Physiology of Hyperbaric Oxygenation Of Wounds

The basic pathway to non-healing wounds is the interplay between tissue hypo-perfusion (Decreased blood flow), resulting hypoxia(deficiency in the amount of oxygen reaching the tissues), and infection. A large body of evidence exists which demonstrates that intermittent oxygenation of hypo-perfused wound beds, a process only achievable in selected patients by exposing them to hyperbaric oxygen treatment, mitigates many of these impediments and sets into motion a cascade of events that leads to wound healing.

Hyperbaric oxygenation is achieved when a patient breathes 100% oxygen at an elevated atmospheric pressure. This produces an increase in the plasma volume transported oxygen for cellular metabolism. Availability of substrate for oxygen dependent enzymatic reactions critical to repair and resistance to infection is even more important than normalization of the healing rate. Furthermore, oxidants appear to be among the most important signals that control the healing process, this may be another mechanism for the benefits of HBOT in hypoxic/non-healing wounds.

Normal wound healing proceeds through an orderly sequence of steps involving control of contamination and infection, resolution of inflammation, regeneration of the connective tissue matrix, angiogenesis, and resurfacing. Several of these steps are critically dependent upon adequate perfusion and oxygen availability. The end result of this process is sustained restoration of anatomical continuity and functional integrity. Problem or chronic wounds are wounds that have failed to proceed through this orderly sequence of events and have failed to establish a sustained anatomic and functional result. This failure of wound healing is usually the result of one or more local wound or systemic host factors inhibiting the normal tissue response to injury. These factors include persistent infection, mal-perfusion and hypoxia, cellular failure, and unrelieved pressure or recurrent trauma.

Problem wounds represent a significant and growing challenge to our healthcare system. The incidence and prevalence of these wounds are increasing in the population resulting in growing utilization of healthcare resources and dollars expended. Venous leg ulcers represent the most common lower extremity wound seen in ambulatory wound care centers with recurrences frequent and outcomes often less than satisfactory. Pressure ulcers are common in patients in long term institutional care settings adding significant increases in cost, disability, and liability. Foot ulcers in patients with diabetes contribute to over half of lower extremity amputations in the United States in a group at risk representing only 3 per cent of the population. In response to this challenge specialized programs have emerged designed to identify and manage these patients using standardized protocols and a variety of new technologies to improve outcomes. Hyperbaric oxygen treatment (HBOT) has been increasingly utilized in an adjunctive role in many of these patients coinciding with optimized patient and local wound care.