

# The firing of horses

## A review for the Animal Welfare Advisory Committee of the Australian Veterinary Association<sup>c</sup>

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## **Summary**

A literature review of the firing (thermocautery) of horses was conducted from the standpoint that veterinarians in the 21<sup>st</sup> Century have an obligation to be rational and considerate in their choice of therapy. They should have evidence that a therapy works and, better still, should be able to explain how and why an effective therapy works. The history, indications, proposed mechanisms of action, and effectiveness of firing are explored, with particular reference to two main experimental studies of the subject. Legislation and Policies of Veterinary Associations in Australia and overseas are considered. The authors are unable to find any evidence that firing is an effective therapy. Instead, evidence is presented that it is more likely to do harm than good. Pain and stress are caused to the fired animal for at least 24 hours. Accordingly, the current policy of the Australian Veterinary Association is inappropriate in 2001, regardless of the welfare aspect of the practice. It is even less appropriate when welfare is considered. Continued acceptance of firing puts at risk community confidence in the veterinary profession and the reliability of veterinarians.

Our suggested wording for a replacement policy is set out below.

### “2.10 Thermo-cautery of horses

The Firing (thermo-cautery) of horses is unethical in view of the evidence that either demonstrates its harm or refutes its therapeutic benefit. Clinical or experimental research is unlikely to shed light on remaining doubts that firing may be beneficial in some special situations.”

## **Introduction**

The Australian Veterinary Association has published a number of policies that are intended to guide its officers and members in public statement and in the conduct of their professional lives. Those policies that are designed to enhance or protect the welfare of animals help to fulfil a major aim of the members: “The enhancement of animal health and welfare”<sup>1</sup>.

The AVA regularly reviews its policies on animal welfare in the light of new scientific knowledge. At the same time, it considers changing social opinion. As a consequence, the AVA’s Animal Welfare Advisory Committee decided at its meeting in Perth in June 2000 that the current policy on the firing (thermocautery) of horses was ripe for review. Accordingly, this committee gave the present authors two tasks. One was to review the evidence in the scientific literature on the advantages, disadvantages and therapeutic efficacy on “firing” of horses with a view to the implications for animal welfare. The other was to ascertain the current legal position on firing in Australia and overseas.

## **Methods**

Determinations about the welfare implications of procedures performed on animals can be difficult. They can, however, be assisted by a two-step process that addresses the facts and concepts about animal welfare before moving to the moral and ethical considerations. The first step is to marshal, in a dispassionate and objective manner,

evidence about the circumstances and conditions of animals that is relevant to their welfare. The second is to use this evidence as a rational basis for judgements on whether their welfare is acceptable or not. The situation is usefully summarised in the following excerpt from Fraser and Broom's textbook on animal behaviour and welfare.

“The assessment of welfare can be carried out in a scientific way without the involvement of moral consideration. The term welfare refers to the state of the animal and not to any human care for the animal. The question which must be asked is how poor welfare must be before people consider it to be intolerable. A moral decision must be taken, and different people will draw the line, marking what is acceptable, at different points on the welfare continuum. The moral decision depends upon the availability of evidence about welfare but the process of deciding about morality and the processes of assessing welfare are quite separate.”<sup>2</sup>

The scientific evidence for whether the firing of horses is ethically acceptable relates to two issues, the second of which is dependent on the first. They are:

Is firing an effective therapy?; and

If it is effective, is the level of suffering caused justified by the effectiveness and long term benefit to the animal? The most obvious source of suffering is pain related to the thermal burns that come with firing.

Our review will attempt to answer these two questions and draw attention to the implications for the AVA's policy on firing in the context of its current legal position in Australia and overseas. Preliminaries include some comments on the current AVA policy on firing, a description of what it is and the rationale behind it and a short history of the practice. Our principal task of marshalling evidence reflects the nature of the literature on firing. Knowledge about firing has accumulated two ways. The result is two distinct compartments in the literature. The first compartment comprises the occasional letter or paper that reports on clinical experience or the book chapter or review that attempts to collate this clinical experience in a critical manner. This is referred to as the “general literature”. The second compartment contains the results of designed experiments and deliberate and planned surveys that attempt at statistical validity. This is referred to as “surveys and experiments on firing”.

### **A disclaimer**

A disclaimer is necessary. The authors are not specialists in the treatment of injuries in the horse. However, the biological issues of injury, repair and inflammation are common across all of veterinary science and should be understandable to all veterinarians. In addition, veterinarians should be able to make a fair attempt at evaluating the veterinary literature in fields outside their own.

A guide to scientific writing observes that it is prudent for specialist authors to run papers past their intelligent generalist colleagues before they are submitted. The aim is to test whether their paper makes general biological sense. We have cast ourselves as generalists for our present task and are seeking to understand whether firing makes biological sense and how this sense might guide the ethical assessment of the practice.

We recognise the possibility of bias derived from addressing the published literature alone.<sup>34</sup> The forefront of knowledge lies in the minds of equine specialists and may be unpublished. Accordingly, we hope our treatment of published literature provides a context for a statistically sound and intelligible survey of the moving front of this specialist knowledge – if such a survey is indeed necessary. A review of current best practice for the treatment of injuries where firing may be a possible treatment would be valuable complementary material in its own right. We know of no such review. In the meantime, we feel free to draw conclusions based on the published literature alone.

## **Current Policy**

The current policy of the Australian Veterinary Association (AVA) on thermocautery of horses is shown in Box 1:

### **Box 1**

#### **2.10 Thermocautery of Horses**

- 2.10.1 The AVA upholds the right of the veterinary practitioner to decide on the method and type of treatment to be recommended in each individual case but exhorts its members to consider whether the use of thermocautery (firing) is likely to produce the greatest relief of pain, healing and return of function with minimum discomfort to the horse.
- 2.10.2 The Association considers thermocautery of horses should be carried out only by veterinary surgeons to ensure there is understanding of the pathological processes involved, and there is provision of effective anaesthesia and post-operative analgesia if required. The veterinary surgeon is also best able to judge whether any coincidental treatment is required and prescribe post-operative care and training before return to work.

#### *Discussion*

The AVA has noted the research of Silver et al (1983) at Bristol University and their conclusions that they can find no evidence that line or pin firing has any marked effect on tendon healing nor that it produced particularly severe stress.

The AVA notes that this research was carried out on soft tissue only and is unaware of any similar work on firing of bony tissue. The AVA hopes that finance will soon be made available in Australia for research to study the effectiveness of firing of bony tissues and to investigate alternative treatments.

Some comments on the current policy can be made before addressing the literature on firing.

1. If there is an obligation for veterinarians to be rational and considerate in their therapy, this notion is not highlighted in the policy as it is written. It is implied in paragraph 2.10.2 as a reason for restricting the practice of thermocautery to veterinarians. The question is whether veterinarians should assert their professionalism more strongly and differentiate themselves not just on the right to decide therapy but also on their obligation for this therapy to be rational.
2. The major work of Silver et al (1983)<sup>45</sup> is noted only. It has not been recorded as evidence considered in the process of developing policy.
3. The discussion states that the AVA is hoping for finance for research. The policy could state that the AVA believes that particular research should be undertaken. The AVA should exercise its prerogative to recommend research.

## Definition of firing

The following definition of firing is taken from a general encyclopaedia on veterinary science.

“Firing is a “traditional treatment, usually for leg injuries, now dying out in the face of claims that it is cruel. Skin over the flexor tendons, splints, fetlock and knee joints, ringbone or curbs is burned with red-hot iron. Penetration varies from superficial to underlying tissues and causes scar tissue to form, hardening the area; carried out under general or local anaesthesia. **Line f.** Lines or bars burned into skin surrounding flexor tendons and continuing at intervals for length of cannon bone. **Pin/point f.** Individual puncture marks made over joints or over tendons. (Most common **f.** now in use.) All cases need rest after treatment – up to a year or more depending on the severity of injury and whether horse is required to do fast work.”<sup>5</sup>

The definition is representative of most of the general literature on the subject in that it is silent about the rationale behind firing. The use of the word traditional does not mean that the practice should be dismissed out of hand. Effective traditional treatments have been stepping stones towards rational therapy. The fact that something works precedes investigations into why it works and then into refinements. The issue for firing as a therapy is not whether it is traditional but whether it actually works.

## History of firing

The use of heat in the various branches of medicine has an ancient lineage. Its first recorded usage is in the writings of Vegetius, who lived from about 450 to 500 AD. This was the era of “spirits” and “noxious humours”, and firing, bleeding, sweating and the like were used to draw off these humours. In ancient times, fire, as one of the four elements (earth, air, fire and water) was credited with magical properties. Other medicinals of the time include urine, faeces and other animal extracts.<sup>6</sup>

Vegetius recognised that cautery could do harm, and warned against its use in certain circumstances “for a perpetual weakness follows upon it”. Blundeville, writing in 1565 advised “you must beware that you touche not the sinewes chordes or lygaments, lest the member be weakened, or that cramp ensueth”. The first specific recommendation for “firing” injured tendons in English veterinary literature occurs in 1796. John Hunter, in his Dictionary of Farriery and Horsemanship, considered that burning the outside of chronically injured tendons and joints would allow the “inclosed matter to discharge itself”.<sup>7</sup>

Two theories were proposed in the second half of the nineteenth century to explain why firing might be effective. Youatt (1851) lectured at the University of London, “that no two intense inflammations could exist in neighbouring parts, or perhaps in the same system, at the same time.” Hence, applying an acute inflammation might lessen or remove a chronic inflammation. This theory was common at the time, and so humans had their chests blistered for pneumonia, and their abdomens for bowel disorders, and horses had a red hot shovel applied to their belly for colic. This was the beginning of the idea of the “counter-irritant”. The practice is still used by traditional healers in primitive societies.<sup>8</sup>

The second theory, of which Youatt was also a proponent, was that the scarring of the skin over the treated area acted as a permanent bandage. Others (eg Ferguson 1862 and Walsh 1875) dismissed this idea.<sup>9</sup>

By the turn of the century, firing was recommended for “bone spavin”, “sprain of the back tendons of the front legs”, “broken down” (suspensory ligament rupture), and “ring bones, curbs, and sprains of the back, tendons etc”. The authors comment that firing was performed less frequently than previously, and counsel that firing be performed by a qualified veterinary surgeon, “for it is very easy to ruin a good horse by firing too deep”. They note that while some authorities hold that “every case can be cured of lameness by repeating the firing, if necessary, half a dozen times”, “it is accepted as fact, by most surgeons, that when the articular ends of the bones are ulcerated there will be permanent lameness.”<sup>10</sup>

### **The general literature on firing**

Very little literature is available to guide equine veterinary surgeons to form an opinion about firing. Most of the published material emanates from the United Kingdom, where there was an ongoing debate in the correspondence pages of “The Veterinary Record” for many years. The advocates for the continuation of firing recommend its use to treat long-standing chronic tendonitis (bowed tendon) in performance horses (the National Hunt)<sup>11</sup>, and for the treatment of chronic curbs and suspensory ligaments in old hunters<sup>12</sup>. They claim that animals, which have continued lame despite other treatments and rest up to 2 years, have been cured and successfully returned to racing<sup>13</sup>.

The following notes are drawn from the correspondence pages of The Veterinary Record:

“As a student, I was lectured on equine lameness by Professor OR Adams, the author of “Lameness in Horses”, who stated that the only uncontested value of firing was to obtain adequate rest time for healing to take place”<sup>14</sup>

“During the last 30 years practitioners involved with National Hunt horses have been searching for a satisfactory replacement for firing. This has been occasioned not because cautery is cruel (a fact borne out by the [Silver] report), but rather because the results have been disappointing.”<sup>15</sup> (The author was the Veterinary Advisor to the National Trainers Federation, UK.)

“The lack of alternative treatments can never support its [firing] use”<sup>16</sup>

### *The indications for firing*

The textbook of Adams (1974)<sup>17</sup>, may still provide the best capsule description of firing and its indications. The relevant passage is reproduced below.

*Purpose:* To produce an acute inflammatory process in a chronic or subacute inflammation in the hope that it will undergo resolution.

*Indications:* It is one of the most misused therapeutic agents in veterinary therapy. It is often used on normal tissues for conditions for which it is contra-indicated.

Conditions for which therapeutic cautery is used are listed below (Caution – always radiograph a joint before using any type of therapy):

- a) Soft tissue damage, especially around joints, ligaments and tendons
- b) Carpitis (popped knee). In this condition it is of most value when no periosteal new bone growth is present.
- c) Chronic arthritis

- d) Osselets. Osselets is one of the few conditions for which firing may be of definite value. By creating an acute inflammation, resolution of the chronic serous arthritis may occur as healing takes place. This also usually makes it easier to obtain the proper rest for the horse. Four to six months' rest should follow the firing of osselets. It is of little value after periosteal new bone growth involves the joint.
- e) Tendosynovitis and tendinitis. Although firing is commonly used on these conditions, there is little indication to do so. There is already too much inflammation and scar tissue present.
- f) Sesamoiditis. Firing is of doubtful value in this condition. It is commonly used but seldom effects a cure.
- g) Bone spavin. Bone spavin is commonly fired in an effort to aid ankylosis of the distal intertarsal and tarsometatarsal joints. These joints may ankylose regardless of whether firing is done. Surgical arthrodesis is of more value.
- h) Splints. Splints are commonly fired even though they will heal without any therapy. Rest must be enforced to obtain healing of the splint and firing usually will aid in forcing this rest."

### *Opinions about firing*

The literature is somewhat divided in its opinion of firing. Some authors "agree that firing is a cruel form of therapy which should be controlled by legislation", but still believe that it can be effective where all other therapies have failed<sup>18</sup>. However, virtually all printed opinion about firing is either against it on the grounds of its welfare implications and its poor efficacy or concede its welfare implications but believe it can be effective therapy in some instances. Champions for both the efficacy and welfare neutrality of firing have not published their views. The following examples of opinion reflect the prevailing tone of the literature on firing.

In Australia, a lecturer at a continuing education course in 1983 recommended against firing. Albert A Gabel, Head of Equine Section, Department of Clinical Sciences, Ohio State University, stated: "Therapeutic cautery (firing) in my opinion is completely irrational since only the superficial layers of skin are destroyed. Evidence shows that it does not increase the circulation to the tendons. If the fire points get into the tendon tissue it has been shown destruction of tendon fibres occurs. There is very little increase in circulation even a few mm away."<sup>19</sup>

"Firing will not influence actual healing of the tendon but it has been proposed that it protects the animal by producing scar-thickened skin that acts as a support for the superficial digital flexor tendon. The opinion held by many clinicians is that firing should be abandoned as part of a rational therapy in the horse."<sup>20</sup>

The authors of a review of firing, who also conducted the long research program at Bristol University, consider that "the art of 'firing' persists as an anachronism. It is high time we acknowledged that "firing" is a deforming, painful and superfluous operation for which there is no modern justification. If it has real therapeutic value it is curious that no figures have been accumulated and analysed to prove the point. A procedure that has been in constant use for 3000 years should have given rise to enough data to satisfy even the most demanding statistician ..... in the words of Miles (1883): "The absence of the red-hot iron in the hands of the veterinary surgeon is a proof of his judgement and skill as well as of his humanity"."<sup>21</sup>

"Some things in practice never change. Firing was a cause of discussion between the older and younger members of the profession 100 years ago as it is now. In a copy of

The Veterinarian of 1870 a Mr Hill of Wolverhampton, while accepting that “the day is long distant when the veterinary surgeon will be able to lay aside the firing iron”, still felt that in many cases its use was “that most barbarous of all practices”.<sup>22</sup>

“We have found no convincing evidence to support the contention that firing is a useful treatment in equine tendinitis. The practice of firing has been abandoned as part of rational therapy for all other species and it is difficult to escape the conclusion that its retention in equine practice is more the result of desperation than of scientific thought.”<sup>23</sup>

“Firing is regarded by some as a form of twentieth-century barbarism, and by others a brutal means of enforcing rest;”<sup>24</sup>

Others believe that firing “causes little or no distress”<sup>25</sup>, or equate the level of “post operative discomfort” to “that of a sutured wound. Only if blistering follows firing is pain evident.”<sup>26</sup> It is contended that “firing and the necessary after treatment can be carried out in a humane manner, provided efficient anaesthesia is employed before, and a suitable leg paint is applied after the iron is used.”<sup>27</sup> The Silver project, to be described more fully, concluded “nor have we found evidence that it produces particularly severe stress”.<sup>28</sup>

No reference viewed by these reviewers found recommendations for ongoing analgesia, except that provided by local therapy.

#### *Proposed mechanism of action of firing*

Straiton drew on clinical impressions to observe in 1972 that “there is no completely satisfactory explanation of how successful deep point firing produces its curative effect”<sup>29</sup>. Various theories have been proposed, including:

- the release of noxious humours (see above),
- the development of hyperaemia (deep vs. superficial by penetrating firing into tendons, or when over a joint capsule – diminution and rounding off of exostosis formation within the joint, or, when introduced directly into the exostosis and interior of the affected joint – an attempt to stimulate not the resorption of the diseased tissue but further bone deposition, with fusion of the joint as a result)<sup>30</sup>
- “applying a bandage under the skin”<sup>31</sup>, or externally through tightening and thickening the skin<sup>32</sup>
- the production of anti-collagen antibodies. “damaged collagen [from cautery] which has been denatured in a burn wound stimulates the production of anti-collagen antibodies and anti-collagen lymphocytes. Both of these elements may attack primitive type 3 collagen, which is a major constituent of unhealed tendon, thus modifying the scar tissue which is disrupting the architecture of the surviving mature collagen and thereby improving the strain resisting efficiency of the collagen bundles.”<sup>33</sup>

#### *Alternatives to firing*

It is not the purpose of this paper to suggest, or even to review, alternative therapies to firing in horses. A wide range of treatments have been tried. Some may be more arbitrary than firing. They include:

- “injection of acid”<sup>34, 35</sup>,
- “injection of Lugols Iodine”<sup>36</sup>,
- “brachytherapy (ionising radiation)”<sup>37</sup>,
- “months of gradually increasing work including uphill trotting on hard ground”<sup>38</sup>
- “warfarin therapy”<sup>39, 40</sup>,
- “rest, induced heat current, faradism, ultra-sonic therapy, barium sulphate/fullers earth, plaster of paris bandages, “Pickering” splint, intra-tendinous injection of cortico-steroids, treatment with radio-active cobalt seeds, tendon splitting, both longitudinal and lateral, extensor tendon implants, implants from fascia lata, section of annular ligament”<sup>41</sup>
- “cold beam lasers”<sup>42</sup>,
- “blisters, sweats; Teflon sheaths, carbon fibre implants, cryotherapy”<sup>43</sup>
- raised heel shoeing

The large number of treatments suggests that no one treatment showed a significantly better result than any other, despite anecdotal claims about some or all of those listed.

### *Effectiveness of firing*

McCullagh et al (1979), in a commissioned article for the Veterinary Record, state: “In reality, firing causes a thinning of the skin, produces an acute inflammatory response in the subdermis, and does nothing to stimulate better healing in deep tendinous structures. The subdermal reaction is likely to increase peritendinous adhesions and thus hinder the return of gliding functions in the tendons”. And later, “an injured tendon will never function as effectively as a smooth healthy one. The real answer to the problem lies in reducing the incidence of tendinitis by emphasising a gradual approach to training and work and.....not to overstress...the equine lower limb.”<sup>44</sup>

### **Surveys and experimental studies on firing**

Two studies are treated under the heading of surveys and experiments on firing. The first is a major and influential clinical and experimental study conducted at the University of Bristol over a five-year period from 1977 to 1981. This is the Silver and Rossdale report<sup>45</sup>. The second is an unpublished Ph.D. thesis from the University of Sydney, dated 1960. The author is the late Professor L.H. Larsen who held the Chair of Veterinary Surgery.

#### *The Silver and Rossdale Report*

The Silver and Rossdale Report<sup>45</sup> covers a 5-year clinical and experimental investigation into the practice of firing. The investigation was conducted under the leadership of Professor Silver of Bristol University and the research team included other noted experts such as Peter Rossdale. It included a series of 350 post mortems. The study had a rational basis in pathology and physiology and was designed to satisfy statistical and epidemiological scrutiny.

Aspirations in the clinical component were not achieved in their entirety. The authors ran into some familiar difficulties; “lack of numbers, uniformity of injury and adequate documented history and follow up, inadequate co-operation between field

and laboratory workers and the natural reluctance of owners and veterinary surgeons to allow measurements that did not give an immediate clinical or financial return.

A synopsis of the Silver and Rossdale study is shown in Box 1. In short, Silver and Rossdale concluded that firing of the skin above limb tendons did not improve tendon healing and, indeed, collagen synthesis was unaffected or reduced. Tendons took at least 15 months to heal, and cautery either failed to accelerate the rate of healing, or retarded it. Skin subjected to cautery became thinner and weaker.<sup>45</sup> They found no evidence of an *in vivo* bandage, found no improvement in tendon neo-vascularisation, and found no evidence of an improvement in locomotion as assessed by force plate studies in fired over unfired horses with identical injuries.<sup>46</sup>

The suggestion that firing induced anti-collagen III antibodies and thus assisted the removal of this immature and weaker substance, aiding tendon healing, was also investigated. Specific stains showed that the distribution of Type III collagen in fired tendons at 3, 6, and 14 months was not significantly different from that in untreated injuries. Tendon “splitting” was found to increase the amount of Type III collagen.

**Box 1: A synopsis of the Silver and Rossdale study.**

Silver IA, Rossdale PD (eds.) 1983 “A clinical and experimental study of tendon injury, healing and treatment in the horse” Equine Veterinary Journal Supplement 1, July 1983, 43 pages.

The study was conducted in two sections – the gathering of clinical data, and the execution of experimental work on firing itself and with ponies injected into the tendon with collagenase. The authors used a variety of measure to establish that tendon injury, healing, and the response to various treatments was the same in the experimental ponies receiving collagenase as in the clinically affected horses. Some doubt must remain, however, whether collagenase treatment reproduced identical tendon injury to trauma.

Investigations included:

- Collection of tissue from post mortems
- Histo-pathology
- Electron microscopy
- Biochemistry (collagen content, sub-types)
- Immunofluorescence
- Chromatography and electrophoresis
- Determination of protein synthesis (incorporation of C14-proline)
- Determination of collagen synthesis
- Injection of a mixture of proteolytic and collagenolytic enzymes to induce a consistent lesion very closely similar to or identical with spontaneous traumatic tendon sprains
- Determination of fibril diameter, alignment and extent of crimping
- Determination of number of reducible crosslinks and the proportion containing hydroxylysine
- Force plate of gait
- High speed cinematography
- Tendon transducer implantation
- Behavioural and observational indicators of “stress”
- Plasma electrolytes, cortisol, glucagons and free fatty acids

These investigational techniques were used to compare uninjured with injured tendons, spontaneous with artificially induced injuries, and various treatments including rest only, line firing, pin firing, tendon splitting, and carbon fibre implantation.

*“Overall conclusions*

Thus \*line ‘firing’ does not improve tendon healing and, if it has any effect, tends to be deleterious. By

implication, the pathology of \*'pin firing' suggests that it must have similar, if not more detrimental, effects.

The biochemical findings showed that \*line 'firing' produces major short term changes in skin collagen synthesis and destruction but this rapidly returns to normal. In one case only, 'firing' caused an increase in protein synthesis (but not collagen synthesis) in the underlying tendon, but this had returned to normal in three to four weeks. In all cases, tendon collagen synthesis was unaltered or decreased slightly in 'fired' animals. In some animals, organisation of fibrinous inflammatory exudates caused peritendinous adhesions after firing.

Pathological studies showed that tendon healing is a very prolonged process and continues after 15 months. 'Firing' did not alter this process except in the case of 'pin firing' where injury to the actual tendon prolonged the healing and resulted in further damage. Scar collagen in \*'pin fired' tendons did not align along lines of stress and remained as 'cores' of permanent weakness.

'Fired' skin, after an initial period of acute inflammation and oedema, produced local areas which were weaker than normal skin.

**On the basis of these observations we have to conclude that 'line firing' is not an effective treatment for acute or chronic injury and that 'pin firing' and tendon splitting are detrimental.**

### *The work of L.H. Larsen*

Leonard Larsen was Professor of Veterinary Surgery at the University of Sydney from (*date period*) who studied the consequences of firing for a PhD Thesis titled "*The Reaction of Mesodermal Tissues to Irritation*" and dated 1960.

Professor Larsen observed that cautery of the musculoskeletal system had been discontinued in human medicine<sup>47</sup>. He found many field observations on firing of horses in the published literature, but little critical evidence as to the nature of changes in the tendon after cauterisation, or on the impact on tendon strength.

Larsen quotes Irving R.C<sup>48</sup>, who cites an experiment performed by Hunting. Twelve horses with bilateral forelimb sprains were studied. In each case the less affected limb was cauterised. The horses returned to work in 4 months but all broke down on the cauterised limb.

Larsen used micro-radiography and stereoscopic micrography to examine limbs after various treatments including thermo-cautery. Up to 40 thermo-cautery canals 3/8 inch (~10mm) apart were created over the flexor aspect of the limb under procaine local anaesthesia. The depth of insertion was "visually assessed", but the intention was to penetrate skin and subcutis and synovial sheath only, not the tendon. A "dressing" of 50% tincture of iodine, 25% phenol and 25% glycerine was applied daily, and the limb bandaged. He believed that the phenol provided local analgesia.

Larsen found no behavioural evidence of post-operative pain or irritation. Pulse rates and body temperatures were slightly elevated for various periods after thermo-cautery. Marked local inflammation with heat, and swelling was noted within one hour and reached a maximum at three days. Pain could be elicited by palpation. It was significant on firm pressure to three days and had diminished by 6-10 days. Wound

discharges diminished after 4 days. Some horses had marked sloughing and eschar formation. The skin still felt hot for up to 18 days when experimental horses were slaughtered.

Histopathology showed a coagulated zone a few cells thick, and a zone of cell damage approximately half the thickness of the skin, around each cauterization point. There was active hyperaemia, and by three days blood vessels were engorged with erythrocytes, distended and tended to rupture. Most swelling in the limb occurred in the subcutis and synovium and was caused by hyperaemia, congestion and oedema, and later by deposition of connective tissue. The tendons were unaffected.

Cauterisation was found not to increase the vascularity of tendons (indeed, vascularity was reduced for the first few days), but it did stimulate marked blood vessel proliferation in the subcutis and synovium in the area of cauterisation. The anterior aspect of the limb was unaffected.

Larsen pointed out that the normal inflammatory process associated with repair following tendon injury is characterised by intense hyperaemia and increase in blood vessel concentration in the affected and surrounding synovial membranes. In normal repair "fibroplasias and blood vessel formation are in excess of that necessary for repair," [therefore] "considerable doubt is cast on the value of cauterisation in tendon healing." Tissue reacts to repeated strain by hyperaemia, oedema and reduction in tensile strength. As a consequence, the prolonged hyperaemia induced by cauterisation further predisposes to tendon sprain.

Accordingly, Larsen considers that "cauterisation is of doubtful value in promoting tendon repair", but may lead to restrictive adhesions between the tendons and their synovial sheaths. He left open the possibility that cauterisation might have value in converting chronic to acute inflammation and could lead to satisfactory resolution of lesions involving bursae and joints where movement was unimportant. Bursae and joints were not the subject of his thesis.

## **Policies and Legislation on Firing**

### *Australia*

Examination of the Animal Welfare, Animal Protection and Prevention of Cruelty to Animals Acts and associated Regulations from all Australian States and Territories has only revealed one jurisdiction in which firing is mentioned. The following is a quote from the NSW *Prevention of Cruelty to Animals Act (1979)*

“PREVENTION OF CRUELTY TO ANIMALS ACT 1979 - SECT 21A  
21A Firing prohibited

A person who applies a thermal stimulus (such as hot wires) to the leg of an animal with the intention of causing tissue damage and the development of scar tissue around tendons and ligaments of the leg is guilty of an offence.

Maximum penalty: 250 penalty units in the case of a corporation and 50 penalty units or imprisonment for 6 months, or both, in the case of an individual.”

In the ACT, the *Code of Practice for the Welfare of Horses*, gazetted under the *Animal Welfare Act 1992* (8 Dec 1993) states (p9)

“4.4.3 Surgical and Medical Procedures

Practices such as firing, knicking (cutting the skin or ligaments of the tail to ensure the tail is held high) and limb neurectomy for the purpose of performance enhancement are not acceptable.”

It is not clear whether the Code refers to all firing as being not acceptable, or whether only firing for performance enhancement is not acceptable, and that firing for other reasons may be. In the ACT, Codes of Practice do not have legislative stature, but may be used as a defence against prosecution under the Act.

No other State or Territory in Australia mentions firing or thermocautery in its Animal Welfare or Prevention of Cruelty to Animals Act, or equivalent legislation, nor in a Code of Practice. Victoria has indicated it is moving to institute a ban through its Prevention of Cruelty to Animals Act (Lee-Anne Wahren *pers. comm.*).

The position of Australia’s Harness Racing Association is as follows:

“Pin firing or similar treatment on a pacer or trotter prohibits that horse from participating in a race (Australian Rules of Harness Racing). The National Rules cannot permit a procedure which is prohibited by another Act in a State.”

*Overseas*

**New Zealand**

The Animal Welfare Act (1999) states:

Surgical Procedure Offences 21

- (2) A person commits an offence who  
--- (a) Crops, or causes to be cropped, the ears of a dog;  
or (b) Performs, or causes to be performed, blistering or firing or nicking on a horse.

**Royal College of Veterinary Surgeons (UK)**

Given the extensive debate in the UK veterinary literature, and the fact that significant research into the effectiveness of the procedure was performed there, it is not surprising that the registering body for veterinary surgeons in the UK would rule on this matter.

In 1983 the Equine Sub-Committee discussed firing, in the light of Silver’s work. They considered whether the procedure was an effective form of therapy for tendon strains and whether the pain involved was justified by the results. They agreed that the procedure was painful, but decided that the procedure, while not ideal, was the best treatment available for tendon sprain.<sup>49</sup>

The British Government declined to abolish the firing of horses in 1986. In 1991, J.B. Johnson proposed that “the Council [of the RCVS] should now declare firing to be an unethical procedure and prima facie evidence of conduct disgraceful in a professional respect”. This motion was unanimously agreed, and the effective date was set at 1st September 1991<sup>50</sup>.

This ruling provoked, as might have been expected, significant debate, including raising concerns that firing would continue by European vets (in the UK or in Europe), or by lay people, with significant detriment to horse welfare.<sup>51,52</sup> Further, the ability of the Royal College to pursue a case against a veterinarian who, after due consideration, performed the procedure with diligence, effective anaesthesia and analgesia and postoperative care, and a successful result perhaps saving a horse from euthanasia, was challenged.<sup>53</sup>

In 1992 it was reported that the Royal College had agreed not to pursue a notified occurrence of firing, casting doubt on their ruling.<sup>54</sup> The Royal College now lists “firing of horses” in its “16. Category C “Unacceptable Procedures” Annexe – c.) Practices which Council deplors as being ineffective and/or lacking justification as methods of treatment and which should be discontinued.”<sup>55</sup> (see box 3)

**Box 3: RCVS Position on firing of horses**

Firing (horses)'Preventive' firing has been condemned by RCVS Council as totally unjustifiable and prima facie grounds for prosecution under the Protection of Animals Acts 1911 and 1912. Firing for tendon injuries, allegedly for therapeutic purposes, has been condemned by Council as being therapeutically ineffective and unjustifiable. Council has expressed the hope that, in the light of our better understanding of the pathology of tissue injury, this practice will be abandoned.

Report of Working Party Established by RCVS Council to consider the mutilation of animals (Endorsed and Adopted by Council June 1986/February 1987)

**16. CATEGORY C: UNACCEPTABLE PROCEDURES**

- a. When carried out for non-therapeutic reasons whereas if carried out for therapeutic purposes they are acceptable and fall under Category B(b) above i All those procedures referred to in Category B(b) above
- b. Being normally carried out for non-therapeutic reasons only and when those reasons are not considered adequate to justify their being carried out
  - i Branding, corrosive chemical
  - ii Branding, hot (NB: legislation covering farm livestock)
  - iii Cropping of ears
  - iv Devoicing (birds, dogs, horses, mules) (NB: legislation covering cockerels)
  - v Dewinging (NB: legislation covering farm livestock)
  - vi Drilling of tortoise shells
  - vii Ear implants (dogs)
  - viii Mules-type operations (sheep), ie removal of folds of skin from around the vulva and tail
  - ix Venom ducts, ligation of
  - x Venom apparatus, removal of
- c. Practices which **Council deplors as being ineffective and/or lacking justification as methods of treatment and which should be discontinued**

i Application of corrosive acids to the skin

**ii Firing (horses)**

iii Teeth cutting (sheep): so extensive as to leave the pulp cavity exposed, but not falling within the definition of grinding in Category A, above.

### **Canadian Veterinary Medical Association**

#### **PIN FIRING OF HORSES**

**Position:**

"The Canadian Veterinary Medical Association (CVMA) is opposed to the procedure known as pin (hot) firing."

**Background:**

Pin firing has been used in the past as therapy in the treatment of lameness in horses. Although counter-irritation remains the basis for some therapies in veterinary and human medicine, there is insufficient evidence of the efficacy of pin firing to justify the pain and tissue damage caused by the procedure. (Revised, November 1992 - C29992)<sup>56</sup>

### **American Veterinary Medical Association and American Association of Equine Practitioners**

The American Veterinary Medical Association (AVMA) "does not presently have a position on the firing of horses". (Dr Gail Golab, Assistant Director, Education and Research, AVMA *pers comm.* 18/4/01).

The American Association of Equine Practitioners' "Ethics and Professional Guidelines Position Statement Protocol (1997)" states:

Therapeutic Options: The AAEP supports the rights of the veterinary practitioner to select and prescribe a course of therapy believed to be in the best interest of the horse and consistent with the Veterinary Oath of Practice.

Position on Thermocautery or Pin Firing (1998): Pin firing or thermocautery has value for certain conditions in the horse. When done properly, the AAEP considers pin firing an acceptable form of therapy.

### **Discussion**

We have examined the literature on the firing of horses in order to evaluate the evidence on questions that determine its animal welfare acceptability. Is the pain, however slight or short-lived, caused by firing justified by the effectiveness of the procedure? Our survey of the literature has failed to reveal any compelling evidence that firing is an effective therapy with benefit or advantage to the horse. Investigators into the effects of firing state that it was of no benefit, and indeed was more likely to do harm than good, in both the short and long terms. Furthermore, our survey has not identified a cogent explanation for how firing may benefit horses. The result is that the biological grounds for making a decision on the ethics of firing are clear-cut. Firing has no therapeutic value that justifies the harm inherent to it.

Some discussion about our evaluation is necessary because the current AVA policy accepts firing's lack of therapeutic value for "tendon healing" but refers to a gap in knowledge around firing and bony lesions. It also observes that Silver and Rossdale

found no evidence that line or pin firing produced particularly severe stress. This is so, but the conclusion requires discussion in view of advances in knowledge since 1983. Finally, firing has been an issue that has polarised opinion between those who automatically reject firing on the grounds of suffering and those who believe that a degree of suffering can be justified by the end result.

The absence of evidence for the benefits of firing is not that there is no information at all. In this regard, we found both the Silver and Rossdale report<sup>45</sup> and the Larsen thesis compelling. Silver and Rossdale admit that their clinical study did not measure up to the gold standard, which may indeed be unachievable with equine medicine. However, one must look at what their study did accomplish, not what it may have failed to do. Their conclusion that ‘line firing’ is not an effective treatment for acute or chronic injury and that ‘pin firing’ and tendon splitting are detrimental” is made within the limits of their study. Furthermore, it is backed up with detailed observations on the accompanying patho-physiological processes. There was no evidence from these that firing stimulated any recognisable mechanism associated with healing.

In hindsight, the difficulties encountered by Silver and Rossdale<sup>45</sup> were:

- an apparent lack of co-operation from practitioners which limited the amount of clinical material;
- the absence of clear and testable hypotheses around firing which limited the scope for experimentation;
- too many options to check (for example, line firing or pin firing, pin firing into the tendon or just through skin and peritendinous tissues, with or without various post operative dressings, and their use for shin soreness, bowed tendons, osselets, arthritic joints and so on);
- the possible challenge to the validity of collagenase treatment as a model for tendon sprain, although it does provide a model of tendon physiology and healing; and
- the fact that the study was performed in 1983, before the introduction of ultrasound as a standard tool for the investigation and monitoring of tendon sprain in horses and in the absence of more recent knowledge about pain and stress.

The Silver and Rossdale report attempts to answer the demanding question of pain and stress associated with firing. Their conclusions are useful but could not be concrete, mainly because of the difficulties in assessing these phenomena. They observed that firing produced an acute period of discomfort for the first 24 hours, that animals rapidly returned to normal as judged by behavioural and biochemical grounds, and that the “stress” involved was almost certainly less than that produced by the original injury – a good “internal” standard.

Pain, suffering and distress are subjective phenomena. With the present state of knowledge, it is often possible to recognise them as states but harder to define what they actually are.<sup>57</sup> “Pain in animals is an aversive sensory experience that elicits protective motor actions, results in learned avoidance and may motivate species specific traits of behaviour, including social behaviour”.<sup>58</sup> This definition includes behavioural and physiological responses that may be measured or observed.

Behavioural responses to pain in horses include escape or attack behaviours, stamping of limbs, picking up and replacing limbs, holding limbs with toes down or with weight taken from the limb, tail swishing, general restlessness, jerky movements, agitation or depression (if pain is prolonged), lack of responsiveness to external stimuli, “playing” with water and interruption of eating. Physiological signs include dilated pupils, glassy eyes, increased respiratory and heart rates, flared nostrils, copious sweating<sup>59,60</sup> and the release of adrenal corticoids, adrenaline, noradrenaline, endorphins and enkephalins.<sup>61</sup>

Many investigators have attempted to employ concentrations in plasma or cerebrospinal fluid of various endogenous hormones and neurotransmitters, which are recognised to play a central role in the animal’s response to noxious stimuli, as objective measures of pain and stress. Currently, the relationship between endocrine changes (corticosteroids<sup>62,63</sup> and  $\beta$ -endorphins<sup>64</sup>) and other physiological and behavioural indicators of pain (“grouped signs”<sup>65</sup>) is unclear. A relationship has been found between pain and plasma concentrations of epinephrine and norepinephrine<sup>66</sup>.

It is problematical whether newer methods (“area under the curve” assessments of epinephrine and nor-epinephrine or cortisol levels) would have further elucidated the pain response to “firing in horses”. It is prudent to accept the behavioural indicators of significant pain for at least a short period, 24 or so hours.

Silver and Rosedale did not address all indications for firing. According to Adams<sup>17</sup>, the bony lesions where firing may be indicated are osselets (where he suggests definite value), sesamoiditis (no value), bone spavin (where firing may help with ankylosis but where surgical arthrodesis is more definitive) and splints (where firing may simply promote effective rest). This suggests that the use of firing for bony lesions is quite limited and that the research called for in the current AVA policy on firing would also be limited.

It is questionable whether the future research referred to in the current AVA policy is either feasible or ever likely to be conducted. What would the research question be, given the dearth of testable hypotheses about possible therapeutic mechanisms that were identified during our review of the literature? Who would do the research? Competent equine researchers may see little value in allocating valuable time to a practice they may regard as irrelevant to improving the treatment of injuries. How does the question of firing rank in regard to other possible scientific research into horses and where would it be done? Resource issues such as these mean that research into firing is unlikely to be undertaken at all. Furthermore, research into firing would not be possible by law in NSW at least. The final difficulty would be in gaining approval from an institutional Animal Ethics Committee, particularly if the research included the assessment of pain and suffering in control animals not receiving any analgesia or anti-inflammatory therapy. Our opinion is that support for policies on animal welfare should not be sought in scientific research that has no reasonable chance of coming to fruition.

Australian legislators, except for the State of NSW, have not addressed the issue of firing. Only NSW has made firing illegal. It seems that Victoria may introduce similar legislation. The Animal Welfare Advisory Committee in the ACT, the authors

of the Code of Practice on horses, regard firing as unacceptable, but this document does not have weight of law. Firing is illegal in New Zealand.

In Britain, the Registering body regards firing as unethical and disgraceful conduct, and in Canada, the CVMA regard firing as unethical behaviour. The AAEP's position is to support the right of veterinarians to select therapy, and consider that there are indications for firing. Comment must be made that the AVMA has not yet, as a professional body, taken a stance against other practices that can be classified as mutilations. These include tail docking and ear cropping of dogs and de-clawing of cats. Attitudes toward some areas of animal welfare in the USA are patchy. They sometimes appear to trail the opinion that prevails in other countries.

The authors believe there is sufficient evidence against firing for the AVA to take a strong stance opposing this practice. In so doing, we will ally ourselves with organisations for whom we have regard and allegiance. Further, the AVA should encourage the banning of firing in all States and Territories of Australia. We believe that there are very few veterinarians still performing this act, and that there is unlikely to be significant opposition to, or hardship caused by, such a ban.

An additional issue for the ethics of firing, separate from that of animal welfare, became apparent during our survey of the literature. It is that biological explanations for firing as a therapy are archaic and unsatisfactory in 2001, particularly when the evidence is against its effectiveness and provides no empirical justification. It is our view that veterinarians, as trained scientists, have an obligation to deliver rational treatment. They should have evidence that a therapy works and, better still, should be able to explain how and why an effective therapy works. As a consequence, we consider that the current AVA policy on firing is inappropriate for 2001 regardless of the welfare aspects of the practice. It is even more inappropriate when welfare considerations are included. The continued acceptance by the AVA of firing poses a risk to community confidence in the competency and reliability of all veterinarians. It reflects badly on the whole of the veterinary profession.

## **Conclusion**

Our survey of the published evidence about firing in horses leads us to the conclusion that it infringes professional ethics to either perform or tolerate the practice. To our mind, cost-benefit considerations indicate no justification for further research into firing. The cost is to the horses involved. An additional opportunity cost relates to foregone research into other and more important areas. The benefit is to the few people who may still perform the practice in the face of the evidence against it. We recommend that the AVA revoke its current policy. We also urge the AVA to lobby for the practice to be banned under State and Territory Animal Welfare or Prevention of Cruelty to Animals Acts, or equivalent.

Our suggested wording for a replacement policy is set out below.

### **“2.10 Thermo-cautery of horses**

The firing (thermo-cautery) of horses is unethical in view of the evidence that either demonstrates its harm or refutes its therapeutic benefit. It is unlikely that clinical or

experimental research can ever shed light on remaining doubts that firing may be beneficial in some special situations.”

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The committee provides a review of activities to ensure animal welfare priorities established by the range of stakeholders are considered appropriately. The feedback and direction provided by committee members ensures that CAWE facilitates outcomes in line with its mission and values. The research and activities performed by the CAWE are, in part, dependent on funding opportunities, but priorities for the CAWE are within the following strategic actions: evaluating current animal husbandry and industry practices; conducting objective scientific research to develop, improve, or recommend alternative management strategies to benefit the welfare of animals; monitoring and analyzing attitudes to animal welfare nationally and internationally which will. The Australian Veterinary Association (AVA) is the national organisation representing veterinarians in Australia. Our 9,500 members come from all fields within the veterinary profession. Clinical practitioners work with companion animals, horses, farm animals and wildlife. This submission makes comment on the Review of the Australian Standards for the Export of Livestock (ASEL) - Working Draft "Reformatted Standard1, dated 30 October 2018 (the draft standards). Reference to the Stage 2 Report (the Report)2 is also made where applicable. There are some recommendations and proposed changes to the draft standards that the AVA supports. The firing of horses. A review for the Animal Welfare Advisory Committee of the Australian Veterinary Association. (accessed on 20 April 2012). M Hayward. D Adams. Minimising injury and associated welfare issues could involve a radical approach to the timing and implementation of conditioning and training. Tendons were examined from Thoroughbreds, Dutch Warmblood foals, working horses and also a group of wild horses to evaluate effects of age, function and exercise.