How Does Hyperbaric Oxygen Work?

Normal Blood Flow: There is 21% oxygen in the air that we breathe, and our lungs transfer this oxygen to our red blood cells (via hemoglobin). These oxygen-filled red blood cells are carried around the body by the plasma (fluid), which travels through the blood vessels. The oxygen diffuses into the surrounding tissue ensuring that it is delivered to where it is needed most.

Restricted Blood Flow: When there is a restriction (occlusion) in blood flow due to surgery, illness, or injury, the red blood cells block the blood vessel and are unable to transfer oxygen to the cells on the other side of the occlusion. This causes swelling and starves the area of oxygen, causing hypoxia (a lack of oxygen); when this occurs the tissue begins to break down.

Hyperbaric Oxygenation: Breathing 100% oxygen under pressure causes the oxygen to diffuse into the blood plasma. This oxygen-rich plasma is able to travel past the restriction, diffusing up to 3 times further into the tissue. The pressurized environment helps to reduce swelling and discomfort, while providing the body with at least 10-15 times its normal supply of oxygen to help repair tissue damaged by the original occlusion or subsequent hypoxic condition. Hyperbaric Oxygenation (HBOT) directly increases the saturative effects of tissue oxygenation slowing and reversing hypoxic induced apoptosis - restoring blood supply to the compromised region by the development of new capillary networks (neovascularization) enabling the body to alter the course and impact of the disease process.

Neurovascular Regeneration: HBOT mobilizes the body’s circulating stem cells. American Journal Physiology - Heart and Circulatory Physiology (Nov 05) reports a single 2-hour exposure to HBOT at 2 ATA doubles circulating CD34+ progenitor stem cells (primordial cells targeted to salvage and restore damaged structures); and at approx. 40-hours of HBOT; circulating CD34+ cells increases eight fold (800%).
Mechanisms of Action of Hyperbaric Oxygen

1. Hyperoxgenation
Breathing 100% oxygen while under 2-3 atmospheres of pressure delivers 20x more oxygen to the tissues than if you were breathing room air (21%) under normal living conditions. This provides immediate help to ischemic and compromised tissue even with marginal blood flow.

2. Direct Pressure
Oxygen under pressure shrinks the size of gas bubbles leading to reabsorption. This is the mechanism by which HBOT treats arterial gas embolisms and nitrogen in the tissues, caused by diving accidents.

3. Bacterioccidal and Bacteriostatic
Hyperoxgenation of the tissues enhances the killing of bacteria and is critical in curing deep seated, resistant infections.

4. Vasoconstriction
Hyperbaric Oxygen vasoconstricts the small vessels in the body, especially in injured tissues. This decreases edema and is important in the treatment of burns, crush injuries and injured tissues in general.

5. Angiogenesis
Hyperbaric Oxygen creates collateral blood flow, critical to injured tissues. Collateral blood vessels are produced by increased fibroblast leading to increased collagen. Therefore creating new vascularization in ischemic, injured tissues, these new collateral blood vessels are functional as opposed to the collateral blood vessels from hypoxic tissue or ischemic tissue, which are not functional.

6. Stimulates Superoxide Dismutase (SOD)
Superoxide Dismutase is one of the body's main antioxidants and free radical scavengers. HBOT gives critically needed help to compromised, injured tissue by stimulating the Antioxidant, which in turn rids the affected area of the products of inflammation and free radicals.

7. Antibiotic Synergy
Hyperbaric Oxygen creates synergy with the following antibiotics: Fluoroquinolones, aminoglycosides, and amphotericin B. These antibiotics use oxygen to transport across cell membranes.

8. Decreased Lactic Acid
Hyperbaric Oxygen decreases lactate accumulation in ischemic tissue, which greatly aids healing.

9. Increased Destruction of Anaerobes
HBOT is very effective against anaerobic bacteria that thrives in tissue with not enough oxygen. HBOT facilitates the oxygen-dependent peroxidase system by which leukocytes kill bacteria. (Gill and Bell '97)

10. Leukocyte Oxidative Killing
In anaerobic environments (with limited oxygen), the killing capacity of certain white blood Cells (Leukocytes), is markedly reduced. By providing supplemental oxygen, HBOT supercharges the destructive capacity of these white blood cells, thus allowing more bacteria to be killed. (Leach et. Al, BMJ)

11. Decrease in Inflammation
Hyperbaric Oxygen Therapy decreases inflammation by several mechanisms. Cytokines and other inflammatory chemicals, including lactic acid, are cleared with HBOT. Oxidative Stress Markers and C-Reactive Protein were reduced with HBOT. (Biomedcentral) HBOT stimulates the body's internal antioxidants to help clear inflammation.