Explaining Laminitis and its Prevention ©

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Chapter 3 - The aims of foot treatments, shoeing and surgical treatments.

1. Laminitis cases

As it is not possible to tell whether a laminitis case is going to deteriorate and founder. It is sensible to treat them all as if they might. The aim of foot treatments is to try and optimise the horse's comfort whilst counteracting, as far as practicable, the downward movement of the pedal bone. Nothing should be placed under the horny sole because a) the sole of the foot is not designed to bear weight, in fact it will bruise and abscess if forced to do so, and b) there is nowhere on the sole that support could be applied to achieve a mechanical advantage. By referring to Figure 15 it can be seen that the only place where a supporting influence can be provided to the pedal bone is between the two open arrows under the frog. Pushing further forward than the front arrow would not support the pedal bone but rather extend the coffin joint and risk fracturing the tip off the pedal bone. Supporting further back than the back arrow tends to flex the coffin joint, worsening the phalangeal alignment. Any form of frog support must only be applied within the margins of the trimmed frog; pressure elsewhere risks damage to the arteries under the horn (Fig. 11). Only by X-raying the foot can we get an appreciation of the relative positions of the structures in the foot. At this point it would be as well to describe how X-rays should be taken.

X-ray technique

A few simple preliminaries will make the difference between an X-ray that is some use for diagnostic and prognostic purposes and one which is not. A wooden block is needed about 3 inches high and wide enough for the horse to stand on. A piece of the vicar's bicycle spoke is embedded into the top of the wooden block to highlight the ground line. The horse's foot is picked and brushed out and any flaking horn or shaggy frog trimmed away. It is important to trim the frog so that the collateral sulci can be seen to their depths on both sides of the frog which are then beveled. The frog does not show up well on lateral X-rays, in order to show the frog in relation to the pedal bone inside, a marker (usually a drawing pin) is used to highlight the frog. The pin is pushed into the front inch of the frog. It does not matter exactly where the pin is placed as long as its position on the frog is marked in some way. I prefer to draw a felt tipped pen line right across the sole and frog. Then reference can be made back to the frog following examination of the X-ray (Fig. 20).

Figure 20. Prior to taking an X-ray, the frog is trimmed and a drawing pin with a shortened point is placed about 1 cm back from the point of frog. The position of the pin is marked by drawing a line across the frog and sole.

Figure 21. In addition to the pin marker a piece of straight stiff wire about 40 mm long is taped to the front of the wall of the foot. THE TOP OF THE WIRE IS PLACED WHERE THE HORN CHANGES FROM HARD TO SOFT. It is sometimes necessary to lightly rasp the wall to smooth the horn before fitting the wire marker.

For prognostic purposes when X-raying laminitis, acute founder and sinker cases, another marker is used on the front of the hoof wall. This time a straight stiff wire with square ends and of known length (about 40 mm long) is used to highlight the front and top of the hoof wall. It is important to know the length of the wire so that the effects of magnification in taking the X-ray can be allowed for. Firstly the top of the hoof wall just below the coronary band is lightly rasped to remove flaking or excessive perioplic horn. The top of the wall in the midline is gently pushed with your finger and the top of the wire marker taped to the wall with the top of the wire where the wall starts to yield into softer perioplic horn (Fig 21). The position where the top of the wire was placed may be marked with an indelible pen. The horse should ideally stand with one foot on the block with the cannon bone vertical, this doesn't happen very often in practice so we usually have to lift the other leg. The X-ray beam should be parallel to the top of the block and perpendicular to the axis of the limb so that an absolutely sideways-on X-ray picture is produced (Fig. 22).

Figure 22. X-ray of a normal foot, compare with Figure 12. The phalanges are in a straight line, the wire marker is parallel to the front of the pedal bone, the top of the wire is in a normal position just above the top of the pedal bone and the pedal bone is at a normal angle to the ground.

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Frog supports

Fig 23. A TLC Frog Support glued to the foot for demonstration purposes

A variety of materials can be used to make frog supports, triangles of carpet felt or rubber can be formed and bandaged over the frog. (Remember not to bandage tightly over the coronary band and to pad the heels with cotton wool to avoid rubs.) Because the materials used to make frog supports are fairly soft it is not necessary to X-ray the foot prior to fitting them provided they are fitted within the margins of the frog. The idea of a frog support is like an arch support in your shoe. It should not be so thick so the horse has to take most of his weight on it; this would make him much more lame.

However none of the materials commonly available are ideal and in 2004 we launched the TLC Frog Support which is made of a special material with 100% compression memory and a consistency nearly identical to frog horn. TLC Frog Supports provide immediate comfort giving a forgiving support which relieves the strain on the laminae. They can be used on shod or unshod hooves. They are easy to fit and available from Equi Life Ltd and most good tack shops, farriers and veterinary surgeons.

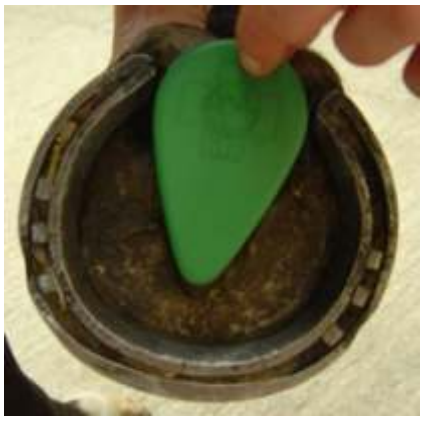

Fig 24. Sequence to show how to bandage on a TLC Frog Support using a figure of eight overlap technique.

2. Acute Founder cases

Although the frog supports are extremely valuable as an essential first aid treatment and will function for about two weeks, founder cases will usually soon need more permanent and stronger forms of frog support known as heart bar shoes. A variety of styles of heart bar shoes is available. The farrier can only make a heart bar shoe fit properly if the feet have been X-rayed in the manner previously described (Fig. 25). NO FORM OF HEART BAR SHOE SHOULD BE FITTED WITHOUT MARKED X-RAYS HAVING BEEN TAKEN.

The non-adjustable steel heart bar shoe is shown in Figure 26. The heart bar shoe is a precision instrument being made to fit each foot individually. The essential feature of the shoe is that, during fitting, the heart bar contacts the frog before the branches of the shoe touch the walls of the foot. Thus the shoe exerts pressure on the frog when it is nailed on even before weight bearing occurs. The amount of support provided by the shoe is judged before nailing on by pressing the shoe firmly to the foot. If the horse resents this there is too much pressure from the heart bar which should be hammered back a little and the test repeated. Like all nailed on shoes it suffers from the major disadvantage that most sore-footed horses resent nailing on. The adjustment of this sort of shoe is thus a little hit and miss.

However it provides a strong means of frog support when fitted.

An all-steel adjustable heart bar shoe was developed in the USA (Fig. 27). In this design the base of the heart bar (the piece which covers the frog) is hinged at the heels. A bar is welded between quarter and quarter and is drilled and tapped to accept a grub screw. By turning the grub screw with an Allen key the heart bar is raised or lowered thereby altering the amount of frog support. This type of shoe again has the disadvantage of being nailed on but the advantage of being able to perform the adjustment when the shoe is on the foot.

Figure 26. A good example of an all steel non-adjustable heart bar shoe correctly fitted. The shoe is fitted with the minimum of nails, the shoe is well seated to avoid the shoe pressing on the sole, the toe is rolled and the shoe has been fitted with sufficient length and width at the heels. Most importantly no part of the heart bar extends outside of the margins of the trimmed frog.

The shoe which was developed and is used routinely at The Laminitis Clinic is a plastic and steel glue-on adjustable heart bar shoe (Eustace shoe) (Fig. 28). This has the advantage of being glued to the foot, the shoe can be made and fitted with the horse lying down, if necessary. Strong, constant and adjustable frog support is achieved by turning an Allen key in the same way as the previous shoe. Nailing shoes to the feet of very lame horses is no longer necessary with the advent of the glue-shoe technology.

Figure 25. An X-ray of an early case of acute founder. The pedal bone has started to move down and backwards within the foot (compare with Figure 22) as shown by an increased vertical distance between the top of the wire and the top of the pedal bone (see Figure 54). There is a loss of parallelism between the wire and the front of the pedal bone.

Figure 27. An all steel adjustable heart bar shoe. The heart bar is hinged at the base. The shoe is fitted with no pressure on the heart bar. Frog support is increased after nailing on by turning the grub screw (near the centre of the foot) with an Allen key.

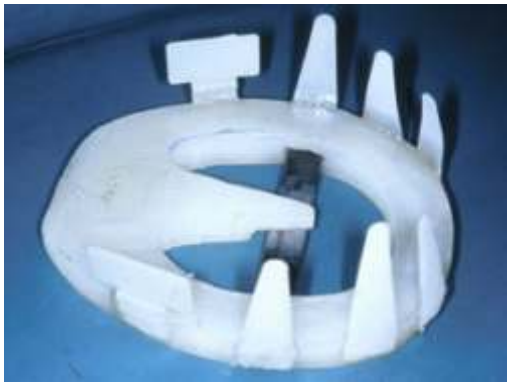

Figure 28. The plastic and steel glue-on adjustable heart bar shoe (Eustace shoe) developed at the Laminitis Clinic. The shoe is adjusted in the same way as that in Figure 27 but is attached to the foot by means of glue rather than nails. Shoeing with this device has proven to be less traumatic to both the horse and the farrier!

Another form of all plastic heart bar shoe is available, the Imprint shoe (Fig 46a, 46b). This has the advantage of being easier to mould and fit than the Eustace shoe but there is no adjustment to the amount of frog support provided.

3. Sinkers

These cases need to be treated by means of a glued-on adjustable frog support shoe, within a few hours of sinking if the horse is to have any sort of chance of becoming sound again. As we have seen, all the laminal attachments have been destroyed in a sinker and the pedal bone is sitting on the bottom of the hoof capsule (Fig. 29). Unless the pedal bone can be lifted (or the hoof capsule dragged down) to restore the normal relationship between the pedal bone and the hoof, i.e. straighten the coronary papillae and remove the pressure on the circumflex artery and vessels of the solar corium, the horse will have to be destroyed. This normalising of the anatomy is only possible for a short few hours after sinking because as time progresses there is haemorrhage and gross swelling of the laminar corium which prevents movement of the bone within the hoof. If this stage has been reached there is a real possibility of the hooves dropping off. This may happen very quickly with the pedal bones of all four feet penetrating the soles within 36 hours or it may take several weeks before the hooves detach.

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Surgical treatments for acute founder cases

Figure 29. X-ray of a foot of a sinker. The founder distance (between the top of the pedal bone and the top of the wire, see Fig. 54) is greatly increased from normal (compare with Fig. 22) and the tip of the pedal bone is resting on the inside of the horny sole causing it to become convex. This pony was destroyed.

Figure 30. This foot is at the old founder stage. The first part of the dorsal wall resection operation has been performed by removing the bulk of the wall horn with half-curved nippers. This pony showed no discomfort during the procedure which has exposed the leaf-like epidermal laminae. These are longer than normal and soaking wet with serum. Notice a 'waist'in the hoof wall, just below the coronary band. The horn above this line has grown since the pony foundered following re-alignment of the coronary papillae. The new horn is much 'tighter' around the pedal bone because the old stretched laminae are being pushed down the foot by the new horn growth. I usually leave the resection at this stage for 48 hours to dry out. The laminar horn is then much more easily removed with an electric milling tool.

Having addressed ourselves to the bottom of the foot and the problems of a descending pedal bone in founder and sinker cases, there is the area of the fluid-soaked laminae below the front part of the hoof wall to be discussed. In the early stages of founder considerable volumes of serum fluid can accumulate under the front wall of the hoof. This fluid has leaked from the damaged blood vessels in the laminar corium. Additionally there may be areas of haemorrhage from the same source. These fluids can, in some cases, build up considerable hydrostatic pressure under the wall of the hoof. The human analogy would be the blood blister under the finger nail, exquisitely painful until the pressure is released by burning through the nail with a red hot needle. The difference is that the fluid under the horses hoof wall is not usually in one nice big pocket, rather it is compartmentalized by the leaf-like laminae. X-rays are of no help to decide whether there is fluid trapped under the hoof wall as fluid does not show up on X-rays. The only way to decide in a case of acute founder is to drill a hole through the hoof wall near the midline about one third of the way up the wall. This must be done carefully, of course, to avoid drilling too deeply and into the laminar corium. If a pocket of fluid is entered the pressure may be so great as to spurt out of the drill hole. Drainage of a substantial pocket of fluid will give the horse great relief. If no fluid is released, a cotton wool swab soaked in Solution[4] Feet can be used to plug the hole and no damage will have been done. This is known as DORSAL WALL DRILLING. Dorsal, in this situation means 'the front of '. When there is a large accumulation of fluid and the front of the pedal bone is no longer attached to the inside of the hoof wall, it will be best to extend the dorsal wall drill hole into a DORSAL WALL RESECTION (removal of the front hoof wall) (Fig. 30). This will allow release of pressure on the laminar corium in the front of the foot, removal of dead laminar tissue and drainage of any infection which may have developed. The dorsal wall resection also allows the new coronary horn to grow down and remain parallel to the front of the pedal bone. (Remember that coronary horn grows in tubules so new horn has to follow the old. If the old horn is no longer parallel to the pedal bone it is better to remove it and allow new growth to assume the correct direction.) A dorsal wall resection can be done with a sharp hoof knife and half curved hoof nippers. However an electrically driven high speed milling (Dremel) tool is necessary to make a tidy job and to remove the horn closest to the laminar corium with delicacy. This procedure does not require a general anaesthetic nor a local anaesthetic as live tissue is not being cut. Most cases do not even need a tranquilliser. The occasional animal is irritated by the noise of the drill or tickled by horn shavings flying onto the pastern. I do not recommend performing a dorsal wall resection until at least 6 weeks after the horse foundered.

Abscesses

It is not uncommon for abscesses to form in the feet of acutely foundered horses. They can occur up to three months after the initial onset of founder. During their formation and until they are either drained or they burst, the horse is very lame on the affected leg(s). Abscesses occur in areas of dead or dying laminar or solar corium, between the pedal bone and the hoof capsule. These abscesses often start as pockets of haemorrhage or serum accumulation which are invaded by bacteria from the surviving blood supply at the periphery of the pocket. If this occurs in the front part of the foot the situation can be dealt with relatively easily by performing a dorsal wall drilling or resection and draining the affected area. Even if the abscess is located in the solar corium in the front part of the foot it is better to drain it via a dorsal wall resection than by making a hole in the horny sole. This is because the solar corium of foundered horses tends to swell and protrude through the hole in the sole. Such tissue can then take many weeks to heal and form new solar horn. The horny sole is the clinician's best ally and should not be touched.

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If the abscess arises in the back part of the foot, in the laminar, solar or frog corium, the situation is less easily remedied. Attempts at direct drainage should be resisted; one never finds a pocket of infection. Rather, the foot should be tubbed in hot water at least three times a day to encourage the infection to erupt. The coronary bands on the heels and the back of the foot should be kept moist with an udder cream type ointment. Eventually the abscess will burst, usually above the bulbs of the heels and the lameness resolves. Very occasionally the abscess may burst internally into an important synovial structure like the navicular bursa or the coffin joint. This unfortunately is the end of the day and there is no humane alternative but to put the horse down.

Most abscesses burst to the outside and, although painful for the horse at the time, do not worsen the long term prognosis. There is no point in treating the horse with antibiotics at this stage, if they do anything at all antibiotics will just temporarily retard eruption of the abscess. Pus in a horse's foot will only resolve by drainage. The horse should be vaccinated against tetanus.

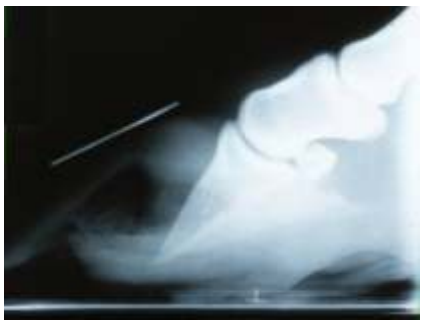

Figure 32. Another case at the old founder stage, this time a cob gelding. This foot shows a very large gas shadow extending around the foot to the quarters. This owners of this cob had been badly advised and the horse neglected. Following extensive reconstructive work the horse made a full recovery.

Figure 33. Similarly to the situation of the cob in Figure 32, when the old hoof capsule becomes so detached from underlying corium and new horn that it moves largely independently, the animal is often more comfortable if it is removed. This allows the new horn to grow closely down around the pedal bone instead of being pulled away at every stride. This is the same animal as in Fig. 8, the pedal bone had penetrated the sole in this foot and in the other feet which were treated similarly.

4. Old founder cases

Another stage of the founder process can be described between acute and chronic founder. This can be called ‘old founder’ and represents a stage at which the foundered horse is not deteriorating further, i.e. the bone is no longer descending and the tissues of the foot are starting to heal. These cases are usually over the worst of their lameness by this time. When the feet of these cases are X-rayed a black area can often be seen under the hoof wall or under the sole (Figs. 31 & 32) This indicates the presence of gas. The gas may be air that has entered the foot from the outside through a crack in the white line or it may have been produced internally by bacteria acting on a pocket of serum or haemorrhage. Gas between the hoof wall and pedal bone means that a dorsal wall resection is indicated. You do not expect to release any fluid from an old founder foot; most of that has been resorbed into the foot and the areas filled by gas. However, some serum or blood-soaked dead laminar tissue can be removed and the overlying old wall removed ready for the growth of the new coronary horn.

Figure 31. X-ray of a front foot of an Arab mare at the old founder stage, 7 weeks after the acute founder. In this case the founder distance is small, within the normal range, the coronary tissues have remodelled and reduced the founder distance. There is a linear gas shadow under the hoof wall. This indicates that a small pocket of fluid has been resorbed, some abnormal laminar horn has started to form from the damaged laminar corium. This is evidenced by the gas shadow being so close under the hoof wall; generally the closer the shadow to the hoof wall (as opposed to being close to the bone) the longer the time since the acute founder stage. The mare became sound.

The collateral extent of the separation between the old hoof wall and the horse will determine the need for specialist foot treatments and shoeing. Although extensive collateral separation does not alter the prognosis of the case it can prolong the treatment period and may incur more expense. In some cases at the old founder stage most of the hoof capsule will have only very weak connections with the corium. If this occurs it is often better to remove this old hoof capsule and either leave the animal unshod in a deeply bedded stable or build it a new hoof using artificial horn materials. Note this is at the old founder stage, when any solar prolapse has healed and formed new solar horn (Figs. 33 & 34). If this procedure, which can be called a wall resection, is not done there is independent movement between the old hoof and the corium and new horn. This results in squeezing or pinching at the coronary band when the old wall bears weight, which causes pain to the horse.

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Other surgical treatments for founder and sinker cases

In some cases of founder another complicating factor may start to operate. The muscle which works the deep digital flexor tendon starts to work overtime and contract. The reasons for this are unknown but may be related to the animal's individual pain threshold and the founder distance. As the muscle continues to contract the pedal bone is pulled away from the inside of the hoof wall (Figs. 35 & 36). This is painful to the animal as the laminal attachments are physically torn apart. The pull on the pedal bone forces it to tilt or rotate and results in pain in the coffin joint due to malalignment of the pedal bone and the short pastern bone. Once this process starts it rarely stops. Mechanical release of tension on the deep flexor tendon can be obtained by raising the heels of the foot. However, this is not at all recommended in an acute founder or sinker case as even more compression is being placed on the coronary corium in the front of the foot and the pedal bone is likely to `slide down' the laminae and drastically worsen the founder. The alternative methods of treatment are to surgically cut the deep digital flexor tendon, cast the limb to the elbow or inject botulinum toxin into the deep digital flexor muscle. Surgery can provide instant relief in suitable cases and if done on sinker or acute founder cases can return them to normality (Fig. 37). The operation can be performed under local anaesthetic in the standing animal. With good technique the end result is cosmetically very acceptable (Fig. 38). Veterinary surgeons are advised to divide the DDFT low down just above the proximal limit of the fetlock sheath, as the inferior check ligament inserts lower in some horses than stated inthe anatomy books! The two ends of the tendon are not stitched together and in fact they often spring apart by up to an inch. The tendon ends send out new tendon fibres to bridge the gap; this can occur in about three months. This new tendon is juvenile and the horse should be rested for a year before putting strain on the new tendon. These cases need to be fitted with Eustace shoes with posterior extensions at the time of the operation. This is necessary to help foot placement on uneven bedding and prevent over-extension of the coffin joint. This style of shoeing will be necessary for three months during which time the animal should not be turned out loose. It can be walked out in hand on smooth ground. Free exercise is inadvisable for at least 6 months. Provided the deep digital flexor tendon is cut at the correct time, i.e. when contracture is noticed but before irreversible damage is done to the coronary corium through compression, the animal can return to a normal life of riding or driving work after a year's rest (Fig. 39).

Figure 35. An X-ray of the right fore foot of the pony in Figure 36 at the old founder stage, see the black gas shadows under the wire marker. Notice how the pedal bone has become tilted out of alignment with the proximal phalanges by the pull of the deep digital flexor tendon. Incidentally, see how by leaving the nail heads proud of the fullering in the shoe this has tilted the shoe onto the heels. This is a bad practice not only in terms of laminitis but also relating to navicular syndrome.

Figure 37. The same foot as in Figure 35 six days later, the deep digital flexor tendon has been cut in the interim. The phalanges are all back in alignment, the heels of the foot have been lowered to set the angle of the pedal bone correctly in relation to the ground. A dorsal wall resection has also been performed and a Eustace shoe fitted.

Figure 36. This pony has foundered in all four feet and is now at the old founder stage. Although superficially the pony appears to be adopting a classical laminitis stance with the forelegs stretched out in front; closer inspection shows the pony to be standing on its toes rather than its heels. This condition is due to excessive deep digital flexor tendon strain which can only be corrected by cutting the tendon (see Figs 37 & 39).

Figure 39. The same pony as in Figure 36 two months later, able to adopt a normal stance and on the way to a full recovery for ridden work. This pony went on to win County standard showing classes which is more a testament to the fallibility of judges than the quality of my surgery!

In some cases in which there appears to be an abnormally strong pull from the deep flexor tendon, yet not enough to warrant cutting it, another operation can be performed. This involves removing the inferior check ligament. This is a short fibrous structure connecting the deep flexor tendon to the back of the top of the knee and cannon bone. It is hard to rationalise why this operation should work; in practice this seems to give more laxity to the flexor tendon and reduce the pull. A general anaesthetic is needed for this operation.

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5 - Chronic founder cases (Types 1 & 2)

Figure 38. The arrow highlights the site where a standing deep digital flexor tenotomy was performed on this mare 12 months previously.

I have described the changes in the horse's foot which characterise chronic founder. Many acute founder cases will develop these changes to a variable extent. When faced with such a foot there is a limit to what the veterinary surgeon or farrier can do to 'cure'' the animal. However, by correct foot dressing and shoeing the gait of these animals can be greatly improved and they can often lead a pain-free life.

The aim of foot treatment in the chronic founder case is to restore the relationship between the phalangeal bones, the hoof and the ground to as near normality as possible. We have seen that chronic founder cases tend to produce an excess of laminar horn around the front part of their feet and grow their heels faster than their toes. This tends to force the pedal bone into an ever more tilted or 'rotated' position. The farrier must compensate for this by removing rather more heel than toe; the exact amount can be judged by looking at the relative widths of the growth rings. Most importantly, the front wall must be rasped back to keep it parallel with the front of the pedal bone inside. This often means in neglected or long standing cases that the front wall proper, the tubular horn produced by the coronary corium, must the rasped right through to expose the laminar horn underneath. In many chronic founder cases this laminar horn is produced relentlessly, because of alterations to the laminar corium which occurred at the time of founder; the laminar horn is in fact under pressure. The horn is compressed between the harder outer tubular wall horn and the front of the pedal bone inside.

Figure 40. A chronic founder Type 1 foot. This foot would look longer with a concave front wall rather than a convex one if someone had not nibbled at the toe with a rasp. The most recently produced horn, about the top inch, just below the coronary band is at a much more upright angle than the rest of the front wall. If this line is extended to the ground removing all the horn in front, the remaining wall will be within 2 degrees of parallelism to the front of the bone inside (see Fig. 41).

Figure 41. Same foot as in previous figure 10 minutes later. Rasping back the toe has exposed a crescent of the abnormal whitish laminar horn so characteristic of chronic founder cases. This animal was much more comfortable after this foot dressing, it must be like having a pair of clogs replaced by running shoes!

When the outer wall is rasped through, it is common to see the laminar horn 'expand' or unwrap and become proud of the level of the wall horn around it. This unreleased pressure in the front of a chronic foundered foot causes discomfort, making the horse walk on the heels, which are already overgrown.

Keeping the feet correctly dressed, at least every six weeks, the phalangeal axis is kept straight and the pedal bone is at a normal angulation (about five degrees depending on the breed) to the ground. It is sometimes not easy for the farrier to be sure how much of the front wall must be rasped away to restore parallelism with the front of the pedal bone. An excellent guide is to look at the foot from the side and study the angulation of the most recent horn, just below the coronary band at the front (Fig. 40). If this line is extended to the ground and all the horn in front is rasped away the remaining wall will be within two degrees of parallelism with the front of the pedal bone inside (Fig. 41). The farrier should ask for an X-ray to be taken if he is not sure how much to rasp back. Farriers refer to this rasping of the front wall of the foot as 'dressing the foot forwards'. If no X-rays are available for a chronic founder case the farrier is safe to keep dressing the foot forwards and pressing onto what remains of the dorsal hoof wall. When it starts to yield, that is the time to put the rasp away.

There are some chronic founder cases with very high heels which, when one sees them should ring warning bells. These are often long standing cases which have developed deep digital flexor tendon contracture. The pedal bone is kept in a tilted position by the pull of the deep digital flexor muscle. If a lot of heel is suddenly removed from these cases they are likely to be more lame and may even be unable to put their heels on the ground. The only way to improve these cases is to cut the deep digital flexor tendon. It is possible to test for these animals by using a simple test. Before much heel horn is removed a crescent-shaped wedge is placed under the toe; this has the same effect as lowering the heels.

If the animal is more uncomfortable with the toe wedge in place and the other limb lifted it is likely that the flexor muscle is involved and it would be unwise to lower the heels without full discussion between owner, farrier and veterinary surgeon. When using the wedge test, be sure that the wedge is not placed under the sole and the animal made to stand on it as this will make it more uncomfortable whether the flexor muscle is involved or not. Either use a crescentic wedge which only bears around the hoof wall or perform the test while the foot is shod. The types of chronic founder cases just described, whether the flexor tendon is involved or not, I refer to as Type 1 (Figs. 42 & 43).

Chronic founder Type 2

There is another type of case which develops the same type of foot distortion as in the chronic founder Type 1 yet is mortally affected; these cases I call a chronic founder Type 2. The essential difference between the two types is that the Type 1 animals can lead almost pain-free lives whilst the Type 2 cases remain severely lame from the time they founder. Type 2 cases only have a life expectancy of up to three years. That is three years as a cripple before someone finally puts them down on humane grounds. There may be intermittent periods of relative improvement in the level of lameness. The periods of most severe lameness are associated with the build up of serum pockets which may then progress to form abscesses. These are usually under the sole around the tip of the pedal bone and will erupt periodically through the sole or by migration up the wall and out of the coronary band. The serum pockets form because there is an abnormal and permanently distorted circulation in the foot. In addition the pedal bone to some extent rests on the inside of the horny sole because there is insufficient support from the laminae. This leads to chronic bruising of the sole with intermittent formation of serum pockets or abscesses. The pedal bone itself is much smaller than normal and the 'tip' looks ragged on X-ray (Fig. 44). This is because when the pedal bone is not subject to the normal suspending pull from the laminal attachments it is absorbed into the blood stream; this is known as absolute disuse atrophy. Another reason for part of the pedal bone to disappear is because it is being pressed onto the inside of the horny sole; this is known as pressure atrophy (Figs. 45 & 46). In some cases there may be osteomyelitis or pus-like infection of the bone itself. This is extremly painful for the horse and a very difficult complication to try and treat. The discharge from osteomyelitis cases has a particular and violent odour.

Figure 42. An old Sheltand pony's foot, an example of chronic founder Type 1

Figure 43. X-ray of the foot in Figure 42. The phalangeal alignment is not straight but easily corrected by lowering the heels. The toe is overgrown, but see how the new horn in the top half of the foot is nearly parallel with the front of the pedal bone this is characteristic of chronic founder Type 1 cases. The dark line indicates the area of insertion of the deep digital flexor tendon. Importantly, the drawing pin was placed 1 cm behind the point of frog without first trimming the frog. If the apex of a heart bar shoe had been fitted at the pin mark on this foot without bothering to take this X-ray, the bar would be too far forward and might easily have caused the tip of the pedal bone to fracture!

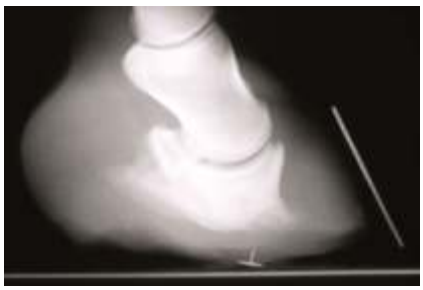

Figure 44. X-ray of chronic founder Type 2 foot. See how much of the pedal bone has disappeared (compare to Figure 43). The overgrown toe is a solid wedge of laminar horn right up to the coronary band. This horse was destroyed.

Figure 45. Split foot: Chronic founder Type 2. A very similar foot to that in the previous figure. This foot is grossly abnormal, compare to Figure 12. The distal half of the pedal bone has been resorbed, the bone is resting on the inside of the horny sole resulting in continual bruising and abscessation. Close examination shows that the coronary groove has become stretched and is in fact longer than the laminar corium! With so little laminar corium left there is no wonder that the horse cannot be supported within this hoof capsule (see Fig. 46).

If the feet of a chronic founder Type 2 case are dressed i.e. trimmed according to the recommendations for a Type 1, the speed of founder can increase. This is because the pedal bone in a Type 2 case is weakly held up by a mass of abnormal laminar horn onto the inside of the wall. If the foot has grown very long and much toe is removed to restore the parallelism between the front of the pedal bone and the front of the hoof wall, a significant part of the already weak support will be removed. This can result in the bone starting to sag down within the hoof more quickly than previously. The horny sole becomes more and more convex, depressions deepen at the coronary bands and pockets of serum develop under the sole. This scenario is untreatable and the animal should be put down.

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Figure 46. Close up view of the coronary groove area in Figure 45. The horn tubules from the coronary corium are pointing nearly horizontally instead of down the wall parallel to the front of the pedal bone (compare with Figure 7). There is also a wave or crimp in the horn tubules which is typical of chronic founder Type 2 cases at this stage of the disease. The crimp is caused by chronic instability of the pedal bone within the hoof capsule.

Fig 46a. The Imprint shoe, developed by Andrew Poynton FWCF. An excellent development in glue-on shoe technology. The Imprint has the limitation of being non-adjustable for acute cases, but the advantage of being easier to fit than the Eustace shoe.

Fig 46b. A pair of fitted Imprint shoes. As with all cuff shoes they have the disadvantage of restricting any foot expansion. Unless carefully fitted they prolong the toe length and can cause sole pressure. However, as with any shoe, in the hands of a competent farrier they are a very useful and user-friendly type of shoe.