Subcutaneous Injection of SVF in Combination with HBOT Improves Viability of Unfavorably Designed Cutaneous Flaps

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INTRODUCTION: Soft tissue reconstruction is inherently complicated by ischemia and reperfusion injury. Efforts to minimize these deleterious effects include meticulous surgical design, minimizing the ischemic period and optimizing vascularity.[1] Adjunctive measures have included free microvascular transfer, supercharging, caspase inhibitors and free oxygen radical scavengers. In this study, we explored the potential complementary effects of HBOT and stem cell delivery on cutaneous flap survival.

MATERIALS AND METHODS: The potential healing benefits of HBOT preconditioning and stromal vascular fraction (SVF) delivery on flap survival were examined in a guinea pig model.[2] Animal subjects were randomly assigned to one of four study groups: SVF/saline injections followed by HBOT, SVF/saline injections only, HBOT only, or neither HBOT nor injections. In order to enhance clinical relevance, an additional group of animals underwent HBOT prior to SVF/saline injections. Thereafter, an unfavorably designed cutaneous flap was elevated and clinically assessed via study-blinded observer, as well as by quantification of TUNEL-positive cells.

RESULTS: Distal necrosis of the tissue flap was most often observed in the no intervention group (72.8% of the flap, $p < 0.001$), similar to tissue flaps treated with HBO only (62.9%, $p = 0.036$) and SVF injections (46.7%, $p = 0.013$). The most significant difference occurred in the combination HBO and SVF delivery group, where distal necrosis was only visible in 24.6% of the flap ($p < 0.05$). Most notably, SVF delivery immediately prior to flap elevation further minimized distal necrosis of the flap to 18 percent. These findings were mirrored by the TUNEL assay, indicating the highest percentage of cell death in the no intervention and HBO only groups ($p < 0.05$).

CONCLUSION: Findings not only indicate that combining HBO treatment and SVF improves flap viability, they also suggest that it may be more appropriate to deliver SVF at the time of tissue elevation, providing a more clinically relevant way to treat these patients.

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