

Effect of irradiation on the binding capacity of bovine collagen for inflammatory cytokines

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Introduction

Physiological wound repair involves a cascade of highly regulated events, resulting in the repair of the damaged tissue. A change or delay of any of these processes can result in incomplete healing and lead to the formation of a chronic wound. As several studies have shown, the exudates of chronic wounds contain elevated levels of inflammatory cytokines like IL-1 and IL-6 [1,2]. Therefore the binding of these inflammatory mediators to reduce the overall concentration seems a suitable way to support the healing process. The aim of the present study was to investigate the binding capacity of native as well as γ - and β -irradiated (maximum dosis of 20 kGy) wound dressing Suprasorb® C containing bovine collagen for the interleukine IL-1 β und IL-6.

Material and methods

The wound dressing samples were cut into pieces by means of punch biopsies (8 mm diameter, corresponding to 0.5 cm²). Each specimen was taken in a final volume of 1 mL of interleukin solution (100 pg/mL). Samples were incubated up to 24 h at 37°C on a plate mixer. After incubation supernatants were collected, immediately frozen and stored at -20 °C until testing. The concentration of unbound interleukins in the supernatants were determined by means of specific ELISAs (milenia biotec, Bad Nauheim, Deutschland).

Results

As could be shown in previous studies, the native bovine collagen from Suprasorb® C is able to decrease ($p < 0,01$) the concentration of IL-1 β in solution significantly. γ - and β -irradiated collagen can also bind significant amounts of IL-1 β over the examined period of 24 h (fig. 1). Moreover, Suprasorb® C possesses binding capacity for IL-6. Already after 8 h a significant decrease ($p < 0,05$) of unbound IL-6 in solution was detectable. The γ -irradiated collagen was also capable of reducing the concentration of IL-6 in solution significantly (fig. 2). After the treatment with β -radiation the wound dressing sample achieved a decline of the IL-6 concentration in the experiments but the results were outside of the used statistical significance limits. Interestingly, there was found no significant difference between native and γ -irradiated bovine collagen.

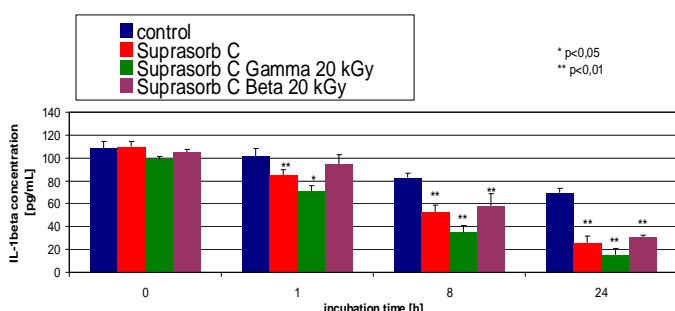


Fig. 1: Binding of IL-1 β by native as well as γ - and β -irradiated Suprasorb® C from IL-1 β solution (mean \pm SE).

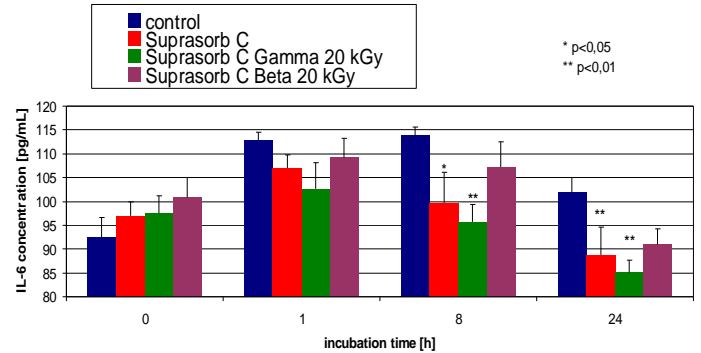


Fig. 2: Binding of IL-6 by native as well as γ - and β -irradiated Suprasorb® C from IL-6 solution (mean \pm SE).

Conclusions

As the presented data show, Suprasorb® C is able to bind interleukines in different rates because of its porous structure (fig. 3). Suprasorb® C possesses a particularly high binding affinity for IL-1 β .

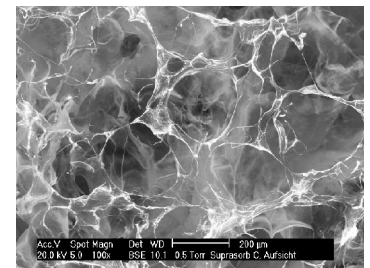


Fig. 3: SEM of native Suprasorb® C

IL-1 β plays a central role during the inflammatory phase of the healing. It stimulates the synthesis of several matrix metallo proteases (MMPs) by fibroblasts and macrophages and inhibits the formation of TIMPs. In exudates from chronic wounds up to 100-fold concentrations of IL-1 β were determined compared to acute wound fluid [3]. The binding of IL-1 β by bovine collagen lowers the overall concentration of IL-1 β in the wound fluid and should improve the healing outcome. Furthermore, Suprasorb® C exhibits a significant binding capacity for IL-6. The concentration of this interleukin is elevated in chronic wounds as well [3].

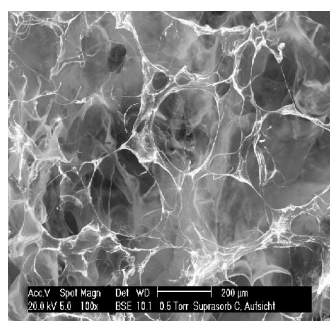


Fig. 4: SEM of 20 kGy γ -irradiated Suprasorb® C

Treatment with γ - as well as β -radiation is commonly used as sterilisation method but can severely alter the characteristics of biomolecules such as collagen fibres. As the presented data show, treatment of bovine collagen with γ - as well as β -radiation of 20 kGy (fig. 4) does not change the binding affinity for IL-1 β and IL-6 compared to native collagen significantly.

References

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