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Title

Improvement of wound healing in acute wounds through topical use of superoxide dismutase mimetic

Purpose

Negative Pressure Wound Therapy (NPWT) is a method of choice commonly used in wound care, promoting wound healing but its mechanism of action remains poorly documented. We investigated the tissue and cellular response to NPWT using human samples and a rodent-injury model to decipher new mechanism(s) and trying to use this acquired knowledge to design new methods facilitating wound healing.

Methods

The primary step was the biochemical analysis of patient samples collected before and after NPWT treatment, followed by the implementation of a rodent-injury model to perform similar analysis between control and NPWT-treated rats, enabling us to compare the molecular mechanisms triggered by NPWT. The biochemical analysis focused on signaling pathways such as hypoxia, angiogenesis, metabolism and redox modulation.

Results

We identified modifications in redox homeostasis in tissues treated with NPWT associated with higher antioxidant capacity. Biochemical analysis revealed that this was correlated with a higher protein level of Superoxide Dismutase 2 (SOD2) and a sustained SOD2 activity in treated tissues. Based on these results we tested the possibility to use SOD mimetic agents (MnTE-2-PyP5+) as wound healing promoter using our model. The results showed a significant improvement in epithelialization and wound closure with the SOD-mimetic-treated group compared to the untreated animals.

Conclusion

These results show the ability of NPWT to modulate redox-homeostasis within the wounded tissues and constitute the basis on which we tested the validity to use SOD mimetics to promote wound healing and ameliorate current methods used in wound care.