Polyacrylate-superabsorber binds inflammatory proteases in vitro

C. Wiegand1, M. Abel2, P. Ruth2, U.-C. Hipler1

1Department of Dermatology, University Medical Center Jena, Germany
2Lohmann & 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. These destructive processes prevent wound closure and lead to persisting wounds. It has been shown, that the binding of the proteolytic enzymes contributes to the treatment of chronic wounds. The aim of this study was to investigate the binding capacity of a polyacrylate-superabsorber for elastase and MMP-2 in vitro. Wound dressings containing polyacrylate-superabsorber 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.

Material & Methods
The wound dressings (Vliwasorb®, Lohmann&Rauscher; Zetuvit® plus, Hartmann; Sorbion® sachet, Sorbion AG) was cut into equal pieces (0.5 cm²), taken in a final volume of 1 mL of protease solution (PMN elastase: 250 ng/ml and MMP-2: 4000 pg/ml), and incubated up to 24 h at 37 C. Supernatants were collected and stored at -20 C. The concentrations of unbound protein in the supernatants were determined by specific ELISAs (neutrophil elastase ELISA, milena biotec; and Quantikine Immunoassays for total MMP-2, R&D Systems).

Results
The polyacrylate-superabsorber containing wound dressings exhibited a high binding capacity for neutrophil elastase (fig. 1) and MMP-2 (fig. 3). Most noticeable was the very fast uptake of the proteases by the polyacrylate superabsorbers leading to a reduction of protease concentration right after contact (0h of incubation). Subsequently, only marginal amounts of elastase (fig. 2) could be eluted from the samples after incubation, while MMP-2 could not be detected at all in the eluate (data not shown).

Conclusions
Polyacrylate-superabsorbers are able to absorb large amounts of fluid, because of their porous structure and high capillary activity, while retaining a moist environment which is thought to promote wound healing [1]. Furthermore, Eming et al. have been able to show that polyacrylate superabsorbers can inhibit MMP activity [2]. The presented study reveals that the polyacrylate superabsorber tested is not only able to shortly bind large amounts MMP-2 but also exhibits a significant binding capacity for neutrophil elastase. 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 especially in highly exuding wounds.

References