

Review Article

Equine acupuncture methods and applications: A review**D. Z. Pellegrini[†], T. R. Müller^{†*}, J. H. Fontequé[†], L. P. de Souza[†], A. F. de Souza[‡]  and J. G. F. Joaquim[§]**[†]Department of Veterinary Medicine, Agroveterinary Sciences Center, Santa Catarina State University (CAV/ UDESC), Lages, SC; [‡]Faculty of Veterinary Medicine and Animal Science, University of São Paulo (FMVZ/USP), São Paulo; and [§]Bioethicus Institute, Botucatu, SP, Brazil

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Keywords: horse; Traditional Chinese veterinary medicine; oriental art; acupuncture**Summary**

This review discusses the applications of acupuncture (AP) and its eastern medical philosophy in equine health, and the main techniques used to stimulate acupoints in equine practice. These methods include dry needling, electroacupuncture (EA), moxibustion, laser therapy, haemopuncture, aquapuncture, pharmacopuncture, acupressure and gold implants.

Introduction

The word 'acupuncture' (AP) comes from the Latin word 'acus' (needle) and 'pungere' (to puncture/drill). It consists of many techniques aimed at stimulating acupoints to promote healing and maintain homeostasis of the organism. Stimulation of these points has achieved therapeutic effects, and increased sensitivity to palpation, heat or electrical stimuli can also be used as a diagnostic indication of injury, especially in the musculoskeletal system (Martin and Klide 1997).

The philosophical basis of AP in Traditional Chinese Veterinary Medicine (TCVM), particularly in the treatment of horses, dates back to the period 475–221 BC. In the Liang Dynasty (502–587 AD), Bole Liaoma Jing (Bole's Equine Therapy Classic) was published.

Western civilisation discovered TCM (Traditional Chinese Medicine) later and has sought to scientifically explain its mechanisms. Findings from basic medical research that AP stimulation causes release of endorphins, serotonin, enkephalins, γ -amino-butyric acid (GABA; a major inhibitory neurotransmitter of the brain), norepinephrine and dopamine helped to explain the effects of AP in a biomedical and pharmacological basis that was acceptable to the western medical establishment (Lu and Lu 2013).

The volume of research and technology has accelerated in the last 50 years, giving rise to techniques such as electroacupuncture (EA) and laser therapy. The objective was to determine effective acupoints (AP points) to diagnose and treat each disease. Effective acupoints may be mapped by two theories:

Ancient theory (1), according to Tangjitjaroen *et al.* (2009), says that certain chronic diseases were treated successfully in horses after an injury at a particular location of the body. Other horses were then treated the same way leading to the deduction that those points had the potential to heal a particular disease.

Theory (2), as described by Schoen (2000), uses the transpositional method, viz, the Channels (Meridians) known and established in humans are extrapolated to horses and

applied with consideration of the animal's anatomy. While there are criticisms of the use of comparative anatomy, where there are compatible anatomical structures (which may sometimes correspond to the classical equine points), such as lumbosacral space, present in both species, one can have clinical response when using those points (Michelotto Júnior *et al.* 2007), suggesting transpositional points have clinical effects.

Palpation and conventional clinical examination, together with knowledge of the acupoints, has contributed greatly to the understanding of diagnostic points, which are trigger points mapped leading to what we now know as diagnostic and therapeutic points for various infirmities. They are widely used in the management of diseases that affect the locomotor system (McCormick 1997; Michelotto Júnior *et al.* 2014). A comprehensive study of AP requires a basic knowledge of the Chinese characters for the common clinical patterns and the acupoint names of the main points. It is not enough to know the points by their western alphanumeric codes. At the very least, in their attempts to master AP, western trained clinicians must know the meaning of the Chinese names of the key acupoints. For example, Bai Hui means 100 meetings, which is related to the nerves meeting at the lumbosacral plexus. Also, Ho Hai, also known as GV1, means Lotus flower which grows in the manure and refers to the point location close to the anal sphincter.

In contrast with other species, horses show great sensitivity on palpation of acupoints. This makes it possible to perform a 'scan' of the animal for diagnostic purposes and to localise these reactive points (Ashi Points) more easily relative to other species (Angeli *et al.* 2007). The main clinical applications of AP in horses are its use to diagnose and treat lameness (Schoen 1993). Together with the name of the acupoint, its anatomical location is very important in its relationship with function. It is postulated that the acupuncture points are mainly located at the junction of two or more muscles, between the fascia and close to peripheral nerve branches and nervous ganglia which are related to the internal organs (Robinson *et al.* 2007). The points related to the nervous ganglia are mainly those in the back, parallel to the spinal cord (Chapple 2013).

Chinese medicine uses complex diagnostic methods, based on a range of information such as changes in the acupoints of one or more Channels, sensitivity at the paravertebral Shu-Association points, the theory of Five elements [Wood, Fire, Earth, Metal, Water], and consideration of both internal and external pathogens. The Five elements theory is an ancient idea of balance to control and stimulate

the internal organs, which is very similar to the idea of hormone feedback positive and negative that is present in the endocrine physiology and glandular/hormonal balance (Fig 1). With this concept it is possible to choose what points one must 'stimulate' in kidney failure to improve kidney function and what points are needed to 'sedate' in a gastritis case or in a case of muscular pain. Another concept is the internal and external pathogens, which tries to explain and treat the animal when the disease originates from a virus, bacteria or other micro-organisms (external pathogen) or when it comes from hormonal or physiological problems (internal pathogen). In addition, in the TCM, terms such as wind, cold, dampness, heat, fire and dryness are considered metaphoric pathogenic factors and are related to the concepts of the western medicine (Table 1). Diagnosis takes into account clinical signs such as pain, appetite, neurological signs, the digestive system, changes in mucus and sense organs. Thus, it is possible to diagnose tendon injuries and ligament, joint, bone and muscle diseases in the limbs (McCormick 1996, 1997, 1998).

Acupuncture modulates the body's homeostatic mechanisms. When used by experienced practitioners it can help in diagnosis and treatment of many clinical cases in routine practice. AP can benefit any disease, sometimes as a sole/primary treatment, and sometimes as a complement to other therapies. It can reduce the use of medications and can reduce or eliminate drug-related side effects in some cases (Alvarenga et al. 1998). AP use can be simple, cheap and practical in the field. It is applicable in places that lack medical facilities, for example hurricane-stricken areas, or earthquake-stricken zones.

Caution is necessary with the use of equine AP in chronic equine disease. Such cases require a prolonged course of treatment, or continuous treatment, depending on the severity and chronicity of the patient's condition. Thus, one is advised to monitor the horse for recurrence or worsening of the disease picture and to adopt concurrent conventional treatment, or other supportive therapy, in some cases of chronic disease (Wen 2009). Some studies indicate that AP, combined with correct saddle-fit, skilled hoof trimming and

specific mounting techniques, can improve equine performance in 85–90% of treated cases (Angeli et al. 2007; Angeli and Luna 2008). After 1–4 AP sessions, given by proficient therapists, horses can recover or exceed their original performance level (Harman 1997; Hielm-Bjorkman et al. 2001). Unfavourable aspects of equine AP include the stress and risk of infection generated by inserting multiple needles or implanting other foreign materials into the animal. However, the risks of invasive methods are minimal to negligible if AP is done by trained clinicians.

Many techniques can be used to stimulate the acupoints. These include most commonly AP with dry needles, electroacupuncture, aquapuncture, moxibustion, laser stimulation, gold implants and acupressure. The duration of each treatment may vary from 5 to 30 min depending on operator preference and the desired treatment plan (Schoen 1993). However, Rogers (2012) reported that the release of muscle spasm/pain can occur relatively quickly, within 10 s, or usually within <5 min. If equine myofascial pain and spasm persists for more than a few minutes after needle insertion, either inappropriate points were used, or that particular horse will not respond to the acupuncture protocol used. The number of treatments required depends on the disease and its severity and chronicity.

Acupuncture - dry needling

Altman (1997) defined acupoints as input ports and power output points of an organism. When compared with adjacent skin areas, these points have electrical properties that are distinct and measurable: high conductance, lower resistance, organised field patterns and electrical potential differences (Chapple 2013). According to Hwang and Egerbacher (2001), acupoints are generally defined as skin points with spontaneous sensitivity to stimulation, characterised by reduced electrical resistance. Electrical skin resistance does not define all acupoints, however. Some studies fail to show lower resistance at acupuncture points which means not all of them can be defined by this method of 'point location' (Ahn et al. 2008).

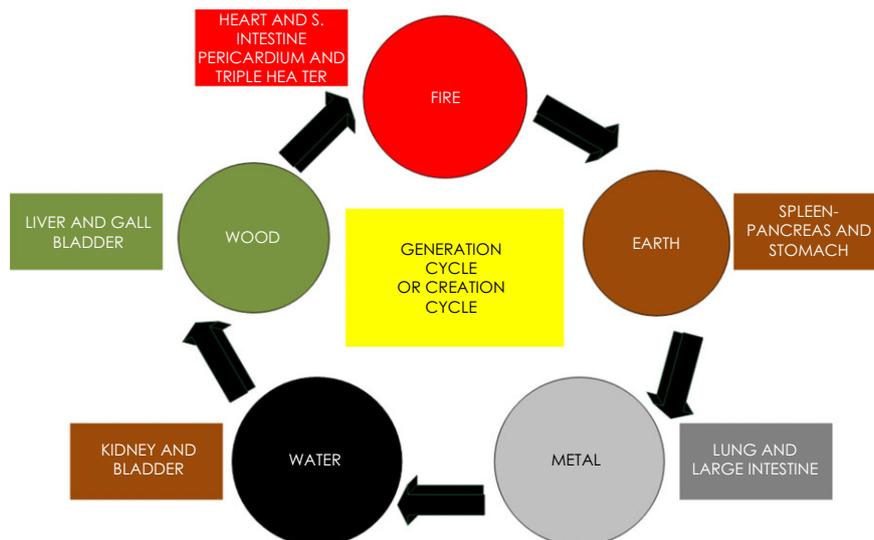


Fig 1: Five elements cycle – generation cycle.

TABLE 1: Chinese metaphoric pathogenic factors and its relationship with the western medicine concepts

Chinese pathogenic factor	Characteristic	Western Medicine Association
Wind	Acute signs; movement; contractions, myoclonia; pain; vertigo; agitation;	Neurological signs; virus; pruritus; rheumatoid factors with it clinical signs; respiratory diseases; vestibular and cerebellar syndrome
Cold	Yin factor, can consume Yang; commonly in winter; impair blood circulation; intense local pain; contraction; diminished metabolism; tongue with white coat; deep pulse;	Muscle contractions; neuropathic pain; osteoarthritis; myositis; disc disease with local pain and paralysis; associated with watery diarrhoea and vomiting;
Dampness	Yin factor; heaviness sensation; oedema; turbidity; chronic wounds; sticky; painful; large pulse; excess of saliva;	Lymphangitis; spondylosis; sinusitis; cystitis; swollen arthritis;
Heat	Yang factor; inflammation; painful; increased metabolism; mucosal congestion; irritability; affect the high parts of the body preferentially; strong and superficial pulse;	Inflammation; post-operation wounds; all inflammatory diseases with fever, redness, erythema; scanty and concentrate urine; faecaloma; dry stools; hyperthyroidism; hyperadrenocorticism;
Fire	Dehydration; agitation; mouth and mucosal ulcers; mental illness; epistaxis; gingivitis; haematoquesia; metrorrhagia;	Ulcers; dehydration; scanty urine; hyperthermia; sepsis; petechiae; haemorrhage; infectious disease; immune mediated diseases with skin lesions (pemphigus; lupus);
Dryness	Dehydration; loss of fluids;	Dry eyes; dry skin; dry cough; faecaloma; asthma;

The Chinese character for an Acupoint (Xue) does not mean 'point'. It means 'hole/cavity/depression'. Many acupoints are located in shallow depressions in muscle or joints and are skin areas with high concentrations of free nerve endings, nerve plexuses, mast cells, lymphatic vessels, arterioles and venules.

Acupoint stimulation can induce therapeutic effects in several different ways, including effects on (a) local structures, (b) remote/distant areas, (c) specific organs and related TCM functions and (d) systemic effects (Silva and Dorsher 2014).

(a) *Local effects*: Points within or adjacent to an affected area influence the area, viz, points near the eye influence the eye; points near the elbow influence the elbow; points near the hoof influence the hoof

(b) *Remote/distant effects*: TCM Channel Theory holds that there are 12 main channels, 6 Yin and 6 Yang, each bilateral, with its own specific set of acupoints:

- 3 Hand Yin channels, relating to the lung, pericardium and heart, begin on the chest and end at the fingers.
- 3 Hand Yang channels, relating to the large intestine, Sanjiao [endocrine-related] and small intestine, begin at the fingers and end at the face.
- 3 Foot Yang channels, relating to the stomach, gallbladder and bladder, begin at the eyes and end at the toes.
- 3 Foot Yin channels relating to the spleen, liver and kidney, begin at the toes/or foot-sole and end at the chest.

In addition, there are two midline vessels, governing vessel (GV, Yang) in the dorsal midline and conception vessel (CV, Yin) in the ventral midline. These begin in the perineum and end at the lip area.

Traditional Chinese Medicine theory holds that each acupoint on a channel influences pathology in, or along the course of, the entire channel, and also influences its related organ and the TCM functions of that organ. For example, all points on the liver channel influence the course of that channel, but also influence the liver organ itself, and its related TCM functions. Another TCM law is that points at one

end of a Channel influence disorders at the opposite end of that Channel. For example, the last point of the stomach channel (ST45) may influence eye diseases [ST01 is on the orbital rim directly below the pupil]; GV20 (at the highest point of the head) influences perineal irritation and prolapse of the anus/vagina/uterus [GV01 is between the anus and coccyx]; and GB34 (between the upper heads of the tibia and fibula) influences neck pain [GB21 is on the trapezius muscle and GB20 is near the atlas].

The mechanism of point stimulation effect relies on the restoration of the balance between Yin and Yang, which can then be resumed in deficiency or excess patterns of disease. The concept is to balance the points in a way that excess conditions should be suppressed, and deficiency conditions should be tonified. The ability to determine if the condition is an excess or deficiency, requires Traditional Chinese diagnostic skills which may include tongue, pulse and palpation examinations. **Table 2** shows the relationship between the Yin and Yang concept and the environment. It also shows the intersection between Yin and Yang and the disease clinical signs.

In TCM, each of the five main Yin organs (liver, heart, spleen, lung and kidney) influences a specific sense organ and has a specific pathological emotion/temperament. For example, liver (LV) influences the eye/vision and stagnation in the LV Channel, caused by Qi flow obstruction, can manifest as anger/rage/viciousness. The obstruction of Qi can be caused by liver diseases, channel pathway block (trauma, tumours, inflammation) or internal imbalance. **Tables 2 and 3** provides a summary of some concepts related to the five elements according to the Traditional Chinese Medicine.

Equine AP is theorised to use these ancient tenets to promote a beneficial clinical effect. For example, the gallbladder governs sinew and movement. Although horses have no physical gallbladder, they have a GB (gallbladder) channel that governs processes and functions that mimic human GB functions. In fact, equine GB34-Yanglingquan, whether transposed from its human location (see above) or placed at its TCVM location (mid-lateral stifle area, behind the femoral condyle), is a most powerful acupoint for equine

TABLE 2: Yin and Yang concepts and its relationship with the disease patterns

Characteristic	Yin	Yang
Onset of clinical signs	Chronic	Acute
Metabolism Nature	Hypometabolism Cold, chronic, degenerative, cool, deficiency, night, moon, negative, humidity,	Hypermetabolism Heat, acute, proliferative, warm, excess, light, sun, positive, dryness,
Preferred climate	Heat	Cold
Urine	Clear, polyuria, incontinence	Dark, anuria, retention
Nerve Fitness	Parasympathetic Weakness	Sympathetic Strength
Shape	Flat	Round
Body surface	Abdomen, ventral, medial	Back, dorsal, lateral
Qi/ blood	Blood	Qi

locomotor problems and tendon/myofascial disorders (semimembranosus/semitendinosus, stifle, lateral thigh, hip, rump, back, mid-lateral line, neck, occipital/temporomandibular joint and eye pain/spasm). Similarly, LV points, like LV03 (below the distal end of the medial splint bone of the hindlimb), can be used to treat eye diseases (conjunctivitis/photophobia), or behavioural vices of the horses (biters/kickers), especially those with pain or spasm over the last few ribs on the right side, or with icteric mucosae or yellowish sclera (all liver-related signs).

(c) *Effects on specific organs and related TCM functions:* Each of the 12 main organs has an organ-associated reflex point (back-shu point) on the bladder channel in the medial paravertebral line between vertebrae T8 to S4. Each organ also has an alarm point (Front Mu point) on the abdomen or thorax. These Shu and Mu points are anatomically close to their related organs. Although the transpositional theory located the back-shu points at a specific vertebral level, the spinal nerve roots do not obey this sequence. The back-shu point for equines should therefore be considered more as a region than as a point, a concept which is supported by other authors (Robinson 2006). Combination of the back-shu

and Front Mu points for an organ is a classical point selection to treat disease of that organ (Xie and Preast 2011).

(d) *Systemic effects:* As well as effects listed in (a), (b) and (c) above, some key acupoints, or combinations of points, have marked systemic effects. For example, combination of ST36, LI10/LI11 and GV14 can ease fever. Points like SP10 (Xuehai-Blood Sea), or BL17 (Geshu-Diaphragm Shu and Influential Point for Bleeding) can influence bleeding and other blood diseases.

The Chinese characters for acupoint names often give a clue to their therapeutic functions, including treatment of systemic diseases. Points with the Blood (Xue in Chinese) character in their names influence blood diseases; those with Yin or Yang characters in their names influence Yin (deficiency patterns) and Yang (excess patterns) diseases. Those with the characters for Energy (Qi in Chinese), Wind (Feng in Chinese), Water (Shui in Chinese) in their names influence metabolism, movement disorders and vascular disorders in some way. Those with the characters for Cold (Han in Chinese) or Heat (Re in Chinese), in their names can influence systemic diseases involving viral infection signs and fever/infection signs.

Some authors state that needle manipulation-twirling and sparrow-pecking (rapid partial insertion and removal) evokes a strong muscle action potential. This in turn depends on the presence, amount and distribution of intrafusal muscle fibres present at the point of needle insertion (Yan *et al.* 1984). The leakage of intracellular potassium to the outside of muscle fibres affected by the needle appears to be the main mechanism responsible for the change in the action potential. This can result in a sufficient depolarisation to reach adjacent nerve fibres, triggering effects at the site of insertion of the acupuncture needle which ultimately reach the central nervous system (Steiss 2001). The muscle fibres respond to the insertion of the needles through changes in the action potential. This reflex phenomenon is related to the intrafusal muscle tissue and to type II motor fibres. It remains even after removal of vascular and nerve supply (Kendall 1989).

Dry needling is an invasive, treatment used to treat myofascial pain and dysfunction. Needles are inserted into the muscle areas known as trigger points (TPs) to 'release' or unblock it (Dunning *et al.* 2014). The TPs are located within a taut band of skeletal muscle and commonly located within a larger muscle group (Figs 2 and 3). Active TPs are hypersensitive to touch, heat, electricity and needling. They

TABLE 3: Five elements relationship with the body and physiology

Characteristic/5 elements	Water	Wood	Fire	Earth	Metal
Organs	Kidney and bladder	Liver and gall bladder	Heart, small intestine, pericardium, triple heater (endocrine system)	Spleen-pancreas and stomach	Lung and large intestine
Orifice	Ears	Eyes	Tongue	Mouth	Nose
Sense	Hearing	Vision	Speech	Taste	Smell
Tissue	Bones	Tendons, ligaments	Vascular system	Muscles	Skin, hair coat
Functions	Elimination	Purification	Circulation	Digestion	Respiration
Secretion	Urine	Tears	Sweat	Saliva	Nasal fluid
Exterior	Head hair	Hoof	Complexion	Lips	Skin pore
Emotion	Fear	Anger, irritation	Joy, serenity	Preoccupation, frustration	Sadness

refer pain and/or autonomic and/or proprioceptive dysfunction to distant parts of the body (Travell and Simons 1998, 2003). For example, TPs in neck and head muscles can trigger and maintain neck spasm, headache, tinnitus, xerophthalmia (or epiphora), xerostomia (or sialorrhoea) and vertigo in man. Equine muscle TPs in scapular muscles can trigger and maintain shoulder/neck pain/spasm and/or upper limb ataxia. Dry needling of the TPs can release/inactivate the referred symptoms very quickly (Xie and Preast 2011).

An interesting technique for wounds is called 'Circling the Dragon'. A local stimulation with dry needling can be done by the insertion of acupuncture (or fine hypodermic) needles surrounding the wound. This is a classical AP method where the idea is the same or similar to scarification to improve blood circulation to heal the wound (Parmen *et al.* 2014).

For classical acupuncture, filiform needles, 26–30 gauge, made of stainless steel, are the most commonly used needles (dry needling and EA). These needles have great strength, durability and electrical conductivity. The use of hypodermic needles, 50–70 mm, 20–22 gauge, is also efficacious in cattle and horses (Xie and Preast 2011; Rogers 2012). Hypodermic needles are reported to be quicker and easier to insert than the much thinner filiform needles.

Acupressure

Acupressure may be applied to selected acupoints with strong digital pressure, or pressure applied using wooden massage-sticks, or plastic needle-holders (Scognamillo-Szabó and Bechara 2010; Rogers 2012) in order to avoid the use of dry needle technique. In horses, daily acupressure to selected Diagonal Mirror Points, combined with physical therapy, applied to the pain areas, complements and enhances the clinical outcomes of weekly veterinary AP sessions (Rogers 2012).

Electroacupuncture

Electroacupuncture (EA) is a method of stimulation of acupoints by passing an electric current through needles inserted into the points. The needles are electro-stimulated with the output power adjusted to the animal's tolerance.



Fig 2: Application of dry needling in the BaiHui acupoint (arrow).

The aim is to gain a more vigorous and prolonged stimulation (Fry *et al.* 2014).

Cachado (2012) states that low frequency/high intensity (below the level of pain but causing muscle contractions) should be used in chronic diseases, since its effect and its duration are cumulative. In contrast, high frequency/low intensity (pleasant vibrational sensation) induces the production of dynorphins, has a short duration, and can be used in acute or surgical pain. According to Xie and Preast (2011), high frequencies are appropriate to drain excess (pain) and low frequencies are used to tonify in deficiency/disability (rehabilitation).

In horses, EA is recommended for musculoskeletal disorders (Xie *et al.* 1996) and other acute or chronic conditions. It is used to treat chronic pain and to accelerate axonal regrowth in paralysis of peripheral motor nerves (facial, radial, suprascapular and laryngeal paralysis, etc). Prolonged treatment, over 3–9 months is needed in peripheral paralysis (Sumano *et al.* 1997).

A study using EA to treat equine low back pain noted that pressure-induced pain threshold was significantly higher in treated horses (Fry *et al.* 2014). EA also reduces the session duration as compared with dry needling as an alternative stimulus for pain control (Schweinitz 2014).

Electroacupuncture also can be used for surgical analgesia (more correctly termed surgical hypoalgesia). Janssens *et al.* (1988) reported that AP analgesia works by stimulating large myelinated nerve fibres that conduct the stimulus to the spinal cord and higher centres. The ascending pain impulses are blocked by an interaction in which serotonin, endorphins, enkephalin, norepinephrine and substance P all play important roles (Sheta *et al.* 2015).



Fig 3: Coronary band puncture. Bleeding is a common result after trigger point's manipulation – believed to release stagnation of the channels – small volume bleeding on the coronary band.

The practical applications of EA for surgery in animals are limited and require careful surgery with minimal traction on the mesentery. Conventional anaesthetics may be unavailable, or in short supply. That said, surgical EA can be used to great advantage in combination with conventional sedatives and anaesthetic agents (Sheta *et al.* 2015). Sheta *et al.* (2015) studied the analgesic effects of EA in surgery in horses and donkeys. They concluded that EA allowed the surgeon to operate without visible signs of pain from, or discomfort to, most animals. Inflammatory lesions at the operated sites induced a state of hyperalgesia and decreased the pain threshold. EA regulated this hyperalgesia and reduced the degree of pain. There were no complications during or after surgery. During suturing, a few cases needed infiltration of the incision line with local anaesthetic.

Gold implant

Gold, silver and the noble metals, have been used to treat various diseases since antiquity (Burmester 2001). Several forms of gold/gold compounds are used therapeutically today, one of which is sodium aurothiomalate (GSTM) (Mangalam *et al.* 2001). Earlier studies suggested that gold inhibited lysosomal enzymes of phagocytic cells in the inflamed synovial tissue (Persellin and Ziff 1966). Although the mechanism of action of gold ions on the cellular immune response is not yet understood fully, gold ions are known to be powerful inhibitors of macrophages and polymorphonuclear leucocytes (Vernon-Roberts 1978; Fleming *et al.* 1996; Hostynek 1997). Gold also has an anti-inflammatory action in rheumatoid joints in human subjects (Sutcliffe *et al.* 1973; Danscher 2002). Gold ions inhibit antigen processes and inhibit NF-kappa B activation by blocking I-kappa B kinase (IKK) activity, thereby decreasing production of pro-inflammatory cytokines (Yang *et al.* 1995; Traber *et al.* 1999; Yoshida *et al.* 1999; Jeon *et al.* 2003).

Ben-Yakir (2008) summarised the scientific basis of gold bead implants. Gold is biocompatible and extremely resistant to corrosion. In living tissue, gold releases positively charged ions, such as aurocyanide $\text{Au}(\text{CN})_2^-$. The negative charge is neutralised by Au^{3+} that binds with thiolate and thioether ligands on protein, neutralising the negative charge. The $\text{Au}(\text{CN})_2^-$ action is to destroy the inflammatory cells around the joint that are contributing to joint inflammation (Lie *et al.* 2011). The use of gold implants to treat canine hip dysplasia has been reported. One-time implantation of gold has been demonstrated to replace multiple AP sessions (Durkes 1992; Jaeger *et al.* 2006). The technique has been improved and is used widely to treat hip dysplasia (Klitgaard 1995; Hielm-Bjorkman *et al.* 2001).

Currently, apart from its use in hip dysplasia, gold implantation at relevant acupoints is used to treat many other canine/feline diseases, including arthropathy (arthritis/spondylopathy), asthma, dermatitis (allergic dermatitis, sensory neurodermatitis), incontinence (faecal/urinary), neuropathy (certain types of paralysis/paresis, epilepsy/seizures, traumatic nerve injury, degenerative myelopathy, wobbler syndrome), osteochondritis, spinal problems (intervertebral disc disease, spondylosis), results of trauma (chronic injuries, lick granulomas, nonhealing fractures) and other chronic conditions in animals (Durkes 1999; Rogers 2009; Xie and Preast 2011).

The first report of gold implantation in horses was conducted to reduce granulation tissue in skin lacerations (Frauenfelder 2008). That study reported that the use of gold implants displayed efficacy in wound healing. Furthermore, the gold implants avoided exuberant granulation tissue formation and decreased fibrosis. Gold has anti-inflammatory and immunomodulating effects with no systemic or local adverse effects (Märki *et al.* 2018). In Brazil the use of gold implants in orthopaedic cases has been reported to achieve clinical improvement in up to 70% of equine cases treated (Joaquim *et al.* 2012).

The success of gold implants in animal diseases has led to its use in human dentistry, surgery and medicine (Demann *et al.* 2005; Yun and Lee 2016). By 2008, more than 30,000 people in Europe alone had gold implants for various chronic diseases (Rogers 2009; Li and Pei 2015). Gold wire/bead implantation is a surgical procedure, in which gold fragments (24-carat jeweller's gold wire, circa 2–3 mm long and 1 mm in diameter), is the most used material, but special gold beads are also used and inserted into acupoints. The implants are approximately 2–3 mm long and are made with a wire of 0.95–1 mm diameter, wound to form a compact spiral, with no protrusions or sharp edges (Behrstock and Petrakis 1974) in order to hinder the migration of the implant. Each fragment is implanted with the aid of syringe fitted and attached to a hypodermic needle 18 gauge (1.2 mm). It is a low-cost, convenient and fast procedure. When performed aseptically under sedation by proficient clinicians, it gives no discomfort to the animal and requires no exercise restraint. Post-operative complications are rare but allergic reactions can occur due to the impurity of the gold implant, resulting in a local inflammatory reaction (Hielm-Bjorkman *et al.* 2001; Nunes *et al.* 2007).

Moxibustion

This technique is often used to treat chronic arthritis and musculoskeletal disease in TCVM (Kim *et al.* 2012) and TCM. It is a safe technique that can be taught to animal owners if necessary (Xie and Preast 2011). However, moxibustion poses a fire-risk if glowing moxa should fall on flammable material. Therefore, cases should be treated on concrete in an area protected from wind/draughts. Small animals can be treated in the clinic while standing or lying on a non-flammable surface.

Indirect moxibustion using a burning cigar of *Artemisia sinensis* and/or *A. vulgaris* is most often used (Scognamiglio-Szabó and Bechara 2010). When burning moxa on equine Shu-Back Points, some vets wet the areas with water and apply a thin slice of fresh ginger, or a 5 mm layer of common salt, on which a 1 cm ball of moxa punk is placed and ignited.

Direct moxibustion applies burning moxa directly on the selected acupoints. The moxa cigar is broken into 1–2 cm cylinders or rubbed into 'moxa snakes' or rice-sized pellets. These are placed directly on a thin layer of gel (*Aloe vera*) (**Fig 4**) that is rubbed on the skin over the selected acupoints.

Needle Moxa uses AP needles inserted into selected acupoints, especially on the back. A moxa cigar is broken into 1–2 cm cylinders that are pushed firmly onto the handle of each needle. Before ignition, a special ash-guard, or a layer of aluminium foil, is placed underneath the moxa to prevent glowing ash from falling on the skin. The burning moxa transmits heat to the tissues via the needle.

According to Xie and Preast (2011), whether moxibustion is applied indirectly, directly or by Needle-Moxa, heat from burning moxa warms Qi and blood inside the Channels. Thus, it increases Qi flow and warms the channels in cases of stasis, moves Qi and eliminates the internal cold and damp, as well as some forms of local toxic heat. One should avoid moxibustion in pregnant cases and near sensitive areas, such as near mucosal surfaces/large blood vessels or sensory organs, especially the eyes and nose.

Recently some studies showed that analgesic effects of moxibustion could be explained by opioid release theory (Uryu *et al.* 2007). It can also help control renal failure by blocking sympathetic nerve action or controlling blood pressure (Paterno *et al.* 2012).

Laser therapy

Laser therapy refers to the use of apparatus containing compounds of diode or helium laser emission at low power (5–500 mW), operating at 630–904 nm for stimulating acupoints (Xie and Preast 2011). It has anti-inflammatory and analgesic properties, and promotes wound healing. This modality is likely highly effective for treating of superficial AP points in the areas of thin integument. It is a painless and noninvasive technique. It is limited to treating larger areas (large animals) and takes up more time in application which may be disadvantageous for agitated cases. Pérez-Samartín (2016) defines numerous biological effects attributed to laser therapy and stimulation of mitochondrial respiratory chain, increasing ATP synthesis, increased synthesis of reactive oxygen species and improvement in the state of the nervous tissue, muscle and joint. These effects are due to energy absorbed by the materials that energy passes through and not the energy lost as heat.

Laser therapy is a technique widely used in cases with low tolerance to needle insertions (Scognamillo-Szabó and Bechara 2010). Other advantages include low risk of infection and may be ideal for cases afraid of needles. However, the objective evaluation of laser AP efficacy is difficult because the depth of action for the laser energy, probably an important determinant of effectiveness, is governed not only by these parameters, but also by the properties of the skin,



Fig 4: Applied moxibustion technique to accelerate wound healing.

such as thickness, age and pigmentation – factors that have also received little consideration in laser acupuncture.

Aquapuncture

Aquapuncture or injection-AP is a method wherein vitamin B1 or other solutions are injected within a certain acupoint (Xie *et al.* 1996; Luna *et al.* 2008).

This method is useful in animals that do not tolerate the continued insertion of needles, as an adjunct to dry needling (Scognamillo-Szabó *et al.* 2008) or in agitated cases. Furthermore, the AP needles are more difficult to insert and take longer; horses have a very strong skin reflex contraction, which makes it difficult to keep the needle in certain acupoints making the method an advantage. However hypodermic needles have some disadvantages: they are hollow and thick, their introduction is more painful, and needling is more likely to cause bleeding and laceration. They are less resistant to twisting and when they bend, there is greater risk of breakage (Cachado 2012).

AP-injection has also been studied to treat dairy cattle with reproductive disorders and horses with lameness and back pain. Acupuncture can also be used to inject medication or vaccines for immunisation to obtain the added benefit of stimulating acupoints besides the drug effect of the medicine used in the point (Pérez-Samartín 2016).

Haemotherapy at acupoints

Injection of autologous blood (*viz.* blood from the animal itself) became common in autoimmune or inflammatory disorders. Blood is drawn from a larger vessel (jugular, cephalic vein) and injected into selected acupoints (Xie and Preast 2011). It is also important to distinguish haemotherapy from haemopuncture that means blood drainage from an acupuncture point with a needle (Hackett *et al.* 1997).

Haemopuncture is used to extract venous blood (Xie *et al.* 1996). It is indicated only for specific acupoints over veins in situations of blood Stasis, blood heat and imbalance by excess heat in a robust animal (Xie and Preast 2011) (Fig 5). For example, one can let 20–50 mL blood flow from acupoints on engorged digital veins in acute laminitis. Another method extracts jugular blood, which is injected immediately intramuscularly (5 mL per point) at specific acupoints, *viz.* BL23, BL26, Baihui in repeat-breeder mares. This technique is also named autohaemotherapy.

Pharmacopuncture

This is the injection into selected acupoints of drugs (antibiotics, sex-hormones, steroids) at doses of 25–50% of usual doses. This has been successful in some diseases. Chinese authors claimed that this technique increases the mechanical stimulus period and produces effects similar to conventional doses (Luna *et al.* 2008). In large animals, pharmacopuncture can reduce the undesirable side effects of medications and reduce treatment costs (lower doses). It is a good option for AP in large animals, since it requires a short period of restraint and uses common material such as hypodermic needles (Luna *et al.* 2008).

In a study by Godoy *et al.* (2014) based on the hypothesis that stimulation of acupoints can reduce the stress induced by transport, this study compared the effects of



Fig 5: Haemopuncture applied in thyroid acupoint in a horse.

pharmacopuncture in acupoint GV01, aquapuncture (saline injection) in GV01 and acepromazine. Decrease in heart rate (HR) was seen, suggesting a possible autonomic effect. However, it was not able to change other variables such as transport-induced increases in cortisol, body temperature and respiration rate. Moreover, acepromazine sedation produced a significant reduction in respiratory rate of horses during transport without changing the stress-induced increase in cortisol. Its use in horses during transport should be considered with caution because it did not prevent the deleterious effects of stress and can cause respiratory depression.

Cupping therapy

This involves the use of special suction cups to apply a vacuum to the skin over selected acupoints. There are three main forms of cupping: (a) Fire Cupping; (b) Vacuum Cupping; (c) Sliding Cupping. In all cases, massaging the target areas with a lubricant oil or with stimulant massage creams, gives better cup-adhesion and enhances the outcome of cupping. The cups are removed when the skin turns deep red or purple (Michalsen *et al.* 2009). If a cup loses suction before the desired time, it can be removed and reapplied as in (a) or (b) below. The main use of cupping therapy is pain (Ullah *et al.* 2007).

- (a) *Fire Cupping*: This is the Traditional method. A cotton swab, soaked in pure ethanol/methylated spirits, is lit and plunged into an inverted glass suction cup. The flame consumes the oxygen within the cup immediately. After 2 s, the cup is pressed onto the skin, creating an immediate vacuum. The skin and underlying tissue is pulled into the suction cup.
- (b) *Vacuum Cupping*: This is a modern and more convenient method that eliminates fire-hazards. It uses special PVC cups, each fitted with an air-valve. Each cup is pressed onto the skin and evacuated in seconds using a detachable hand-pump.
- (c) *Sliding Cupping*: This is a very effective method in human subjects but not easy to use in shaggy-haired animals. Before cupping, the target area is massaged liberally with a lubricant oil or stimulant massage cream. The cups are applied as in (a) or (b) above and allowed to

act until the skin turns deep red or purple. Then, all cups are removed, except two. The remaining two cups are slid longitudinally and laterally in a slow rhythmical movement to give the area a relaxing and stimulating massage for a few minutes before removal.

Cupping can be used in fine-coated horses if a vegetable oil is smeared liberally over the area before the vacuum is applied. It is not easy to judge the degree of hyperaemia in the vacuumed skin in dark-haired skin/dark-coloured animals. Clinical uses in horses include muscle pain/spasm, back pain, respiratory and reproductive disorders.

Conclusion

The techniques used in acupuncture to diagnose, treat and prevent equine diseases use the endogenous/homoeostatic mechanisms of the case to induce 'self-healing'. Acupuncture can be considered complementary and integrative in an equine clinical practice setting. However, further studies are necessary to ascertain the efficacy and safety of currently applied TCM techniques in equine clinical practice.

Authors' declaration of interests

No conflicts of interest have been declared.

Ethical animal research

Not applicable.

Source of funding

None.

Authorship

D. Pellegrini contributed to literature review and preparation of the manuscript. T. Muller contributed to preparation of the manuscript, correction and translation of the manuscript into English. J. Fontequé contributed to correction of the manuscript. L. Souza contributed to literature review, preparation and correction of the manuscript. A. Souza contributed to correction, formatting and submission of the manuscript. J. Joaquim contributed to literature review and correction of the manuscript.

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