SOLE ULCER
Causes, Prevention and Treatment

Sole ulcer is the most common non-infectious cause of lameness in dairy cows, primarily (>67%) affecting the outer claws of the hind feet. Figures 1 and 2 illustrate how the cow’s weight is transferred through the pedal bone onto the soles of each of the claws. When the claw is correctly placed on the walking surface, weight is distributed over a relatively large area (figures 1a and 1b).

If claw horn growth exceeds wear without corrective trimming, the claw becomes overgrown at the toe end of the outside wall while the sole and heel bulb tend to crumble and wear off. The pedal bone tilts, shifting weight toward the inside of the claw and backwards as illustrated in figures 2a and 2b. This puts extra pressure on a small area of the sole directly below the rear prominence of the pedal bone, resulting in bruising and hemorrhage in the sole horn (figure 3a).

Fluid and blood oozes from the corium, hindering new horn formation and staining the horn already formed. Locally, an irregular scar-like structure will appear in the horn—this is the typical sole ulcer (figure 3b).

The development of sole ulcers may also be related to weakening of the structures that suspend the pedal bone within the claw horn capsule, including the laminae and the suspensory ligaments illustrated in figure 4.

Inflammation and weakening of the laminae may result from ruminal acidosis or the release of toxins from bacterial infections such as mastitis and metritis although little evidence to support this idea has been presented. Likewise, relaxation of the suspensory ligaments may occur pre-calving, but clear evidence that this could be related to the development of sole ulcers is also lacking.
A study conducted in a New York state dairy herd demonstrated an association between digital cushion thickness (DCT) and the prevalence of sole ulcers and white line lesions. DCT was correlated with body condition score suggesting that loss of body condition in early lactation could be a risk factor for these lesions.

**Prevention**

To reduce the incidence of sole ulcers resulting from claw horn overgrowth, all cattle should be routinely subjected to corrective hoof trimming by a qualified hoof trimmer. The required trimming frequency will be dependent on the relative rates of horn growth and wear. Holstein cows housed on concrete floors typically require trimming at 4 to 8 month intervals.

**Treatment**

Treatment of a sole ulcer should only be attempted by either a qualified veterinarian or professional hoof trimmer. Sole horn is excised down to the corium, removing all affected tissue. If granulation tissue protrudes beyond the surface of the sole, it should only be removed to the level of surrounding tissue. This will encourage the living epidermis (corium) to expand into the surface of the granulated area from the periphery. In complicated cases, depending on the depth of destruction, the lesion will need protection. This can be provided by a plastic bag held in position with duct tape. The purpose of deep excision is to relieve pressure on the lesion itself by lowering its surface, transferring weight-bearing to the opposite (usually medial) claw. It is often advisable to glue a ‘lift’ to the other claw, in the form of a wooden or synthetic block, of either uniform thickness or wedge-shaped. Various shoes and slippers, designed specifically for this purpose are also available. In any case, the lift should wear or fall off or be removed within 3 to 4 weeks of being applied. There will be little further healing after this time and problems can arise due to loss of the lift’s initial shape and structure.

**Figure 4.** Suspensory ligaments and laminae suspend the pedal bone within the claw capsule; the digital cushion (fat pad) helps to distribute downward pressure on the sole.

**Figure 5.** After excision of the sole ulcer, a block is attached to the opposite claw to elevate the lesion and eliminate pressure on it while it heals.