IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Medical Care for Humans in Space (3)

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HEALING OF EX VIVO SUTURED WOUND MODELS IN HUMAN TISSUES EXPOSED TO SPACEFLIGHT

Abstract

Wound healing (WH) allows the body to survive injuries by restoring its integrity. On Earth, WH dysfunction leads to serious conditions, such as chronic ulcers and fibrosis. The effect of spaceflight on WH is almost completely unknown. The relatively few studies carried out using in vitro and animal models suggest that the healing progression might be impaired and delayed. Therefore, the management of serious injuries that could happen to crew members is a major concern for future interplanetary missions. The only way to develop targeted therapeutic strategies is to learn more about WH in Space. The Suture in Space (SiS) experiment, that was launched with SpX 26 and performed on board the ISS from 28th November to 7th December, 2022, aims to study for the first time the behavior and healing of ex vivo sutured wound models in human tissues exposed to spaceflight. Sutured wound models were prepared from skin and blood vessel biopsies collected from plastic and cardiovascular surgery, with informed consent and Ethical Committee approval, at Careggi hospital, Florence, Italy. To extend the viability of the explants throughout the experiment, culture media were enriched with hormones and nonoates, and an automated culture chamber reproducing and monitoring the physiological tensile strength in the tissues was developed. Before launch, hardware integration was performed at KSC, Cape Canaveral, U.S.A. After

return to Earth, tissue samples were recovered without thawing from the frozen hardware. The ground control experiment is currently underway, Then, ISS- and control samples will be analyzed and compared for structure/ultrastructure, mechanical properties, gene expression, ECM proteins, etc, to understand if and how spaceflight affects WH mechanisms. The results showed that the new ex-vivo tissue culture system devised for the SiS experiment allows human skin and vein specimens to maintain viability for 5 weeks. Events associated with WH were observed in the tissues close to the wound, namely collagen and elastic fibers remodeling, keratinocyte proliferation and expression of endothelial functional markers (eNOS and FGF-2). Beyond the SiS experiment, the new culture system can be applied on Earth for studies on WH, tissue engineering/regeneration, drug effects, etc The results that we will obtain from the in-flight/ground-control experiment will be shown at the symposium. We expect that they help shed light on WH mechanisms in unloading conditions.