage. The muscles responsible for poll flexion include the longus capitis, ventral rectus capitis and sternocephalicus muscles. Soft tissues limits to flexion include tension within the nuchal ligament, dorsal poll musculature and impingement of the mandible and soft tissues of retromandibular space. Soft tissue diseases that contribute to restricted atlantooccipital joint flexion include insertional desmopathy of the nuchal ligament, cranial nuchal bursitis or pain and hypertonicity of the dorsal poll musculature. Using a diagnostic acupuncture examination, horses with atlantooccipital joint pain will have exaggerated responses at specific poll muscle sites, at the base of the ear or along the caudal margin of the mandible. Lateral asymmetries in the retromandibular space can be assessed via digital palpation of the distance between the caudal border of the mandible and the wing of the atlas. The dorsal poll region is also palpated for the presence of pain, hypertonicity, or asymmetry in the development of the cranial capital oblique and dorsal rectus capitis major muscles. Restrictions in the quantity and quality of atlantoaxial joint motion can be detected during induced passive flexion, extension and lateral bending. Lateral radiographs can demonstrate evidence of bony proliferation, malformation, or occipital or atlantal fractures at the atlantooccipital articulation. Occipitoatlantoaxial malformation may produce variable signs of ataxia or paresis and a reduced ability to flex at the atlantooccipital joint. Ultrasonography is used to evaluate the nuchal ligament insertion site at the external occipital protuberance for evidence of enthesophytes. Diagnostic local anesthesia in areas of enthesophytes or the atlantooccipital joint is useful to help localize sources of pain.

The atlantoaxial joint is characterized as a pivot joint; therefore, a large amount of axial rotation is possible at this articulation. Axial rotation at the atlantoaxial joint is produced by unilateral contraction of the dorsal rectus capitis major, caudal capital oblique, longissimus capitis and atlantis, longus capitis, splenius, semispinalis capitis, and cleidomastoid muscles.
Soft tissue limits to axial rotation include restraint by the atlantoaxial ligaments and adjacent muscle tone. Injuries to this region produce signs of stiffness, localized soft tissue swelling, abnormal head or neck carriage, heavy on one rein, or an asymmetry in turning ability. Soft tissue palpation of the poll musculature is used to assess pain, hypertonicity, or asymmetry in the development of the caudal capital oblique and dorsal rectus capitis major muscles. To fully assess the tone and ability of the poll musculature to relax, the head of the horse needs to be lowered toward the ground so that the poll muscles are relaxed as the passive nuchal ligament takes over as the primary support of the head. Osseous conditions of the atlantoaxial joint include atlantoaxial instability or luxation due to ventral displacement of the dens below the ventral arch of the atlas, fractures or congenital hypoplasia of the odontoid process of the axis. Lateral and dorsoventral radiographs confirm atlantoaxial alignment and anatomic integrity.

Rehabilitation of the cranial cervical region involves pain management, restoration of normal joint motion in all planes of movement, and addressing any osseous lesions with appropriate medical or surgical approaches.

The caudal cervical vertebrae are characterized by rudimentary spinous processes, large articular processes and articular facets and craniocaudal expanded transverse processes with transverse foramina. The synovial articulations of the articular processes (zygapophyseal joints) vary in shape, size and orientation, which determine the type and amount of flexion-extension and lateral bending present at each intervertebral articulation. Flexion, extension and lateral bending predominate in this spinal region. The articular facets are placed wider and oriented progressively more vertical within the caudal cervical vertebrae, which supports a gradual increase in flexion and extension and lateral bending. For much of the caudal cervical spine, the spinal cord segments are located at the junction of the corresponding vertebrae. The C3 spinal cord segment is located at the C2-C3 intervertebral level; as are the following cervical spinal cord segments located at the junction of the corresponding vertebrae. Important centers for posture and coordination are located in the brainstem and the C6-T2 and L4-S2 spinal cord segments.

Muscles responsible for flexion of the caudal cervical region include the sternocephalicus, sternothyrohyoid, omohyoid, longus colli and scalenus muscles. Restricted flexion within the caudal cervical region or an inability of a horse to lower its head to feed off the ground can be produced by either soft tissue or articular restrictions. Normal soft tissue structures within the cervical region that limit flexion include the epaxial musculature, nuchal ligament, joint capsules, ligamentum flavum, dorsal longitudinal ligament and dorsal fibers of the intervertebral disks. Bony structures that limit flexion include the cranial and caudal articular facets and the extremities of the vertebral bodies. Epaxial muscle hypertonicity, fibrosis of any of the dorsal soft tissue structures, or disruption or degeneration of the articular surfaces could be causes of painful or reduced flexion within the caudal cervical region. Compression or entrapment of the synovial folds within the cranial aspect of the cervical joint capsules between the articular facets could also be potential sources of joint pain and restricted cervical flexion. In horses with stenotic myelopathy, cervical flexion can aggravate the spinal cord compression and restrict flexion movements. Thoracic limb lameness and compensatory head and neck carriage may also produce exaggerated cervical extension and a relative cervical flexion restriction.

Cervical vertebral lesions often produce signs of pain, stiffness, ataxia, asymmetry cervical range of motion, altered head and neck carriage, epaxial muscle atrophy, and unwillingness to work on the bit. From a lameness perspective, toe dragging, forelimb lameness, altered gait associated with changing head or neck positioning, neck stiffness in one or both
directions, and resistance to the bit need to be assessed.\(^7\) From an acupuncture perspective, horses with cervical pain will have exaggerated responses at specific neck muscle sites or over the transverse or articular processes of the cervical vertebrae. Reduced MNTs will also be found over bony and soft tissue landmarks of the neck.\(^2\) Normal MNTs within the cervical region are between 7-11 kg/cm\(^2\). An abbreviated list of differential diagnoses of the caudal cervical region include adverse reactions to intramuscular injections, equine protozoal myeloencephalitis, equine herpesvirus myeloencephalitis, osteoarthritis of the articular facets, osteochondrosis of the vertebral body or articular processes, and cervical vertebral myelopathy. Ultrasonography can be used to image the size, shape and symmetry of the articular processes and for guidance of intraarticular injections of the cervical synovial articulations.\(^8\) Lateral and oblique radiographic views are used to evaluate the shape of the vertebral canal, alignment of the vertebral bodies, shape and size of the epiphyses, regularity of both intercentral and synovial articulations, and the size of the intervertebral foramina. Narrowing of the cervical vertebral canal is diagnosed by dividing the minimum sagittal diameter by the maximum height of the cranial vertebral body to calculate the sagittal ratio. Reference values are 52% at C4 to C6 and 56% at C7. Cervical myelography provides definitive diagnosis of cervical spinal cord compression.

Rehabilitation of the caudal cervical region includes medical and surgical management of associated infectious agents or gross vertebral instability or stenosis. Therapeutic exercises are tailored to address pain, stiffness, muscle atrophy, and proprioceptive deficiencies. Stretching and active mobilization of the cervical region are indicated for overt neck stiffness. Obstacles, ground poles, cavalletti and proprioceptive limb positioning are useful for addressing proprioceptive, coordination and motor control issues.

**Cranial thoracic region**

The cranial thoracic vertebrae are characterized by tall spinous processes that form the wither region. This spinal region forms an important foundation for thoracic limb attachment, cervical stability, and transition to the more mobile caudal thoracic region which primarily supports the rider during sporting events. The vertical orientation and rigid attachment of the cranial rib cage and the robust fibromuscular sling of the thoracic limb girdle provides increased stability to this spinal region. The funicular portion of the nuchal ligament widens at its attachment on the apices of the T3-T7 spinous processes and continues caudally as the fibrous supraspinous ligament. The thoracic spinalis muscle is superficial in the wither region and often becomes painful with poor fitting or improperly used saddles. The shallow concavity of the T3-T18 vertebral body extremities and the narrow intervertebral disks limit spinal motion within the thoracolumbar region. The range of motion at a single thoracic motion segment is small, but the sum of movements across the entire thoracic region is considerable. The thoracic articular facets have a nearly horizontal orientation from T2 to T16, which supports lateral bending and rotation movements. Lateral bending is limited at T1-T7 because of the configuration of the tall spinous processes and supraspinous and interspinous ligaments and the overlying scapula.

Positive clinical signs in this region include localized pain, resentment to placement of the saddle or tightening of the girth or cinch, bucking when mounted to ridden, dermal lesions associated with wear, epaxial muscle atrophy, flattened wither conformation due to falling over backwards and landing on withers and vague thoracic limb lameness. The dorsolateral contours of the withers and dorsal scapular region need to be assessed for asymmetry. Asymmetric feeding postures are thought to contribute to long-term asymmetries in hoof development, which are transferred up the thoracic limbs and displayed as left-right asymmetries in dorsal scapular
development. Flexion tests and diagnostic joint and nerve blocks are needed to rule out thoracic limb lameness. If lameness is present, then the source of lameness needs to be identified and treated, as lameness frequently causes changes in spinal kinematics and may contribute to spinal dysfunction. Poor saddle fit and use are frequent causes of pain and dysfunction in the cranial thoracic region. Diagnostic imaging is important in the evaluation of a horse with a back problem because of the inaccessibility of many of the affected spinal structures to direct visualization or palpation. Due to the large differences in tissue attenuation between the dorsal spinous processes and the ventrally located vertebral bodies and articular processes, at least two radiographs of the same thoracolumbar region should be taken at different exposures.

Based on the horse’s history and clinical signs, a suspected back problem can be identified; however, the definitive diagnosis of the exact cause of the back pain is often difficult. Jean-Marie Denoix has proposed a 4-step method for evaluating and treating back problems. The first step is identifying if back pain is present or not, which is often based on the history, behavior, performance, and physical examination. The second step is localizing the site of pain to a specific vertebral region, which is again based on a detailed spinal evaluation and on diagnostic imaging modalities such as radiography and possibly nuclear scintigraphy. The third step addressed what specific structure or tissue is the cause of the pain and followed up with selective placement of small volumes of local anesthesia. The final step is to determine how the injury or lesion should best be treated with general recommendations for bony, articular, ligamentous, muscular or neurologic disorders.

Rehabilitation of the cranial thoracic region involves addressing any concurrent thoracic limb lameness, front hoof asymmetries and improper saddle fit or use. Specific spinal rehabilitation is focused on pain management and core stability issues.

Caudal thoracic and lumbar region

The caudal thoracic vertebrae undergo increased ranges of motion in lateral bending and axial rotation; whereas, the lumbar vertebrae are designed for lateral stability and increased amounts of flexion-extension movements. The intertransverse joints of the caudal lumbar and lumbosacral junction provide lateral and rotational stability, which it required for transfer of the propulsive forces generated from the pelvic limbs during high-speed locomotion or jumping. The thoracolumbar longissimus muscle occupies the space dorsally between the spinous processes and ribs or transverse processes. The thoracolumbar fascia is a strong fascial sheet that covers the longissimus muscles and inserts on the cranial edge of the ilial wing, deep to the cranial portion of the middle gluteal muscle. Many practitioners do not appreciate that the cranial extent of the middle gluteal muscle lies over the dorsal surface of the lumbar longissimus muscle as far cranial as the L1 vertebral level. The sublumbar or hypaxial muscles that attach to the thoracolumbar spine include the crura of the diaphragm at the T15-L3 vertebral bodies and the psoas minor and major, which are important for stability and mobility at the lumbosacral junction and sacroiliac joints. The abdominal musculature is also an important muscle group that contributes to core stability of the trunk and pelvis.

In general, reduce trunk mobility is related to vertebral morphology and the restrictive nature of connective tissue (i.e., fascia, ligaments, joint capsules) and changes in locomotor patterns and postural behavior. The rectus abdominis, psoas major and psoas minor muscles are the primary flexors of the lumbar region and lumbosacral junction. Weakness or deconditioning of the abdominal musculature will contribute to lumbar lordosis or extension of the lumbosacral joint. The lumbar longissimus and cranial portion of the middle gluteal muscles
are the primary extensors of the lumbar region or the lumbosacral joint. Weakness or atrophy of the lumbar epaxial musculature does not limit extension and possibly even contributes to extension of the lumbosacral region because of the effects of gravity on the trunk and abdominal viscera.

Signs of back problems within the caudal thoracic and lumbar spine include pain, stiffness, kyphosis, epaxial muscle atrophy, reduced or poor performance with reluctance to canter, cross cantering and poor upward and downward transitions. Diagnostic acupuncture examination reveals localized or generalized back pain will have exaggerated responses at specific epaxial muscle sites. Reduced MNTs may be found in the lumbar region over both bony and soft tissue landmarks. Normal MNTs within the lumbar region are between 11-16 kg/cm². Since pelvic limb lameness is often associated with lumbar and lumbosacral joint disorders, flexion tests and diagnostic joint and nerve blocks are needed to rule out limb lameness. If lameness is present, then the source of lameness needs to be identified and treated, as lameness frequently causes changes in spinal kinematics and may contribute to spinal dysfunction. Measures of core stability and neuromuscular coupling at the lumbosacral joint can be assessed using pressure applied bilaterally near the tail head to induce a reflexive elevation of the trunk and flexion of the lumbosacral junction. The response to axial traction applied to the tail can also provide insights into neuromuscular coupling at the lumbosacral joint. Rectal palpation may be indicated to assess soft tissue injuries of the hypaxial muscles and arterial pulses of the internal and external iliac arteries and bifurcation of the abdominal aorta.

Supraspinous ligament desmitis can produce a painful thickening (i.e., acute desmitis) or nonpainful bony proliferation over the dorsal aspect of the spinous processes (i.e., enthesopathy). Impinged or overriding spinous processes (kissing spines) is a common clinical condition characterized by spinous processes that closely appose each other (i.e., narrowed interspinous space), which induces local pain, soft tissue inflammation, bony remodeling and sclerosis. Since spinous process impingement occurs commonly in perceived normal horses, it is important to differentiate clinically significant and incidental impinged spinous processes. Osteoarthritis of the articular facets is a commonly underdiagnosed degeneration of the dorsal synovial articulations of the articular processes. Exertional rhabdomyolysis is characterized by muscle cramping that occurs during or after physical exertion and be due to polysaccharide storage myopathy.

Recent advances in percutaneous ultrasonography provide improved imaging of the supraspinous ligament, impinged spinous processes, and asymmetry or osteoarthritis of the lumbar articular processes and guidance for injection. Transrectal ultrasonography provides imaging of the caudal abdominal aorta and the internal and external iliac arteries, sublumbar musculature, ventral aspects of the L4-L6 lumbar vertebrae, the lumbosacral junction, ventral spinal nerve roots, and the ventral aspect of the lumbar intertransverse joints and the sacroiliac joints. Local and periarticular injections of anesthetic assist in confirmation of soft tissue pathology, osteoarthritis of the lumbar articular process, and spinous process impingement.

Rehabilitation of the caudal thoracic and lumbar region involves pain management, increasing joint mobility and improving core stability through proprioceptive and strengthening exercises.

Sacropelvic region

The equine pelvis is characterized by having three strong bony prominences for trunk and pelvic limb muscle attachments: dorsally the tuber sacrale, laterally the tuber coxae, and caudally

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the tuber ischii. The pelvis articulates with the vertebral column at bilateral sacroiliac articulations and provides attachment for the pelvic limbs at the coxofemoral articulations. The bony pelvis provides stability during weight bearing and assists in transfer of propulsive forces from the pelvic limbs during locomotion. The sacroiliac joints consist of paired synovial articulations located between the ventral wing of the ilium and the dorsal wing of the sacrum. The sacrum is connected to the ventral wings of the ilium by a series of strong sacroiliac and sacrosciatic ligaments. The sacroiliac ligaments support the weight of the caudal vertebral column as it attaches to the ilial wing. The weight of the caudal vertebral column is suspended from the sacroiliac ligaments, which function similarly to the fibromuscular sling found between the proximal forelimb and the lateral thoracic body wall. Subsequently, the sacroiliac articular cartilage may never be fully weight bearing in the standing horse, unlike most articular cartilage. Dynamically, the sacroiliac joints aid in locomotion via transfer of hind limb propulsive forces to the vertebral column. Sacroiliac joint movements are restricted to small amounts of flexion (counternutation) and extension (nutation), with an apparent axis of rotation oriented transversely near the caudomedial aspect of the joint. The thoracolumbar fascia blends medially with the supraspinous ligament and forms a strong, bilateral tendon, which inserts on the cranial aspect of the tubera sacralia and blends with the dorsal sacroiliac ligament.

Most of the muscles of the pelvic region contribute to extension of the pelvic limb and propulsion. The rectus femoris, iliopsoas, tensor fasciae latae, and cranial portion of the superficial gluteal muscles cross the hip joint and produce hip flexion and pelvic limb protraction. The middle gluteal, accessory gluteal, and vertebral portions of the biceps femoris, semitendinosus and semimembranosus produce hip extension and pelvic limb retraction. The psoas minor is a flattened, highly pennate muscle that lies along the ventrolateral aspect of the thoracolumbar vertebral bodies and inserts on the psoas tubercle along the cranilateral body of the ilium to produces flexion of the lumbosacral and sacroiliac articulations. The psoas major and iliacus combine into a single iliopsoas muscle that inserts on the lesser trochanter of the femur to supports flexion and external rotation of the hip. The rectus abdominus muscle inserts on the pubis via the strong prepubic tendon and produces thoracolumbar flexion.

Horses with sacroiliac joint injuries vary in clinical presentation, usually based on the duration and extent of injury present. Clinical signs of sacropelvic pain and dysfunction include localized sensitivity to palpation of the surrounding soft tissues or tuber sacrale, reduced or poor performance, tuber sacrale height asymmetries, gluteal muscle atrophy or asymmetry, vague upper pelvic limb lameness, and resentment or the inability to back up. The most consistent clinical feature of chronic sacroiliac joint injury is a prolonged, nonprogressive history of poor performance that includes back stiffness, resisting jumps, and lack impulsion from one or both hind limbs. A pain response or palpable muscle hypertonicity of the iliopsoas muscles may be noted during rectal examination. On acupuncture examination, affected horses may have localized or generalized pelvic pain with exaggerated responses at specific gluteal muscle sites. Reduced MNTs can be found in the pelvic region over both bony and soft tissue landmarks. Normal MNTs within the pelvic region are between 14-18 kg/cm². Flexion tests and diagnostic joint and nerve blocks are needed to rule out pelvic limb lameness. If lameness is present, then the source of lameness needs to be identified and treated, as lameness frequently causes changes in pelvic kinematics and may contribute to sacroiliac joint dysfunction.

Variable degrees of tuber sacrale height asymmetry occur frequently and may be due to chronic asymmetric muscular or ligamentous forces acting on the malleable osseous pelvis, and
not due to direct sacroiliac ligament injury. Tuber sacrale height asymmetries are common in horses without documented sacroiliac joint injuries. Fractures of the ilial wing are the most common location of pelvic fractures, which produce acute lameness, depending on the articular or non-articular location and severity of the fracture. Neuromuscular disorders of the sacropelvic region include exertional rhabdomyolysis, polysaccharide storage myopathy, equine protozoal myeloencephalitis, which can produce focal muscle atrophy of the middle gluteal and quadriceps muscles with ataxia and incoordination of the pelvic limbs. Dorsal sacroiliac ligament desmitis occurs at the insertion on the tubera sacralia (i.e., enthesopathy) and ultrasound findings include irregular bone surfaces, hypoechogenicity and altered fiber pattern alignment. Sacroiliac joint osteoarthritis is common, although its clinical significance remains uncertain. Most lesions are bilaterally symmetrical and localized mostly to the caudomedial aspect of the joint. Sacral fractures usually result from rearing over backwards, rapid dog-sitting or forceful backing up into a solid object. Clinical signs vary depending on the location of the fracture and the amount of neurologic compromise due to nondisplaced or displaced fracture fragments. Presenting complaints include the loss of tail tone and voluntary movement (i.e., paresis and paralysis) or the inability to lift the tail during defecation and micturition.

Diagnostic ultrasonography has been used to visualize the dorsal surface of the iliac wing, ilial shaft, tuber sacrale, tuber coxae, and tuber ischii to identify cortical irregularities associated with incomplete and complete pelvic fractures. The primary indications for pelvic radiography include acute or severe pelvic asymmetries, upper hind limb lameness, coxofemoral joint luxation, and pelvic crepitus or fractures. Radiographic imaging of the equine pelvis is difficult in adult horses due to the large pelvic size and poor penetration. Primary indications for radiography of the sacrum include sacral trauma that produces crepitus or soft tissue swelling. Subjective evaluation or quantitative analysis of nuclear scintigraphy is typically able to identify asymmetric radioisotope uptake over the affected tuber sacrale, tuber coxae, tuber ischii or wing of the ilium. However, presumed normal horses, without a history of hind limb or sacroiliac joint injuries, may also have asymmetric uptake over the tuber sacrale. Oblique views of the ilial wings are recommended to confirm left-to-right asymmetries in radioisotope uptake and to separate the tuber sacrale dorsally, from the sacroiliac joint region ventrally.

Periarticular sacroiliac injection techniques have been developed to reliably medicate the equine sacroiliac joint, without disrupting adjacent neurovascular structures. The author recommends a caudomedial approach to the sacroiliac joint region due to anatomic and pathologic considerations. Using other caudal approaches, ultrasound guidance is recommended to provide visualization of the caudomedial aspect of the sacroiliac joint and identification of neurovascular structures that must be avoided at the greater sciatic foramen. A less specific, cranial approach involves ultrasound guidance of needle insertion along the cranial border of the ilial wing with injection of large volumes of injectate.

Since definitive diagnosis of sacroiliac joint pathology is difficult, treatment recommendations are usually symptomatic. In general, rest and various forms of physical therapy are indicated for ligamentous injuries. Treatment of chronic sacroiliac joint injury typically focuses on a gradual return to a low level of exercise to maintain muscle development of the back and gluteal regions to counteract the clinical signs of poor performance and reduced hind limb impulsion.
References