BINDING CAPACITY OF TWO POLYACRYLATE SUPERABSORBER DRESSINGS FOR THE INFLAMMATORY PROTEASES PMN ELASTASE AND MMP-2 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

Non-healing wounds contain elevated levels of neutrophil elastase and matrix metalloproteinases (MMPs) which are responsible for the degradation of extracellular matrix and growth factors [1-3]. These destructive processes prevent wound closure and lead to persisting wounds. The binding of these proteases contributes to the treatment of chronic wounds. The aim of this study was to compare the binding capacity of two polyacrylate-superabsorber dressings for PMN elastase and MMP-2 in vitro. Polyacrylate-superabsorber containing wound dressings are able to take up large quantities of exudates while keeping the wound environment moist; an additional binding of matrix degrading proteases would be a beneficial attribute.

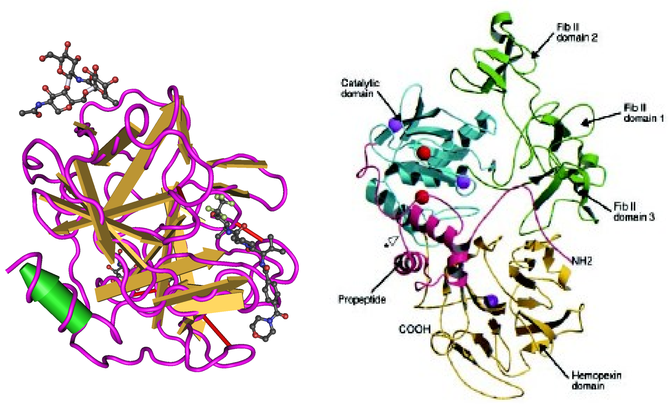

Figure 1: Crystal structures of human neutrophil Elastase created from the Protein Data Bank (left; Nevit Dilmen, 2002) and pro-MMP-2 (right; Science 1999; 284:1667-70).

Material & Methods

Samples of the dressings SAP and SAP Pro were cut (0.5 cm^2), taken in a final volume of 1 mL of protease solution (PMN elastase: 250ng/mL; MMP-2: 4000pg/mL), and incubated up to 24h at 37° C. The concentrations of unbound protein in the supernatants were determined by specific immunoassays for PMN elastase and MMP-2. In addition, it was checked if proteases can be eluted from the dressing samples subsequently.

SAP: Vliwasorb® / Lohmann & Rauscher; SAP Pro: Vliwasorb® Pro / Lohmann & Rauscher

References

[1] Barrick et al. Wound Rep Reg 1999; 7:410-422

[2] Trengove et al. Wound Rep Reg 1999; 7:433-441

[3] Nwomeh et al. Clin Plast Surg 1998; 25(3):341-356

Results

SAP exhibited a high binding capacity for both proteases tested. After 24h of incubation PMN elastase concentrations were significantly reduced about 95% ($p<0.001$) and MMP-2 amounts completely abolished (100%, $p<0.001$). Subsequently, only marginal amounts of elastase and MMP-2 could be eluted from the samples after incubation. SAP Pro demonstrated a comparable high binding of PMN elastase and MMP-2. No distinct differences in the performance of the dressings were noted.

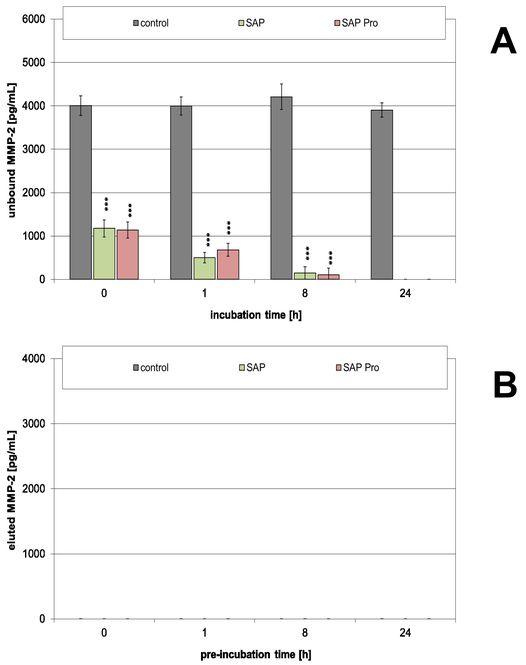

Figure 2: Binding of MMP-2 SAP and SAP Pro (A) and release of MMP-2 from the dressing samples into the eluate (B). (n = 4, data presented as mean ± SE)

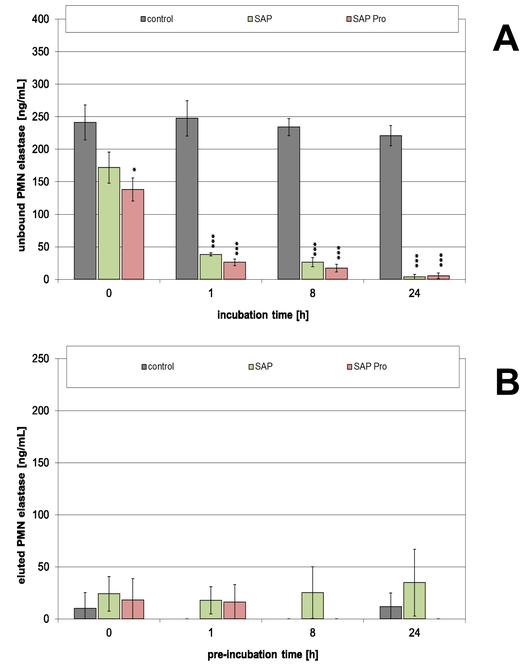

Figure 3: Binding of PMN elastase by SAP and SAP Pro (A) and release of PMN elastase from the dressing samples into the eluate (B). (n = 4, data presented as mean ± SE)

Conclusion

The polyacrylate superabsorber dressings SAP and SAP Pro are able to shortly bind large amounts of PMN elastase and MMP-2 in vitro. Elution of the wound dressing samples revealed a strong, possibly irreversible binding of both proteases. The decrease of these matrix degrading proteases should aid the establishment of a physiological wound milieu in vivo and thus support the healing process.

This work has been made possible by a research grant from Lohmann & Rauscher, Rengsdorf, Germany