

# Osteoradionecrosis of jaw- a review

## Abstract

Osteoradionecrosis (ORN) jaw is a serious complication after radiation that involves the osseous structures of jaw mostly mandible. Pathophysiology is radiation induced fibroatrophic process. The predisposing factor is mostly trauma (extraction) and sometimes spontaneous. Marx staging of ORN is used for diagnosis and treatment with surgical and oxygen therapy. The preventive measure includes avoiding predisposing factors and medical management.

**Keywords:** osteoradionecrosis, marx staging, medical and surgical management

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## Introduction

Osteoradionecrosis (ORN) or post radiation osteonecrosis (PRN) is a debilitating complication after radiation therapy for the head and neck cancer that involves the osseous structures within the radiation zone. ORN is defined as an area of exposed irradiated bone tissue that fails to heal over a period of 3 months without a residual or recurrent tumor.<sup>1</sup> ORN is a bone ischaemic necrosis caused by “3H” hypovascular, hypocellular, and hypoxic tissue and tissue breakdown (i.e. cellular death and collagenolysis that exceed cellular replication and collagen synthesis) followed by a nonhealing wound (e.g. tooth extraction), in which oxygen and metabolic demand exceed supply thus inhibiting substitution of cells to complete the turnover for the maintenance of homeostasis and wound cicatrisation.<sup>1-3</sup> The affected cells are the ones of vascular endothelium, fibroblasts which makes stroma and parenchyma cells.<sup>3</sup> The newer concept of ORN has three phases: prefibrotic phase, organized phase and fibro atrophic phase but it disagrees with hypoxia as a persistent cause for ORN.<sup>4</sup> Mandible is most commonly involved in 2.6 to 22% and lesser in the maxilla.<sup>5</sup> Various predisposing factors associated are trauma (from surgical procedures), active periodontal disease or denture trauma, idiopathic or spontaneous necrosis, high-dose radiation >65Gray, field of radiation (volume of the mandible included in the field and proximity of maximal dosing to bone), use of implant sources too close to the bone, and combined interstitial and external beam irradiation. Marx staging and treatment of osteoradionecrosis was considered the most effective tool to approach such patients.<sup>2,3</sup> The three stages classification proposed by Marx and Myers appears to be the most relevant:

1. Stage 1: less than 2 mm of exposed bone with or without pain and with radiological signs of diffuse demineralisation.
2. Stage 2: more than 2 mm of exposed bone.
3. Stage 3: pathological fracture, oral fistula, fistula or lesion of the inferior border of the mandible.<sup>6</sup>

Treatment modalities in stage 1 and 2 are medical management and in later advances and refractory stages not responding require hyperbaric oxygen therapy with surgical therapy and reconstruction grafts. Before radiotherapy preventive measure like oral prophylaxis, flouride application and extractions should allow as much healing time as possible; with minimal trauma at least 2 weeks, ideally 3 weeks, before initiation of radiation therapy.<sup>7,8</sup> After radiotherapy measure to reduce osteoradionecrosis include endodontic therapy over extraction, avoid using denture after 60 Gray, use of local anaesthetics that contain no or low concentration epinephrine, atraumatic surgical procedures (if surgery is necessary); prophylactic antibiotics plus post-surgical antibiotics during the week of healing and hyperbaric oxygen before invasive procedure.<sup>9</sup> Preventive measure ORN are taken 1 week before extraction, Pentoxifylline (800 mg/d) and Alpha-Tocopherol (vitamin E) 1000 gm/d (Evion) for 2 months if ORN develop continue for 6 months and add Clodronate (bisphosphonates) after 3 months 1600mg/day 5 days a week for 6 to 12 months and if sequestrum is present give all the three drugs for 3 months before the planned sequestrectomy. Pentoxifylline (PEN, increase oxygenation) and alpha-Tocopherol (TO, antioxidant) synergistically reduces radiation induced fibrosis and is potentiation by combination with Clodronate (CLO, reduces bone destruction) also called PENTOCLO protocol for 3 to 12 months appears to be effective in ORN. First phase of protocol for treatment includes anti-inflammatory (20 mg of prednisone), antifungal (50 mg of fluconazole), antibiotic (2 g of amoxicillin-clavulanic acid/1 g of ciprofloxacin) and 20 mg omeprazole daily for 4 to 6 weeks to control local super infection in the irradiated zone followed by second phase of PENTOCLO protocol. Hyper baric oxygen therapy can also be used.<sup>10,11</sup>

## Conclusion

The main goal of management is to prevent ORN by measures prior to the radiation but in diseased, prognosis of ORN depends on the stage of the diagnosis with early stage having better treatment outcome with medical management and later stages requiring surgical therapy and reconstruction with grafts.

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## Conflicts of interest

The authors declare that there is no conflict of interest.

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