

DEVELOPMENT OF A PORCINE MODEL OF DELAYED WOUND HEALING



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BACKGROUND

- Chronic wounds do not proceed through the normal phases of wound healing and often stall in the inflammatory phase.
- Chronic wounds affect over 6 million people in the US due to slower wound healing associated with aged skin, impaired blood circulation, diabetes and other comorbidities [1].
- Rodent or porcine diabetic models are frequently used to model chronic wounds, such as diabetic ulcers, but these models are unable to fully replicate the clinical complications, especially chronicity of the wound.
- In this study, we developed a model to mimic healing impairment that is caused by glycosylation of collagen resulting from extended exposure to hyperglycemia [2].

OBJECTIVES

- To assess feasibility of simulating chronic wound healing by pretreating wounds with glutaraldehyde
- To characterize wound healing and re-epithelialization and demonstrate wounds pretreated with glutaraldehyde experience a delayed healing response compared to untreated wounds

METHODS

Model

- Full thickness wound model
- 10 Yorkshire pigs
- 16 circular defects (2 cm diameter) on dorsum

Chemical treatment

Wounds pretreated with glutaraldehyde on Days 0 and 1 post wounding

Experimental groups

- Untreated (control)
- Chemically treated
- Chemically treated + collagen matrix
- Untreated + collagen matrix

Sacrifice/Histology

- Days 14, 28 and 42
- H&E, Masson's Trichrome

RESULTS

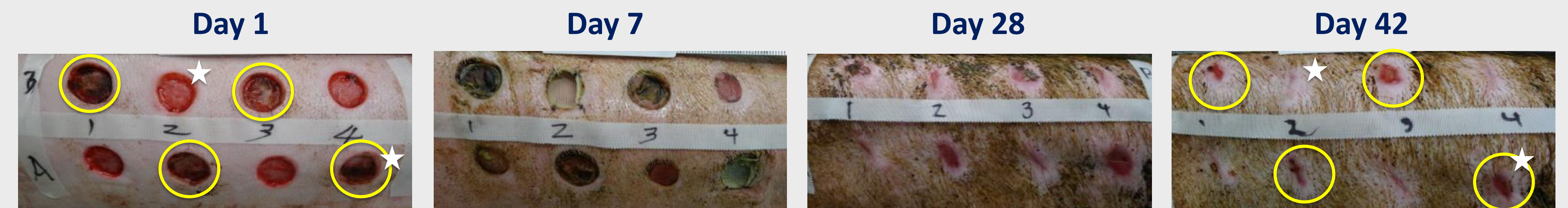
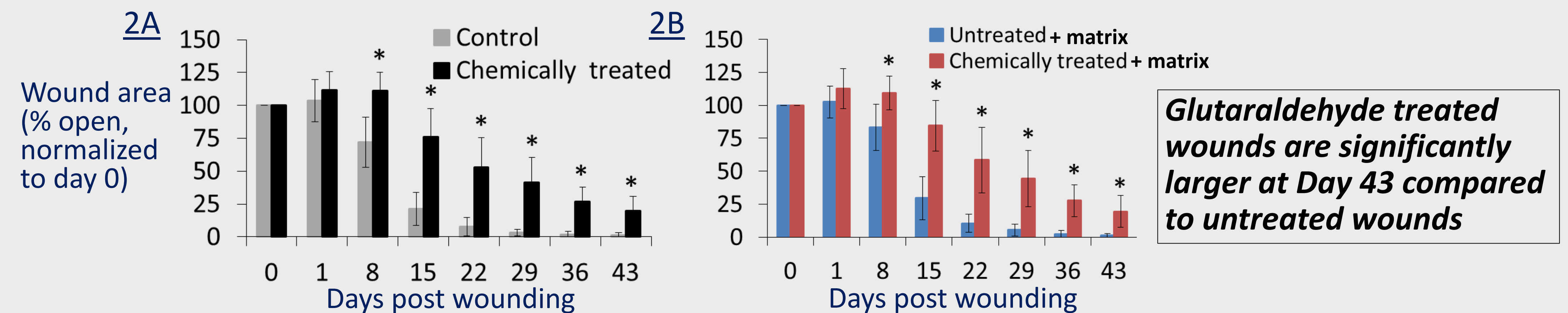


Fig. 1. Full-thickness defects at Days 1, 7, 28 and 42 showing effect of glutaraldehyde pretreatment. Yellow circles indicate glutaraldehyde pretreatment, asterisks indicate collagen-matrix treatment.



Glutaraldehyde treated wounds are significantly larger at Day 43 compared to untreated wounds

Fig. 2. Group data showing (A) effect of glutaraldehyde pretreatment and (B) effect of skin substitute on glutaraldehyde pretreated wounds. Number of replicates (n) = 48 at days 0, 8, 15, n= 36 at days 22, 29 and n= 24 at days 36, 43. Data are reported as mean \pm standard deviation; *p<0.05 vs. control at same time point (One way ANOVA, Tukey's post hoc).



Fig. 3. Histological observations. At day 43, re-epithelialization is complete in control wounds (A, black arrows) while significantly delayed in glutaraldehyde treated wounds (B) New collagen deposition and maturation is distinct in control wounds while suppressed in glutaraldehyde treated wounds.

CONCLUSIONS

- Pretreatment with glutaraldehyde can simulate delayed wound healing in a porcine model quickly and reproducibly.
- Wounds pretreated with glutaraldehyde are significantly delayed in re-epithelialization compared to untreated wounds.
- Overall, this model demonstrates potential to simulate different aspects of chronic wound development and can be utilized to characterize chronic wound etiology and also to identify novel treatments.

REFERENCES

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