

Shifting focus: implications of periwound bacterial load on wound hygiene

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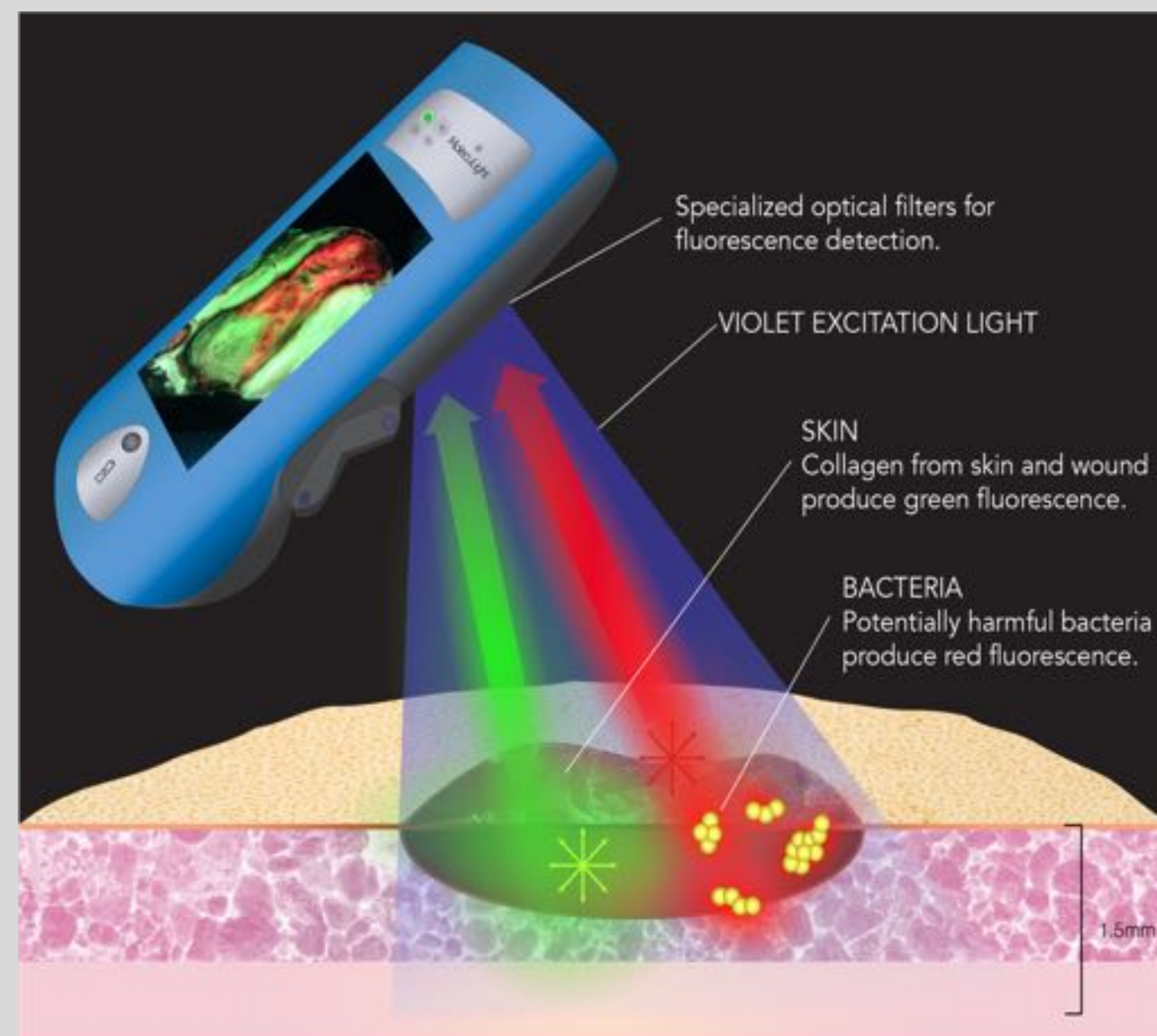
INTRODUCTION

- Wound cleansing is the most ubiquitous method to maintain optimal wound hygiene as it is available at all clinical settings and skill levels.
- The periwound is often a neglected area, but serves as a source for microbial recontamination if not adequately cleansed.
- Fluorescence imaging has been used to visualize fluorescing bacteria in real-time at the bedside using a non-contact device²⁻⁴.
- This study reports the use of bacterial fluorescence imaging to assess bioburden in the wound and periwound area to optimize wound hygiene using a new cleansing agent, using lower concentration sodium hypochlorite (NaOCl), compared to standard practice.

METHODS

Bacterial Fluorescence Imaging

- When excited by 405 nm violet light, tissues fluoresce green while bacteria fluoresce red (e.g. *Staphylococcus aureus*) or cyan (e.g. *Pseudomonas aeruginosa*).
- This enables real-time, point-of-care detection and localization of bioburden ($\geq 10^4$ CFU/g) within and around wounds²⁻⁴.



- Bacterial fluorescence imaging was incorporated into assessment of 10 wounds of mixed etiology (e.g. DFU, VLU, SSI, PU).
- Fluorescence imaging was performed at baseline, after cleaning with saline and after cleaning with low concentration sodium hypochlorite.
- Fluorescence images were used to assess presence of bioburden after each cleansing step and determine the region to target further cleansing or debridement if cleansing did not eliminate the bioburden.

RESULTS

Visualization of bacterial load can be incorporated into routine wound care to optimize wound hygiene by guiding targeted cleansing

Standard practice cleansing with saline was performed on 10 wounds in this study.



ST-image

FL-image

Case 1:

- 72 year old male treated with NPWT after midline surgery complication
- Distinct odour observed at the time of assessment
- Swab obtained from the wound bed prior to fluorescence imaging were negative for bacterial growth
- Red fluorescence indicates presence of bacteria

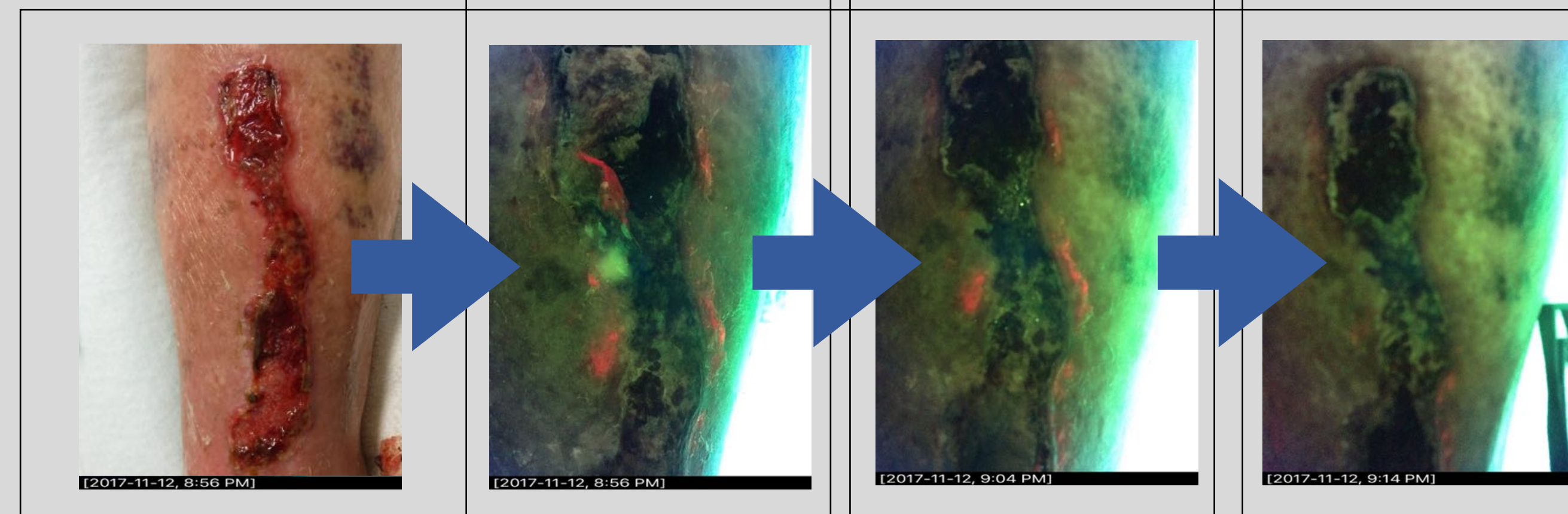
Based on fluorescence images after initial saline cleanse, in which bacterial (red) fluorescence was present in 100% of wounds, clinician chose to more aggressively cleanse all 10 wounds using low concentration sodium hypochlorite, specifically targeting regions of bioburden. 3 cases are demonstrated.

Baseline - ST-image

Baseline - FL-image

After saline

After NaOCl

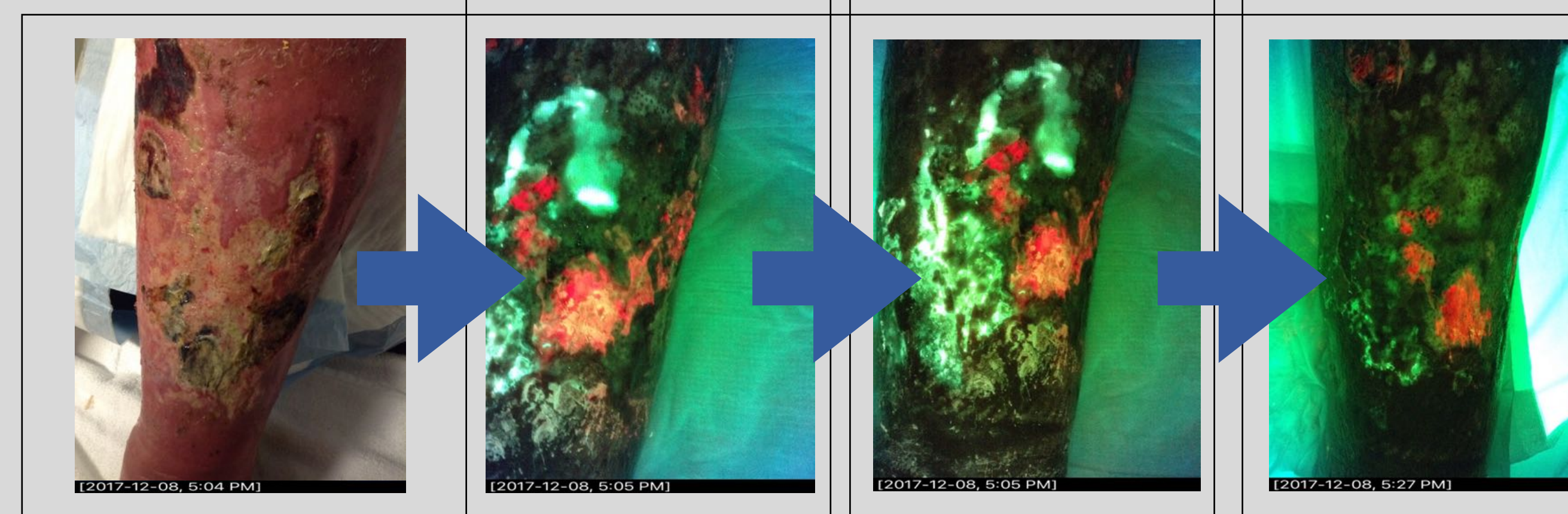
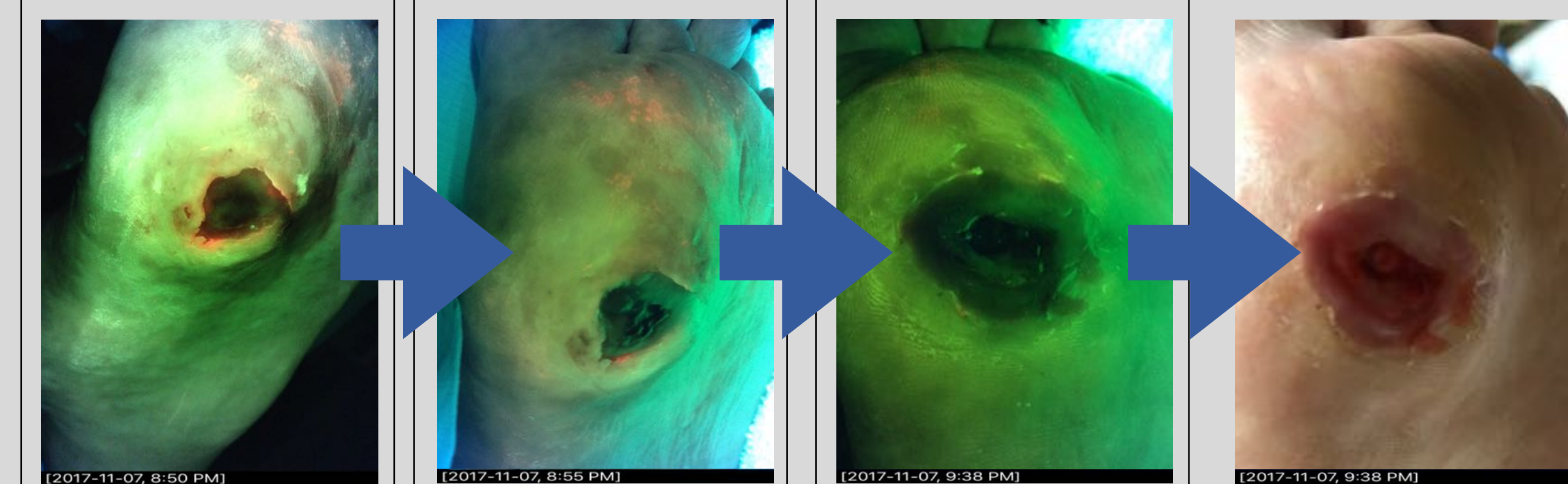


Case 2: Skin Tear

- Saline cleanse was moderately effective in removing red fluorescent bacteria
- NaOCl cleanse successfully removed red fluorescing bacteria

Case 3: DFU

- Red fluorescing bacteria present at the wound bed and peri-wound site.
- Saline cleanse did not eradicate fluorescent bacteria
- NaOCl cleanse successfully removed all red fluorescence



Case 4: VLU with necrosis

- Cleansing with saline did not remove cyan or red fluorescing bacteria
- NaOCl was very effective on cyan fluorescing bacteria
- Red fluorescence remained after NaOCl cleanse and the patient required debridement

RESULTS

# of Wounds Cleansed		
Initial periwound fluorescence	Periwound fluorescence after saline cleanse	Periwound fluorescence after low concentration NaOCl
10/10	10/10	3/10

Note: Off-site bacteria was also observed in all 10 wounds

CONCLUSIONS

- Bacterial (red and/or cyan) fluorescence was present in the periwound area in 100% of wounds. The fluorescence persisted after initial, standard of care cleansing with saline.
- This is concerning given that red fluorescence equates to a bacterial load of 10^4 CFU/g or higher (i.e. moderate/heavy bacterial loads)⁴.
- 30% of wounds required debridement after cleansing with low concentration sodium hypochlorite solution (NaOCl)
- Thus, results of this study demonstrate that bacteria is located outside of the wound bed, and poses a cross-contamination risk. Current best cleansing practices using saline:
 - do not maximize removal of bioburden, and
 - leave behind an unacceptably high bacterial load ($\geq 10^4$ CFU/g) that is considered detrimental to wound healing⁵
- Incorporation of bacterial fluorescence imaging into routine wound care resulted in more aggressive cleansing. This specifically targeted regions of bioburden, and indicated to the clinician if additional therapy (e.g. debridement) was required to fully eliminate the bioburden.
- Results highlight the potential of bacterial fluorescence imaging to dramatically improve current cleansing practices by enabling point-of-care, bioburden based decision making on when cleansing is sufficient, and when additional techniques are required to remove bioburden.

REFERENCES

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