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Image analysis parameters to quantify the healing of superficial model wounds in vivo

Stephan Bielfeldt (1), Arne Böhling (1), Sabrina Laing (1), Klaus-P. Wilhelm (1)

(1) proDERM Institute for Applied Dermatological Research, 22869 Schenefeld, Germany

Introduction

A wide range of topical drugs and dermocosmetics are on the market that claims to improve the healing of superficial wounds. In vivo test methods on humans with minimal invasive abrasive model wounds that avoid formation of scars are available to proof such claims (2). For superficial wounds, different aspects of healing are of importance. Two important of them are: First, the early closure of the wound that stops the excessive transepidermal water loss (1, 3). And second, the active contraction of the wound that is caused by myofibroblast activity (4). In this poster we introduce image analysis methods for these two aspects of healing.

Material & Methods

Superficial wounds of approximately 10 mm in diameter were raised on the forearms of healthy subjects with the abrasive wound model (5). For 2 test products and untreated control the healing of the wounds was documented by highly reproducible advanced photography with a dermatoscope equipped with a CLR camera (Dermlite®, Canon EOS 5D, 24 M Pix). Photographs were taken directly after wound raising and on days 3, 5, 8, 9, 10, 12, 15. An image analysis tool was developed that allowed easy interactive color-marking of wound margins on the wound images. The experts who demarcate the wound margins could easily change the wound image size from original wound size up to 38 fold magnification without loss of image resolution. Processing of large sets of evaluated images by calculation of wound areas from the demarcation lines was performed automatically (5).

Results

The two parameters revealed distinctly different aspects of wound healing. Starting already on the first days of wound healing the formation of a thin layer spreading from the wound borders was observed. As a parameter for early wound closure the wound area that was not yet covered with a thin layer was demarcated. On the observed wounds it took about 12 to 15 days to close the wound with a thin layer. Distinct differences among the treatments were observed. The dimension of closure time fits well to previously published data where abrasive wounds treated with adhesive dressings were investigated (6).

To measure the contraction of the wound the original wound margin was demarcated. During the course of wound healing the wound area under all treatments decreased until day 9 and from then started to increase again, without coming back to original size even on investigation day 15. The wound contraction data reveals distinct treatment differences in onset, magnitude and



partially also degradation of myofibroblasts activity.

Conclusions

We conclude that the two presented imaging parameters are well applicable for abrasive wounds. Compared to direct clinical wound assessments they are more precise and objective and well verifiable by simple inspection of the demarcated images.

Literature

- (1) Czaika et. al., 2012, “Comparison of Transepidermal Water Loss and Laser Scanning Microscopy Measurements to Assess Their Value in the Characterization of Cutaneous Barrier Defects”, *Skin Pharmacol Physiol*, 25(1): 39–46
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- (3) Kottner et. al., 2013, “Characterisation of epidermal regeneration in vivo: a 60-day follow-up study”, *J wound care*, 22(8): 395–400
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