

## THE 'GROUND PARALLEL' COFFIN BONE DEBATE

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The horse stands on four legs and the foundation for each is a pedal bone or pedestal. These bones, somewhat belittled by also being known as coffin bones, are the horse's base. Each coffin bone itself also has a base. A fundamental source of misunderstanding between 'shoers' and 'barefooters' might, it seems, be related to differing opinions as to what constitutes the base of these important bones.

### Anatomy

The 'shoers' might be regarding the base of the coffin bone as its sole surface, whereas the 'barefooters' regard the base as its distal border. I support the distal border viewpoint but many clinicians and pathologists look at radiographs and sagittal sections and appear to focus on the vault. However, arguments can be made for either point of view **and for both**.

The ventral surface of the coffin bone, its base, is shaped like an upturned saucer. The saucer is broken and a crescent-shaped section is missing (at the heel). However, it is still stable when upside-down and resting on a flat surface. In books on anatomy, the vault of the saucer is described as comprising the sole and flexor surface of the bone. The rim of the saucer is described as its distal border. From an engineering point of view, both the vault and the rim give the bone mechanical strength to withstand the forces placed on it, and so it is reasonable to regard both as an integral part of the bone's base. However, the only portion of the dry bone that touches a bench when the bone is placed on it is the rim. As it is the rim that determines the stability of the bone in relation to the bench, it is – I maintain – appropriate to focus on the rim, rather than the vault, when determining the correct orientation of the coffin bone within the hoof capsule. I support the barefooters' statement that their base of the coffin bone (ie., its distal border) should be ground parallel.

Misunderstandings are bound to arise if, when barefooters refer to the 'base' they are talking about the distal border and when shoers refer to the 'base' they are talking about the solar surface. The barefooters aver that their base of the coffin bone should be ground parallel. This is fundamental premise of the method. The shoers disagree with this premise but they may disagree because they are talking about a different base. I have been unable to discover where the shoers would wish their base to be in relation to the ground. Though they disagree with the barefooter's premise, they seem reluctant to commit themselves to any specific alternative. If they should ever state that their base (the sole surface) should be at an angle of about 17° to the ground, they would agree with the

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barefooters, because a 17° solar surface has to be accompanied by a ground parallel distal border in a healthy (evenly worn hoof). Because of the geometry of the bone, if they would also agree that the dorsal surface of the bone in the forelimb should slope at about 45°, this too would bring them into agreement with the barefooters. Both camps already agree that the dorsal wall of the coffin bone should be parallel with the dorsal wall of the hoof. By definition, if the dorsal wall of the bone is at 45°, the distal border has to be parallel with the ground surface of a healthy hoof capsule, i.e., one that is either wearing evenly or is being trimmed regularly to keep it even.

### **Home-made model of the hoof:**

For further clarification, a model of the hoof can be made out of a pint tub of Haagen-Dazs ice cream (I prefer the coffee ice). Here is the recipe. Take a fresh tub out of the deep freeze. Remove the lid and the paper cover. With a pointed knife, draw a facsimile of the palmar surface of the hoof on the circular ice cream 'canvas.' Using the same knife as a sculpting tool, carve out the vaulted sole and the wedge-shaped frog with its collateral and central grooves. If you are ambitious, you can indicate the bars. When you are finished, the sole around the apex of the frog will be lowest point of your ice sculpture, i.e., the furthest away from the level of the tub rim (which represents the wall of the hoof capsule and the base of the frog at the bulb of the heel). The bars will only be at rim level for their most posterior section. All of the sole will be below the rim of the tub, except perhaps for a small moon-shaped section at the toe. If you have sculpted away enough, you should have removed at least two teaspoons of ice-cream. Enjoy! When you turn the tub upside down, the only portion of the model that should be touching the table is the cardboard rim (the wall, the frog at the bulb of the heel, and the most posterior section of the bars) and perhaps an ice-cream 'moon sickle.' The cardboard rim of the tub is mimicking the distal border of the coffin bone, except at the heel where it mimicks the portion of the frog immediately under the bulb of the heel.

### **Radiographs**

The wall, distal border and sole of the coffin bone is porous in nature - like pumice stone. Because the distal border is thin and sharp, it requires specially selected exposures to demonstrate it on a lateral view X-ray. If radiographs are taken with the sort of kilovolt exposure that is most commonly selected for diagnostic purposes, the radiographic shadow of the rim of the coffin bone (its distal border) will be washed-out. The most obvious shadow of the coffin bone on such an X-ray is its densest portion, which amounts to a profile of a mid-line sagittal section. The sole surface of the coffin bone is prominent on a lateral view and easily identified but this is not the barefooters base of the bone. Their base is its distal border, which may not be apparent on a standard survey radiograph.. The sole surface of the bone is the surface that corresponds to the vaulted sole of the hoof capsule. The distal border is the thin, sharp and

irregularly notched rim of the bone, which corresponds with the ground surface rim of the hoof capsule.

### **Sagittal sections of the foot as seen in the post-mortem room**

The same source of misunderstanding occurs when interpreting a mid-line sagittal section of the coffin bone in the post-mortem room. In such a section, one sees the sole surface but not its distal border.

### **Discussion**

I wonder if some of the disagreements between the shoers and the barefooters arise because of a confusion over terminology. If shoers are referring to the sole surface of the bone as its base and barefooters (more correctly in my opinion) are referring to its distal border, the two camps are arguing from different premises. The shoers' base will never be ground parallel, whereas the barefooters' base must always be ground parallel.

I estimate that if the barefooters' coffin bone base is ground parallel, their sole surface will be at an angle of about 17° to the ground in a fore limb. If, for example, it was at an angle of 30° this would be an indication of a deformed foot. The sole surface/ground angle of the coffin bone is something that shoers might, in future, start measuring. Apart from its importance to hoof health, it would enable both camps to compare statements on a common footing (excuse the pun).

If an agreement could be reached on the correct angles of a horse's hoof (dorsal wall, solar surface, and coronet angles) these would result in an agreement over the shape of the horse's hoof, which is dependent on these angles and continuous wear of the hoof wall. Once the correct shape for a hoof is agreed, it will become self-evident that a shod hoof cannot ever be the correct shape. Even if it was correct on day one following shoeing (unlikely at the present state of farriery), it would be doomed to becoming increasingly incorrect every day for the next six weeks, as the hoof wall became progressively overgrown due to lack of wear.

The horse's hoof wall is analogous to the human fingernail. Overgrown fingernails in man do not interfere too badly with the function of the fingers because we do not walk on our fingernails. Imagine how uncomfortable it would be if we did walk on our fingernails and toenails ... and if these were overgrown ... and had a rim of metal riveted on each nail.