Comparison of the effect of non-adhering dressings and a drainage foil during NPWT in vitro

C. Wiegand[1], M. Abel[2], S. de Lange[2], P. Ruth[2], U.-C. Hipler[1]

[1]Department of Dermatology, University Medical Center Jena, Germany [2]Lohmann & Rauscher GmbH & Co. KG, Rengsdorf, Germany

Introduction

Negative pressure wound therapy (NPWT) has been shown to be clinically effective in the treatment of chronic-stagnating wounds. It is thought that the decrease of the local and interstitial tissue edema, increased perfusion of the (peri-)wound area, reduction of bacteria, and mechanical stimulation of the wound bed account for the beneficial effects [1,2]. It was further suggest that the positive effects of NPWT result from the recruitment of cells to the wound site. Previously, it could be shown that the dressings used for NPWT exhibit different effects, cells especially show a significant tendency to grow into large-pored foams [3]. In vivo this may lead to disruption of newly formed tissue during dressing changes. We have used an in-vitro-model for NPWT to investigate if the use of non-adhering dressings, such as DT or MP, can prevent ingrowths of fibroblasts into a large-pored PU foam dressing+ and compared the outcome to the use of a drainage foil.

References

[1] Moues et al. Wound Rep Reg 2008; 16:488-494

[2] Borgquist et al. Wounds 2009; 21:302-309

[3] Wiegand et al. Wound Rep Reg 2013; 21:697-703

DT – Duratouch◊, Smith & Nephew; MP - Mepitel®, Mölnlycke Health Care; DF - Suprasorb® CNP drainage foil, Lohmann&Rauscher; PU foam - CNP®foam, Lohmann&Rauscher

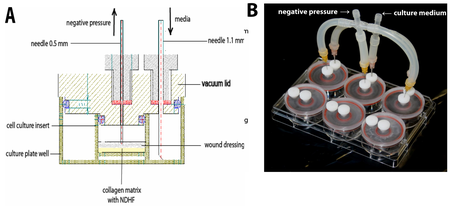

Figure 1: Schematic set-up (A) and photograph (B) of the assembly with the 3D-fibroblast cultures covered with the dressings and placed in the 6-well-plate with a VAL.

Material & Methods

Either the non-adhering dressing samples DT and MP or the drainage foil (DF) were placed on fibroblast 3D-cultures in combination with a large-pored PU foam dressing. The 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. Experiments were carried out at -80mmHg for 48h. Histology specimens were stained with haematoxylin/eosin and fibroblasts were detected using anti-vimentin-antibodies. Cell viability and ingrowths of cells into samples was determined.

Results

Fibroblasts responded to subatmospheric pressure by migrating in direction of the applied vacuum (figure 2). Using the combination of the non-adhering dressings or drainage foil and PU foam samples during NPWT at -80 mmHg did not affect fibroblast migration in vitro (figure 3). However, using non-adhering dressings, cells did not stop at the pellicle edge but continued to migrate into the PU foam (figure 4). In contrast, placement of a drainage foil between collagen pellicle and PU foam inhibited ingrowths of cells into the PU foam.

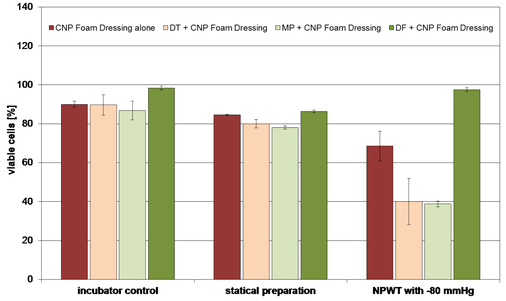

Figure 2: NPWT at -80 mmHg with PU foam alone and in combination with the non-adhering dressings decreased the number of fibroblasts in 3D-cultures compared to incubator and a static control indicating a loss of cells by migration beyond the pellicle edge. In contrast, cell numbers remained high in the group with the drainage foil

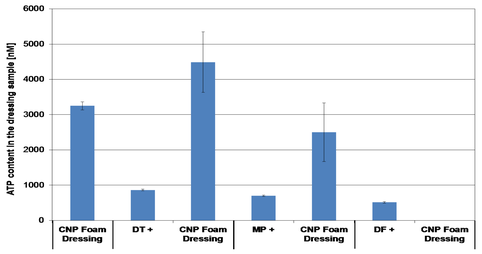

Figure 4: By measurement of cellular ATP content in the dressing samples, it could be shown that cells migrate into the CNP Foam Dressing during NPWT at -80 mmHg. The non-adhering dressings DT and MP cannot prevent the ingrowth of cells into the large-pored PU foam. However, application of a drainage foil can prohibit migration of cells into the foam and in accordance, no cellular ATP was found in the CNP Foam Dressing in combination with DF.

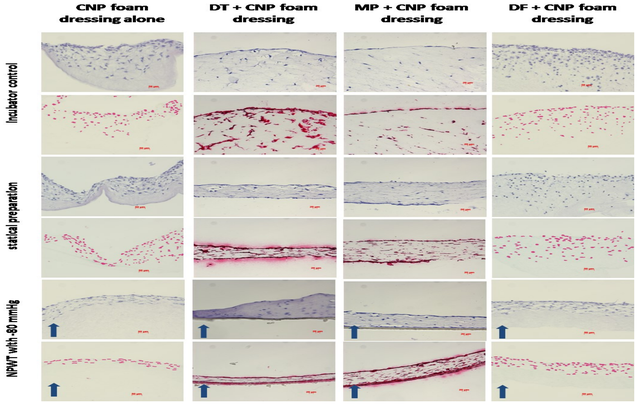

Figure 3: Fibroblasts in the 3D-cultures responded to NPWT by migrating in the direction of the applied vacuum irrespectively if the PU foam was used alone or in combination with the non-adhering dressings DT and MP or if the drainage foil was applied.

Conclusion

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. While the combination of non-adhering dressings and PU foam demonstrated good cell compatibility and does not negatively affect cell migration negatively, DT and MP were not able to prevent ingrowth of cells into the PU foam during NPWT at -80 mmHg.

Wounds UK 2017 Wound Care Conference, Harrogate 13-15th November 2017

Scientific grant of Lohmann & Rauscher, Rengsdorf, Germany