

# Influence of the collagen wound dressing Suprasorb® C on proteases and cytokines in chronic wounds

Friedrich-Schiller-Universität Jena

J. Norgauer<sup>1</sup>, U. Schönfelder<sup>1</sup>, C. Wiegand<sup>1</sup>, M. Abeß, P. Elsner<sup>1</sup>, U.-C. Hipler<sup>1</sup>

<sup>1</sup>Department of Dermatology, Friedrich Schiller University of Jena, Germany

<sup>2</sup>Lohmann & Rauscher GmbH & Co. KG, Rengsdorf, Germany



## Introduction

There is significant difference in the healing of acute and chronic wounds, e.g. diabetic or venous ulcers. Numerous studies have shown that exudates from non-healing wounds contain elevated levels of proteolytic enzymes and inflammatory immune modulators [1]. As a previous study has shown, the wound dressing Suprasorb® C, composed of bovine collagen type I, is able to bind significant amounts of PMN elastase and to scavenge reactive oxygen and nitrogen species [2]. The aim of this study was to quantify the concentrations of PMN elastase and pro-inflammatory cytokines in the exudates of chronic and acute wounds and to investigate the ability of Suprasorb® C to bind these proteins and thus to support the normal wound healing process.

## Material and Methods

Wound fluid was collected from patients with chronic wounds as well as from patients with small acute lesions. Subsequently, the concentrations of PMN elastase or cytokines in the supernatants were determined using suitable ELISAs (Milenia). Statistical analysis was performed with the SPSS software (version 10.2).

Each sample was included in 1 mL of a defined solution from PMN elastase (250 ng/mL), IL-1 $\beta$  (100 pg/mL), IL-6 (100 pg/mL), or IL-8 (100 pg/mL), respectively, and incubated up to 24 h at 37°C. Afterwards, the supernatants were collected and the concentration of the unbound proteins could be determined by means of suitable ELISAs (Milenia).

## Results

The concentrations of PMN elastase, IL-1 $\beta$ , IL-6 and IL-8 were significantly higher in the exudates of chronic wounds (fig. 1 and 3). In addition, incubation with Suprasorb® C lowered the concentration of unbound PMN elastase (fig. 3), IL-1 $\beta$  and IL-6 significantly. Only a minor effect was found for IL-8. However, double-sized (1.0 cm<sup>2</sup>) pieces of Suprasorb® C bound the cytokine significantly (fig. 2). In contrast, bacterial cellulose was only effective to bind IL-6.

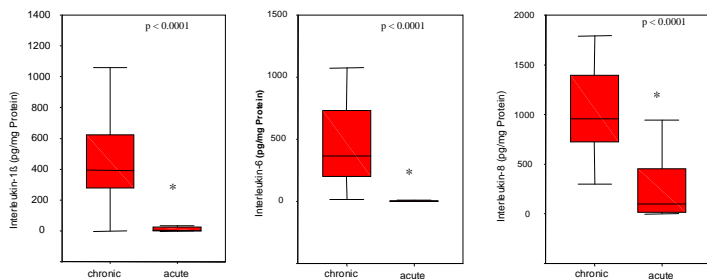


Fig 1: Concentration of pro-inflammatory cytokines in the fluid of chronic and acute wounds determined by ELISAs. (n= 35)

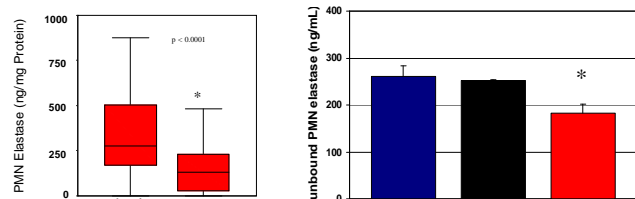


Fig. 3: Concentration of PMN elastase in the fluid of chronic and acute wounds and binding of the protease after 24h: control samples without dressing (blue bars), bacterial cellulose (black bars), Suprasorb® C (red bars).

Samples of Suprasorb® C and bacterial cellulose as an unspecific control were cut to pieces with biopsy punches of 8 mm in diameter (corresponding to 0.5 cm<sup>2</sup>).

## Discussion

The physical properties of Suprasorb® C such as porous structure (Fig. 4) and capillary activity allow the absorption of large quantities of fluid. As the results of this study demonstrate, Suprasorb® C is also able to absorb substantial amounts of PMN elastase, IL-1 $\beta$ , IL-6 and IL-8.

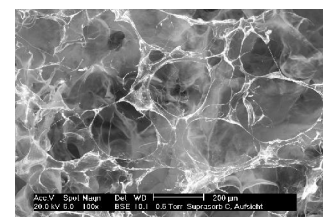


Fig. 4: Scanning-Electron-Micrograph of Suprasorb® C

Differences in the binding capacity of the collagen sponge for different proteins might be due to structural differences of the target proteins. For instance, IL-8 has been found to form dimers [3], which probably impede the absorption process.

## References

- Schultz GS, Mast BA. Molecular Analysis of the environment of healing and chronic wounds: cytokines, proteases, and growth factors. *Wounds* 1998;10 Supplement F:1F-9F.
- Schönfelder U, Abel M, Wiegand C, Klemm D, Elsner P, Hipler UC. The influence of selected wound dressings on PMN elastase in chronic wound fluid and their antioxidative potential in vitro. *Biomaterials* 2005;26:6664-6673.
- ET Baldwin, IT Weber, RS Charles, J Xuan, E Appella, M Yamada, K Matsushima, BFP Edwards, GM Clore, AM Gronenborn, and A Wlodawer. Crystal Structure of Interleukin 8: Symbiosis of NMR and Crystallography. *PNAS* 1991 88: 502-506.

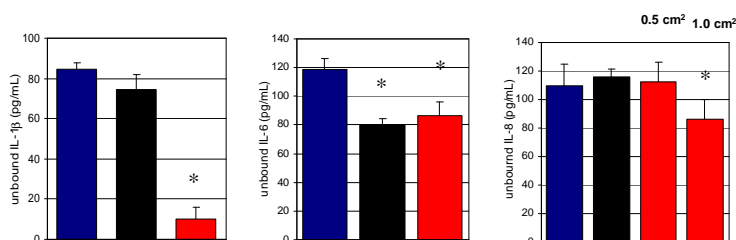


Fig. 2: Binding of pro-inflammatory cytokines after 24h: control samples without dressing (blue bars), bacterial cellulose (black bars), Suprasorb® C (red bars).