AN INTEGRATED APPROACH TO DIAGNOSING AND TREATING BACK PAIN IN HORSES (from Proceedings of Conference on Equine Sports Medicine and Science, Cordoba, Spain, 1998)

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Performance problems in horses impact directly on their jobs as professional athletes, and so are a major concern of equine veterinarians. While most lamenesses can be isolated to the distal limbs, there remain many cases in which traditional lameness diagnostic techniques fail to localize a problem and prescribed rest has not restored the animal to its former level of performance. Often these cases involve proximal joints, pelvic or spinal problems. In recent years, several non-traditional techniques--acupuncture and chiropractic care--have augmented the veterinarian's abilities to address these difficult cases. These treatment modalities are not an *alternative* to a complete and thorough lameness exam, but, in appropriately chosen cases, are *complementary* to and often synergistic with standard veterinary care. This paper will present the indications, philosophy, mechanisms of action and clinical applications for equine acupuncture and chiropractic, and discuss the integration of complementary techniques into a traditional veterinary practice.

Why do we think there is a back problem?

The diagnosis of a spinal disorder is often through a process of elimination: the horse does not block out on any limb, has no demonstrable lesions and the problem persists despite rest. The typical scenario is a chronic (2-24 month) history of vague lameness which cannot be isolated to a single joint, and has been unresponsive to traditional treatments, such as joint injection. In these chronic cases, several layers of problems are created by the animal's long-term compensation for pain syndromes. The acute presenting problem is generally the most recent compensatory mechanism, and treating it will reveal the layer underneath, like peeling the layers of an onion. It is important to remember that quadrupeds, unlike humans, have many different ways to limp, and the presenting syndrome may be anatomically far removed from the primary injury.

Sometimes, a specific behavior or sensitivity will point to back pain (see **Table 1**). Sometimes the problem has an acute onset obviously linked to a traumatic event, such as a fall, transporting accident, or general anesthesia for surgery. These are a veterinarian's most challenging--and frustrating--cases. Once the traditional approach has proved inadequate, it is important to take a step back and evaluate the entire animal rather than the individual limbs and joints.

Table 1. Some behavioral indications of back pain

- Resentment with girthing
- Reduced neck or back flexibility
- Heavy on the bit or line
- Favors one lead
- Poor collection or transitions
- Tail held to one side, or swishing
- Uncoordinated
- Drags one toe consistently
- Refuses jumps
- Lack of impulsion
- Rushing
- Bucks or kicks when ridden
- Hypersensitivity to grooming
- Difficult to shoe

The whole horse approach to diagnosis

As in any tricky case, the first step is to get a detailed history. Through careful questioning, we must try to establish whether the problem is related to the patient's external environment, behavioral or training issues, or physical pain. After discerning the nature and onset of the problem, try to focus on the more subtle aspects....is the severity of problem always the same, or does it wax and wane? Does it get better or worse when the animal works? Is it evident when the horse is worked from the ground or only under saddle? Is it evident when the animal is turned out, moving freely? Does it change with the weather or time of day?

Take a step back and look at the entire world of the patient. Have there been changes in barn management or feeding? Have there been changes in training procedures? Has the horse recently been advanced to a new level of competition or training? Is there a new rider? Is there a new saddle, bit or bridle?

Table 2. Management and training practices that strain the horse's body (from J. Harman, *Holistic Approach to Equine Practice, 1997)*

- ponying racehorses
- longing (for sedation)
- training devices
- muscles neglected after exercise
- failure to observe warm-up and warm-down
- use of mechanical hot-walkers
- excessive use of swimming to condition
- blankets that are too tight

Conformation of the horse should be evaluated within the context of its performance specialty. Sometimes habitual postures from back or neck pain can mimic poor conformation. Conformational anomalies that lead to joint strain are often compensated through the back, which can lead to chronic muscular soreness, discomfort or movement restriction. Examine the standing horse on a reliable, level surface. If placed in a square position, does it stay square, or revert quickly to an asymmetrical stance? Evaluate symmetry in muscle mass (atrophy or compensatory hypertrophy) and position of bony prominences while standing and while walking and trotting. The feet should be thoroughly examined for signs of uneven wear.

Evaluating saddle fit

Performance pain can have many etiologies. It is important to rule out discomfort from external sources, such as the tack or the rider. Improper saddle fit is one of the most common causes of back pain. Some of the more obvious signs of saddle fit problems in the horse are **white hairs, sores, local inflammation and muscle atrophy in the withers**. Convincing someone their saddle is the source of their horse's pain can be very problematic. Very often, the client only has one saddle which is used for several horses with different sizes and conformations. Others buy saddles for status reasons or their own comfort, and do not consider the comfort of the horse. The majority of horse-owners in the U.S. simply have no access to knowledgeable saddlers, and rely upon the advise of friends and trainers, which is usually inadequate. The art of saddling can not possibly be imparted within this article, but I would strongly recommend an instructional videotape made by Performance Saddlery (ordering information in reference section). If the horse has an extreme reaction to being tacked, the tree, or internal structural support of the saddle which is constructed of metal and wood, may be broken or damaged. Check for a broken tree by assessing the spring of the tree in every direction, or radiographing the saddle. Also check for fracture of the spinous processes of the withers.

Aside from structural issues in saddle construction (such as tree damage, depth of gullet, width of panels and lumpiness in the flocking), there are four important points to consider in saddle fit: **position, tree size, balance** and **stability**. The most common mistake, especially in jumping horses, is to **position** the saddle too far forward on the back. This impinges upon the free movement of the shoulder and upsets the balance and fit of the saddle. It should be placed so that the leading edge of the tree is two fingers' width behind the most caudal position of the scapula, which is when the foreleg is fully protracted. The **tree size** should be evaluated once the correct position is established. While exerting pressure on the seat of the unpadded saddle, (simulating a rider's weight) you should be able to fit 3-4 fingers between the pommel and the top of the withers. If you can fit your entire hand, the tree is too narrow, and is impinging on the muscles alongside the withers. If you can only fit less than two fingers, the tree is too wide and will impact upon the spinous processes of the withers during locomotion. If the tree is marginally too wide, an extra saddle pad can sometimes prevent discomfort, like an extra pair of socks in shoes that are too large. When a tree is too narrow there is *no amount or type of padding* that will resolve this problem. To evaluate the **balance** of the saddle, let a pencil roll to the lowest point on the tacked horse: this should be halfway between the pommel and cantle, so that the rider's weight is right in the middle. If either the cantle or pommel is high, the rider will be thrown off balance which will profoundly affect the horse's performance and comfort. Raising with half-pads usually disturbs other aspects of saddle fit, and should be avoided when possible. Generally speaking, most so-called *therapeutic pads* usually do more harm than good, and should be discouraged. Finally, since each horse is muscled differently, you must check the **stability** of the saddle: do the panels contact the horse in a smooth and continuous fashion? If the panels have more curve than the horse's back, it will rock , with the midpoint as a fulcrum. If the back has more curve than the panels, the saddle may bridge, i.e. leave a gap under the rider's weight, which focuses pressure on the cantle and pommel. The results of these stability problems are very obvious in the animal: after being ridden, there is heat and soreness either in the center (rocking) or under the cantle and pommel (bridging).

All of these saddle fit issues must be addressed both in the standing and moving horse. For instance, a saddle that is bridging in the standing horse may fit perfectly when the horse is moving in collection. Similarly, a saddle that fits perfectly in the standing animal may become unstable when it raises its back to move. In addition, saddle fit changes with the fitness and development of the horse, as its back musculature changes. If a horse is only worked seasonally, the saddle should be tailored to its most fit conformation, and extra pads used in the early training periods before its muscles are developed. It is essential to convince the client that the saddle fit is critical to their horse's performance, and that no horse can do well when it's saddle hurts them. If a client who has five horses and one expensive saddle resists this idea, ask them if they would expect everyone in their family to wear the same pair of shoes to run a race, or dance a ballet. Similarly, the bridle (or harness) and bit should be checked for chaffing or instability. The horse should be able to move its tongue freely with the bit in its mouth. Make sure the teeth are well-maintained and problem free.

Problems due to the rider must be addressed with great tact. Aside from the skill level, there are many situations where a physical problem in the rider causes problems in the horse. This can be especially significant if the rider has a back or neck injury, malformation or fixation. Pain and stiffness in the rider is transferred directly to the horse's sensitive back. Sometimes the help of the trainer can be enlisted to encourage the rider to seek treatment for their own discomfort.

Soft tissue palpation

Before embarking on the specific diagnostic techniques of acupuncture and chiropractic, there is a great deal of information to be gained from laying hands on the muscles and ligaments surrounding the spine. The entire length of the topline should be evaluated for heat (inflammation) or cold (impaired circulation) by running your hand just above the skin surface. Myospasm, areas of edema or hyperesthesia can all be found through light palpation from head to tail. Many horses who are "head-shy" are suffering from pain in their atlanto-occipital joint and are very frightened of being touched in that area. Look for a habitually asymmetric head carriage and reports of resistance to bending or collection. Evaluate the silhouette of the spine from the tuber sacrale to the mid-thoracic region. There should not be any areas of "roaching" or convexity in the lumbar spine. The commonly seen "hunter's bump" may indicate pelvic problems. Exert pressure with a needle case in the depression along the xiphoid cartilage to dorso-flex the spine. Resistance to this is often a compelling indication of back pain. Flex the head to both sides and down between the legs and evaluate the smoothness of the curve formed, the range of motion and the symmetry or willingness to bend. The soft tissue exam can often help in localizing the anatomic region of pain.

Specific diagnosis of spinal problems

Our ability to specifically diagnose back and neck problems is relatively new. High technology tools, such as technetium scanning, radiography and ultrasound have only recently been applied to spinal diagnostics, as we have become more aware of the back's relevance to performance problems. As in distal limb lamenesses, these methods are adept at visualizing focal lesions within bone and soft tissue. However, the sensitivity of these tools is less than optimal for spinal diagnosis. Subtle performance problems are sometimes due to subtle lesions. While the technetium scans are extremely sensitive in the bone phase, obtaining good results in the soft tissue phase is more tricky. Radiography is limited to the tips of the dorsal spinous processes because of the large muscle mass surrounding the spine in the back region. Ultrasound can be very effective in diagnosing pelvic fractures and lesions of the supraspinous ligament, but is more difficult to use in visualizing deeper soft tissue structures. Even with these advanced technologies, localizing an anatomic lesion in the back can not be guaranteed.

The biomechanical nature of the spine is a synsytium of related elements, which rely upon total integration and interconnection to function. Each spinal unit (two adjacent vertebrae) has ten ligaments connecting it, only one of which (supraspinous) is easily visualizable on ultrasound examination. The epaxial muscular system that surrounds the spine has contiguous elements that range from the sacrum to the first thoracic vertebrae. Faster gaits depend upon energy storage and exchange between the front and hind end, which is mediated by the back. If the exchange mechanisms of the back are impaired, the resulting imbalances can strain the distal limbs. This kind of subtle disorder may be *functional*, rather than anatomic or pathologic, which can account for some of the diagnostic difficulties using methods that visualize lesions. This is where alternative methodology, such as acupuncture and chiropractic can become very useful. Both of these healing arts assess *functional* parameters of the musculo-skeletal system, and in the hands of a skilled practitioner, can enormously expand their diagnostic and therapeutic range. It is important to remember that any modality of treatment has its strong points and its limitations,

whether it be acupuncture, surgery or joint injection. The best strategy is the use each method for its strengths and not expect any one approach to solve all problems.

Complementary methods of therapy often invoke medical philosophies and systems that are outside the mechanistic-based "western medicine" of traditional veterinary training. To effectively use these systems, serious post-graduate study is necessary, both to understand the new system and to gain skills in its implementation. Both acupuncture and chiropractic have become widely used in human and veterinary medicine, especially in recent years. There are post-graduate specialty courses offered world-wide to train veterinarians in these modalities. Information on contacting the appropriate professional societies will be referenced at the end of this article.

Acupuncture

Acupuncture is an ancient Chinese system of medicine, which relies upon the concept that the living organism has a continuous flow of life energy (called Qi--pronounced "chee") in careful balance with its environment. It is important to remember that this system of medicine is the result of five thousand years of clinical observation, around which the philosophic basis was created. The traditional acupuncture treatments are those which were found to be effective, and explanations were later found in the codification of the **t**raditional **C**hinese **m**edical (TCM) principles. Modern, mechanistic medicine, with its strong emphasis on pharmaceuticals and surgery has only been around for one hundred years and, even so, has many procedures and treatments whose scientific basis is unknown. Use of any therapeutic aid should be based upon safety and efficacy, and the same standards of "proof" or "belief" need to be applied rigorously whether it is a new drug protocol, an innovative surgical method or a complementary modality of treatment.

According to TCM theory, pathology is an imbalance or obstruction of Qi, which results in illness or dysfunction. The *ying-yang* symbol represents this balance of life, or, in more familiar terms, homeostasis. While "ying-yang" seems odd, foreign and suspicious, the concept of balancing opposites is pervasive in our medical training, whether it is acid-base interactions or hyper/hypo-active glands. In TCM, the term *Yin* describes concepts or processes that are inner, introverted, cold and chronic, while its opposite, *Yang* describes those which are superficial, excessive, hot and acute. By this classification, a bacterial infection is a *yang* pathology, while a hypothyroid condition is *yin*. This organization of conditions, pathologies and patients is critical to treatment strategies, which aim to balance the forces and restore homeostasis.

Table 3. Yin and Yang in Physiology

	Yin	**Yang**
Autonomic Nervous System	Parasympathetic	Sympathetic
Central Nervous System	Serotonin, Endorphin Enkephalin, cAMP	Epinephrine Dopamine, cGMP
Vasculature	Vasoconstriction	Vasodilation
Immune Function	Anti-inflammatory	Inflammatory
Behavior	Meditation	Stress Response

Acupuncture therapy stimulates the flow of Qi through channels, called meridians. Most acupoints used in veterinary medicine are located along these meridians, each of which is associated with a specific internal organ or energy concept. The therapeutic goal of a traditional Chinese medical practitioner is to remove obstructions so that the patient may find balance and heal themselves. Acupuncture can be very effective in treating a wide variety of medical conditions, but, in the West, it is most extensively used for relief of musculoskeletal pain.

How acupuncture works

While the clinical efficacy of acupuncture therapy has been demonstrated in many well-regarded studies (even the conservative U. S. National Institutes of Health made a public statement in November 1997 that acupuncture is an effective treatment for musculoskeletal pain), the mechanisms of action are not as clearly defined. The demonstrated physiologic effects of acupuncture therapy can not be explained in terms of a single mechanism, but rather a series of interactions between the nervous system, the endocrine and the immune system. There are several theories that contribute to our understanding of how acupuncture works. For a more complete discussion of this complex subject, with extensive references, consult *Veterinary Acupuncture, Ancient Art to Modern Medicine*, ed. A. Schoen, Moseby 1995.

The (**gate theory**) neurophysiologic explanation of acupuncture analgesia hypothesizes that the acupuncture stimulus, traveling on large myelinated sensory nerves acts on interneurons in the substantia gelatinosa of the spinal cord to block impulses from the smaller, slower, unmyelinated C-fibers which carry pain sensation, thus "closing the gate" on pain perception at the higher levels of the CNS. The **autonomic theory** focuses on somato-visceral synapses in the spinal cord, through which the parasympathetic or sympathetic nerves of the autonomic system seem to be selectively stimulated by cutaneous acupuncture treatment. Research supports the sensitivity of autonomic neural transmitter levels to acupuncture stimulation. The opiod **humeral theory** of acupuncture is perhaps the best documented because opioid effects can be tested through simple experimental designs, unlike some of the more complex metabolic and immune effects of acupuncture treatment. Blood from acupuncture stimulated animals circulated to other animals, results in a similar rise in pain threshold. The observed changes in pain threshold are naloxone reversible implicating beta-endorphin as an active neurohumor in acupuncture analgesia. This is supported by findings that cross-tolerance can develop between acupuncture treatment and morphine, and that tolerance develops in cases of prolonged acupuncture treatment. The most controversial mechanism is the **bioelectrical** current of healing, as put forth by Becker and Seldon (1985). These researchers hypothesize that a primitive data transmission and control system, whose prime function is detecting injury and controlling the healing process, functions on DC electronic signals generated by perineural cells within the CNS. Acupuncture points have been demonstrated to have reduced electrical resistance--this is the basis of many electronic "point-finder" devices--to act as amplifiers along the DC channel formed by the acupuncture meridian. It is hypothesized that insertion of the metallic needle at this amplifier point will alter the transmission, and so intervene with the set point of the body's healing process. No single theory seems to be able to account for all the effects of acupuncture. Probably some combination or segregation of mechanisms is responsible for effects at different points or groups of points, depending upon condition, location, innervation and stimulus.

TCM and acupuncture diagnosis

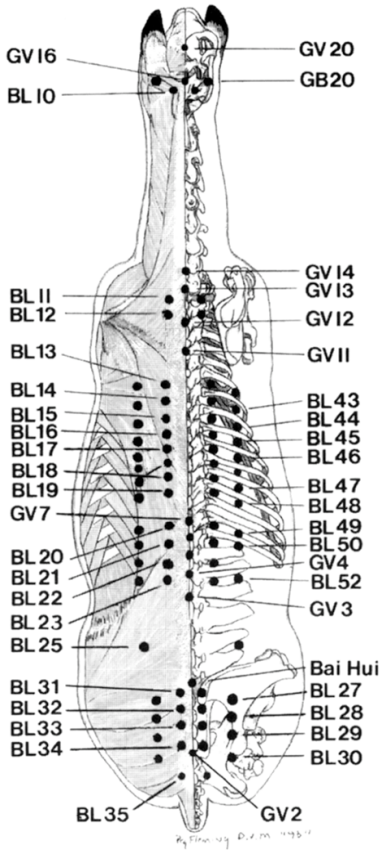
There are 14 meridians or channels that traverse the body, most of them starting or ending on a distal limb and running along the medial (yin) or lateral (yang) aspect of that limb. Yin and Yang meridians, named after the internal organs, are paired conceptually (for example, liver and gall bladder, heart and pericardium), and have associations with specific elements, body tissues, sensory organs and emotional states. The meridians are not directly correlated to the anatomic organs, for instance, although the horse has no anatomic gall bladder, it has a gallbladder meridian. On the dorsal and ventral midline, respectively, are the Governing Vessel and Conception Vessel meridians, which encompass very powerful points for whole body function. Perhaps the two most important points are GV 26, located at the philtrum of the nose and Bai Hui, at the lumbosacral junction. GV 26 is a powerful autonomic point that can be effectively used to stimulate the sympathetic nervous system at times of respiratory arrest. Stimulation of this point also results in endorphin release, and is commonly used in equine practice when a horse's upper lip is "twitched" for restraint. Bai Hui is Chinese for "one hundred meetings", and is considered to be the central junction point for all treatments. While there are hundreds of major and minor acupuncture points located on and off meridians, certain points are more powerful than others. Important points in formulating treatments are master points(useful for treating conditions of certain areas), source points (located at the beginning or end of a meridian in the distal limb) and connecting points (useful for transferring Qi between yin and yang channels). Association points and alarm points are important for both diagnosis and treatment.

Even without a profound and detailed study of TCM and acupuncture, the **association points** can be useful for everyday practitioners to augment their diagnostic abilities. Each meridian has an association point along the Bladder meridian, sensitivity in which will indicate an imbalance in that channel or its associated organs or tissues. The Bladder meridian is located on either side of the dorsal midline, running from the eye to the caudal aspect of the hind hoof. (See **Figure 1**) From the poll to the sacrum, it runs one hand's width from the midline and its points are located in the intervertebral spaces. Palpation of these can produce a reactivity, or involuntary muscle twitch at points associated with a problem. This is seen both for local pain syndromes on the back, and for systemic problems in organs/meridians associated with the point. For instance, a horse with COPD will usually be reactive at BL 13, which is the Lung association point. Local pain and splinting in the longissimus muscle can be reflected in sensitivity in all the Bladder points. As a clinician, it is important to differentiate between local and systemic pathologies using history, clinical signs and conventional diagnostic techniques. When all the Bladder association points show sensitivity, the likelihood of a local muscular problem far outweighs that of a multi-systemic illness in a poorly performing but generally healthy horse.

The two most commonly reactive point in athletic horses are BL 18 and BL 25. Bladder 18 is the association point for the liver meridian, which in TCM is influential for bone, muscle and tendon. The liver meridian runs along the medial aspect of the hind limb, and is associated with the visual sense and the emotion of anger. BL 18 is also located in mid-back at the spot where most saddles end. It would not be unusual to see a case--very reactive at BL 18-- with a chronic stifle problem, who is prone to conjunctivitis on the same lateral side and has an bad temperament. Reactivity at BL 18 could be indicative of local pain from saddle instability, musculo-skeletal injury anywhere in the body, or a problem along the path of the liver meridian.

Bladder 25, located halfway between the tubers sacrale and coxae, is very commonly reactive in horses that are working hard. It reflects the stress of bringing the hind end underneath the horse in collected movement, and also is reactive with most hind leg or pelvic problems.

Figure 1. The Bladder Meridian



BL 13 Association point, Lung meridian
BL 14 Association point, Pericardium meridian
BL 15 Association point, Heart meridian
BL 16 Association point, Governing Vessel
BL 17 Association point, Diaphragm meridian
BL 18 Association point, Liver meridian
BL 19 Association point, Gallbladder meridian
BL 20 Association point, Spleen meridian
BL 21 Association point, Stomach meridian
BL 22 Association point, Triple Heater meridian
BL 23 Association point, Kidney meridian
BL 25 Association point, Large Intestine meridian
BL 27 Association point, Small Intestine meridian
BL 28 Association point, Bladder meridian

From *Veterinary Acupuncture, Ancient Art to Modern Medicine.*

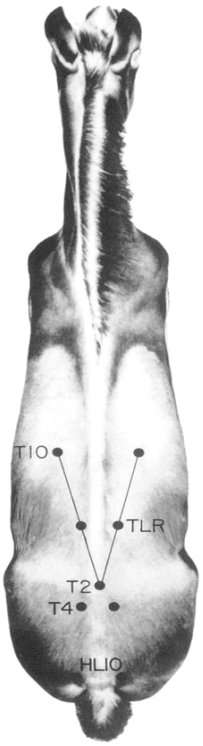
Techniques and treatment strategies

Most veterinary acupuncturists use sterile metallic needles: either injection needles (25 gauge, 1.5 inch/3 cm are most commonly used in equine practice) or traditional acupuncture needles. The advantage of using injection needles is that "aqua-puncture", or injection of a liquid into the acupoint can be accomplished simultaneously. Points can be injected with sterile saline, or saline in combination with

vitamin B-12 or homeopathic muscular remedies. By injecting the point with a liquid, the mechanical pressure of the fluid bolus extends the length of the treatment until the fluid is absorbed. Some sites in the thoracic region or the distal limbs are inappropriate for treatment with injection needles because greater flexibility is required. In these points, traditional needles should be used (32 gauge, 2"). There are also several techniques that are less invasive than needles, such as acu-pressure massage, stimulation of points with cold laser devices and use of moxa, a Chinese herb that is burned near the acupoint to create focal heat. Use of moxa is indicated for certain types of conditions defined in the TCM system. Moxa is highly effective in treating osteo-arthritis, and because of its non-invasive nature, clients can be easily taught to treat their chronically arthritic horses between the veterinarian's visits. These supplies are readily available through Chinese medical catalogues, or in Chinese population centers.

There are many strategies in TCM for designing treatment protocols, based upon different interactions of the system. All treatments have the goal of restoring balance (homeostasis). Textbooks offer "cookbook" combinations of points that have been formulated by advanced practitioners to address the specific imbalances of certain conditions, such as navicular disease, hock osteoarthritis or COPD. For the practitioner who wants to improve their ability to treat back pain, but is not ready or able to get comprehensive acupuncture training, "cookbook" methods have a great deal to offer. Specifically, a study done at the University of Pennsylvania (Martin & Klide, 1987) demonstrates a simple and effective treatment plan for chronic back pain in horses. This method, in which saline is injected into specific back points, has been extensively used by conventional veterinarians in the U.S. to great effect (See **Figure 2**).

Figure 2. The Penn Method of treating back pain



The labeling of points in the Klide & Martin study is coded simply as T= trunk, LR= last rib and HL= hind limb. The points shown here are the most successful ones for back pain.

T2 (Bai Hui)	dorsal midline at lumbosacral space
TLR (BL 21)	a hand's width from the midline at the caudal border of the last rib
T10 (BL 18)	in the cleft between the longissimus costarum and longissimus dorsi at the 15th intercostal space
T4 (BL 32)	a hand's width from midline at the level of S2
HL10 (BL 35)	at the proximal terminal end of the muscle furrow between the biceps femoris and the semitendinosus muscle.

A novice practitioner can achieve good results simply by treating points which show sensitivity to palpation ("ah shi" points) on the Bladder meridian, in combination with master points for the affected area. Another simple way to add acupuncture to a conventional practice is through "ting-zone therapy", in which source points on the coronary band are treated, either with needles, moxa or cold laser therapy. This method was developed and extensively used by Dr. A. Thoreson in Norway, and claims 60-70% success rates with a single treatment (Thoreson, 1994**).**

Number of treatments and length of treatment intervals will vary widely between patients depending upon the etiology and chronicity of their problem. By combining acupuncture and chiropractic treatments, in my experience, most mild to moderate back pain cases can be returned to normal work with 1-3 treatment

sessions, separated by one to two weeks. Some long term chronic lamenesses will require a series of 6-10 treatments to stimulate the neuro-muscular apparatus to heal itself. Chronic, "incurable" diseases, such as arthritis, laminitis or navicular disease require re-treatment at regular intervals, ranging from six months to four weeks. In these cases, although the anti-inflammatory effects of acupuncture will aid in stabilizing the primary condition, the treatment is aimed at helping the rest of the musculoskeletal system compensate for the weakness of the chronic debility. In practice, the rider will know when the animal needs to be treated again, as they will be the first to perceive a decline in performance. Horses in high level competition will often be treated on a regular basis to keep them at their peak performance level.

Although any medical treatment is not without its risks, acupuncture therapy for analgesia of musculoskeletal pain is generally safe and effective, even when used by a veterinarian inexperienced with TCM. There are some strong contraindications, however, in pregnant mares and great care should be taken in these cases to avoid abortion. While it is not necessary or advisable to surgically prepare the needle insertion sites, using sterile, single-use needles and syringes will help avoid infections and cellulitis. The speed of recovery and duration of analgesic effects from acupuncture treatment are greatly enhanced by combining it with chiropractic care.

Chiropractic

Chiropractic is a system of health care that, like TCM, aims to restore the body to homeostasis through self-healing. The specific pathology that chiropractic addresses is impairment of movement at intervertebral joints, termed ***subluxations***. Chiropractic subluxations are treated with an ***adjustment***: a specific physical action designed to restore the biomechanics of the vertebral column and indirectly influence neurologic function (Willoughby, 1997). Chiropractic adjustments are not equivalent to other, less specific, manipulative therapies. The adjustment is a carefully regulated thrust delivered with controlled speed, depth and magnitude to articulations at or near the end of the physiologic range of motion (Haldeman, 1992). While veterinary chiropractic care does not attempt to encompass the entire spectrum of health care needs, it is highly efficacious at treating problems of a neurologic or biomechanical origin.

Various spinal manipulative therapies have been documented in every system of ancient medicine, but the history of chiropractic is both modern and contentious. It was developed by an American visionary named D.D. Palmer in the late nineteenth century, around the same time that the traditional medical profession began to organize itself around the mechanistic disease model. Since that time, chiropractors and medical doctors have engaged in mutual hostility, with the medical community dismissing chiropractic care as "quackery". However, despite open condemnation by the medical profession, chiropractic has remained the most widely used "alternative" health care option in the U.S., especially for relief of chronic back pain syndromes. Only recently, in human health care, has the tide of public opinion washed over the reluctance of the medical community to accept chiropractic. Now, most health insurance policies cover chiropractic care, since research has proven it to be the most efficacious and cost-effective way to treat chronic back pain. The availability of chiropractic training and care is more widespread in the U.S. than the rest of the world. For human practice, the training and licensure is rigorous, requiring four years of academic and clinical training *beyond* the standard university degree.

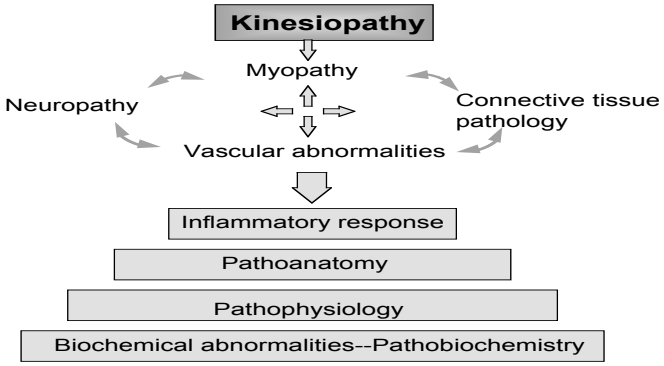
Chiropractic was practiced on animals in the early days as a research adjunct: to prove the validity of the techniques outside the "placebo" effect in humans. Until recently, however, veterinary work would have been an occasional sideline for licensed chiropractors. In the 1980s, an equine veterinarian named Sharon Willoughby, frustrated with her inability to effectively treat performance problems of spinal origin, enrolled in Palmer's original chiropractic college. Through her training in human chiropractic, she was able to develop and codify a system of techniques for adjusting animals. She began training both veterinarians and chiropractors to apply these principles and techniques in veterinary care, and founded the American Veterinary Chiropractic Association. The AVCA and its educational adjunct *Options for Animals* provide training programs worldwide in veterinary chiropractic.

Neurophysiologic basis of subluxation theory

Chiropractic can be defined as a discipline within the healing arts concerned with the etiology, pathogenesis, diagnostics, therapeutics and prophylaxis of **functional disturbances, pain syndromes** and other **neurophysiological effects** related to the statics and dynamics of the neuromuscular system, particularly those related to the spine and pelvis (Leach, 1986). Ultimately, chiropractic is concerned with structure and its relationship to function, which roots it in the basic sciences of anatomy and physiology. The pathology of chiropractic, the *subluxation*, is defined (in contrast to a veterinary subluxation, which is a mildly luxated joint) as a "disrelationship of a vertebral segment in association with contiguous vertebrae

resulting in a disturbance of normal biomechanical and neurologic function" (Homewood, 1962). Current chiropractic theory describes the pathophysiology as an integrated complex (see **Figure 3**), from which neural, biochemical and inflammatory responses to the spinal disrelationship can be understood. There are many hypotheses that describe the complex sequelae of the VSC: neural facilitation, somato-autonomic dysfunction, nerve compression, compressive myelopathy, vertebrobasilar arterial insufficiency, axoplasmic aberration and neurodystrophic modification of the local and systemic immune response (Leach, 1986). All the aforementioned mechanisms have considerable experimental validation.

Figure 3. The Integrated Vertebral Subluxation Complex



To understand the interactions described by the VSC, one must consider the anatomy of the vertebral spinal unit, which is defined as two contiguous vertebrae and their associated structures. As students of anatomy, we study the intervertebral foramen as a space on a skeleton, through which the spinal nerves emerge. In the living animal, there are a multitude of structures co-existing with the spinal nerve in that "space": the recurrent meningeal nerve, the dural extension, cerebro-spinal fluid, intervertebral veins, the spinal artery, lymphatic vessels and connective tissue filling in spaces between all of the others. Spinal units contain 3 to 5 bony articulations, which contain articular cartilage that must be nourished by the flow of synovial fluid generated by movement. If the movement of a spinal joint is compromised, the health of the joint is compromised as well, leading to the initiation of an inflammatory cascade, which has profound consequences for the nearby structures. Changes in the local environment of the intervertebral foramen can act as a reostat on visceral nerves, changing the quality of impulse transmission. Interference with impulse transmission can result in dysfunctions of proprioceptive patterning. In other words, vertebral joint dysfunction leads to **local inflammation**, resulting in edema and vasoactive mediators that affect the function and integrity of the **spinal nerve root** in the region. All of these effects, which can include ligament strain, segmental spinal ischemia and altered neural transmission, are considered to be part of the subluxation pathology. Chiropractic adjustment **restores joint function** and so allows the body to heal any reversible tissue changes.

There are limitations, as in any mode of therapy, to the expected results. A geriatric animal in the last stages of degenerative joint disease will not miraculously transform into a premiere athlete. It is important to recognize when irreversible tissue change has occurred. Unfortunately, the first symptoms appear when the condition is well on the way to degeneration, (see **Table 4**) and often much time is spent on fruitless traditional diagnostics before coming to a practitioner that can effectively treat the problem. The initiating **misalignment** is generally caused by some sort of trauma and its primary results are altered proprioception, muscular hypertonicity, tension in joint ligaments (which contain pain receptors) and meningeal attachments and disc wedging. The **neuropathies** that follow can take the form of nerve facilitation or inhibition. Related mobility problems, or **kinesiopathies**, result in joints that are either hyper or hypo mobile. The joint becomes **dysfunction**al when the tissues fail to perform normally, joint biomechanics are impaired and the neurological input to the end organ is affected. This leads to **symptoms**, and often, due to delayed recognition of the problem or previous failed treatments, to **degeneration**.

Table 4. Phases of Subluxation

- Misalignment
- Neuropathy
- Kinesiopathy
- Dysfunction
- **Symptoms**
- Degeneration

The structure and function of the spine

The equine spine has more than 140 diarthrodial joints, including the tail. Despite some researchers' assessment of ex vivo immobility in the back of the horse, the structure must be designed to move, else the joints would have become fused over evolutionary time. As a mechanical structure, the vertebrae move in controlled directions by a complex of levers and pivots restrained by ligaments and activated by muscles (White, Panjabi, 1990). Athletic performance depends upon freedom of movement, which encompasses full flexibility, precise proprioception, maximal muscular response and an absence of musculoskeletal pain. Though the range of an individual spinal unit is small, the additive effects are much larger: for instance, a three degree lateral bending motion in a single joint can result in a thirty degree axis change when executed throughout the caudal thoracic region. When spinal motor units are restricted in their range of motion, the movement of the extremities is likewise affected, like the arc of a pendulum is influenced by its attachment point. Chronic aberrations in spinal movement can lead to imbalance and disruption of joint loading in the extremities, resulting in degenerative joint disease.

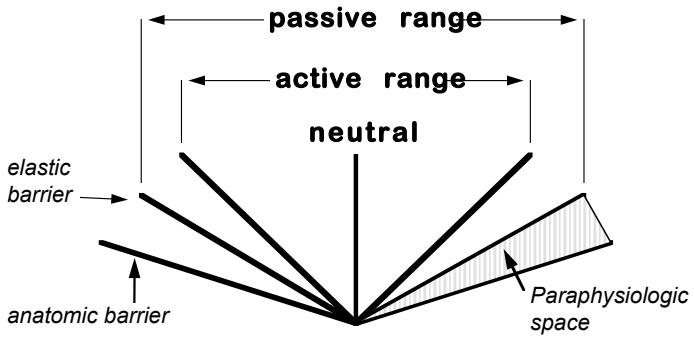
The spine of a vertebrate moves in three dimensions: dorso-ventral flexion, lateral bending and axial rotation. This creates a variety of forces and coupled motions. In a quadruped, the operative mechanical model for the spine is a horizontal beam, as opposed to the human spinal "column". Mechanically, dorsal tension and ventral compression will dominate as the static forces acting on a simple horizontal beam. The animal body has provided passive resistance to these forces with the ligamentous system of the dorsal supraspinous ligament, and the pressurized abdominal and thoracic cavities. However, the spine is not a simple beam: its segmental structure makes it vulnerable to shear forces at the spinal articulations from gravity or external lateral forces. Torque on the spinal beam is created when two directions of bending are induced simultaneously: for instance, if the neck is dorsoflexed and turned to the right, a clock-wise axial rotation will be induced. Bending is created segmentally, through the additive motions of individual vertebrae. Axial tension and compression, the predominant forces on the human spine, are seen when the body is accelerated and decelerated from ground contact. All of these movement directions and forces are part of normal animal locomotion, and the restriction of any one motion will necessitate compensation in another. Often the presenting symptoms in the patient are due to the compensations, rather than the inciting cause. For example, if movement is restricted in the right zygopophyseal joint of L2, the joints of L1 and L3 will become hypermotile attempting to restore the spine to its full movement. Hypermotility can result in strained ligaments, myospasm and increased neural facilitation, leading to pain syndromes. Although the obvious discomfort of the animal may be localized in the longissimus muscle, treating the muscular spasm alone will not cure the condition, since it is a secondary compensation for the hypomotility of the L2 joint.

A joint can become fixed in its neutral position, or at the extreme of its range of motion (see **Figure 4**). The chiropractic adjustment applies a focused thrust through the plane of motion of the joint, using the closest bony prominence to the subluxation as a lever, using just enough force to mobilize the joint, but not incur injury. To accomplish this, the practitioner must have a thorough knowledge of the musculoskeletal anatomy in order to visualize the orientation of the joint and must cultivate sensitive palpation skills to locate bony prominences that may lie deep under layers of muscle and fascia. Considerable advanced training and experience are necessary to attain this level of skill. Human chiropractors have the necessary skills, but lack the veterinary knowledge for accurate diagnosis. Veterinarians can, with application, become proficient in the basics of adjusting animals.

The chiropractic exam

As discussed earlier, the spine of the horse should be seen as part of the bigger picture of the performance abnormality. It is essential to evaluate the animal as a functional, integrated unit, not the sum of its parts. Specific chiropractic diagnostic techniques can be incorporated into the palpation phase of the poor performance examination. Both static and motion palpation are used to assess the motility of every spinal articulation. Since we are assessing *function*, static examination has limited value in diagnosing motility flaws. However, it can be useful to determine symmetry, balance and soft tissue aberrations in the paraspinal region. It is important not to misinterpret normal anatomic variation as pathology. There are mild malformations commonly found in the neural spines that can seem like a "bone out of place". Similarly, the spine may appear normal in the standing horse when a vertebrae is severely restricted in its range of motion.

Figure 4. Range of motion



Motion palpation is the essential tool to accurately diagnose fixated joints. Through motion palpation, the examiner evaluates the active and passive range of motion in each vertebral motor unit (see **Figure 4**). The active range of motion is that which is available through voluntary muscular action. The passive ROM is the "safety zone" beyond the active range which protects the joint from tissue damage. It is more limited and can not be produced by muscular contractions, but can be assessed through external forces applied during an exam. Gentle traction or repulsion within the passive range of motion ends at the *elastic barrier*--this is the limit of the passive "joint play". Finally, there is the *anatomic barrier*, or structural limits of the tissue. The chiropractic adjustment aims to mobilize the joint beyond the elastic barrier, but within the structural limits of the tissue. To accomplish this requires a precise application of force, carefully modulated in both magnitude and direction.

Like most advanced diagnostic skills, motion palpation requires experience and integration of wide-ranging clinical observations. The "normal" range of motion will vary between species, between ages and between individuals. In addition, it may be difficult to get the patient to cooperate, especially if the animal is painful and/or fearful. The goal of the adjustment is not to return a vertebra to a specific position, but to initiate or activate the homeostatic mechanisms of vertebral kinesthetics (Willoughby, 1997). The healing process is not instantaneous, since it often involves repair of damaged ligaments and neurologic reprogramming of muscular contraction. However, it is not uncommon for a patient to find profound relief from muscular pain after a single treatment. If the problem is a long-standing one, the subluxation may recur (usually in a milder form) until the muscles and nerves have re-learned their normal proprioceptive positioning. In these cases, a series of treatments is indicated.

To correctly and safely perform motion palpation, a comprehensive knowledge of the three-dimensional topography of each vertebra is required. The spine can be separated into functional regions, each of which has a different orientation of facet joints and spinous processes. In order to avoid stressing ligaments and causing greater damage, a joint can only be moved through its plane of articulation, which will vary depending upon the specific articulation and the location of the vertebra. It is also recommended to use the shortest possible mechanical lever (i.e. use the bony prominence closest to the affected joint as a contact point) to move the bone, so that the force used can be accurately controlled. Long lever adjustments are capable of generating far greater forces, and so can inflict severe damage, and should be avoided. The motion palpation exam systematically evaluates the movement of every spinal unit in the animal by gently rocking the joints through their plane of motion. Freedom of movement for each joint is assessed by comparison to the clinician's knowledge of "normal" (for that species, age and fitness) and in comparison to the joints nearby. Resistance to movement can result from a variety of anatomic or physiologic barriers (see **Table 5**). The amount of force necessary will vary with the size of the animal and the condition. However, it is important to realize that the clinician is not moving a 500 kg horse with the palm of her or his hand. All adjustments are **specific** to a **single** joint. Spinal articulations are small and can be easily moved by a person of normal strength. From elementary physics, we know that Force = Mass x Acceleration. Using a low mass instrument, like the human hand, force can be maximized through increasing the acceleration of the movement. In other words, for the focus and accuracy needed in adjusting, a light, *fast* thrust is better than one "with your weight in it".

Table 5. Restrictive Barriers: Structural and physiological changes which interfere with normal joint motion.

Pain	physiological barrier
Edema	mechanical barrier
Muscle Spasm	mechanical barrier

Contracture	mechanical/structural barrier*
Intra- and Peri-articular Adhesions	mechanical barrier
Altered Neural Reflexes	physiological barrier
Articular Artifacts	structural barrier*
Osseous Anomalies	structural barrier*

* These are irreversible conditions that can not be "cured". However, the patient's ability to compensate, performance level and quality of life can be vastly improved with chiropractic treatment.

Integration of Chiropractic into conventional practice

It is not recommended for veterinarians to attempt chiropractic adjustments without advanced training. However, with anatomic study, any veterinarian can learn motion palpation skills, which will assist them in localizing back lesions. The first step is to acquire a set of spinal vertebrae for analysis. Using a small pony cadaver is best, and is also useful for client education. Avoid any animals younger than five years, as the vertebral epiphyses will not have closed, and will fall off your model. Clean the spine of muscle and cut the ribs short so that it will fit in your boiling pot. If possible, retain the pelvis and do not attempt to disarticulate it. Boil the bones in water and laundry detergent for at least 18 hours, then clean off any remaining soft tissue. The vertebrae can then be strung through the neural canal with a cord or rubber tubing, and used for study or demonstration.

There are three major regions of morphological similarity, (cervical, thoracic and lumbar) and transitional vertebrae between them. Each region has a characteristic angle of zygopophyseal joint creating an articular plane which is vertical in the lumbar region, angled at 45 degrees off the horizontal spinal beam in the thoracic region and 45 degrees off both the horizontal and the lateral in the cervical region. This allows increasing mobility of the joints from the caudal to the rostral. Similarly, the neural spines, which are the best contact point for motion palpation, are oriented cranio-dorsal in the lumbar region through the anti-clinal vertebrae (T15 in the horse) and caudo-dorsally from T14 through T1. In the cervical region, the vestigial dorsal spines will be deep within the muscular mass of the neck and unpalpable in the living horse. In the cervical region, the laminar-pedicle junction is the contact point on either side.

The transitional vertebrae are the most common region for pathologies and fixations, since they are mediating the conjunction of differing spinal movements. Cranially, the axial-atlanto-occipital articulations are fixated in many horses. These complex joints must be carefully studies to understand their ranges of motion and articular planes. The cervical-thoracic junction is particularly problematic, as it is located deep within the muscle mass of the shoulder and inaccessible to direct manual mobilization. The thoraco-lumbar and lumbo-sacral joints are far easier to assess because of their relatively superficial location.

The pelvic articulation with the spine is a focal problem zone for most performance horses. Note the position of the sacro-iliac joint and its relationship to the tuber sacrale and tuber coxae. The tuber sacrale is much closer to the joint, giving a direct, short lever contact, compared to the longer lever of the tuber coxae. In the standing horse, however, motioning the tuber coxae is an easy way to evaluate the mobility of the pelvis. Asymmetry of the tuber sacrale in the standing horse is also a useful way to see pelvic rotation about the spinal axis. The "hunter's bump" commonly seen in jumping horses is actually a subluxation of the sacro-lumbar-pelvic articulation, and can be corrected, improving performance. The sacrum can become fixed dorsally or laterally, creating distortions of the caudal region which can be seen as abnormal tail carriage. Understanding the articulations of all these joints from the skeleton can enable the practitioner to assess their mobility by gentle rocking through their articular planes. The clinical picture is then completed by synthesizing aberrations in joint mobility with soft tissue palpation findings and reactivity in acupuncture points.

Exercises and stretches

There are several ways in which clients can be educated to maintain the health of their horse between treatments. For most dressage and jumping horses, the strain of collection will create tension points in hind quarters. Deep massage of acupuncture point Bladder 25 (also known as the gluteal trigger point), will release this strain and help the horse to mobilize and use its hind end more effectively. Instruct the client to locate a small depression in the (gluteal) muscle halfway between the highest point of the back (tuber sacrale) and the whorl of hair at the "hip" (tuber coxae). This point should be massaged very slowly, using deep pressure with the tips of the fingers in a counter-clockwise direction for one minute each side before and after work. The caudal thigh muscles can be stretched afterwards by picking up the hind leg, holding it gently by the fetlock and hoof, and gently bringing it forward, close to the ground, in the plane of gait motion. Bring it forward until the horse resists, then hold, allowing the horse to relax and stretch a little further. The foreleg should also be mobilized before work, especially if the horse has been

blanketed. Heavy winter blankets will impede circulation to the shoulder and withers, and can lead to fixation of the cervical-thoracic articulation. Pick up the front leg and slowly flex it fully. Then flex the shoulder forward and back, finishing by moving the leg in a circular motion to free up lateral and medial movement. Holding the hoof in your hand, rotate the pastern joint, and "shake" out the foot while holding the fetlock.

For maintenance of neck flexibility, the client can learn to stretch the horse's neck using a carrot, or other treat. Standing close to the side of the horse, bring the carrot around to the tuber coxae, inducing the horse to stretch around smoothly in order to get the treat. Stretch three times to each side before and after work, and stretch three times ventrally by bringing the carrot slowly down between the front legs to the ground beneath the girth. These stretches are important for any athlete, to warm up and mobilize muscles before and after exertion.

Training opportunities in complementary medicine

Contacting the appropriate professional association is the best way to find out information on post-graduate training in these specialties. Following is information for U.S. organizations:

International Veterinary Acupuncture Society
P.O. Box 1478
Longmont, CO 80502-1478
Phone: 303-682-1167
Fax: 303-682-1168

American Veterinary Chiropractic Association
623 Main
Hillsdale, IL 61257
Phone: 309-658-2920
Fax: 309-658-2622

REFERENCES AND RECOMMENDED TEXTS

Rather than picking and choosing among the myriad individual citations, I would strongly recommend the following texts:

Acupuncture, Ancient Art to Modern Medicine, ed. A. Schoen, Mosby, St. Louis, Missouri 1994

Complementary and Alternative Veterinary Medicine: principles and practice, ed Schoen and Wynn, Mosby, St. Louis, Missouri USA 1997

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