No feet, no horse

The basis of every horse are its hooves. And a good farrier is the best way to prevent injuries from occurring.

Anatomy
The hoof is made up of the frog, the sole and the hoof wall. The coronary band is located along the top edge. The horn of the wall is formed at the level of the coronary band and grows downwards from there. The horn of the sole is formed on the bottom of the hoof. Where these two meet the white line is located. The horn is connected to the coffin bone by laminae which are vertical ridges in the dermis. This is also where the blood vessels in the hoof are located. The back part of the hoof are called the heels, the front the toe.

Mechanics
Inside the hoof are the coffin bone, the navicular bone and (partly) the short pastern bone. The deep digital flexor tendon runs at the back and attaches to the coffin bone. To allow it to slide easily over the navicular bone, the navicular bursa is located between this bone and the tendon. In addition, there are many small ligaments and collateral ligaments in the foot to connect all these structures. The hoof cartilage is located within the heel bulbs. This is connected to the coffin bone and allows the hoof to deform upon landing and absorb the impact. When the horse's foot lifts off the ground, the hoof returns to its old shape. This acts as a pump for the blood in the blood vessels in the hoof and thereby stimulates blood flow.

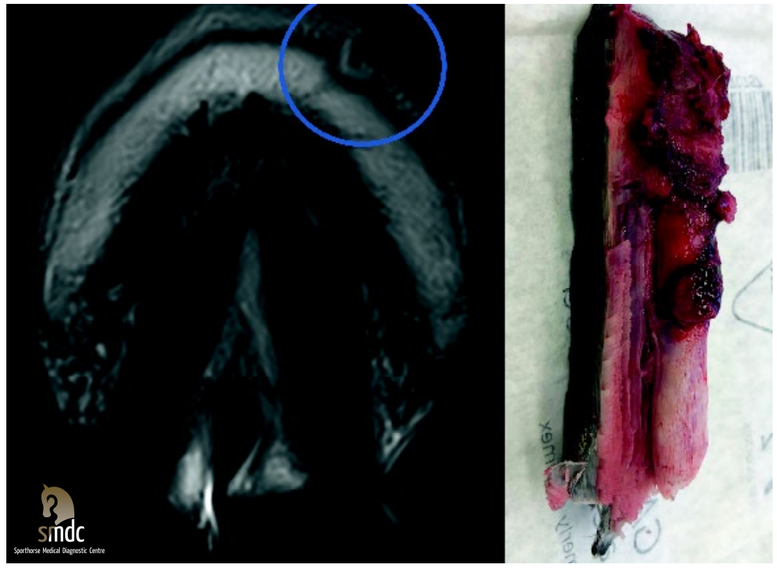
Hoof balance
The balance in the foot is very important to prevent injuries. When the horse lands crookedly, it can put asymmetric stresses on the joints. This puts a lot of strain on a small part of the joint, which can cause excessive wear and eventually osteoarthritis. In addition, this leads to extra traction on the tendons and ligaments in the other parts of the hoof, which may lead to injuries. Seen from the front, the hoof must therefore land straight, with the inside and outside touching the ground at the same time. The hoof pastern axis can be assessed from the side. The coffin bone, short pastern bone and long pastern bone must be in line with each other. If the line through these bones makes a backwards angle, it is referred to as a broken back hoof pastern axis. Likewise, a broken forward hoof pastern axis may be the case. These conditions may also lead to an overload of joints, ligaments or tendons. Seen from the side, the horse should land flat or slightly earlier at the heels.

Results of unbalance
If the balance in the foot is not correct, more pressure can be placed on the hoof wall in one location and a quarter crack may develop. This may even start to bleed and be a source of lameness. The solution is not to connect pieces of the hoof wall on both sides of the crack, but to restore the balance in the foot. An option may be to temporarily shorten the part of the wall that is torn, so that most pressure will be distributed over the rest of the wall when landing. The crack will heal from the coronary band and in time the wall will grow back neatly.

Treatment of conditions
Due to a painful process in the back of the hoof (for example a hoof abscess) or by contraction of the deep flexor tendon (a congenital defect that is regularly found in foals), a club foot may develop. The hoof then has an upright conformation with high heels and it will be showing a broken forward hoof pastern axis. Treatment can consist of correction by trimming the hoof. To prevent the hoof from extra wearing and returning to the club foot conformation a shoe is applied. This shoe can be equipped with an extension at the toe to encourage the horse to touch the ground with its heels. If the result of this procedure isn't satisfactory, surgical cutting of the support ligament of the deep flexor tendon (the check ligament) may be considered. The foal should then be given painkillers to encourage it to put weight on the leg and thus stretch the deep flexor tendon to the correct length.

Bacteria
With a hoof abscess there is an infection of the dermis, the living part under the hoof wall or sole. This is often caused by the fact that bacteria can get into the hoof wall via the white line. An abscess develops and is located between the hoof wall and the coffin bone. Since they can hardly deform, high pressure is created in this location, which often causes horses to become acutely and severely lame. Opening the abscess through the white line allows the pus to drain from the abscess. Rinsing with soda or biotex can then control the infection. If it is not possible to open the abscess from below, the pus seeks the path of least resistance, forming a channel to the coronary band. An abscess can also develop in the heel bulb, which will open over time and takes a longer period of time to recover from.

Hoof abscess.



Removed keratoma.

The big one: laminitis
When the laminae in the foot become inflamed, we speak of laminitis. The causes for this inflammation can be diverse. For example, there may be an inflammation elsewhere in the body, a hormonal imbalance or an excess of sugar in the diet. It is of utmost importance to uncover and resolve the underlying cause as soon as possible. In addition, the inflammation in the laminae should be treated with anti-inflammatory drugs and by extensive cooling of the legs. In addition, medication that stimulates blood flow in the hoof can be helpful. When the inflammation of the laminae is extensive, circulation can become obstructed and the dermis can become hypoxic. This loosens the connection between the wall and the coffin bone and the coffin bone can rotate due to the traction of the deep digital flexor tendon. In severe cases, the coffin bone can even puncture the sole. Acting quickly and accurately is therefore of vital importance. Orthopedic shoeing, such as a a reverse shoe, can ensure that the deep flexor tendon exerts less traction on the coffin bone.

The area of orthopedics
Orthopedic shoeing can also be used selectively for other conditions. With more support underneath the heels (wide branches, eggbar shoe, reverse shoe), the deep digital flexor tendon will be unloaded when it is injured. On the other hand, a shoe with a wide toe and narrow branches can ensure that the suspensory ligament and the superficial digital flexor tendon are spared. When the injury is in one part of the tendon, an asymmetrical shoe is an option. A wide branch is placed under the affected side and a narrow branch underneath the opposite side. This way, the hoof sinks less in the footing on the side of the injury and less traction is exerted on that side of the tendon. This principle can also be applied the other way around, when less compression is desired. For example a painful bone injury. In that case a narrow branch is placed under the affected side. The advantage of this method is that the horse can stand straight on its foot when in the stable and the redistribution of the forces only takes place when it is needed, namely when the horse is moving. This is not the case when wedges are placed between the sole/hoof wall and the shoe or when a structure is fitted onto the shoe.

The white line
The white line can be affected by fungus. This may loosen the connection between the hoof wall and the underlying bone. Over time a loose hoof wall is developed. In this case, rigorous removal of all the loose horn is the only option. By removing this extensively, the environment becomes less attractive for the fungus. By combining this with an anti-fungal agent, the infection can be controlled and the hoof wall has the chance to grow back with its normal attachment at the level of the laminae.

Keratoma
Sometimes something goes wrong with the growth of the horn and horn is formed between the hoof wall and the coffin bone. We call this a keratoma. Having a structure at this location will create pressure and over time a part of the coffin bone will dissolve. Some horses with this condition can be very painful, others have no clinical symptoms. If necessary, a part of the hoof wall and the complete underlying keratoma can be removed. It can take up to nine months to regrow the hoof wall. Initially, an orthopedic shoe may be required to achieve stability in the hoof wall.

And it all comes back to balance
A well-balanced hoof with a correct hoof pastern axis is essential to prevent injuries. Should these nevertheless occur, orthopedic shoeing can be used to spare the affected structures and give them the opportunity to heal. To decide which kind of shoe is indicated a correct diagnosis is crucial. Only then can correct orthopedic shoeing be applied and an optimal treatment plan drawn up. A multidisciplinary approach between veterinarian and farrier is key. ■

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ABOUT SMDC
Sporthorse Medical Diagnostic Centre (SMDC), based in the Netherlands, is a multidisciplinary centre of excellence where all orthopedic diagnostic and treatment modalities can be utilized in combination with experience, extensive knowledge and individual attention. Dr. Bergman, Dr. van Toor, Dr. Cokelaere, Dr. Hoogelander and Dr. van Veggel dedicate their time to optimize sporthorse performance while considering all factors which might influence it. Their caseload contains horses showing lameness but also includes horses with spine related problems, pre-purchases examinations as well as preventative sporthorse care. www.sporthorsemdc.com