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## **Protective rabbit socks for pododermatitis or paw wounds**

**Esther van Praag**

**Rabbits are prone to pododermatitis or foot sole problems after a (jump) injury. Bandaging keeps the wound clean and provides cushioning between the foot and the floor. An easier option is the use of a custom-made padded rabbit sock (Figs 1, 2).**

The layer of skin that covers the central tarsal portion of feet is very thin in rabbits, resulting in susceptibility of the hind feet to pododermatitis (hock sores or sore hocks) or injury wounds. The plantar surfaces of the

limbs are affected, and, to a lesser extent, the hocks, and phalanges at the metatarsal/metacarpal levels. Pododermatitis is a skin disorder that may be linked to the presence of an underlying health



**Figure 1:** Virgil and his MediRabbit rabbit socks. This rabbit suffered from severe pododermatitis. Rabbit socks and laser therapy helped him recover from it. Image credit: Tracey Watt





**Figure 2:** Benny hurt his foot after a missed jump and the resulting wound did not heal, due to excessive cleaning and grooming. Since he is wearing the rabbit sock his posture improved and his gait returned to normal. The ulcerated wound is clean, dry and decreased by half its original size after 3 months.



Cotton fabric and soft padding allow comfort and aeration, thus promoting wound healing. Benny never tried to destroy or to take it off. A clean sock is put on as soon as the used one is wet, dirty, or after 7 days maximum.



Inflammation of the skin is followed by open sores, and infection of the tissues of the foot, conditions that can spread to the bones. Major causes include:

#### Compromised health

- Traumatic injury – spinal cord injury and fracture, arthritis, spondylosis, ataxia, paralysis.
- Incontinence – urine and urine-soaked feces can adhere to the soles, burn the skin and lead to pododermatitis.
- Parasites – if the site of infestation is located on the plantar surface, on or between digits, the presence of burrowing mites (e.g., *Demodex* sp. or *Sarcoptes scabiei*) can lead to alopecia and to self-mutilating behavior.

#### Physical factors

- Mechanical – some rabbits take a wrong posture; putting the bulk of their weight on the metatarsus and hocks instead of the toes (rabbits are digitigrade). Others extend their posterior limbs too far forward, creating pressure on the hocks. This can lead to pressure sores, ulcers, and abscesses.

- Age and size – adult rabbits are more commonly affected than young rabbits, and larger rabbits more than smaller ones.
- Obesity – causing incorrect body positioning and undue pressure on the feet.
- Breed – the feet of Rex rabbits are padded with short, soft fur that provides little protection (Figs 4, 5). In Angora rabbits that are shaved for their coat, hair must never be removed from the bottoms of the feet.
- Behavioral factors Character – nervous, anxious, or shy rabbits tend to thump excessively.

#### Environmental factors

- Hygiene – poor hygiene in the living environment or urine-soaked litter boxes.
- Flooring – abrasive surfaces, e.g., rough, or synthetic carpets, can lead to trauma to the feet. On slippery surfaces (e.g., tile, vinyl) the rabbit must adjust its gait to achieve better traction and avoid slipping, leading to pressure-related problems on feet and joints of the shoulder and hip. On wire flooring pressure is generated at the



**Figure 3:** Early prototypes of rabbit socks for 3 different rabbits. They turned out a success and rapid recovery was observed in case of feet wounds or pododermatitis



**Figure 4:** Parpar, about 9 years, is a Rex female rabbit developed pododermatitis on her hind feet. Here, she is wearing an improved model of the rabbit socks. Image credit: Tal Saarony

contact points between the feet and the wire.

- Confinement to a small cage – lack of movement and sitting long periods of time in the same position led to poor blood circulation and decreased oxygenation of the limb and foot tissues, irritation, and inflammation of the skin.

#### **Clinical features and diagnosis**

The clinical signs as well as observation of the stance and gait of the rabbit, reluctance to move, are usually sufficient for a proper diagnosis. One or more limbs can be affected. A rabbit suffering from pododermatitis in all 4 limbs will start to tiptoe.

The first manifestation of the condition is a pressure sore. A hairless spot appears on the sole; the skin becomes red and inflamed, with keratinization and development of necrotic tissue in the center of the wound. The progression of pododermatitis is characterized by several stages in rabbits:

1. Compression of the hair follicles in the dermis leads to alopecia. The naked skin thickens, with onset of epidermic cell growth (hyperplasia) and abnormal keratinization (parakeratosis). Bleeding is unusual at this stage.
2. The skin has become thick, exhibiting advanced epidermic hyperplasia and parakeratosis; callosity forms. Bleeding is



**Figure 5:** After wearing the socks a few weeks, fur started to grow on the sole of Parpar's hind feet. Image credit: Tal Saarony

observed. The rabbit suffers pain at this stage.

3. The skin is naked, hardened, and thick, with crusty hyper- and parakeratosis. Despite apparent healing, cicatrization of the wound is difficult. Ulcers appear and necrotic tissue develops as deep as the dermal skin layer. Healing is extremely difficult at this stage. The rabbit is usually in great pain, restless, and shows decreased appetite, weight loss, and reluctance to move.

Secondary bacterial infections are possible. If left untreated, the infections will spread to subcutaneous tissues, affecting the lymph nodes and the bone (osteomyelitis). Once the bone has been infected, displacement of the superficial flexor ligament and tendons can occur. The rabbit will sit in a peculiar position and adopt a distinctive gait, unable to put pressure on its toes, and forced to use the wounded hocks instead. The condition is painful; the rabbit will avoid hopping, and eventually lose control over both urination and defecation. Onset of sepsis is possible.

When the ligaments are affected, the gait is irreversibly modified, and the rabbit will be permanently disabled. Decreased exercise



reduces proper blood circulation in the limbs, leading to ischemia and extensive necrosis of the surrounding tissues that will, in turn, lead to further decreased mobility. The general condition of the rabbit will deteriorate rapidly.

In cases of advanced pododermatitis, radiography of the affected limb/s helps to rule out or confirm osteomyelitis or bone fracture. Although *Pasteurella* sp. or *Staphylococcus aureus* are often suspected bacteria in the secondary infections, it is highly recommended to perform a bacterial culture in order to identify the bacteria, followed by an antibiogram to determine which antibiotic will be most effective.

### **Treatment**

The treatment of foot injuries or pododermatitis should include a thorough general examination.

It is recommended to clip the hair around the wound so that it does not come in contact with the infected area, while allowing as much hair as possible to remain long enough to protect the unaffected part of the foot. The wound should be debrided with enzymatic debridement agents, followed by disinfection with a diluted povidone-iodine and by topical application of an antiseptic cream. Long term use of chlorhexidine is not recommended. In rabbits, it leads to cutaneous scaling and prevent healing of the skin and growth of new hair.

Good results have been obtained with the following products:

- Creams containing propylene glycol, salicylic acid, and organic acids;
- Neomycin 2%, Bacitracin-Neomycin-Polymyxin B, or silver sulfadiazine;



**Figure 6:** Benny's foot was first bandaged. Although he tolerated the bandage well, it was very difficult to put the soft padding material and the adhesive bandage around his foot.



- Mupirocin 2%;
- Natural bioactive enzymes solutions used in the treatment of otitis (e.g., Zymox Otic® Enzymatic solution);
- Manuka honey;
- Calendula/Echinacea 5% gel;
- *Aloe vera* based soothing cream.



**Figure 7:** After a month of wearing rabbit socks, there has been a massive and dense regrowth of Nouky, under his feet. The color was a bit different (red circles).





**Figure 8:** The sock does not bother the rabbit in its daily and social life. Since the toes are free, it can be used to groom or scratch the neck or ear.

Topical treatment must be accompanied by systemic antibiotic therapy. Injected cephalosporin and azithromycin have proven effective in treating abscesses that result from secondary bacterial infections. The antibiotic treatment should be continued over an extended period, in some cases for life.

Analgesics must be administered to reduce the pain caused by pododermatitis or a foot injury. Meloxicam is a good choice as it can be used over prolonged periods in rabbits; however, this analgesic does occasionally induce loss of appetite, stomach ulceration, and renal failure. The reduction in pain does encourage the rabbit to move, improving blood circulation in the affected limb/s. If this is not the case, blood circulation can be stimulated with massage.

Ulcerative pododermatitis is often difficult to treat and recurrence is common.

### **Bandaging rabbit feet**

Bandaging the affected limb/s facilitates healing. Materials needed for bandaging include a cream or gel with disinfecting properties (e.g., a neomycin-based cream) or with skin healing properties (e.g., *Echinacea* sp., *Arnica* sp., or *Aloe vera* based gels or creams, Bag Balm), soft sterile gauze padding, an adhesive elastic bandage, and scissors.

If no infection is present, a thick layer of healing cream is applied directly onto the injured skin. After covering the wound with several layers of soft, sterile gauze, an elastic cohesive bandage is wrapped around the lower part of the limb. Bandaging should be loose, to prevent restricting the blood circulation, but tight enough to remain in place; it must be changed regularly to maintain proper hygiene (Fig. 6).





**Figure 9:** Current model of rabbit socks, adapted to the feet of each individual rabbit.

**If you are interested in custom made sock(s) for a rabbit suffering from hind limb foot problems,**

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In addition to keeping the wound clean and preventing infection, bandaging will provide cushioning between the affected foot

and the floor, protecting against friction and pressure and giving some added pain relief.

The foot must, however, never, be wrapped with a protective plastic film like plastic stretch food wrap, even if it seems tempting to isolate the wound from urine. The wrapping will prevent proper healing of the skin due to lack of oxygen. Instead, the accumulated moisture will promote bacterial growth.

### **Protective rabbit socks**

Many rabbits react strongly and aggressively when their foot is bandage with elastic bandages. Indeed, bandaging can trigger reactions of pain, escape, or fight in rabbits. As a result, they attack/scratch/bite the hand of the person handling them. This situation is dangerous for the rabbit and the handler. Socks with soft padding (Figs. 3, 9, 10) are designed for a relatively easy put on, and safe closure, without restriction of the blood circulation. The soft padding provides a soft insulating barrier between the foot and the floor surface, allowing to keep the wound clean and dry, to prevent skin maceration and to promote healing (Fig 1, 2, 4).

There is also a "special" protective MediRabbit sock, easy to put on, for rabbits who are calm or suffering from fracture, or osteoarthritis, or foot deformity.



**Figure 11:** Special sock with an opening of the foot part. This makes it easy to put on the sock for rabbits suffering from fracture or osteoarthritis.

On the left: open foot part, on the right: foot part closed by a velcro.

This sock also opens around the foot (Fig. 11).

The gait of a Champagne d'Argent 5 kg rabbit that suffered a foot sole injury improved within days already (Fig 8). The ulcerated wound stopped bleeding and healed slowly, without any more bleeding (Figs 1, 2, 6). Another Champagne d'Argent rabbit that suffered from pododermatitis shows improved within weeks. The newly grown fur was dense, with a slightly different color (Fig. 7) A Rex female rabbit with pododermatitis showed



**Figure 10:** Socks are custom made to the feet of each rabbit. From dwarfs' rabbits (top) to giant rabbits (bottom).

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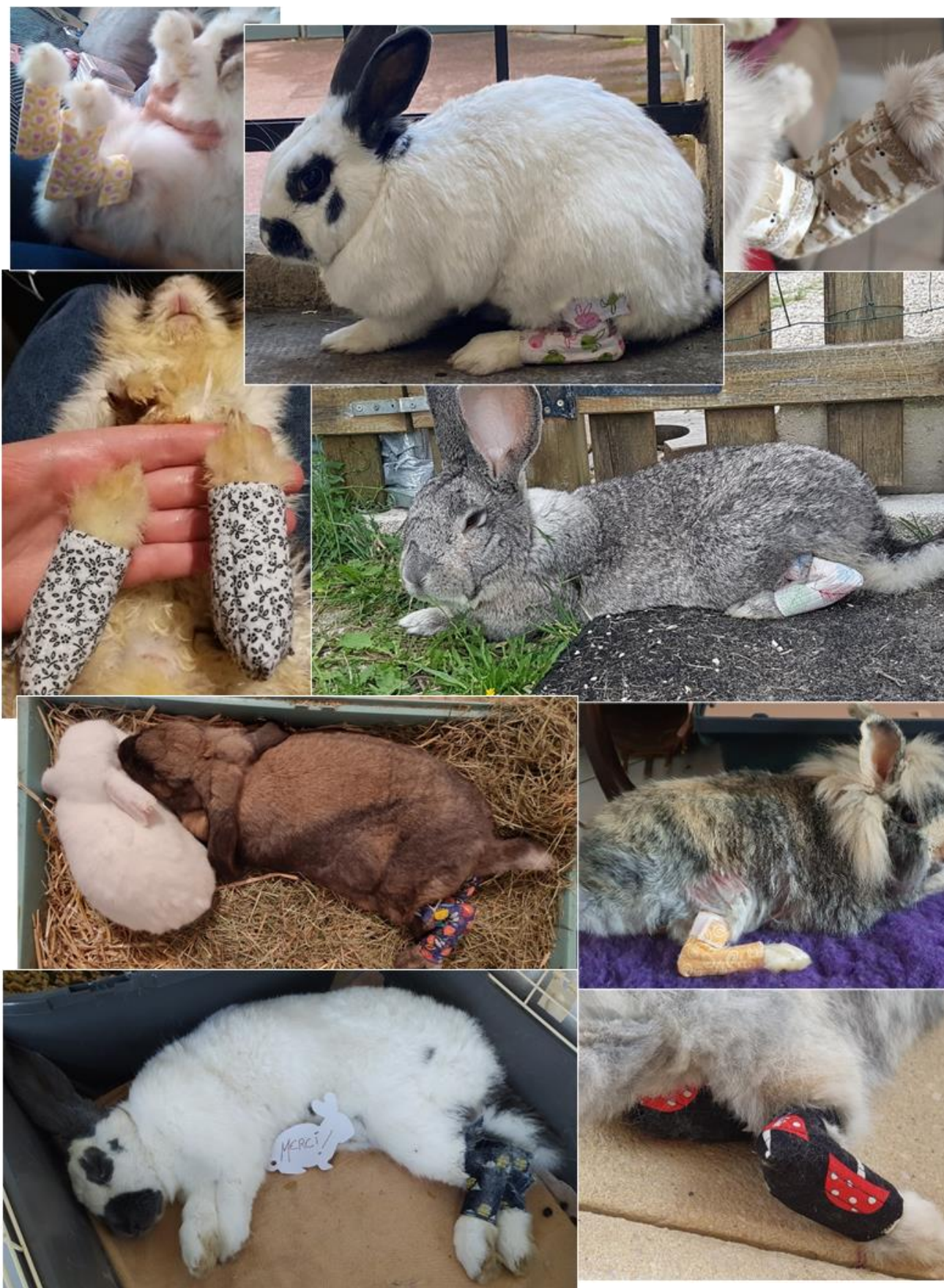
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rapid improvement of the naked skin under the sole of her hind feet (Figs 4, 5). Fur started to grow within weeks. A Belgian Bearded rabbit with infected pododermatitis has just started wearing this sock too.

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