in-Vitro Analysis of Simulated Wound Fluid and MMP Transfer from the Periwound Using a Fluid Management Dressing

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BACKGROUND & PURPOSE

Precise regulation of wound matrix metalloproteinases (MMPs) promotes optimal wound healing. For chronic wounds, the balance of MMPs is often disrupted, which may stall the healing process in the inflammatory phase.[1,2] Specifically, elevated MMP levels (e.g. MMP-9) are believed to result in delayed wound healing.[3]

A validated periwound test method[4] in conjunction with fluorescence imaging was utilized to quantify the ability of the study dressing to remove MMP's from a simulated wound, through the study dressing, and into a secondary absorptive layer. An ideal dressing should actively move exudate and MMP-9 away from the wound bed, leaving the periwound unsaturated and reduced levels of MMP-9 in the wound.

METHOD

The test consisted of applying the dressing over a simulated wound bed and exposing the dressing to a constant rate of simulated wound fluid (SWF) containing MMP-9 tagged proteins. The amount of FITC-Lectin and MMP-9 that was present at simulated wound and dressing interface was quantified.

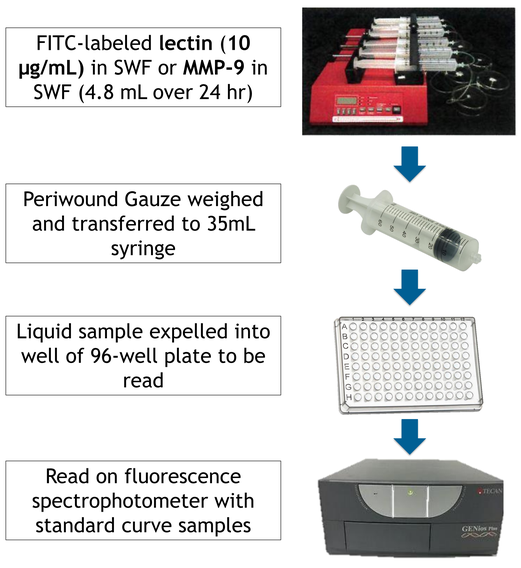

Figure 1. Testing process flow for the analysis of the simulated periwound saturation levels for FITC-Lectin and MMP-9.

RESULTS

The study dressing was tested alongside negative and positive control dressings. Each of the simulated periwounds were rinsed to remove remaining FITC-labeled lectin or MMP-9 in SWF. Fluorescent imaging was completed to visually represent the amount of FITC-Lectin left behind in the simulated periwounds for each test dressing setup. The greater the amount of FITC-Lectin present in the periwound, the darker they will fluoresce.

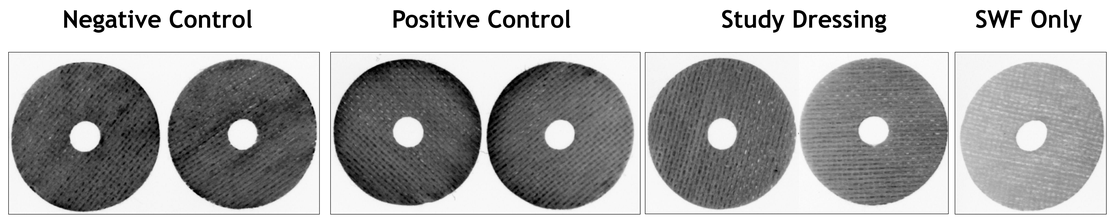

Figure 2. Representative fluorescent images showed differences between the amount of FITC-Lectin saturated within the periwound samples.

Actual FITC-Lectin recovered average values demonstrated highest in the simulated periwound with negative control, then the positive control and the study dressing had the lowest. The average MMP-9 value calculated was a negative value due to the levels MMP-9 being below that can be detected in the periwound. The simulated periwound for the study dressing setup showed lower saturation levels for both FITC-Lectin and MMP-9, when compared to the negative and positive controls.

Primary Dressing	Average FITC-Lectin recovered (µg)	St Dev	Average MMP-9 recovered (ng)	St Dev
Negative Control	4.067	0.176	0.923	0.179
Positive Control	1.667	0.049	0.214	0.058
Study Dressing	0.542	0.040	-0.006	0.041

Table 1. Summary of the data shown as average FITC-Lectin (µg) and average MMP-9 (ng) recovered from the periwound and the standard deviation calculated from the experimental replicates.

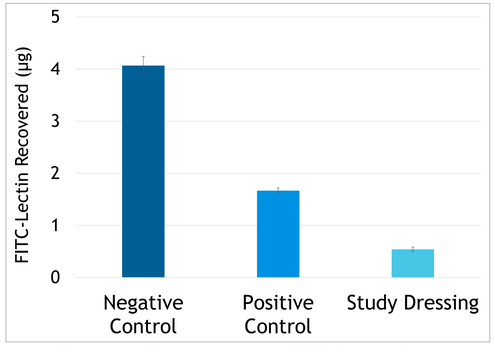

Figure 3. The amount of FITC-Lectin Recovered.

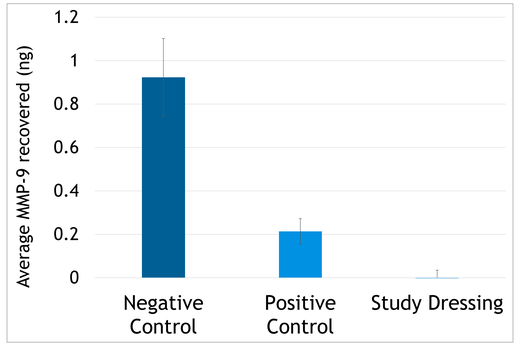

Figure 4. The amount of MMP-9 recovered.

DISCUSSION

There were significant differences in the amount of FITC-lectin and MMP-9 detected in the solutions isolated from the simulated periwounds of the study dressing, negative and positive control. The positive control removed the FITC-Lectin and MMP-9 compared to the negative control. The study dressing was the most efficient removing both the MMP-9 and FITC-Lectin.

This demonstrated the study dressings effective active fluid management properties for transfer of MMPs from the wound bed and into the secondary absorptive layer in an *in-vitro* setting.

CONCLUSION

The technology* within the study dressing† is designed to move exudate up and away from a simulated wound into a secondary absorptive layer. The results of this work demonstrate that in addition to exudate, the study dressing effectively moved MMP-9 from the simulated wound into a secondary absorptive layer.

Understanding how dressings manage exudate (and its contents) will be critical to improving future dressing designs and performance. Additional *in-vivo*/clinical studies are being considered to quantify the removal of MMP's from a chronic wound bed.

FOOTNOTES

*Active Fluid Management® (AFM), †Study Dressing: TRITEC™, Milliken Healthcare Products, LLC, Spartanburg, SC

Negative Control: Curity Gauze Sponge, Covidien, Ireland
Positive Control: Drawtex, Steadmed, Fort Worth, TX

Testing completed by iFyber, LLC, Ithaca, NY

REFERENCES

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