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Dental assessment pre radiotherapy for head and neck cancer

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Statement of the problem

Head and neck cancer (HNC) and its treatment can dramatically change a patient's appearance, speech, and oral function. Radiotherapy (RT) as a primary or adjuvant management strategy can result in osteoradionecrosis (ORN), salivary gland hypofunction, and can contribute to dental caries, among other sequelae. Assessment by a dentist prior to RT is important to remove suspect teeth in the field of radiation and commence preventive and restorative care for the long term. This can reduce subsequent ORN risk, reduce oral complaints during RT, and optimise oral health-related quality of life (OHRQoL).

Purpose of the study

This is a large-scale cohort study investigating dental treatment provided to a group undergoing RT for primary tumours of the head and neck.

Materials and methods

A retrospective chart review was carried out of all patients who had presented at the pre-RT dental clinic at Dublin Dental University Hospital from 2018 to 2019.

Results

A total of 490 patients were included. The mean age at presentation was 63 years (SD = 11). Approximately 50% of patients required removal of at least one unit and 12.7% of patients required basic dental restorations prior to commencement of RT. Most patients (93%) were assessed and treated within the requested timeframe.

Conclusions

Pre-RT assessment of HNC patients is important, as many require dental treatments such as extractions or basic restorations. Early planning for dental review should be considered to allow adequate time for assessment and proper treatment of long-standing dental issues.

INTRODUCTION

Head and neck cancers (HNCs) encompass a broad variety of cancers of the oral cavity, salivary glands, oropharynx, hypopharynx, nasopharynx, nasal cavities, and other tissues such as ear and scalp, which are mainly squamous cell carcinomas (SCCs). On average, 707 HNCs were reported in Ireland in each year between 2015 and 2017, with 465 patients (66%) requiring radiotherapy (RT).[1,2] This is projected to increase to an overall 1,161 cases (+66%) in 2045 (at a rate of 1.9% and 1.6% per year for males and females, respectively).[3] Median age at diagnosis has decreased in females from 67 years from 1994-2004 to 63 years from 2004-2013, and from 64 to 63 years in males.[3] This decline in age was seen in all cancers of the head and neck, including hypopharynx, nasopharynx, and oropharynx malignancy, but excluding oral cavity cancer, which shows no such decline.[3]

The main risk factors for HNCs are modifiable lifestyle factors such as tobacco and alcohol consumption, which have a combined multiplicative effect.[4] A diet containing high levels of vegetables and fruits may be protective against carcinogenesis, while a low BMI appears to increase the risk of upper aerodigestive tract malignancy.[4] Human papillomavirus (HPV) is now recognised as another independent risk factor for oropharyngeal SCC, which can manifest in a subpopulation without traditional smoking and drinking risk factors.[5] Up to 70% of oropharyngeal SCC is now HPV-associated disease, and this anatomical location, which may be recorded as one of a number of sites (tonsil, pharynx, base of tongue) makes up one-third to one-half of HNCs in Ireland.[3,5]

The management of HNCs may involve surgery, RT, chemotherapy, or a combination of treatments. Most sites in the oral cavity and oropharynx are best managed with primary surgery. RT as a primary or adjuvant treatment is

particularly effective for ablating residual cancer cells, to reduce recurrence rates or as a sole management for certain tumours.[4] Perceptible side effects depend on the site irradiated, dose administered, fractionating rate, age, and the condition of the tissues.[6,7] Ionising radiation disproportionately affects rapidly dividing cells (such as malignant cells and basal keratinocytes) and narrow blood vessels.[8–10] Small blood vessels are more susceptible to undergoing obliterative endarteritis, which is followed by vessel thrombosis, and mucosal and periosteal fibrosis, further resulting in vascular congestion and reduced permeability of vessel walls.[10] This describes the pathogenesis of osteoradionecrosis (ORN).

Salivary gland tissues are also vulnerable to radiation and exhibit breakdown and progressive fibrosis.[8] Acute reactions like mucositis and pain are typically reversible; however, late-stage symptoms such as xerostomia, trismus, and a predisposition to ORN are usually irreversible. Radiation-related side effects are inevitable and can significantly affect a patient's quality of life (QoL).[7] For tumours of the oropharynx where the morbidity of surgery is significant and the cure rate of RT is high, RT and/or chemotherapy is indicated.

A holistic approach comprising a central multidisciplinary team (MDT) of HNC surgeons, oncologists, radiation oncologists, HCN nurses, dieticians, speech and language therapists, and dentists optimises QoL.[7] Pre-radiation assessment by a specialist in restorative dentistry is also essential to implement preventive regimes for long-term oral hygiene maintenance and for reducing dental disease risk post treatment.[11] What is also important is supportive management of complaints such as xerostomia, mucositis, loss of taste or smell, and skin complications from the radiation beam. These complaints significantly affect a patient's oral intake and QoL.[4,12] During RT, many patients require oral nutritional support, while others require supplemental feeding with nasogastric tubes (NGT) or feeding gastrostomies.[4] It is therefore essential for HNC patients to reach 'dental fitness' to maintain masticatory function during RT.[12]

With this in mind, the aim of this study was to investigate the pre-RT dental treatment needs of HNC patients attending the Oral Surgery Department at Dublin University Dental Hospital and to assess whether any further dental treatment was needed after RT completion.

MATERIALS AND METHODS

All HNC patients attending Dublin Dental University Hospital as new patients for pre-radiation assessment between January 1, 2018, and December 31, 2019, were included in this study. Patients who were receiving palliative treatment or treatment for recurrences were excluded. This decision was made on the basis that the dental treatment plan may change if the lifespan is perceived to be truncated or where many doubtful teeth have already been removed. No exclusions were made based on premorbid conditions, age, or other factors.

Gender	Male	376
	Female	114
Age group	0-45	42
	46-59	168
	60-69	175
	70+	105
Smoking status	Current smoker	222
	Ex-smoker	65
	Non-smoker	203

Table 1. Demographics of patients referred for pre-radiotherapy assessment.

A retrospective chart review was undertaken by the principal investigator, and a proforma including the patient's age, gender, smoking status, and treatment received was used for data extraction.

Ethical approval was waived by the ethics committee of the Dublin Dental University Hospital.

RESULTS

Table 1 shows that 490 patients seen during 2018 and 2019 were included in this study. A total of 45% of the patients were current smokers and 13% were ex-smokers, including those who had recently quit after their diagnosis.

Almost 50% of patients (236) had at least one tooth removed. Following treatment, 231 patients had fewer than 21 teeth remaining. The average number of teeth removed (3.36) was similar based on all age groups once those who had no teeth removed were excluded. Twenty out of 490 patients were edentulous. A total of 104 patients had teeth removed due to caries, 123 patients had teeth removed due to periodontal disease, and 30 patients had tooth extractions due to periapical pathology (Figure 1). Sixty-two patients had fillings provided for dental caries. Due to time constraints, periodontal treatment was not instituted generally. However, 72% of patients had tooth debridement and almost all were prescribed high-strength fluoride toothpaste or tooth mousse with diet advice. Most patients (93%) were seen within the timeframe requested by the referring radiation oncologist. One-tenth of the study cohort (42 patients) were referred with their RT held until a dental assessment had taken place, a similar number (44) were referred for RT as soon as possible, and 15 patients had either started or were starting RT within a week. Thirteen patients had extractions less than two weeks prior to RT. The most common reason was insufficient time before the start of RT to plan and schedule treatment (Figure 2).

FOLLOW-UP

Some 284 patients returned for follow-up appointments during data collection, finishing in July 2020. Many patients may have sought care from their own dentist, while others may have died or failed to return.

Nineteen returnees required further restorative treatment with fillings, while 41 had dentures made. Three pa-

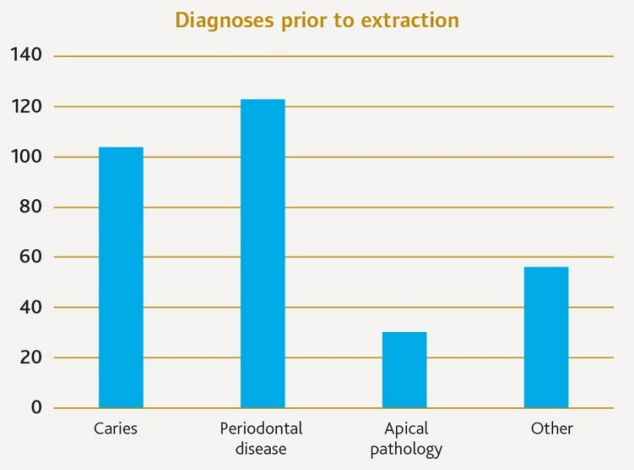

Figure 1. Diagnoses leading to dental extraction.

Figure 2. Reasons for extractions close to radiotherapy.

tients needed endodontic treatment, while three more received dental implant surgery.

Three patients developed ORN, which was diagnosed in our hospital during the study period. All three patients had oropharyngeal tumours that were treated with RT (no chemotherapy) and developed ORN at the site of a removed mandibular molar. Notably, all patients in this cohort had extractions just before or after RT. One patient had their teeth removed two weeks prior to RT, one had a tooth removed one week prior to commencement of RT, and another had their extractions one week after RT.

DISCUSSION

RADIOTHERAPY AS A TREATMENT MODALITY

Compared to a similar study conducted from 1994 to 2007, this study showed a younger average age, illustrating the change in the age profile of HNC patients. The mean age in this study (mean = 63, SD = 13) is consistent with worldwide trends.[13] HPV-associated oropharyngeal cancer has become widespread worldwide and has a different pathogenesis to the traditional smoking- and drinking-related HNC, affecting people who are likely to be younger, healthier, white, and of higher socio-economic status.[4,5,14] Although HPV-related tumours have better prognosis due to being more radio- and chemo-sensitive, the combined effects of RT and chemotherapy can cause considerable morbidity, such as trismus, reduced salivary flow, and ORN risk.[15] Delays or interruptions to RT decrease local tumour control and lower outlook.[4] Thus, dental assessment and treatment should be completed prior to RT, and as early as possible, to allow time for any dental treatment and prevent any interruptions or delay in RT for oral complaints.

More than 100 patients were referred with fewer than two weeks to go before RT, with RT beginning immediately after dental review, or with the RT's start date having passed. Although it is necessary that many patients are expedited to RT, early planning would reduce delays in starting RT due to dental assessment. A tight requested timeframe can result in undertreatment, although any instance of this was not possible to conclude from our data. An integrated treatment plan with early involvement of dentists would give more time for planning and executing treatment.

While there are currently no universally accepted guidelines for dental assessment prior to RT, extractions of any teeth with dubious prognosis in the field of radiation are indicated prior to commencing RT.[16] Teeth should be removed at least ten days prior to RT and, if possible, three weeks beforehand to reduce the risk of ORN.[17] A total of 13 patients had teeth removed two weeks or less before RT. The most common reason for this was a short time period (less than three weeks) between the date of referral and the start of RT. In our study, all three patients who developed ORN following extractions had teeth removed either less than two weeks pre RT or after the completion of treatment. The MDT meeting is an ideal time to plan removal of suspect teeth at the time of tumour ablation, or if carried out, at the time of tumour exploration under anaesthesia (EUA). EUA is sometimes deemed necessary to determine the size of a tumour in an inaccessible location (e.g., base of tongue) in order to plan ablative surgery, although this is seldom carried out today due to advances in medical imaging techniques.

There are numerous difficulties when carrying out dental treatment after cancer surgery, including: poor access with limited opening; reduced access due to flap reconstructions; and, possible non-union if the mandibulotomy sites are stressed during the extraction. Three patients were referred to the clinic for assessment after finishing RT or mid-treatment. Using plain local anaesthetics in irradiated tissue allows revascularisation, while prescribing concomitant antibiotics is an established protocol for reducing the risk of ORN.[16] The risk of ORN when removing teeth in irradiated bone does not decline over time.[16] We found that preventive interventions may be successful, with only three patients requiring further extractions in the hospital after their initial course of treatment and preventive regime.

TREATMENTS PROVIDED

Approximately half of the HNC patients required removal of at least one unrestorable tooth. The average number of teeth removed was 3.36 (range 0-18). The most commonly

removed teeth were molars. The most common reason for dental extractions was periodontal disease. This implies that many patients would benefit from periodontal treatment.

Longer-term health interventions are also needed for these patients. Oral health-related quality of life (OHRQoL) indicators, including ease of speech and mastication as well as dental and oral pain, have been shown to deteriorate during RT, while HNC patients are disproportionately more likely to display cognitive impairment, anxiety, depression, alcohol-related disease, and a higher suicide rate.[11,15] Prosthetic rehabilitation formed an important part of the work post RT, with dentures being the most commonly prescribed treatment. A majority (53%) of patients had fewer than 21 teeth after treatment, which is generally accepted as the minimum number for a functional dentition.[12] One of the most prescribed treatments following an initial course of treatment was dental implants. Implant treatment has the potential to rehabilitate patients to a functional dentition, restoring speech, swallowing, and facial aesthetics following extensive surgery to the head and neck. However, implant treatment in irradiated bone has a higher risk of failure, as poorer vascular supply can contribute to failure of osseointegration, wound breakdown, or ORN. An integrated treatment plan with placement of implants at the time of surgery would seem advantageous. However, these may have a higher failure rate due to poor positioning.[13]

Following the completion of dental treatment, patients may be discharged to a dentist in the community. However, they should be followed up more often due to increased risk of periodontal disease, caries, and ORN.[16] Many patients request hospital management due to ongoing dental problems and a lack of suitable primary care facilities.

CONCLUSIONS

Many HNC patients will require dental extractions prior to RT. A plan for a dental review should be put in place at head and neck MDT meetings when the decision on surgery and/or RT Is being made. This may improve the scope for preventive and periodontal treatment in order to maintain a functional dentition, thereby improving QoL and reducing the risk of ORN.

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