Aggressive Mechanical Bioburden Control Improves Wound Healing:

Liberal 22.5 KHz Ultrasonic Debridement Reduces Bioburden

Refractory Ischemic Ulcers

Right 5th metatarsal head ulcer present for 10 months. Pain made sharp debridement a futile exercise. Note rubor swelling and maceration of the forefoot.

Three ischemic ulcers on R foot after 10 months of futile advanced weekly wound therapy, including 3 months of resource intense NPWT. Patient steadfastly refused a R BKA. Observe the maceration due to wound exudates. Exudates decreased dramatically after the first ultrasonic aided debridement.

Problems:

- Previous L BKA
- Paraplegia with knee contractures
- Profound arterial ischemia (ABI 0.0)
- Concurrent tobacco use
- Pressure on R ankle from mobility chair
- Little progress with 10 months of advanced wound care
- Refused R BKA

Debridement with 22.5KHz hand piece. Note extensive fibrinoid exudates containing chronic biofilm between the Longitudinal Yarn Compression stockinet's fuzzy yarns. We had been "ignoring" this fibrinoid material for about 10 months. Sharp debridement was exquisitely painful. Patient refused sharp debridement and refused BKA .

Treatment:

- Three ultrasonic* debridements (22.5KHz) to control bioburden at 7 day intervals
- HEMA nano particle powder **
- Yarn Focused Compression stockinet†† directly on the granulating surface to control edema
- BioEngineered Skin Substitute grafting†

R ankle 5 weeks post cultured human skin grafting healing 80% complete.

5th metatarsal ulcer healed in 5 weeks after three ultrasonic debridements and BioEngineered Skin Substitute.

Outcome:

- 100% healing of 5th metatarsal head ulcer
- 80% healing of ankle wound area in 5 weeks
- Three ultrasonic debridements reversed 10 months of stalled healing and expensive, futile care. Ultrasonic debridement controlled bioburden in granulation tissue allowing BeSS graft to heal on a refractory ischemic ulcer

Idiopathic Diabetic Ulcers

Patient referred from community wound center. Wound healing "stalled" after 7 months of treatment with honey.

Painful diabetic ulcers refractory to 7 months of community wound center therapy.

Problems

- L lateral ankle ulcers treated in community wound center for 7 months
- Ulcers with uncertain origin. Thus "diabetic ulcers" by exclusion
- Palpable pedal pulses
- Ulcers are painful; Sharp debridement excruciatingly painful
- Diabetic - Insulin x 14 years

Treatment

- Two debridements, 22.5 KHz ultrasonic hand piece*, at weekly intervals
- Wounds grafted with BioEngineered human Skin Substitute††

Left ankle wounds are deep and painful. Observe scant granulation tissue and no migration of epithelial cells from wound edges.

Wounds healed 9 weeks after ultrasonic debridement x 2 and BioEngineered human Skin Substitute.

Outcome:

- Wounds healed 9 weeks after BeSS grafting
- Debridement of bioburden with 22.5KHz ultrasonic energy hand piece x 2, jumpstarted healing in a wound stalled (getting deeper, not granulating) for 7 months
- Ultrasonic debridement was "comfortable" for the patient who had endured multiple sharp debridements

Recurrent Venous Stasis Ulcers

Patient "bounced back" to wound clinic with recurrent R calf stasis ulcers. Language barrier and limited resources are obstacles.

Problems:

- Recurrent painful R calf stasis ulcerations
- Chronic skin fibrosis and massive edema

R calf wound one week after sharp dissection. Ulcers are exquisitely painful. Serum weeps from the wound. Note curette in background. Patient was NOT happy with sharp debridement.

Extensive scarring and fibrosis of skin surface gives this chronic stasis ulcer the appearance of a burn.

Note macerated necrotic skin around the ulcer edges. After four weeks of sharp debridement with scalpel and curette, this wound supports a large bioburden.

Note presence of cornrow furrow in the granulating surface. Furrows result from fuzzy yarn compression in contact with the healing surface. This photo, two weeks after a single ultrasonic powered debridement with 22.5 KHz hand piece, showed dramatic improvement.

Treatment:

- Five weeks of Longitudinal Yarn Compression†† as first layer of a four layer dressing before grafting
- A single debridement with the ultrasound powered hand piece* cleaned up the wound (presumably dramatically lowered bioburden) enough to support skin graft
- Two weeks after ultrasonic debridement, BioEngineered human Skin Substitute† grafting

Five weeks after cultured human skin grafting, BeSS, and 7 weeks after a single acoustic debridement, wound is declared to be "Healed!" Note how robust the skin appears: no edema, no redness.

Outcome:

- Dramatic healing seven weeks after ultrasonic debridement and five weeks after grafting ulcers with Bio Engineered human Skin Substitute

Stasis Ulcers with Ischemia on Steroids

Veteran of the occupation of Japan with painful stasis dermatitis.

Problems:

- Painful stasis ulcers present for 13 months
- Steroid dependent COPD
- Occlusive vascular disease

Note the erythemia and swelling in skin around the ulcers due to severe stasis dermatitis.

Patient (and family) self referred after several months of treatment with enzymatic debridement in a community wound center. No sharp debridement had been done.

This photo, showing the wound after a painful, unsuccessful session of sharp debridement with scalpel and curette, was taken five minutes after the photo above. Several clinic visits later, a single ultrasonic debridement completed the debridement with minimal discomfort.

Treatment:

- Four layer dressing with Longitudinal Yarn Compression†† textile as the base layer for about 30 weeks
- HEMA nanoparticle powder** dressing used for 12 weeks
- Sixteen weeks after cultured human skin† grafting, three small stubborn ulcers remained unhealed
- Three acoustic powered* debridements at weekly intervals "cleaned up the wound." Presumably biofilm was the culprit that blocked complete healing
- A second graft of BioEngineered human Skin Substitute† accomplished complete healing

Note improvement in the appearance of the skin. Longitudinal Yarn Compression Stockinet has dramatically improved stasis dermatitis.

Outcome:

- After ultrasonic debridement x 3, which presumably controlled bioburden, a second graft of BioEngineered human Skin Substitute accomplished complete healing sixteen weeks after the first BeSS graft

Stasis Ulcer, CHF and Senile Skin

Stasis ulcer at the classic location above the medial malleolous is surrounded by edematous skin with senile changes. Note the healing pretibial shear injury.

Problems:

- Classic L medial calf stasis ulcer
- CHF with edema
- Senile skin with healing pretibial shear wound

Ultrasonic debridement underway at first wound clinic visit. Superficial debridement revealed a 1cm deep organized hematoma with extensive necrotic fat.

Ultrasonic debridement #2. Note decrease in swelling and redness around the wound.

Treatment:

- Weekly acoustic debridement X 3*
- Longitudinal Yarn Compression††

Four weeks of compression therapy.

Six week after initial ultrasonic debridement, wound is healing by contraction and epithelial migration.

Outcome:

- Wound nearly healed in six weeks with three weekly ultrasonic debridements and elastic longitudinal yarn compression

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*SonicOne®, Misonix, Farmingdale, NY
**Altrazeal™, ULURU Inc., Addison, TX
†Apligraf®, Organogenesis Inc., Canton, MA
††EdemaWear®, Compression Dynamics LLC, Omaha, NE

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Problem:
[illegible]

Methods:
Seven "learning curve" patients were treated with 22.5 kHz ultrasonic debridements at weekly intervals to control bioburden. Photos document healing.

Results:
Four of seven patients had stalled wounds, wounds under treatment for more than 90 days, when ultrasonic debridement was initiated. These stalled wound "cleaned up" after one or more ultrasonic debridements to a point where bioengineered human skin substitute grafting was feasible and successful.

Conclusion:
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References:
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