



**Title: Ultrasound Simulation versus Hyperbaric Oxygen for Osteoradionecrosis of the Mandible: Clinical Effectiveness and Guidelines for Use**

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**Context and policy issues:**

Osteoradionecrosis (ORN) is necrosis of the bone following radiation injury. It may occur spontaneously or be induced by subsequent injury in the irradiated area (e.g. tooth extraction or implant subsequent to radiation therapy).<sup>1</sup> ORN is considered to be characterized by hypocellularity, hypoxia, and hypovascularity.<sup>2,3</sup> ORN of the mandible (lower jaw bone) is a potential complication of radiation therapy, used in the treatment of head and neck, and mouth cancers.<sup>4-6</sup> It is a serious and debilitating condition and impacts the quality of life of the patient. The incidence of mandibular ORN varies widely, from 0.4% to 56%, but most commonly it is reported to be around 10%  $\pm$  5%.<sup>1,4,5</sup> Given the increased use of radiation therapy and combined chemotherapy-radiation therapy regimens in the treatment of head and neck malignancies, it is anticipated that ORN will continue to be an important clinical problem.<sup>7</sup>

Management of ORN includes medical procedures such as hyperbaric oxygen therapy (HBOT) and ultrasound therapy.<sup>8-10</sup> The purpose of HBOT and ultrasound therapy is to promote revascularization and neocellularity.<sup>11</sup> HBOT is expensive whereas ultrasound therapy is relatively less expensive.<sup>10,12,13</sup> This report was undertaken in response to a request for evidence on how these two procedures compare in their clinical effectiveness.

**Research questions:**

1. What is the clinical effectiveness of ultrasound simulation versus hyperbaric oxygen for treating osteoradionecrosis of the mandible?
2. What is the clinical effectiveness of ultrasound simulation versus hyperbaric oxygen for prevention of osteoradionecrosis in post-irradiated patients requiring dental surgery?
3. What are the guidelines for use of ultrasound simulation for osteoradionecrosis?

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## Methods:

A limited literature search was conducted on key health technology assessment (HTA) resources, including OVID's MedLine, Biosis, CINAHL, and Embase, Pubmed, The Cochrane Library (Issue 1, 2008), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, EuroScan, international HTA agencies, and a focused Internet search. Results include articles published between 2000 and May 2008, and are limited to English language publications only. No filters were applied to limit the retrieval by study type. A limited hand search was also conducted.

## Summary of findings:

No HTA reports, systematic reviews, randomized controlled trials or non-randomized studies were identified which compared ultrasound stimulation versus HBOT for the treatment of ORN of the mandible or for prevention of ORN in post-irradiated patients requiring dental surgery.

One guideline<sup>8</sup> recommended that the use of HBOT may be necessary for the management of ORN in severe cases, but did not provide details. The guideline also mentioned that recent evidence suggested that ultrasound may be helpful. However, the recent evidence referred to in the guideline was an *in vitro* study in which ultrasound of different frequencies were applied to human gingival fibroblasts and mandibular osteoblasts.<sup>13</sup>

Pitak-Arnop *et al.*<sup>14</sup> recently published a review on several different modalities used for the management of ORN of the jaw. They identified 118 relevant reports, which included one systematic review, three randomized controlled studies, three non-randomized controlled studies and 111 case-series studies. They concluded that most of the reports on treatment of ORN provided weak evidence and that the current information seemed insufficient for establishing definite treatment guidelines. They suggested that well-designed and long term studies are needed.

## Conclusions and implications for decision or policy making:

There was no evidence identified on the clinical effectiveness of ultrasound compared to HBOT for treatment or prevention of osteoradionecrosis. The one guideline that was identified on the use of ultrasound was of poor quality and based on limited evidence. A definitive conclusion on the clinical effectiveness of therapy with ultrasound compared with HBOT for prevention and treatment of ORN is not possible at this time as no relevant evidence could be identified.

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