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Editorial

Hyperbaric Oxygen Therapy in Osteoradionecrosis of Jaw (ORNJ) Undergoing Radiation Therapy- A Perspective on Contemporary Understanding

Nanda Kishore Ghoshal

Consultant Prosthodontist, Kolkata, India

***Corresponding Author:** Nanda Kishore Ghoshal, Consultant Prosthodontist, Kolkata, India.

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Radiation therapy is a prevalent treatment approach for head and neck cancer. Nevertheless, high-dose radiation therapy can lead to numerous side effects, including xerostomia, dysgeusia, dysphagia, mucositis, radiation caries, fibrosis, limited mouth opening, and candidiasis. Surgical procedures performed in irradiated areas may also lead to complications such as infections, delayed healing, and dehiscence. One of the most serious complications associated with radiation therapy is osteoradionecrosis (ORN), which may manifest during or after the treatment process. Specific strategies are necessary to prevent and manage this condition, with hyperbaric oxygen therapy frequently cited as a potential intervention. This article aims to provide a comprehensive review of the existing literature regarding hyperbaric oxygen therapy for patients who have undergone radiation treatment in the head and neck region, focusing particularly on oral and maxillofacial therapies.

The occurrence of ORN varies between 0.9% and 35% in patients with head and neck radiation exposure, with a prevalence that is three times higher in males compared to females.

The clinical manifestations of ORN include exposed necrotic bone, sequestra, ulceration, pain, purulent discharge, swelling, trismus, paresthesia, orocutaneous fistulae, and pathological fractures. It is noted that ORN is more commonly found in the lower jaw than in the upper jaw, as the lower jaw possesses a more cortical structure, is less vascularized, and typically receives a greater amount of radiation than the upper jaw. ORN predominantly arises between four months and two years following the conclusion of radiation therapy.

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The development of osteoradionecrosis (ORN) is influenced by several factors, including the original location of the tumor, the stage of the tumor at diagnosis, the type of surgical intervention performed, the radiation field, its type and dosage, the duration since irradiation took place, any chemotherapy administered, the pre-existing condition of dental health, chronic trauma from prostheses, surgical procedures involving the jaw, nutritional health, as well as alcohol and tobacco consumption.

The selection of treatment is influenced by the degree of severity of the ORN.

Conservative treatment includes debridement, which is crucial for the removal of all necrotic tissue to facilitate self-healing, along with irrigation and prophylactic antibiotic therapy aimed at preventing secondary infections. This conservative strategy is typically reserved for emerging or localized lesions.

Patients presenting with pathologic fractures, orocutaneous fistulas, or full-thickness devitalized bone do not benefit from this

treatment. Surgical interventions, such as resection, reconstruction using bone grafts, and fistulectomy, are recommended for these more severe conditions.

Hyperbaric oxygen (HBO) therapy, a method primarily utilized in treating air embolism, carbon monoxide poisoning, and compartment syndrome, serves as an important adjunct to both conservative and surgical interventions for osteoradionecrosis (ORN). The therapy involves inhalation of pure oxygen under heightened pressure conditions, typically above 1.5 atmospheres. According to the Marx protocol, ORN treatment necessitates a 90-minute daily session at 2.4 atmospheres, spanning 30 days prior to surgery and continuing for 10 days post-surgery. In cases where HBO therapy is employed prophylactically, the protocol comprises daily sessions for 20 days preceding surgery followed by 10 days thereafter, highlighting its critical role in enhancing therapeutic outcomes.

Osteoradionecrosis (ORN) presents a complex progression that varies for each individual, requiring careful consideration at every stage. In Stage I, the bone remains exposed yet unfractured, prompting an initial intervention of 30 Hyperbaric Oxygen Therapy (HBOT) sessions aimed at promoting healing; an extension of 10 additional sessions may be warranted if the bone shows promising signs of recovery. Stage II escalates the approach, necessitating potential surgical intervention to excise the damaged bone should initial HBOT prove inadequate, with continued HBOT to facilitate post-surgical recovery. Stage III represents a critical phase where the bone has fractured or succumbed to severe infection, demanding comprehensive surgical efforts-possibly involving reconstructive procedures-complemented by HBOT to enhance recovery outcomes.

Hyperbaric oxygen therapy (HBOT) stands as a validated treatment option for osteoradionecrosis of the jaw, with its efficacy supported by extensive research over the years. This method is noteworthy for its profound impact on patient recovery, as highlighted by a 2023 systematic review. The review demonstrates that HBOT, when combined with surgical interventions, leads to healing in 70% of patients, a significant improvement over the 51% healing rate achieved through surgery alone. Furthermore, beyond mere healing, HBOT contributes to meaningful symptom relief, with patients reporting substantial reductions in pain, enhanced jaw functionality, improved speech capability, and decreased occurrences of dry mouth. These figures underscore the importance of HBOT in alleviating the complex challenges posed by osteoradionecrosis of the jaw.

Hyperbaric oxygen therapy (HBOT) plays a significant role in the prevention and treatment of osteoradionecrosis (ORN), particularly among patients who have undergone radiation therapy to the head and neck. A retrospective audit conducted in 2023 revealed that only 9.1% of patients who received prophylactic HBOT after dental extractions developed ORN, indicating a meaningful protective effect. Furthermore, HBOT enhances surgical outcomes, as demonstrated in a 2020 study where its integration with surgical procedures led to improved healing rates and fewer complications. HBOT has also shown therapeutic benefits in managing irradiated wound care, particularly when surgical intervention is not an option. These findings underscore the potential of HBOT as a crucial element in managing ORN and related conditions.

The short-term impacts of Hyperbaric Oxygen (HBO) therapy are notable for including vasoconstriction, reducing edema, activating phagocytosis, and exhibiting anti-inflammatory properties. Over the long term, HBO therapy plays a crucial role in stimulating collagen production through fibroblast activity, encouraging bone formation, and, most significantly, promoting neovascularization. Remarkably, the angiogenesis triggered by this therapy becomes evident following eight sessions, with a progression to a plateau at 80–85% of vascularity compared to non-irradiated tissue after completing 20 sessions. The modifications in tissue oxygen pressure produced by HBO therapy seem to be enduring; observations show that three years post-treatment, the tissue's oxygen pressure remains at 90% of the levels seen immediately after therapy concludes.

Hyperbaric oxygen (HBO) therapy must be approached with caution due to its associated contraindications, both relative and absolute. Claustrophobia, seizure disorders, upper respiratory tract infections, chronic sinusitis, and a history of spontaneous pneumothorax are recognized as relative contraindications, warranting careful consideration before HBO therapy is administered.

More gravely, optic neuritis, a history of bullous pulmonary disease, congenital pulmonary blebs, untreated pneumothorax, and poorly managed chronic heart failure are categorized as absolute contraindications, making HBO therapy unsuitable for individuals with these conditions. Historically, active tumors were considered a contraindication to HBO therapy; however, Feldmeier and colleagues have scrutinized existing clinical data and determined that there is no substantiated evidence supporting the notion that HBO therapy promotes tumor cell growth.

A recent systematic review has rigorously determined that hyperbaric oxygen (HBO) therapy is advisable following the extraction of mandibular teeth located within the irradiated region in patients subjected to radiation doses exceeding 60 Gy. This recommendation underscores the importance of addressing the potential complications associated with oral care in irradiated patients. However, it is crucial to acknowledge that even with the application of HBO therapy, the risk of developing osteoradionecrosis (ORN) persists. Evidence from a study encompassing 40 irradiated patients who underwent prophylactic HBO treatment revealed that 1.6% of 371 tooth extraction sites failed to heal within a year. Moreover, another investigation involving 20 patients who received HBO therapy both before and after surgery reported a concerning ORN prevalence of 15.8% at six months post-extraction. These findings highlight the persistent challenges and gravity of managing dental health in patients exposed to high radiation doses, emphasizing the need for continued research and careful clinical practice.

Dental implants significantly enhance the quality of life for patients who have undergone radiation therapy, especially for those who are completely toothless or struggle with poorly fitting dentures. It is promising to note that radiation therapy is no longer deemed a definitive contraindication for dental extraction.

Today, the widespread use of HBO therapy for ORN.

Treatment appears to be based on personal beliefs and experience rather than convincing scientific evidence. Some findings raise significant concerns about Marx's theory, which attributes osteoradionecrosis (ORN) to hypovascularity, hypocellularity, and hypoxia. The observation that hyperbaric oxygen (HBO) therapy appears to impede osteoblast proliferation by enhancing apoptosis and reinforcing cell-cycle arrest necessitates careful consideration as researchers explore alternative hypotheses.

The primary drawbacks associated with HBO therapy include its significant expense, scarcity of treatment centers, the considerable time commitment required-often leading to challenges in securing patient adherence-and the potential for postponing definitive treatment.

In recent years, a range of substances including pentoxifylline, a peripheral vasodilator, vitamin E, and clodronate, a bisphosphonate, have been explored as potential alternative therapies for ORN. These interventions are grounded in varying pathophysiological theories of ORN, such as the suppression of osteoclasts or the fibroatrophic process. The observed effectiveness of these treatments prompts critical revaluation of the underlying assumptions regarding hyperbaric oxygen (HBO) therapy, thereby calling into question the reliability and effectiveness of HBO as a treatment option for ORN.