

University of Patras

Department of Pharmacy, Greece



APPLICATION OF WIRELESS MICROCURRENT ELECTRICAL STIMULATION IN TREATMENT OF COMPLICATED WOUNDS: CLINICAL & IN VITRO STUDIES

Konstantinos Poulas^{1¥}, Manousos E. Kambouris¹, George Lagoumintzis¹, Adisaputra Ramadhinara²

¹University of Patras, Dept of Pharmacy, Greece, ²University of Jakarta, Wound Medical Care Service Center, Indonesia

[¥]Corresponding author: Tel: +30 2610-969953, E-mail: <u>kpoulas@upatras.gr</u>



University of Patras

Department of Pharmacy, Greece



BACKGROUND

□ Electrostimulation (ES) is an effective method for accelerating wound healing. ES was traditionally conducting current through pads in contact with the body, restarting the wound-healing process by mimicking the "current of injury".

□ The method was not adopted widely, because of disadvantages related with the proximity of the electrodes with the tissues next to the wound, causing discomfort and possibly infection.



University of Patras

Department of Pharmacy, Greece



PRIMARY AIM

□ We here present results of the use of innovative device, based on the method of Wireless Micro Current Stimulation (WMCS), for rapid and effective wound healing.

 \Box By using *Wetling*[®] device, charged air gases (O₂ ions) are used to create/maintain the electric current to the wound, without any contact with the tissue.



University of Patras

Department of Pharmacy, Greece



DESIGN OF STUDY-METHODS

We have assessed WMCS in a number of cases and we present the treatment of two complicated cases:

□ A 70-years-old male, with a hard-to-heal chronic diabetic ulcer, at the lower right leg which had been amputated at the ankle level, due to a serious diabetic ulcer.

□ A 47-years-old female, with a known type 2 diabetes, presented with cellulitis on the left hand after a skin injury due to neuropathy, as a complication of her diabetes



University of Patras

Department of Pharmacy, Greece



RESULTS

 \Box Both cases were treated with WMCS apparatus only, using 1.5 μ A for 1 hour daily (Case 1) and every other day (Case 2), plus standard wound care.

□ Both ulcers were healed following WMCS therapy (Figure 1 & Figure 2), while assays have shown abundance of myofibroblasts and focal increase of mast cells (Figure 3).

□ The rapid progress of wound healing in the above patients using WMCS seems very promising and the method indeed very effective.



University of Patras



Department of Pharmacy, Greece

CASE 1



Figure 1: Indicative figures taken before (A) and after treatment (B-C). A: Day 0, before treatment, B: Day 10, C: Day 45.



University of Patras



Department of Pharmacy, Greece

CASE 2



Figure 2: Indicative figures taken before (A) and after treatment (B-C). A: Day 0, before treatment front and side aspect. B: Day 5 (after 3 sessions) front and side aspect, C: 3 weeks after the last session front and side aspect.



University of Patras

Department of Pharmacy, Greece



Figure 3: Histological staining of patients' tissue samples during the WMCS treatment. A: increased myofibroblastic proliferation, B: focal increase of mast cells, C: CD117 staining of mast cells (c-kit antigen).



University of Patras

Department of Pharmacy, Greece



CONCLUSIONS

The two clinical cases tested herein clearly indicate that **WMCS promotes an excellent wound healing result** in skin trauma, even if of considerable extend and depth.

□ The treatment for these patients was **non-invasive with minimal risk of infection**. Both patients **didn't report any side effect** from the treatment nor discomfort.

□ The implementation of ES by WMCS technology is a promising approach to promote wound healing in patients with chronic ulcers on the ground of diabetes type 2.



University of Patras

Department of Pharmacy, Greece

REFERENCES

 ✓ Kloth LC. Electrical stimulation for wound healing: a review of evidence from in vitro studies, animal experiments, and clinical trials. *Lower Extremity Wounds* 2005;4(1):23-44.

✓ Cutting KF. Electrical stimulation in the treatment of chronic wounds. *Wounds* 2006;2:3-11.

✓ Zhao M, Penninger J, Isseroff RR. Electrical Activation of Wound-Healing Pathways. *Adv Skin Wound Care*. 2010;1: 567–573.

 ✓ Castana O, Dimitrouli A, Argyrakos T, Theodorakopoulou E, Stampolidis N, Papadopoulos E, Pallantzas A, Stasinopoulos I, Poulas K. (2013) Int J Low Extrem Wounds. 12(1):18-21.

AKNOWLEGEMENTS

This study was funded by an FP-7 Research potential Program/Regpot SEEDRUG of University of Patras. (Grant number: EU FP7 REGPOT) CT-2011-285950