

Combination Negative Pressure Wound Therapy with Topical Oxygen Decreases Bioburden in Translational Porcine Pilot Study

Mario C. Reyes, DPM, Ariane B. Lazzarini, BS, Lawrence A. Lavery, DPM, MPH

Statement of Purpose

- The aim of this pilot study was to evaluate the effect of a novel device combining NPWT with adjunctive topical O₂ (NPWT-TOT) vs. intermittent NPWT on bioburden in infected porcine wounds.

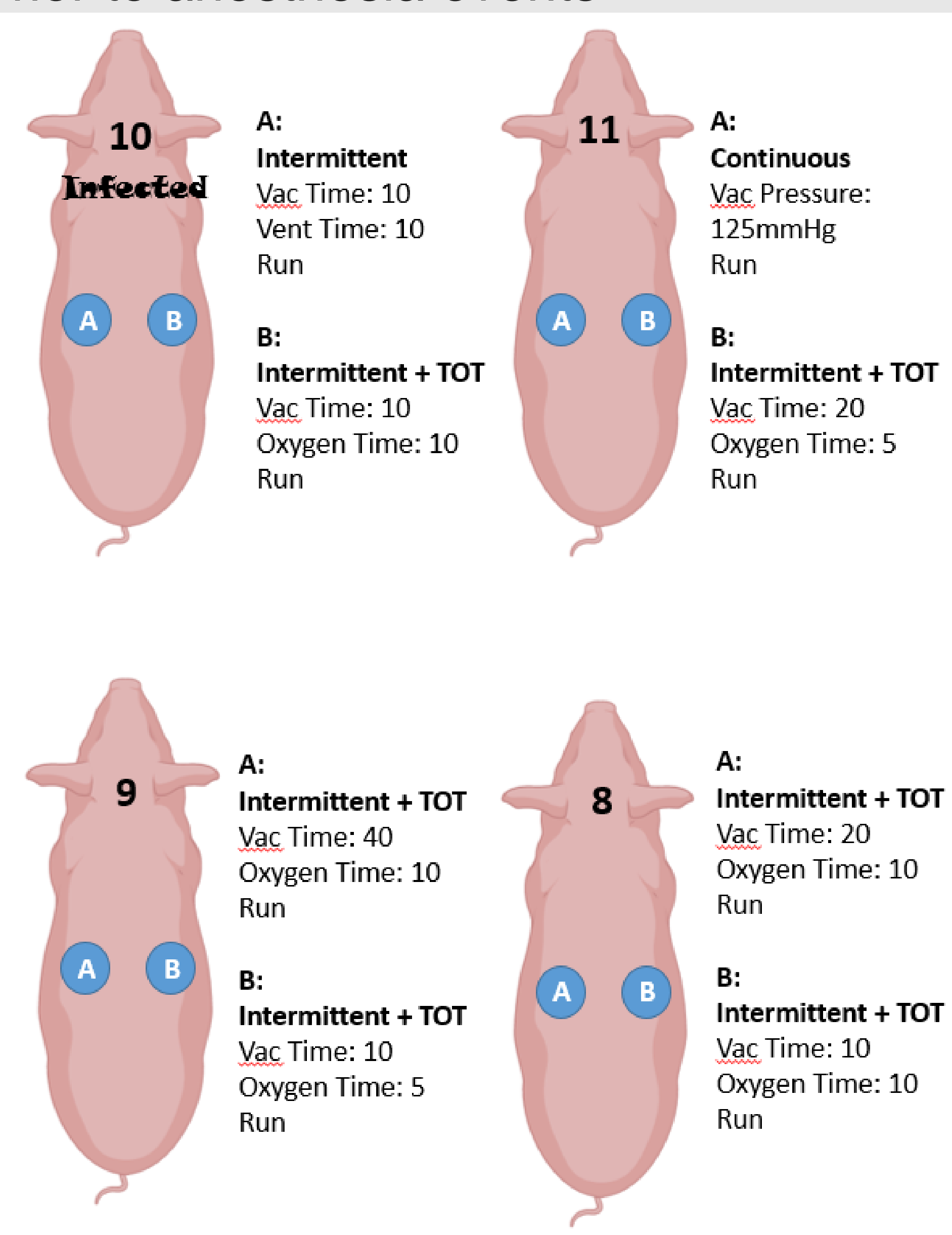
Introduction

- Negative pressure wound therapy (NPWT) is a vital tool in the management of wounds, improving wound closure and time to wound closure.
- Topical oxygen therapy (TOT) has been demonstrated to promote wound healing.

Methodology

Design:

- Four female Yorkshire-cross pigs were singly housed in the same room with 12-hour light and dark cycles.
- Animals were allowed to acclimate to the facility for 2 days, followed by application of a harness.
- Animals were allowed to acclimate for an additional 3 days before attaching the harness to an articulating, engineered arm.
- Animals were housed for six days before surgical intervention to ensure no distress at the initiation of therapy
- They were fed chow ad libitum and fasted for 12 hours prior to anesthesia events



Methodology

Wounding Technique:

- Two 5-cm diameter full thickness wounds were created on the dorsal paravertebral surface of 4 pigs.

Inoculation:

- Both wounds on one pig were inoculated with 1x10⁶ CFU/mL Staphylococcus aureus (ATCC-35556) under occlusion for 3 days.

Treatment:

- Wounds were debrided and application of NPWT-TOT and intermittent NPWT commenced for 28 days
- Swab specimens were collected post-debridement on days 0, 7, 14, and 21
- Punch biopsies of the leading edge of the wound were collected on days 0, 7, 14, and 21
- Study outcomes included changes in bioburden, wound area and volume, and histology

Wound Assessment

Debridement of wounds was performed with a dermal curette 2x/week and wounds were assessed for:

- Area, depth, volume
- Granulation
- Induration
- Inflammation
- Discharge

No adverse reactions occurred with TOT therapy.

Results

Histology:

- Histological changes revealed **increased trichrome staining** at the end of therapy across all wounds signifying increased collagen maturity
- Increased WBC staining** was noted at Day 14 of NPWT-TOT compared to Intermittent NPWT

Microbiology:

- On day 0, wounds A and B had 1.78x10⁷ and 3.50 x 10⁷ 16s copies per swab, respectively.
- On day 7, wound B with NPWT-TOT showed a **2-log reduction** while wound A with traditional NPWT maintained the same bioburden, which continued until day 14.

Wound Reduction:

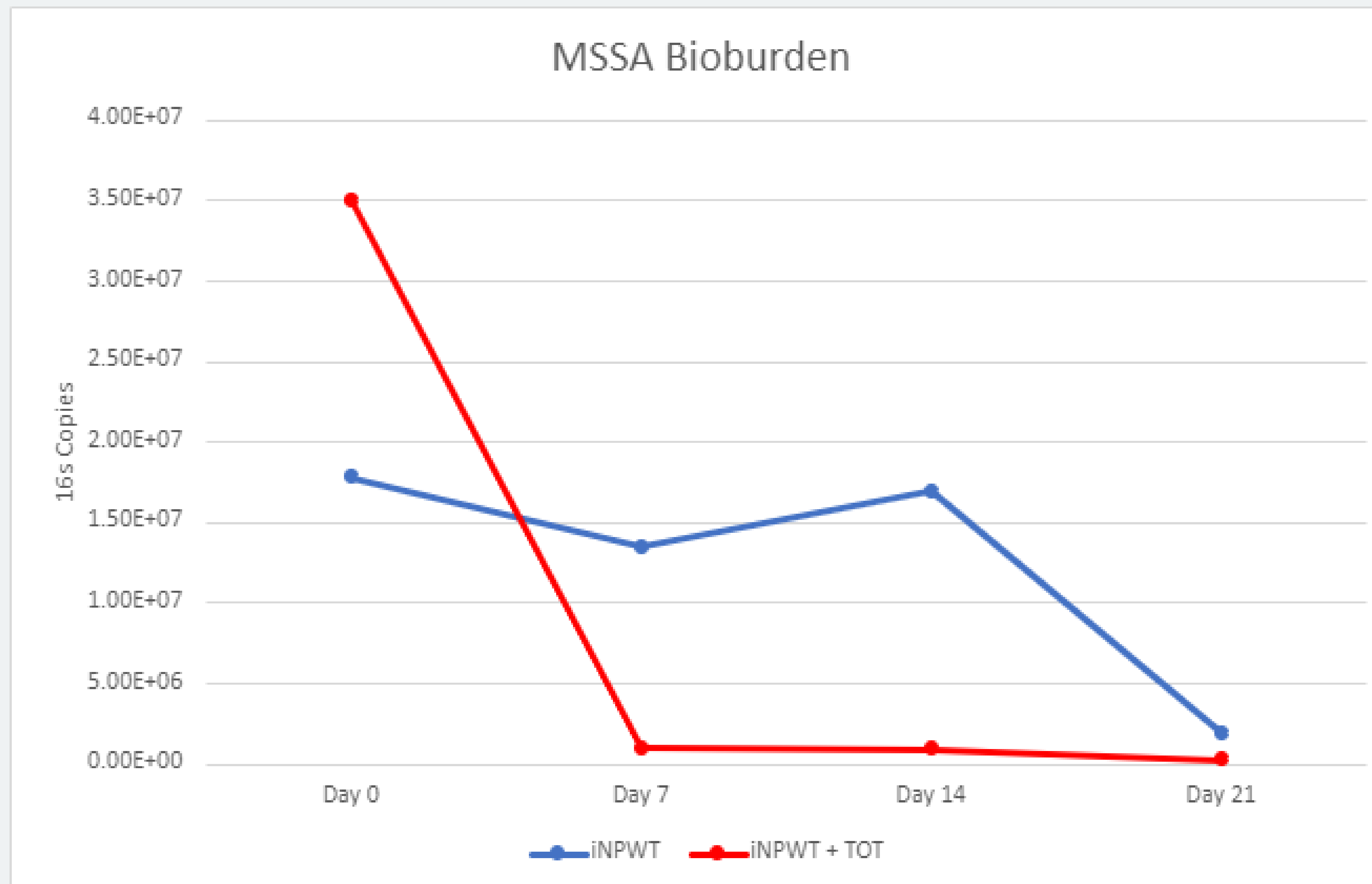
- Both wounds had a 50% wound area reduction by day 7 and a 90% reduction by day 28.

Discussion and Conclusions

- Our analysis shows NPWT-TOT resulted in a similar wound area reduction and a clinically significant decrease in bioburden when compared with intermittent NPWT alone in a porcine translational model. Further study on a larger scale is warranted for human application.

Funding:

This study was supported by Bechtel Medical, Inc., Collegeville, PA



	Day 0	Day 7	Day 14	Day 21
iNPWT	1.78E+07	1.35E+07	1.69E+07	1.90E+06
iNPWT + TOT	3.50E+07	9.84E+05	9.25E+05	2.51E+05