

Efficacy of a Type I Bovine Collagen Powder in the Wound Healing Process

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Background

Collagen is an important component of wound healing, as it promotes healing through the attraction of fibroblasts and granulation tissue formation. While there is evidence to suggest its effectiveness, the formulations and type of collagen best for wound healing is still debated.¹ This study looked to evaluate the efficacy of a Type I Bovine Collagen powder intended for use in wound healing. The 100% Type I Bovine Collagen powder tested was manufactured without chemical cross-linking to ensure the triple helix compound structure was left intact in order to build strong granulation tissue.

Methods

Six Gottingen minipigs were selected for the study and were randomized into two groups. Housing and care were as specified in the USDA Animal Welfare Act (9 CFR, Parts 1, 2, and 3) and as described in the Guide for the Care and Use of Laboratory Animals from the National Research Council.² Each minipig received eight 10-millimeter (mm) wounds created through punch biopsy. The control group received a standard wound dressing, and the experimental group received an 85mg dose of collagen powder placed into the wound before the standard wound dressing was applied. The wounds were redressed on Days 3, 7, and 14, with the experimental group receiving a repeat application of the collagen powder prior to the dressing being applied. Wounds were evaluated at Days 3 and 7 for erythema and edema, and wound size reduction was evaluated at Days 3, 7, 14, 21, and 28.

Results

On day 3, erythema was present in 37.5% of wounds of the standard dressing compared to 8.3% of wounds with the collagen powder ($\chi^2 = 5.78$, $p = 0.016$). By day 7, edema was seen in 33.3% of wounds in the control group compared to just 16% in the experimental group ($\chi^2 = 1.79$, $p = 0.18$). All wounds were closed by day 28, with the experimental group having a greater reduction in wound size compared to the control group (74.7% vs. 67.8%). The predefined cell type (polymorphonuclear cells, lymphocytes, plasma cells, and giant cells) scores, predefined responses (necrosis, neovascularization, fibrosis, and fatty infiltrate) scores, as well as routine histopathologic evaluation results for the control and sites treated with the collagen powder on Day 14 and Day 28 were consistent with what one would expect in a healing wound and revealed no differences between control or treated sites. By Day 28, the wound healing process continued with, as evidenced by the epidermis, progression toward normal skin.

Conclusion

Dermal administration of the Type I Bovine collagen powder to the minipigs at a dose of 85mg on Day 1 following wound creation and on corresponding open wound sites following rinsing on Days 3 and 7 resulted in no unscheduled deaths and no gross pathology observations. All cell types indicative of wound healing (macrophages, lymphocytes, etc.) were also comparable in both groups. The collagen powder reduced erythema and edema, as well as provided a greater reduction in wound size when compared to the standard wound dressing. This study suggests that collagen powder placed into the wound bed may promote wound healing and a reduction in the severity of the wound more effectively than the standard wound dressing, with no adverse effects seen.

TEST MATERIAL	Erythema		Edema			
	Day 3	Day 7	Day 3		Day 7	
	Grade 1	Grade 1	Grade 1	Grade 2	Grade 1	Grade 2
Control	9	0	3	0	7	1
Type I Bovine Collagen	2	1	5	0	4	0

Table 1. Number of Wounds that Reported Erythema or Edema by Test Material

References

1. Mathew-Steiner SS, Roy S, Sen CK. Collagen in Wound Healing. *Bioengineering (Base)*. 2021;8(5):63. Published 2021 May 11. doi:10.3390/bioengineering8050063
2. Guide for the care and use of laboratory animals. Washington, D.C.: National Academy Press. NRC (National Research Council); 2011.

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