Wireless Micro Current Stimulation (WMCS) - An Innovative Technology for Management of Hard to Heal Wounds

Konstantinos Poulas
Associate Professor,
Department of Pharmacy, University of Patras
GREECE

kpoulas@upatras.gr

IT IS WELL KNOW THAT THE CURRENT:

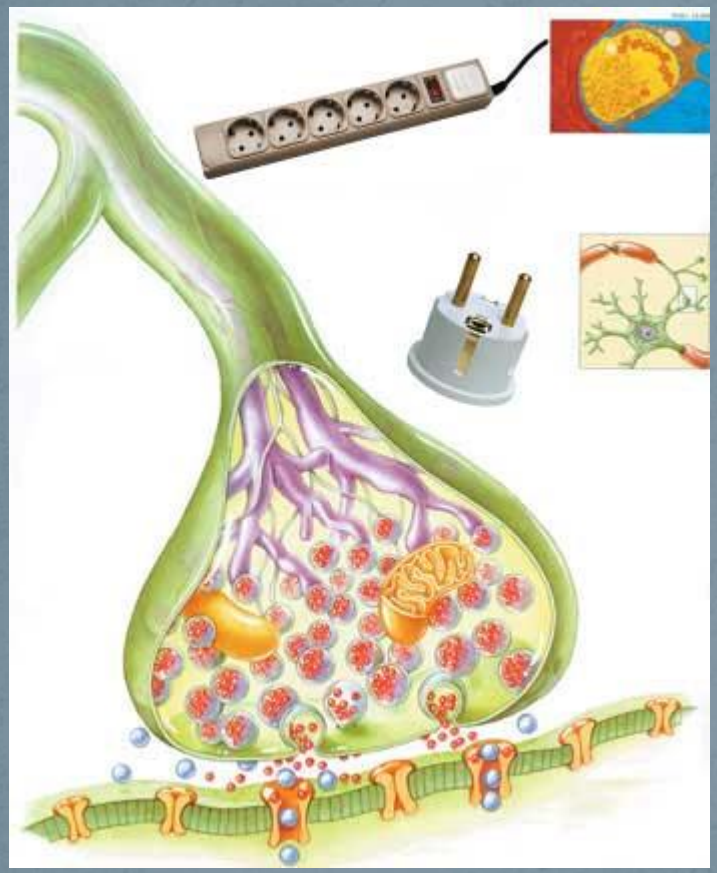
Can influence cell functions

Can influence structure and function of molecules

Can influence signal transmission and information carriage

NEURONS: CELLS THAT PRODUCE ELECTRICAL CURRENT

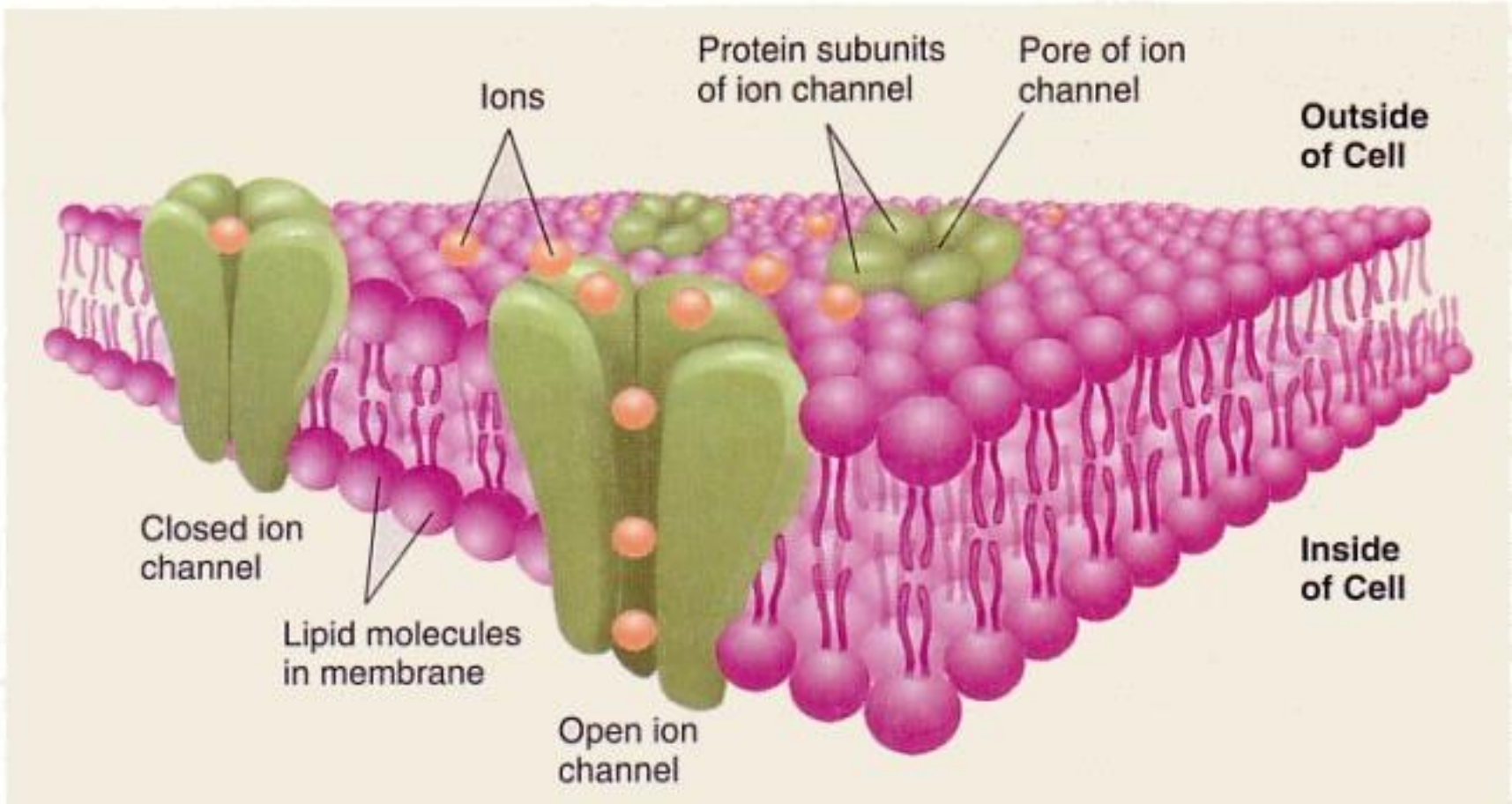
Synapses



- Nerve cells are connected to one another by special electrical circuits known as synapses, which prevent the body's electrical system—the brain, spinal cord and nerves—from being damaged.

Ion channels

Ion channels. When they are open, ions can pass through them, entering or leaving the cell.



Electricity = Drug?

- Modern medicine used to focus for intervention on three main (although not exclusive) approaches:
- A. surgery,
- B. irradiation and,
- C. (Bio)chemistry.

- This trinity **does not capitalize** on one modality long known for its key role in many functions in cell and, most important, in whole organism level: **electric currents**.

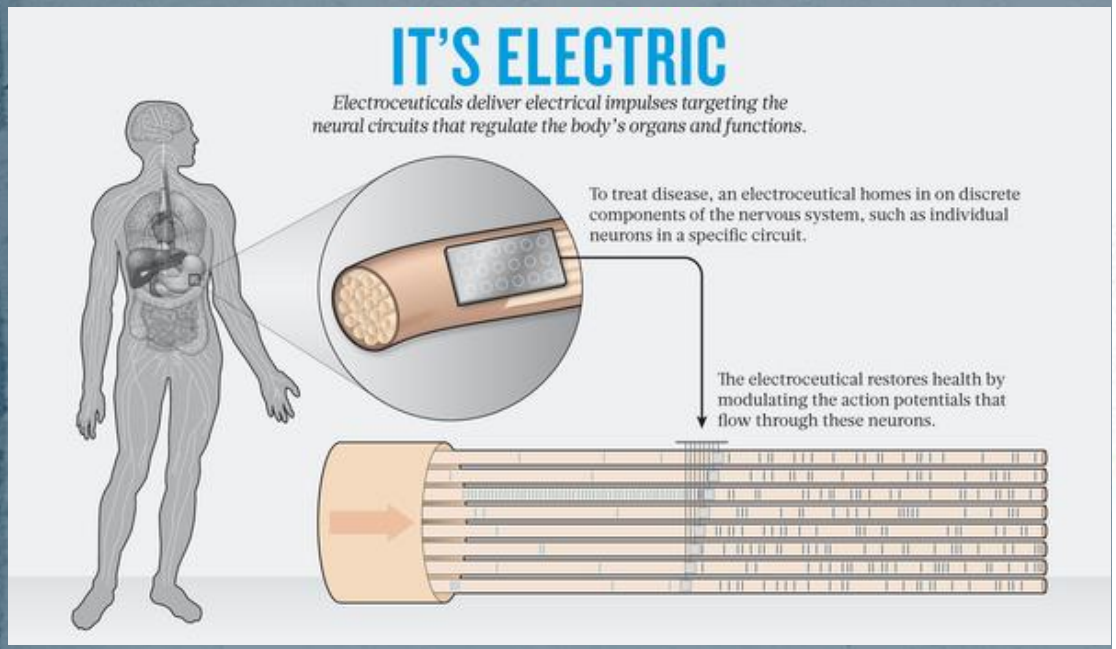
- There is indication enough that therapeutic use of electric currents or fields (which result in currents) may exert its therapeutic potential at an upstream level compared to chemicals

- Such protocols may be used uniformly for multiple ailments with a common basis; such grouping may be much larger and more generalized than similar ones currently attainable by biochemical pharmaceuticals.

- Thus, the concept of **"electroceuticals"** emerges, which is used to describe different modalities, differing in principle, form, quantity, time and other parameters, but focused on administering an external or induced electrical current for amending impaired biological functions.

GSK Bioelectronics

D rug discovery: A jump-start for electroceuticals, Kristoffer Famm, Brian Litt, Kevin J. Tracey, Edward S. Boyden & Moncef Slaoui Nature 496, 159–161 (11 April 2013)

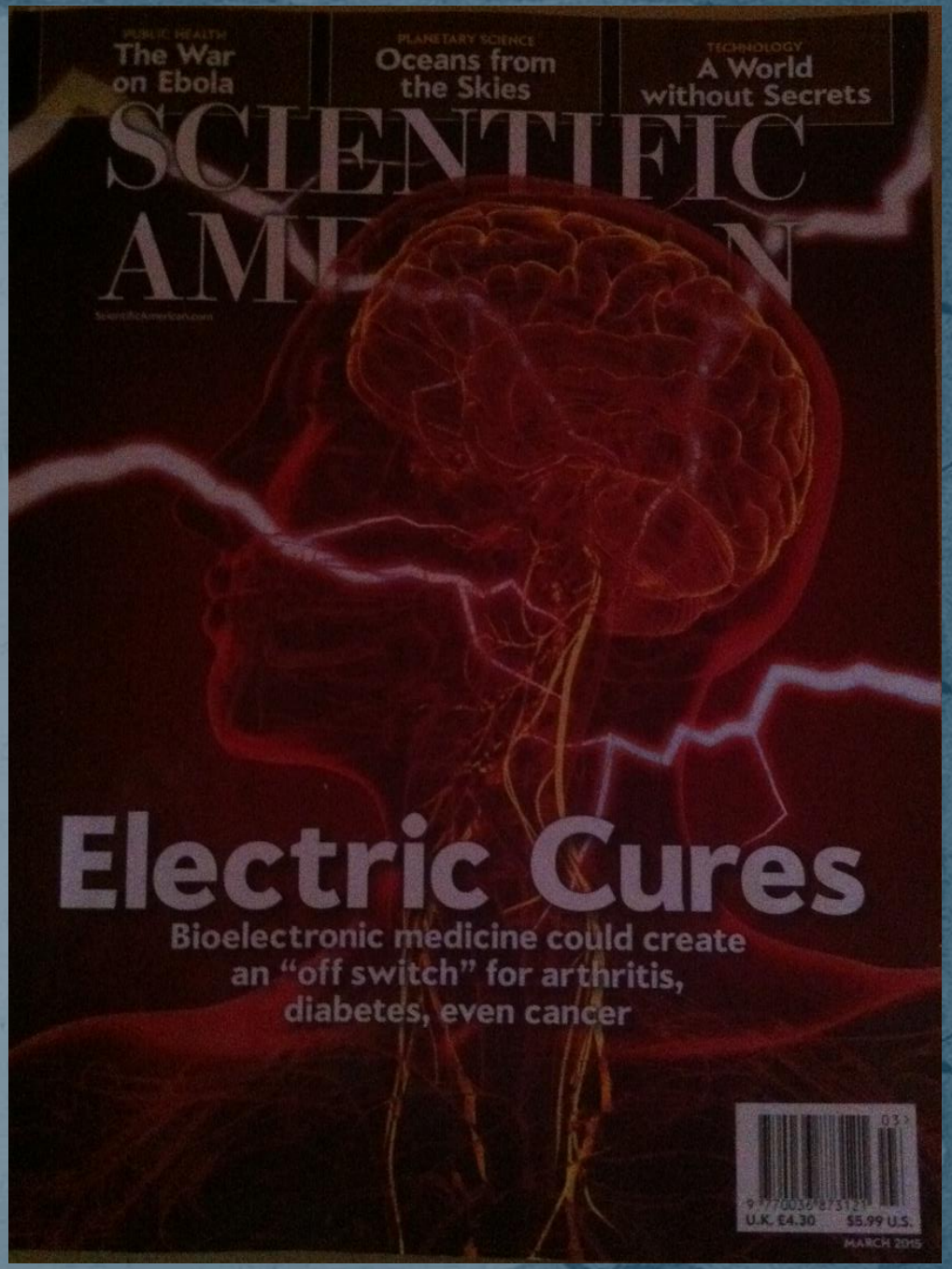



NEWS

Charged by GSK investment, battery of electroceuticals advance

Electric Cures:

Scientific American, March 2015



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Chronology	Accomplishments-events
1st millennium BC	Amber and magnetite (static electrism) used by Egyptians for headache and arthritis.
420 BC	Hippocrates prescribes shocks from torpedo fish
5th c BC	Asklepeia near ionized water environment (falls).
17th c AD	Golden artifacts, charged, to treat smallpox lesions.
1752	Franklinism by Ben Franklin; static electricity to relieve pain.
1800s	Galvanism; DC to relieve pain.
1825	Sarlandiere and Berlioz combine Galvanism ES and acupuncture.
1832	Faradism; use of AC for ES; Duchenne employs it for muscle stimulation.
1850	Publication of the use of ES for bone fractures in US.
1888	D'Arsonvalisation: use of high frequency currents.
1900	Carnage foundation establishes Fleiner committee.
1910	Fleiner results discontinue ES in the US.
1930s	ES modalities actively marketed in Europe.
1944	Galvanic Exercise for wounded personnel of US Armed Forces.
1957	Electric properties of the bone first published by Fukada & Yasuda.
1960s	ES effect on cell wall-principle of electroporation.
1967	Wall &Sweat: 100Hz ES in skin proved analgesic.
1970s	Bruce Lee perfects galvanic exercise for accelerated training.
1980s	Regular ES use in sports injuries and muscle atrophy; discovery of skin battery potentials; antimicrobial effect of ES in vivo, usual treatment of bone fractures.
1982	Cheng et al publish the impact of ES to ATP generation.
1990s	Wound healing by ES becomes prominent.
2000s	Development of NCCT combining different ES schemes' advantages.
2010s	Massive development of different ES schemes and approaches.
2013	Concept of electroceuticals.

Electrical stimulation (ES) is used (traditionally) for wound healing

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Difficulties

I) The electrodes can cause pain
II) Difficulties in usage
III) Infection danger
IV) Can not be used for large wounds

Electrical stimulation (ES) is used (traditionally) for wound healing

Konstantinos Poulas, University of Patras, GREECE

"Current of Injury"

Potential difference

Cells of repair

Electric fields in the edge of the wound

In a chronic wound this process is interrupted

Vol 442|27 July 2006|doi:10.1038/nature04925 nature

LETTERS

Electrical signals control wound healing through phosphatidylinositol-3-OH kinase-γ and PTEN

Min Zhao[1], Bing Song[1], Jin Pu[1], Teiji Wada[2], Brian Reid[1], Guangping Tai[1], Fei Wang[3]†, Aihua Guo[1], Petr Walczysko[1], Yu Gu[1], Takehiko Sasaki[4], Akira Suzuki[5], John V. Forrester[1], Henry R. Bourne[3], Peter N. Devreotes[6], Colin D. McCaig[1] & Josef M. Penninger[2]

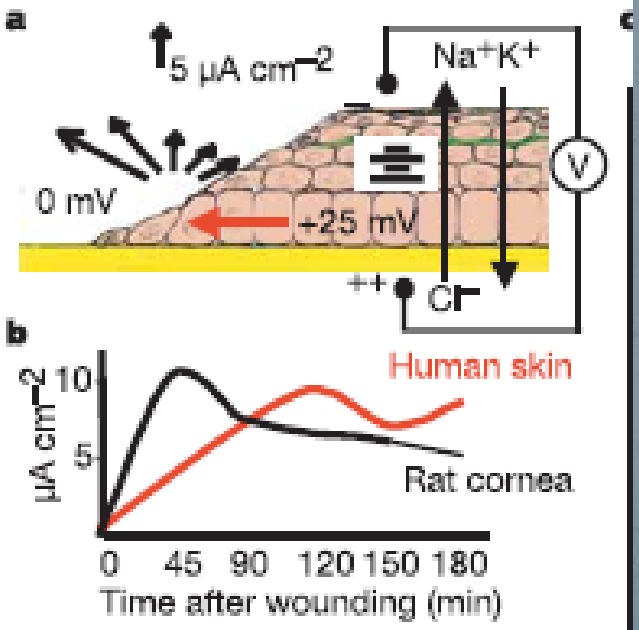
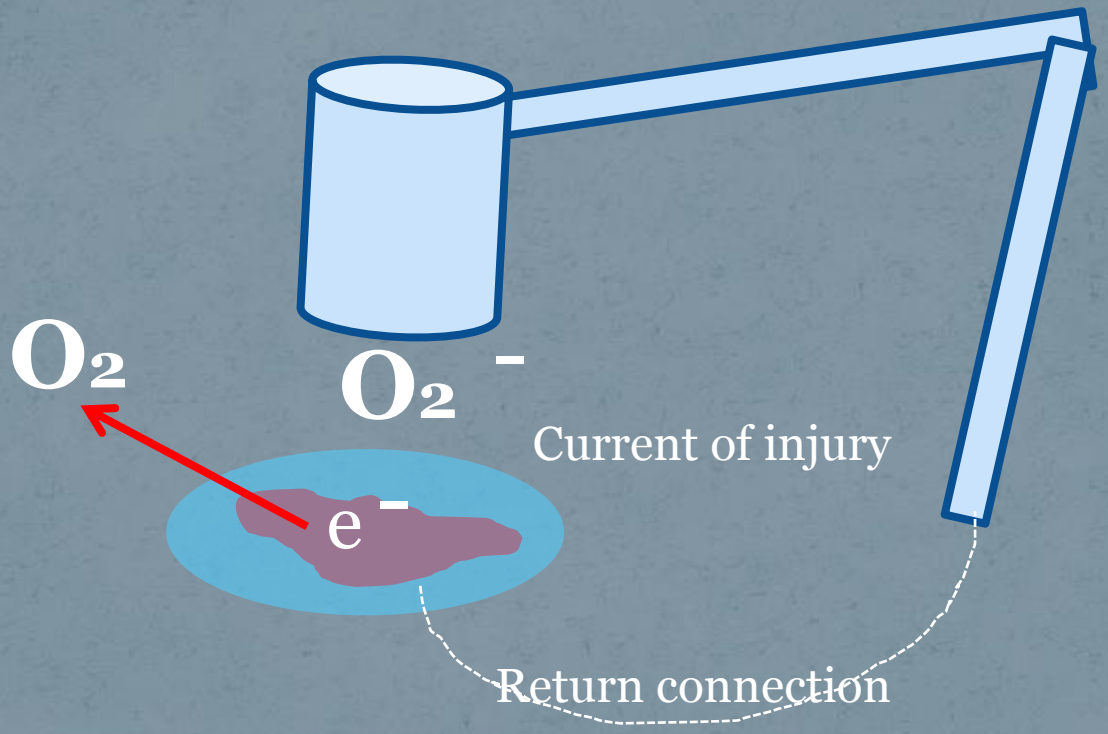


Figure 1 | Electrical signals direct cell migration in wound healing and activate selected signalling pathways. a, Wounding induces lateral electric fields directed towards the wound centre (red arrow), by collapsing the local transepithelial potential difference (V). Black arrows represent sizes and directions of currents. **b**, Directly measured currents increase over time in

WMCS
Wireless Micro Current Stimulation



Konstantinos Poulas, University of Patras, GREECE

B

C D E

Wireless Electrical Stimulation: An Innovative Powerful Tool for the Treatment of a Complicated Chronic Ulcer

Extremity Wounds
XX(X) 1–4

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SAGE

Castana Ourania[1], Aekaterini Dimitrouli[1], Theodoros Argyrakos[1], Emilia Theodorakopoulou[2], Nektarios Stampolidis[1], Emmanouil Papadopoulos[1], Athanasios Pallantzas[1], Ioannis Stasinopoulos[1], and Poulas Konstantinos[3]

Use of Wireless Microcurrent Stimulation for the Treatment of Diabetes-Related Wounds: 2 Case Reports

Adisaputra Ramadhinara, MD, and Konstantinos Poulas, PhD

ABSTRACT

Wireless microcurrent stimulation (WMCS) is a new method in wound healing that may have advantages compared with conventional electrical stimulation (ES) devices. Although ES has been widely known as an effective method to promote the wound-healing process in patients with type 2 diabetes mellitus, to the authors' knowledge, there are still no data about the ability of WMCS to match the desired effect. In this article, the authors report the results of 2 cases of diabetes-related wounds (1 acute and 1 chronic) that have been treated successfully using WMCS. Neither patient reported discomfort during treatment, and the risk of infection was minimized because there was no direct contact from the device during the treatment course.

KEYWORDS: electrical stimulation and wound healing, microcurrent stimulation, diabetic ulcer, acute and chronic wounds

ADV SKIN WOUND CARE 2013;26:1–4

Clinical experience with a new electrical stimulation (ES) technique, the wireless micro current stimulation (WMCS), for the treatment of chronic wounds is described. WMCS transfers the current to any surface wound from a distance, by using oxygen's and nitrogen's ability to exchange electrons. We studied 47 patients with hard-to-heal wounds. Patients with venous, arterial and mixed leg ulcers were predominant; other aetiologies such as diabetic foot lesions, pressure ulcers, vasculitis and pyoderma were also included. WMCS treatment protocol specified treatment twice or thrice per week, for 45–60 minutes per session, with 1·5 μA current intensity. Standard wound care was applied to all patients, including compression bandages, if necessary. Clear progress of wound healing, even after 2 weeks, was observed in all cases. The mean reduction of the wound surface after WMCS treatment was 95% in 8 weeks. Complete healing was achieved within 3 months for the majority of the cases. No clinical side effects were observed. WMCS technology significantly accelerated wound healing for patients with hard-to-heal wounds of different aetiologies. This new therapy offers multiple advantages compared with the previous methods of ES, as it is contactless, free of pain and very easy to use.

47 patients

1.5 μA

95% reduction in 8 weeks

International Wound Journal ISSN 1742-4801

ORIGINAL ARTICLE

Wireless micro current stimulation — an innovative electrical stimulation method for the treatment of patients with leg and diabetic foot ulcers

Peter G Wirsing[1], Alexander D Habrom[1], Thomas M Zehnder[2], Sandra Friedli[2] & Marlise Blatti[2]

1 Wundzentrum, Ostalb-Klinikum Aalen, Aalen, Germany
2 Angiologie, Spital STS AG Thun, Thun, Switzerland

Key words
Chronic wounds; Diabetic foot; Electrical stimulation; Leg ulcer; Wireless micro current stimulation

Wirsing PG, Habrom AD, Zehnder TM, Friedli S, Blatti M. Wireless micro current stimulation – an innovative electrical stimulation method for the treatment of patients with leg and diabetic foot ulcers. Int Wound J 2013; doi: 10.1111/iwj.12204

Figure 9 Wound at (A) treatment start (525 mm^2), (B) after 4 weeks (265 mm^2) and (C) after 16 weeks (190 mm^2).

Wireless micro current stimulation — an innovative electrical stimulation method for the treatment of patients with leg and diabetic foot ulcers

Peter G Wirsing[1], Alexander D Habrom[1], Thomas M Zehnder[2], Sandra Friedli[2] & Marlise Blatti[2]

1 Wundzentrum, Ostalb-Klinikum Aalen, Aalen, Germany
2 Angiologie, Spital STS AG Thun, Thun, Switzerland

Figure 5 Wound at (A) treatment start (875 mm^2), (B) after 4 weeks (630 mm^2) and (C) after 10 weeks (251 mm^2).

OTHER CASES

1st month of WMCS therapy

4th month of WMCS therapy

12th month of WMCS therapy

OTHER CASES

Healing of the wound after 8 days of WMCS therapy

2nd day after WMCS therapy

day after WMCS therapy

8th day after WMCS therapy

WMCS and Burns

Figure 2. *Photographs illustrating the burn 1 hour post injury (A) and following WMCS treatment (B, C, D, E, F, G and H). B: Day 2, (after 1 session). C: Day 4 (after 3 sessions), D: Day 5 (after 6 sessions), E: Day 9 (after 8 sessions), F: Day 11 (after 10 sessions), G: 1 week after last WMCS sessions (i.e. 1 week after Day 11), H: 1 month after WMCS sessions.*

Conference

MOBIHEALTH 2014, Athens Greece

WIRELESS MICRO CURRENT STIMULATION TECHNOLOGY IMPROVES FIREWORK BURN HEALING.

Konstantinos Poulas, University of Patras, GREECE

Charcot Disease (A week after)

Charcot Disease (Two weeks after)