PLASTIC SURGERY RESEARCH COUNCIL 65th ANNUAL MEETING ABSTRACTS

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Transdermal Deferoxamine Alleviates Radiation-Induced Damage In Porcine Skin

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Purpose: Adjuvant radiation therapy is an effective treatment for oncologic malignancies; however, it can cause adverse collateral effects to surrounding soft tissue such as dermal thickening, destruction of vessels, and loss of skin elasticity making reconstruction a burden. To alleviate these detrimental effects, we tested the efficacy of a novel transdermal drug delivery system (TDDS) to provide cutaneous delivery of deferoxamine (DFO) to irradiated porcine skin. DFO is an FDA approved drug which stabilizes hypoxia-inducible factor-1 alpha to increase tissue vascularization. Direct inject of DFO has previously been shown to improve irradiated mouse skin. We hypothesize that application of the DFO TDDS to irradiated soft tissue will also improve radiation-induced fibrosis in our pig model.

Methods: Three, red Duroc pigs (three months old) were irradiated with a single fraction of 30 Gray delivered to 5 equal localized regions on either side. The pigs were allowed to recover for eight weeks allowing for chronic radiation damage to develop. At the end of recovery period, the pigs were divided into 3 treatment conditions: 1% DFO TDDS patch, control TDDS patch with not medication, and no treatment. Biopsies from each group, with their respective adjacent non-irradiated skin, were acquired at 1, 2, 3, 4, and 8 week time points. Histological sections were stained with hematoxylin and eosin and Picrosirius Red to evaluate dermal thickness and collagen deposition. Vascularity was determined by CD31 immunofluorescence staining. Mechanical testing was performed to determine skin stiffness, and cutometer readings for each condition were performed to test for skin deformation.

Results: Skin histology revealed that DFO TDDS treated irradiated skin demonstrated significant reduction in dermal thickness (hematoxylin and eosin), lower collagen content (Picrosirius Red), and higher vascularity (CD31 immunofluorescence) compared to no patch (***$p<0.001$, **$p<0.01$, *$p<0.05$, respectively) and control patch treated skin (*$p<0.05$, ****$p<0.0001$, **$p<0.01$, respectively). Furthermore, mechanical testing of DFO treated skin exhibited decreased stiffness starting from week 2 onwards after patch placement. Finally, overall skin deformation, from cutometer data, was higher for DFO treated skin compared to the control and no patch treatment groups.

Conclusions: Currently, there are limited effective treatments for radiation-induced skin damage. The DFO TDDS patch provides a method to mitigate the chronic effects of radiation-induced skin damage for oncological patients who are in need of reconstructive surgery. The histological and immunofluorescent data indicate the morphological characteristics of the irradiated skin after DFO TDDS patches are similar to normal skin. Furthermore, the mechanical properties of the irradiated skin after DFO TDDS patches mirror normal skin. As porcine skin closely resembles human skin, our findings establish incredible potential to treat patients with radiation induced soft tissue fibrosis.

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Heat Generating Nanocomposite To Reduce Infection

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Purpose: To evaluate the combination of mild hyperthermia plus antibiotics for reducing Stapylococcus aureus biofilms associated with silicone materials.

Methods: The additive effect of non-ablative hyperthermia with antibiotics was explored in a mouse model. Small disks of silicone with [4,4-bis(2-ethylhexyl)cyclopenta[2,1-*b*;3,4-*b*']dithiophene-2,6-diyl-*alt*-2,1,3-benzoselenadiazole-4,7-diyl] (PCPDTBSe) nanoparticles were inoculated with