The superabsorber Vliwasorb® irreversibly absorbs Proteases, which delay the healing process (elastase, MMP-2)

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Introduction

Chronic wounds with severely delayed wound healing typically show high amounts of neutrophil elastase and matrix metalloproteases (MMPs), which degrade extracellular matrix and growth factors. These catabolic processes prevent the closure of the wound and may result in delayed wound healing¹,².

Thus, absorbing these proteolytic enzymes may help to improve the imbalance and consequently promote wound healing.

The objective of this study was to investigate the absorption capacity of the Vliwasorb® superabsorbent wound dressing with regard to elastase and MMP-2 in a defined enzyme solution. Wound dressings which contain polyacrylate superabsorbent polymers are capable of absorbing large amounts of exudates and retaining them safely inside the dressing³. Another desirable feature would be the capability of absorbing matrix-degrading proteases as well.

Methods

For this study, the wound dressing was broken down into its individual components, of which only the polyacrylate superabsorbent polymers were used. The material was cut into segments of equal size (0.5 cm² each) and subsequently immersed in 1 ml protease solution. The specimens were subsequently incubated at 37 °C for up to 24 h. The supernatant was removed after 0, 1, 8, and 24 h, and the samples were immediately frozen at -20 °C.

The concentrations of free MMP-2 and elastase were determined by means of specific ELISAs (PMN Elastase ELISA, milenia biotec; and Quantikine human/mouse (total) MMP-2, R&D Systems).

Results and discussion

The polyacrylate superabsorbent polymers in Vliwasorb® have a high absorption capacity for all the proteases tested (see graphs). Only marginal amounts of elastase and MMP-2 were eluted from the material after incubation.

In vitro, Vliwasorb® can absorb and retain several times its own weight in liquids with proteases in a very short period of time.

When the wound dressing was washed out, a strong and irreversible absorption of both proteases was apparent.

In vivo, the reduced concentration of those matrix-degrading proteases helps to restore a physiological wound environment. The healing process in heavily exuding wounds—the primary indication for superabsorbers—is thus enhanced.

Graphs: reduction in MMP-2 and elastase activity achieved by incubation with Vliwasorb®

Literature

**Glossary**

**Elastase**: A type of protease which degrades denatured tissues

**ELISA**: Enzyme-linked immunosorbent assay; enzyme immunoassay (immunological determination of bioactive substances in (body) fluids, e.g. determination of elastase or MMP)

**Extracellular matrix**: A type of tissue found outside (in between) the cells

**Incubation**: Treatment of samples in an incubator or water bath

**In vitro**: "In a test tube", i.e. outside of an actual living organism

**MMP**: Matrix metalloprotease

As opposed to acute wounds, the exudates from slowly healing chronic wounds have extremely high levels of MMP-2 or MMP-9.

**Neutrophil granulocytes** ("neutrophils")

A subgroup of white blood cells which phagocytise foreign bodies, bacteria and destroyed tissues.

They can also release the so-called "neutrophil elastase".

**Phagocytise**: The process of actively "ingesting" living or dead particles into a cell in order to destroy them

**Proliferation**: Growth of new (additional) tissue

**Proteases**: Proteolytic enzymes

**Proteolytic**: Something which digests/cleaves/hydrolyses proteins

**Growth factors**: Growth-promoting substances which are essential for building cells and tissues