

IN VITRO ASSESSMENT OF THE COMPATIBILITY OF APPLICATION OF PU FOAM AND DRAINAGE FOIL DURING NPWT USING DIFFERENT PUMPS

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Introduction

NPWT has been advocated for virtually all kinds of acute and chronic wounds. Treatment is based on local negative pressure applied to the wound surface. 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]. NPWT is mainly carried out using open-cell polyurethane foams. It could be shown that cells especially show a significant tendency to grow into these foams which can be inhibited by application of a drainage foil without interfering with induction of cell migration [3]. Hence, it is of interest to investigate if this combination is robust and workable with different vacuum pumps.



Figure 1: For NPWT the hDF-3d-cultures were positioned in a Petri dish (A), connected to medium supply and sealed airtight with V.A.C.® Drape (B) before the set-up was linked to the vacuum pump KCI* (C).

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

Material & Methods

The drainage foil** was placed on fibroblast 3D-cultures in combination with large-pored PU foam dressing***. Assemblies were positioned in Petri dishes and sealed with air-tight film after medium supply and vacuum pumps* were connected. Experiments were carried out at -80mmHg and -120mmHg 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.

* pump L&R: Suprasorb® CNP-P1, Lohmann & Rauscher; pump HM: ATMOS® S 042 NPWT, Hartmann; pump SnN: RNASYS® GO, Smith & Nephew; pump KCI: ActiV.A.C., KCI
** Suprasorb® CNP drainage foil, Lohmann & Rauscher
*** CNP®foam, Lohmann & Rauscher

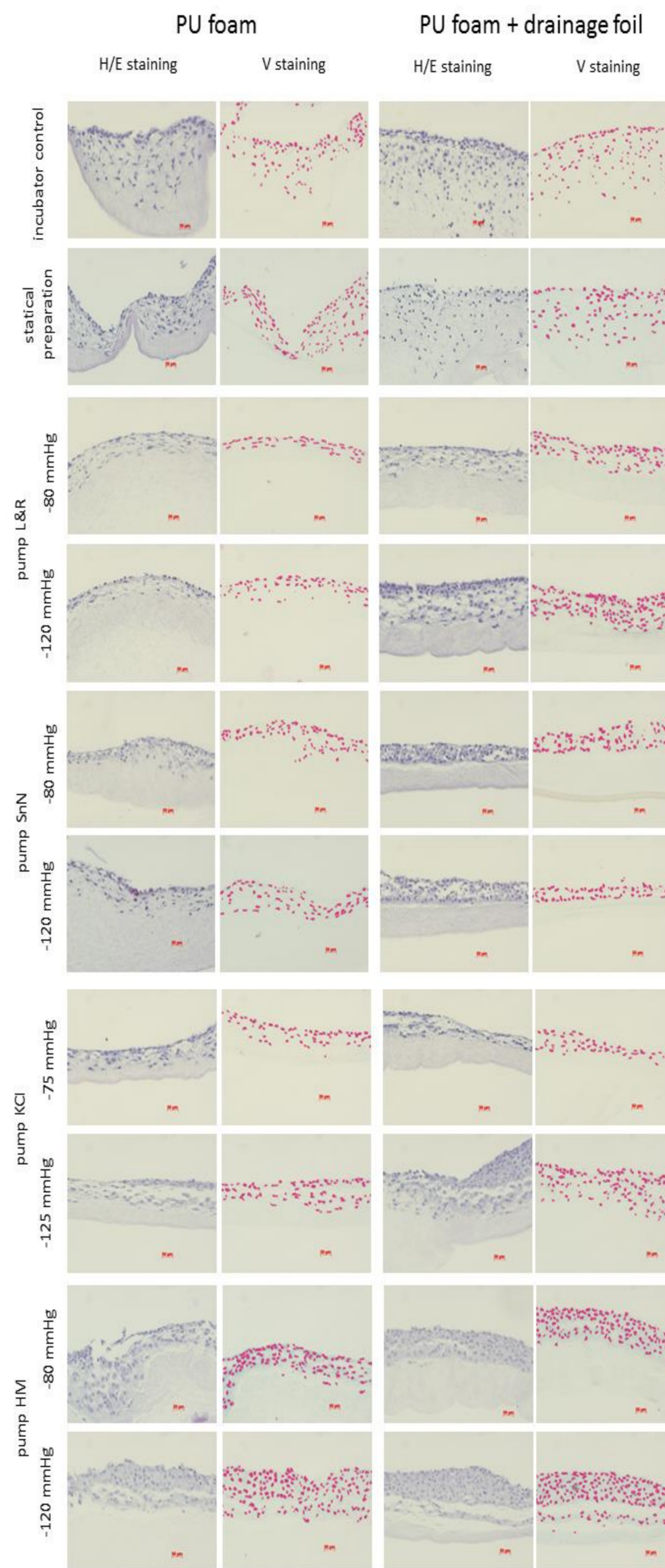


Figure 2: Cross sections of hDF-3D-cultures stained with haematoxylin and eosin (H/E) as well as for vimentin (V) show the influence of PU foam dressing alone (left) and in combination with the influence of drainage foil (right) on the migration of fibroblasts in hDF-3D-cultures during NPWT for 48h compared to incubator control and statical preparation. The arrow specifies the direction of the applied vacuum. Pictures were taken at 200x magnification (scale bar = 50 µm).

Results

Using the combination of drainage foil and PU foam samples during NPWT at -80 mmHg with different vacuum pumps led to the same cellular responses in vitro (figure 2). With the PU foam dressing alone, cells did not stop at the pellicle edge but continued to migrate into the PU foam (figures 3 and 4). In contrast, placement of a drainage foil between collagen pellicle and PU foam inhibited ingrowths of cells into the PU foam.

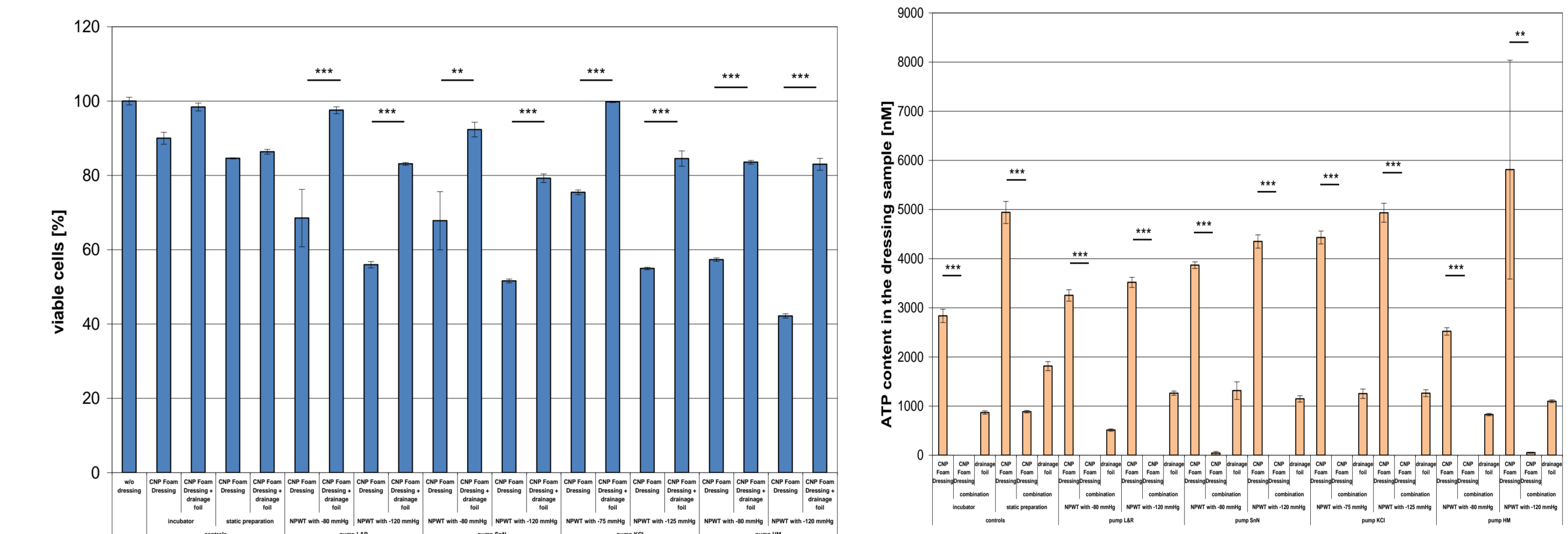


Figure 3: Determination of the amount of viable cells in the hDF-3D-cultures in the control w/o dressing and with application of the PU foam dressing alone or the combination of PU foam dressing and drainage foil w/o treatment (incubator control), as statical preparation, and after NPWT with vacuum pumps from the different manufacturers at -80 and -120 mmHg or -75 mmHg and -125 mmHg. Asterisks indicate significant differences between PU foam dressing alone and the combination of PU foam dressing and drainage foil (* p < 0.05, ** p < 0.01, *** p < 0.001).

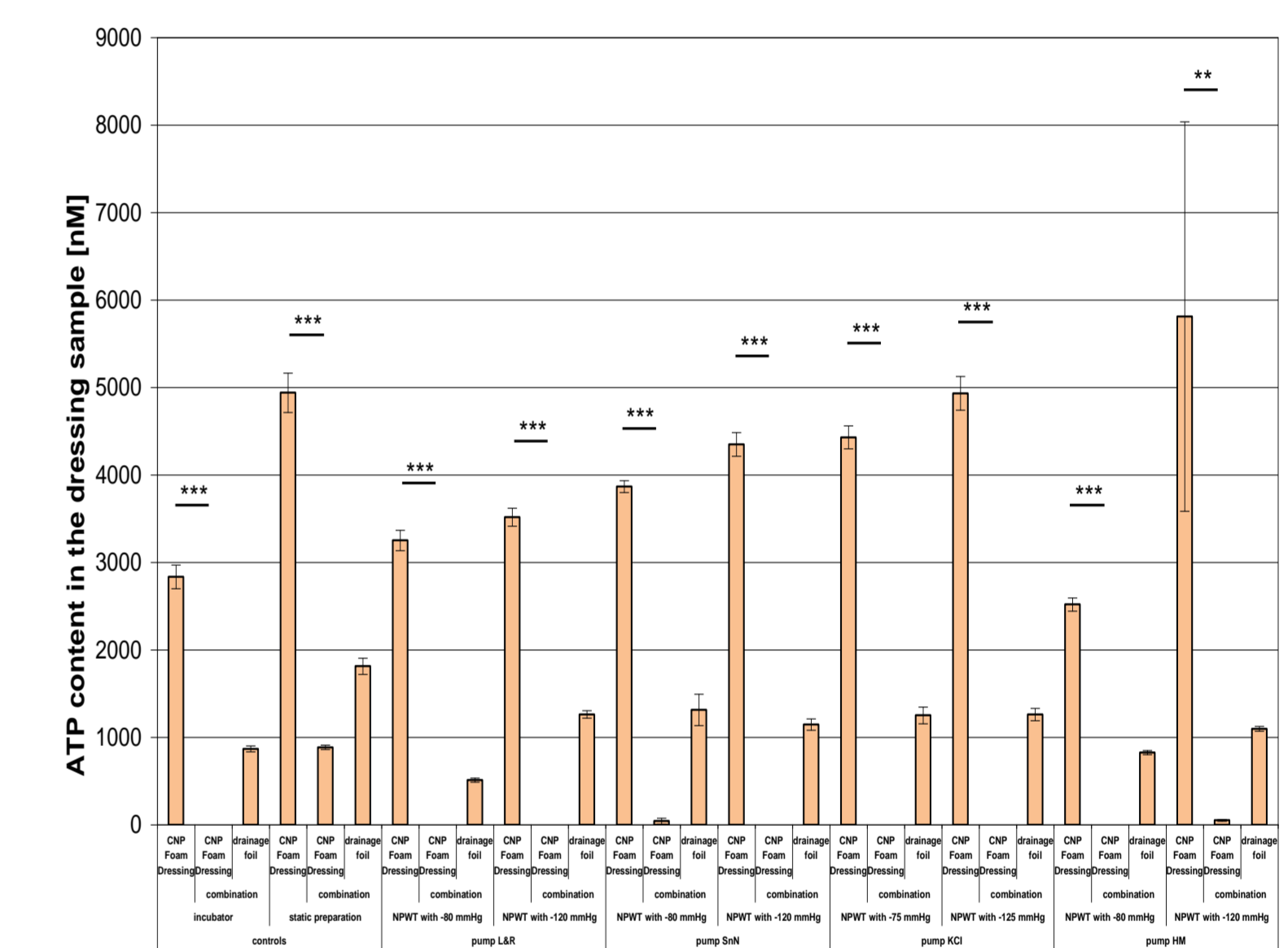


Figure 4: Ingrowth of cells into the PU foam dressing alone or into the PU foam dressing in the combination with drainage foil w/o treatment (incubator control), as statical preparation, and after NPWT with vacuum pumps from the different manufacturers at -80 and -120 mmHg or -75 mmHg and -125 mmHg. Asterisks indicate significant differences between PU foam dressing alone and the combination of PU foam dressing and drainage foil (* p < 0.05, ** p < 0.01, *** p < 0.001).

Conclusion

It could be shown that the combination of a drainage foil with a PU foam dressing for NPWT is workable with pumps from different manufacturers. The 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.