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OFF-LOADING ADHESIVE FELT

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DM (diabetes mellitus) is a disease that is the subject of much debate and effort on the part of all those involved in this clinical process.

Among the chronic complications associated with DM are ulcers of the lower extremities, with particular emphasis on foot ulcers, which occur in 15% of patients at some time during their disease.

Depending on their aetiology, ulcers can be arterial, venous, neoplastic, or neuropathic. We will focus on pure neuropathic and neurochemical ulcers.

A neuropathic foot has altered sensory fibres (temperature, pressure), motor fibres (muscles, tendons, joints, ligaments) and autonomic fibres (sweating disorder, oedema). The prevalence increases with poor glycaemic control and the time of evolution of diabetes.

They cause loss of tone in the sole of the foot, generate high plantar pressures and are the main cause for the formation of plantar ulcers. The pressure threshold for ulcer development, according to Armstrong et al. Pressures above 99N/cm.

The different intervening factors for ulcer development are the type of ambulation, pressure time, patient's weight, footwear, skin conditions, vascular (neurochemical) risk as well as structural alteration. All these together with the absence of sensitivity can lead to injury.

It is difficult to establish a quantitative pressure value at which a plantar ulcer develops. Relief in the treatment of diabetic feet is an important aspect both for healing and for preventing subsequent recurrences and to prevent recurrence later.

The aim of the off-loading is to distribute or transmit the load over large areas, reducing pressure peaks at certain points.

Pressure reduction depends on 3 factors.
1. The use of a specific treatment alternative for pressure reduction.
2. Patient compliance.
3. Biomechanics.

GENERAL CHARACTERISTICS OF PRESSURE RELIEF STRATEGIES.

The generating concept that any unloading device must comply with is to vary some factor, numerator, or denominator, of the mathematical expression for pressure.
PRESSURE = FORCE (Newton) / AREA (cm2)
If we want the result to tend to zero, the F applied must be reduced, or the area must be increased.

Distribution of pressures
Other factors must also be added to the pressure (I/A):
- Duration and direction of F, which will influence the occurrence of overloads.
- Risk of ulceration.
Guzman et al. discovered several ideal characteristics that unloading devices should meet:

- Provide effective reduction of ulcer pressure on a continuous basis
- Applicable to different types of patients
- No side effects, or side effects that are less than the intended beneficial effect
- Easy to apply
- Adequate cost-effectiveness
- Allow for other complementary treatments
- Facilitate patient compliance with treatment

ALTERNATIVES FOR PRESSURE RELIEF

There are many different strategies for the reduction of plantar pressure, many of which are not mutually exclusive, but must be applied in a protocolised manner in order to achieve favourable results in ulcer healing.

Among the different strategies are:

- Lamellar cutting
- Silicone orthoses
- Temporary off-loading
- Customised plantar orthoses
- Temporary post-surgical shoe
- Total contact cast (TCC)
- Preventive surgery

We are going to focus on temporary off-loading; the application of these off-loads is a promising method for the temporary reduction of plantar pressures in the ulcer area.

Different materials or their combination can be used for this treatment. If we had to highlight one of them for its ease of use, cost, and good results, it would be adhesive felt.

Adhesive felt is a fabric formed by conglomerating wool fibres by means of steam and pressure, which have the property of adhering to each other to form a compact fabric. On one of its sides, an adhesive film is added to fix it to the foot (hypoallergenic). It is a temporary off-loading and there are different thicknesses (2, 3, 4, 5, 8, 10 mm). The most used for plantar ulcers are 8-10 mm.

The off-loading is performed by applying the cut-out felt around the ulcer, isolating it by means of a design adapted to the size, location, and biomechanics of the patient. This is the most important point in off-loading because an error in the pattern can lead to therapeutic failure or worsening of the ulcer.

We must make sure of two factors:
- That there is selective off-loading of the ulcer area.
- That there is no overloading of another area of the same or the contralateral foot, with the consequent risk of re-injury.

To minimise this effect, we need to shock the foot in contact with as much of the sole of the foot as possible and then fix it.

Another factor is the physical characteristics of the material.
- Poor memory

- Low influence limit so change after 3-4 days of treatment is recommended.

"My experience is that it should not be prolonged for more than 48 hours to maintain continuous ulcer off-loading".

Finally, it should be noted that the adhesive of the material may cause some allergic reaction and the appearance of perilesional excoriations during the change.

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Normally a minimum of 8-10mm is applied and in some cases 15-20mm (it is checked that the area is unloaded, totally in suspension once the unloading has been applied and the patient is in a standing position). Due to the pressure exerted during ambulation, the felt gradually loses thickness, i.e. its effectiveness. Localisation, the patient's weight, the ulcer surface and the type of support are some of the causes. Therefore, the off-loading should be changed every 48-72 hours under normal conditions, and it should be checked to ensure that it is in place and in good condition; it should never be worn for more than 7 days. If the ulcer is very exudative, it should be changed more frequently as it loses effectiveness and worsens the lesion (perilesional maceration, infection, displacement of the off-loading etc.)

REMARKS.

The shocks must have an anterior (distal) horseshoe or lateral opening, those that follow the contour of the lesion. They should never be circular so as not to cause window oedema. The topical-local treatment (dressings - gauze) should be applied in this opening and should be of the same size as the opening and, of course, should not exceed the thickness of the felt as this would reduce its effect.

The off-loading is usually fixed with tape (adhesive strips) as a tie from plantar to dorsal to prevent displacement when walking.

The footwear must be of sufficient height to accommodate off-loading and bandaging if necessary and must not compress the foot.

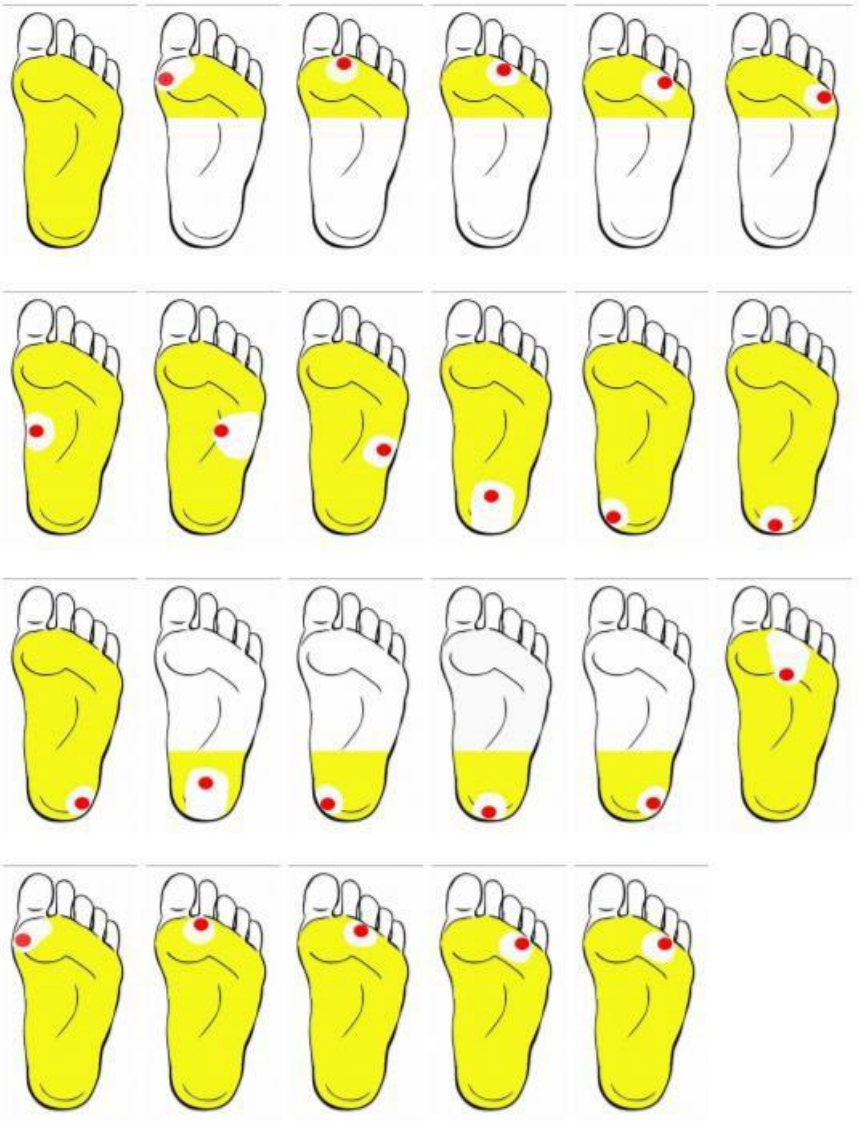
In the event of an unfavourable evolution, it will have to be re-evaluated because osteomyelitis and/or ischaemia may be present.

PRACTICE

Diabetic foot deformities can be associated with the anatomical location of the plantar ulcer, causing an increase in plantar pressure in prominent areas and subsequent ulceration and poor prognosis of the ulcer if the pressure in this area is not eliminated.

The design of the off-loading must always be personalised and can be modified according to the evolution and load on the ulcer until complete healing.

By way of example, different off-loading silhouettes are shown depending on the location of the plantar ulcers in the diabetic foot. The aim is to guide the clinician in the structural deformity and to apply the most effective type of off-loading possible. It must be considered that in most diabetics there are combinations of deformities with the presence of amputations, fractures, surgical processes (grafts, flaps...) and in this case it is necessary to design a different type of off-loading to those shown here (standard).



CONCLUSIONS

Plantar ulcers in patients with DM develop due to elevated plantar pressure and must be considered a precursor to MMII amputation. However, there is a gap between evidence-based guidelines and current practice, as only 41% of ulcers in the USA and 34% in Europe were treated using an off-loading device.

The recommendation for the use of off-loading in the treatment of uncomplicated plantar neuropathic ulcers is that relieving pressure on ulcers should always be part of the treatment plan.

Temporary off-loaders such as adhesive felt achieve:

- Reduce pressure and shear forces on the ulcer.

- Redistribute plantar pressures by enlarging the contact area.

- Mechanically align unbalanced structures to prevent further ulceration during the healing process.

- Stabilising or unloading rigid structures and areas at risk of ulceration without generating a load transfer syndrome.

We must not forget that the treatment does not end with the closure of the ulcer, and that it is necessary to subsequently apply off-loads for definitive and preventive treatments, such as insoles and custom-made shoes.

Steps in the local treatment of a lesion using felt:

1. Debride the lesion, essentially the hyperkeratotic halo.
2. Decide on a dressing and place it on the lesion.
3. Off-loading the adhesive felt:

See location of the ulcer-lesion and the type, once it has been ensured that the treatment with off-loading is ideal, the patient's variables are studied (how much he/she walks, if he/she lives alone, weight, interest in his/her pathology, glycaemic levels, previous amputations, footwear worn, etc.). The thickness of the felt is determined based on all this to prevent the lesion from being in contact with the ground when standing upright and during ambulation. Once the thickness has been decided, it is trimmed, leaving a horseshoe-shaped fenestration distally or laterally (to avoid window oedema) and the area proximal to the heel is bevelled at 45º to avoid pain, pressure, and problems during ambulation. Not in the injury, which should be at 90º, as this would generate expansion of the wound and could encounter the ground, so it would be absurd to wear the off-loading, just as if you do not cut the window of the injury (I have found the felt stuck without cutting the area where the injury is located).

Thin felts can be used when the lesion is superficial or is in its final phase of healing (epithelializing), always under the criteria of a professional. It is all a question of common sense, with a good study of the patient, consideration of variables and the battery of felt thicknesses that exist on the market, a good therapy can be provided with which we will obtain satisfactory results.

4. Once the felt off-load has been obtained according to the variables, place the felt off-load, leaving 1 - 2 mm over the lesion.
5. Fix the off-loading with tape from plantar to dorsal (in the form of a tie).
6. Apply cotton bandage and mesh. If we are sure that there is no ischaemia, we can apply a crepe bandage; otherwise, WE MUST NEVER APPLY CREPE BANDAGE!
7. Post-surgical shoe. The use of orthopaedic footwear combined with adhesive felt offers satisfactory results in the treatment of diabetic foot ulcers.

Reduces pressure: plantar, dorsal, and lateral.
With rear heel or inverted heel reduces forefoot pressure by 66% and is used for forefoot ulcers.
Without heel reduces heel pressure by 36%. Indicated for midfoot, rearfoot and dorsal ulcers.

45º Proximal zone
90º PERIPHERY OF THE LESION

Ulceration off-loading after six months partial amputee, hyper pressure in V mtt

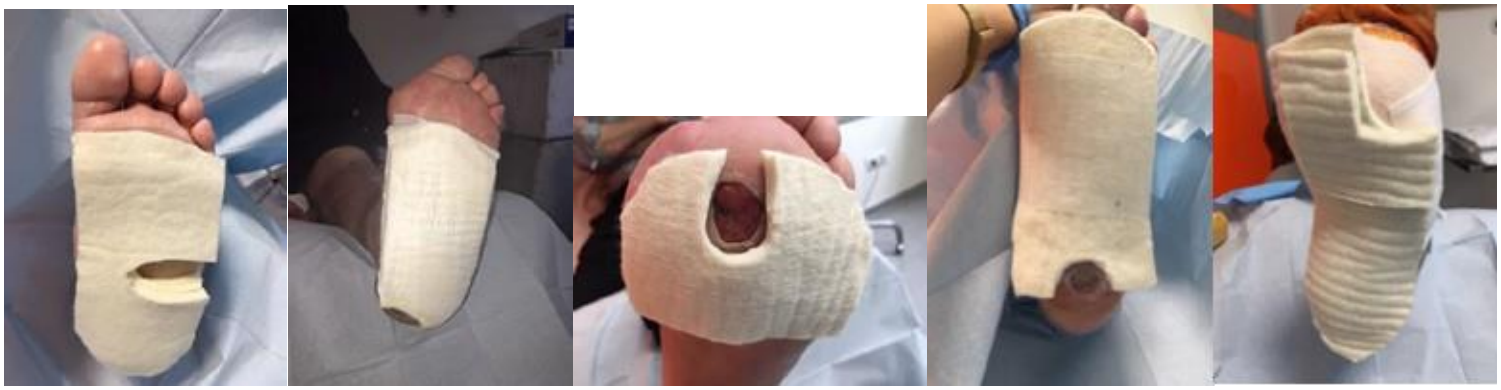
Other uses of the adhesive felt, mainly the thinner one, are for plantar papilloma-verrucae that once they have been cauterised can be used to establish normal, non-algid walking; for recently removed helomas (a few days), study and design of future and definitive plantar orthoses to test if the patient has previously worn them, manufacture of heel pads (with and without fenestration), to leave a graft free, etc.

Off-load in hyper pressure after removal of hyperkeratosis.

Hyperpressure off-loading in metatarsal area in both feet caused by digital amputations.

Charcot foot ulcer off-loadings.

Partial amputee rocker-foot off-loading.



Various types of off-loading depending on anatomical location.

Partial amputation off-loading.

Off-load partial amputation for Negative Pressure Therapy (NPT) treatment.

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