EFFECT OF NON-ADHERING DRESSINGS ON PROMOTION OF FIBROBLAST PROLIFERATION AND WOUND HEALING IN VITRO

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Introduction
Dressings can stick to the wound surface due to dried drainage, ingrowths of newly formed tissue or a clammy dressing surface. This adhesion can cause problems since dressing removal will disrupt the wound bed and destroy newly formed, healthy tissue. Wound contact dressings are non-adhering dressings that are most commonly used during the phase of granulation, tissue formation, and re-epithelialisation. However, any dressing that is applied to a wound comes into intimate contact with cells involved in the healing process. Determination of the effects of different non-adhering wound dressings on cell viability and proliferation during wound healing but also on their migration capacity is consequently of interest. Cell reactions may also be accompanied by changes in cell morphology and structure, where cytotoxic effects lead to the loss of actin and tubulin networks [1] while positive signals could result in an improved expression of these cell structure proteins.

Material & Methods
The non-adhering dressings Lomatuel® Pro (Lohmann & Rauscher), UrgoTüll® (URGO), Atrauman® Impregnated dressing (HARTMANN), and HydroTüll® (HARTMANN) were investigated. Wound dressing samples were cut aseptically corresponding to 1.5 cm x 1.5 cm and specimens were either used directly for testing or were extracted prior to testing. The number of viable, metabolically active cells was determined using the photometric MTT assay. Determination of cell proliferation was carried out using a luminescent ATP assay. For evaluation of cell morphology and structure, the cell nucleus was stained using DAPI. F-actin was dyed with MFP TMDY-549P1-Phalloidin, and tubulin was detected using an anti-alpha-tubulin monoclonal antibody and Alexa Fluor® 488 goat anti-mouse IgG (H+L). NHDF monolayers were scratched with a sterile pipette tip and wound dressing samples were placed directly on the scratch to be incubated for 4, 24, 48, and 144 hours. After the respective incubation periods, cells were stained with hematoxylin and eosin. Micromosaic evaluation was carried out using the Axioscope A.1 (Carl Zeiss GmbH) and images were obtained with the digital camera ColorView II (Soft Imaging Systems).

Figure 1: Cell growth in the untreated control (A) and under the wound dressings Lomatuel® Pro (B), UrgoTüll® (C), Atrauman® (D), and HydroTüll® (E) after 168 hours. Cell layer was visualized by MTT staining (1). Cell morphology was investigated after staining for F-actin (red) and tubulin (green) subsequently to the incubation of 168 hours (2).

Results
It could be shown that the non-adhering dressings Lomatuel® Pro and UrgoTüll® do not negatively affect NHDF in vitro. During treatment with these dressings, the cells demonstrated good viability (figures 1 and 2) as well as normal cell morphology (figure 1) and proliferation (figure 3). In contrast, the products HydroTüll® and Atrauman® noticeably decreased cell viability and proliferation in this study (figures 2 and 3). In accordance, treatment with these dressings led to lost of normal cell morphology. Furthermore, it was demonstrated that Lomatuel® Pro and UrgoTüll® exhibit no harmful effects on scratch wound healing in vitro (figure 4). In contrast, the products HydroTüll® and Atrauman® noticeably decreased the healing progression and the scratches remained open.

Conclusion
Here, a comprehensive in vitro approach was used to evaluate possible effects of non-adhering wound contact dressings used during the phase of granulation, tissue formation, and re-epithelialisation. Results clearly showed that different outcomes can be expected. It was observed that non-adhering dressings like Lomatuel® Pro can prevent damage to newly formed tissue and might thereby positively influence the wound healing outcome.

References