Appendix 5, A
Equine Chiropractic: General Principles and Clinical Applications

Kevin K. Haussler, DVM, DC, PhD

Chiropractic techniques provide additional diagnostic and therapeutic approaches that may help equine practitioners to identify and treat select musculoskeletal disorders. Direct measures of chiropractic techniques in horses demonstrate substantial induced vertebral motion, usually beyond the normal range of segmental motion that occurs during locomotion. Future studies need to evaluate the long-term functional effects of chiropractic.

Summary

A thorough knowledge of equine vertebral column anatomy, biomechanics, and pathology is required to understand the principles and theories behind chiropractic and to apply its techniques properly. Chiropractic provides additional diagnostic and therapeutic means that may help equine practitioners to identify and treat the primary cause of lameness or poor performance. Chiropractic provides specialized evaluation and treatment of joint dysfunction and conservative treatment of neuro-musculoskeletal disorders that are currently lacking in traditional veterinary medicine. However, limited research is currently available on equine chiropractic and other nontraditional modalities in veterinary medicine. In 1996, the AVMA's Committee on Alternative and Complementary Therapies suggested that the research community should be encouraged to prioritize avenues of research and to allocate research funds to projects that will provide further scientific evaluation of these modalities. The use of chiropractic principles and techniques on animals is dependent on future research into the clinical effectiveness and indications for management of back problems in horses.

References

1. Wynn SG. Wherefore complementary medicine? *J Am Vet Med Assoc* 1996;209:1228 –1233.
2. Jeffcott LB. Guidelines for the diagnosis and treatment of back problems in horses in *Proceedings.* AmAssocEquine Pract 1980;26:381–387.
3. Liebenson C. *Rehabilitation of the spine.* 1st ed. Baltimore, MD: Williams & Wilkins, 1996.
4. Willoughby SL. Equine chiropractic care, in *Proceedings.* Am Assoc Equine Pract 1993;39:31–32.
5. Leach RA. *The chiropractic theories: principles and clinical applications.* 3rd ed. Baltimore, MD: Williams & Wilkins, 1994.
6. Haldeman, S. *Principles and practice of chiropractic.* 2nd ed. Norwalk, CT: Appleton & Lange, 1992.
7. Reggars JW, Pollard HP. Analysis of zygapophyseal joint cracking during chiropractic manipulation. *J Manipulative Physiol Ther* 1995;18:65–71.
8. Herzog W, Zhang YT, Conway PJW, et al. Cavitation sounds during spinal manipulative treatments. *J Manipulative Physiol Ther* 1993;16:523–526.
9. Unsworth A, Dowson D, Wright V. Cracking joints: a bio- engineering study of cavitation in the metacarpophalangeal joint. *Ann Rheum Dis* 1971;30:348 –358.
10. Gatterman MI. *Foundations of chiropractic.* St. Louis: Mosby-Year Book, Inc., 1995.
11. Jeffcott LB. Disorders of the thoracolumbar spine of the horse a survey of 443 cases. *Equine Vet J* 1980;12:1 97–210.
12. Willoughby SL. *Equine chiropractic care.* 1st ed. Port Byron, IL: Options for Animals Foundation, 1991.
13. Jeffcott LB. Back problems in the horse - look at past, present and future progress. *Equine Vet J* 1979;11: 129 –136.
14. Cauvin E. Assessment of back pain in horses. *In Practice* 1997;19:522–533.
15. Steckel RR, Kraus-Hansen AE, Fackelman GE, et al. Scintigraphic diagnosis of thoracolumbar spinal disease in horses: a review of 50 cases, in *Proceedings.* Am Assoc Equine Pract 1991;37:583–591.
16. Chaitow L. *Palpation skills.* New York, NY: Churchill Livingston, 1997.
17. Jeffcott LB. Radiographic features of the normal equine thoracolumbar spine. *Vet Radiol* 1979;20:140 –147.
18. Haussler KK, Stover SM, Willits NH. Pathology of the lumbosacral spine and pelvis in Thoroughbred racehorses. *Am J Vet Res* 1999;60:143–153.
19. Kessler RM, Hertling D. Assessment of musculoskeletal disorders. In: Hertling D, Kessler RM, eds. *Management of common musculoskeletal disorders: Physical therapy principles and methods.* 2nd ed. Philadelphia: J. B. Lip- pincott, 1990;68 –71.
20. Haussler KK, Bertram JEA, Gellman K. *In-vivo* segmental kinematics of the thoracolumbar spinal region in horses and effects of chiropractic manipulations, in *Proceedings.* Am Assoc Equine Pract 1999;45:327–329.
21. Ga´ l JM, Herzog W, Kawchuk GN, et al. Movements of vertebrae during manipulative thrusts to un-embalmed human cadavers. *J Manipulative Physiol Ther* 1997;20:30 – 40.
22. Ahern TJ. Cervical vertebral mobilization under anesthetic (CVMUA): a physical therapy for the treatment of cervico -spinal pain and stiffness. *J Equine Vet Sci* 1994;14: 540 –545.
23. Allan DB, Waddell G. A historical perspective on low back pain and disability. *Acta Orthop Scand Suppl* 1989;60:1.
24. Smith CA, Tessier GJ. AVMA at work: houses approves guidelines on alternative, complementary medicine. *J Am Vet Med Assoc* 996;209:1026.

Appendix 5, B

Review of the Examination and Treatment of Back and Pelvic Disorders

Kevin K. Haussler, DVM, DC, PhD

Author's address: Gail Holmes Equine Orthopaedic Research Center, Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO 80523; E-mail: Kevin.Haussler@ColoState.edu.

American Association of Equine Practitioners - AAEP -
Focus on Lameness and Imaging, 2007 - Fort Collins, Colorado, USA

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 intra-articular 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 mal-positioning (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 hyper-tonicity 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 hypo-mobility 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 non-mechanically-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.

References

4. Liebenson C. *Rehabilitation of the spine*. 1st ed. Baltimore, MD: Williams & Wilkins, 1996.
23. Cameron MH. *Physical agents in rehabilitation*. Philadelphia: W.B. Saunders Company, 1999.
31. Leach RA. *The chiropractic theories: Principles and clinical applications*. 3rd ed. Baltimore, MD: Williams & Wilkins, 1994.
32. Haldeman S. *Principles and practice of chiropractic*. 3rd ed. New York: McGraw-Hill, 2005. 180
33. Cassidy JD, Lopes AA, Yong-Hing K. The immediate effect of manipulation versus mobilization on pain and range of motion in the cervical spine: A randomized controlled trial. *J.Manipulative Physiol.Ther.* 1992;15:570-575.
34. Pickar JG. Neurophysiological effects of spinal manipulation. *Spine J* 2002;2:357-371.
35. Brodeur R. The audible release associated with joint manipulation. *J.Manipulative Physiol.Ther.* 1995;18:155-164.
36. Reggars JW, Pollard HP. Analysis of zygapophyseal joint cracking during chiropractic manipulation. *J.Manipulative Physiol.Ther.* 1995;18:65-71.
37. Herzog W, Zhang YT, Conway PJW, et al. Cavitation sounds during spinal manipulative treatments. *J.Manipulative Physiol.Ther.* 1993;16:523-526.
38. Tullberg T, Blomberg S, Branth B, et al. Manipulation does not alter the position of the sacroiliac joint. *Spine* 1998;23:1124-1129.
39. Altman S. Small animal acupuncture: scientific basis and clinical applications In: A. M. Schoen and S. G. Wynn, eds. *Complementary and alternative veterinary medicine: principles and practice*. St. Louis: Mosby, 1998;147-167.

Appendix 5, C
Thoracolumbar Spinal Region in Horses and Effects of Chiropractic Manipulations

Kevin K. Haussler, DVM, DC, PhD; John E. A. Bertram, PhD; and Karen Gellman, DVM

Authors' address: Dept. of Biomedical Sciences, NYS College of Veterinary Medicine, Cornell University, Ithaca, NY 14853-6401. r 1999 AAEP.

In vivo segmental kinematics of the thoracolumbar spinal region vary in amplitude, direction and patterns of motion during different gaits. Direct measures of chiropractic adjustments demonstrate substantial induced segmental spinal motion in horses, usually beyond the normal range of segmental motion that occurs during locomotion. Future studies need to evaluate the long-term effects of chiropractic techniques in veterinary medicine.

Discussion

Locomotion and spinal motion were not visibly affected by the weight or resistance of the spinal transducers when viewed pre- and post-spinal instrumentation. The spinal transducer attachment to the dorsal spinous processes was minimally invasive and allowed direct measurement of segmental spinal motion. Based on clinical observations pre- and post-pin placement and other reports,4,5 it appears that spinous process pins are well-tolerated and do not induce clinical lameness.

The largest amount of segmental motion was recorded at the lumbosacral junction, as anticipated. However, the presence of considerable lateral bending and axial rotation at the lumbosacral junction was not expected, based on known articular features. Segmental spinal motion characteristics induced during chiropractic manipulations in horses are similar to those reported in humans. Direct measures of chiropractic manipulations demonstrate substantial induced segmental spinal motion in horses, usually beyond the normal range of segmental motion that occurs during locomotion. The induced spinal motion supports current theories on the effects of chiropractic manipulations on joint physiology.

Future studies need to evaluate the long term mechanical and neurophysiologic effects of chiropractic techniques in veterinary medicine. Knowledge of normal segmental spinal motion and response to manual therapies will further our understanding of the pathophysiology, clinical diagnosis, and treatment of back problems in horses.

References

1. Jeffcott LB. Disorders of the thoracolumbar spine of the horse—a survey of 443 cases. *Equine Vet J* 1980;12:197–210.
2. Licka T, Peham C. An objective method for evaluating the flexibility of the back of standing horses. *Equine Vet J* 1998;30: 412–415.
3. Pourcelot P, Audigie´ F, Degueurce C, et al. Kinematics of the equine back: a method to study the thoracolumbar flexion/extension movements at the trot. *Vet Res* 1998;29:519–525.
4. Steffen T, Rubin RK, Baramki HG, et al. A new technique for measuring lumbar segmental motion *in vivo. Spine 1997;22: 156–166.*
5. Schendel MJ, Dekutoski MB, Ogilvie JW, et al. Kinematics of the canine lumbar intervertebral joints: An *in vivo* study before and after adjacent instrumentation. *Spine* 1995;20: 2555–2564.
6. Ga´ l JM, Herzog W, Kawchuk GN, et al. Movements of vertebrae during manipulative thrusts to unembalmed human cadavers. *J Manipulative Physiol Ther* 1997;20:30–40.

Appendix 5, D

CLINICAL APPLICATION OF CHIROPRATIC IN THE EQUINE PRACTICE (BACK PAIN, VISCERAL PAIN, AND LAMENESS)

Dennis Eschbach, DC, CAAC

Administrator, Curriculum Development, Options for Animals College of Animal Chiropractic, Wellsville, Kansas, USA,
the International Academy of Veterinary Chiropractic, Sittensen, Germany,
the Anglo-European College of Chiropractic, Bournemouth, England
& the Los Angeles College of Chiropractic.

PAIN

The International Association for the Study of Pain's widely used definition states: "Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage".[33] It is important to note that today we know the perception of pain is conceptual and has emotional components. It is always subjective, but may or may not be objective.[5] This is also true in the horse, where emotional centers in the limbic system of the brain play a strong and leading role in the horse's behavior. Horses experiencing pain may exhibit withdrawn social behavior and possibly experience a decreased appetite and decreased nutritional intake. (This is also important in the discussion of visceral pain and colic below.)

'Pain' begins as a noxious stimulus anywhere in the body. Nociceptors are neurons that respond to damaging, or potentially damaging, mechanical, thermal or chemical stimuli.[21] When fired, they send a pattern of electrical signals to the brain, where it is processed in many coordinating areas. The brain perceives the pattern of input and makes a response decision. Perceptions include nothing (thresholds are not met), itching, ticklishness or pain. Responses may be nothing, scratching, evasion, or fight and/or flight.

Sustained peripheral noxious stimuli can lead to spinal cord plasticity resulting in hyperalgesia, allodynia and spontaneous discharge of neurons. The pain symptoms may remain even when the original stimulus is stopped.[10,49] Windup, long-term potentiation and long-term depression are concepts describing this nociceptive plasticity.

Nociceptors also play an important role in the inflammatory response. Together with the sympathetic nervous system, efferent action in nociceptors create neurogenic inflammation.[36] This may explain why stressful conditions may exacerbate inflammatory conditions.[5]

The ability to perceive pain is critical to survival, but at times it is just as important to be able to modulate pain. Horses must be able to escape from a pack of wolves, even if injured. When the immediate threat has passed, the pain is perceived and may become severe or even immobilizing. A part of this modulation is when nociceptors fire into the cord they activate c-fos and c-jun which initiate the production of enkephalins and dynorphin. These endogenous opiates can play a part in inhibiting dorsal horn cells and gating pain.[27] Other modulation comes from descending pathways from the periaqueductal gray, ventral medullary raphe nuclei and the basal ganglia.[5]

BACK PAIN

"The condition of back problems in horses is frequently disregarded as a viable entity in veterinary medicine; ... As a profession, our task is to acknowledge that primary back problems do exist in horses. New models of human spinal rehabilitation include multidisciplinary approaches [integrative care] in the management of back problems. Advances in the treatment of equine back problems will incorporate some of the same philosophies." Kevin Haussler, DVM, DC, PhD

Sources of Pain

Local tissue damage can lead to direct activation of nociceptors. Chronic muscle pain can result from excessive stretch as in a traumatic accident, or, after the overload of a muscle during unaccustomed exercise. This is common during compensatory gait patterns due to lameness or poor biomechanics. If the nerves are also stretched, damaged or inflamed, radiating pain may result. Inflammation within the intervertebral foramen can cause irritation of the dorsal root ganglia and hyperalgesia of the foot as well as ongoing activity localized to the dorsal root ganglia.[26,39] Nociceptors in somatic tissue and the viscera can create referred pain in the back. These nerves fire into the wide dynamic neurons in the spinal cord which are designed to relate intensity rather than location.[32]

Example 1: Facet Syndrome

Facet syndrome is a condition in which there is an acute or chronic injury to one or more zygapophyseal joints, generally from excessive movement in one or more planes. It may include pinching or excessive stretching of the joint capsule. There is immediate discharge of nociceptors in the joint capsule.[16] This results in inflammation in the joint and surrounding tissue due to the release of noxious chemicals.[40] Since the effected tissues are paraspinal, diagnosis becomes difficult due to the diffuse bilateral nociceptive dysafferentation.[5]

Diagnosis

Back pain is more difficult to diagnose than other types of pain due to the divergent pattern of afferent nociceptors from the paraspinal structures. Nociceptors from limbs terminate ipsilateral; you need to know which hand to pull from the fire, and paraspinal tissue nociceptors terminate bilaterally.[15,16] Additionally, when nociceptors enter the spinal cord through the dorsal root ganglia and the dorsal nerve roots, they synapse at as many as 5 spinal cord segments cranial and caudal.[31] This leads to poorly defined areas of back pain, and the need for bilateral examination.

Animal chiropractors, with their knowledge of spinal anatomy and enhanced palpation skills, can be an important part of the diagnostic team when back pain is involved.

Treatment

The integration of chiropractic adjustments with the traditional methods of anti-inflammatory and pain medication with modified work has several advantages. One, substantial evidence suggests that stimulating mechanoreceptors inhibits nociceptor activity. The adjustment will help control the pain. Two, improving spinal mechanics will help direct the proper orientation of collagenous tissue during repair and aid in keeping stress off the injured segments.[5] And three, maintaining 'normal' movement in surrounding motion units will help insure normal afferent mechanoreceptive patterning in the constant neuronal pathways driving up-stream functions from gait to visceral function.[4,28]

Example 2: Hypomobility of the L6-S1 Motion Unit

The lack of supraspinous ligament, the shape and orientation of the lumbar dorsal spinous processes and sacral tubercles, and the shape and orientation of the intertransverse joints assure that the movement of the equine lumbosacral motion unit is almost pure flexion/extension, with little or no axial rotation and lateral flexion. This is important for the transfer of energy created in the horse's rear limb and pelvis up the spine for forward ambulation. It is common for the L6-S1 motion unit to become hypomobile due to the tremendous amount of stress put on this transitional zone of the spine. As compensation, the lumbar spinal motion units

become hypermobile, and the spinal flexors (the lumbosacral hypaxial muscles such as the psoas muscle groups) become overworked. This creates a shortening of the muscles and an increase in the kyphosis in the lumbar spine. The horse will still be able to walk, trot, and cantor, but only in a compensatory gait pattern. The longer this pattern persists, the more plastic it becomes. The added stress to the soft-tissue structures will eventually lead to lameness and pathology.

Diagnosis

Motion palpation may lead the animal chiropractor to a diagnosis of vertebral subluxation complexes in any of the lumbar vertebrae or sacrum.

Treatment

Spinal adjustments would primarily be aimed at correcting the hypomobilities, but in doing so, would also have the effects of restoring normal muscle activity, pain control, would help direct the proper orientation of collagenous tissue during repair and aid in keeping stress off the injured segments[5], and would return 'normal' movement in surrounding motion units to help insure normal afferent mechanoreceptive patterning in the constant neuronal pathways driving up-stream functions from gait to visceral function.[4,28]

Chiropractic, Back Pain and Research

There is a great deal of research that heightens the efficacy of animal chiropractic for back pain using meta-analysis, systematic reviews, and randomized controlled studies. Guidelines have also been established by consensus meetings.[11] Although these guidelines are established for the care of humans, like other forms of health care, it is not implausible that these guidelines would also be appropriate in the equine patient.

Equine back pain and chiropractic research is limited, but does exist.[13,17,24,42] Chiropractic care for horses has been discussed thoroughly in texts such as the Veterinary Clinics of North America, Equine Practice, Henson's Equine Back Pathology, Ross and Dyson's Diagnosis and Management of Lameness in the Horse and Back and Clayton's Equine Locomotion. It is also important to note that although current research has limited or varying results, no high level research has ever shown chiropractic to be contraindicated or of harm to horses.

VISCERAL PAIN

In spite of all the progress made in equine medicine in the last 30 years, colic is still considered the most common cause of death in adult horses, and accounts for a large proportion of emergencies for horse owners and veterinarians.[46] One reason for the high numbers is that colic does not refer to any one disease, but to any abdominal pain, of any origin or etiology. Many of the signs and symptoms of visceral pain such as curling the upper lip, refusing to eat, biting the flanks, looking at the abdomen, expressions of anxiety, or even kicking at the belly, rolling, pawing, and getting up and down frequently are all descriptions of reaction to pain.[29,46] Visceral structures are highly sensitive to stretch, ischemia and inflammation, but relatively insensitive to other stimuli that normally evoke pain in other structures, such as burning and cutting. Visceral pain is diffuse, difficult to locate and often referred to a distant, usually superficial, structure.[47] A 2003 meta-analysis of randomized clinical trials found that spinal manipulation was "more effective than sham therapy" in the treatment of pain.[1]

Regulation of motility of the gut is based on a complex interaction between central innervation, autonomic innervation, and the enteric nervous system.[19,30] The enteric nervous system is a collection of neurons in the gastrointestinal tract that control motility, exocrine and endocrine secretions, and microcirculation.[18] Coordination of all these systems is imperative in maintaining normal and balanced gut function.

Choosing the appropriate treatment requires knowledge about the physiology and pathology of equine gastrointestinal motility.[30] Chiropractic can be a part of that treatment regime, particularly in medical, non-surgical types of colic, such as distension gas colic or spastic colic, or simple obstructions such as feed impactions or entrapments. True chiropractic treatments, not other forms of manipulation or manual therapies, attempt to restore normal movement to the motion units in the spine and extremities. This provides the nervous system with thousands of normal input patterns from both mechanoreceptors and nociceptors, influencing the entire system to collaborate and equalize. The chiropractic treatment's goal is to help the nervous system recognize normal input patterns so that it can make better decisions in coordinating and normalizing output patterns to the viscera, thus helping to restore normal motility patterns in the gut.[6-9,12,22,38,43,44,48,50] Interestingly, anecdotal effects of chiropractic and colic have been both positive and negative. Some treatments have been reported to cause immediate, short lasting symptoms of colic.

Although chiropractic may have a place to play in the treatment of certain types of colic, more research is needed to define its role. Since colic is always potentially life threatening, a veterinarian should be called immediately when signs or symptoms are present, and any chiropractic treatment must be performed by a qualified doctor after discussing options with the primary veterinarian.

LAMENESS

There are four major biomechanical mechanisms in the horse; the stomatognathic system, the bow and string, the stay apparatus and the use of the body in ambulation called engagement. The function of these mechanisms is to conserve energy and to reduce stress on the soft tissue and bone that are part of the mechanisms. In other words, the anatomy of the horse has evolved to allow the horse to perform as we want, with as little stress and as efficiently as possible. Any deviation from 'normal' will put too much, or too little force on the structures involved. Over time, this asymmetrical and unbalanced use will cause the structures to fail, creating lameness.

Lameness is the most common cause of poor performance in sport horses.[34] In 1998 in the United States, $678,000,000 was spent on lameness, with $448 M on lost use, $195 M on vet bills, $35 M on death loss.[45] Lameness typically results from pain associated with the musculoskeletal system, including abnormalities with joints, bones, tendons, ligaments and muscle. The majority of cases of lameness are localized to areas within the distal limb; however, the sources, causes and locations of lameness are diverse. Lameness can be caused by numerous and diverse conditions, including but not limited to wear-and-tear, overuse, and trauma. The diagnostic approach to lameness in horses should involve consideration of the signalment (age, breed and sex), pertinent medical history, past and present use of the horse, physical examination, lameness evaluation and ancillary diagnostic procedures.[34]

Today, traditional methods of diagnosis and treatment protocols rely on pain and inflammation. Gait analysis, blocking, palpation, hoof testers, flexion tests, etc. all rely on pain and inflammation. Treatment most often centers on anti-inflammatory medication, joint support (which may be from medicine to good shoeing), and decrease in activity. Positive results are when the patient appears to be going without pain or apparent 'lameness' and they are released from care.[2,3,37] What about the horses that don't respond; the ones that have no apparent pain signs on examination; or, the ones that come back?

Chiropractic treatment focuses on the biomechanics of the whole horse. A chiropractic examination and treatment examines every joint in the spine and extremities.[14,35] By doing this, the horse becomes more balanced and symmetrical. The well-trained chiropractor focuses on the before mentioned biomechanical mechanisms, attempting to assist them to become as efficient as possible. He does this while working with the primary veterinarian who attempts to alleviate any of the damage to the structures that are present do to the prolonged abnormal stresses on these structures.

Example: Poor Engagement and Front Suspensory Apparatus Pathology

Below is a picture of a horse with a very common posture. Standing on a level surface the stay apparatus should be engaged and the muscles of her body should be relaxed and flaccid. There is a dip in front of the withers giving the appearance of a neck set on too low, the back is becoming lordotic except over the lumbar spine, there is wasting in the gluteal muscles and she has her weight shifted forward with her front legs underneath her. This is a perfect example of a horse that is not engaging (collecting) well, has difficulty going forward, will not frame properly, is not using her bow and string and has severe problems with her stay apparatus that will eventually lead to front suspensory apparatus pathology, including flexor tendon damage, suspensory desmitis and even navicular syndrome. A biomechanist can tell this just from the photo. That is the advantage of studying the biomechanical systems of the equine. What he cannot tell you is what came first, the chicken or the egg. All of the above problems must be addressed and managed.

Diagnosis

This is the typical non-patient. The horse may begin to have difficulty performing, the farrier may be struggling to repair long toes and under-slung heels and the rider may start to become frustrated, but they won't seek care from the veterinarian until someone discovers lameness, and that is when it is usually grade 2 or 3. Animal chiropractors, with their knowledge of spinal anatomy and entire equine biomechanical systems can be an important part of the diagnostic team when a horse like this presents itself at the front door.

Treatment

Traditional diagnosis may be high suspensory desmitis, tendon strain, etc. and care would include anti-inflammatory medication and altered work patterns until the pain, hence lameness, disappears. Then the

horse is returned to work, many times reappearing at the clinic some months later with a relapse. This is because the compensatory gait patterns have been present for so long, the neural pathways have plasticized, and now recognize the compensatory patterns as normal.

The integration of chiropractic adjustments with the traditional methods of care would again have many advantages. The first would be to adjust the spine, bombarding the nervous system with normal patterns of movement in an attempt to 'wake-up' the old, correct patterns. This is like getting on a bicycle after 20 years. It doesn't take long for the old plastic pathways to wake-up because they were set when you were young and your nervous system was still developing. The horse also has patterns hard-wired into his nervous system and stored in the central pattern generators in the spinal cord. This treatment of the hypomobile segments with stimulation of the old neuronal pathways is one of the best ways to repair the ineffective biomechanical systems and get the horse back on the road to long-lasting reparation.

Remember that the adjustments will also help control the pain, help direct the proper orientation of collagenous tissue during repair, aid in keeping stress off the injured segments[5], and maintain 'normal' movement in surrounding motion units helping to insure normal afferent mechanoreceptive patterning in the constant neuronal pathways driving up-stream functions from gait to visceral function.[4,28]

References: (50)

1. Assendelft, W.J.J., Morton, S.C., Yu, E.I., Suttorp, M.J., Shekelle, P.G., 2004. "Spinal manipulative therapy for low back pain".
2. Baxter, Gary M., 2011. Manual of Equine Lameness, Wiley-Blackwell.
3. Baxter, Gary M., 2011. Adam's and Stashak's Lameness in Horses, Wiley-Blackwell.
4. Beck, Randy W., BSc(Hons), DC, PhD, DACNB, FAAFN, FACFN, 2011. Functional Neurology for Practitioners of Manual Medicine, Churchill Livingstone/Elsevier.
5. Bove, G.M., DC, PhD and Swenson, R.S., DC, MD, PhD, 2003. Nociceptors, Pain, and Chiropractic, in Redwood, D, and Cleveland, C.S. III, Fundamentals of Chiropractic, Mosby, St. Louis, MO.
6. Brennan, P.C., Triano, J.J., et al, 1992. Enhanced neutrophil respiratory burst as a biological marker for manipulation forces: Duration of the effect and association with Substance P and tumor necrosis factor. J Manip Physiol Ther 1992; 15:83-89.
7. Briggs, L., Boone, W.R., 1988. Effects of a chiropractic adjustment on changes in pupillary diameter: A model for evaluating somatovisceral response. J Manip Physiol Ther 1988; 181-189.
8. Cassidy, A., Quon, J.A., et al, 1992. The immediate effect of manipulation on pain and range of motion in the cervical spine: A pilot study. J Manip Physiol Ther 1992; 15:495-500.
9. Cassidy, J.D., Lopes, A.A., et al, 1992. The immediate effect of manipulation versus mobilization on pain and range of motion in the cervical spine: A randomized controlled trial. J Manip Physiol Ther 1992; 15:570-575.
10. Chen, R., et al, 2002. Nervous system reorganization following injury, Neuroscience 111(4):761.
11. Council on Chiropractic Practice, 2008. Clinical Practice Guideline, "Vertebral Subluxation in Chiropractic Practice", Third Edition.
12. Dhami, M.S.I., Coyle, B.A., et a. Evidence for sympathetic neuron stimulation by cervicospinal manipulation, in Proceedings of the first annual conference on research and education of Pacific Consortium for Chiropractic Research, California Chiropractic Association, Sacramento, CA:A5 1-5.
13. Faber, M., van Weeren, P.R., Scheepers, M., and Barnevald, A., 2003. Long-term follow-up of manipulative treatment in a horse with back problems, J of Vet Med A 2003;50:241-245.
14. Gatterman, M.I., 1995. Foundations of Chiropractic. Mosby, St. Louis, MO.
15. Gillette, R.G., et al, 1993. Characterization of spinal somatosensory neurons having receptive fields in lumbar tissues of cats, Pain 54:85.
16. Gillette, R.G., et al, 1993. Spinal projections of cat primary afferent fibers innervating lumbar facet joints and multifidus muscle, Neurosci Lett 157:67.
17. Gomez Alvarez, C.B., l'ami, J.J., Moffatt, D., Back, W. and van Weeren, P.R., 2008. Effect of chiropractic manipulations on the kinematics of back and limbs in horses with clinically diagnosed back problems, Eq Vet J 2008;40.
18. Goyal R.K. and Hirano, I., 1996. The enteric nervous system. N England J Med. 1996;334:1106–1115.
19. Guyton, A. and Hall, J., 2000. General principles of gastrointestinal function — motility, nervous control, and blood circulation. In: Guyton A, ed. Textbook of Medical Physiology — 10th ed. Philadelphia: WB Saunders, 2000:718–727.JHB.
20. Jaobson, M., 1991. Developmental Neurobiology, third ed. Plenum Press, New York/London.
21. Handwerker, H.O., Reeh, P.W., 1994. Nociceptors in animals. In Besson, J.M., Peripheral neurons in nociception: physiopharmacological aspects. John Libby Eurotext, Paris.
22. Harris, W., Wagnon, R.J., 1987. The effects of chiropractic adjustments on distal skin temperature. J Manip Physiol Ther 1987; 10:57-60.
23. Haussler, K., DVM, DC, PhD, 1999. Back Problems. Vet. Cl. N. Am., Eq. Pract. Volume 15, Number 1, April.
24. Haussler, K.K., Hill, A.E., Puttlitz, C.M. and Mellwraith, C.W., 2007. Effects of vertebral mobilization and manipulation on kinematics of the thoracolumbar region, Am J Vet Research 2007;68:508-516.
25. Henson, F.M.D., 2009. Equine Back Pathology. Wiley-Blackwell, Sussex.
26. Homma, Y., et al, 2002. A comparison of chronic pain behavior following local application of tumor necrosis factor-alpha to the normal and mechanically compressed lumbar ganglia in the rat, Pain 95(3):239.
27. Iadorola, M.J., et al, 1988. Enhancement of dynorphin gene expression in spinal cord following experimental inflammation: stimulus specificity, behavioral parameters and opioid receptor binding, Pain 35:313.
28. Kandel, Eric R., Schwartz, J., Jessel, T., 1991. Principles of Neuroscience, McGraw-Hill.
29. Keen, K. and Coates-Markle, L., 2005. Preventing and Treating Colic in Your Horse, Oregon State University Extension Service, April 2005.
30. Koenig, J. and Cote, N., 2006. Equine gastrointestinal motility - ileus and pharmacological modification, Can Vet J. 2006 June; 47(6): 551–559
31. Light, A.R., Perl, E.R., 1979. Normal anatomy and physiology of the spinal cord dorsal horn, Appl Neurophysiol 51:78.
32. Lundeberg, T., Ekholm, J., 2002. Pain - from periphery to brain, Disabil Rehabil 24(8):402.
33. Merskey, H. and Bogduk, N., 1994. Classification of Chronic Pain, IASP, Seattle, WA.
34. Moore, R. M. Musculoskeletal Causes of Lameness and Poor Performance in Horses, School of Veterinary Medicine, Louisiana State University.
35. Redwood, D., Cleveland, C.S., 2003. Fundamentals of Chiropractic. Mosby, St. Louis, MO.
36. Rees, H, et al, 1994. Do dorsal root reflexes augment peripheral inflammation?, Neuroreort 5:821.

37. Ross, Michael W., DVM, DACVS and Sue J. Dyson MA VetMB PhD DEO FRCVS, 2010. Diagnosis and Management of Lameness in the Horse, Elsevier, St. Louis, MO.
38. Shambaugh, P., 1987. Canges in electrical activity in muscles resulting from chiropractic adjustment: A pilot study. J Manip Physiol Ther 1987; 10:300-304.
39. Song, X.J., et al, 1999. Mechanical and thermal hyperalgesia and ectopic neuronal discharge after chronic compression of dorsal root ganglia, J Neurophysiol 82(6):3347.
40. Steen, K.H., et al, 1995. A dominant role of acid pH in inflammatory excitation and sensitization of nociceptors in rat skin, in vitro, J Neurosci 15:3982.
41. Stevens, C.F., 1979. The neuron. Sci. Am. (Sept), 241, 54.
42. Sullivan, K.A., Hill, A.E., and Haussler, K.K., 2008. The effects of chiropractic, massage and phenylbutazone on spinal mechanical nociceptive thresholds in horses without clinical signs, Eq Vet J 2008;40:14-22.
43. Terrett, A.C.J., Vernon, H., 1984. Manipulation and pain tolerance. Am J Phys Med 1984; 63:217-225.
44. Tran, T.A., Kirby, J.D., 1977. The effectiveness of upper cervical adjustment upon the normal physiology of the heart. ACA J Chiro 1977; XI S 58-62.
45. United States Department of Agriculture APHIS Info Sheet, National Economic Cost of Equine Lameness, Colic, and EPM in the United States, October, 2001.
46. University of California, Davis, The Horse Report, Volume 26, Number 1, January 2008.Williams, P.L., Warwick, R., 1980. Some general features of neural organization. Gray's Anatomy, Churchill Livingstone, Edinburgh, pp. 808-810.
47. Urch, C.E. & Suzuki, R. Pathophysiology of somatic, visceral, and neuropathic cancer pain. In: Sykes N, Bennett MI & Yuan C-S. *Clinical pain management: Cancer pain*. 2 ed. London: Hodder Arnold; ISBN 978-0-340-94007-5. p. 3–12.
48. Vernon, H.T., Dhami, M.S.I., et al, 1986. Spinal manipulation and Beta-endorphin: A controlled study of the effect of a spinal manipulation on plasma beta-endorphin levels in normal males. J Manip Physiol Ther 1986; 9:115-123.
49. Woolf, C.J., 1989. Recent advances in the pathophysiology of acute pain, Br J Anesth 63:139.
50. Yates, R.G., Lamping, D.L., et al, 1988. Effects of chiropractic treatment on blood pressure and anxiety: A randomized, controlled trial. J Manip Physiol Ther 1988; 11:484-488.

Appendix 5, E

Effect of chiropractic manipulations on the kinematics of back and limbs in horses with clinically diagnosed back problems

C. B. Gómez Álvarez, J. J. L'Ami, D. Moffat, W. Back and P. R. van Weeren

© Equine Veterinary Journal - 2008 Mar;40(2):153-9

Department of Equine Sciences, Faculty of Veterinary Medicine, Utrecht University, Yalelaan 112, NL-3584 CM Utrecht, The Netherlands.

Reasons for performing study:

Although there is anecdotal evidence of clinical effectiveness of chiropractic in treatment of equine back pain, little scientific work has been reported on the subject.

Objectives:

To quantify the effect of chiropractic manipulations on back and limb kinematics in horse locomotion.

Methods:

Kinematics of 10 Warmblood horses were measured over ground at walk and trot at their own, preferred speed before, and one hour and 3 weeks after chiropractic treatment that consisted of manipulations of the back, neck and pelvic area. Speed was the same during all measurements for each horse.

Results:

Chiropractic manipulations resulted in increased flexion-extension range of motion (ROM) ($P<0.05$) at trot in the vertebral angular segments: T10-T13-T17 (0.3°) and T13-T17-L1 (0.8°) one hour after treatment, but decreased ROM after 3 weeks. The angular motion patterns (AMPs) of the same segments showed increased flexion at both gaits one hour after treatment (both angles 0.2° at walk and 0.3° at trot, $P<0.05$) and 3 weeks after treatment (1.0° and 2.4° at walk and 1.9° and 2.9° at trot, $P<0.05$). The lumbar (L3 and L5) area showed increased flexion after one hour (both angles 0.3° at walk and 0.4° at trot $P<0.05$), but increased extension after 3 weeks (1.4° and 1.2°, at trot only, $P<0.05$). There were no detectable changes in lateral bending AMPs. The inclination of the pelvis was reduced at trot one hour (1.6°) and 3 weeks (3°) after treatment ($P<0.05$). The mean axial rotation of the pelvis was more symmetrical 3 weeks after the treatment at both gaits ($P<0.05$). There were no changes in limb angles at walk and almost no changes at trot.

Conclusions:

The main overall effect of the chiropractic manipulations was a less extended thoracic back, a reduced inclination of the pelvis and improvement of the symmetry of the pelvic motion pattern.

Potential relevance:

Chiropractic manipulations elicit slight but significant changes in thoracolumbar and pelvic kinematics. Some of the changes are likely to be beneficial, but clinical trials with increased numbers of horses and longer follow-up are needed.

Appendix 5, F

Effect of chiropractic manipulations on the kinematics of back and limbs in horses with clinically diagnosed back problems

Sullivan KA, Hill AE, Haussler KK.

© Equine Veterinary Journal - 2008 Jan;40(1):14-20

REASON FOR PERFORMING STUDY:

Common methods used to treat back problems in horses need to be assessed objectively.

OBJECTIVES:

To measure spinal mechanical nociceptive thresholds (MNTs) and evaluate the effects of chiropractic, massage and phenylbutazone, compared with active and inactive control groups.

METHODS:

Baseline MNTs at 7 sites within the thoracolumbar and sacral regions were measured in 38 healthy mature horses exhibiting no clinical signs of lumbar pain. Horses were assigned to one of 3 treatment groups: instrument-assisted chiropractic treatment, therapeutic massage and phenylbutazone; or 2 control groups: ridden exercise (active control) or routine paddock turnout with no ridden exercise (inactive control). MNT measurements were repeated at 1, 3 and 7 days post treatment. The percentage change from baseline MNT values was calculated within groups.

RESULTS:

On Day 7, the median MNT had increased by 27, 12 and 8% in the chiropractic, massage and phenylbutazone groups, respectively. MNT changes of <1% were seen within the active and inactive control groups.

CONCLUSIONS:

Chiropractic treatment and massage therapy increased spinal MNTs within horses not exhibiting signs of lumbar pain.

POTENTIAL RELEVANCE:

Pressure algometry provides an objective tool to evaluate the effects of commonly used, but currently unproven treatment modalities on spinal MNTs. Future studies need to evaluate combined treatment effects and longer-term MNT changes in horses with documented back pain.

Appendix 5, G

Long-term follow-up of manipulative treatment in a horse with back problems.

Faber MJ, van Weeren PR, Schepers M, Barneveld A.

© J Vet Med A Physiol Pathol Clin Med. - 2003 Jun;50(5):241-5.

REASON FOR PERFORMING STUDY:

Common methods used to treat back problems in horses need to be assessed objectively

Source

Department of Equine Sciences, Faculty of Veterinary Medicine, Utrecht University, Utrecht, The Netherlands.

Abstract

In order to objectively quantify the effect of manipulation on back-related locomotion anomalies in the horse, a recently developed kinematic measuring technique for the objective quantification of thoracolumbar motion in the horse was applied in a dressage horse that was suffering from a back problem. In this horse, clinically, a right-convex bending (scoliosis) from the 10th thoracic vertebra to the second lumbar vertebra was diagnosed.

As a result, there was a marked asymmetric movement of the thoracolumbar spine. Functionally, there was severe loss of performance. Thoracolumbar motion was measured in terms of ventrodorsal flexion, lateral flexion, and axial rotation using an automated gait analysis system. Measurements were repeated before and 2 days after treatment, before the second treatment 3 weeks later, and at 4 weeks and 8 months after the second treatment to assess long-term effect. At the same time, performance of the horse was assessed

subjectively by the trainer as well. Symmetry of movement improved dramatically after the first treatment. After this, there was a slight decrease in symmetry, but 8 months after the last treatment the symmetry indexes for the various joints were still considerably better than during the first (pre-treatment) measuring session. Subjectively, the trainer did not notice improvement until after measurement session 4. Between sessions 4 and 5 (at 4 weeks and 8 months after the second treatment) there was a change of trainer. The new trainer did not report any back problem, and succeeded in bringing the horse back to its former level in competition. It is concluded that manipulation had a measurable influence on the kinematics of the thoracolumbar spine. However, it is recognized that an improvement in symmetry of motion is not equivalent to clinical improvement and that other measures, such as changes in management, may be more decisive.

Appendix 5, H

The role of physical medicine and rehabilitation for patients in palliative and hospice care.

Downing R.

© Vet Clin North Am Small Anim Pract. -
2011 May;41(3):591-608. doi: 10.1016/j.cvsm.2011.03.011. Epub 2011 Apr 13.

The Downing Center for Animal Pain Management, LLC, 415 Main Street, Windsor, CO 80550, USA. drrobin@downingcenter.com

Abstract

Veterinary patients in palliative and hospice care have progressive and often degenerative diseases that can cause pain as well as loss of function and decreased quality of life. These patients can often benefit from the application of physical medicine and rehabilitation techniques to maximize comfort and function. Physical medicine and rehabilitation are most effective as adjuncts to pharmacologic pain management. Physical medicine and rehabilitation can decrease the doses of analgesics required to keep these patients comfortable. The blend of physical and pharmacologic medicine allows an optimum balance between maximum comfort and maximum mentation.

Appendix 5, I

Back problems. Chiropractic evaluation and management.

Haussler KK.

© Vet Clin North Am Equine Pract. - 1999 Apr;15(1):195-209.

Department of Biomedical Sciences, New York State College of Veterinary Medicine, Cornell University, Ithaca, USA.

Abstract

A thorough knowledge of equine spinal anatomy, biomechanics, and potential pathology is required to understand the principles and theories behind chiropractic and to apply its techniques properly. Chiropractic provides additional diagnostic and therapeutic means that may help equine practitioners to identify and treat the primary cause of lameness or poor performance. Specialized training in the evaluation and treatment of vertebral joint dysfunction and neuromusculoskeletal disorders places chiropractic in the forefront of conservative treatment of spinal-related disorders. Nevertheless, limited research is currently available on equine chiropractic and other nontraditional modalities in veterinary medicine. In 1996, the American Veterinary Medicine Association's Committee on Alternative and Complementary Therapies suggested that the research community should be encouraged to prioritize avenues of research and to allocate research funds to projects that are designed to provide further scientific evaluation of these modalities. The future of equine chiropractic in veterinary medicine is dependent on future research into the clinical effects of chiropractic techniques and the basic pathophysiology of spinal-related disorders in horses.
PMID: 10218250 [PubMed - indexed for MEDLINE]

Chiropractic is a health profession that is legally recognized in several countries under a regulatory framework to deal with neuromusculoskeletal conditions [1, 2]. Spinal manipulation is one of the key aspects of chiropractic treatment, often combined with advice on life-style, physical activities, specific exercises, and ergonomics [3, 4]. Clinical experience shows that manipulation of joints can have a pain-reducing effect, and.Â We decided to restrict the present review to FN theories and their clinical applications in the chiropractic context, i.e. we were interested only in sources that included the use of manual therapy. Thus, the work presented here does not depict the whole field of FN, which is wide and merits further explorations.