

Effectiveness of Noncontact, Low-Intensity, Low-Frequency Therapeutic Ultrasound in Wound Treatment: A Case Series Study

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Objective

This case series study evaluated the effectiveness of noncontact, low-intensity, low-frequency therapeutic ultrasound treatment (MIST Therapy® System, Celleration, Eden Prairie, Minnesota) for inpatients with wounds in 2006.

Methods

Eight consecutively selected patients with wounds received 3-5 weekly treatments of 3-20 minutes duration depending on wound size. Wounds were evaluated pre- and post-treatment by changes in wound dimensions, drainage amount, percentage granulation tissue, treatment and wound pain using a visual analog scale, and wound infection using cultures. Lower-extremity wounds of various etiologies (pressure, surgical, abscess-related, vascular, and diabetic), with and without bacterial colonization, predominated.

Outcomes

Estimated time-to-healing was reduced by at least 50% of expected healing rates in all patients as determined by reduction in wound area and increase in granulation tissue. Overall, drainage was substantially reduced or eliminated. Bacterial infections, including MRSA, were cleared. Wound-associated pain was eliminated post treatment in 3 of 4 patients reporting wound pain. No patient reported treatment-associated pain.

Summary

In this case series study, noncontact, low-intensity, low-frequency therapeutic ultrasound substantially reduced time-to-healing and improved wound pain in wounds resulting in shorter inpatient hospitalizations, fewer and less costly wound dressings, and lower medication usage (antibiotics and pain medications).

Patient #1 - Chronic left calf abscess (unknown origin). 54 yo Caucasian woman: MRSA+ pneumonia. Medical hx: hepatitis C, possible liver cirrhosis, heroin abuse, bipolar disorder, jaundice, hepatotoxicity. Time-to-discharge estimate: 1 mo. Began treatment with iodine packing dressing. 10 MIST treatments over 15 days; discharged with thin foam dressing to be changed every 3 days.

Time point	Area cm ²	Volume cm ³	Drainage	Tissue color, %				Pain (0-10)
				Red	Pink	Yellow	Black	
Start	3.7	5.6	Mild	0	90	10	0	0
End	1.3	0	Mild	100	0	0	0	0

Patient #2 - Acute MRSA+ perineum abscess. 82 yo Native American man; increased white blood cells, urinary tract infection. Medical hx: diabetes, chronic renal insufficiency, chronic hypertension, anemia. Estimated time-to-discharge: 4-6 weeks. Undermining at 12:00 (2.5 cm) and 6:00 (2.2 cm) reduced to 1 cm and 0 cm at discharge. 9 MIST treatments over 15 days; discharged with dry dressing and minimal wound packing.

Time point	Area cm ²	Volume cm ³	Drainage	Tissue color, %				Pain (0-10)
				Red	Pink	Yellow	Black	
Start	2.0	6.1	Mild	0	90	10	0	Lite
End	0.8	1.6	None	100	0	0	0	0

Patient #3 - Dehisced right medial calf wound (femoral-popliteal graft site) secondary to MRSA infection. 83 yo Caucasian woman. Previously closed with vacuum-assisted device. Medical hx: hypertension, peripheral vascular disease, chronic atrial fibrillation. Estimated time-to-discharge: 4-6 weeks. Aquacef® Ag packing to control exudate. Oxycodone required for pain. Discontinued oxycodone after 1 wk of MIST and IV antibiotics. 8 MIST treatments over 12 days; discharged with MRSA-negative, open-to-air wound.

Time point	Area cm ²	Volume cm ³	Drainage	Tissue color, %				Pain (0-10)
				Red	Pink	Yellow	Black	
Start	5.0	10.0	Moderate	0	80	20	0	3-4
End	0.4	0.2	None	100	0	0	0	0

Patient #4 - Right heel wound with history of MRSA infection.

80-year-old Caucasian man with altered consciousness. Medical hx: early osteomyelitis, moderate chronic plantar fasciitis, mild generalized atherosclerotic disease right LE, *Clostridium difficile* colitis (requiring IV antibiotic), acute renal failure, dehydration, diabetes, hypertension, chronic low back pain, hyperlipidemia, diabetic neuropathy, cerebrovascular attack, 50-year smoking hx. Hypergranulation tissue developed after 18 MIST treatments over 29 days resulting in discontinuation of treatment.

Time point	Area cm ²	Volume cm ³	Drainage	Tissue color, %				Pain (0-10)
				Red	Pink	Yellow	Black	
Start	20.0	10	Moderate	0	5	95	0	0
End	18.9	0	Moderate	95	0	5	0	0

Patient #5 - Three Lower-Extremity Wounds (chronic cellulitis). 77 yo Caucasian woman with right cerebellar stroke, pneumonia, dehydration, increased confusion. Medical hx: hypertension, pulmonary embolism, deep vein thrombosis, hyperlipidemia, basal cell skin cancer. Projected healing time: 4-6 weeks; wounds completely re-epithelialized after 7 MIST treatments over 9 days.

Time point	Area cm ²	Volume cm ³	Drainage	Tissue color, %				Pain (0-10)
				Red	Pink	Yellow	Black	
Wound #1 - Left LE								
Start	11.2	0	Minimal	0	80	20	0	5-6
End	0	0	None	Healed	0	0	0	5-6
Wound #2 - Right distal LE								
Start	3.2	0	Minimal	0	80	20	0	5-6
End	0	0	None	Healed	0	0	0	5-6
Wound #3 - Right proximal LE								
Start	13.6	0	Minimal	0	80	20	0	5-6
End	0	0	None	Healed	0	0	0	5-6

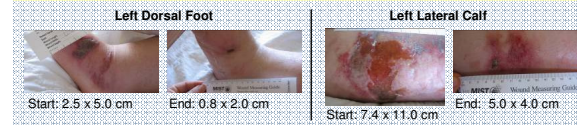


Patient #6: Two MRSA+ perirectal abscesses (previous incision and drainage surgeries). 53 yo Hispanic man with increased white blood cells. Medical hx: T5 paraplegia, uncontrolled diabetes, spinal fusion. Wheelchair-bound and gel-cushion noncompliant. Buttocks wound undermining at 2:00 (3.8 cm). Alginate dressing for heavy exudate; IV antibiotic. After 1 MIST treatment, 85% yellow slough removed with sharp debridement. 24 MIST treatments over 36 days, no undermining and exudates decreased. Thin foam dressing to be changed on alternate days. Left lateral malleolus wound completely closed after 4 MIST treatments.

Time point	Area cm ²	Volume cm ³	Drainage	Tissue color, %				Pain (0-10)
				Red	Pink	Yellow	Black	
Wound #1 - Left distal buttocks								
Start	3.7	7.9	Heavy	0	0	100	0	0
End	1.5	0.6	Mild	100	0	0	0	0
Wound #2 - Left lateral malleolus								
Start	1.2	0	Mild	10	0	90	0	0
End	0	0	None	Healed	0	0	0	0

Patient #7 - Two left LE wounds secondary to venous insufficiency (wound #1) and cellulitis (wound #2). 49 yo Caucasian woman; 4-day hx of fever and 1-day hx of erythema. Medical hx: previous cellulitis wound on right LE requiring extensive inpatient care, obesity, diabetes, anemia, non-occlusive thrombus in left popliteal vein. Estimated time-to-discharge: 4 wks. 12 MIST treatments over 2.5 wks; wounds progressed to open-air status and 100% granulation. Discharged with Vaseline® gauze and Kling® dressing.

Time point	Area cm ²	Volume cm ³	Drainage	Tissue color, %				Pain (0-10)
				Red	Pink	Yellow	Black	
Wound #1 - Left foot, dorsum								
Start	12.5	0	Minimal	0	0	100	0	6
End	1.6	0	None	Thin scab remained over wound				0
Wound #2 - Left lateral calf								
Start	81.4	0	Minimal	0	0	100	0	6
End	20.0	0	None	100	0	0	0	0



Patient #8: 14 LE wounds (pressure and bilateral cellulitis). 66 yo Caucasian man. 11 partial thickness wounds, 3 full-thickness pressure ulcers on right lateral malleolus, right 5th metatarsal head, right lateral to medial heel, and dorsum of left foot. Medical hx: brain trauma with right hemiparesis and some spasticity, alcohol abuse, peripheral vascular disease, treatment noncompliance. Two-month hx of right LE swelling and redness. Severe cellulitis of right leg. Amputation considered, decided to try MIST. Projected time-to-healing: 6 to 12 mos, if at all. 59 MIST treatments over 8 wks; all wounds progressed to low-level care. Patient's leg saved from amputation.

Time point	Area cm ²	Volume cm ³	Drainage	Tissue color, %				Pain (0-10)
				Red	Pink	Yellow	Black	
Wound #1 - Right lateral malleolus								
Start	8.1	n/a	Moderate	0	0	0	100	7
End	0	0	None	Healed				0
Wound #2 - Right 5th metatarsal head (lateral foot)								
Start	13.5	n/a	Moderate	0	0	0	100	7
End	5.3	0	Minimal	75	0	25	0	0
Wound #3 - Right heel								
Start	83.2	n/a	Moderate	0	0	0	100	7
End	23.0	0	Minimal	100	0	0	0	0

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