Compromised Skin Grafts and Flaps

These wounds usually develop in a compromised host with multiple local and systemic factors contributing to impaired healing and tissue necrosis. Although each skin graft or flap problem is unique, inadequate oxygenation of tissue is the most common factor leading to tissue necrosis.

Hyperbaric oxygen provides immediate support to poorly perfused tissue in areas of acutely compromised blood flow. While hyperoxygenation is only a temporary measure, it will often serve to buy time and maintain tissue viability until corrective measures can be implemented or until neovascularization is established. Multiple studies have shown significant enhancement of graft and flap survival in a variety of experimental and clinical situations. Solid evidence has demonstrated that hyperbaric oxygen as an adjunct therapy can mean the difference between success and failure. Medicare and most private insurances cover this cost effective treatment modality.

What is Hyperbaric Oxygen?

Hyperbaric oxygen (HBO) is a daily treatment, in which a patient breathes 100% oxygen at pressure greater than normal atmospheric pressure in a hyperbaric chamber.

HBO therapy systemically delivers 100% oxygen at 2-3 times greater than atmospheric pressure. This elevated pressure within the hyperbaric chamber results in a 10-15 fold increase in plasma oxygen concentration, which translates to arterial oxygen values of between 1,500 and 2,000 mmHg. This steep oxygen gradient produces a four-fold increase in the diffusing distance of oxygen from functioning capillaries.

Most treatment regimens for compromised skin grafts and flaps will be 90-120 minutes long with the duration of treatment being highly individualized.

What are the Beneficial Mechanisms Associated with HBO as a Treatment for Compromised Skin Grafts and Flaps?

Reperfusion is a primary etiological factor in compromised flaps and grafts. Hyperbaric oxygen therapy is critical in preventing white cell mediated cellular injury resulting from the ongoing lipid peroxidation and oxygen radical generation that constitutes the reperfusion injury. HBO prevents the irreversible binding of the white blood cells to the endothelium and serves as a cellular protector in the reperfusion scenario.

In addition, several other beneficial mechanisms of action are associated with intermittent exposures to hyperbaric oxygen (daily treatments). The most important effects of hyperbaric oxygen for the surgeon are the stimulation of leukocyte microbial killing, enhancement of fibroblast replication, increased collagen formation, neovascularization of ischemic tissue, and the provision of protection from ischemic reperfusion injuries and vasoconstrictive shunting.
HBO is the only intervention that has been shown to increase neovascularization in poorly perfused tissue. Furthermore, all freshly applied skin grafts and flaps are initially relatively hypoxic.

Hyperbaric oxygenation improves the survivability of grafts and flaps by increased capillary proliferation and to a lesser extent by direct oxygenation. In the compromised host or in a patient with a previously failed graft or flap, pre-treatments with hyperbaric oxygen have proven to be valuable in laying down a healthy granular tissue bed for grafting.

Researchers have suggested that graft/flap failure may also be secondary to the development of arteriovenous shunts within the distal portion of a graft or flap. The vasoconstrictive properties of HBO not only reduce edema within this tissue, but may also act to close these shunts selectively in non-ischemic areas thereby improving blood flow to ischemic tissue.

Hyperbaric oxygen therapy used as an adjunct to aggressive, comprehensive wound care can often improve the “take” of compromised skin grafts and flaps resulting in healing of these difficult wounds.

References


