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incidence of pathology included lateral (85 % of horses) and dorsal (90 % of horses) wall flares, presence of laminar rings (80 % of horses) and bull nose tip of the distal phalanx (75 % of horses) and a suspicion of chronic laminitis in a large percentage of horses.

There is evidence to support the possibility that feral horses from hard substrate environments may suffer from foot pathology similar to the traumatic laminitis model induced in domestic horses. Linford \(^4\) induced traumatic laminitis by trimming the hoof wall bearing border to the level of the sole and housing the horses on hard footing for four months. The intervention caused disruption of the lamellar architecture, haemorrhage in the solar corium, solar margin fractures and distal phalanx remodelling. The necessity of some feral horses to travel long distances over hard substrate may also lead to overuse or concussive injuries to the distal phalanx and lamellar suspensory apparatus of the distal phalanx. The high incidence of calcified ungual cartilages in the hard substrate environments supports a hypothesis of concussive injury aetiology. The majority of feral horse travel is performed at a slow straight, short walled hoof capsule is a feature of horses surviving in the hard substrate environment and predispose horses to foot abnormalities.

However, horses living in the hard substrate environment did not appear overtly lame. These feet had a shorter toe length (29.1 mm) than horses from soft substrate (34.6 mm) and domestic horses from previous studies (Kummer \(^5\), Warmblud: 36 mm and Linford \(^6\), Thoroughbreds: 33.4 mm). A reduction in toe length has been shown to reduce substantially the peak moment at the onset of break-over. It may be that the robust foot structure and the unique foot morphology of these horses are protective against mechanical trauma and the pain associated with chronic laminitis.

The soft substrate horses did not have abnormal radiographic features and there were no radiographic signs of laminitis. Hoof wall flaring and splitting, were common in feet from soft substrate environments but were absent in feet from hard substrates. The hard substrate may have induced significant internal abnormalities but the high rate of hoof wear may have protected against less significant foot abnormalities. A straight, short walled hoof capsule is a feature of horses surviving in the hard substrate environment and appears to withstand the pathological consequences of this lifestyle. This point is worth noting when considering trimming models for the management of foot diseases such as laminitis. The form of the hard substrate feral horse foot may be a good model to consider in these situations.

Substrate hardness may not be solely responsible for the more significant abnormalities observed in the feral horses. The presence of laminitis in some of these populations may be explained by nutritional factors. Laminitis in some feral horse populations may be due to carbohydrate overload from opportunistic feeding, similar to laminitis caused by grain and pasture overload. Thus the importance of controlled nutrition for laminitis prevention is highlighted.

Feral horses in Australia and New Zealand, like many places throughout the world, survive in conditions not entirely natural for horses. These environments at times provide abundant food sources which may be inappropriate for horses. At other times feral horses experience sustained droughts and food and water shortages. The separation between food and water affects travel distance and the choice of terrain over which horses travel. This in turn affects the form and structure of horse feet. Feral horse feet often appear aesthetically beautiful, robust and pathology free, and appear at first glance to be an ideal model for horse feet.

While some features of feral horse feet appear to give guidance for trimming practices, others have been misinterpreted and over-emphasised. In light of recent more detailed study of feral horse feet there is sufficient argument for the model to be reconsidered.

REFERENCES


Fig 1: Combined capsular and phalangeal rotation (see wedges)


THE LAMINITIC / FOUNDERED HORSE, BETTER SHOD OR BAREFOOT?

Hans Casteljins, DVM - certified farrier, Cortona, Italy

1. DEFINITIONS

Laminitis is the inflammation of the laminar suspensory apparatus of the equine or asinine hoof; founder is the loss of normal relationship between the hoof capsule and the distal phalanx (DP) contained within. Founder can be a consequence of laminitis, but can also occur in the case of extensive onicocymosis (white line disease).

In the case of founder there can be:

- Capsular rotation - the hoof capsule detaches from the dorsal laminae and rotates upward and away from the DP.
- Phalangeal rotation - the distal inter phalangeal joint (DIPJ) does not extend normally; the pull of the Deep digital flexor tendon (DDFT) pulls the DP in a more upward position relative to the axis of the middle and proximal phalanx (PPA).
- A combination of the above. (Fig. 1)
2. ACUTE LAMINITIS

Laminitis can be triggered in many different ways and is the second cause of untimely loss of horses according to AAEP data.

In the acute phase, the logical first hoof care steps include box rest on deep, soft bedding. The next step is to relieve the laminar suspensory apparatus of the DP by unloading the wall, recruiting the bars and frog into weight bearing, and to diminish the pull of the D.D.F.T. by raising the heels and facilitating dorsal and lateral medial break over. This can be achieved with plaster casting, styrofoam pads, silicone imprint material, and specialty boots. Other measures which may be useful / necessary in the acute phase are cryotherapy and the use of the Michael Puhl swing lifter.

- In the case of the coronary band being displaced upwardly, reset it by coronary grooving, so as to allow for new, parallel hoof wall growth.
- Carefully try to maintain or to restore phalangeal alignment by trimming the heels behind the largest part of the hoof if necessary, compensating for increased DDFT pull by moving the dorsal point of break over back.

It is indispensable to use x-ray guidance for the trimming and shoeing procedures and it can be useful to use venography. In the authors experience, correct foot radiographs, with the appropriate positioning, focus distance, height and known enlargement factors, are still the exception, making optimal results from the vet – farrier collaboration difficult.

On those limbs where the position of the DP within the hoof capsule does not stabilize, which do not improve clinically, or even worsen, and where the phalangeal rotation of the DP keeps increasing, DDFT tenotomy is an appropriate salvage measure. After the tenotomy, the heels should be trimmed for phalangeal alignment and the foot needs a caudal extension to limit the subluxation of the DIPJ.

The author’s choice of shoeing the painful, sub-acute cases, which have trouble stabilizing their DPs, is the application, on the trimmed hoof capsule, of a glue on cuff with a screwed on aluminum, closed, full rolling motion shoe and silicone imprint material under the frog and bars. This type of shoeing, the biomechanical principles and versatility of which are similar to the use of Steward Clogs, increases sole clearance due to the distal rim of the cuff, permits a considerable lever arm reduction - thanks to the reduced ground surface of the full rolling motion shoe and its placement under the cuff - and permits accurate application of the silicone imprint material. Relative to the Steward Clog, there is the added advantage of being able to inspect the bottom of the foot and to medicate prolonged soles on an even daily basis, as the screwed on full rolling motion shoe functions as a hospital plate.

4. CHRONIC FOUNDER, PAST FOUNDER

Horses can go back to more normal shoeing and/or barefoot trims if:

- They get enough sole depth under the distal margin of the DP (in the case of tenotomized feet this may mean keeping enough sole depth under the palmar processes).
- They have a decent dorsal hoof wall attachment. After a large dorsal hoof wall resection in the case of severe onicomyositis, for example, the dorsal hoof wall should be soundly attached all the way to the distal border of the DP, before shoeing without some kind of frog support.
- The ground conditions are good; ideal are dry, soft surfaces.
- There is not too much scarring of the (dorsal) laminar suspensory system; (permanently) stretched white lines are easily prey to “gravel” and ascending infections, whether fungal or bacterial in origin.

5. SIZE AND BREED

A factor in determining whether a horse or donkey can cope with bare feet, after a severe episode of founder, is size and breed.

Small ponies, like Shetlands and small donkeys like Sardinian donkeys, seem to have more “redundancy” in their general management, diet and exercise after initial laminitis. On the one hand, they seem to have the capacity to come back and grow normal hooves again, on the other hand, they are also easily victims to new episodes of laminitis if their body condition score...
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- Redistribute the weight bearing function, recruiting bars and frog.
- Diminish the lever arms dorsally and latero medially so as to diminish laminar wear and tear while walking and turning.

3. SUB-ACUTE LAMINITIS WITH FOUNDER
In the sub-acute – chronic phase, when at least the initial cause (endometritis, carbohydrate overload, colic, Cushing’s syndrome etc. etc.) has been addressed and laminitis has led to some form of painful founder, each hoof has to be treated individually, with some common principles as a guide:

- Preserve the DP; preserve or promote sole depth under (the distal margin) of the DP.
- Realign the dorsal hoof wall with the dorsal aspect of the DP.
- Redistribute the weight bearing function, recruiting bars and frog.
- Diminish the lever arms dorsally and latero medially so as to diminish laminar wear and tear while walking and turning.

The author’s choice of shoeing the painful, sub-acute cases, which have trouble stabilizing their DPs, is the application, on the trimmed hoof capsule, of a glue on cuff with a screwed on aluminum, closed, full rolling motion shoe and silicone imprint material under the frog and bars. This type of shoeing, the biomechanical principles and versatility of which are similar to the use of Steward Clogs, increases sole clearence due to the distal rim of the cuff, permits a considerable lever arm reduction - thanks to the reduced ground surface of the full rolling motion shoe and its placement under the cuff – and permits accurate application of the silicone imprint material. Relative to the Steward Clog, there is the added advantage of being able to inspect the bottom of the foot and to medicate prolapsed soles on an even daily basis, as the screwed on full rolling motion shoe functions as a hospital plate.

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5. SIZE AND BREED
A factor in determining whether a horse or donkey can cope with bare feet, after a severe episode of founder, is size and breed.

Small ponies, like Shetlands and small donkeys like Sardinian donkeys, seem to have more “redundancy” built in their hooves, relative to their weight/size. Some breeds, like Haflinger ponies/cobs and P.R.E. horses (“Andalusians”), although often the victim of laminitis/ founder, due to their propensity to fatten even on light diets (so called easy keepers), often have strong, fast growing hooves and seem to have a higher capacity to come back from founder. All these type of horses and donkeys need extreme care in their general management, diet and exercise after initial laminitis. On the one hand, they seem to have the capacity to come back and grow normal hooves again, on the other hand, they are also easily victims to new episodes of laminitis if their body condition score
is not carefully controlled. The key hoof care in these patients consists in x-ray guided trims, which:

- Leave enough (12-15 mm) sole depth below the distal margin of the DP.
- Bring back the, often excessively, long and under run heels to the widest part of the lateral and medial crest of the frog, by trimming the heels from the largest part of the hoof backwards.
- Realign the dorsal hoof wall, parallel to the dorsal aspect of the DP.
- Trim a rocker in the toe area at 30°-40° to the bottom of the hoof, starting dorsally of the projection of the distal dorsal margin of the DP.
- Round off the distal borders of the trimmed hoof.
- Treat exposed horny lamellae with hoof hardener and/or disinfectant to prevent fungal/bacterial infections. (Fig. 7a, 7b)

Fig. 7a, 7b: Foundered pony hooves, trimmed for keeping barefoot.

All obese horses, ponies and donkeys which are on a low carb/energy diet, benefit from a good hoof growth supplement, to assure them the microelements for adequate hoof growth.

Soft paddocks allow for a better hoof unrollment pattern and therefore more exercise without pain, which together with a strict diet is the best way to a lower body condition score.

Older horses and ponies with confirmed Cushing’s syndrome (pituitary pars intermedia dysfunction-adenoma) need to be put on the adequate dose of daily pergolide to keep them from having recurrent bouts of Laminitis.

REFERENCES ON REQUEST.


COMMON THEMES IN FARRIERY TREATMENT FOR CHRONIC FOUNDER

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Abstract: The term laminitis covers a broad spectrum of conditions relating to the laminae. Lameness can vary from imperceptible to unable to stand. The pathways and phases of the syndrome are not simple and definitions of these are not always clear. Treatment varies according to the severity and the phase of lameness. Successful farriery treatment is aimed at stabilising the condition, reducing pain and promoting new horn growth that is as healthy and normal. There are many farriery treatments described which seem may seem counter-intuitive or contradicting recognised methods. The author believes there are some common themes, which are used in most shoeing treatments of chronic founder: 1) giving digital support through the frog and caudal palmar sole; 2) improving the break-over at the toe, to reduce leverage on the dorsal laminae; 3) elevating the heel to reduce deep digital flexor tendon (DDFT) tension and to return the palmar solar angle to normal after radical heel trimming.

INTRODUCTION

The term laminitis covers a broad spectrum of conditions relating to the laminae. Lameness can vary from imperceptible to unable to stand. The pathways and phases of the syndrome are not simple (Figure 1). Definitions of these are not always clear and even when ‘acute’ becomes ‘chronic’ is debated. Treatment varies according to the severity and the phase of lameness (Figure 2). Successful farriery treatment is aimed at stabilising the condition, reducing pain and promoting new horn growth that is as healthy and normal as possible. There are many farriery treatments described which seem may seem counter-intuitive or contradicting recognised methods. This author believes that, when looked at in detail there are some common themes, which are used in most shoeing treatments of chronic founder:

1. reducing exercise,
2. giving digital support through the frog and caudal palmar sole,
3. improving the break-over at the toe, to reduce leverage on the dorsal laminae,
4. elevating the heel to reduce deep digital flexor tendon (DDFT) tension and to return the palmar solar angle to normal after radical heel trimming.

Figure 2: A flow chart of the possible pathways of laminitis; from Corrective Farriery - a textbook of remedial horseshoeing, Vol. I.