

Therapy of chronic wounds with water-filtered infrared-A (wIRA)

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Abstract

The central portion of chronic wounds is often hypoxic and relatively hypothermic, representing a deficient energy supply of the tissue, which impedes wound healing or even makes it impossible. Water-filtered infrared-A (wIRA) is a special form of heat radiation with a high tissue penetration and a low thermal load to the skin surface. wIRA produces a therapeutically usable field of heat and increases temperature, oxygen partial pressure and perfusion of the tissue. These three factors are decisive for a sufficient tissue supply with energy and oxygen and consequently as well for wound healing, especially in chronic wounds, and infection defense. wIRA acts both by thermal and thermic as well as by non-thermal and non-thermic effects. wIRA can advance wound healing or improve an impaired wound healing process and can especially enable wound healing in non-healing chronic wounds. wIRA can considerably alleviate the pain and diminish wound exudation and inflammation and can show positive immunomodulatory effects.

In a prospective, randomized, controlled study of 40 patients with chronic venous stasis ulcers of the lower legs irradiation with wIRA and visible light (VIS) accelerated the wound healing process (on average 18 vs. 42 days until complete wound closure, residual ulcer area after 42 days 0.4 cm² vs. 2.8 cm²) and led to a reduction of the required dose of pain medication in comparison to the control group of patients treated with the same standard care (wound cleansing, wound dressing with antibacterial gauze, and compression garment therapy) without the concomitant irradiation.

Another prospective study of 10 patients with non-healing chronic venous stasis ulcers of the lower legs included extensive thermographic investigation. Therapy with wIRA(+VIS) resulted in a complete or almost complete wound healing in 7 patients and a marked reduction of the ulcer size in another 2 of the 10 patients, a clear reduction of pain and required dose of pain medication, and a normalization of the thermographic image.

In a current prospective, randomized, controlled, blinded study patients with non-healing chronic venous stasis ulcers of the lower legs are treated with compression garment therapy, wound cleansing, wound dressings and 30 minutes irradiation five times per week over 9 weeks. A preliminary analysis of the first 23 patients of this study has shown in the group with wIRA(+VIS) compared to a control group with VIS an advanced wound healing, an improved granulation and in the later phase of treatment a decrease of the bacterial burden.

Some case reports have demonstrated that wIRA can also be used for mixed arterial-venous ulcers or arterial ulcers, if irradiation intensity is chosen appropriately low and if irradiation is monitored carefully. wIRA can be used concerning decubital ulcers both in a preventive and in a therapeutic indication. wIRA can improve the resorption of topically applied substances also on wounds.

An irradiation with VIS and wIRA presumably acts with endogenous protoporphyrin IX (or protoporphyrin IX of bacteria) virtually similar as a mild photodynamic therapy (endogenous PDT-like effect). This could lead to improved cell regeneration and wound healing and to antibacterial effects.

In conclusion, these results indicate that wIRA generally should be considered for the treatment of chronic wounds.