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

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Introduction

For a wide range of topical applied drugs and cosmetics, improvement of healing of superficial wounds is claimed. In vivo test methods on humans are available to proof such claims (2). For superficial wounds two aspects of healing are of interest and will be discussed on this poster: 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.

Materials & Methods

Superficial wounds of approximately 10 mm in diameter were induced on the forearms of healthy subjects with the abrasive wound model (5). For 2 topical test products and untreated control the healing of the wounds was documented by highly reproducible advanced photography. A dermatoscope equipped with a SLR camera (DermLite®, Canon EOS 5D, 22 M Pix) was used. Photographs were taken directly after wound induction and on days 3, 5, 8, 9, 10, 12, 15. An image analysis tool was developed at proDERM that allowed easy interactive color-marking of wound margins on the images. A validated image analysis tool was used for automated processing of the images to calculate the wound areas from the demarcation lines (5).

Results / Discussion

The two parameters of wound healing, (a) open wound area as parameter for early wound closure and (b) outer wound margin as parameter for contraction of the wound, revealed distinctly different aspects of wound healing.

(a) The formation of a thin layer spreading from the wound borders starts already within the first days of wound healing. As a parameter for early wound closure the wound area that was not yet covered with a thin layer was demarcated (Figure 1: red lines). 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, which fit well to previously published data (6).

(b) To measure the contraction of the wound the original wound margin was demarcated (Figure 1: green lines). 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 at the end of observation. On day 15 - in some cases - the original wound margin was not visible anymore. The wound contraction data reveals distinct treatment differences in onset, magnitude and partially also degradation of myofibroblasts activity.

Conclusion

The two presented imaging parameters are well applicable for wound healing studies with abrasive model wounds. Compared to direct clinical wound assessments they are more precise, objective and results are easily verifiable by simple inspection of the demarcated images.

Literature

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