

## Peripheral Artery Disease. Double Focal Compression Bandaging Technique

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### Abstract

When applying compression bandaging to a leg with a vascular ulcer, one of the biggest fears of professionals is that they may not detect severe peripheral artery disease. Measuring the ankle-arm index is a crucial diagnostic tool for the detection of this disease. According to the guidelines for treating peripheral arterial disease, compression therapy is contraindicated, without clinical evaluation by a vascular expert, when this index is below 0.80. Double focal compression bandage technique is a type of compression therapy, based on physiological principles such as arteriogenesis and angiogenesis, which uses only bandages and gauze, to obtain pressure gradients that stimulate collateral circulation in the affected area, leading to healing of the vascular ulcer. It is now recognized that compression is not a contraindication for patients whose ankle-brachial index is at least 0.50, but the clinical course of the ulcer should be monitored daily, in the first weeks. This article describes the clinical evolution of arterial ulcers in the legs, in five patients diagnosed with severe peripheral arterial disease, where the compression bandaging was contraindicated, according to angiologists who had already treated them. Since the various treatments had failed, I decided to use this technique, which was successful. Daily monitoring of clinical course during the first few weeks is required, to detect signs/symptoms of worsening, we taught patients how to detect them, in which case themselves would remove the bandaging and come to the medical office. The fourth case is a patient diagnosed with Leriche syndrome, who has undergone several surgeries to restore circulation in the legs. The surgical options are over, the next treatment would be amputation. We applied the technique, for 2.5 months, to reduce oedema and heal the wound of the amputated toe. The patient reduced the oedema and healed the wound, but he worsened, when he removed the bandaging, for indication of angiologist. In my opinion, this led to the amputation of both lower limbs.

**Keywords:** Peripheral Artery Disease; Vascular Leg Ulcers; Compression Therapy

### Introduction

The Ankle-Brachial Index (ABI), is a reliable, reproducible, simple, and inexpensive diagnostic tool for the detection of peripheral arterial disease [1]. The only diagnostic tool available in primary care for the detection of peripheral arteriopathy. This non-invasive test can indicate (ABPI): (1.0-1.4) →No narrowing or blockage of the leg-arteries; (0.9-1.0) →Acceptable state of arteries in legs; (0.8-0.9) → Some arterial disease; (0.6-0.8) →Moderate arterial disease; (less than 0.5) →Severe arterial

disease, critical ischaemia. The guidelines recommend referring the patient to a vascular specialist when this value is below 0.8. Compression is strongly contraindicated in serious peripheral arterial disease, when this index, measured by Doppler ultrasound, is below 0.6 [2]. There is consensus that compression therapy is contraindicated for patients with severe peripheral artery disease (ABPI < 0.5), however, in expert hands and considering signs and symptoms, we can use compression therapy to improve arterial flow [3]. Severe medical compression therapy-associated adverse

events are very rarely encountered if compression is used correctly, and contraindications are considered [4].

We report four clinical cases of patients diagnosed with severe peripheral arterial disease, in which the compression bandaging was contraindicated, according to the medical specialists who treated them. They were treated with Double focal compression bandaging technique, getting the healing of ulcers.

### A pathophysiologic explanation which explains the result

Angiogenesis is defined as the growth and proliferation of blood vessels from existing vascular structure [5]. The remodelling of pre-existing collateral channels is termed arteriogenesis. In their normal state, these collateral channels are narrow, high resistance vessels, and they provide little blood flow to their distal tissue bed. However, when a major conduit becomes obstructed, blood flow is redirected through the collateral channels, which causes alterations in vascular wall shear stress. This hemodynamic stimulus provokes an increase in the diameter and wall thickness of the collateral channels, with proliferation of vascular cells and turnover of the vascular matrix [6-8]. An interesting document on what has been learned to advance medical revascularization for peripheral artery disease, and how this information could lead to novel approaches for therapeutic angiogenesis and arteriogenesis for peripheral artery disease [9]. To understand the pathophysiologic basis for the technique, it is important to know the difference between arteriogenesis and angiogenesis [10] (Figure 27).

### Material and diagnostic tools

All we need are bandages and gauze to apply this technique. It is a material simple and inexpensive [11]. We use the following: A/ Gauze to make the padding, that we put over the wound bed (focalized pressure). B/ Adhesive bandage to attach the padding to the leg. C/ An inelastic bandage of 10 x 10 centimetres (short stretch), to perform a progressive external compression of the toes, up to 2-3 cm below the knee flexure. D/ Saline physiological solution, for cleansing the wound bed. E/ Adhesive tape, to attach the compression bandage.

The diagnostic tools are: 1/ A hand-held Doppler, to check peripheral pulses and calculate the ankle brachial index, to rule out severe peripheral artery disease. 2/ A weight-control scale. 3/ The Edinburgh Claudication Questionnaire. 4/ A camera to realize the photographic sequence of the clinical course.

### Method

I named this technique “double focal compression bandaging” because we use two bandages. The first, used for focused compression over the wound bed, and the second covers the first, to get a gradual external compression of the toes to the knee. Each turn of the band covers the preceding tour by 50-70%. So, the ulcer area receives pressure from 3 layers (pressure exerted by padding on the wound bed and the double effect of the external gradual compression bandaging) (Figure 1).

**Figure 1:** Double focal compression bandaging technique.

### Results

These five clinical cases of patients diagnosed with severe peripheral arteriopathy, where compressive therapy was contraindicated, according to guidelines for the treatment of arterial ulcers. All were treated successfully, except one which worsened at the time of removing the bandaging, by the indication of the angiologist.

### Case Report 1

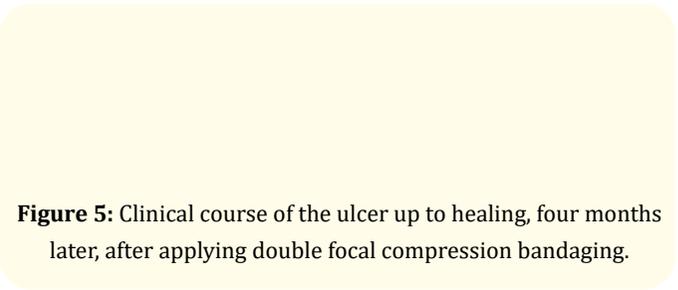
A 72-year-old woman with these diseases: type 2 diabetes mellitus, arterial hypertension, asthma, hawthorn-cerebellar ataxia, thalassaemia anaemia and coxarthrosis. On May 19, 2015, the patient went to the emergency department of the hospital, because of suffering intense pain in the third right toe, in the last weeks, which prevented her from walking and sleeping. The ankle-brachial index was 0.42 (right leg). She was admitted to hospital angiology department, being diagnosed with diabetic foot and bilateral peripheral arteriopathy and. She was treated with intravenous antibiotics. The arteriography (05-25-2015) confirmed the diagnosis, showing occluded right superficial femoral artery, and middle third occlusion of the left superficial femoral (Figure 2).

**Figure 2:** Angiography showing multi-segment arterial occlusive disease.

The patient underwent surgery (05-28-2015): Endovascular surgery on the right superficial femoral with local fibrinolysis, angioplasty, and stent. On May 30, 2015, she was discharged from the hospital (05-30-2015). Twenty-four days later (06-24-2015), he went to the hospital for severe pain in the left lower extremity, which prevented him from walking, and sleeping at night. Three weeks ago, he had hit her left leg, forming an ulcer in the pretibial area. She was admitted to the angiology department, where she was diagnosed with peripheral arterial disease. Peripheral pulses were clear and strong, in the surgical leg (right leg). Since the patient had symptoms of intermittent claudication, a vascular recanalization was suggested, but later conservative treatment was decided. On June 7, 2015, she was discharged from the hospital, with an ulcer in the pretibial area to be treated in primary care, with the indication of the angiologist not to use compression bandaging. The patient was treated by her doctor and primary care nurse, following these instructions. One month later, since the ulcer was not progressing favourably, she was referred to our medical consultation, for a clinical evaluation of the ulcer and subsequent treatment. The ankle-brachial pressure index was 0.54 (June 2015), before applying the double focal compression bandaging (Figure 3). I considered that it was possible to apply the technique, with a daily follow-up of the clinical course of the ulcer. We followed up daily for four months, with periodic measurements of the ankle-brachial index to remove the bandaging, in case of clinical worsening, something that did not happen.

**Figure 3:** Improved ankle-brachial index after use of compression bandaging.

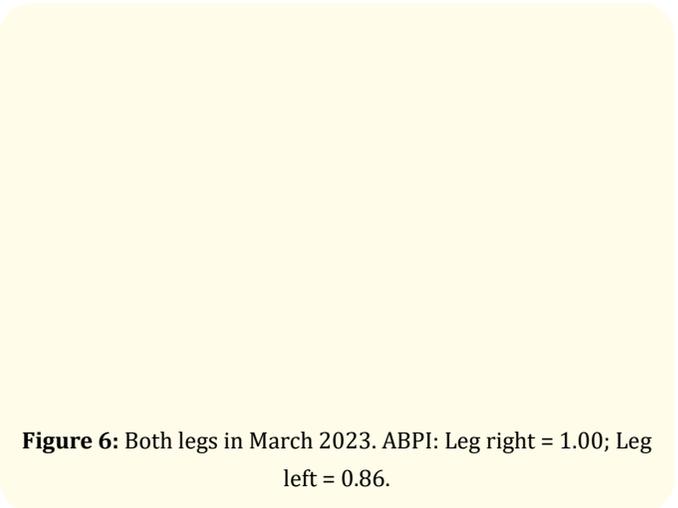
Four cell cultures were ordered on different dates, which gave the following result: Two were positive for *Pseudomonas aeruginosa* and the next two were negative (Figure 4). At no time were signs/symptoms of infection observed. The wound bed may become contaminated, which does not mean it is infected. The pressure focused on the wound bed prevents infection [12]. The ulcer healed within four months (Figure 5).



**Figure 5:** Clinical course of the ulcer up to healing, four months later, after applying double focal compression bandaging.

**Eight years after applying this technique**

We asked the patient to bandage her legs, alternating the bandage every day on one leg, removing it at night, when going to sleep. Because of the ataxia, the patient needed to be bandaged for her husband, so we trained him, in applying the compression bandaging. His collaboration was essential for the success of the treatment. The ankle-brachial index has improved and has been maintained over time (Figure 6).



**Figure 6:** Both legs in March 2023. ABPI: Leg right = 1.00; Leg left = 0.86.

**Case Report 2**

A 56-year-old male, smoker, regular drinker, and sedentary lifestyle, who for months presented symptoms of intermittent claudication in the left leg. He didn't usually go to his doctor's office, except for his psoriasis problem. On March 15, 2011, he went to the emergency room of the hospital, because for a week, he has had intense pain in the forefoot and the first toe of his left foot, that had increased in the last two months, extending to the fourth toe. The patient was diagnosed with severe peripheral arterial disease and admitted to the Angiology service of the hospital. On March 23, an

arteriography was performed, showing the following: Occlusion of the third segment of the left popliteal artery with outlet through the fibular artery. Permeable right popliteal artery. Two days later, the patient underwent surgery: Femoral-peroneal bypass surgery in the left leg, with amputation of the first toe. There was an unfavourable post-operative course, with a dehiscence of the wound during the digital amputation and an event of heart failure (Figure 7-A), which was resolved with drugs (Figure 7-B).



**Figure 7:** A/ Chest X-ray (03-26-2011). B / Chest X-ray (05-05-2011).

Twelve days later, it was decided to carry out a second surgery, a trans-metatarsal amputation (04-06-2011). The patient was discharged 67 days after admission with the diagnosis of Chronic Ischemia Grade IV, Femoral-peroneal bypass, Trans-metatarsal Amputation (Left lower limb) and Heart failure.

For 5 years, he attended all the consultations scheduled in the angiology service of his reference hospital, where the permeability

of the bypass was checked. In these years, the ankle-brachial index remained around 0.60 (Figure 9).

Five and a half years later (07-20-2016), the patient was admitted to the cardiology service, for suffering from worsening heart failure and episodes of unstable angina. Cardiac catheterization confirmed coronary obstruction, so, drug-eluting stents were implanted. By having the patient, a cold lower limb, with very weak peripheral pulses, the cardiologists requested a consultation with angiologists, to assess peripheral arterial disease [12].

On August 12, 2016, the patient was released from hospital and one month later (09-15-2016), the arteriography showed the following result: A/ Right lower extremity: Common and deep femoral artery permeable. No significant injuries. Superficial femoral artery and popliteal artery with multiple diffuse, non-significant lesions. B/ Left lower extremity: Superficial femoral artery seriously damaged, with critical stenosis in the upper third. The popliteal artery is occluded, in the first section (Figure 8).



**Figure 8:** Arteriography lower left limb. A/ short critical stenosis of the left superficial femoral artery. B/ Right popliteal artery occlusion.

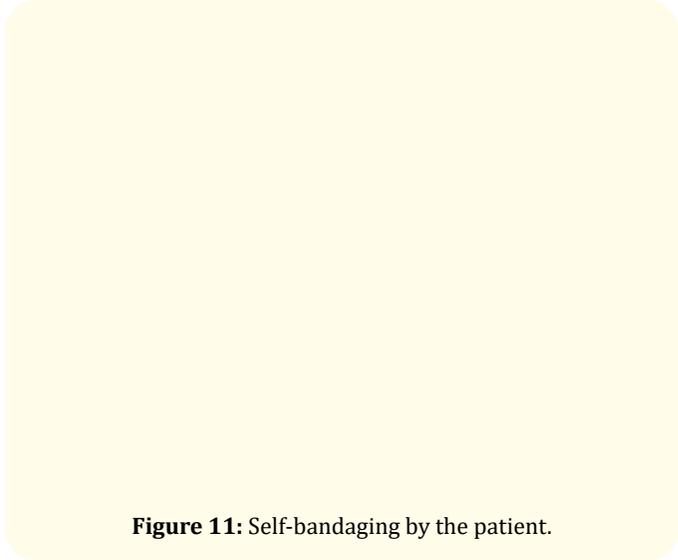
The patient wanted a second medical opinion, so he went to our doctor’s office. On physical examination, I noted a coldness of the lower limb, with very weak peripheral pulses. The decision to apply the compression bandaging was risky, considering that the ankle-brachial index, after surgery, remained around 0.60 (Figure 10). However, the risk may be minimized by daily monitoring of the clinical course of the ulcer.

The patient was informed of the risks and benefits of applying the technique. He accepted and signed the informed consent. We instructed him in detecting signs/symptoms of worsening, in which case, he would remove the bandage and come to our medical office. A daily follow-up was carried out during the first few weeks, to detect any signs/symptoms of worsening, but this did not happen. We trained the patient in the compressive bandage technique, so that he could bandage himself (Figure 11), which he has done for years and still does. As the pressure of the bandage decreases throughout the day, the advantage of performing a self-bandage is that the patient applies, every morning, the bandage with the initial pressure. The strength with which the bandage is applied, is that which is tolerated by the patient. He should remove it, when he goes to sleep at night or when he feels extreme pain. The improvement of the ankle-brachial index by comparison, before and after application of double focal compression bandaging is evident, as shown in the graph (Figure 9).

increased pressure on the walls of the cardiac chambers, which secrete natriuretic peptides, as a compensating physiological mechanism. Natriuretic peptides (NPs) are hormones which are mainly secreted from heart and have important natriuretic and kaliuretic properties. Apart from blood pressure lowering properties, natriuretic, diuretic, and/or kaliuretic properties of the NP originating from the ANP prohormone [13] and from BNP, inhibition of the renin-angiotensin system, sympathetic outflow, and vascular smooth muscle and endothelial cell proliferation have been attributed to NP [14].



**Figure 10:** A/ Chest X-ray (05-05-2011). B/ Chest X-ray (03-21-2023).



**Figure 11:** Self-bandaging by the patient.

Two clinical facts made it difficult to apply compression bandaging: 1<sup>st</sup>/ The patient had suffered a half-foot amputation. 2<sup>nd</sup>/ He was a heart patient with heart failure and coronary artery disease. The importance of daily follow-up in the first weeks in these patients, must be highlighted.

Over these years, the patient has not had any episodes of heart decompensation. Cardiomegaly has reduced (Figure 10). The hypothesis that would explain this result would be the following: Movement of blood volume to the heart cavities, by compression of the legs, causes increased cardiac preload. This leads to

I would like to end with a question, to make us think about the usefulness of compression bandaging, in patients with heart failure: To what extent compression bandaging improved cardiac symptoms? More studies are necessary to answer this question.

### Case Report 3

A 76-year-old man was diagnosed with severe peripheral arterial disease. Left leg bypass surgery was performed in July 2018. Other medical problems include chronic obstructive pulmonary disease and non-Hodgkin's lymphoma, which is in remission. Smoker since adolescence of a daily package. On June 2, 2019, he went to the hospital emergency room for severe pain in his left leg, being diagnosed with severe ischaemia, secondary to left distal femoral by-pass thrombosis. The patient was admitted to vascular surgery service. The patient had small ulcers in the outer malleolus of the left foot, with a painful necrotic lesion at the tip of the big toe. He was diagnosed with severe peripheral arterial disease (grade IV ischaemia), with necrotic lesions on the first toe of the left foot and erythrosis, reaching the middle third of the leg. The Doppler signal for the peripheral pulses was exceedingly weak, not being able to measure the ankle-brachial index.

On February 12, 2019, an arteriography was carried out to try to reroute bypass surgery, which was not operational. He was treated with painkillers, sedatives, including morphine. Three days later, a left lumbar sympathectomy (Ganglionectomy L1-L2) was performed. Then, he was treated with prostaglandins (Alprostadil) in the hospital and continued treatment, for 4 weeks, by Home Hospital Care. After 28 days of unsuccessful prostaglandin treatment, he was referred from "hospital care" to primary care (03-15-2019), with the following medical report: The patient has a lot of pain in his left leg, both when walking and resting, so he needs powerful painkillers. The pain is so strong that it keeps you awake most nights. Small ulcers persist, near the external lateral malleolus, with distal necrosis of the left big toe, with redness and coldness in the extremity.

Five days later (03-20-2019), the patient came to our medical office for a clinical assessing (Figure 12). In the hospital, they had told him, that if the treatment failed, the amputation should be considered, so he wanted a second medical opinion.

The first thing that caught my attention was the coldness of the foot and the weakness of the peripheral pulses. I explained to the patient and his wife, the therapeutic possibilities and the risks of using this technique (double focal compression bandage). They understood the explanation and provided their consent. In the first

weeks, we did a daily follow-up of the clinical course of the ulcers, to detect any worsening signs/symptoms of worsening, in which case, we would remove the bandage, but this did not happen. In my opinion, compressive therapy was the only therapeutic option to save the leg. On March 20, 2019, we began the treatment, emphasizing the importance of daily attendance at appointments.

**Figure 12:** Left limb prior to compression therapy. A/ Small ulcers on the foot (external malleolus). B/ Distal necrotic area on the big toe.

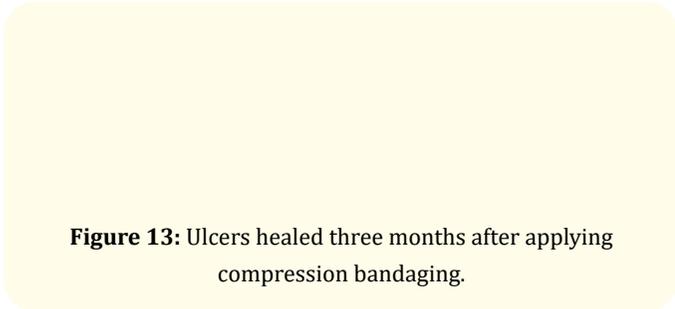
Three months later, the small ulcers were healed (Figure 13). The necrotic lesion, on the tip of the big toe of the left foot, took about a year and a half to heal (Figure 14). Focused pressure on the wound bed stimulates arteriogenesis and angiogenesis, which increases blood circulation around the ulcer. Macrophages carry out the autolytic action, making the use of any debriding agent unnecessary [15] (Figure 27).

#### The application of this technique involves doing two types of debridement:

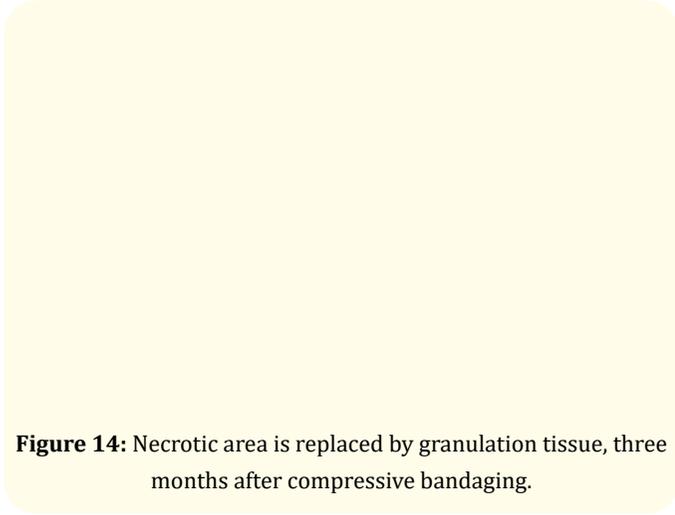
- A mechanical when we make the cure and take the padding off.
- An autolytic caused by the action of macrophages. Macrophages originate from monocytes.

We trained the patient's wife in the double focal compression bandaging technique. Her collaboration was essential for treatment success. In this case, we highlight the following:

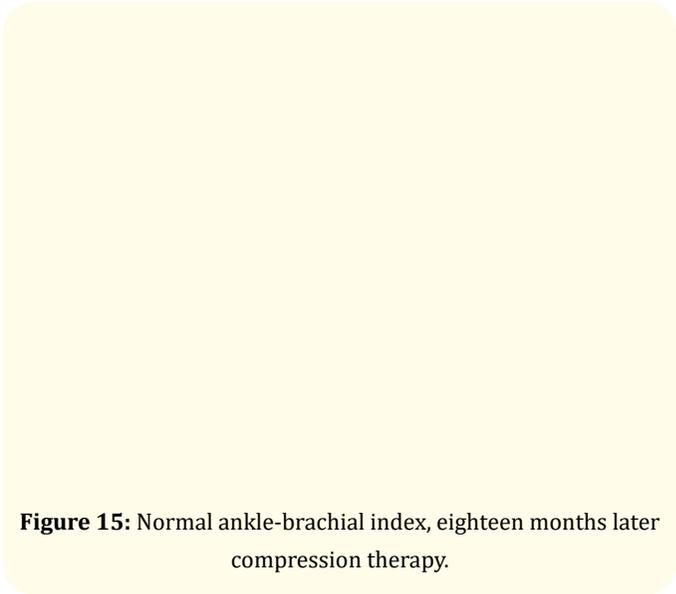
- When he went to see the angiologists (07-18-2019), four months after leaving the hospital, they did not know that he was using compression therapy, which they said was contraindicated. They confirmed improved leg, as well as decreased pain.
- Before applying the technique, the ankle-brachial index could not be calculated, owing to the extreme weakness of the peripheral pulses. Eighteen months later, this index is: 1.01 and 0.88 (Left and right leg; Figure 15).
- When he came to our medical office, he used the cane for walking. He had a cold, painful foot, with a necrotic lesion on the tip of the large toe of his left foot. Currently, he does not use a cane and his leg is warm and no pain (Figure 16). All previous therapeutic measures had failed (lumbar sympathectomy and prostaglandin therapy) and the last option was amputation.



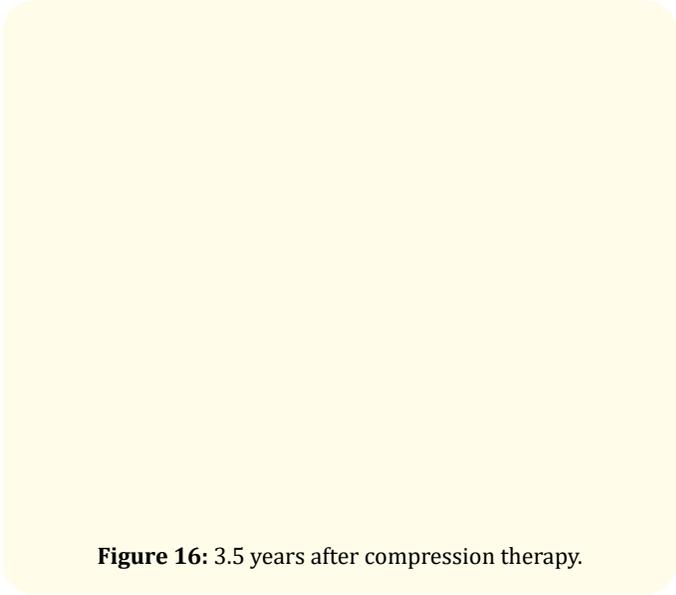
**Figure 13:** Ulcers healed three months after applying compression bandaging.



**Figure 14:** Necrotic area is replaced by granulation tissue, three months after compressive bandaging.



**Figure 15:** Normal ankle-brachial index, eighteen months later compression therapy.



**Figure 16:** 3.5 years after compression therapy.

We recommend the patient, wear compression socks, for life, removing them at night, when going to sleep. Patient confidence in treatment and adherence to instructions were critical to prevent amputation.

We cannot heal peripheral arterial disease, but collateral circulation can be activated, through pressure focalized on the wound bed, which stimulates arteriogenesis and angiogenesis.

#### Case Report 4

A 49-year-old male was diagnosed with Leriche syndrome and metabolic syndrome. Smoker of more than 40 cigarettes per day (Figure 17). He had been operated on four times, to improve circulation in the legs. The first was performed on September 9, 2008: Aorto-bifemoral bypass. Right branch thrombectomy, bypass to the right deep femoral artery. He had three additional surgeries, the last of which occurred on September 18, 2017, which involved the amputation of the fifth toe of the right foot. On October 15, 2017, the patient was discharged from the hospital. He should follow the hygienic and dietary measures and prescribed treatment, as the next surgery would be amputation.

**Figure 17:** Patient with Leriche syndrome and four surgical interventions. Any surgical options were exhausted.

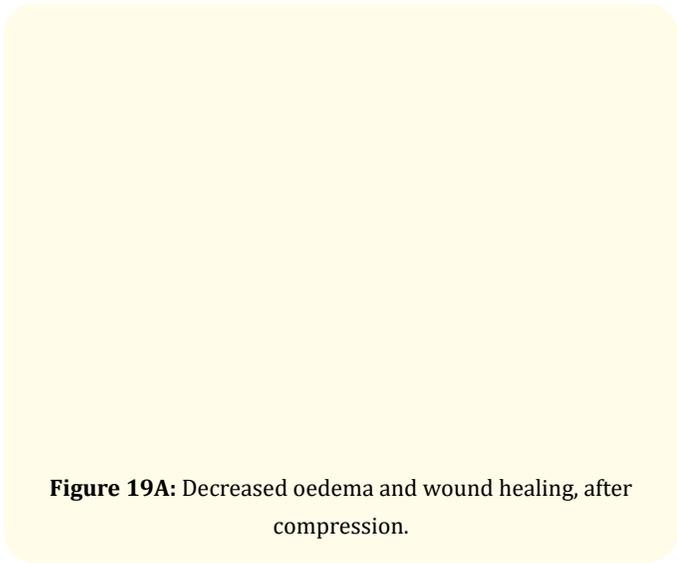
On October 18, 2017, the patient went to the primary care centre, for cures on the amputated toe. Since the patient had oedema in the right leg (Figure 19), We value the use of a compression bandaging to reduce it. The ABPI was 0.70. We apply a compression bandaging, with focused pressure on the wound bed of the amputated toe, with a daily follow-up, during the first weeks, to detect any signs or symptoms of worsening, in which case we would remove the bandaging, but that did not happen. The wound healed in 3 months (Figure 18-A). He had a small necrotic lesion on the tip of the 2<sup>nd</sup> right toe, which healed in 2.5 months (Figure 18-B). In the months he used the compression bandage, the symptoms improved and the oedema was reduced (Figure 19-A).

On December 15, 2017, he had an appointment scheduled at the angiology department. Eighteen days later, he arrived at our doctor's office, with severe pain and coldness in the lower extremities. We asked him, why haven't you come to our medical office? He answered that as he was feeling well, he did not deem it necessary, recognizing that, since the day he went to the angiology service, he had not put on the bandage, following the instructions of the angiologist. We tried to resume compression bandaging, without success. There was no choice but to send the patient to the hospital, knowing that amputation would be inevitable. Both lower limbs were amputated.

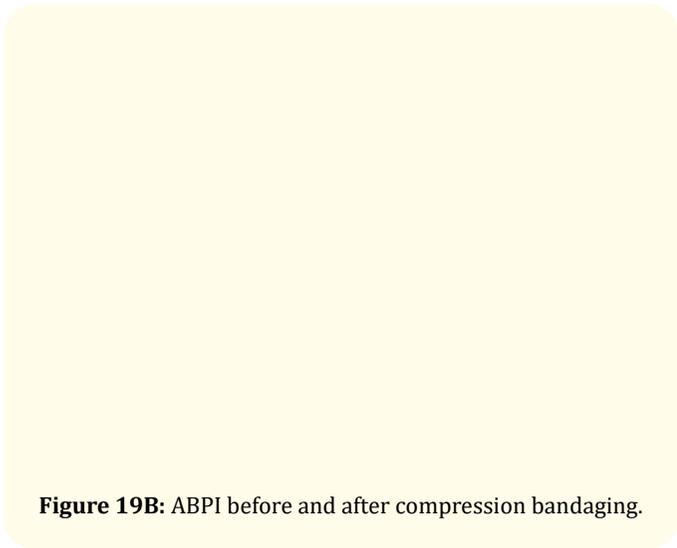
**Figure 18A:** The wound of the amputated toe, healed in 2.5 months.

**Figure 18B:** Necrosis resolved, 2.5 months after compression.

If compression therapy could not be used in this patient, the symptoms worsen when applying, something that did not happen. but quite the opposite. they improved and the oedema was reduced (Figure 19).



**Figure 19A:** Decreased oedema and wound healing, after compression.



**Figure 19B:** ABPI before and after compression bandaging.

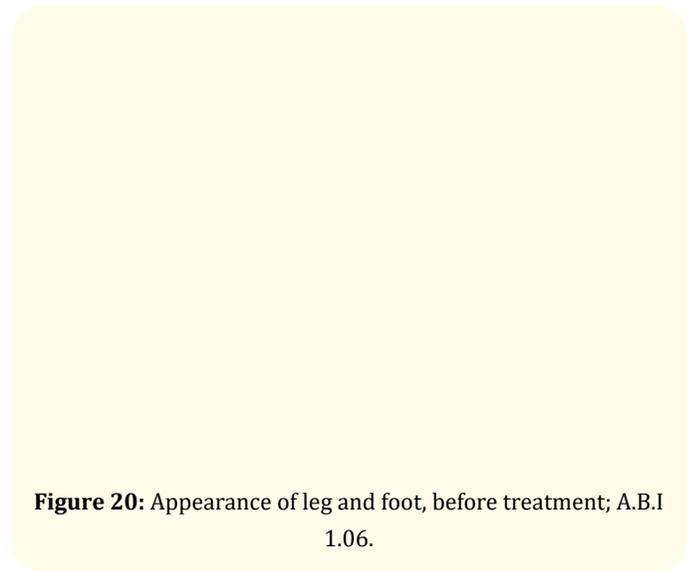
What would have happened if the patient hadn't removed the bandage? Is there a connection between removing the bandage and getting worse? Maybe amputation would have been unavoidable, but I believe he missed a great opportunity.

### Case Report 5

A 60-year-old male with type 2 diabetes mellitus for over more 30 years, to treatment with Rapid-acting insulin, Dapagliflozin/metformin combination, and Dulaglutide. He was diagnosed also with arterial hypertension and dislipidaemia.

On February 13, 2023, he went to the emergency room of the hospital, for suffering severe pain in the third toe of he right foot, for six days. The patient was diagnosed with an ischaemic ulcer on a diabetic foot, therefore, inter-consultation with vascular surgery was requested. The diagnostic of angiologist was: Femoropopliteal obstruction in the right lower limb. He was sent home with antibiotic therapy and a consultation with the vascular surgery, within a week. Whith the diagnosis of diabetic angiopathy, the patient is referred to primary care, warning not to use tcompression bandaging.

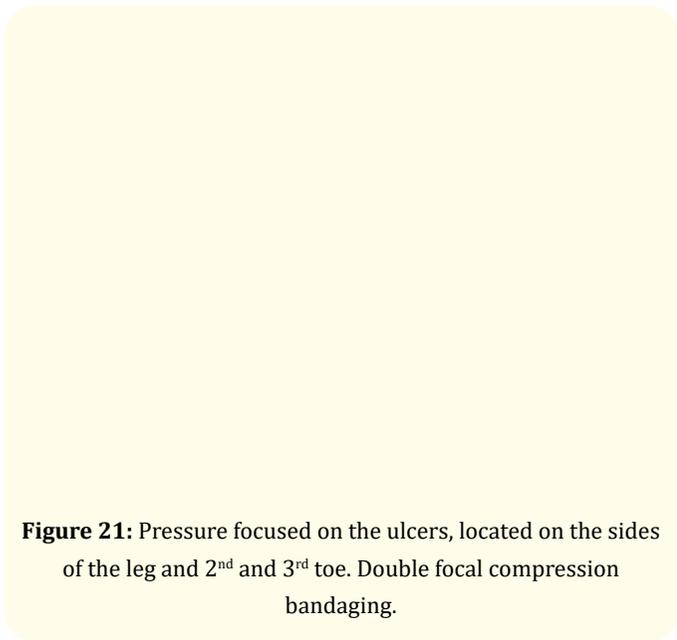
On February 24, 2023, the patient came to our medical office. In the initial examination, highlights the coldness of the foot, however surprisingly, the ankle-brachial index was 1.06, so we applied the double focal compression bandaging (Figure 20).



**Figure 20:** Appearance of leg and foot, before treatment; A.B.I 1.06.

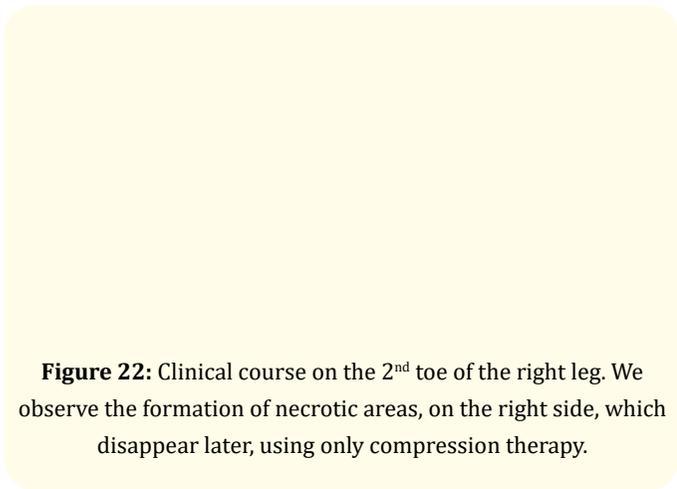
We can see wounds on the 3<sup>rd</sup> and 4<sup>th</sup> toes of the right foot, with two small scabs on the sides of the right leg. I thought there would be two small ulcers underneath, so I focused the pressure on them. Days later, my suspicion was confirmed (Figure 21).

When I started the treatment, the patient had affected the 3<sup>rd</sup> and 4<sup>th</sup> toes. Seven days later, necrotic areas were observed on the left side of the 2<sup>nd</sup> toe, with sub-ungual extension (Figure 22).



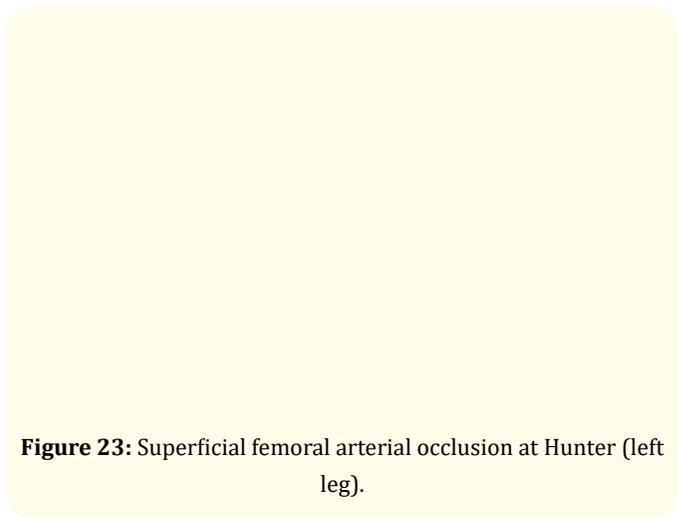
**Figure 21:** Pressure focused on the ulcers, located on the sides of the leg and 2<sup>nd</sup> and 3<sup>rd</sup> toe. Double focal compression bandaging.

This means that compression bandaging causes a redistribution of blood flow, diverting more blood to some areas, to the detriment of others. Clinically, it manifests as necrosis, in those areas with little blood flow. Once the affected areas have been repaired, blood flow will be directed to those deficit areas.

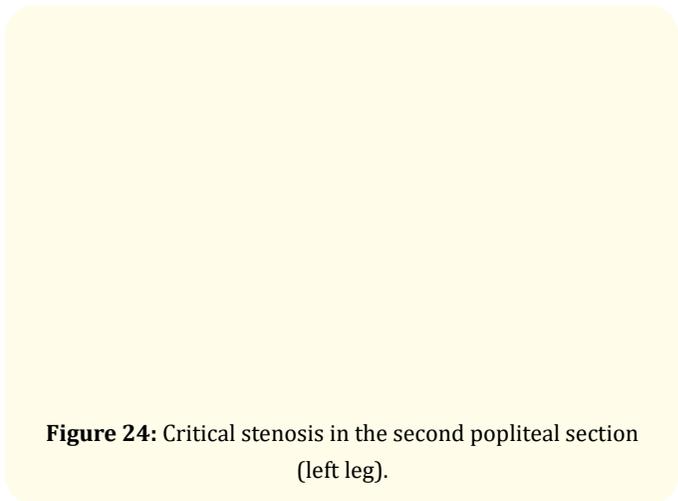


**Figure 22:** Clinical course on the 2<sup>nd</sup> toe of the right leg. We observe the formation of necrotic areas, on the right side, which disappear later, using only compression therapy.

A CT scan was carried out one month later (03-25-2023), confirming diabetic peripheral arteriopathy (Figure 23,24).



**Figure 23:** Superficial femoral arterial occlusion at Hunter (left leg).



**Figure 24:** Critical stenosis in the second popliteal section (left leg).

We monitored the clinical course of foot injuries daily, for three months, to detect signs/symptoms of worsening, in which case, we would remove the compressive bandage. It was not necessary, as the patient improved and the small ulcers healed, three months after applying double focal compression bandaging (Figure 25).

Coldness of the foot at the beginning of the treatment, disappeared when applying compression therapy. In a few days, his foot was hot. Finally, it should be noted that the fact of having to come daily to the curtesy, was essential for the success of the treatment. On May 10, 2023, the patient had a vascular surgery



**Figure 25:** Toes healed, three months after applying double focal compression bandaging.

appointment scheduled, for probable surgical intervention. They were surprised by the result of applying the compression bandaging, that they themselves had contraindicated. The patient's peripheral pulses were clear and powerful. Of course, surgery was ruled out, at least for now, having to continue with the compression bandaging. We must not forget that, although we have improved circulation, peripheral arterial disease persists and consequently, we have to tell the patient that he should keep the compression bandage for life, removing it at night, when falling asleep and when certain situations, make it very difficult to use. such as very hot weather.

If I had followed the instructions of the angiologists, about not wearing the compression bandaging, I think the patient would have

gotten worse and required surgery. According to current clinical guidelines, this patient should not receive a compression bandaging. Having healed other patients with the same pathologies, forced me to use compression therapy. It was necessary to carry-out a daily follow-up of the clinical evolution, during the first weeks, until ulcer healing.

### Discussion and Conclusion

Severe peripheral arterial disease is considered as a contraindication for applying compression therapy. Ankle-brachial index measurement is a basic diagnostic tool for detecting peripheral arterial diseases. The ABI threshold score was derived from extensive epidemiological studies. The value is defined as 0.9 in the guidelines issued by the European Society of Cardiology (ESC) [16], the American College of Cardiology/American Heart Association (ACC/AHA) [17], the National Institute for Health and Care Excellence (NICE) [18] and the Transatlantic Inter-Society Consensus (TASC) II [19].

The contraindications for compression treatment are: severe peripheral arterial occlusive disease (PAOD) with ankle brachial pressure index (ABPI) <0.6, ankle pressure <60 mm Hg, toe pressure <30 mm Hg, or transcutaneous oxygen pressure <20 mm Hg; suspected compression of an existing epifascial arterial bypass; severe cardiac insufficiency (New York Heart Association [NYHA] class IV) [20].

The guidelines indicate that an ankle-brachial score of 0.8 indicates peripheral arteriopathy and requires clinical evaluation by the angiologist. In all the cases described, they were evaluated in the angiology department, contraindicating compression therapy. According to my clinical experience, compression therapy can be used as long as the ABPI is not less than 0.5, but a daily monitoring of the clinical course of the ulcer is required, in the first weeks, to detect any signs/symptoms of worsening, in that case, we would take off him the compressive bandage. It was not necessary to do so and the patient who was told to take it out, the patient got worse in a few weeks. Another noteworthy fact is that, no antimicrobials were used because no signs/symptoms of infection (cellulite and/or fever) were detected. Focalized pressure on the wound bed prevents infection [12].

When there is an obstruction in an artery, in the area prior to the obstruction, there's an increase in pressure on the artery wall,

which stimulates arterogenesis with the formation of collateral vessels, which bypass the obstruction. There is an increase in blood flow, through the collateral vessels, around the ulcer. In this picture, we can see how that shows up in clinical practice, when changing the padding-gauze, twenty-four hours after applying double focal compression bandaging. In the photographic series of a few seconds, we see how blood flows spontaneously, after applying pressure on the ulcer (Figure 26). On the other hand, in the post-obstructive area, there is a decrease in pressure in the arterial wall, with decreased blood flow leading to hypoxia. Arteriogenesis is induced by physical forces, most importantly fluid shear stress and angiogenesis is induced by hypoxia and results in new capillaries [10].

I think in patients diagnosed with severe peripheral arterial disease, compression bandage should be the first treatment option, to improve blood circulation through the arteries that are still functioning, by effect of focused pressure on the wound bed, which stimulates atherogenesis and angiogenesis in the affected area (Figure 26,27).

**Figure 26:** 24 hours after applying double focal compression bandaging. We pressed with gauze the wound bed, and it can be observed an increase of blood flow.

**Figure 27:** Diagram explaining, why compression heals a vascular ulcer.

Why are not ulcers infected and it is not necessary to use any debridement agent, when applying focused compression on the wound bed?

The answer lies in the antibacterial, anti-viral and antifungal properties of monocytes, and subsequently transformed into macrophages, which perform an autolytic debridement [15]. On the other hand, when changing the padding, we carry out a mechanical debridement. I had developed a graphic scheme, trying to explain the hypothesis on which I base this outcome (Figure 27).

Based on my clinical experience, double focal compression bandaging technique alone would be contraindicated, for severe peripheral artery disease (ABI <0.5) and grade IV heart failure. The risks of compressive treatment can be minimized, by daily monitoring of the clinical course. Other contraindications should be considered. In my opinion, compressive bandaging should be the first option, for treating a patient with a diagnosis of peripheral artery disease. We can heal arterial ulcers by compression therapy [21,22].

I know the cases described may be controversial, but the results are overwhelming.

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