

# A Retrospective Analysis of the Utilization of "Hydrolyzed" Type I Bovine Collagen as Demonstrated in a Wide Variety of Wound Etiologies in Multi-Centers

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## ABSTRACT

This meta-analysis study will demonstrate the use of hydrolyzed type I bovine collagen in the use of multi-spectrum wound etiologies and co-morbidities. The sub-cellular mechanism of hydrolyzed collagen and fibroblastic activity is well known in the literature.

Native collagen is a stable rigidly coiled helical molecule and must be acted on by macrophages to expose the amino acid components. Hydrolyzed collagen is the conversion of the rigidly coiled helix to a random coil which supports fibroblast activity needed to produce wound granulation tissue.

Activated collagen is the most biologically active form of collagen available. It principally acts as a major chemo-attractant for epithelialization. Thus, the process of wound closure is potentially facilitated through the use of activated collagen.

To illustrate the use of hydrolyzed (activated) type I bovine collagen on wounds that demonstrated efficacy in patient populations of complex co-morbidities. Patients were randomly selected from diverse socioeconomic backgrounds. Exclusion criteria included patients with osteomyelitis, patients that deceased prior to wound closure and non-adherence to treatment. Inclusion criteria involved wounds of the following etiologies: acute traumatic (skin tears), partial and full-thickness burns, metabolic/diabetic, venous/chronic, neuropathic, recalcitrant and wound with bio-burden. Initial treatment methods included full thickness excisional debridement, biological wound debridement, ultrasonic and mechanical. Application of hydrolyzed bovine collagen in paste and/or gel form was applied with appropriate secondary dressings. Follow visits included peri-wound assessment and re-application of hydrolyzed bovine collagen and secondary dressings only.

## PURPOSE

Evidence based medicine is defined as the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. An essential mechanism to wound healing is fibroblastic activity which cleaves collagen. Fibroblasts influence migration/proliferation, ECM production, growth factors and cytokine production, angiogenesis and protease release. Migrating epithelium cannot migrate over collagen but must convert the extracellular matrix granulation tissue collagen to hydrolyzed collagen in order to advance. Additionally, those cleaved amino acid segments which were hydrolyzed are "activated" as they are prepared to participate in the repair process as a function of their introduction into the biological pool.

## METHOD

Fifty patients (twenty-one shown) representing 1) diverse socio-economic backgrounds, 2) various clinical facilities and settings, 3) complicated co-morbidities and 4) all wound and burn etiologies such as, diabetic, neuropathic, venous stasis, arterial insufficiency, traumatic, acute, chronic, surgical, pressure, skin tears, superficial and 1<sup>st</sup> and 2<sup>nd</sup> degree burns were managed with hydrolyzed "activated" collagen powder and or gel. Some of the patients were compared against a control group which consisted of a hydrogel. The wounds were dressed with an appropriate secondary dressing. The average dressing change frequency was every 3-4 days, some subsequent dressings were changes every 7 days.

## RESULTS / CONCLUSIONS

Hydrolyzed "activated" collagen is the most biologically active form of collagen available. It principally acts as a major chemo-attractant for epithelialization. "Activated" collagen is 1/100<sup>th</sup> the size of native, intact collagen and is immediately available for the body to use. In addition to cleaving the "activated" collagen the fibroblasts in wound migration/proliferation, ECM production, growth factor, cytokine and interleukin release (IL-6, IL8, IL-10), angiogenesis and protease release all of which is integral to the production of granulation tissue. This is clearly evident in the patients' represented in this study. Additionally, the patients' subjectively commented on the reduction of wound pain. This is attributed to the formation of an occlusive dressing which mitigates pain. Some of the patients' presented with an infected wound. The "activated" collagen in both the gel and powder form easily mixed with appropriate topical anti-microbial agents. This biocompatibility was effective in treating the wound infection as well as producing granulation tissue. The gel form of the "activated" collagen was extremely useful in managing all wound challenges, namely undermining and tunneling. The overall clinical impression is that hydrolyzed, "activated" collagen healed wounds faster than standard of care as well as compared to the control groups.

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Patient #1  
70 y/o, female  
H/O: osteoarthritis, hypertension,  
breast cancer  
DX: Venous ulcer, leg



5/31/2011  
1.0 x 1.0 x 0.1 cm



9/6/2011  
Healed: 14 weeks

Patient #2  
70 y/o, male  
H/O: tobacco smoker  
DX: Second degree burn, ankle



8/26/2011  
6.5 x 7.5 x 0.1 cm



9/6/2011  
Healed: 11 days

Patient #3  
80 y/o, male  
H/O: diabetes, type II, abnormal  
gait, right side BKA, PVD  
DX: Diabetic pressure ulcer,  
stage III



7/7/2011  
4.0 x 3.5 x 0.2 cm



9/1/2011  
Healed: 8 weeks

Patient #4  
42 y/o, female  
DX: 1<sup>st</sup> & 2<sup>nd</sup> degree burns, left  
volar and dorsum forearm  
secondary to a cooking accident



8/24/2011



9/6/2011  
Healed: 14 days

Patient #5  
61 y/o, male  
H/O: diabetes, hypertension,  
dyslipidemia, depression  
DX: Traumatic thermal wound,  
left heel



7/28/2008  
5.5 x 3.5 x 1.0 cm



9/2/2008  
Healed: 35 days

Patient #6  
72 y/o, female  
H/O: diabetes, hypertension,  
tachycardia, pulmonary  
dysfunction, renal impairment  
DX: Digital ulcer, cellulitis,  
multiple plantar abscesses, right  
foot



Debridement of three plantar  
abscesses



Healed: 8 weeks

Patient #7  
55 y/o, male  
H/O: uncontrolled diabetes,  
smoker, non-compliant  
DX: Diabetic ulcer, leg



6/28/2005  
4.0 x 2.3 x 0.1 cm



9/1/2005  
Healed: 64 days

Patient #8  
100 y/o, female  
H/O: hypertension, ischemic  
heart disease, dementia,  
bilateral leg edema  
DX: Venous ulcer, leg



5/11/2011  
5.0 x 3.0 x 0.2 cm



6/2/2011  
Healed: 3 weeks

Patient #9  
86 y/o, female  
H/O: chronic atrial fibrillation,  
venous hypertension, CHF  
DX: Skin flap with desiccated  
subcutaneous tissue exposed



Day 1  
4.8 x 2.0 cm



Day 13  
Healed: 13 days

Patient #10  
93 y/o, male  
H/O: CHF, diabetes, CAD post  
bypass, angioplasty, mild  
dementia  
DX: Skin tear, forehead

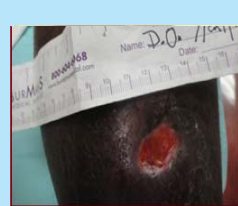


Day 1  
4.0 x 4.0 cm



9/6/2011  
Healed: 14 weeks

Patient #11  
DX: Pyoderma gangrenosum



Day 1



After 4 weeks of treatment

Patient #12  
78 y/o, male  
H/O: polymyalgia rheumatica,  
eczema, polyneuropathy  
DX: Exposed subcutaneous  
tissue, right patella



Day 1  
4.0 x 1.5 cm



Day 15  
Healed: 15 days

Patient #13  
DX: Diabetic ulcer, leg



Day 1  
2.0 x 3.0 x 1.0 cm



Day 60  
Healed: 60 days

Patient #14  
65 y/o, male  
H/O: Hemiplegia, spina bifida,  
obesity, peripheral neuropathy  
DX: Peripheral vascular disease



6/23/2011  
1.5 x 1.0 x 0.1 cm



7/14/2011  
0.4 x 0.3 x 0.1 cm  
Healed: 3 weeks

Patient #15  
78 y/o, male  
H/O: diabetes, type II, tobacco  
smoker, PVD, obesity  
DX: Diabetic ulcer, leg, s/p  
incision and drainage



5/26/2011  
4.0 x 3.5 x 0.1 cm



6/23/2011  
Healed: 10 weeks

Patient #16  
52 y/o, male  
H/O: uncontrolled diabetes, non-  
compliant, tobacco smoker  
DX: Diabetic ulcer, leg



5/3/2005  
2.0 x 3.0 x 1.0 cm



6/28/2005  
Healed: 7.5 weeks

Patient #17  
DX: Diabetic ulcer, leg



Day 0  
3.0 x 3.0 x 1.0 cm



Day 35  
Healed: Average 5 weeks

Patient #18  
88 y/o, female  
H/O: nursing home, poor  
functional status, depression,  
refractory colostridium difficile,  
dementia  
DX: Skin tear, left anterior tibia



Day 1  
3.5 x 1.0 cm



Day 8  
3.0 x 2.0 cm  
Healed: 8 days

Patient #19  
71 y/o, male  
H/O: diabetes, peripheral  
neuropathy  
DX: Diabetic ulcer, foot



5/3/2011  
1.5 x 1.5 x 0.3 cm



8/9/2011  
Healed: 9 weeks

Patient #20  
78 y/o, female  
H/O: Eczema, non-healed leg  
ulcer for 3 months, progressive  
polyneuritis  
DX: Exposed subcutaneous  
tissue, right elbow



Day 1  
6.2 x 2.3 cm



Day 8  
Healed: 8 days

Patient #21  
93 y/o, female  
H/O: diabetes, type II, PVD,  
dementia, macular degeneration  
DX: Skin tear, right elbow



Day 1  
1.3 x 3.2 cm, partial thickness



Day 14  
Healed: 14 days