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Oxygen: Implications for Wound Healing

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Background: Oxygen is vital for healing wounds. It is intricately involved in numerous biological processes including cell proliferation, angiogenesis, and protein synthesis, which are required for restoration of tissue function and integrity. Adequate wound tissue oxygenation can trigger healing responses and favorably influence the outcomes of other treatment modalities. The Problem: Chronic ischemic wounds fail to heal appropriately secondary to extreme hypoxia that leads to cellular demise. Wound tissue hypoxia is typically greater at the center of the wound. Accordingly, oxygen requirements of the regenerating tissue will vary. Basic/Clinical Science Advances: As oxygen levels decrease within the wound, cell response mechanisms (hypoxia inducible factor [HIF]) trigger the transcription of genes that promote cell survival and angiogenesis. HIF stabilizers are currently being tested to determine wound healing potential. Clinically, topical oxygen therapy (TOT) has been proved as an effective therapeutic modality for chronic wounds. TOT is reputed to have several advantages over hyperbaric oxygen therapy. Namely, TOT has a lower risk of oxygen toxicity, it is less expensive and is relatively easy to apply to target areas. Clinical Care Relevance: Wound tissue oxygen is necessary for appropriate wound healing; however, the relative complexity of the healing process requires a multifaceted approach for successful healing outcomes. A key component of this multifaceted approach should be specific oxygen dosing as a function of tissue hypoxia. Conclusion: New treatment approaches that exploit cell hypoxia sensing and response mechanisms and that enable the precise application of oxygen therapy to hypoxic areas of regenerating tissue are very promising.