Establishment of a moist environment by a new foam dressing* beneficial for wound healing *in vitro*

B. Morgner [1], M. Abel[2], N. Lobitz[2], C. Roes[3], U.-C. Hipler[1], C. Wiegand[1]

[1]Department of Dermatology, University Hospital Jena, Germany
[2]Lohmann & Rauscher GmbH & Co. KG, Neuwied, Germany
[3]Lohmann & Rauscher GmbH & Co. KG, Rengsdorf, Germany

Introduction

Modern wound dressings are expected to maintain a humid wound milieu, which is thought to aid cell proliferation and migration resulting in faster and better wound healing. Foam dressings are thought to aid in the establishment of a beneficial moist wound environment as they exhibit excellent fluid management capacity by absorbing as well as donating fluid. Therefore, a scratch wound healing model using human fibroblasts and keratinocytes was developed depending on the donation of fluid by the applied dressings. The effect on cell proliferation and migration necessary for wound healing and epithelization was investigated for the new foam dressing (NFD)* and compared to cotton gauze as standard of care dressing (SOCD)**.

Material & Methods

Human dermal fibroblasts (DF) and human epidermal keratinocytes (HaCaT) were seeded into 6-well-plates and cultivated for 48h until confluence before scratching. Cell scratches cultivated in medium served as positive controls for optimal wound healing (figure 1). Samples of NFD (*Suprasorb® P sensitive, Lohmann&Rauscher) and SOCD (**cotton gauze, Fuhrmann) were cut aseptically (d = 3.5 cm), soaked in medium and applied directly on the cell scratches without further addition of medium supply. Cells were stained with hematoxylin/eosin after 1, 6, 24, and 48 hours. Scratches were photographed using a digital microscope (Keyence) and the scratch area was evaluated using the Image J program.

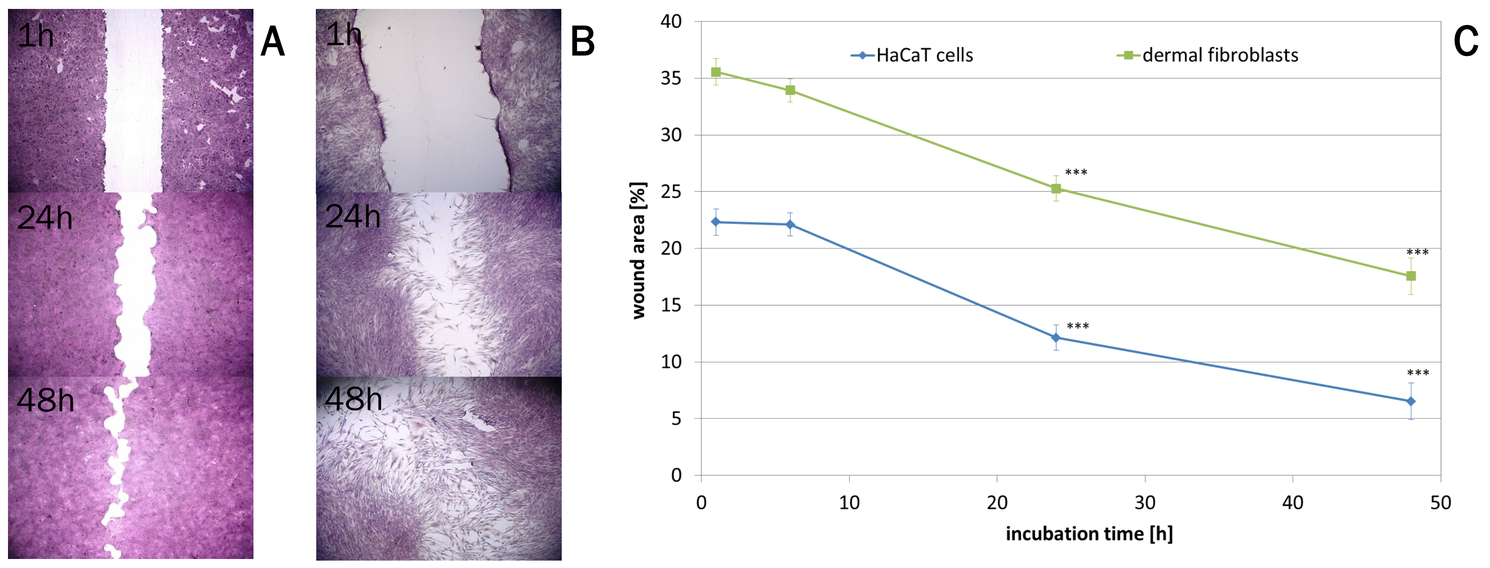

Figure 1: Scratch wound assay with HaCaT keratinocytes (A) and dermal fibroblasts (B) over 48 hours. Cultivation of cell scratches in medium served as positive control for optimal wound healing (C). (*** $p < 0.001$ compared to start of the experiment)

Results

Scratches covered with SOCD cotton gauze exhibited no tendency for healing (figures 2 and 3), which could be attributed to a distinct parching of the cells under the conditions of the scratch wound assay+. Accordingly, cells featured a roundish phenotype and cell confluence was partly lost with the scratches remaining open at the end of the experiment. In contrast, NFD supported the scratch healing *in vitro* by promoting keratinocyte (figure 2) and fibroblast (figure 3) proliferation and migration through establishing a moist wound environment. A slight tendency of the cells to adhere to the foam dressing, which provides a 3D matrix for the cells, could be observed featuring a possible explanation why scratch healing under the dressing samples was slower compared to the medium control.

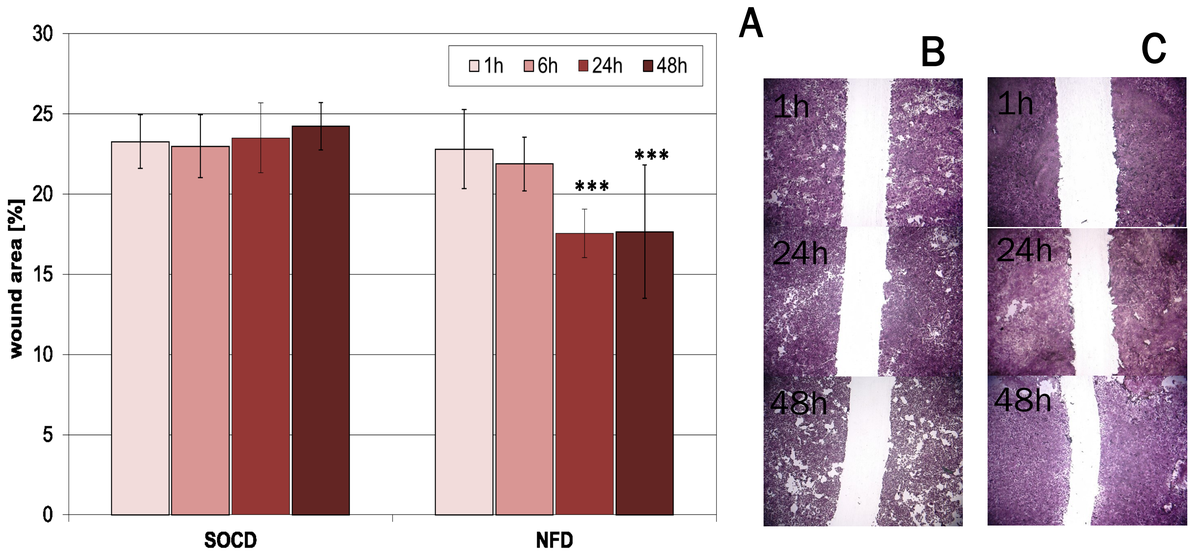

Figure 2: HaCaT keratinocyte scratch wound assay+ (A) with SOCD (B) and NFD (C). (*** $p < 0.001$, compared to SOCD)

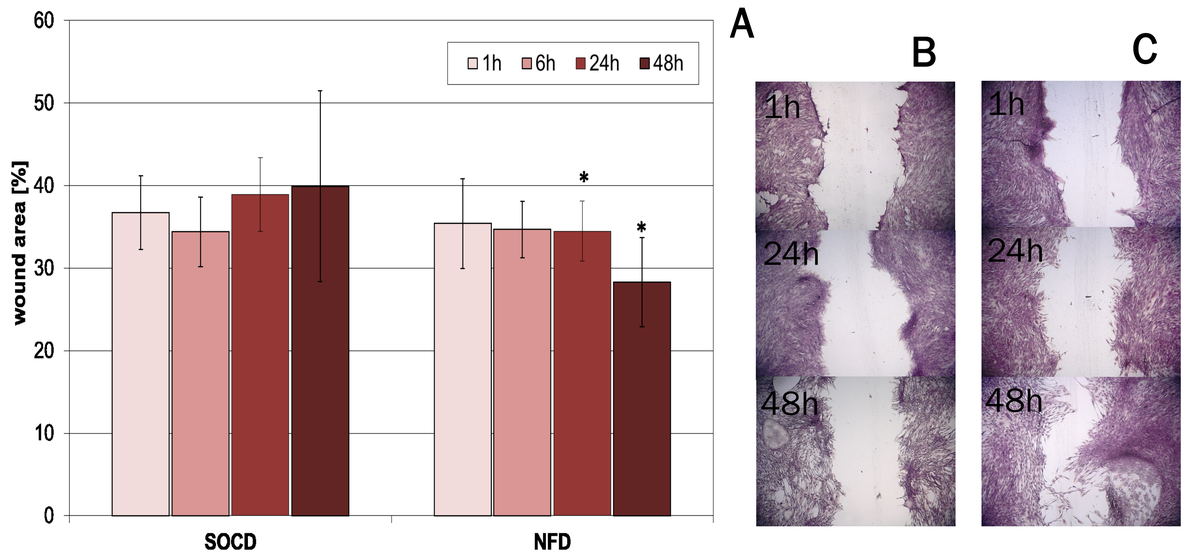

Figure 3: Dermal fibroblast scratch wound assay+ (A) with SOCD (B) and NFD (C). (* $p < 0.05$, compared to SOCD)

Conclusion

A scratch wound healing model using human fibroblasts and keratinocytes depending on the donation of fluid by the applied dressings could be successfully developed. It can be used to assess the capacity of wound dressings for establishing a moist wound environment that is thought beneficial for healing. Here, it could be shown that the NFD is able to promote wound healing in vitro by effectively creating humid conditions favouring wound closure while the SOCD was not able to maintain the moist environment resulting in non-healing cell scratch wounds in vitro.

Journées Cicatrisations 2020, 26.-28. Janvier 2020, Palais des Congrès de Paris