

# Limb Salvage Using Low-Intensity, Low-Frequency, Noncontact Ultrasound\* in a Patient with Osteomyelitis and Clinically Low Capability of Healing



Tracy Mose, PT, CWS, Prairie Manor Nursing and Rehabilitation Center, Chicago Heights, Illinois

## Purpose

To present a compelling case of alternative treatment for a medically complex diabetic patient refusing toe amputation for an infected, nonhealing traumatic wound.

## Background

Approximately 50 to 60% of serious diabetic foot infections are complicated by osteomyelitis.<sup>1</sup> Treatment depends on the site of infection, local vascular supply, extent of soft tissue and bone destruction, presence of systemic illness, and patient preference. When infection involves deep soft tissue structures or bone, surgical debridement, bone resection, or partial amputation are usually necessary.<sup>1</sup>

Low-intensity, low-frequency, noncontact ultrasound\* (aka noncontact ultrasound) delivers acoustic pressure to the wound tissues via a fine, sterile, saline mist. The device does not contact the wound tissues and is not associated with any pain for the patient. Noncontact ultrasound has been shown to improve healing rates and time to healing in a variety of lower-extremity wounds, including recalcitrant diabetic foot ulcers and wounds complicated by chronic critical limb ischemia.<sup>2</sup> Additionally, an in-vitro experiment identified a potential bactericidal effect of this novel ultrasound therapy.<sup>3</sup>

\* MIST® Therapy, Celleration, Eden Prairie, Minnesota

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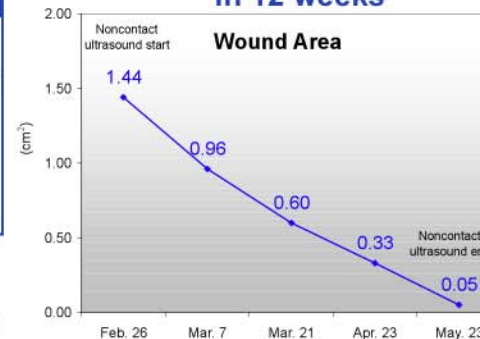
## Case Report

This 80-year-old diabetic man, who uses a wheelchair, was diagnosed with osteomyelitis in the left toe/forefoot after sustaining a cut to the plantar surface of his left great toe in Nov. 2006. Medical history and labs are shown in the table below. The wound, which was infected with methicillin-resistant *S. aureus*, was not healing and he was admitted for 3 separate hospital stays in Nov. and Dec. 2006 and Jan. 2007. A femoral-popliteal bypass in Dec. later failed. He was treated with intravenous antibiotics and pulsatile lavage with sharp selective debridement in Dec. and Jan.

Medical History	Prior Surgeries	HbA1c	Serum Albumin	Sedimentation Rate
congestive heart failure, coronary artery disease, myocardial infarction, peripheral artery disease, type 2 diabetes, spinal stenosis, peripheral neuropathy atrial fibrillation, depression, osteoarthritis, gastrointestinal bleeding, hypothyroidism, past alcohol abuse, former smoker (20 years)	coronary artery bypass graft, left femoral-popliteal bypass	6.2	3.0	13.0
<i>Initial lab values. Later lab values not reported after 40-lb weight loss, &lt;50% intake at all meals, and refusal of nutritional supplements.</i>				

Referral to podiatry on Feb. 1, 2007, resulted in recommendation for first ray amputation with primary closure. Patient refused amputation and was then admitted to a long-term care facility for local wound care. The patient agreed to and received noncontact ultrasound treatments beginning Feb. 26, 2007. Noncontact ultrasound was administered 3 times weekly for 3 minutes per treatment for 12 weeks. Dressing was clostridium collagenase with nonadherent gauze. Weekly wound evaluations included dimensions, exudates, wound bed composition and periwound integrity. Results are shown in the photos and graph below.

### 97% area reduction in 12 weeks



Feb 26

Mar 7

May 3



## Discussion

Near-complete closure of this patient's toe wound after 12 weeks of noncontact ultrasound (36 treatments) in addition to moist wound healing and intravenous antibiotics saved his toe from amputation. Unfortunately, worsening medical condition resulted in admission to the hospital where the patient later expired.

The outcome of this case suggests that noncontact ultrasound may be a useful adjuvant therapy to assist in wound closure of deeply infected wounds typically thought to require amputation. Other adjuvant therapies studied to reduce the need for amputation in the infected diabetic foot include recombinant granulocyte colony stimulating factor (randomized studies) and systemic hyperbaric oxygen (nonrandomized studies).<sup>1</sup> The expense and clinical burden of hyperbaric oxygen therapy, however, are substantial.

This case illustrates the potential clinical, psychosocial, and economic benefits of noncontact ultrasound for a patient faced with toe amputation. Prospective studies are needed to evaluate noncontact ultrasound for limb salvage in lower-extremity wounds at risk for amputation.

## References

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