

Martorell's Ulcer Successfully Treated by Wireless Microcurrent Stimulation Technology

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ABSTRACT

Martorell's ulcers are hard-to-heal leg ulcers typically accompanied by a significant elevation of blood pressure and severe pain. This case study examines the use of an innovative technology, wireless microcurrent stimulation, for the healing of a Martorell's ulcer. Using wireless microcurrent stimulation, study authors managed to reduce the size of a large Martorell's ulcer by 90% within 8 weeks. In this article, the case of a 65-year-old woman is discussed in detail, and this new, contactless method is compared with traditional ulcer healing methods.

KEYWORDS: leg ulcer, Martorell's syndrome, Martorell's ulcer, microcurrent stimulation, wireless microcurrent stimulation, wound care

ADV SKIN WOUND CARE 2019;32:81–4.

these 105 cases, there is a predominance of female patients ($n = 82$), and mean reported age varies from the mid-50s to mid-60s.⁶

However, pathologic changes probably do not, by themselves, account for the development of Martorell's ulcers. Further studies suggest that the lower skin perfusion pressure in Martorell's patients is attributable to a local increase in vascular resistance.⁹ This inability to vasodilate in response to the arteriolar narrowing of hypertension may reduce tissue perfusion to a level that results in ischemic ulcer formation.

Such ulcers usually present for long periods and are refractory to the usual topical therapies for ulcer healing. Although it is important to lower the patient's blood pressure to reduce further arteriosclerosis, limited benefit can be derived from successful blood pressure control.^{10–12} Antihypertensive agents should not only reduce blood pressure but must also reduce local vasoconstriction.^{6,13}

CASE REPORT

A 65-year-old woman presented with a 5,700-mm² superficial ulcer on her left leg and two small, recently healed ulcers on her right leg. Before her first visit to the authors' clinic, the patient had been given a diagnosis of pyoderma gangrenosum. She had been receiving treatment (including modern hydroactive therapy) without effect for 20 months at a different clinic. The ulcers started as small satellite lesions (Figure 1), which "melted" together to form larger ulcers.

The patient had a 25-year history of insulin-dependent diabetes mellitus and a 30-year history of chronic hypertension with blood pressure values up to 220/125 mm Hg. On physical examination, her systolic blood pressure was 180 mm Hg, and diastolic blood pressure was 95 mm Hg. She was examined for renal dysfunction, endocrine disorders, vascular disease, or tumor as the potential cause of the hypertension, but without any pathologic findings. There were no signs of venous stasis, but a lipedema was ascertained. Arterial occlusive disease of the lower limbs was excluded by color Doppler duplex examination.

A biopsy of the ulcer exhibited hyalinization and thickening of the arteriole media. These pathophysiologic findings suggested a Martorell's ulcer.

Before the initiation of the authors' treatment, her left leg ulcer grew in size constantly, reaching a peak of approximately 5,700

INTRODUCTION

First described by Martorell^{1,2} and Hines and Farber,³ hypertensive leg ulcers or Martorell's ulcers are characterized by the absence of clinically significant arteriosclerotic large artery occlusive disease or venous disease of the lower extremity and a painful ulcer on the anterior–exterior surface of the lower two-thirds of the leg, as well as lesions that are often symmetrically present in the lower extremities.^{2,3} They are often misdiagnosed as pyoderma gangrenosum or necrotizing vasculitis.⁴

According to the literature,⁵ about 0.5% of adults in Western countries suffer from Martorell's ulcers. They are characterized by episodic and irregular extension and skin infarction, as well as by the development of satellite lesions.⁶ The pain accompanying Martorell's ulcers is frequently reported to be far more severe than would be expected for the size of the ulcer.⁷ Moreover, there is significant reduction in wall-to-lumen ratio compared with that found in patients with other types of chronic leg ulcers.^{3,8}

These ulcers are defined by the presence of significant, systemic elevation of blood pressure. Hypertension in Martorell's ischemic leg ulcers is poorly controlled and often severe. In 60 of the 105 cases that have been studied since 2001 (and for which blood pressures levels were noted), the mean systolic blood pressure was 204 mm Hg (range, 120–290 mm Hg), and mean diastolic blood pressure was 115 mm Hg (range, 70–160 mm Hg).⁶ Among

Figure 1.
LOWER LEFT LEG 4 MONTHS BEFORE TREATMENT



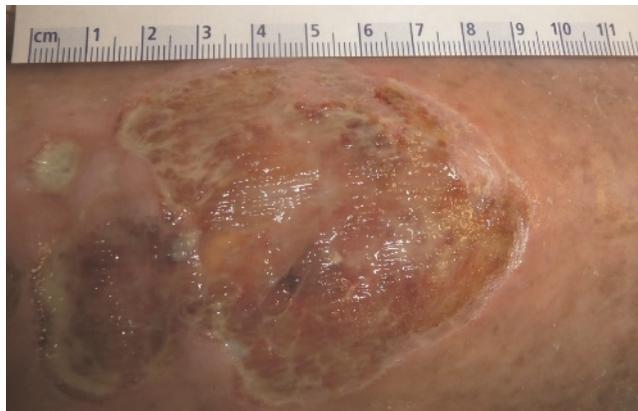
mm² (Figure 2). When the treatment began, the wound was 5,680 mm² with telltale satellite lesions but without peroneus longus tendon exposure (Figure 3).

At the beginning of treatment, the patient self-reported her pain using the visual analog scale (VAS; 1 = no pain, 10 = extremely painful) as an 8. After being prescribed opioids, her VAS reached 4.

WIRELESS MICROCURRENT STIMULATION THERAPY

Wireless microcurrent stimulation (WMCS) therapy is a new method that uses the current-carrying capacity of charged air gas (based on the ability of nitrogen and oxygen to accept or

Figure 3.
LOWER LEFT LEG AT TREATMENT START

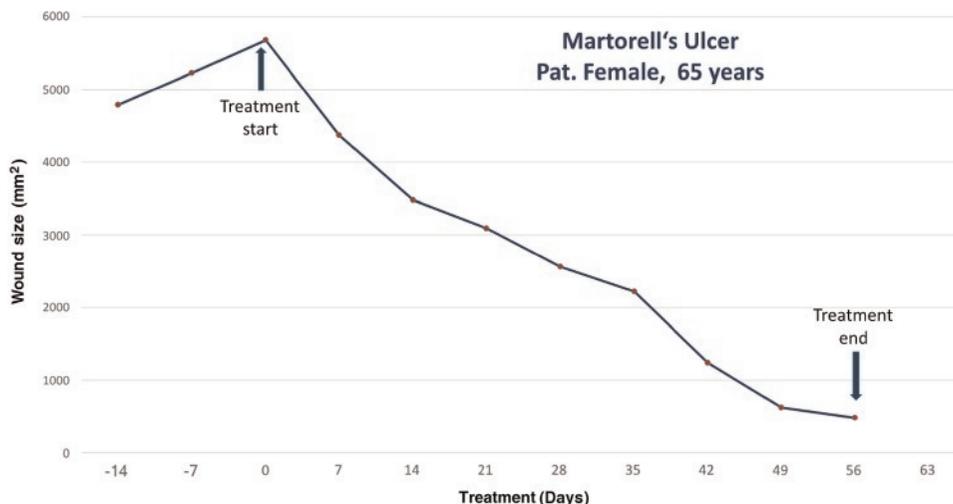


donate electrons) to reinitiate or accelerate the healing process. The use of this technology for the healing of hard-to-heal wounds has been described elsewhere.¹⁴⁻¹⁶

For this patient, the WMCS W200 device (Wetling Health, Allerød, Denmark) was used. The patient consented to this treatment and signed an informed consent form to receive 1 hour of WMCS therapy 3 days a week (Monday, Wednesday, and Friday) on her left leg (Figure 3).

Her hypertension was treated with antihypertensive and antidiuretic medication (furosemide and valsartan), and her diastolic blood pressure stabilized to 80 mm Hg. After 4 weeks of

Figure 2.
ULCER SIZE



The graph indicates the Martorell's ulcer size of our patient in mm² over the treatment course. Day 0 = start of treatment; day 56 = end of treatment.

treatment with WMCS, the size of her Martorell's ulcer reduced from 5,680 mm² to 2,560 mm², and the sizes of the satellite lesions were reduced as well (Figure 2). Following 8 weeks of treatment with WMCS, the size of the Martorell's ulcer further reduced to 480 mm² (Figure 2), and the satellite lesions were healed (Figure 4). Two weeks after WMCS use, the patient's self-reported VAS score reached 0, and opioids were discontinued.

DISCUSSION

Of the 900 cases of Martorell's ulcer that have been reported, only 23 relevant articles were identified by Vuerstaek et al,¹⁷ in which 615 cases of Martorell's ulcers are described. This patient presented with the main clinical characteristics of Martorell's ulcer, such as chronic hypertension, the absence of clinically significant arteriosclerotic large artery occlusive disease, and the presence of satellite lesions. In addition, several other criteria such as (1) the location of ulcer on the anterolateral part of the lower legs, (2) the lack of chronic venous insufficiency, and (3) strong, increasing pain levels were also described by this patient.¹

This patient had been suffering from chronic hypertension for 30 years. Before the application of the WMCS technology, she was treated with an antihypertensive agent, among other therapies, to reduce and stabilize her diastolic blood pressure. Moreover, this patient's ulcers had been present for approximately 20 months, and there was no response to topical treatments for ulcer healing, whereas enlargement of the ulcer was observed just before the initiation of WMCS therapy. Characteristic

satellite lesions appeared (Figure 1) and progressively reduced in size (Figure 2).

Although the clinical appearance of Martorell's ulcers tends to be consistent, the ulcers' physiology can be very similar to the livid, elevated edges of a pyoderma gangrenosum ulcer.¹⁵ Given a deep ulcer, it may be even more difficult to differentiate between the two; histopathology is required.¹⁷ However, in this case, the ulcer was superficial so the distinction was easier. Further, a better distinction was made based on several important pathophysiologic findings such as (1) the exclusion of arterial occlusive disease of the lower limbs and (2) the hyalinization and thickening of the arteriole media. These findings were supported by the results of the biopsy.

The usual methods of treating Martorell's ulcer are (1) surgical treatments that involve the debridement of devitalized tissue with second intention closure, (2) skin grafting, and (3) lumbar sympathectomy. Surgical treatment, in combination with anticoagulation, is the mainstay for invasive treatment of Martorell's ulcer, and surgical closure of lesions greater than 4 cm² is recommended.^{16,18} Skin grafting is also a promising treatment strategy.¹⁹ However, both of these methods are invasive, and neither is pain-free. Lumbar sympathectomy aims to promote vasodilation, improve perfusion of the affected limb, and control pain; it is a relatively low-risk operation.²⁰

However, reported results of these treatments are variable, ranging from complete recovery to little impact on healing.²¹ In this case, the WMCS technology proved to be an effective, low-risk, pain-free noninvasive alternative to the usual methods of treatment.

Local wound care measures, such as hyperbaric oxygen therapy, have also been suggested for this condition, but there is no significant evidence in the literature to support its use.¹⁰ Hyperbaric oxygen therapy promotes healing of chronic wounds, but its beneficial effect on Martorell's ulcer is not yet documented. In a recent pilot study, patients with Martorell's ulcer were treated with vacuum-assisted closure. However, this technique also needs further investigation.²²

The current case report suggests that WMCS can be an effective method of local wound care for Martorell's ulcer. Overall, the outcomes of WMCS therapy included quick healing with no infections, positive effects seen only 1 week after starting treatment, a pain-free patient after 2 weeks, excellent tolerability with no adverse reactions, and easy application of the device.

CONCLUSIONS

Based on the results of this case study, the authors suggest that an effective approach to the treatment of Martorell's ulcer is the combination of WMCS technology and antihypertensive agents. It would be useful to investigate the performance of

Figure 4.
LOWER LEFT LEG AFTER 8 WEEKS' TREATMENT



WMCS treatment on more patients with Martorell's ulcer, either in combination with selective antihypertensive agents such as calcium-channel blockers and angiotensin-converting enzyme inhibitors⁶ or with other antihypertensive selective β_1 blockers that reduce local vasoconstriction, including highly selective blockers such as bisoprolol¹⁷ or nebivolol.²³

To the authors' knowledge, this treatment has not been previously documented for this type of ulcer. It would therefore also be useful to extend the investigation of the effectiveness of WMCS as a preventive measure and in early treatment for patients who show initial symptoms for the development of painful ulcers (eg, with chronic hypertension) and especially in those for whom ulcer diagnosis is ambiguous. ●

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