Ingrowths of fibroblasts into large-pored foams during negative pressure wound therapy (NPWT) can be inhibited *in vitro* using a drainage foil

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Introduction

NPWT has been shown to be clinically effective in the treatment of chronic-stagnating wounds. In vitro studies suggest that the positive effects of NPWT may result from the recruitment of cells to the wound site, where they contribute to formation of granulation tissue. However, it could be shown that the dressings used for NPWT exhibit different effects, cells especially show a significant tendency to grow in to the dressing if large-pored foams are used. In vivo this may lead to the disruption of newly formed tissue during dressing changes. We have used an in vitro model for NPWT on chronic wounds using fibroblast in a 3D-culture system to investigate if the use of a drainage foil can prevent ingrowths of fibroblasts into a large-pored-foam dressing.

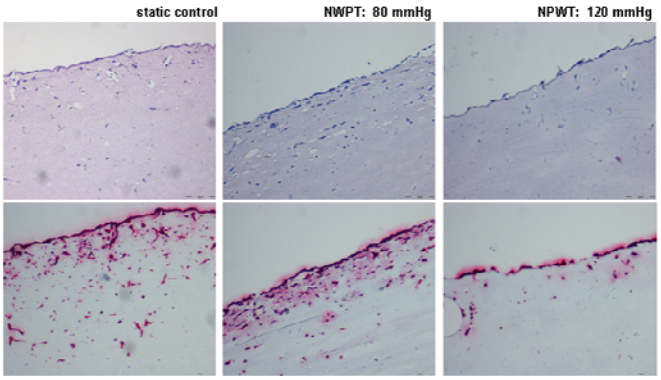

Figure 1: Fibroblasts in the 3D-cultures responded to NPWT by migrating in the direction of the applied vacuum (upper panel: staining with haematoxylin/eosin, lower panel: staining with anti-vimentin-antibodies).

Material & Methods

Fibroblasts were seeded on collagen pellicles and cultured for 14d. Dressing samples*#+ were placed on the cultures; this assembly was positioned in a 6-well plate and sealed with a vacuum-applicator-lid (VAL). VALs were connected to medium supply and vacuum pump (PRO-I, Prospera). Experiments were carried out at -80mmHg and -120mmHg for 48h. Static controls were run at each assay. Histology specimens were stained with haematoxylin/eosin and anti-vimentin-antibodies. Cell viability (CellTiter-Blue viability assay, Promega) and ingrowths of cells into samples (ATPlite M kit, Perkin Elmer) was determined.

*V.A.C.GranuFoamDressing/KCI, #Suprasorb® CNP drainage foil/Lohmann & Rauscher, +Suprasorb® CNP foam/Lohmann & Rauscher, °Kerlix AMD/Kendall

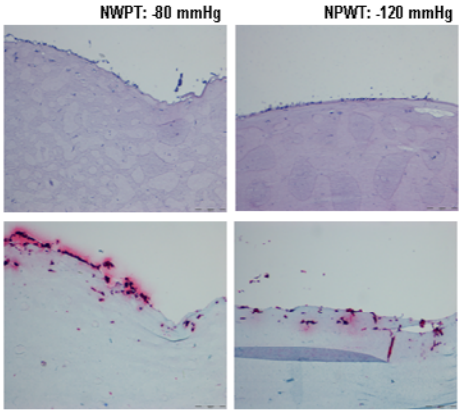

Figure 2: Fibroblasts tend to migrate into large-pored foams* during NPWT. (upper panel: staining with haematoxylin/eosin, lower panel: staining with anti-vimentin-antibody).

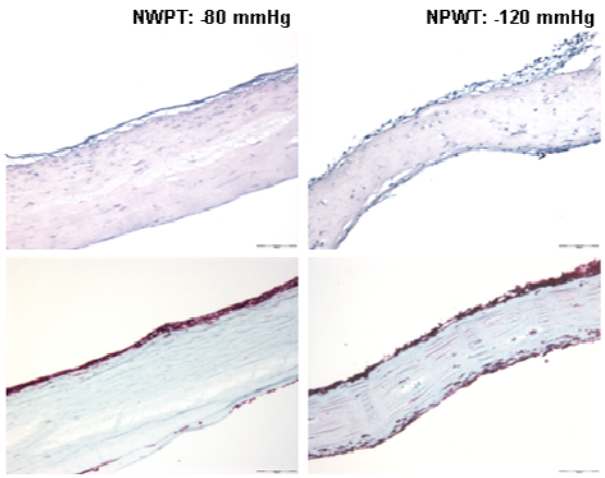

Figure 3: The combination of a large-pored foam+ with the drainage foil# inhibited the ingrowth of fibroblasts into the dressing. Hence, the cells are localized at the edge of the collagen matrix. (upper panel: staining with haematoxylin/eosin, lower panel: staining with anti-vimentin-antibody)

Results

Fibroblasts responded to the subatmospheric pressure by migrating in direction of the applied vacuum (figure 1). No difference between cells treated with -80mmHg and -120mmHg was found. Using the large pored foams, it could be observed, that cells did not stop at the pellicle edge but continued to migrate into the dressing (figure 2). This was confirmed by the increased ATP concentration in the foam dressing samples, e.g. in comparison to a gauze dressing° (figure 4). Placing the drainage foil# between the collagen pellicle and the foam+, the ingrowths of cells into the dressing could be inhibited (figure 3). In accordance, no cells could be found in the combination of the foam dressing+ and the drainage foil# (figure 4).

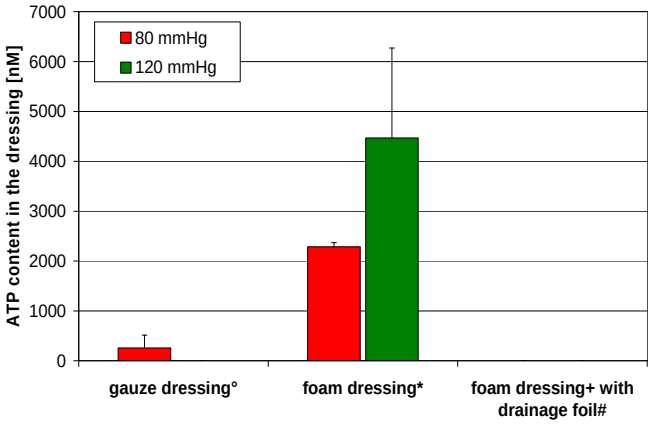

Figure 4: Measurement of ingrowth of cells into the wound dressing samples by determination of the ATP content (mean ± SE).

Discussion

Using an *in vitro* model for NPWT on chronic wounds it could be shown that ingrowths of cells into large-pored foams can be inhibited *in vitro* by application of a drainage foil#. *In vivo* this may prevent the disruption of newly formed tissue during dressing changes.

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