ENDODONTIC TREATMENT OF PATIENTS FOLLOWING RADIATION THERAPY
IUSD Department of Endodontics
A. REXFORD * K. SPOLNIK * M. VAIL

Initial Presentation
Case 1
A 71 year old female with history of radiation therapy to the head and neck in excess of 65 Gy for treatment of a large cell carcinoma presented for the diagnosis of osteoradionecrosis of the mandible (ORN). Her prior practice general dentist requested root canal therapy of a compromised posterior tooth. Initial examination revealed a grossly carious #30. (Fig. 1). The patient had a complaint of throbbing pain in the lower right and #30 was percussion sensitive. The mucosa appeared dry, with no pooled saliva noted during examination.

Case 2
A 92 year old male with history of radiation therapy to the head and neck in excess of 75 Gy for treatment of a squamous cell carcinoma of right lateral border of his tongue and right parotid presented for the diagnosis of endodontic therapy of compromised anterior teeth. His prior practice general dentist requested root canal therapy of compromised anterior teeth #24 and #25. Initial examination revealed a grossly carious anterior teeth #23 & 26. (Fig. 2). The patient was asymptomatic. The mucosa appeared dry, with no pooled saliva noted during examination.

Treatment planning
Case 1
Primary root canal therapy was planned for #30, if a sealed restoration was not possible decoronation was recommended. The mesial aspect of #30 was intact, so it possible that wanted to be able to maintain function of #30.

Case 2
Primary root canal therapy was planned for #24 and #25, with placement of post core and crown. Due to partial necrosis and attachment of remaining tongue to floor of mouth, radiographs were extremely challenging. The patient was informed that both #24 and #26 will likely require RCT in the future.

Treatment
For both patients, root canal therapy was initiated with the primary focus of eliminating existing infection prior to prosthetic restoration. Root canal therapy was completed on a total of 3 teeth (Fig 5 & 6). In both cases standard treatment protocols for orthograde root canal therapy was adhered to and included: rubber dam isolation; copious irrigation with 6% Sodium Hypochlorite (Chlorax, USA), 0.12% Chlorhexidine (JM, Germany), and 17% EDTA Vistra, USA; hand and rotary instrumentation; and sealed gutta-percha obturation. A post-space, per-protocol root canal treatment request, was completed on teeth #24 and #25 prior to coronal seal with Cavit. #30 was sealed with office plugs of glass ionomer, and then built up with resin. Care was taken to limit instrumentation and obturation within the canal to avoid unnecessary stimulation or trauma to the periodontium; thus, limiting the possibility of subsequent complication consistent with ORN.

Follow-up
In each case, all previously completed root canals were assessed clinically and radiographically every three months for signs of healing and development of periapical pathosis. All symptoms associated with tooth #30 resolved within a few days of initial treatment and Ca(OH)₂ placement. No other significant complications in regards to osseous healing were noted. Currently, both patients are functioning without pain.

References

Figure 1. Case 1: A pre-op PA of #30: B) bitewing of #30. C) Immediate post op D, 6 month post op

Figure 2. Case 2: A: pre-op #24, 25. B: post op #24, 25

Table 1: Staging and Treatment

Table 3: ORN clinical photo

Introduction
Radiation therapy in combination with surgery is a common oncologic treatment for head and neck cancers. It is a successful treatment, however there are adverse side effects, the most severe and serious being osteoradionecrosis (ORN). Radiation causes changes in bone that lead to avascular necrosis of bone forming new vessels that lead to bone remodeling. In irradiated jaws, ORN is a condition that characterized by exposed bone that fails to heal (present 6 months) and skin high doses of radiation to the jaws. ORN is a progression of proliferation of irradiated bone that is irreversible. The exposed necrotic bone is accompanied by varying degrees of pain and paresthesia or anesthesia, and as its progresses, intraoral or extroral sinus tracts may develop, as well as the possibility of pathologic fractures. ORN slows progresses and does not heal spontaneously. ORN is difficult to treat and often leads to poor outcome and deformity. It is more common in patients that have had a radical neck dissection and poor vascularization. The majority of cases of ORN are trauma induced (89%), however there is a small percentage of cases that are spontaneous or non-traumatic. ORN is often the most significant complication in patients that are in the maxilla. When located in the upper jaw it usually develops less aggressively and defects are less severe. The risk of developing ORN depends on many factors such as the primary site, T stage, proximity of the tumor to bone, dentate state (endodontic treatment, external beam RT, surgery, and chemotherapy). In addition to the total dose of radiation. Nutritional status of the patient as well as continued alcohol or tobacco use might influence the likelihood of developing ORN.14

Pathogenesis
In 1970, Meyer outlined the classic triad of ORN as radiation, trauma, and infection. Since Meyer’s original explanation, a new concept has been presented to explain the pathophysiology of ORN.11 It is now believed that it does not result from a primary infection of the bone, but rather that present is secondary to the cause of ORN. After bone is irradiated, tissues becomes hypoxic, hypovascular, and hypocalcemic resulting in a significant decrease in its healing capacity. Trauma increases the risk of ORN because it places greater metabolic demands on tissues. Necrosis will occur when the rate of tissue breakdown exceeds the rate of healing, thus irradiated tissues are poorly equipped to cope with injury.12 Studies have shown that areas of the mandible most likely to be affected by ORN are the buccal crest of the premolar, molar, and retromolar regions due to ischemia of the inferior alveolar artery.13

Incidence
While the literature has reported incidences of ORN of 0-3.5%, a retrospective study of 830 cases over a 27 year period found that 9% of patients will develop symptoms from radiation.1 If a total dose of radiation greater than 65 Gy, it is highly likely to develop ORN.15 ORN has occurred in 8-10% of women.1 Incidence of ORN after tooth extraction specifically in irradiated patients is estimated to be around 2–18%.14 A systematic review of the literature regarding incidence of ORN following tooth extraction was done in 2011 in an attempt to clarify this wide reported range. Results of the systematic review found the total incidence after tooth extraction in irradiated patients to be 7%. A reliable finding of this review was that extractions that were performed in conjunction with prophylactic hyperbaric oxygen had a 4% incidence, while extraction in combination with antibiotics was 6%. Additionally, the extraction of mandibular teeth within the radiation field in patients with a history of radiation therapy dose higher than 60Gy represented the highest risk of developing ORN.16 The danger of developing ORN is highest 12 months following treatment, followed by a decrease; however the danger persists throughout the lifetime of an irradiated patient.4

Treatment
The primary treatment for ORN is to prevent its occurrence. Patients at risk for ORN should be advised to take appropriate preventive measures such as selecting endodontic therapy over extraction, the use of non-epinephrine containing local anesthetics, if extractions are required prophylactic antibiotics during the week of healing in addition to hyperbaric oxygen dives prior to extraction.17-19 If ORN occurs; it divided into three stages. Treatment is dictated by the stage. Stage 1 is a superficial ORN that can resolve with irrigation and hyperbaric oxygen (HBO), and no surgical bone removal is required. Stage 2 is stage 1 that is progressive and no healing. Stage 3 is ORN that has an erucateus fistula, pathologic fracture or resection of inferior border of the mandible. Treatments for the various stages of ORN are described in Table 1.4 Since the introduction of Marx’s protocol, there have been advances in surgical techniques as microvascular surgery as well as imaging techniques which allow a patient’s treatment to be based on stage of disease rather than determining the stage of the disease based on a patient’s response to a standardized protocol.14,15

Conclusions
The clinician must inform patients with a history of radiation to the head and neck of the risks associated with extraction. Total dose of radiation is pertinent, as well as the patients social history, such as frequency of smoking or drinking. Location of tooth in question is another important factor to consider when evaluating the best treatment for the patient. When considering the extraction of mandibular teeth on a patient with a history of total dose of radiation greater than 65 Gy, it is important to inform the patient of an increased risk of ORN. Important factors to consider for endodontic treatment are use of anesthetic without a vasocconstrictor and care must be taken to keep all instruments completely within the tooth to prevent any irritation to the bone. Endodontic maybe needed to treat non-restorable teeth on high risk patients to avoid extraction. When isolating these teeth, care must be taken to prevent any pressure or damage to soft tissue or bone.

Figure 3: ORN clinical photo

Table 1: Staging and Treatment

Stage
Clinical presentation
Histological changes
Prognosis
Stage 1
Superficial osteoradionecrosis
Epithelial ulceration
Healing
Stage 2
Progressive osteoradionecrosis
Fibrosis
Healing
Stage 3
Grossly invasive osteoradionecrosis
Cavitary bone destruction
Healing
Stage 4
Pathologic fracture
Cavitary bone destruction
Surgery
Stage 5
Release
Sequela
Surgery
Stage 6
Release
Sequela
Surgery