THE FIBROBLAST-POPULATED COLLAGEN MATRIX MODELS THE RESPONSE OF GRAINULE TISSUE TO DISRUPTION OF WOUND ANCHORAGE

Mark A. Carlsen*, Michael T. Longaker, and Jon S. Thompson
Department of Surgery, University of Nebraska Medical Center, Omaha, NE 68198-3280
Department of Surgery, Stanford University School of Medicine, Stanford, CA 94305-5148
*email: mcarlsen@unmc.edu

Introduction. Models of wound healing are important for dissecting complex healing mechanisms. There is some controversy over whether the fibroblast-populated collagen matrix (FPCM) is an appropriate model of dermal healing. Anchorage of the wound matrix is important for granulation tissue survival. We hypothesized that the gross morphology, cytokeratin morphology, and apoptotic rates of the FPCM vs. excisional wound granulation tissue (GT) would react similarly to disruption of extracellular matrix (ECM) anchorage.

Methods. The FPCM (2 x 10^6 acellular porcine collagen, 0.2 ml bovine collagen, 3 mg/ml) was compared to GT from a wound created 6 days earlier (25 cm full-thickness dermal excision from the rat dorsum) using H&E histology, phalloidin-FITC staining, and TUNEL. ECM anchorage was disrupted by lifting the matrix off the culture well (FPCM) or circumferentially incising the wound edge (GT). Measurements of distance, area, cell population density, phalloidin staining intensity, and TUNEL-positive rate were determined from analysis of digital images using NIH Image (public domain software, http://rscb.nih.gov/nih-image).

Results. In the anchored state, the FPCM and GT both have distinct cross-sectional morphology; this rapidly changes (within minutes) to avoid disruption of ECM anchorage. H&E cellular morphology in both the anchored and disrupted condition was subjectively similar in the FPCM vs. GT. After 24 hr of ECM anchorage disruption, the cross-sectional area and cell population density of both the FPCM and GT decreased compared to anchored controls (*p < 0.05, unpaired t-test). In addition, the actin cytokeratin morphology was similar in the FPCM vs. GT and both the anchored condition (prominent stress fibers) and 24 hr after disruption (very, attenuated fibers); the intensity of phalloidin-FITC staining decreased in both the FPCM and GT 24 hr after ECM anchorage disruption (*p < 0.05 compared to anchored controls). The rate of TUNEL-positive nuclei increased from <1% (anchored matrix) to 5 and 3% in the FPCM and GT, respectively (*p < 0.00 compared to anchored controls).

Conclusions. The FPCM and GT demonstrate a similar response to ECM anchorage and anchorage disruption in terms of gross ECM shape, microscopic cellular shape, cytokeratin morphology, and cell death rate. The FPCM is able to model the behavior of GT with respect to ECM anchorage.

Alejandro L. Cazzaniga, Stephen C. Davis, Patricia M. Mertz
University of Miami School of Medicine
Department of Dermatology & Cutaneous Surgery,
Miami, FL, USA

Abstract Title: A Zinc/Iron Solution Stimulates Epithelialization of Acute Partial Thickness Wounds

Authors: Alejandro L. Cazzaniga, Stephen C. Davis, Patricia M. Mertz
University of Miami School of Medicine
Department of Dermatology & Cutaneous Surgery,
Miami, FL, USA
Address: 1608 NW 10th Avenue, RMB 1379, Miami, FL 33136, USA

Support: research grant from the company: NAWA USA, Bemeug, Germany

Abstract Body: Zinc has been shown to be beneficial in the wound healing process, however, the combined role of zinc and iron has not been studied. The purpose of this study was to evaluate a new zinc/iron solution (ZIS) on the healing of partial thickness wounds. Ten pigs received multiple partial thickness wounds and received one of the following treatments: 1) 0.003% ZIS; 2) vehicle; 3) untreated control. Wounds were treated by sterile 4- to gauge saturated with each agent and then covered with a polyurethane dressing. Wounds were treated daily. Five wounds were excised on days 3 and 8 evaluated for complete epithelization using a well-described salt-split technique. A total of five hundred and forty wounds were evaluated. All wounds that received any treatment epithelialized sooner than untreated area exposed. The 0.003% ZIS enhanced complete epithelization as compared to wounds treated with vehicle alone. This data demonstrates that a new zinc/iron agent is effective at stimulating healing which may have important clinical implications.