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DEVELOPMENT OF "IN VITRO" MODELS TO STUDY WOUND HEALING IN SPACE – THE SUTURE EXPERIMENT

DÉVELOPPEMENT DES MODÈLES "EN VITRO" POUR ÉTUDIER LA CICATRISATION DANS L'ESPACE - L'EXPÉRIENCE SUTURE

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Introduction: In interplanetary missions medical evacuation times to Earth might become too long. Therefore, the future planning procedure for medical care in space should incorporate space surgery and trauma care concepts. A critical aspect in surviving a trauma or surgery is wound healing. The little literature on wound healing in weightlessness is controversial. The prevailing evidence and our previous studies indicate an impairment of the healing process. The experiment "Wound Healing and Sutures in Unloading Conditions", selected by ESA to be performed on the ISS, is conceived to study in weightlessness the behavior and healing of "in vitro" sutured wound models. In addition to biological parameters, the tensile strength will be monitored, because tissue mechanical properties strongly affect wound healing and regeneration processes. The goals of on ground activity for experiment preparation were to model physiological tensile strength and ensure tissue survival throughout the experiment (3 weeks).

Methods: Skin and blood vessels biopsies derived from surgical procedures for abdomino-plasty or breast reduction in healthy subjects (under informed consent). Specimens were stitched to a frame, specifically developed to apply a tension similar to the physiological one, and cultured in different media. To model sutured wounds, little cuts (10 mm length, 2 mm depth) were performed on skin and sutured with interrupted stitch 3.0 non absorbable suture (Nylon), while vessels were completely divided to perform an end-to-end vascular anastomosis with continuous 6.0-8.0 non absorbable suture (Polypropylene).

Results: Applying a proper tension and adding hormones, pro-angiogenic and antioxidant factors to culture media, we strongly improved tissue survival as shown by histology and electron microscopy

Conclusions: We developed a tissue culture technique able to model tensional strength in tissues and ensure tissue survival for over 3 weeks. This technique and resulting models can be applied also on ground to: tissue culture and engineering for transplantation and regeneration, studies for improvement of surgical techniques and materials.