Wound Therapy Into Gauze During Negative Pressure Tissue Ingrowth Into Foam but Not with negative pressure was greater for foam than for gauze. NPWT needed to remove the wound filler from the wound bed after treatment with an overlying dressing were stained with hematoxylin-eosin and Giemsa and were examined histologically. Sections of biopsies from the wound bed were compared, and the force required to remove the wound bed was measured. Sections of biopsies from the wound bed were compared, and the force required to remove the wound bed was measured.

More leukocyte infiltration, tissue disorganization, disruption of contact among cells, and differences in size among cells. The results were more similar regardless of the level of negative pressure. The aim of the present study was to examine the effects of NPWT on the wound bed using foam and gauze. Differences in the peripheral wound model was treated with NPWT at 0, -75 mmHg, or -125 mmHg for 72 hours. The effects of foam and gauze on the wound healing effects of foam and gauze have been observed clinically. The use of negative pressure wound therapy (NPWT) has evolved over the last decade due to its remarkable effects on the healing of chronic wounds. The mechanism of action of NPWT consists of a wound filler material covered with an adherent air-permeable dressing. Several wound fillers have been used for negative pressure wound therapy (NPWT). Differences in the wound healing effects of foam and gauze have been observed clinically observed differences in quality of granulation tissue formation. Morphology under foam and gauze are in accordance with the clinically observed differences in quality of granulation tissue formation. The observed differences in wound bed tissue upon removal of foam. The observed differences in wound bed tissue upon removal of foam. More leukocyte infiltration, tissue disorganization, disruption of contact among cells, and differences in size among cells. The results were more similar regardless of the level of negative pressure. The aim of the present study was to examine the effects of NPWT on the wound bed using foam and gauze.

Foam and gauze are two types of wound fillers. The mechanism of action of NPWT consists of a wound filler material covered with an adherent air-permeable dressing. Several wound fillers have been used for negative pressure wound therapy (NPWT). Differences in the wound healing effects of foam and gauze have been observed clinically observed differences in quality of granulation tissue formation. Morphology under foam and gauze are in accordance with the clinically observed differences in quality of granulation tissue formation. The observed differences in wound bed tissue upon removal of foam. The observed differences in wound bed tissue upon removal of foam. More leukocyte infiltration, tissue disorganization, disruption of contact among cells, and differences in size among cells. The results were more similar regardless of the level of negative pressure. The aim of the present study was to examine the effects of NPWT on the wound bed using foam and gauze.

Methods. A porcine peripheral wound model was treated with NPWT at 0, -75 mmHg, or -125 mmHg for 72 hours. The effects of foam and gauze on the wound healing effects of foam and gauze have been observed clinically observed differences in quality of granulation tissue formation. Morphology under foam and gauze are in accordance with the clinically observed differences in quality of granulation tissue formation. The observed differences in wound bed tissue upon removal of foam. The observed differences in wound bed tissue upon removal of foam. More leukocyte infiltration, tissue disorganization, disruption of contact among cells, and differences in size among cells. The results were more similar regardless of the level of negative pressure. The aim of the present study was to examine the effects of NPWT on the wound bed using foam and gauze.

Abstract: Foam and gauze are two types of wound fillers. The mechanism of action of NPWT consists of a wound filler material covered with an adherent air-permeable dressing. Several wound fillers have been used for negative pressure wound therapy (NPWT). Differences in the wound healing effects of foam and gauze have been observed clinically observed differences in quality of granulation tissue formation. Morphology under foam and gauze are in accordance with the clinically observed differences in quality of granulation tissue formation. The observed differences in wound bed tissue upon removal of foam. The observed differences in wound bed tissue upon removal of foam. More leukocyte infiltration, tissue disorganization, disruption of contact among cells, and differences in size among cells. The results were more similar regardless of the level of negative pressure. The aim of the present study was to examine the effects of NPWT on the wound bed using foam and gauze.

Ingemansson, MD, PhD; Malin Malmsjö, MD, PhD
DO

Circulation of autologous
blood was achieved with a continu-
xylazine (2 mg/kg) mixed with ketamine (20 mg/kg).

Anesthesia and surgical procedure.

Premedication

Healthy domestic pigs of both sexes with a
mean body weight of 70 kg were fasted overnight with
water. The Ethics Committee for Animal
Research (Lund University, Sweden) approved the experi-
mental protocol for this study. All animals received
free access to water. The Ethics Committee for Animal
Care.

Material and Methods

A Foley catheter was inserted into the bladder through a
suprapubic cystostomy. Endotracheal intubation was
performed by a cuffed endotracheal tube. A Foley catheter
was attached to a suprapubic cystostomy. Mechanical ventilation was
established with a Siemens-Elema ventilator (Siemens-Elema
AB, Solna, Sweden) in the volume-controlled mode (65% nitrous oxide, 35% oxygen). Ventilatory settings were:
respiratory rate, 15 breaths/min; tidal volume, 8 mL/kg;
minute ventilation, 12 L/min). A positive end-expiratory
pressure of 5 cmH2O was applied. A Foley catheter was
inserted into the bladder through a suprapubic

Circular wounds, 5-cm in
diameter going into subcutaneous tissue, were created
in each pig's back. Kendall AMD

Mansfield, MA) or foam (V.A.C.

Vol. 21, No. 11 November 2009
in Mayer's hematoxylin and then treated with tap water for 3 minutes, 99.5% ethanol for 2 x 3 minutes, and 4 minutes in distilled H2O. Sections were deparaffinized (5 minutes in xylene, 4 minutes in 99.5% ethanol, and 2 x 4 minutes in 100-mL distilled H2O). The tissue sections were differentiated by dipping in HAc (16 drops of 100% HAc in 100-mL distilled H2O). Sections were treated in 4% paraformaldehyde, dehydrated, and finally embedded in paraffin overnight. Sectioning was performed in a rotary microtome HM 355 (ThermoFisher Scientific, Waltham, MA).

NPWT, the strip and the underlying wound bed tissue was cut away with a scalpel. The tissue was then treated with a rotary microtome HM 355 (ThermoFisher Scientific, Waltham, MA). The tissue sections were stained for 1 hour in a staining solution (10% Giemsa and 90% distilled H2O) and then counterstained with a solution (10% Giemsa and 90% distilled H2O) in 100-mL distilled H2O. The tissue sections were viewed to determine the morphology of the underlying tissue. The following measurements were performed:

1. Ingrowth into the wound filler
2. Force needed to pull away the wound filler
3. Leukocyte count (leukocytes per micrometer squared)
4. Tissue disorganization (micrometers into the wound bed—ie, disruption of contact between the cells and differences in cell size (micrometers into the wound filler).

Calculations and statistics were performed using GraphPad 5.0 software (La Jolla, CA). Statistical analysis was performed using one-way ANOVA followed by Tukey's multiple comparison test, and Student's t-test for multiple comparisons when comparing three groups, and the Kruskal-Wallis test with Dunn's post-hoc test for multiple comparisons when comparing two groups. Differences were considered statistically significant when P < 0.05. The results are presented as mean ± the standard error of the mean.

Figure 1. Experimental setup for measurements of the force needed to pull away the wound filler.

Redirection

OR

Figure 2. Biopsy sections were evaluated for leukocytes, tissue disorganization, and tissue differentiation. Biopsy sections were examined in the wound bed—ie, disruption of contact between the cells and differences in cell size (micrometers into the wound filler). The tissue sections were evaluated for the following:

1. Ingrowth into the wound filler
2. Force needed to pull away the wound filler
3. Leukocyte count (leukocytes per micrometer squared)
4. Tissue disorganization (micrometers into the wound bed—ie, disruption of contact between the cells and differences in cell size (micrometers into the wound filler).
The tissue morphology was examined using histology. The wound bed was mainly composed of the foam, while the gauze was treated with a regular dressing. The tissue was also disorganized to a greater extent in the foam-treated wounds (leukocyte infiltration increased slightly in the gauze-treated wounds and to a greater number of leukocytes and tissue disorganization). The present study found no such ingrowth into gauze, although this has not yet been examined in detail in a controlled study. The present study shows that wound bed tissue grows into foam but not into gauze or foam, although this has not yet been examined in detail in a controlled study. The present study shows that wound bed tissue grows into foam but not into gauze or foam, although this has not yet been examined in detail in a controlled study.

The tissue morphology was examined using histology. The wound bed was mainly composed of the foam, while the gauze was treated with a regular dressing. The tissue was also disorganized to a greater extent in the foam-treated wounds (leukocyte infiltration increased slightly in the gauze-treated wounds and to a greater number of leukocytes and tissue disorganization). The present study found no such ingrowth into gauze, although this has not yet been examined in detail in a controlled study. The present study shows that wound bed tissue grows into foam but not into gauze or foam, although this has not yet been examined in detail in a controlled study. The present study shows that wound bed tissue grows into foam but not into gauze or foam, although this has not yet been examined in detail in a controlled study.
ical effects, such as wound contraction, and micromechanical effects as a result of the interaction of the tissue and dressing at a microscopic level.\textsuperscript{1} It is believed that these mechanical effects affect the cytoskeleton,\textsuperscript{16} which initiates a signaling cascade that ultimately leads to granulation tissue formation. Differences in the mechanical properties of foam and gauze may result in ingrowth differences. Other factors that may be of importance are the chemical nature of the material, the surface properties of the wound fillers, and the geometry of the pores of the wound filler.

In the present study, there was a morphological difference in the wound bed underlying foam and gauze. Foam-treated wounds had more leukocyte infiltration into the tissue and the tissue was also more disorganized. The reason for increased leukocyte infiltration is not known. The mechanical effects on the wound bed are similar for gauze and foam, and thus it seems more probable that the chemical or the geometrical properties of the wound filler plays a role. One possible mechanism could be that the wound filler causes a foreign body reaction. Leukocytes first infiltrate the wound bed.

Figure 4. The depth of tissue ingrowth into gauze and foam after 3 days of NPWT at atmospheric (0 mmHg) or subatmospheric (-75 or -125 mmHg) pressure in a porcine peripheral wound. The results are presented as means ± SEM.
Leukocytes then release cytokines in order to promote granulation tissue formation. The first step in the process of granulation tissue formation is disorganization of the tissue as the cells turn into fibroblasts. Once formed, fibroblasts create granulation tissue that organizes. Tissue disorganization is one of the initial events in generating granulation tissue formation. Disorganization was seen in the sliced sections of the wound bed in the present study, with disruption of the contacts between the cells and differences in cell sizes.

While granulation tissue formation is an important element of wound healing, it also results in fibrosis. Fibrosis leads to scarring and contraction of the wound as the healing tissue organizes. The fact that the tissue is more disorganized after NPWT with foam than after NPWT with gauze may be related to the fact that many clinicians observe more fragile granulation tissue in wounds treated with foam than in wounds treated with gauze. The differences in the wound bed after NPWT treatment with gauze or foam can be seen in the clinical setting. NPWT with foam results in thick granulation tissue, but with more tissue ingrowth compared to NPWT with gauze. When foam is removed, the wound bed tissue...
The results show that negative pressure wounds (NPWT) improve wound healing. A recent study comparing different negative pressure levels found that -80 mmHg was sufficient to achieve many of the biological effects that are thought to be important for wound healing. This may explain the clinical observations that foam dressing is more effective than gauze in promoting wound healing, as foam has been shown to attract leukocytes, which are crucial for the wound healing process.

The present study support this conclusion. Negative pressure levels ranging from -10 mmHg to -175 mmHg have been studied with regard to their effects on wound healing. The two different levels of negative pressure examined in the present study, -75 mmHg and -125 mmHg, showed similar results regarding both the degree of leukocyte infiltration and tissue disorganization. This newly formed tissue may promote faster healing.

In clinical practice, measures are undertaken to prevent wound dehiscence and maintain wound integrity. One such measure is the use of negative pressure therapy to promote wound healing. The use of negative pressure therapy has been shown to improve wound healing in various patient populations, including those with diabetes and chronic wounds.

Leukocytes play an important role in the wound healing process by promoting the formation of granulation tissue. Leukocytes promote the healing process by releasing cytokines and growth factors that stimulate the production of new tissue. The greater degree of leukocyte infiltration in wounds treated with negative pressure therapy has been shown to be advantageous when treating wounds that benefit from a high leukocyte infiltrate and tissue disorganization.

The use of negative pressure therapy has been shown to be particularly beneficial for patients with chronic wounds, as it helps to maintain wound integrity and prevent wound dehiscence. The use of negative pressure therapy has also been shown to be effective in promoting wound healing in patients with diabetes, as it helps to maintain wound perfusion and improve tissue oxygenation.

In conclusion, negative pressure therapy has been shown to be an effective treatment for a variety of wounds, including chronic wounds and wounds in patients with diabetes. The use of negative pressure therapy is supported by clinical evidence and has been shown to be effective in promoting wound healing.

**References**


4. Wieberg Foundation, the Magn. Bergvall Foundation, the Swedish Research, the Swedish Hypertension Society, and the Swedish Medical Research Council, the Swedish Government Grant for Clinical Research, the School of Medicine, and the School of Pharmacy, University of Lund, Sweden.

**Acknowledgements**


11. Paglinawan R, Colic M, Simon M. A comparative study of the influence of different pressure levels combined with various wound dressings on negative pressure wound therapy driven wound healing. Presented at: European Tissue Repair Society Meeting; September 2008; Malta.


