when excited by 405 nm violet light, tissues fluoresce. However, the extent of debridement required to reduce bioburden based on International Best Practice: Wound Management in DFUs. Wounds International, 2013. Rennie MY et al. Point do not maximize removal of bioburden. Incorporation of bacterial fluorescence imaging into routine DFU care enables real-time detection and localization of peri-wound bacteria to target secondary/additional debridement to regions of bacterial burden.

METHODS

Bacterial Fluorescence Imaging

- When excited by 405 nm violet light, tissues fluoresce green while bacteria fluoresce red (e.g. Staphylococcus aureus).
- This enables real-time, point-of-care detection and localization of bioburden (≥ 10^4 CFU/g) within and around wounds.

- Initial curettage debridement aggressively removed multiple layers of tissue on and around the wound, according to current best practices.
- Fluorescence images were acquired after initial debridement. When deemed clinically appropriate, fluorescence images were then used to target remaining regions of bioburden through additional debridement.

RESULTS

**Bacterial Fluorescence Guides More Aggressive, Targeted Debridement and Insight for More Frequent Debridement**

**CASE 1** 57 year old male with DFU on left toe. Patient self-treated DFU with an over-the-counter antibiotic ointment for two months prior to seeking treatment from a wound care practitioner. Patient lacked offloading footwear. Initial curettage debridement was performed per standard of care, after which fluorescence images were acquired to assess initial debridement effectiveness. Bacterial fluorescence was observed throughout the periwound region led the clinician to debride more aggressively, specifically targeting the red fluorescing regions. Wound was debrided until red fluorescence was no longer observed.

**CASE 2** 52 year old male with small (0.3 cm) DFU on left toe. DFU has repeatedly closed/reopened due to patient’s lack of proper offloading footwear. Bacterial fluorescence (red, arrows) was observed pre-debridement, after initial standard of care debridement. Red fluorescence persisted after additional, targeted debridement. Based on the persistence of bioburden after aggressive debridement, clinician determined that patient required more frequent debridement (weekly) in addition to antimicrobial dressings.

**CASE 3** 82 year old male with plantar DFU, heavy callus builder. Clinical indications for treatment of 12 DFUs classified as “healable” within and around the wound. Bioburden was classified as moderate/heavy bacterial load (≥ 10^4 CFU/g). Fluorescence observed surrounding the wound pre-debridement (circled), which prompted thorough cleaning of this region. Persistent bioburden after aggressive, targeted debridement of the wound demonstrated need for more frequent debridement.

CONCLUSIONS

- Red (bacterial) fluorescence was present in 100% of DFUs after initial, aggressive, standard of care curettage debridement. This is especially concerning given that red fluorescence equates to a bacterial load of ≥ 10^4 CFU/g or higher (i.e. moderate/heavy bacterial load).
- Thus, results of this study demonstrate that current best DFU debridement practices of visual inspection and clinician judgement: 1. do not maximize removal of bioburden, 2. leave behind an unacceptable high bacterial load (≥ 10^4 CFU/g) that is considered detrimental to wound healing, and 3. fail to optimally prepare the wound for antimicrobial dressings/treatments.
- Incorporation of bacterial fluorescence imaging into routine DFU wound care resulted in more aggressive debridement. This specifically targeted regions of bioburden, and avoided unburdened tissue, providing a more optimal state for healing.
- Results highlight the potential of bacterial fluorescence imaging to dramatically improve current debridement practices by enabling point-of-care, bioburden based decision making on which tissue, and how much tissue, to selectively remove.

FUTURE DIRECTIONS

- The ultimate goal of debridement intervention is to increase (1) a wound’s ability to heal and (2) wound healing rates. Wound healing rates have not yet been incorporated into this study.
- In future, upon closure of these wounds, a retrospective analysis is planned to compare average healing rates in these twelve patients, debrided regularly under fluorescence guidance, with a separate cohort receiving standard of care only.

REFERENCES


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