



Circulator Boot Therapy to Heal Diabetic Foot Ulcers with Osteomyelitis

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Goals and Objectives

1. Discuss impact of osteomyelitis and digit amputation in the diabetic population.
2. Define diastolic pneumatic compression and identify potential patients

Purpose: Current standard of care for osteomyelitis associated with diabetic foot ulcers (DFU) is surgical resection of the infected bone and systemic antibiotics. Despite aggressive therapy amputation is common leaving the patient at risk for additional amputations and an associated five-year mortality rate of 39-68%. Preventing amputation is therefore critical to maintaining quality of life. Circulator boot therapy (CBT) utilizes end diastolic pneumatic compression to improve arterial circulation in the leg, thereby promoting wound healing. CBT has been used in the management of DFU complicated by osteomyelitis by combining compression with local injection of antibiotics into the affected area. We have validated the effectiveness of this technique to treat patients with DFU and underlying osteomyelitis.

Methods: The study group consisted of patients with DFU and radiographically diagnosed osteomyelitis who failed to heal despite antibiotics, aggressive offloading and appropriate local wound care. Surgical debridement was refused by all study patients. Patients received three, forty-five minute CBT sessions per week plus weekly local injections of antibiotic solution into the wound as determined by culture results. Aggressive offloading and appropriate local wound care efforts were continued.

Results: We present a series of healed patients who completed a 4-6 week course of CBT plus local injection of an antibiotic.

Discussion / Conclusion: Osteomyelitis complicating a DFU is often associated with amputation. CBT combined with local antibiotic injection has been shown to be effective in the management of selected patients in this group and should be considered prior to amputation.

Concurrent Venous Insufficiency and PAD Treated with Novel Pneumatic Intermittent Compression Device Timed with Cardiac Relaxation.

Robert Williams (SE TX Center for Wound Care)

Goals and Objectives: Wounds associated with combined venous insufficiency (VI) and peripheral artery diseases (PAD) are extremely difficult to heal. The disease process of each entity limits effective therapy of the other. Can concomitant VI and PAD be safely and effectively treated with intermittent compression therapy (ICT) if timed with cardiac relaxation?

Purpose: Assess the efficacy of a novel pneumatic intermittent compression device that is timed with cardiac diastole in treating wounds associated with concomitant VI and PAD.

Methods: Intermittent pneumatic compression of 45 mm Hg was applied to the entire affected lower limb during cardiac diastole for a duration of 0.40 to 0.45 seconds per compression. Compression was applied to the affected limb for 40 min a day, 5 days a week. Local wound care consistent with principles of wound bed preparation were utilized during the course of therapy.

Results: Swelling caused by VI improved in all three patients with intermittent pneumatic compression therapy. Compression therapy administered as described above did not exacerbate ischemic pain, but rather, patients reported resolution of all pain attributable to either ischemia or ulceration. Wounds in two of the three patients closed and the third patient's wound continues to improve but has not yet closed.

Discussion / Conclusion : This novel ICT that is timed with the diastolic phase of the cardiac cycle improves venous return and reduces edema secondary to VI without impairing arterial blood flow, even in patients with severe peripheral artery disease. The improved venous return facilitates arterial blood flow through capillary bed into the emptied venous system and by enhancing cardiac output as expected according to Starling's Laws of Hemodynamics. Resolution of edema and enhanced blood flow facilitates closure of wounds in limbs that have combined venous insufficiency and peripheral artery disease that would otherwise not be expected to heal.

Periwound TCOM Used to Assess Response of CCLI to Novel Pneumatic Intermittent Compression Device Timed with Cardiac Relaxation.

Robert Williams (SE TX Center for Wound Care)

Goals and Objectives: Periwound transcutaneous oximetry (TCOM) has prognostic value in predicting healing of wounds associated with peripheral artery disease (PAD). Does a novel pneumatic device used to deliver intermittent compression therapy (ICT) used to treat wounds associated with PAD alter periwound TCOM values?

Purpose: Assess transcutaneous oximetry (TCOM) response in periwound tissue of ischemic wounds to novel ICT timed with cardiac relaxation.

Methods: Eight patients with documented PAD with lower extremity wounds clinically appearing ischemic that failed conventional therapy were selected. Periwound TCOM values were assessed with limb supine while breathing room air (RA) and then 100% oxygen (O₂). TCOM values were obtained prior to initiating intermittent compression therapy (ICT) and reassessed every 4-6 weeks during compression therapy. ICT consisted of 45 mm Hg compression applied to the affected lower limb during cardiac diastole for 0.40 to 0.45 seconds at a time for 40 min a day, 3-5 days a week.

Results: Patients reported significant decrease in pain associated with wound. TCOM responses to ICT timed with diastole were categorized as follows:

1. Improved TCOM with both RA and O₂- correlated with wounds that improved or closed.
2. Improved TCOM with O₂ only- correlated with wounds that stabilized or improved. The noted change in O₂ response suggests the detection of early changes in microcirculation resulting from ICT.
3. Worsened TCOM values- correlated with wounds that remained stable and did not worsen despite modest decreases in TCOM values.

Discussion / Conclusion: TCOM demonstrated enhanced periwound blood flow in patients responding to ICT timed with cardiac relaxation. TCOM findings also suggest that a subgroup of patients with initial response in microcirculation may benefit from continued ICT. There was no harm detected clinically in the subgroup with declining TCOM values, but this response may be predictive of patients likely to not respond to ICT.

Case Report: Novel Combined Therapy for Intractable Concomitant Venous and Arterial Disease

Robert Williams (SE TX Center for Wound Care)

Goals and Objectives: Venous insufficiency (VI) and peripheral artery disease (PAD) when present concurrently make lower extremity wounds extremely difficult to treat. Wound healing is impaired by both edema and ischemia. In this setting, each disease process limits effective therapy of the other.

Purpose: Demonstrate the efficacy of combining a novel pneumatic intermittent compression device with a new collagen matrix to successfully close a lower extremity wound associated with combined VI and PAD.

Methods: Intermittent pneumatic compression of 45 mm Hg was applied to the entire affected lower limb during cardiac diastole for duration of 0.40 to 0.45 seconds per compression. Compression was applied 40 min a day, 5 days a week. Local wound care consisted of applying a novel porcine collagen matrix containing carboxymethylcellulose, sodium alginate, and EDTA. The matrix was applied every other day.

Results: Swelling caused by VI markedly improved with intermittent pneumatic compression therapy. Compression therapy administered as described above did not exacerbate ischemic pain, but rather, patient reported resolution of all pain attributable to both ischemia and ulceration. The wound closed within 6 weeks of initiating therapy.

Discussion / Conclusion : The matrix composed of partially denatured porcine collagen, carboxymethylcellulose, sodium alginate, and EDTA introduces unique characteristics that optimize wound bed moisture, impair MMP activity, and facilitate cell migration. Because intermittent compression was timed with the diastole, venous return was improved and edema secondary to VI reduced, without impairing arterial blood flow. Improved venous return facilitated arterial blood flow through the capillary beds into the emptied venous system and enhanced cardiac output. Resolution of edema with enhanced blood flow in the face of optimal wound bed preparation facilitated prompt closure of this wound associated with concomitant venous insufficiency and peripheral artery disease.