CASE REPORT

Successful surgical extraction of an impacted mandibular third molar in a patient treated with head & neck radiotherapy and chemotherapy for oral cancer

Alexandre Perez*, Vera Rita Ferreira Da Cunha, Tommaso Lombardi

Unit of Oral Surgery and Implantology, Division of Oral and Maxillofacial Surgery, Department of Surgery, Faculty of Medicine, University of Geneva & University Hospitals of Geneva, Switzerland

Received: June 1, 2022 **Accepted:** September 8, 2022 **Online Published:** October 31, 2022
DOI: 10.5430/dcc.v9n2p4 **URL:** https://doi.org/10.5430/dcc.v9n2p4

ABSTRACT

Osteoradionecrosis (ORN), a pathological condition characterized by a nonvital bone occurring in the site of radiation injury, is one of the significant risks following extraction of highly impacted third molar teeth in patients treated with head & neck radiotherapy for oral cancer. Therefore, the surgery's meticulous planning is essential to avoid such complications. This case report describes a 63-year-old male patient diagnosed with an impacted lower third molar (tooth #38) with concurrent basal cell carcinoma of the right ear and squamous cell carcinoma of the right vocal cord treated with radiotherapy. Taking into account the patient's health status, a minimally invasive osteotomy and a corono-radicular separation procedure were performed. This procedure allowed us to reduce the risk of mandibular ORN. Three years later, the healing was complete, and the situation was stable.

Key Words: Radiotherapy, Chemotherapy, Third molar extraction

1. INTRODUCTION

Extraction of third molars accounts for 90% of procedures in oral surgery.[1] The most common indication for the extraction is pericoronitis (34.1%), followed by gingival diseases, periapical infections and abscesses, facial cellulitis, and orthodontic or prophylactic treatment.[2]

Extraction of third molars is associated with multiple possible complications such as bleeding, damage to the adjacent teeth or the soft tissues of the mouth, displacement of the extracted tooth into the surrounding areas (maxillary sinus, pterygopalatine fossa or soft tissues), and mandible fractures (3.7%).[3] In addition, postoperative complications (8.3%) can be classified as inflammatories (1.1%), such as swelling, pain, or trismus; infectious, such as alveolar osteitis (0.3% to 26%); neurologic, caused by iatrogenic nerve damage (7.2%), or traumatic, such as mandible fracture.[3]

Risk of complications increases with age, level of tooth impaction, and patient comorbidities. Among the latter, osteoradionecrosis (ORN) of the jaws is one of the most severe oral complications associated with radiotherapy for head and

*Correspondence: Alexandre Perez; Email: Alexandre.Perez@hcuge.ch; Address: Hôpitaux Universitaires de Genève, 1 rue Michel-Servet 1211 Genève, Suisse, Switzerland.

neck cancers. In addition, ORN is often secondary to surgical interventions in the oral cavity, such as simple and surgical tooth extractions.

ORN results from radiation-induced fibroatrophic processes, manifesting as bone tissue necrosis and the inability to heal. ORN is associated with considerable morbidity and negatively impacts patients' quality of life. ORN is hard to treat, so preventive measures such as regular oral follow-ups and good hygiene should be systematically carried out before head and neck irradiation to limit potential treatments in irradiated areas and thus reduce the risk of this complication.

We describe the extraction of an impacted mandibular third molar (tooth #38) and all the other teeth of the lower arch in a patient with a recurrent head & neck carcinoma and a history of several cycles of radiotherapy at the level of the vocal cords and superior part of the mandible, thus presenting an increased risk of ORN. This report describes surgical extraction using a minimally invasive technique on the bone and resulted in complication-free healing.

2. Case presentation

A 63-year-old male patient presented to the Unit of Oral Surgery and Implantology of the Geneva University Hospitals for a dental exam and dental hygiene ahead of radiotherapy for recurrent laryngeal carcinoma. The general medical history of the patient included colorectal adenocarcinoma diagnosed in 2005 and treated with surgical resection and neoadjuvant radio- and chemotherapy; vocal fold carcinoma diagnosed in 2015 and treated with cordectomy with positive resection margins in December 2015, a revision surgery in February 2016 that also yielded positive resection margins and prompted radiotherapy administration (73 Grays) between March and May 2016; chronic alcoholism and active smoking of 1 pack per day (and 100 pack-year). The dental exam revealed poor oral hygiene, plaque, and tartar buildup; hyposalivation associated with the irradiation of the salivary glands; severe periodontal disease; absence of teeth #13, 15, 23, 26, 28 and recurrent caries in teeth #16 and 17; subgingival caries perforating the cervical margins of teeth #33, 32, 31, 41, 42, 43 and carious retained roots of teeth #18, 48, 47, 46, 45, 44, 34, 35, 36, 37; and a periodontal pocket at the distal aspect of the retained root of tooth #37 (see Figure 1). OPG X-ray (see Figure 1) revealed the presence of vertically impacted tooth #38, whose crown overlapped with the carious retained root in position #37, thinning of the mandibular canal in the area around the disappearing apices of tooth #38, and reduced mandibular bone thickness in the area of #38. A complimentary CBCT exam (see Figure 2) revealed that tooth #38 was impacted lingually and that the adjacent lingual cortical plate was thinning. The tooth roots were in direct contact with the mandibular canal, which had lingual course relative to the tooth and a thinned appearance (minimum diameter of 1.3 mm versus 2.2 mm towards the midline).

Figure 1. Clinical view of teeth # 37 and 38 and a panoramic X-ray at first examination

The proposed treatment plan consisted of instruction and oral hygiene care, simple extraction of teeth #17, 16, 33, 32, 31, 41, 42, and 43. It retained roots of teeth #18, 48, 47, 46, 45, 44, 34, 35, 36, 37, surgical extraction of tooth #38, fluoride tray treatment for the upper arch and normal controls. With a single preoperative 2 g dose of prophylactic Augmentin® (amoxicillin and clavulanic acid) and local anesthesia (2 ml Ubistesin®) the teeth #17, 16, 33, 32, 31, 41, 42, 43 and the carious retained roots #18, 48, 47, 46, 45, 44, 34, 35, 36, 37 were extracted. Then, we proceeded with a crestal incision distal to tooth 37, following the horizontal branch along the external oblique line, and raised vestibular and lingual mucoperiosteal flaps. A subperiosteal retractor was inserted lingually to protect the lingual nerve. Minimal osteotomies were performed only at the occlusal level to expose the crown of tooth 38 while preserving intact vestibular bone. The tooth crown was separated in the mesiodistal plane using a Zekria drill, and the lingual portion of the coronal tissue was reduced to fit the size of the occlusal access and then extracted. To remove the root tissue over the occlusal access site and enable extraction of the root fragments, the entire vestibular coronal portion, along with the medial third of the root, was carefully removed with a ball burr (see Figure 3). This allowed the extraction of the roots while applying minimal pressure to the inferior alveolar nerve and the bone. After extraction, the entire alveolar nerve and the vestibular and lingual bone walls were verified, followed by curettage and washing with large quantities of 0.9% NaCl. Primary closure of the wound was achieved with three simple stitches (Supramid® 4-0) in the 38 positions and one running stitch along the alveolar ridge. The patient received the usual postoperative advice and a prescription for Augmentin® (amoxicillin and clavulanic acid) 1 g twice daily for seven days, Dafalgan® (paracetamol) 1 g when needed (up to four times a day), and Curasept® (0.2% chlorhexidine) mouthwash, three times a day. The first control took place three days after the surgery. Mild extraoral swelling and mild trismus were observed. There was no sign of infection, and the sensorimotor system (V/VII) remained unchanged. On postoperative day seven, the sutures were removed. The soft tissue healed within three weeks, and the second radiotherapy was administered. At the one-year postoperative check-up, the clinical and radiological situation was fully stable (see Figure 4).

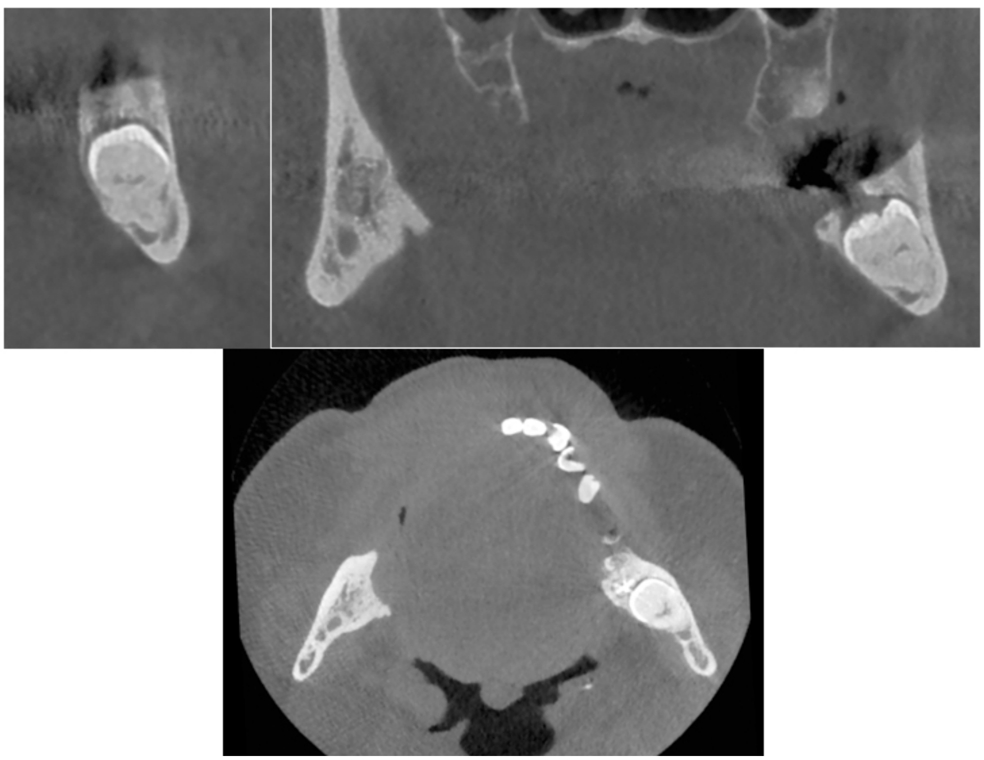

Figure 2. Cone-beam computed tomography (CBCT) frontal and axial views

3. Discussion

Radiotherapy is commonly used in treating head & neck cancers, particularly for oral and oropharyngeal cancers, for which it proved highly effective. However, this treatment can sometimes cause severe complications due to the delayed effects on healthy tissue. The pathological manifestations can have two causes:

(1) Cellular lesions in normal tissues with a lack of cells and fibrotic scarring

(2) Loss of local micro vascularization caused by the development of obliterating endarteritis and its progression to thrombosis and stenosis

At the mucous membrane level causes atrophy and possibly ulceration.[4] At the bone level, particularly in the mandible, the lesions cause a decrease in osteogenic activity underlying frequently observed thinning of the cortical bones and of the trabeculae of cancellous bones. In addition, as osteoclasts are less radiosensitive, they predominate and produce periosteal osteolysis cavities, which cause microfractures.[5, 6]

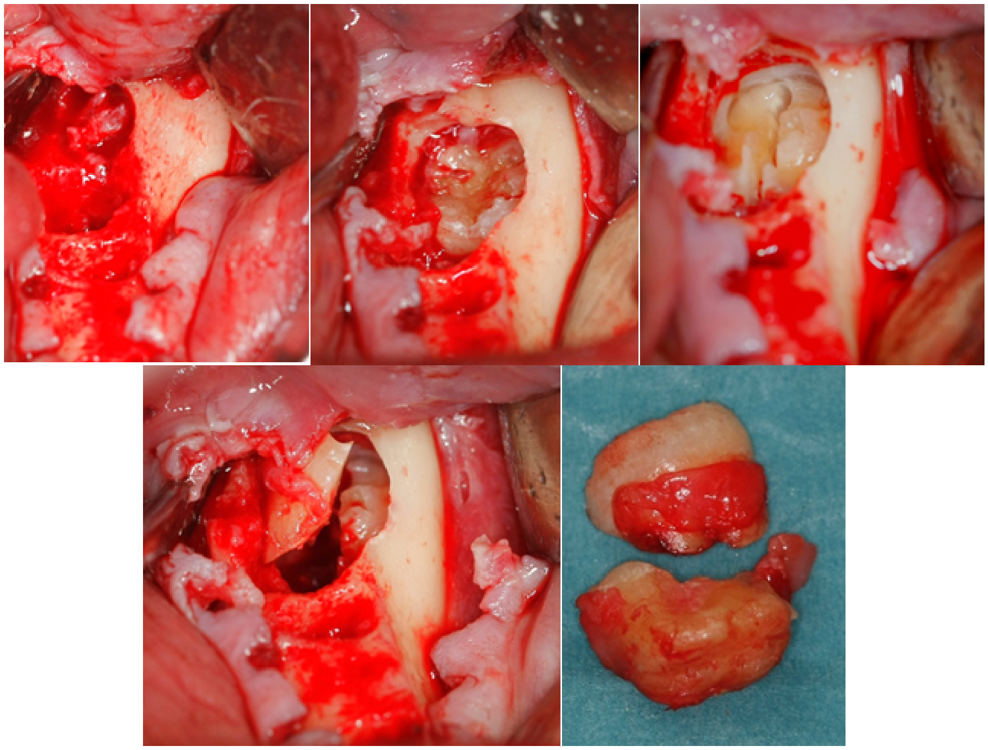

Figure 3. Clinical view showing flaps, osteotomy, separation of crown and root and the avulsed fragments after extraction

Figure 4. Clinical view #37 and 38 teeth area and a panoramix X-ray at 12-month postoperative control showing good healing

At the level of the salivary gland, irradiation induces irreversible changes from 50 Grays upwards, directly inducing apoptosis of the epithelial cells, mainly serous cells of the parotid glands,[7] or via endarteritis and fibrosis. Dose-dependent hyposalivation is frequently observed, and no significant recovery of salivation is expected above 65 Grays. Limited in volume and highly viscous, the saliva loses its function as a mechanical protector. The resulting acidic pH in the mouth promotes the growth of acidogenic and cariogenic bacteria such as mutant streptococci and lactobacilli. This is followed by rapid degeneration of the teeth, which develop quickly evolving caries of the cervical margins, sometimes leading to the destruction of the dental crowns.[8]

ORN is the most severe complication of radiotherapy to the head and neck. According to Marx, three factors induced by irradiation, dubbed «3H» underlie ORN: hypocellularity, hypovascularization, and hypoxia.

The bone tissue necrosis phenomenon only occurs in irradiated areas. It is more common in the mandible, less vascularized than the maxilla, particularly in the posterior mandible, from the premolar region to the retromolar trigone and the ascending ramus.

The risk of developing ORN increases over time, beyond six months after vascular and tissue damage, and persists for life.[9] ORN can develop spontaneously (around 35% of cases) as a result of a metabolic defect of the irradiated bone or, more often (65% of cases), is triggered by trauma such as tooth extraction, where the mucous membrane lining is penetrated, and the irradiated bone exposed.[10]

Several risk factors are related to the irradiation itself: the location and surface of the irradiation field and the total dose (more than 40% necrosis if the dose exceeds 75 Grays). In addition, after surgical intervention, the tolerance of healthy tissues is reduced due to vascular depletion. In such cases, the radiation doses are often reduced.

Concurrent administration of chemotherapy to boost antitumor efficacy can constitute an added cellular assault equivalent to a dose increase.[11] The oral and intestinal mucosae are particularly affected by the toxicity of chemotherapeutics. In addition, the antimitotic activity exerted on hematopoietic cells leads to bone marrow hypoplasia or aplasia. This results in leukopenia (white blood cells < 4,000/mm^3), thrombocytopenia, and anemia (red blood cells < 4,106/mm^3). At the same time, damage to the gastrointestinal and hepatic systems causes coagulation defects. Consequently, acute or chronic bone marrow aplasia and coagulation disorders increase the risk of bleeding in patients undergoing chemotherapy; moreover, the cytotoxic activity, which also affects the stem cells of the immune system, leads to immunosuppression and makes patients particularly susceptible to infections.

The prevention of ORN should therefore be based on strict comprehensive oral and dental healthcare before radiotherapy identifying and eliminating any possible lesions representing potential and active infection foci and on taking into account the dental condition, the radiation fields, and the dose. In addition, other parameters, such as the patient's compliance and psychosocial factors, should also be considered.

Local conservative treatments such as scaling and filling caries should be carried out if necessary. Untreated severed, decayed teeth, teeth with periodontal damage, retained roots, teeth with inadequate endodontic treatment, impacted/semi-impacted teeth, or teeth affected by other lesions such as residual cysts, etc., cannot be reasonably preserved and should be removed. Of note, isolated, deeply buried, asymptomatic third molars should be left in place so as not to delay treatment. A healing delay of 2 to 3 weeks must wait before radiotherapy.[12–14] The patient should be duly informed of the importance of maintaining rigorous oral hygiene. The daily prophylactic application of fluoride gel trays should be started one month after the end of the radiotherapy.[15] During regular check-ups, the patient's compliance with personal preventive measures (oral hygiene, abstinence from tobacco and alcohol) should be checked and encouraged.[16] Proper prevention helps to maintain a satisfactory dental condition in the long term. On the other hand, without adequate care, caries appears as early as two months following radiotherapy. After 3 to 5 years, all teeth can be affected by necrosis due to perforating caries.[17]

If, after radiotherapy, a dental extraction in the irradiated area is necessary, certain precautions must be taken. Systematic broad-spectrum antibiotic treatment may be recommended before the surgery (Augmentin®, 2 g to be started two days before the procedure and continued ten days postoperatively). Hyperbaric oxygen therapy (20 sessions before the process and ten sessions after) was also reported to reduce the risk of ORN fivefold.[18] When using local anesthesia, vasoconstrictors should not be added as they may worsen local hypoxia. Wearing dental prostheses postoperatively should be allowed only after the tissues have fully healed to avoid the risk of compromising the healing process. Finally, dentures must be non-invasive to limit the risk of secondary necrosis.[19]

In the reported case, the patient presented in the context of recurrent laryngeal cancer, which was previously treated with surgery followed by 73 Grays of radiotherapy between March and May 2016, and a concurrent basal cell carcinoma of the right ear. Following this first radiotherapy, the patient did not adhere to the fluoride treatment regimen. As a result, the patient's oral health had largely deteriorated with perforating caries and all the mandibular teeth in the state of retained roots. The new irradiation field was defined to extend over the mandible to the right side of the maxilla. The specific measures implemented were antibiotic prophylaxis, the surgical technique was as minimally invasive as possible, with osteotomy limited to minimum and drilling mainly at the level of the tooth, and healing-facilitating closing of the wound. The patient did not receive a total removable prosthesis for the first few months and had adapted to a liquid diet. This report describes a complication-free recovery after surgical extraction with a minimally invasive osteotomy technique.

Conflicts of Interest Disclosure

The authors declare they have no conflicts of interest.

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