

Complications of head and neck radiotherapy: a dental perspective

Glynn Dale Buchanan¹, Mohamed Yasin Gamieldeen², Sheree Tredoux¹, Andre Uys³, Nicolaas Jacobus Swanepoel²

SUMMARY

For the treatment of head and neck cancers radiotherapy is frequently and successfully performed by medical specialists. However, a number of complications may occur following such therapy. Many of these complications are diagnosed and treated primarily by dental practitioners and specialists. Whilst some are easily managed, others, such as osteoradionecrosis of the jaw, may be very difficult to treat and have a significant impact on a patient's quality of life. The following report documents a case where several complications occurred following radiotherapy. Comprehensive dental assessment and treatment prior to, during and after radiotherapy may lead to a reduction of complications. Greater cooperation and understanding between medical and dental professionals is required during radiotherapy of head and neck cancer patients.

KEY WORDS: complications, head and neck, radiotherapy

INTRODUCTION

Radiotherapy may be applied in the treatment of different head and neck tumours, but it is especially effective in cases of nasopharyngeal carcinoma (1). Although this modality has been applied as curative treatment of many head and neck carcinomas, its effects on local tissues may be severe.

Head and neck irradiation induces changes to many tissues, with clinical consequences such as oral mucositis, xerostomia, caries, trismus, and osteoradionecrosis (ORN). These effects may result in pain and functional changes such as taste alterations, decreased masticatory effort, impaired bolus formation and difficulty in swallowing, leading to a reduction in the patient's quality of life and nutritional status (2, 3).

Nasopharyngeal carcinoma often arises in the lateral wall of the nasopharynx in the pharyngeal recess posterior to the ostium of the pharyngotympanic tube (1, 4, 5). Due to its susceptibility to radiotherapy, standard treatment for nasopharyngeal carcinoma includes irradiation (1, 5, 6).

Although the diagnosis and oncological management of head and neck cancer patients is often performed by members of the medical profession, a number of complications following radiotherapy of the head and neck are managed by dentists and dental specialists. Whilst some complications are easily managed, others, such as ORN of the mandible, may be severe and life-changing (7). Knowledge of potential dental complications and collaborative care provided by medical and dental professionals may reduce the number and severity of these complications.

The following report describes a case of nasopharyngeal carcinoma successfully treated with radiation therapy with specific emphasis on oral and dental complications which developed following the treatment. Ethical approval was granted by the Research Ethics Committee, Faculty of Health Sciences, University of Pretoria (# 69/2019).

CASE PRESENTATION

A 60-year-old female presented to the Oral and Dental Hospital, University of Pretoria, in October 2016 with a complaint of dull pain of the left mandible. The patient was screened and referred to the Department of Maxillofacial and Oral Surgery for extraction of the lower left mandibular first molar, as the tooth was deemed to be unrestorable. On examination

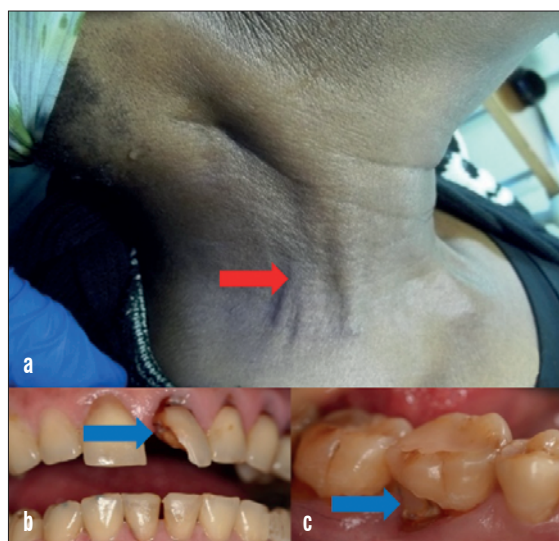


Figure 1. a) Fibrotic changes of the skin overlying the sternocleidomastoid muscle following radiotherapy (red arrow); b) and c) Multiple carious lesions secondary to xerostomia following radiotherapy (blue arrows)

the tooth was found to have a large carious lesion that extended both into the pulp and subgingivally into the root of the tooth. A periapical radiograph confirmed this finding and revealed bone loss in relation to the area surrounding the root of the tooth.

Upon review of the medical history, the patient reported a previous diagnosis of nasopharyngeal carcinoma in 2011. Successful treatment, received in 2013, included a combination of radiotherapy and chemotherapy. Further investigation of the medical records revealed that intensity-modulated radiotherapy, with a total dose of 69 Gy, was administered as the primary treatment. On follow up, positron emission tomography (PET) and computed tomography (CT) performed in May 2016 revealed no evidence of metabolically active local disease or distant metastases. Past dental records revealed that a healthy oral condition was present before the initiation of radiotherapy for the treatment of nasopharyngeal carcinoma. No evidence of dental caries or bone loss prior to the radiotherapy could be found.

Arch Oncol 2019; 25(2):19-21

Published Online

May 17, 2019

<https://doi.org/10.2298/A001903200028>

¹ University of Pretoria, School of Dentistry, Department of Odontology, Pretoria, South Africa

² University of Pretoria, School of Dentistry, Department of Maxillofacial and Oral Surgery, Pretoria, South Africa

³ University of Pretoria, School of Dentistry, Department of Oral Pathology and Oral Biology, Pretoria, South Africa

Correspondence to:

Glynn Dale Buchanan,
Oral and Dental Hospital,
31 Bophelo Road, Prinshof Campus,
Riviera, Pretoria, 0002, South Africa.
glynn.buchanan@up.ac.za

Received 2019-03-20

Received in revised form 2019-04-08

Accepted 2019-04-08



This work is licensed under a Creative Commons Attribution 4.0 license

Extra-oral examination in October 2016 revealed fibrotic changes on the skin of the neck (Figure 1a). Intra-oral examination revealed xerostomia with multiple carious lesions, which had occurred in spite of excellent oral hygiene (Figures 1b and c).

Despite the poor restorative prognosis of the lower left first molar, it was decided that dental extraction should be avoided due to the increased risk of ORN of the mandible in irradiated patients associated with this procedure. The patient was referred to the Department of Odontology, Oral and Dental Hospital, University of Pretoria, in October 2016 for endodontic and restorative treatment. Conservative dental treatment was rendered shortly after initial evaluation.

In May 2017, the patient developed acute pain in the left mandible. Radiographically, extensive bone loss was seen in relation to the lower left second and third molar. Pulp necrosis of the lower left second molar was diagnosed. Clinically, the lingual bone plate of the mandible adjacent to these teeth had become exposed and appeared necrotic. Spontaneous ORN was suspected to have developed, despite the avoidance of surgical intervention in the mandible. Referral for specialist evaluation at the Department of Maxillofacial and Oral Surgery was made.

The diagnosis of ORN of the mandible was confirmed based on the clinical and radiological features (Figure 2). At the time of evaluation, the patient was diagnosed with ORN limited to the lingual dento-alveolar bone with no active infection or purulent exudate. Surgical removal of the necrotic bone was considered to carry significant risk. It was therefore decided that conservative dental treatment should continue despite the presence of exposed bone. Given good oral hygiene and patient compliance, a watch-and-wait approach was adopted.

Conservative treatment and follow-up examinations continued over the following year, during which time disease progression did not occur. After this time however, slow progression of the disease process became clinically evident.

A pharmacological regimen of Pentoxifylline, 400 mg twice daily and Tocopherol 1000 UI daily per os was initiated. This was based on the fibro-atrophic theory of ORN described by Delanian et al. (8) The pharmacological management was aimed at improving tissue hypoxia and hypovascularization by inducing neovascularization in the region (8–11). Unfortunately, due to financial constraints, the pharmacological regime was abandoned by the patient.

Further disease progression was noted radiographically with demineralisation involving the dento-alveolar bone up to the level of the inferior alveolar canal. The patient continued to experience chronic pain in the lower left jaw, which adversely affected quality of life.

Surgery to remove the necrotic bone and molar teeth in the left mandible was performed in August 2018. Hyperbaric oxygen therapy was provided pre- and post-operatively based on the Wilfred-Hall protocol described by Marx et al. (9). Sequestrectomy of devitalized, necrotic bone up to vital bleeding bone was performed, together with removal of the affected molars. Figure 3 demonstrates the surgical defect one month following surgery (defect packed with Bismuth Iodine Paraffin Paste impregnated gauze). Due to the volume of bone removed, an increased risk of future pathological fracture of the mandible exists. Further surgical intervention may be required, including possible hemi-mandibulectomy. Although regular follow-up continues, the long-term prognosis is poor.

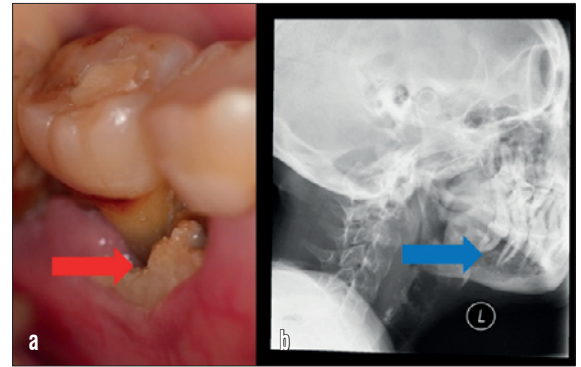


Figure 2. Clinical appearance of osteoradionecrosis of the mandible. Note the bone and soft tissue necrosis with exposure of root surfaces of the lower left second molar (a - red arrow). Radiographically the bone appeared lytic with areas of sclerosis and sequestra (b - blue arrow)

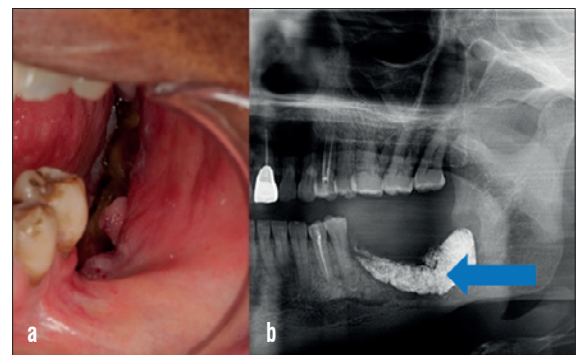


Figure 3. The clinical and radiographic appearance of the defect one month following surgery in August 2018. Defect packed with bismuth iodine paraffin paste impregnated gauze (blue arrow)

DISCUSSION

This case demonstrates many of the post-irradiation sequelae seen following radiotherapy to the head and neck (2, 3). These are frequently divided into acute effects; such as mucositis of the oral cavity, salivary gland alteration (resulting in xerostomia) and infection of the oral mucosa, as well as long-term effects which generally involve soft and hard tissue changes due to a decrease in cellularity and vascularity of the irradiated tissues (12).

ORN of the mandible is one of the most serious manifestations which can occur following head and neck radiotherapy. It is described as a progressive devitalisation of bone following irradiation and this process is irreversible. Soft tissue necrosis accompanies the devitalised bone (12). Several case reports have previously described the development of ORN following radiotherapy for the treatment of the head and neck cancer (13–16).

In cases of persistent pain, pathological fracture, oro-cutaneous fistulae or trismus resulting from ORN of the mandible, a hemimandibulectomy may be indicated (7). Reconstruction of such defects is normally accomplished with vascularised flaps with or without osseointegrated implants (15). The effects of such procedures on a patient's quality of life may be far-reaching and should not be underestimated. Autologous platelet-rich plasma (PRP) has previously been used in the repair of necrotic mandibular defects caused by ORN (14). Man et al. reported a case of ORN following radiotherapy to the mandible which required hemi-mandibulectomy

and reconstruction using stereolithographic 3-dimensional printing modelling technology. The patient presented with severe asymmetry and facial collapse following the surgery to treat the ORN (13). Although the present case has not yet required such advanced interventions, the long-term prognosis of the case is uncertain and such procedures may still be required in future.

Strategies to mitigate the effects of acute and long-term post radiotherapy sequelae include the following:

It is vital that a comprehensive oral assessment of all patients requiring head and neck radiotherapy is made by an experienced dental practitioner prior to irradiation. Any teeth with a questionable long-term prognosis should be considered for extraction prior to radiotherapy (12). During radiotherapy, good oral hygiene must be maintained, including the daily application of topical fluoride and frequent saline rinses. Following radiotherapy, jaw opening exercises may help to reduce trismus following fibrotic changes to the muscles and skin. After the completion of radiotherapy, frequent dental follow-up is mandatory to maintain the oral condition and to assess for any recurrence of the primary malignancy or the development of other serious sequelae such as ORN (7).

The complications demonstrated in this case highlight the need for closer collaboration between the medical and dental fields – especially in the care of patients presenting with cancer of the head and neck. Both medical and dental teams are involved in the care of patients suffering from head and neck cancer (7), however, for optimal outcomes neither should proceed in isolation.

It is essential that provision be made for comprehensive dental assessment of head and neck cancer patients prior to medical treatment with radiotherapy in this region.

Greater cooperation and understanding between medical and dental professionals regarding the management of head and neck cancer patients undergoing irradiation will lead to a reduction of, earlier detection and better management of post-irradiation complications.

Declaration of Interests

Authors declare no conflicts of interest

REFERENCES

- Chua MLK, Wee JTS, Hui EP, Chan ATC. Nasopharyngeal Carcinoma. *Lancet*. 2016;387:1012–24. <https://www.sciencedirect.com/science/article/pii/S0140673615000550>.
- Vissink A, Jansma J, Spijkervet FKL, Burlage FR, Coppes RP. Oral sequelae of head and neck radiotherapy. *Crit Rev Oral Biol Med*. 2003;14(3):199–212. <https://journals.sagepub.com/doi/pdf/10.1177/154411130301400305>
- Sciubba JJ, Goldenberg D. Oral complications of radiotherapy. *Lancet Oncol*. 2006;7(2):175–83. Doi: 10.1016/S1470-2045(06)70580-0.
- Sham JST, Wei WI, Yong-Sheng Z, Choy D, Yan-Qin G, Yan L, et al. Detection of subclinical nasopharyngeal carcinoma by fiberoptic endoscopy and multiple biopsy. *Lancet*. 1990;335:371–4. [https://doi.org/10.1016/0140-6736\(90\)90206-K](https://doi.org/10.1016/0140-6736(90)90206-K).
- Wei WI, Sham JST. Nasopharyngeal carcinoma. *Lancet*. 2005;365(9476):2041–54. Doi: 10.1016/S0140-6736(05)66698-6.
- Chou J, Lin Y, Kim J, You L, Xu Z, He B, et al. Nasopharyngeal carcinoma - Review of the molecular mechanisms of tumorigenesis. *Head Neck*. 2008;30:946–63. <https://onlinelibrary.wiley.com/doi/pdf/10.1002/hed.20833>.
- Koka VN, Deo R, Lusini A, Roland J, Schwaab G. Osteoradionecrosis of the mandible: Study of 104 cases treated by hemimandibulectomy. *J Laryngol Otol*. 1990;104(4):305–7. Doi: 10.1017/S0022215100112551.
- Delanian S, Lefaix JL. Complete healing of severe osteoradionecrosis with treatment combining pentoxifylline, tocopherol and clodronate. *Br J Radiol*. 2002;75(893):467–9. Doi: 10.1259/bjr.75.893.750467.
- Nadella KR, Kodali RM, Guttikonda LK, Jonnalagadda A. Osteoradionecrosis of the Jaws: Clinico-Therapeutic Management: A Literature Review and Update. *J Maxillofac Oral Surg*. 2015;14(4):891–901. Doi: 10.1007/s12663-015-0762-9.
- Martos-Fernández M, Saez-Barba M, López-López J, Estrugo-Devesa A, Balibrea-del-Castillo JM, Bescós-Atín C. Pentoxifylline, tocopherol, and clodronate for the treatment of mandibular osteoradionecrosis: a systematic review. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2018;125(5):431–9. Doi: 10.1016/j.oooo.2018.02.004.
- Lyons AJ, Brennan PA. Pentoxifylline – a review of its use in osteoradionecrosis. *Br J Oral Maxillofac Surg*. 2017;55(3):230–4. Doi: 10.1016/j.bjoms.2016.12.006.
- Hancock PJ, Epstein JB, Sadler GR. Oral and dental management related to radiation therapy for head and neck cancer. *J Can Dent Assoc*. 2003;69(9):585–90. <http://www.cda-adc.ca/JCDA/vol-69/issue-9/585.pdf>.
- Man QW, Jia J, Liu K, Chen G, Liu B. Secondary reconstruction for mandibular osteoradionecrosis defect with fibula osteomyocutaneous flap flowthrough from radial forearm flap using stereolithographic 3-dimensional printing modeling technology. *J Craniofac Surg*. 2015;26(2):e190–3. Doi: 10.1097/SCS.0000000000001456.
- Scala M, Gipponi M, Mereu P, Strada P, Corvo R, Muraglia A, et al. Regeneration of mandibular osteoradionecrosis defect with platelet rich plasma gel. *In Vivo*. 2010;24(6):889–93. <http://iv.iiarjournals.org/content/24/6/889.full.pdf>
- Khatami AH, Toljanic JA, Kleinman A. Mandibular Reconstruction With Vascularized Fibula Flap and Osseointegrated Implants: A Clinical Report. *J Oral Implantol*. 2010;36(5):385–90. Doi: 10.1563/aaid-joi-d-09-00066.
- Raghoobar GM, Jansma J, Vissink A, Roodenburg JLN. Distraction osteogenesis in the irradiated mandible. A case report. *J Craniomaxillofac Surg*. 2005;33(4):246–50. Doi: 10.1016/j.jcms.2005.02.007.