

DEVELOPMENT OF A TEXTILE WOUND DRESSING BASED ON EMBROIDERY TECHNOLOGY

[Erdal Karamuk](#)¹, Mario Billia², Bernhard Bischoff³, Renato Ferrario³, Bärbel Wagner⁴, René Moser⁵, Marcus Wanner⁶ and Jörg Mayer¹

¹*Biocompatible Materials Science and Engineering, ETH, Zürich, Switzerland,* ²*TISSUPOR AG, St. Gallen, Switzerland,* ³*Bischoff Textil AG, St. Gallen, Switzerland,* ⁴*Swiss Federal Laboratories for Materials Testing and Research (EMPA), St. Gallen, Switzerland,* ⁵*Institute for Biopharmaceutical Research (IBR)-Inc, Matzingen, Switzerland,* ⁶*Swiss Paraplegics Center (SPZ), Nottwil, Switzerland*

INTRODUCTION: Non healing wounds have a great economic impact because they need intensive wound care for very long periods, often disabling the patient and causing high health care costs. One of the key issues in tissue regeneration of chronically non healing wounds is controlled revascularisation of the epidermal tissue. In textile implant materials tissue formation and vascularisation depend on the size and distribution of pores and fibers¹. An arrangement of pores of different orders of magnitude will favour the tissue ingrowth and the formation of new blood vessels and capillaries¹. We developed a new textile wound dressing based on embroidery for the treatment of chronically non healing wounds (TISSUPOR[®]). Embroidery technology allowed to achieve a 3-dimensionally structured textile architecture that combines pores for directed angiogenesis and elements for local mechanical stimulation of the wound ground² (fig. 1).

METHODS: The adaptation of the industrial embroidery process to medical textiles requires thorough biocompatibility testing to find possible toxic effects of chemical residues from machine, base cloth or yarn sizing. We performed cytotoxicity assays using a 3T3 fibroblast cell line. In direct and indirect (using extracts) exposure methods, endpoints and time course of mitochondrial activity (MTT) and cell mass (DNA / direct counting) were measured. In both cases no significant toxic effects were detected. Clinical pilot studies were initiated, focussing on the treatment of venous leg ulcers (ulcus cruris) and pressure soars (decubitus). Decubitus was treated at the wound care clinic at the SPZN under according to SPZ protocols. Wounds were treated with TISSUPOR[®] after initial debridement until 50 % wound surface reduction.

RESULTS: First results show a comparable healing rate to conventional moist wound care. A high induction of granulation tissue was observed,

especially in deep (wound volume >80ml, fig. 2) and infected wounds.

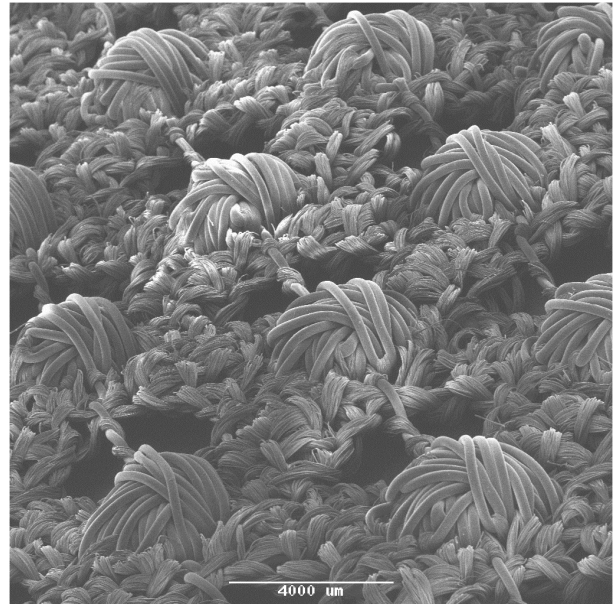


Fig. 1: SEM image of the embroidered textile layer of the wound dressing. The porous structure is made from PET multifilament yarns, whereas the stiff elements for mechanical stimulation consist of PA monofilaments.



Fig. 2: Example of wound treatment with TISSUPOR[®]: Female patient, age 69, inidaction decubitus. Wound volume after one week was 80ml. Dressing was changed twice a week. After 2 weeks the wound volume was 40 ml (left) The wound was surgically closed after 3.5 weeks of application, when the wound volume was 11 ml (right).

DISCUSSION & CONCLUSIONS: The application concept of TISSUPOR® which is based on the working hypothesis that bleeding must be induced when changing the wound dressing to reactivate the wound healing by creating an acute inflammatory reaction resulted in much less frequent dressing change (2 times per week instead of twice a day) which seems promising for a commercial success both in clinical and ambulant treatment of chronic wounds. A European wide multicenter study was initiated for the treatment of chronic wounds with a wide range of indications.

REFERENCES: ¹E. Wintermantel, et al. (1992), in: *Angiogenesis: Principles - Science - Technology - Medicine*. ² E. Karamuk et al. (1999) in S. Anand ed *Medical Textiles '99*, Woodhead, UK, in press.

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