TISSUE REGENERATION AND WOUND HEALING UTILIZING PLANT BASED STEM CELL NANOTECHNOLOGY IN PATIENTS NONRESPONSIVE TO NPWT

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INTRODUCTION

Negative Pressure Wound Therapy (NPWT) has been an important modality for wound healing for many years. In modern medicine and since the advent of the NPWT machine, the use has been invaluable to healing hard to heal wounds. There are a subset of patients who do not respond to NPWT or who have halted in their beneficial response to the therapy. The reasons behind this are largely unknown, but can be postulated. On delicate tissues, inherently hypoxic tissues, or patients with multiple comorbidities or malnutrition, negative pressure may inadvertently dehydrate the wound bed or deplete the wound of vital nutrients. It is important to understand the physiological response of NPWT to wounds and how to utilize variable pressure modes, and choose an appropriate (perhaps lower) pressure to maximize wound healing.

Traditionally deep cavitating and heavily draining wounds have been treated with NPWT to stimulate granulation and decrease in size and depth. There are a large subset of patients who do not respond to NPWT or who have been treated NPWT and have not continued to demonstrate improvement. We postulate that cell signaling; growth factor stimulation, and cell migration are all defective in this population of patients.

Advanced wound care products for non-healing wounds have been a growing area of wound healing technology. Nanotechnology and the creation of Nanodevices for wound healing is an important new area of growth. These new generation of wound products are a 100% bio sustainable way to deliver advanced wound therapies to a greater number of patients in need. The creation of nanometric particle sizes, in specific patterns, that can mimic the physical scaffolding appearance of the extracellular matrix (ECM) has the advantage of direct cell-to-cell signaling. The human ECM is also in nanometric size cellular composition. Therefore the ability to use nanodevices in which the ECM is able to directly recognize substrates and start the cell signaling cascade is the future for wound healing.

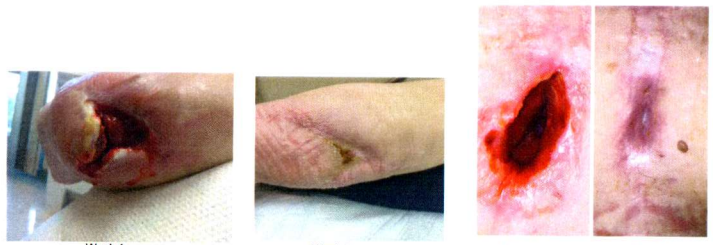
An alternative was to isolate undifferentiated plant stem cells from green tea and create a hemicellulose membrane with Nano particulate fibers. This membrane using 100% non-animal ingredients with the small nanotechnology delivery system is a successful approach to delivering stem cells and much needed vital nutrients directly to the wound bed. Could nanotechnology be as effective in decreasing volume of the wound as NPWT?

METHODS

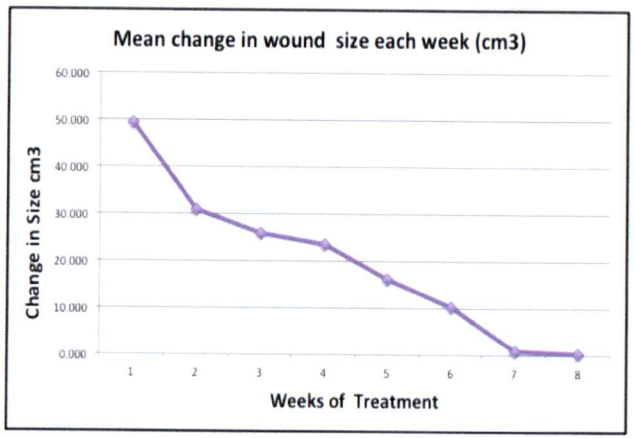
Patients who were placed on NPWT and did not improve by a decrease in 20% wound volume after at least 2 or more consecutive weeks of NPWT were recruited in the case study. The green tea nanodevice membrane was applied twice per week on these wounds while the NPWT was discontinued. Secondary dressings of untreated gauze, ABD pads, or foam were utilized. Wound size and closure rates were monitored over time. Adverse reactions associated with the treatment regime were noted

RESULTS

Week1 Week 3 Week 8 Week 13

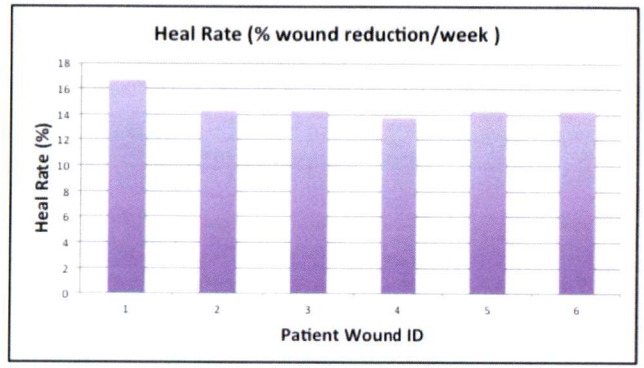


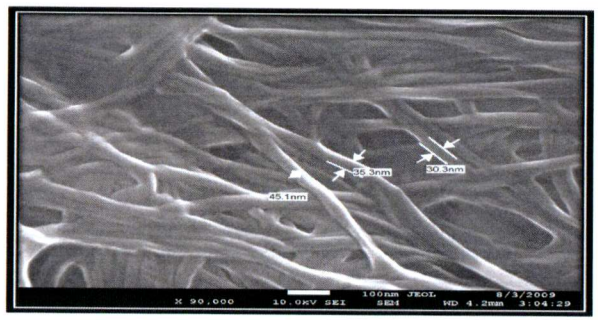
Week 1 Week 8 Week 1 Week 5



- All 6 patients had a decrease in volume reduction
- 5 patients achieved complete closure
- By 7 weeks volume reduction was most likely at its maximal
- Average age of the wound was 4 months (SD +0.41)

RESULTS





Electron Microscopy of Plant Nanofibers

DISCUSSION

The Plant Stem Cell Nanotechnology is a 100% natural biological hemicellulose membrane. It is a green tea based fiber scaffold of nanometric sized particles creating a plant stem cell nanodevice. This nanodevice is an innovative way of delivering stem cells directly into the wound bed. Stem cell nanoparticles have the ability to enter into the cytoplasmic space across cellular barriers and activate specific transport mechanisms with direct cell to cell signaling based on the combination of both quantum particle size and the on the presence of the undifferentiated plant stem cells. This nanodevice membrane helps to replace the extracellular matrix by regulating growth factors, direct cell signaling, and cell to matrix signaling.

The green tea nanodevice membrane also carries a positive charge due to the amine groups on the highly pedicled carboxylic acid cellulose. The positive charge creates an electromagnetic attraction with the negatively charged blood byproducts and negatively charged bacteria. Therefore, upon wound bed stimulation by the membrane it is clinically and qualitatively seen that deep-seated bio burden is removed and edema is improved. It is postulated that perhaps this is the reason for such dramatic decrease in volume is the actual decrease in edema from both the wound and the periwound.

Traditionally deep cavitating and heavily draining wounds have been treated with NPWT to stimulate granulation and decrease in size and depth. There are a large subset of patients who do not respond to NPWT or who have been treated NPWT and have not continued to demonstrate improvement. We postulate that cell signaling; growth factor stimulation, and cell migration are all defective in this population of patients. Utilizing the SCNT system was able to stimulate the proliferative phase of wound healing and show significant wound healing despite having cavitating and draining wounds. Further investigative studies are warranted.

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