PCMP as a Barrier for Complex Wounds: Impact on Clinical Outcomes, Bioburden, and Gene Expression in a Canine Model

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Purpose: Complex surgical wounds often require ongoing irrigation and debridement (I&D) until impediments to wound healing are resolved. Repeated I&D is a resource burden and costly to patients, hospitals, and payers. We hypothesized that using PCMP, a cross-linked native porcine collagen matrix coated with antimicrobial polyhexamethylene biguanide (PHMB), as a protective barrier would support improve wound healing. To test this hypothesis, we utilized a canine complex wound model mimicking clinical complications associated with fractures and associated skin and soft-tissue wounds.

Methods: 8 dogs received bilateral 1-cm fibular ostectomies stabilized with plate-and-screw fixation (IACUC protocol #16680, University of Missouri). Staphylococcus aureus-incubated plates (1 x 105 CFU/mL for 48 hours) were used for stabilization. At day 7, all wounds underwent standard-of-care I&D, and each animal received either a nonadherent dressing or PCMP (n = 8/group) on alternating limbs to minimize bias. Wounds were assessed by radiography and blinded scoring at 3, 7, and 10 days. Bacterial load was quantified pretreatment and 10 days posttreatment. Gene expression of 84 targets was analyzed using RT2 PCR Arrays; $2^{-\Delta\Delta Ct}$ was calculated for normalized genes ($P<0.05$).

Results: Significant improvements in wound healing were observed with PCMP compared to standard of care on days 3 and 7 ($P<0.05$). Post treatment, PCMP trended lower in S. aureus burden (2.67 x 105 vs 3.25 x 105 CFU/g), but the difference was not statistically significant. Quantitative RNA expression revealed that PCMP resulted in significantly greater extracellular matrix gene expression (COL1A1, COL1A2, COL5A1, COL5A2, and COL5A3), and significantly reduced expression of proteases (matrix metalloproteinase [MMP]-1, -2, -7, and -9) and inflammatory cytokines (CXCL11, interleukin [IL]-2, IL-4, and IL-6).

Conclusion: In this study, PCMP was successful in supporting complex open wound healing as evidenced by superior wound scores, reduced bacterial load, and significant changes to key pathways of gene expression, suggesting more effective progression through the healing cascade. While additional work is needed to validate these findings, these data provide evidence that using PCMP in complex open wounds could potentially improve patient outcomes.