THE CONSTRUCTION OF THE HEAR BAR SHOE AND THE TECHNIQUE OF DORSAL WALL RESECTION

Summary

This paper describes a method of fabricating and fitting heart bar shoes and a technique of dorsal hoof wall resection. The rationale behind the treatments and criteria for their use are described. Radiographic technique is also discussed. This article reports the treatment of a series of clinical cases described in an accompanying article.

Introduction

The heart bar shoe is derived from a design originally described by Dollar and Wheatley (1898) for use in cases of road founder (traumatic laminitis). Recently there has been renewed interest in its use for treating laminitis (Chapman and Platt 1984).

Goetz and Cornstock (1985, 1986) described the use of an adjustable heart bar shoe. Redden (1986) described the use of a shoe attached to the foot by screws, incorporating a frog support device beneath a hospital plate.

Dorsal hoof wall resection has been advocated for the treatment of laminitis (White and Baggett 1983, Chapman and Platt 1984, Redden 1986)

This paper summarises the theories behind the use of the heart bar shoe and dorsal wall resection and describes the radiographic techniques used in their application.

Modifications of the techniques found necessary when treating cases are described.

Theoretical Considerations

The aim in fitting the heart bar shoe is to provide support beneath the dorsal half of the distal phalanx without compromising the digital vasculature.

If the heart bar does not extend beyond the limits of the trimmed frog, the digital arterial supply will not be compromised (Chapman and Platt 1984). The point of the heart bar was placed dorsal to the area of insertion of the deep digital flexor tendon (DDFT) to achieve support below the dorsal part of the distal phalanx.

As the frog cannot be seen on latero medial radiographs a drawing pin was used to indicate its position (Fig. 1).

Dorsal wall resection aims to:

1. Remove resistance to upward movement of the distal phalanx caused by the action of the heart bar shoe.
2. Remove hypertrophied epidermal laminar horn present below an overgrown dorsal Wall.

3. Remove the compression on the dorsal coronary corium and improve blood Perfusion of the coronary plexus when the dorsal wall resection was extended to The coronary band.

4. Allow release of fluid trapped under pressure beneath the dorsal wall and The horny sole, thus reducing pain and lameness.

5. Allow re-growth of the dorsal wall in a parallel relationship to the dorsal Surface of the distal phalanx.

Radiographic Technique

The feet we radiographed unshod. Both latero-medial and dorsal 45° proximal-palmaro-distal oblique projections were made with the foot weight bearing on a level wooden block.

No part of the foot was allowed to overhang the edges of the block and the contralateral limb was not raised. To facilitate visualisation of the ground surface on latero-medial projections, a wire was embedded into the upper surface of the block. To highlight the dorsal hoof wall a straight wire marker was taped to the dorsal hoof wall so that the proximal end was at the horn/skin junction to mark the position of the coronary band (Fig. 1). The frog was pared so that the junction of the horn of the frog and hoof the sole was visible, revealing the true point of frog. A drawing pin was placed in the midline of the frog approximately 1-cm posterior to the true point of the frog. Unless the frog is pared as described the drawing pin may penetrate the sole. A mark was scratched on the frog, extended into the sole on either side of the frog and re-enforced with an indelible pen line to denote the position of the drawing pin (Fig.

2). Every effort was made to ensure that the centre of the radiographic beam was parallel to both the top of the block and the long axis of the navicular bone.

Interpretation of Radiographs

Dorsal 45° proximal-palmaro-distal oblique views were used to evaluate osteopenia or remodelling the distal phalanx.

Latero-medial views allowed measurement of the relative positions of the coronary band marker and the extensor process of the distal phalanx. The vertical distance between these two points was increased in cases of distal displacement of the distal phalanx (sinking) (Baxter 1986). Additionally the distance between the solar aspect of the distal phalanx and the ground surface was reduced in these cases.

Any divergence between the dorsal hoof wall and the dorsal surface of the distal phalanx can be assessed by the method of Stick, Jann, Scott and Robinson (1982) as a measure of pedal bone rotation.
However we prefer to measure rotation from the phalangial axis.

A radiolucent line, or irregular area, beneath the dorsal wall indicates the presence of gas between the epidermal and dermal laminae.

A lateral 20° proximal-mediiodistal oblique radiographic view was taken in some cases, after fitting the shoe, to check that the point of the bar was dorsal to the insertion of the DDFT. This view avoids superimposition of the bar and the branches of the shoe.

**Temporary Frog Support Devices**

As a first aid measure, before the farrier was able to attend the case, temporary frog supports were made and fitted as follows: after paring away all overgrown frog horn, triangular shaped pieces of leather or plastic were cut to the shape and size of the frog. These were layered such that when taped together with adhesive bandage and places on the frog they were proud of the level of the walls at the quarters by approximately 0.5 cm. This device was taped to the foot using adhesive bandage, care being taken not to bandage over the coronary band. Alternatively a roll of bandage may be taped on to the frog. As bandage is more compressible than leather or plastic the roll should be 1 cm proud of the level of the walls.

Either of the above frog support devices were taped to lie directly on top of, and along the axis of, the frog.

**Technique of heart bar shoeing**

Heart bar shoes can be forged, i.e. made from a single piece of steel section. However, we prefer fabrication of the shoe using an open horseshoe and a heart bar welded together.

The hear bar shoe was fitted prior to dorsal wall resection except in cases with grossly overgrown toes and a large radiolucent area beneath the dorsal wall. The more severely lame foot was treated first. The sides of the frog were bevelled so that the collateral sulci were clearly visible. The heels were not lowered more than was necessary to fit the shoe onto solid wall. The open horseshoe was fitted using a narrow section of steel to avoid sole pressure. The toe of the shoe was rolled (bend proximodorsally).

The heart bar was forged to the approximate shape. The open shoe was held in position on the foot and the heart bar placed on the frog. The position of the heart bar was adjusted so that it lay parallel with the long axis of the frog and its tip was correctly positioned in relation to the scratch marks on the sole. To facilitate accurate welding, chalk marks were made on the shoe to indicate a) the axis of the heart bar and b) the relationship of the point of the heart bar to the branches of the shoe (Fig. 2). The heart bar was then welded to the shoe and the welds rasped smooth.
The fit of the shoe was checked again. Any septic tanks in the foot were then opened and drained and the sole pared to remove loose horn, infected horn or horn that had failed to exfoliate normally. However, the sole was not thinned so much that it yielded to digital pressure.

Assessment of the correct amount of support to be provided by the heart bar was made as follows: the heart bar was adjusted by hammering so that the point of the heart bar was approximately 3 mm above the level of the branches. The shoe was held onto the foot and the branches pressed down onto the walls. If the horse withdrew the foot to showed resentment to the procedure, the shoe was adjusted. The heart bar was hammered back towards the ground surface and the procedure repeated until the horse showed no resentment to pressing the shoe onto the foot.

The shoe was then nailed on using a nail at each quarter and the animal allowed to bear weight on the limb. If the animal appeared comfortable on the shod foot and would allow the contralateral limb to be lifted without struggling, the amount of support was considered satisfactory. Maximum pressure from the heart bar shoe that would allow the animal to fulfil these criteria was applied. The shoe was nailed to the foot and finished off. The shoes were reset every 30 days or new shoes made to fit as necessary.

The frogs of some feet were atrophic and recessed. In these cases it was impossible to exert pressure with the bar through the frog without setting the bar at an acute angle to the frog.

In this event a piece of leather or plastic was attached by two brads to the bar to increase the thickness and enable pressure to be applied to the frog without setting the bar at an acute angle.

In some cases of solar prolapse the sole was convex and solar corium protruded below the level of the ground surface of the branches of the shoe. To prevent contact of the prolapsed solar corium with the ground, which was painful to the animal, a rim of plastic leather was fitted between the shoe and the hoof walls.

The rim material was cut to the shape of the shoe and then attached to the shoe using two nails as temporary brads. When the shoe was attached to the foot with other nails the two temporary nails were discarded.

A hospital plate can be fitted to the ground surface of the heart bar shoe as follows: a sheet of steel, aluminium or plastic (approximately 3mm thick) was cut to the exact size and shape of the shoe leaving enough metal to bend into a lip and fit over the heels of the shoe. The edges of the plate were rasped smooth. The holes were drilled in the plate at the toe and each heel to correspond to holes drilled previously and tapped in the heart bar shoe. The holes in the plate were countersunk to receive the heads of screws, which attached the plate to the shoe.

**Technique of Dorsal Wall Resection**
A dorsal wall resection was carried out when any of the following criteria were fulfilled:

1. The presence of a depression behind the dorsal part of the coronary band when passing a finger down the front of the pastern and into the dorsal hoof wall of an acute laminitis case.

2. The presence on latero-medial radiographs of a radiolucent line or area beneath the dorsal hoof wall.

3. The absence of growth rings on the proximal dorsal hoof wall.

The proposed limits of the dorsal wall resection were marked on the hoof wall with chalk. The hoof wall was removed using hoof pincers and an electrically driven high-speed flexible drive motor tool with abrasive milling bits. The colour of the horn beneath the hoof wall varied from black to buff coloured and changed to creamy white just prior to encountering capillary haemorrhage from dermal laminar capillaries. When this creamy white tissue was encountered the resection was not made deeper.

If a palpable depression was present behind the coronary band the dorsal wall resection was extended proximally so that the horn over the dorsal coronary groove was thinned.

When there was no depression behind the dorsal coronary band the dorsal wall was removed up to the point where the wall diverges from the dorsal surface of the distal phalanx (as seen radiographically).

Whenever possible the dorsal wall resection was made deep enough under to under-run the horny sole, allowing drainage of haemorrhage and exudates and flushing beneath the sole via a dog urinary catheter. Minimal haemorrhage was achieved by careful debridement of tissue.

The laminar tissue within the dorsal wall resection was anointed with a tincture-of-thiomersal (Merthiolate Eli Lily) and the foot bandaged. A plastic barrier boot (Closetru Mineral Wells, Texas) proved useful in keeping the feet clean and dry.

Every 30 days the exuberant epidermal laminar horn within the dorsal wall resection was removed.