

Chapter **10** Therapeutic Shoeing

The overriding problem of laminitis is failure of the distal phalanx to remain attached to the inner hoof wall. Descent and palmar rotation of the distal phalanx, prolapse of the bone through the sole of the hoof with its attendant sepsis and osteomyelitis and, above all, severe unrelenting pain all derive from this fact. Prompt, effective mechanical support of the distal phalanx can spare weakened, separating lamellae, give them time to heal and thus improve the outcome of horses showing the early signs of laminitis. Procedures designed to support the distal phalanx, and by implication the weakened lamellae, must be instituted early if significant benefit is to be gained. The ideal time is before the appearance of foot pain or at least at its very onset. To wait for the appearance of increasing foot pain and radiographic evidence of palmar distal phalangeal displacement, before applying mechanical support, is a therapeutic opportunity lost.

Mechanical support of the distal phalanx

Significant mechanical support of an unstable distal phalanx can be achieved by the application of a frog/sole support device. Experience with a large number of cases by veterinarians and farriers, from around the world, indicates that the severity of founder is lessened if some form of frog/sole support device is applied. The simplest form of temporary frog support is a roll of 2 inch gauze bandage taped to the frog. The gauze bandage can be unrolled and shaped into a triangular shaped pad that applies even pressure over the frog when the foot bears weight. The gauze wad is compressible so when applied it should be 1 cm proud of the edge of the distal hoof wall. A triangular, rubber, frog support pad (**Figure 10.1**) is commercially available (Lily Pad, Therapeutic Equine Products, Box 36157, Indianapolis, IN 46236, USA. see appendix 1 for Australian distributors). Unfortunately, frog pads can only act to stabilise the distal phalanx when the foot is placed on the ground. If the horse is recumbent the support effect is lost. They provide no protection from the shearing forces of ‘break-over’ at the toe or from sole injury if the sole and the prolapsing distal phalanx are beginning to make ground contact.



FIGURE 10.1 Lily Pad applied to the frog of a horse in danger of developing laminitis. This simple form of temporary frog support, taped to the foot of a horse, is a useful temporary measure. The back part of the pad should be trimmed as prolonged contact with the bulbs of the heels will cause ulceration.

Foam sole support

Foundered horses derive considerable pain relief from the application of foam digital supports. Foam digital support allows horses to bear weight on the palmar (back) two thirds of the foot. This spares the painful, dorsal (front) third of the foot, where the corium of the sole is being crushed by the descending distal phalanx. This easy, economical technique has received wide international support and is probably the best, first step to take in the rehabilitation of a foundered horse. Use foam digital support for the first few weeks. If the horse responds and stabilises clinically, then proceed to more expensive and technically demanding procedures.

Styrofoam® blocks, 50-60mm thick, cut to the size of the foot, supply relief to foundered horses when taped in place over the sole. Always blue in colour, **Styrofoam®** has a closed, uniform cell structure and is manufactured by continuous extrusion with a non-CFC containing gas. It is used for insulation in the building industry and for flotation in pontoons and surfboards. It is chemically inert, does not rot and its closed cell structure makes it remarkably resistant to water penetration. **Styrofoam®** pads for horse's feet are

Styrofoam® is the trademark of the Dow Chemical Co.

distributed in Australia by Classic Horseshoes Pty. Ltd. (see appendix 1). White polystyrene foam 50-60 mm thick (H-grade), purchased from suppliers to the refrigeration industry (**RMAX**, see appendix 2), can be substituted for **Styrofoam**® although it is less suitable, because its beaded composition creates a tendency for it to split and crumble when used as a sole pad.

Creating foam sole supports for foundered horses requires two foam blocks for each foot and is a two step procedure. The first foam block is applied to the sole and taped in place with two short lengths of PVC duct tape (**Figure 10.2**). A longer length of tape is then wrapped around both the foam and the hoof and high around the heels to keep the block firmly in place (**Figure 10.3**). Weight bearing by the horse over the next 24-48 hours, compresses the first foam block, creating a cast (15-20mm thick) of the sole. This foam cast is modified by trimming away all foam that was beneath the descended, rotated solar margin of the distal phalanx. The position of the solar margin of the distal phalanx can be determined in the field by the judicious use of hoof testers. Hoof tester pressure on the sole, over the solar margin of a distal phalanx displaced downwards by laminitis, elicits a pain withdrawal response. This spot is marked on the sole with a permanent felt marker pen. Hoof testing and marking are repeated until the marks on the sole have created a map indicating the position, under the horny sole, of the painful solar margin of the distal phalanx. This is the zone that must receive no pressure from the foam sole cast. Foam that would apply pressure is trimmed away. Hoof tester pressure on the sole palmar (behind) to the solar margin causes significantly less pain (or no pain in some cases) and it is this part of the sole (and frog) that can support weight.

The second step of the procedure is the taping to the foot, of a second foam block (similar in dimensions to the first), over the top of the first. This will compress as well and the resultant foam sandwich is taped together and left taped in place. Foam pads can be replaced or modified as governed by the response of the horse. They last several days if the environment of the horse does not damage the foam. Ideally the horse should be confined to stables covered with deep shavings or sand.

Digital support shoes

To date only properly designed, digital support shoes, firmly attached to the hoof wall, have satisfactorily stabilised the distal phalanx, supported the damaged lamellae and protected the sole from injury when it makes contact with the ground. Taped-on foam sole supports and frog pads, are useful temporary measures, until digital support shoes can be



▲ FIGURE 10.2 Application of a foam sole support pad. The foam is first trimmed to size and then taped to the sole of the foot using PVC duct tape. Initially 2 strips of tape, (A&B), are applied to the foam. The foam is then placed on the foot and strips A&B applied to the sides and front of the hoof. Tape is then wrapped around the foot to anchor the foam securely to the foot.



▲ FIGURE 10.3 Foam sole support pad taped in place to the sole of a foundered foot. The duct tape is wrapped high around the heels to keep the pad securely in place.

applied.

The heart-bar shoe (HBS)

The use of the HBS in the treatment of foundered horses is the rediscovery of a 19th century frog plate shoe used on the forefeet of harness horses experiencing excessive road trauma. A description of the shoe can be found in Dollar and Wheatley's (1898) Handbook of Horseshoeing (Dollar JAW and Wheatley A: A Handbook of Horseshoeing. D Douglas, Edinburgh 1898: pp 352-353. Facsimile edition 1993: Centaur Forge Ltd., Burlington, Wisconsin, USA). J.A.W. Dollar was a member of the Royal College of Veterinary Surgeons based in London.

The regular therapeutic use of the HBS on foundered horses began in 1968 when Burney Chapman and Dr George Platt, a farrier/veterinarian combination from Texas, USA, realised that the frog could be recruited to share, along with the hoof wall, a substantial proportion of the normal weight bearing load without being damaged and without causing additional discomfort to the horse. The frog is not normally involved in significant load sharing when the foot makes ground contact. However, to Chapman and Platt, stabilisation of the distal phalanx and support of the skeletal axis of the limb appeared necessary, to limit the mechanical destruction of the foundered foot. A correctly applied heart-bar shoe loads the palmar (back) structures of the foot, shifts the weight bearing load away from the toe, thus sparing the dorsal (front) structures of the foot. When non-surgical, dorsal hoof wall resection was combined with the use of the HBS the recovery rate and the speed of effective hoof wall regeneration in selected cases increased. The combined procedure appears to release the coronary band from the pressure of the dislocated distal phalanx and provides drainage for infected lamellae if sepsis has developed beneath the dorsal hoof wall.

The epidermal lamellae beneath the dorsal hoof wall of a chronically foundered horse often proliferate wildly to form a wedge of material (the lamellar wedge) which physically prevents the hoof wall from reestablishing effective attachments to the distal phalanx. Non-surgical dorsal hoof wall resection and removal of the lamellar wedge, in selected cases (those where lamellar separation is confined to the toe), often results in improved alignment of hoof wall and distal phalanx as a "new" hoof wall grows down from the hair line. The procedure requires monthly re-setting of the heart-bar shoes and removal of any lamellar wedge that may return. Foundered horses treated early are sometimes able to return to previous performance levels. On the other hand foundered horses treated late, can be made

pasture sound and able to return to stud duties. Some horses, especially “sinkers”, fail to respond, and should be euthanased on humane grounds.

The widespread international use of the HBS and the need for veterinarians and farriers to work cooperatively together on cases of laminitis has caused what many consider to be a resurgence in the art of farriery. Many modern equine practices retain a specialist farrier on either a part-time or full-time basis. The use of the heart-bar shoe has enabled veterinarians and farriers to rehabilitate and salvage many horses and ponies that, previous to its introduction, would have been lost.

Construction of the HBS

Factory made heart bar shoes are readily available in a range of sizes and with the aid of a forge can be shaped to fit most horses. For ponies and the giant breeds, or if a prefabricated HBS cannot be obtained, a HBS can be custom forged by a farrier. HBSs are also available made of plastic (**Ibex Equine Ltd, see appendix 1 for suppliers**) in adjustable and non-adjustable forms. The plastic HBS does not require nailing and can be glued to the hoof wall and this is helpful if the horse is recumbent because of painful feet. The insertion of a metal-bar, or a hospital plate, to the underside of a plastic HBS will maintain the rigidity of the frog plate when it bears weight (**Figure 10.4**).

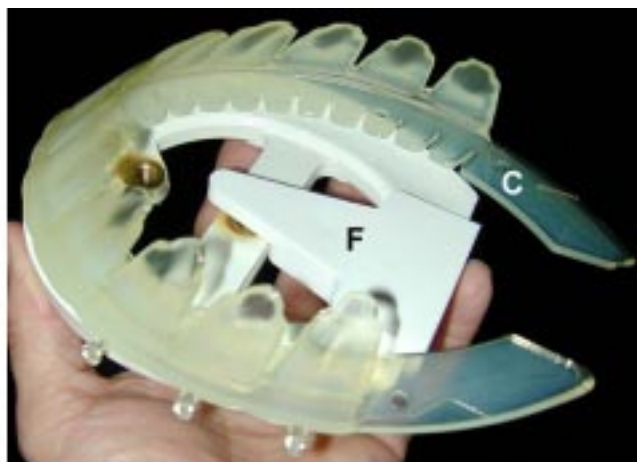
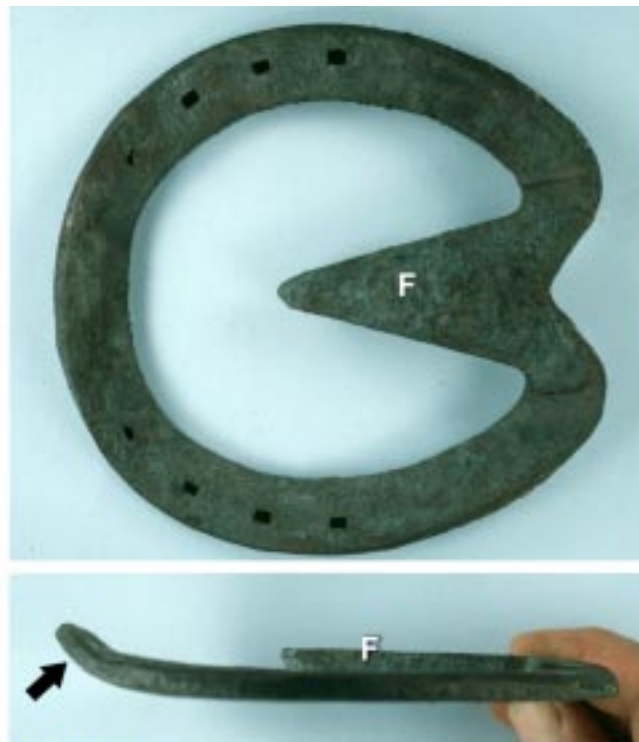


FIGURE 10.4 The plastic, “Thera-Glue” heart-bar shoe. The adjustable cuff (C) is fitted to the horse’s hoof and bonded with a powerful adhesive to both the hoof wall and the shoe. The frog plate (F) clips firmly to the back of the shoe and frog pressure can be adjusted via a grub screw under the tip of the frog plate.

The frog support plate of the shoe must be adjusted so that when fitted the shoe applies even, mild pressure over the entire length of the frog. The shape and depth of the frog varies between horses and sometimes the frog has to be trimmed and shaped so that it makes even contact with the frog support plate of the HBS. The tip of the frog plate should not be angled upwards; it should instead be parallel to and 2-3mm above the level of the adjacent branches of the shoe (Figure 10.5). The toe of the shoe should be square and forged to resemble the tip of a snow ski. The break-over point of the shoe should be close to the tip of distal phalanx.

Moving the break-over fulcrum under the tip of the distal phalanx shortens the lever arm of the toe and reduces the shearing stress on the dorsal lamellae. No part of the shoe must encroach on the sole or bars. For the horse with minimal displacement of the distal



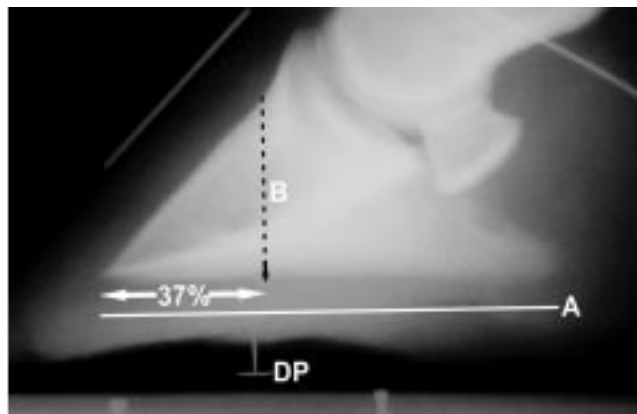
▲ FIGURE 10.5 The heart-bar shoe. Factory made heart-bar shoes are readily available in a range of sizes and be shaped to fit most horses. As supplied, the shoe is flat and must be adjusted so that the frog plate (F) is "set up" above the level of the branches of the shoe. The frog plate should be parallel to and 2-3 mm above the level of the adjacent branches of the shoe. The frog support plate of the shoe should apply even pressure over the entire length of the frog. Rolling the toe of the shoe (arrowed), eases breakover of the foot during locomotion, and relieves tension on lamellae weakened by laminitis.

phalanx, the shoe can be fixed in place with the tip of the frog bar covering all but 10-15 mm of the tip of the frog. In all other case it is dangerous to apply a HBS without knowledge of the position of the distal phalanx within the hoof capsule. In other words the HBS is fitted to the distal phalanx, not the external hoof. The position of the distal phalanx within the hoof capsule can only be determined with radiographs. Radiography and fitting the HBS to a foundered foot go together and necessitate vet/farrier co-operation.

A radiopaque marker such as a drawing pin or thumb-tack placed in the apex of the frog is used to transfer the measurements from the radiograph to the foot and the shoe. The tip of the frog plate of the HBS should be positioned on the frog, beneath the insertion of the deep flexor tendon on the palmar distal phalanx. This point can be located on the lateral to medial radiograph by measuring the distance between the tip of the distal phalanx and the extremities of the superimposed lateral and medial palmar processes (**Figure 10.6**). Alternatively the same point can be located by dropping a line from the base of the extensor process, perpendicular to the outline of the solar margin. Reference to the radiopaque marker allows the correct location of the point to be transposed from the radiograph to the horse's foot (**Figure 10.7**). It is vital that positioning of the foot, x-ray beam and film is correct to ensure a true lateromedial projection. The position of the distal phalanx, within a hoof capsule affected by laminitis, may shift dramatically so fitting the HBS with reference to the bone, using a radiograph, is important. The principle behind the application of a heart-bar shoe is that lamellar separation and tearing can be limited by the application of a counterforce, exerted by the unyielding frog plate of the shoe, on the palmar distal phalanx via the digital cushion and the resilient frog.

Heel elevation

Although the weight of the horse, transferred through the limb skeleton to the distal phalanx, is considered to be the primary force causing progressive separation of compromised lamellae, additional separation appears to be caused by the rotary force exerted by contraction of the deep digital flexor muscle via the palmar insertion of its tendon (the deep flexor tendon) to the palmar distal phalanx. Raising the heels of feet affected by acute laminitis, 12-18 degrees, is claimed to decrease the biomechanical tension in the deep flexor tendon 50-60%, arrest further dislocation of diseased lamellae and to reduce pain. Wedges for elevating the heels of horses are available commercially (see appendix 1). If the initial radiographs show no palmar rotation of the distal phalanx heel elevation can proceed immediately. If rotation of the distal phalanx is present the hoof should be trimmed to normalise the position of the



▲FIGURE 10.6 Fitting the heart-bar shoe (A). When laminitis causes the position of the distal phalanx within the foot to alter, it becomes important that the heart-bar shoe is made and fitted with reference to the internal structures of the foot. If the frog plate of the shoe is too far forward (i.e. more dorsal than the insertion of the deep flexor tendon) an increase in lameness will result. The construction of the shoe and the placement of the frog plate should be determined with reference to radiographs whenever possible (particularly in long-standing cases). A radiopaque marker such as a drawing pin (DP) placed in the apex of the frog is used to transfer the measurements from the radiograph to the foot and the shoe. The tip of the frog plate of the HBS should be positioned on the frog, beneath the insertion of the deep flexor tendon on the palmar distal phalanx. This point can be located on a true latero medial radiograph by measuring the distance (line A) between the tip of the distal phalanx and the extremities of the superimposed lateral and medial palmar processes. The correct location for the tip of the frog plate is 37% of this distance palmar to (back from) the tip of the distal phalanx. Alternatively the same point can be located by dropping a line (line B) from the base of the extensor process, perpendicular to the outline of the solar margin. Reference to the radiopaque marker allows the correct location of the point to be transposed from the radiograph to the shoe and the horse's foot.



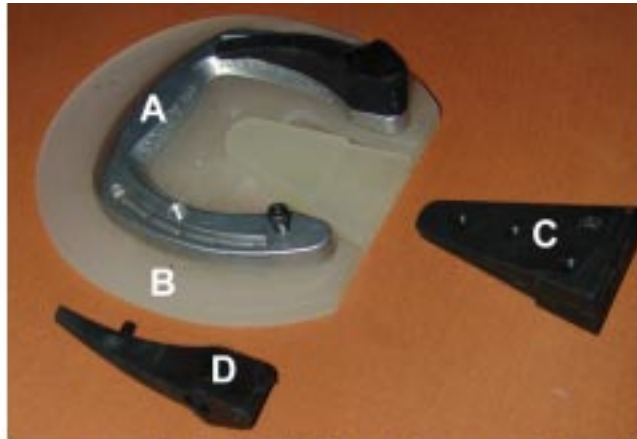
▲FIGURE 10.7 Fitting the heart-bar shoe (B). Reference to the position of the drawing pin on the radiograph allows the measurement of the correct position for the tip of the frog plate to be transferred to the under surface of the hoof.

distal phalanx, in relation to the hoof capsule, (de-rotated) before heel elevation is performed. Strict rest in a stall with deep bedding is mandatory when using heel wedges. The wedge is removed 10-15 days after the signs of laminitis have disappeared (without analgesia). The principle of temporary heel elevation is that lamellar distraction can be prevented, or at least ameliorated, if the force exerted on the distal phalanx by the deep flexor tendon is neutralised.

The Equine Digit Support System

Gene Ovnicek, a farrier from Columbia Falls Montana, USA, developed the **Natural Balance Shoe™** in conjunction with a system of pads, heel wedges, frog inserts and silicone impression material (known as the Equine Digit Support System or EDSS) specifically for the rehabilitation of foundered horses. The system is marketed as a kit (available in Australia from Classic Horseshoes Pty., Ltd., see appendix 1) and is supported by a comprehensive website (www.edsshoofcare.com). The EDSS shoe is a version of the **Natural Balance Shoe™** with predrilled and tapped holes for the attachment of other components of the EDSS (**Figure 10.8**). The hole at the toe is used to attach the EDSS pad while the holes on the shoe branches are for the attachment of heel elevation wedges or “wedge rails”. This ingenious system of interchangeable parts allows adjustments of heel height to be made without removal of the shoe. The shoe has a rolled, square toe, designed to promote easy break-over during locomotion, thus limiting further mechanical separation and tearing of damaged lamellae. A plastic pad with a stainless steel insert embedded into its toe is used in conjunction with the **Natural Balance Shoe™**. When screwed firmly into place (in the pre-drilled toe hole) the pad conforms to the seated-out design of the shoe and frog support is provided by a built-in frog plate. Frog support can be added to by attaching one of a range of different sized, plastic frog inserts. The amount of heel elevation can be adjusted by attaching a pair of “wedge rails” to the shoe utilising the predrilled holes in the shoe and pegs and holes in the plastic rails. EDSS styrofoam pads are part of the kit and are recommended for horses in the early stages of acute laminitis. When the horse has stabilised clinically (this may take 2-3 weeks), support of the foundered feet can progress from foam pad support to a shoe based system. Completing the system is a two-part silicone based impression material that, when blended together, cures into a rubber-like consistency. A cast of the bottom of the foot is made by placing the freshly blended impression material over the sole, bars and frog. The impression material is then covered with a hard rigid pad that is quickly taped to the foot. The horse is made to stand on the pad while the impression material cures. The rubber cast is then trimmed so that only the back part of the foot (the palmar sole, frog and bars) is used

Natural Balance Shoe™ is the trademark of the shoe patented by Gene Ovnicek in U.S. Patent No. 5,727,633 and by David M. Duckett in U.S. Patent Nos. 5,165,481 and 5,368,104



▲ FIGURE 10.8 Components of the Equine Digital Support System are the Natural Balance Shoe (A), a plastic pad with a built-in frog plate (B), additional frog inserts (C) and wedge rails (D). The plastic pad can be screwed to the shoe firmly via the pre-drilled and tapped in the toe of the shoe (arrowed). Frog support can be increased by the addition of frog inserts of various sizes. The holes and pegs in the branches of the shoe are for accurate and secure placement of the wedge rails.



▲ FIGURE 10.9 Fitting the EDSS Natural Balance Shoe. When fitting the shoe the heels are trimmed to the widest part of the frog. Lateral radiographs assist in visualising the distal phalanx within the foot. The foot is shod to accommodate the new, altered, position of the distal phalanx. The point of break-over of the shoe (arrowed) should be aligned beneath the tip of the distal phalanx to minimise further separation of weakened lamellae.

for support. There should be no contact between impression material or any part of the pad with the painful, descended, corium beneath the solar margin of the distal phalanx.

Correct foot trimming is essential if the EDSS is to achieve its potential. A detailed instructional video is available and it is highly recommended that this be studied prior to using the EDSS. The heels of the foundered foot are trimmed so that a bearing surface is created, adjacent to the widest part of the frog (**Figure 10.9**). Lateral radiographs assist in visualising the new altered position of the distal phalanx. The foot is shod to accommodate the new position of the distal phalanx and for the time being the toe can be ignored. After selection of the appropriate shoe, pad, frog inserts and wedge rails, a supportive sole cast is made with the impression material. After appropriate trimming, the silicone rubber sole cast is fitted to the foot and the assembled shoe is nailed in place. If nailing is too painful for the horse, a shoe with aluminium tabs is available, that can be attached with special hoof adhesives (eg. Equilox, Flex n Bond, see appendix 1 for suppliers). After the horse is shod the degree of comfort provided by the system should be assessed. Adjustments to the amount of frog support and the height of the heels can be made by selection of different sized components. The responses of the horse can be used to select the EDSS configuration that provides the most comfortable support.

Heart-bar support shoe

A shoe combining the principles of the heart-bar, heel elevation, a support pad and silicone rubber impression material has been developed by the veterinarian Dr Lionel Richards and farrier Craig Jones of Brisbane, Queensland. The shoe is hand forged from a single length of aluminium bar stock 1/2 inch in thickness, 3/4 inch in width. The base of the frog plate is welded to the heel of the shoe in the forge and the branches of the shoe are fullered and punched. The frog plate is kept level with the branches of the shoe. The toe of the 1/2 inch thick aluminium is easily forged and rasped into a ski-tipped shape to provide ease of break-over (**Figure 10.10**). A leather pad is cut and riveted to the shoe. Impression material (**Coltene Lab-Putty available from Halas Dental, see appendix 2 for supplier**) is mixed and applied to the sole, bars and frog of the foundered foot. Before the impression material cures the shoe is taped or temporarily nailed to the foot (using just 2 nails at this stage) so that weight-bearing by the horse, compresses the lab putty thus creating a silicone rubber support cast (**Figure 10.11**). The shoe is then removed and the cured rubber cast is trimmed, removing any material that may exert pressure to the sole beneath the rotated solar margin of the distal phalanx. The heels can be elevated by bolting triangular shaped aluminium rails to the base



▲FIGURE 10.10 Hand forged heart-bar support shoe. The toe of the shoe has been rolled and the ease of break-over is being demonstrated. Triangular shaped rails have been bolted to the underside of the shoe to provide heel elevation (Shoe forged by Craig Jones of Brisbane, Queensland).



▲FIGURE 10.11 Silicone rubber cast of the palmar sole, bars and frog. Used in conjunction with special shoes and pads silicone rubber casts spread the task of load-bearing over the entire palmar half of a foundered foot.

of the shoe. The shoe is fitted and the hoof trimmed in accordance with the anatomical principles outlined previously. The combination heart-bar support shoe utilises the excellent shock-absorbing qualities of aluminium, leather and silicone rubber and is being used by a growing number of vet-farrier teams.

Deep flexor tenotomy

If, despite the initial therapy, the distal phalanx continues to rotate and descend into the hoof capsule and pain is ever present, the option of deep flexor tenotomy can be considered. The aim of the operation is to remove the disto-palmar force exerted on the distal phalanx by the deep flexor tendon. The surgery is best performed at the mid-metacarpus, under local anaesthesia, with the horse in the standing position, deeply sedated with xylazine or a combination of xylazine and butorphanol. After surgery is complete, the legs should be kept bandaged and the horse confined to a stall for 6-8 weeks. The hoof should be trimmed to place the distal phalanx in a normal position within the hoof capsule. Most horses show an initial clinical improvement. This supports the hypothesis that the unopposed palmar tension exerted by the deep flexor tendon on the distal phalanx contributes to the pain of chronic refractory laminitis. If tenotomy is performed before there is significant osteolysis of the distal phalanx, most horses recover slowly. However clinical improvement is sometimes short lived and many horses require euthanasia within 12 months of surgery. The prognosis is poor if osteolysis and abscessation of the distal phalanx develop.

Key Points

- Effective mechanical support, using frog/sole support devices, should be provided early to a horse developing laminitis to improve the outcome of the disease. Frog/sole support devices can be taped to the foot to temporarily support the distal phalanx until digital support shoes are applied.
- The heart-bar shoe stabilises the distal phalanx, supports the damaged lamellae and loads the palmar structures of the foot to shift the weight bearing function back from the toe. Cooperative liaison between veterinarian and farrier is required for correct application of this shoe.
- Raising the heels of feet affected by acute laminitis using wedges reduces the force exerted on the distal phalanx by the deep flexor tendon, and therefore ameliorates further lamellar separation and reduces pain.

- The Equine Digit Support System is a commercially available system of interchangeable parts that allows attachment of support pads and elevation wedges to a specially designed shoe using predrilled holes. A supportive sole cast, made using a two-part silicone based impression material, provides additional support to the back part of the foot.
- An aluminium heart bar shoe, to which a leather support pad, silicone rubber support cast and elevating aluminium rails can be added, is an alternative therapeutical support shoe.

