

Case Studies Demonstrate Effectiveness of Noncontact, Low-Frequency Therapeutic Ultrasound in Complicated Wounds

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Introduction:

We conducted a case study series in 2006 to determine the effectiveness of noncontact, low-frequency therapeutic ultrasound (LFTU) in complicated wounds.

Methods:

Patients with wounds associated with various comorbidities and etiologies were selected. Treatment effectiveness was determined through changes in wound area dimensions, amount of drainage, percentage of granulation tissue, and wound-related pain (rated 0-10 using a visual analog scale [VAS]). Patients were treated until sufficient granulation tissue formation or re-epithelialization was achieved.

Seven patients were selected from an outpatient physical therapy wound management clinic. With the exception of a full-thickness burn to the trunk, wounds occurred on the lower extremities and were associated with diabetes, venous insufficiency, spider bite, community-acquired MRSA, pseudomonas, and/or sickle-cell anemia. Patients received 5-26 treatments for <2-13 weeks, depending on wound size.

Results:

Once LFTU treatment was initiated, wound-associated pain was reduced or eliminated, even in one wound initially rated 10 on the VAS. Time-to-healing was rapid compared with our clinical experience treating similar wounds associated with similar comorbidities.

Conclusions:

This case study series demonstrated that noncontact, low-frequency therapeutic ultrasound was associated with reduced wound-related pain and increased healing rates in complicated wounds of various etiologies.

Patient #1: Right Lateral 5th Metatarsal Head

- 49-year-old Caucasian man, diabetes and osteomyelitis
- Previously treated with IV vancomycin and local care for wound on right lateral 5th metatarsal head secondary to diabetic neuropathy
- Medical history: hypertension, coronary artery disease, angina, smoking
- Wound developed Aug. 18, 2006
- Sept. 14, 2006: began LFTU Therapy, sharp debridement, enzyme-iodine gel, gauze dressing
- Approx. 2 weeks later, added negative pressure wound therapy (NPWT)
- October 30, 2006: LFTU, callous debridement, silver-impregnated hydrofiber dressing, compression wrap
- NPWT discontinued; sufficient granulation tissue
- 26 LFTU treatments over 2 months, wound 98% closed



9-14-06



10-4-06



11-10-06

Patient #2: Left Dorsal Foot

- 60-year-old black man
- Previously treated with IV vancomycin, multiple incision and drainage surgeries, and local care for presumed spider bite infected with *Staphylococcus*, *Streptococcus*, and *Corynebacterium* on left dorsal foot
- Medical history: hypertension, cellulitis of left foot requiring multiple wound débridements, unsuccessful homograft of left dorsal foot, venous stasis with chronic left lower-extremity (LE) edema, and chronic deep vein thromboses of bilateral lower extremities
- Wound developed April 2006
- Aug. 1, 2006: began LFTU, enzyme-iodine gel, foam, mild compression
- Aug. 18, 2006: LFTU, silver-impregnated gauze, moderate compression
- No further incision and drainage surgeries necessary after initiation of LFTU
- Sept. 14, 2006: wound closed with a split-thickness skin graft
- Wound presented for surgical closure with 100% granulation tissue in 6 weeks after 19 LFTU treatments



8-1-06



8-22-06



8-29-06

Patient #3: Right Medial Ankle

- 43-year-old Caucasian woman
- Painful right medial ankle ulcer secondary to venous insufficiency
- Medical history: knee surgery (1989), right medial LE wound requiring split-thickness skin graft (1998), hip replacement (2003)
- Ankle wound developed May 2006
- Aug. 22, 2006: began enzyme-iodine gel, nonadherent gauze, and multilayered compression wrap
- 1 week later: wound infected with *Pseudomonas*
- Treatment: sharp debridement, silver-impregnated gauze, antifungal/antiinflammatory ointment to periwound, multilayered compression wrap
- Sep. 26, 2006: LFTU started plus silver-impregnated hydrofiber, foam with adhesive border, compression class II stocking
- Once LFTU initiated, pain decreased from "8" out of 10 to "0" and signs/symptoms of *Pseudomonas* infection were eliminated
- Nov. 7, 2006: after 12 LFTU treatments in 4 weeks, wound 98% closed despite a previous wound at same site requiring split-thickness skin graft



8-22-06



9-26-06



10-10-06

Patient #4: Left Lateral Ankle

- 74-year-old Caucasian woman, insulin-dependent diabetes
- Recurrent ulcer on left lateral ankle, which historically required 5 months to heal
- Wound developed Jan. 1, 2006
- Mar. 30, 2006: began collagenase, gentamicin ointment, nonadherent gauze, absorbent gauze, and compression wraps 3 times/wk for 1 week
- Physical therapy (PT) intervention held for podiatrist to resume local care
- May 17, 2006: returned for PT re-eval; started LFTU plus hydrofiber, gentamicin ointment, therapeutic compression
- After 2nd LFTU treatment, dressings incl. gentamicin, foam, compression
- Aug. 17, 2006: LFTU discontinued; wound diameter < 1 cm
- Aug. 24, 2006: wound closed in less than 3 months



5-17-06



5-26-06



7-17-06

Patient #5: Left Posterior Thigh

- 26-year-old black man, sickle-cell anemia
- Extremely painful ("10" out of 10) wound on left posterior thigh infected with methicillin-resistant *Staphylococcus aureus*
- Wound developed approximately Oct. 1, 2006
- Nov. 2, 2006: treatment with LFTU, selective sharp debridement of thick yellow debris requiring topical anesthetic, silver-impregnated hydrofiber dressing, gauze, transparent dressing
- Next day, pain level too severe for debridement, but LFTU continued, plus silver impregnated hydrofiber, gauze, transparent dressings
- Discharged approx. 3 weeks later: wound 100% granular and area decreased by > 50%, pain free, and independent with self care
- After completing 12 LFTU treatments, tissue quickly reepithelialized with improvement at each visit and extreme pain quickly diminished



11-2-06



11-8-06



11-17-06

Patient #6: Right Flank/Axilla/Back

- 48-year-old black man
- Sept. 10, 2006: deep partial/full-thickness burns right flank/axilla/back
- Medical history: knee surgery (1998)
- Sept. 11, 2006: began hydrotherapy, selective debridement, silver sulfadiazine, petrolatum dressing, gauze
- Sept. 13, 2006: LFTU initiated plus antibacterial ointment, enzyme mixed with antibacterial powder, bismuth-impregnated petrolatum dressing, gauze
- Surgery considered after conversion of partial-thickness areas to full-thickness
- After 5 LFTU treatments in 12 days, eschar rapidly lifted, tissue reepithelialized quickly, and the need for surgery was eliminated



9-11-06



9-15-06



9-15-06

Wound Characteristics

	Area cm ²	Drainage	Tissue color, %				Pain (0-10)	
			Red	Pink	Yellow	Black		
Patient #1								
Start	9	Moderate	0	0	0	100	0	
End	0	Scant	0	100	0	0	0	
Patient #2								
Start	49	Moderate	0	10	40	50	5 [*]	
End	0	0	0	0	0	0	0	
Patient #3								
Start	5.51	Minimal	25	0	75	0	8	
End	0.01	None	100	0	0	0	0	
Patient #4								
Start	85	Minimal	20	0	80	0	6	
End	1	Scant	100	0	0	0	0	
Patient #5								
Start	7	Minimal	60	0	0	40	10	
End	0.63	Scant	100	0	0	0	0	
Patient #6								
	Back	Axilla	Drainage	Red	Pink	Yellow	Black	Pain (0-10)
Start	40	50	Maximum	0	40	60	0	4
End	< 5	0	None	0	100	0	0	0

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