Evaluation of the Potential for Improved Wound Healing Through the Usage of a Topical Resveratrol Preparation

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INTRODUCTION: Full thickness wounds are a burden to the medical population. Many conservative wound treatment regiments exist. Recently, a grape seed extract known as resveratrol has gained popularity in the media. Previous studies suggest that resveratrol may impact wounds by up regulation of VEGF.1,2 The aim of this study is to evaluate if a topical resveratrol preparation can speed wound healing and reduce scarring.

MATERIALS AND METHODS: In this prospective controlled study, three pigs were anesthetized before each receiving twenty full thickness excisional wounds on their back skin. Wounds were divided into five groups. Each group received treatment with one of the following: low (2 mg/ml), medium (10 mg/ml), or high (50 mg/ml) concentration of topical resveratrol, silver sulfadiazene (SSD), or a control carboxymethyl cellulose gel. Full thickness punch biopsies and digital images of each wound were obtained at 3 days, 7 days, 2 weeks, 3 weeks, 4 weeks, and 6 weeks post wound creation. A blinded evaluator performed histological evaluation.3 Digital planimetry software was used to analyze the area of each wound at each time interval.

RESULTS: A total of 180 biopsies were analyzed. The average histological score for the treatment group (14.68) was lower than that of the control group (16.12) and the SSD group (18.14). However, this trend was not statistically significant (p=0.09). The low (15.82), medium (13.68), and high (14.58) resveratrol concentrations received histological scores less than the control (16.12) or SSD (18.14) groups. Again, this trend did not reach statistical significance (p=0.189). A total of 420 digital images were analyzed for wound surface area, and percent change of that area over time. The treatment group experienced a statistically significantly greater reduction in area (88.4%) compared to the control (86.9%) or SSD (77.2%) groups at the last photographed time period (p=0.000).

CONCLUSION: Topical resveratrol use in full thickness wounds can lead to greater reduction of wound size. This is especially true for low and medium concentrations of resveratrol, but is not the case for a high concentration of resveratrol in our series. In addition, topical resveratrol may demonstrate a benefit on the histological level with regard to scarring of wounds. However, additional studies need to be performed to determine if this trend amounts to significance.

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Suture Materials Containing the Antimicrobial Taurolidine

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The purpose of the study was to demonstrate the antimicrobial property of integrating taurolidine, a taurine derivative, into the matrix of two types of monofilament fibers to simulate sutures with e-caprolactone (the major component of Monocryl) and p-dioxanone (PDS II).

Taurolidine was successfully loaded at 2.6 and 10% by weight throughout the matrix of the fibers. 400 ul of early phase Pseudomonas aeruginosa (PAO1), the Staphylococcus epidermidis (S.epi 35984), and the multidrug resistant Staphylococcus aureus strain SA BAA-44) were plated separately into square plates. 200 ul of each were introduced into 25cmX25cm plates. Four pieces of each fiber were individually placed in the plates. The fibers tested were taurolidine loaded at 2, 6 and 10% dispersed in poly e-caprolactone and 2, 6, and 10% dispersed in p-dioxanone. After 24 hours of exposure the zone of Inhibition surrounding each fiber sample was measured in mm. In order to demonstrate quantitative bacteria kills with living microorganisms, each of the fibers were placed in 12 well bottom culture discs that had 1 ml Tryptic Soy Buffer containing 100 ul of each of the fibers were placed in 12 well bottom culture discs that had 1 ml Tryptic Soy Buffer containing 100 ul of each fiber sample was measured in mm. In order to demonstrate quantitative bacteria kills with living microorganisms, each of the fibers were placed in 12 well bottom culture discs that had 1 ml Tryptic Soy Buffer containing 100 ul of each fiber sample was measured in mm. In order to demonstrate quantitative bacteria kills with living microorganisms, each of the fibers were placed in 12 well bottom culture discs that had 1 ml Tryptic Soy Buffer containing 100 ul of each of the fibers were placed in 12 well bottom culture discs that had 1 ml Tryptic Soy Buffer containing 100 ul of

Results from the zone of inhibition study revealed a statistically significant increase in the zone of inhibition, as measured in mm, of all three bacteria tested in 6% and 10% taurolidine loaded e-carolacone fibers and in 2%, 6% and 10% taurolidine loaded p-dioxanone fibers versus control fibers containing 0% taurolidine. Quantitative determination of Pseudomonas aeruginosa bacteria showed total kills for fibers that contained 6% or greater taurolidine in e-caprolactone fibers. Measurements for Staphylococcus aureus total kills were observed for all the e-caprolactone fibers that contained 2% or greater taurolidine and 6% or greater taurolidine in p-dioxanone fibers. Quantitative analysis of Staphylococcus epidermidis cultures demonstrated total bacteria kills for fibers containing 6% or greater taurolidine in e-caprolactone.

Taurolidine loaded fibers resist growth of bacterial in the vicinity of fibers as evidenced by zone of inhibition studies. Taurolidine loaded fibers have the ability to kill representative microorganisms that have great clinical significance. Taurolidine is an effective anti-microbial, non anti-biotic, where organisms are unlikely to develop resistance.

Generation of a Novel Scaffold for In Vivo Polarization of Therapeutic Macrophages and Delivery of IL10 to Improve Cutaneous Wound Healing

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INTRODUCTION: Defective cutaneous wound healing poses a significant clinical challenge, so it is necessary to develop novel techniques to improve tissue regeneration and repair. Macrophages are critical for effective wound repair, as their deletion slows healing. Specifically, M2 phenotype macrophages are proregenerative. Herein, we develop a novel scaffold to polarize macrophages to the M2 phenotype and examine their ability to improve wound healing in vivo.

METHODS: We developed a proprietary scaffold made from heparin and collagen containing recombinant interleukin10 (IL10). To characterize the release profile of IL10 from the scaffolds, we indirectly assessed the amount of IL10 in solution at ten time points using enzymelinked immnosorbent assays (ELISA). The absorptive properties of the scaffold were determined by swelling studies in phosphatebuffered saline (PBS) at 37ºC. Surface microstructures of the scaffolds after being crosslinked with glutaraldehyde were observed under scanning electron microscope (SEM). Monocytes isolated from the bone marrow of mice were differentiated into macrophages after 7 days in culture with macrophage colonystimulating factor (MCSF) and seeded onto hydrated IL10 scaffolds. Scaffolds were then delivered onto fullthickness splinted excisional wounds in mice to be polarized in vivo. We assessed wound size and healing progression with digital photographs. After wound closure, tissue was harvested for histologic, gene expression, and cellular analyses.

RESULTS: The release profile demonstrated peak release of 35.5 ng/ul of IL10 at 4 hours with a concentration of at least 18.7 ng/ul IL10 maintained for 48 hours. The scaffolds reached full swelling in PBS within 15 minutes with a swelling ratio of 16.53. Gene expression analysis confirmed that macrophages seeded onto IL10 scaffolds were