



RESEARCHARTICLE

WOUND DEBRIDEMENT. DOUBLE FOCAL COMPRESSION BANDAGING TECHNIQUE.

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ABSTRACT

“Double focal compression bandaging technique” is a modality of compression therapy, based on physiological concepts, such as arteriogenesis and angiogenesis. In this technique, we only use bandages and gauze to obtain pressure gradients, in the wound bed, which leads to stimulating arteriogenesis and angiogenesis around the area, which healing vascular leg ulcers. This technique was presented in the 15th World Congress Union Internationale de Phlebologie, October 2005, Rio (Brazil). Over time, we have observed that the use of this technique involves performing two types of debridement: autolytic and mechanical. Focused pressure, by placing padding on the wound bed, makes any other type of debridement unnecessary. The results of this clinical experience, in more than 150 patients with leg ulcers treated with this technique, show that it is not necessary to perform any other type of debridement.

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INTRODUCTION

Debridement can play a vital role in wound bed preparation and the removal of barriers that impair wound healing. It can help remove nonviable tissue, control inflammation or infection, decrease excess moisture, and stimulate a non-advancing wound edge. Failure to use the correct debridement method for a given type of wound may lead to further delays in healing, increase patient suffering, and unnecessarily increase the cost of care (1). The concept of preparing the wound bed to promote re-epithelialization of chronic wounds has been applied to wound management for more than a decade. The 4 general steps to follow for better preparation are compassed in the acronym DIME (Debridement/devitalized tissue, Infection or inflammation, Moisture balance, and wound Edge preparation/wound depth) (2). The concept of debridement refers to the removal of dead, non-viable/devitalized tissue, including necrotic material, eschar, sero-crust, infected tissue, hyperkeratosis, sloughing, pus, debris, bone fragments, or any other type of foreign material/bioburden from the wound with the aim of promoting wound-healing. It is often referred to as the process of removing necrotic tissue from the wound bed (3,4,5). Biofilm formation delays wound healing, and debridement of clean wounds can help remove biofilm? (6). Therefore, we can say that debridement is necessary to aid wound-healing. There are different debridement methods, such as: Mechanical, Autolytic, Surgical, Enzymatic, Ultrasonic, Biological (larval therapy) (7,8). Each technique has its own advantages and disadvantages, but which one is the most appropriate?

METHOD

“Double focal compression bandaging” (Fig.1) is a compression therapy modality, which consists of using two bandages: The first bandage is used to perform focal compression of the wound bed, and the second covers to the first one, to achieve a gradual external compression, from the toes to below the knee, each turn of the band covers the previous turn by 50-70%. This way, the area of the ulcer receives the pressure of 3 layers (that of the pressure over the wound bed, and the double effect of the external gradual compression) (9). Focused pressure on the wound bed can lead to a deficit of tissue perfusion, resulting in necrotic areas that disappear days later, by the effect of arteriogenesis. The photographic sequence shows this effect. Before and after applying the “Double focus compression bandaging technique”, we can observe how the fibrin is transformed into necrotic tissue, disappearing sometime later (Fig.2).

In the following images, we can see the effect of compression on the wound bed. In the first days, there is an increase in the necrotic area (Fig. 3). After 14 days of treatment, we make a cut in the middle of the eschar, observing how underneath there is granulation tissue (Fig. 4). According to the results of this clinical experience, the use of this technique involves the performance of two types of debridement: One mechanical, when changing the dressing, and the other autolytic due to the stimulation of arteriogenesis. This clinical fact can be explained by the effect of arteriogenesis/angiogenesis in the obstruction of a myocardial artery (Fig.5).

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Fig. 1. Double focal compression bandaging technique.



Fig. 2. A necrotic area is formed, that disappears days later applying this technique.

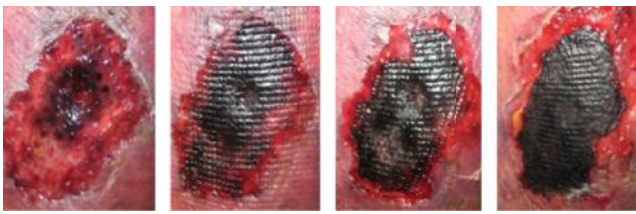


Fig. 3. Increasing of the necrotic areas after applying focused pressure on the wound bed-



Fig. 4. Necrotic area disappears using compression therapy.

An obstruction in the myocardial vessels leads to a decrease in blood pressure, behind the stenosis. Blood flow is redistributed through the pre-existing arterioles, that now connect a high-pressure region (pre-obstruction) to a low-pressure region (post-obstruction)(10). This leads to an increase in flow velocity and, therefore, a greater shear stress on the pre-existing collateral arteries. This causes a marked activation of the endothelium, which increases in the expression of MCP-1 and of endothelial surface receptors involved in monocyte tethering, rolling and migration (11,12,13,14). The upregulation of cell adhesion molecules in the proliferating collateral arterioles under conditions of elevated shear stress was confirmed(15). The resulting increased adhesion of monocytes and their transformation into macrophages are required for the growth of these vessels, as these cells produce numerous cytokines and growth factors involved in arteriogenesis. Why not apply this physiological effect, which occurs in the

obstruction of a myocardial artery, to explain the resolution of necrotic areas in the wound?

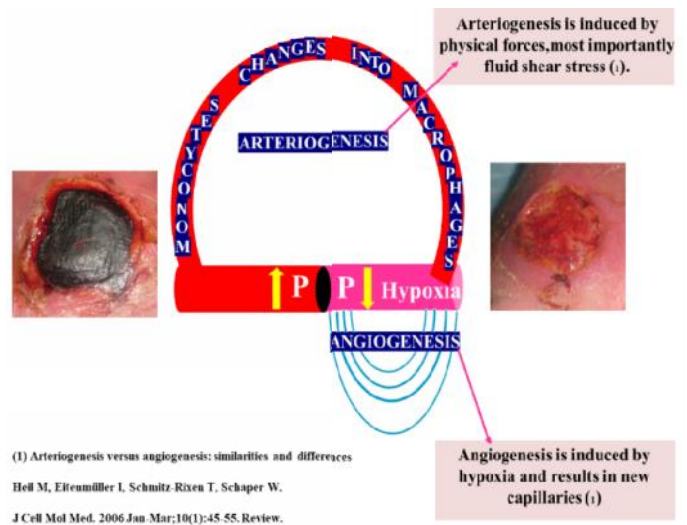


Fig. 5. Physiological effect of compression through the arteriogenesis/angiogenesis

Based on this, it is possible to assume that local pressure focused on the wound bed leads to a growth of pre-existing collateral arterioles, by increasing the pressure around the wound bed (arteriogenesis). On the other hand, there is a blood flow rich in monocytes, which are converted into macrophages leading to *autolytic debridement* of the wound bed. This photographic sequence shows how, when local pressure is applied on the wound bed, small necrotic areas appear, due to hypoxia, disappearing days later by an autolytic debridement. Monocytes transformed into macrophages explain this effect (Fig. 6).



Fig. 6. Necrotic foci disappear, a few days later, after applying this technique.

“*Double focal compression bandaging technique*” is a compression therapy modality that has been used in more than 150 patients, for the healing of venous leg ulcers, some of them arterial. The technique performs two debridement:

A/ Mechanical, when changing the dressings. B/ Autolytic, because of arteriogenesis. The following images show the photographic sequence of the clinical course of the ulcers. We can see how the necrotic foci disappear because of these two types of debridement (Fig.7,8,9,10,11,12,13). In the following case, we can observe the clinical course in one month. The necrotic foci disappear, using only compression therapy (fig 14-15). As an example, we report four clinical cases with the

photographic sequence of the clinical course of the ulcer. We only apply compression therapy.

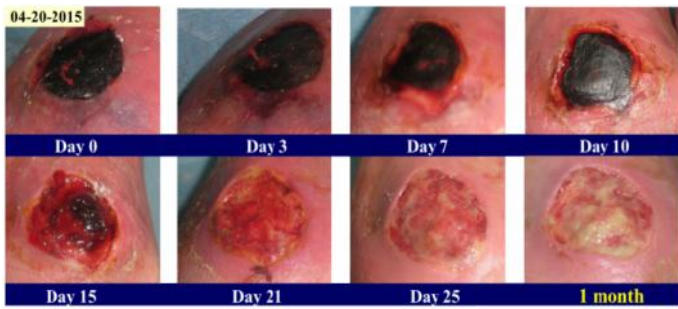


Fig.7: Case 1. The eschar resolved by itself, one month later of compression.



Fig.8: Case 2



Fig.9: Case 3.

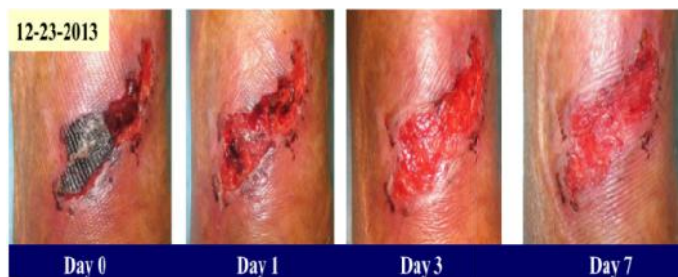


Fig. 10: Case 4



Fig.11. Case 5. Heel ulcer in a bedridden patient.



Fig. 12: Case 6.

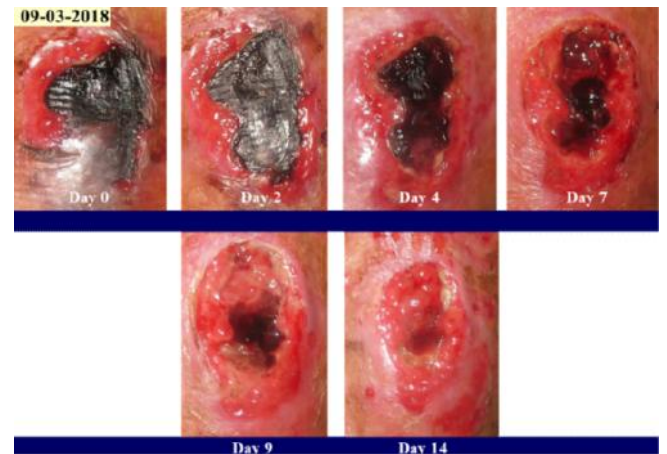


Fig. 13. Case 7. The necrotic foci has been resolved, in a few days, after applying local compression.



Fig. 14.



Fig.15. Case 8. Necrotic areas disappear, after applying compression therapy.

CASE REPORT 1

(Fig 16,17): An 84-year-old man with high blood pressure, a kidney transplant and chronic venous insufficiency, he suffered a trauma to his right leg (08-05-2018), with a cut in the pre-tibial region. We decided not to perform minor surgery, and to apply localized pressure to the wound bed. The ankle-brachial index was 0.94. The pressure focused on the wound would stimulate arteriogenesis, leading to a physiological debridement of the wound, by the effect of monocytes transformed into macrophages (Fig. 16-17).



Fig. 16. Clinical course. Five days after the trauma, a superficial necrotic area formed, which ten days later disappeared, using only compression therapy



Fig. 17. Clinical course of the ulcer until its healing, six months later.

CASE REPORT 2

(Fig 18): An 83-year-old woman with hypertension, chronic obstructive pulmonary disease, chronic venous insufficiency, stage 4 chronic kidney disease. She suffered a deep venous thrombosis event, ten years ago. An ulcer forms on her right leg due to trauma, which was treated for months with different therapies, without positive results. She came to our office on this date (11/18/2016). The ankle-brachial index was 0.98. We started to treat her, and the necrotic tissue (eschar) disappeared, one month later.



Fig.18. Clinical course of the ulcer until its healing.

CASE REPORT 3

(Fig 19): An 84-year-old man with hypertension, valvular cardiomyopathy (surgical repair of the aortic valve), atrial fibrillation and anticoagulation therapy. He came to our office with an ulcer on his right leg, treated for several months with different therapies, without positive results and with a worse clinical evolution. The ankle-brachial index was 0.92. On this date (23/09/2014), we started treating him and the ulcer healed, four months later.



Fig. 19. 24 hours after the application of the compression, a central necrotic zone was formed that became eschar, and disappeared one month later.

CASE REPORT 4

(Fig 20, 21, 22): A 76-year-old male with severe peripheral arterial disease, who underwent femoral-popliteal bypass surgery on his left leg in July 2018. He went to the emergency room for severe pain in his left leg (02-06-2020), where he was diagnosed with critical extremity ischemia secondary to femoral-distal bypass thrombosis, in a previous surgery that was performed in July 2018.

He was diagnosed with severe arterial disease (grade IV ischemia), necrotic injuries on the 1st toe, erythrosis of the foot that extending to mid shaft of the tibia. The ankle brachial index was not detected. Peripheral pulses with low intensity Doppler signal. The patient was treated with the following drugs: painkillers, sedatives, and morphine. Lumbar sympathectomy (Ganglionectomy L1-L2) was performed and nine days after (02-15-2019), treatment with prostaglandins was started (Alprostadiol) by "Home Hospital Care". After 28 days of treatment with prostaglandins, without clinical improvement, the patient was discharged from "Home Hospital Care" (03-15-2019). The patient comes to my office, on 03-20-2019, to make a clinical evaluation of the condition of the leg (Fig 11). He had been informed at the hospital that, if there was no response to treatment, amputation would be necessary. I explained to the patient and his wife, the therapeutic possibilities of the "double focal compression bandaging", understanding and accepting the treatment. We started the treatment on March 20, 2019. The small ulcers on the back of the foot were healed 4 months later (Fig 20).

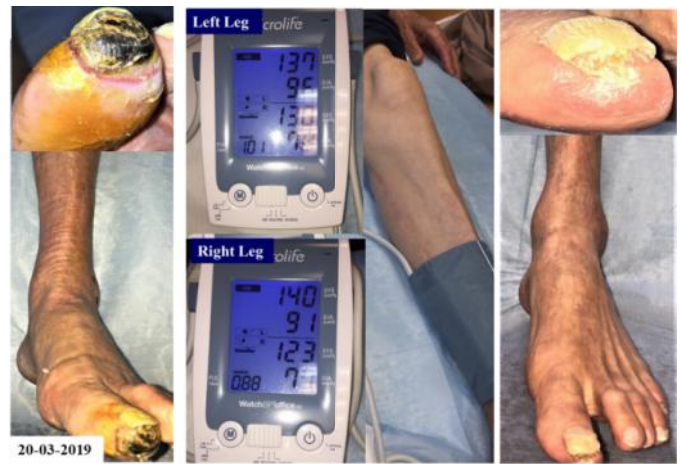


Fig. 21. Necrosis at the tip of the first toe (severe peripheral arteriopathy), resolved eighteen months, with a normal ankle brachial index, after applying "double focal compression bandaging."



Fig. 20. Ulcers healed, 4 months later, applying compression therapy.

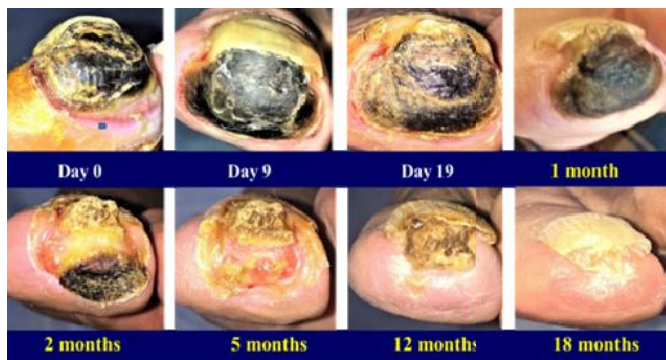


Fig. 21. Clinical course of necrosis at the tip of the first toe.

Conclusions

We showed 4 significant clinical cases, but we have observed this effect in many others. According to the results of this clinical experience, in more of 150 patients, it is not necessary to make any other type of debridement, because this technique involves performing two debridements:

A/ Mechanical by change dressings.

B/ Autolytic by monocytes changed into macrophages by stimulation of arteriogenesis.

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