Use of bioelectric stimulation therapy in wound healing

Microcurrent therapy is cost effective, reduces hospitalisation time and is safe and easy to use. Introducing KFH Novo, a state-of-the-art device, into hospitals and private care could bridge the gap between acute and chronic wound care

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This article focuses on the mechanism of action of microcurrent therapy in wound care, its advantages and the potential benefits for hospitals and patients. It also introduces KFH Novo as a new device for microcurrent therapy.

Introduction

Bioelectrical stimulation therapy (BEST) is defined as the application of microelectric current from electrodes placed directly within a wound or on skin in close proximity to the wound. Its use in wound healing is not new: the use of electrostatically charged gold leaf to enhance the healing of smallpox lesions was noted about 300 years ago[1] and was rediscovered in the 1960s.[2] During the last three decades, the number of published, successful clinical trials has increased, resulting in wide acceptance of the use of BEST for the treatment of chronic soft tissue wounds.[3]

As a consequence, BEST was approved in 2002 for payment by the US Centers for Medicare and Medicaid Services for the treatment of pressure ulcers and wounds that have not responded to standard wound treatment.[3] BEST is a very safe therapy, with no known side-effects or interactions with wound dressings or medicines.[4] This article will focus on a specific form of BEST, called microcurrent therapy.

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Mechanisms of action

Several investigators have reported measuring electronegative voltages from the surface of intact skin and electropositive voltages from the dermis of superficial wounds.[5] Natural bioelectric fields manifesting as ionic current in injured tissues were first demonstrated in 1830 by Matteuci. McGinnis and Vanable have shown that currents escaping through healing wounds and their accompanying lateral voltage gradients are gradually reduced and, ultimately, ultimately, disappear as the resistance created by newly regenerated epithelium increases and the wound heals over.[6]

Different mechanisms are responsible for the beneficial effects of electric fields on wound healing (see Table 1). One important mechanism is by directing cell migration (galvanotaxis).[7] The electric fields guide migration of cells needed for skin regeneration, such as keratinocytes and macrophages, and thus enhance the re-epithelialisation.

Second, microcurrent therapy enhances soft tissue healing by triggering the opening of voltage-sensitive calcium channels in the fibroblast plasma membrane.[3] As a consequence, upregulation of insulin and TGF-ß receptors on the cell surface may cause increased rates of collagen and DNA synthesis, the latter of which suggests that fibroblasts are stimulated to proliferate.

Third, microcurrent has been shown to increase production of vascular endothelial growth factor (VEGF) responsible for angiogenesis. [8] This, in turn, is responsible for improved local transport of oxygen and nutrients resulting in increased survival of cells involved in wound healing and increased resistance to infection by enhancing oxidative killing of bacteria by neutrophils.[9]

Other effects of microcurrent therapy include increased synthesis of proteins, the building blocks of the body,[10] and an increase

Table 1. Mechanisms of action of microcurrent therapy
Cell migration (galvanotaxis)
Increased rates of collagen and DNA synthesis
Increased angiogenesis via production of VEGF
Increased local tissue oxygen tension
Increased synthesis of proteins, the building blocks of the body.
Increase in intracellular ATP levels, providing energy to restart the healing process

Table 2. Advantages of microcurrent therapy for hospitals
Reduced bed time in acute care
No extra nursing resources needed
Decreased nursing time
No need to change standard wound care

in intracellular ATP levels, providing energy to restart the healing process.[11]

New device using microcurrent therapy

KFH Novo (Kingfisher Healthcare NV, Belgium, www.kfhealth.com) utilises the most advanced form of microcurrent therapy in providing a new solution to assist in wound healing. The KFH Novo is a small, portable medical device, designed to be used in a hospital environment or at home. This European-wide approved medical device contains state-of-the art technology. It features a patented, interactive touchscreen front panel and has unique output parameters to optimise wound healing. The potential benefits of KFH Novo are summarised in Table 2.

Currently, this system is the only technology that allows clinics to stick to their preferred standard therapy, as the KFH Novo treatment is located entirely outside the wound and bandage area. Compared with other techniques available for the treatment of chronic wounds, including vacuum-assisted closure, treatment with the KFH Novo is extremely cost-effective, as it can be offered for a very low daily cost. KFH Novo therapy is additional to standard care therapy; however, its potential to significantly shorten the period of hospitalisation can contribute to an overall reduction in costs.

The KFH Novo device is very simple to operate. Patients can be treated in the clinic, or they can even treat themselves in the clinic (resulting in a reduction of nursing time) or at home. The electrodes, which are applied to the skin with a hypo-allergenic gel, are intended for single patient use and need to be changed after eight to 10 applications. Therefore, the device will come with monthly patient packs, containing seven packs of two electrodes.

Standard treatment with KFH Novo takes one hour, twice daily, until the wound has healed. In function of the wound size, this treatment time can be reduced.

Microcurrent therapy is known to be very

BEST temporarily increases the local tissue oxygen tension, which results in increased survival of cells involved in wound healing and increased resistance to infection by enhancing oxidative killing of bacteria...

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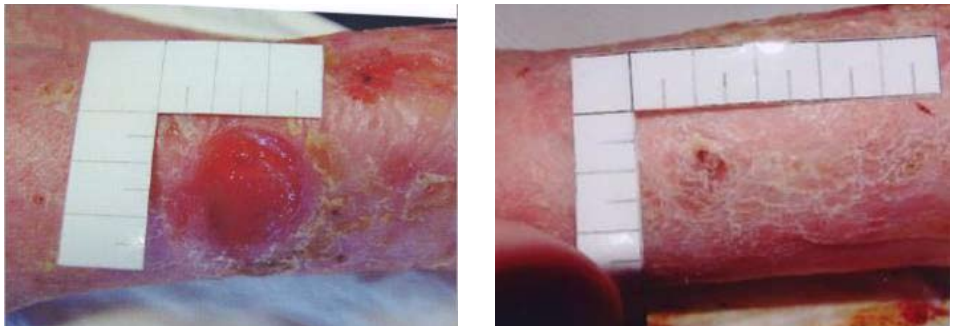
Figure 1. Large pressure ulcer, baseline (a) and after six weeks of treatment (b).

Figure 2. Venous ulcer, baseline (a) and after six weeks of treatment (b)



safe, with no known side-effects or interactions with wound dressings or medicines. KFH Novo treatment can be used to assist in wound healing of venous leg ulcers, pressure sores, chronic wounds and diabetic ulcers.

The beneficial effect of treatment with KFH Novo on chronic wounds is shown in Figures 1 and 2. Figure 1a shows a large pressure ulcer in an 81-year-old female patient suffering from diabetes. This pressure ulcer was resistant to therapy and was open for more than four months. After six weeks of treatment with KFH Novo, the wound healed completely (see Figure 1b).

In a second case, an 82-year-old female patient suffered from venous insufficiency, resulting in a therapy-resistant chronic leg ulcer which was open for more than 1.5 years (see Figure 2a). Again, after only six weeks of treatment with KFH Novo, wound healing was complete, as shown in Figure 2b.

Currently, a clinical trial (ULTRA-BEST) to evaluate the efficacy of bioelectric stimulation therapy, and more specifically the KFH Novo system, in the healing of chronic venous leg ulcers is ongoing (NCT00678847). Fifty patients are included in this randomised, double-blind, placebo-controlled study – the final results of which are expected in 2009.

Conclusion

Microcurrent therapy does not interfere with standard wound care. It is a cost-effective therapy, reducing the time of hospitalisation, and is safe and easy to use. The new KFH Novo is a state-of-the-art device that covers all these advantages using microcurrent therapy for treatment of wounds. Introduction of this new device into hospitals and private care might be the way to bridge the gap between acute and chronic wound care. ■

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