

Delayed Radiation Injuries (Soft Tissue) and Hyperbaric Oxygen

When radiation injury occurs, sometimes long after radiation treatments, tissue undergoes a progressive deterioration characterized by a reduction in the density of small blood vessels and replacement of normal tissue with dense fibrous tissue, until there is insufficient oxygen supplied to sustain normal function. Wounds that present in this relatively avascular, hypoxic tissue often fail to heal. Hyperbaric oxygen (HBO) has been demonstrated to improve oxygenation and stimulate angiogenesis in this damaged tissue, resulting in recovery from delayed radiation tissue injuries and improves the ability to heal.

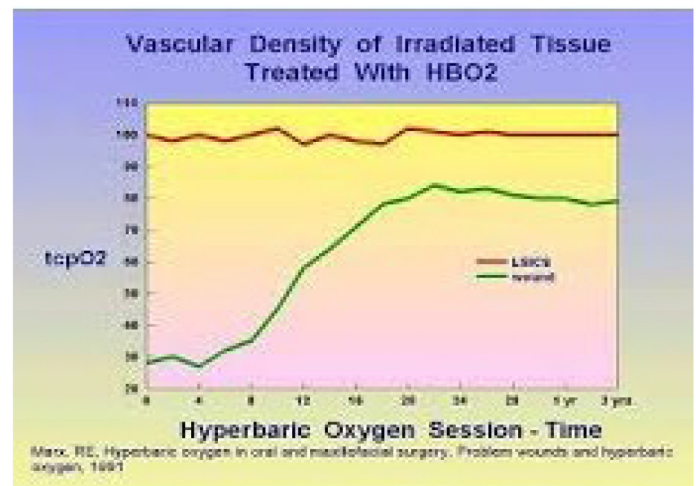
Hyperbaric oxygen therapy is the only intervention that has been proven to increase the number of blood vessels in irradiated tissue. This change can be measured using transcutaneous oximetry.

Hyperbaric oxygen therapy is typically administered daily, Monday through Friday. The intermittent hyperbaric oxygenation allows for periods of hypoxia between daily treatments. During these hypoxic periods angiogenesis factors are released from macrophages, which causes capillary budding. New capillaries, however, cannot advance unless they are surrounded by a collagen matrix. HBO raises the oxygen tension in tissue sufficiently for collagen formation to take place at greater distances from damaged/functioning capillaries.

A minimum of 20 mmHg partial pressure of oxygen is required for fibroblast proliferation and collagen production to occur. Irradiated tissue is often far below this level. In normal tissue at atmospheric pressure, this tension of oxygen exists up to 30 microns away from the capillary wall. Under hyperbaric conditions this tension can be maintained up to 280 microns away. This rich collagen matrix allows capillary buds to invade rapidly and form a new advancing vascular system that returns perfusion to within normal limits, thus allowing the irradiated tissue to heal.

Benefits of HBO include:

- Increased collagen and extracellular matrix protein deposition
- Increased oxygen diffusion distance from the capillaries
- Improved leukocyte-bacterial-killing
- Improved local tissue oxygenation
- Decreased local tissue edema
- Increased angiogenesis
- Reduced inflammation



References

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