



Hyperbaric Oxygen and Medical Centre

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# Hyperbaric Oxygen Therapy to Reduce the Risk of Osteoradionecrosis with Dental Surgery in at Risk Patients

## Background

Patients diagnosed with head and neck cancers are commonly treated with a combination of radiotherapy and ablative surgery and can often require extensive oral rehabilitation following their cancer treatment. Although it is always ideal to complete as much dental work as possible before radiotherapy, patients will still frequently require dental extractions or implant placement afterwards. In these patients, recovery can be complicated by osteoradionecrosis (ORN) and delayed wound healing with negative effects on osseointegration and implant survival.

Although ORN can occur spontaneously months to years after the radiotherapy treatment of head and neck cancers, an important precipitating factor is post-radiotherapy dental surgery. Additional risk factors suggested to increase the risk of developing ORN include pre-radiotherapy osteotomy or prior tooth extraction, poor oral hygiene, tobacco smoking, alcohol consumption, radiation dose, and tumor-to-bone proximity<sup>1</sup>.

Hyperbaric oxygen therapy (HBOT) is known to positively affect surgical outcomes in vulnerable tissues as in those affected by radiotherapy. HBOT works to by increasing the oxygen supply in hypoxic tissues leading to fibroblast proliferation and capillary formation which in turn increases tissue vascularity, viability, and healing capacity. On this basis, many protocols support the use of prophylactic and perioperative HBOT to reduce the risk of ORN and improve implant retention in an irradiated mandible.

## Literature Update

One of the earlier protocols looking at ORN in oral procedures was by Marx, which through a randomized prospective trial demonstrated that ORN incidence was decreased to 5.4% in the group pretreated with HBOT versus 29.9% in those treated with penicillin alone prior to dental extractions<sup>2</sup>. Since then, retrospective reviews have continued to support the role of HBOT in ORN<sup>3,4</sup> including a more recent prospective study that followed 411 patients over 8 years. This study looked at the complete heal rates in patients undergoing ORN surgery and it found that **92% of the 166 patients in the 20 pre-procedure and 10 post-procedure HBOT arm achieved complete healing**<sup>5</sup>.

Furthermore, a comprehensive 2016 Cochrane review of 14 trials encompassing a total of 753 patients found that **HBOT was associated with a 1.3 odds ratio of achieving mucosal coverage in patients at risk of ORN** versus standard care alone (95% CI: 1.1-1.6 P=0.003) and this translated to a number needed to treat of 5 to achieve additional benefit in this patient population<sup>6</sup>.

A study that has been cited in dental literature<sup>7</sup> by Annane *et al*<sup>8</sup> did not support the use of HBOT for patients at risk of ORN undergoing dental procedures, however this paper has come under heavy scrutiny over methodologic concerns and interpretability of data. Firstly, in this study 68 subjects were enrolled from 12 different hospitals making adherence to one standard of care unachievable. Secondly, HBOT treatment schedules were not provided with one quarter of the treated subjects receiving less than 22 sessions (a subtherapeutic regiment when compared to other studies). Thirdly, looking at the statistical outcomes and confidence intervals it is evident that the study was underpowered making accurate interpretation of the findings difficult. Finally, and most concerning, was how treatment failure was defined. In this study HBOT failure was defined as the need for debridement surgery. As per USHMS guidelines, HBOT is to be used as an adjunct therapy in patients at risk of ORN needing dental procedures to improve the odds of tissue healing. This means using it in conjunction with surgical debridement and not trying to replace it.

## Current Recommendation for HBOT use in Patients at Risk of ORN

At the time of writing, a formal consensus has not been reached regarding a standard HBOT protocol in patients undergoing dental procedures who are at risk of ORN and additional data is forthcoming. An ongoing randomized trial “Hyperbaric Oxygen for the Prevention of Osteoradionecrosis (HOPON)” will compare patients receiving oral antibiotics and mouthwashes, with and without the use of 20 pre-procedure and 10 post-procedure HBOT sessions<sup>9</sup>.

In the interim, **HBOT protocols with 20 -30 pre-procedure and 10 post-procedure sessions at 2.4 ATA for 90 minutes should be utilized as an important adjunct treatment in this patient population<sup>10,11</sup>**. This should always be combined with existing standard of care guidelines that include smoking and alcohol cessation, perioperative antibiotics and chlorhexidine mouthwashes, and appropriate surgical timing.

## About Restore Hyperbaric Oxygen and Medical Centre

Restore Hyperbaric Oxygen and Medical Centre is a new outpatient hyperbaric medical unit located in Mississauga near the juncture of the 427 and the QEW. It is staffed exclusively by academic anesthesiologists affiliated with the Faculty of Medicine at the University of Toronto. Our center strives to provide evidence based HBOT for Health Canada recognized indications. The use of HBOT for post radiation patients at risk of ORN is fully covered by OHIP.

Hyperbaric oxygen therapy is a painless, safe, and non-invasive treatment modality. A typical treatment session lasts approximately two hours and is scheduled daily (Monday to Friday). The hyperbaric chambers provide the ability for the patients to rest at a comfortable while watching media for the duration of the treatment session.



## References

1. Chang DT, Sandow PR, Morris CG, Hollander R, Scarborough L, Amdur RJ, Mendenhall WM. Do pre-irradiation dental extractions reduce the risk of osteoradionecrosis of the mandible? *Head Neck*. 2007 Jun;29(6):528-36. doi: 10.1002/hed.20538. PMID: 17230555
2. Marx RE (1983a). A new concept in the treatment of osteoradionecrosis. *J Oral Maxillofac Surg* **41**: 351–357.
3. Feldmeier JJ, Hampson NB (2002). A systematic review of the literature reporting the application of hyperbaric oxygen prevention and treatment of delayed radiation injuries: an evidence-based approach. *Undersea Hyperb Med* **29**: 4–30.
4. Freiburger JJ, Yoo DS, de Lisle Dear G *et al*(2009). Multimodality surgical and hyperbaric management of mandibular osteoradionecrosis. *Int J Radiat Oncol Biol Phys***75**: 717–724.
5. Hampson NB, Holm JR, Wreford-Brown CE, Feldmeier J (2012). Prospective assessment of outcomes in 411 patients treated with hyperbaric oxygen for chronic radiation tissue injury. *Cancer* **118**: 3860–3868.
6. Bennett MH, Feldmeier J, Hampson NB, Smee R, Milross C. Hyperbaric oxygen therapy for late radiation tissue injury. *Cochrane Database Syst Rev*. 2016 Apr 28;4(4):CD005005. doi: 10.1002/14651858.CD005005.pub4. PMID: 27123955; PMCID: PMC6457778.
7. Anne-Frédérique Chouinard, DMD, MSc, FRCD(C); Luc Giasson, PhD; Michel Fortin, DMD, PhD, FRCD(C) MSc. Hyperbaric Oxygen Therapy for Head and Neck Irradiated Patients with Special Attention to Oral and Maxillofacial Treatments. *J Can Dent Assoc* 2016;**82**:g24
8. Annane D, Depondt J, Aubert P, Villart M, Géhanno P, Gajdos P, Chevret S. Hyperbaric oxygen therapy for radionecrosis of the jaw: a randomized, placebo-controlled, double-blind trial from the ORN96 study group. *J Clin Oncol*. 2004 Dec 15;22(24):4893-900. doi: 10.1200/JCO.2004.09.006. Epub 2004 Nov 1. PMID: 15520052.
9. Shaw, R., Butterworth, C., Tesfaye, B. *et al*. HOPON (Hyperbaric Oxygen for the Prevention of Osteoradionecrosis): a randomised controlled trial of hyperbaric oxygen to prevent osteoradionecrosis of the irradiated mandible: study protocol for a randomised controlled trial. *Trials* **19**, 22 (2018). <https://doi.org/10.1186/s13063-017-2376-7>
10. Lauren Anderson, Stephen Meraw, Khalid Al-Hezaimi, Hom-Lay Wang. The influence of radiation therapy on dental implantology. *Implant Dent*. 2013 Feb;22(1):31-8.
11. Granstrom G, Bergstrom K, Tjellström A, Brånemark PI. (1994). A detailed study of titanium fixture implants lost in irradiated tissues. *Int J Oral Maxillofac Implants* **9**:653-662
12. Schoen PJ, Raghoobar GM, Bouma J, Reintsema H, Vissink A, Sterk W, *et al*. (2007). Rehabilitation of oral function in head and neck cancer patients after radiotherapy with implant-retained dentures: effects of hyperbaric oxygen therapy. *Oral Oncol* **43**:379-388
13. Pompa, G., Saccucci, M., Di Carlo, G. *et al*. Survival of dental implants in patients with oral cancer treated by surgery and radiotherapy: a retrospective study. *BMC Oral Health* **15**, 5 (2015).
14. Nabil S, Samman N (2011). Incidence and prevention of osteoradionecrosis after dental extraction in irradiated patients: a systematic review. *Int J Oral Maxillofac Surg* **40**: 229–2