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The Role of the General Dental Practitioner in Managing the Oral Care of Head and Neck Oncology Patients

Abstract: The general dental practitioner (GDP) plays a critical role in managing head and neck cancer patients. The first and most important role is to offer preventive services, particularly to smokers and to patients who drink alcohol to excess. It is of critical importance that every patient has a systematic examination of oral soft tissues when seen by a GDP. All patients with suspicious lesions should be referred for urgent attention to a specialist centre. Once oral cancer has been diagnosed, GDPs may be presented with patients requiring urgent dentistry, including extractions before commencement of treatment, requiring palliation of symptoms during treatment, or requiring general dentistry after treatment. Radiotherapy provides increased survival but has serious adverse consequences, which may be lifelong, including dry mouth, radiation caries, limitation of mouth opening and high risk of osteonecrosis after extractions. Extraction of teeth in irradiated bone should be referred to specialist centres. Improving survival rates and an ageing population mean that GDPs will see many more survivors of head and neck cancer in the future, with an increased burden of dental care in the longer term and an increased need for monitoring and secondary prevention.

Clinical Relevance: The management of patients with head and neck cancer is complex and involves a multi-disciplinary team, both in the primary treatment but also in the long-term care. This paper reviews the consequences of treatment for head and neck cancer and gives practical advice for GDPs and their team in the long-term care of these patients.

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Management of orofacial carcinomas, including prevention, detection and oral care before, during and after treatment of the cancer, should involve the dental team. This paper gives practical advice throughout the care pathway.

Primary prevention

An important role of the primary dental care team is the prevention of oral diseases. In this regard, the two most important environmental risk factors in head and neck cancers are tobacco and alcohol.[1] In addition, a well-managed smoking cessation programme can be successful when delivered by the dental team.[2] The Department of Health has produced guidelines to assist the dental team in aiding their patients to stop smoking (*Smokefree and Smiling, Helping Dental Patients to Quit Tobacco*, Department of Health publication, 2007) and some of these techniques can be modified to encourage patients to moderate their alcohol intake.

The role of nutritional factors in preventing oral cancers is controversial. Nevertheless, NICE guidance encourages the promotion of a healthy diet.[3]

Early detection

There is a large discrepancy in the survival rates between patients presenting with early and late stage disease. Early diagnosis of oral cancers markedly improves the overall prognosis[3] – treatment of early stage oral carcinoma has a two-year survival rate of 90% compared to less than 50% with late presentation and metastases. This discrepancy widens when the five-year

survival rates are taken into account.[4] The GDP plays an essential role in identifying and referring early lesions to improve outcome for the patient.[5]

Department of Health guidelines (2000) advise urgent referral to a tertiary cancer centre if certain signs or symptoms are observed (Table 1). Patients should be seen within two weeks of referral. Examination of individual patients should be differentiated from screening programmes. There are currently no national screening programmes for oral cancers. A Cochrane review demonstrated that there is little evidence to support the use of population-based screening.[6]

Oral care: pre-oncology treatment

A pre-oncology dental assessment prior to head and neck cancer treatment is recommended.[7] The detrimental effects of radiotherapy and ablative surgery to the dentition and oral health necessitate extraction of at-risk teeth. This includes carious and heavily restored teeth, teeth with deep periodontal pockets and inaccessible posterior teeth. NICE recommends that the pre-treatment dental assessment should be performed by specialist dentists.[3] The services of the patient's primary dental practitioner may be called upon to maximize pre-treatment oral health. This may include oral hygiene instruction, calculus removal and simple restorations. It can be challenging to perform these tasks in the short time period between the patient's diagnosis and treatment. Extractions should be at least ten days before the commencement of radiotherapy[7] and may be arranged at the time of surgery.

Symptom/Sign
Hoarseness persisting for more than 6 weeks
Ulceration of oral mucosa persisting for more than 3 weeks
Oral swellings persisting for more than 3 weeks
All red or red and white patches of the oral mucosa
Dysphagia persisting for more than 3 weeks
Unilateral nasal obstruction, particularly when associated with a purulent discharge
Unexpected tooth mobility not associated with periodontal disease
Unresolving neck masses for more than 3 weeks
Cranial neuropathies
Orbital masses

Table 1. Guidelines for urgent referral to a tertiary cancer centre, based on *Referral Guidelines for Suspected Cancer*, Department of Health, 2000.

Effect	Cause
Surgical defect	Surgery
Mucositis	Radiotherapy/Chemotherapy
Xerostomia	Radiotherapy
Radiation caries	Radiotherapy
Taste disturbance	Radiotherapy
Trismus and reduced access	Surgery/Radiotherapy
Osteoradionecrosis	Radiotherapy

Table 2. Oral sequelae of head and neck cancer treatment.

Oral care during oncology treatment

Radiotherapy, chemotherapy and ablative surgery are all associated with side-effects to the patient's oral health (Table 2). Early effects include xerostomia and mucositis with trismus, radiation caries and osteoradionecrosis (ORN) developing later. The side-effects of radiotherapy depend on dose, delivery (number of fractions), site and mode of radiotherapy. The classical toxic effects of external beam radiotherapy (EBRT) have been shown to be reduced with the use of newer intensity modulated radiotherapy (IMRT) with subsequent improvements in the oral health-related quality of life.[8]

Oral mucositis

Mucositis is painful ulceration of the mucosa which appears red, often with yellow sloughing, caused by cell death and injury to connective tissue and bacterial colonization.[9] Its onset is 12–15 days after starting radiotherapy and can last for weeks or months after completion of radiotherapy.[9] There is a risk of sepsis which, if severe, may force a break in radiotherapy treatment or require hospitalization. Oral mucositis is reduced by keeping radiation fields to the minimum necessary,[10] the only effective management for mucositis being benzydamine oral rinse (Difflam™, 3M Health Care).[11] The standard protocol is 15 millilitres 4–8 times per day during radiotherapy and up to 3 weeks after its completion.[12] Other treatment modalities have been advocated, including ice chips, antibiotics, haematopoietic growth factors, hydrolytic enzymes and amifostine.[3] Amifostine is a cytoprotectant and there is some evidence for its value in prophylaxis of mucositis in those treated with concomitant chemo-radiotherapy.[3] The role of antimicrobials in the treatment of mucositis has not been established.[10] Patients often find it is more comfortable to leave removable prostheses out of the mouth. Sharp teeth and restorations may require adjustment.

Mucositis affects dental health since it makes oral hygiene procedures very painful. Standard toothpastes and mouthwashes are often too astringent, so patients discontinue oral care. A very soft brush may be necessary, supplemented with alcohol-free chlorhexidine mouthwash, which may be diluted if too painful to the mucosa.[13]

A fluoride regime should be used as long as the patient is able to tolerate it, if

necessary re-instating it once the oral cavity is less painful (Table 3). Options include either high fluoride toothpaste (Duraphat 5000™, Colgate), fluoride gel (Fluoriguard Gel™ [stannous fluoride 0.4% w/w], Colgate – just recently discontinued in the UK) in splints for 10 minutes per day or alcohol-free fluoride mouthrinse[7] (Table 3). However, splint therapy may not be tolerated by the patient suffering acute mucosal symptoms.

Oral care post-oncology management

Long-term dental care is essential for patients who have undergone treatment for head and neck cancer to maintain the remaining teeth pain-free and possibly to replace missing teeth. There are several side-effects of head and neck cancer therapy which complicate the oral/dental care of these patients.

Xerostomia

Radiation-induced salivary dysfunction is common after treatment of head and neck cancer. Doses above 20 Grays (Gy) are associated with the loss of up to 90% of salivary acinar cells.[14] Xerostomia is a debilitating condition for the patient and is also a major risk factor for the development of caries. It should be prevented as far as possible by minimizing the radiation dose to the salivary glands, either with three-dimensional conformal radiotherapy (3D CRT) or intensity modulated radiotherapy (IMRT).[15] There has been some interest in the use of amifostine to protect against radiation-induced xerostomia.[16] However, there are doubts on its efficacy, associated adverse effects, and a requirement for daily injections has limited its use.[17] Both NICE[3] and SIGN[12] guidelines advise against its use currently as there is a lack of long-term follow-up data.

If some salivary gland tissue is unaffected, there is potential for the use of saliva-stimulating agents. Tactile and gustatory stimuli can be in the form of sugar-free chewing gum.[18] Pharmacologic sialogogues, including pilocarpine, have been investigated. Disadvantages include the fact that the therapeutic effect takes several weeks to develop and improvement ceases on drug withdrawal,[19] and there are several potential adverse effects, including excessive perspiration, bladder and bowel motility, and flushing. There has been some research in the prophylactic use of pilocarpine during radiotherapy to stimulate existing functioning salivary tissue.[20] NICE[3] and SIGN[12] guidelines suggest the use of pilocarpine, if adequate unaffected salivary gland tissue remains, and no medical contra-indications to its use (for example, uncontrolled asthma or COPD) exist.

For many patients, the only option is saliva replacement. The simplest method is by taking frequent sips of water, and often patients that have had radiotherapy will carry a bottle of water with them. The use of saliva substitutes is dependent on the patients' preferences. As the complex actions of saliva are difficult to replicate, the aims of artificial saliva include oral lubrication, reducing the subjective feeling of dry mouth and the prevention of caries.[21] There are several categories of saliva substitutes, including those based on carboxymethylcellulose, mucins, linseed oil, glycerol, polyethyleneoxide and xanthan gum. There is little clinical data to indicate which salivary substitute is the most effective.[22]

Taste

Taste loss or taste distortion commences during the first two weeks of radiotherapy once a threshold dose of 20 Gy has been reached and reaches its worst by the third or fourth week.[23] It improves over six months and possibly longer but it may be persistent and never fully recover.[24] Generally, patients report that bitter and salt flavours are lost first, sweet taste reduced least and loss of umami (which recognizes amino acids and gives pleasure to foods) has the greatest effect on quality of life.[25] The causes of taste changes may be the tumour itself, oral sepsis, medication, nerve damage from surgery or tumour invasion. Taste receptors have a 10-day life cycle and there may be direct damage to taste buds by the radiotherapy. The taste loss is related to the proportion of the tongue irradiated.[26] The degree of xerostomia is not related to taste alteration and is not the most likely factor in taste disturbance.[27] Taste alteration affects the choice of, and desire for, food impacting on general health as maintaining weight and nutritional input is paramount.

Radiation-induced caries

Radiation-induced caries (Figure 1) describes the rapidly developing and aggressive lesions which can appear after radiotherapy. Its distribution tends to be different from those carious lesions in the non-irradiated population, appearing on incisal edges, cusp tips and smooth surfaces.[28] It is often circumferential along the cemento-enamel junction and gingival margins, which can lead to teeth decoronating. All teeth are at risk, not just those in the radiation field. It is believed to be primarily an indirect effect of radiotherapy, related to reduced saliva flow and its reduced buffering capacity, and coupled with dietary changes, often with frequent high sugar supplements, difficulty with oral hygiene and changes in the oral microflora.[29]

A direct histological effect of radiotherapy on tooth structure has been suggested. Studies on enamel are contradictory, some having shown change in the crystalline structure and suggesting this may promote decalcification, but the changes are minor and unlikely to have a clinical effect. In dentine, alterations in the organic component can reduce its structural hardness and may affect the enamel-dentine junction so it cannot support enamel. Studies on dental pulp have demonstrated decreased vascularity and increased fibrosis, but pulpal pain is less severe.[29]

There is evidence of an alteration in the oral flora of patients that have undergone radiotherapy. Reported changes include increases in *Streptococcus mutans* and Lactobacillus, which are acidogenic and cariogenic, and an increase in Candida. It is common to observe a decrease in *Streptococcus sanguis*, Neisseria and Fusobacterium, which are non-cariogenic. These changes occur within one to two weeks of starting radiotherapy then remain after treatment is complete, despite intensive oral hygiene.[30] These reported changes in microflora of the oral cavity following radiotherapy are based on research done over 30 years ago. Recent studies have shown

Figure 1. Photograph of a patient with radiation caries.

head and neck radiotherapy is associated with significantly increased risk of fungal infections.[31] Quality up-to-date research is required to help the understanding of oral disease in the post-radiotherapy and post-surgical patient. In addition, skin grafting in the mouth, which is used increasingly to reconstruct the defect surface, may have an impact on the oral flora.[32] The factors involved in the aetiology of radiation-induced caries are summarized in Figure 2.

Operative dentistry on teeth with radiation-induced caries can be problematic. The process of radiation caries tends to occur rapidly and, therefore, being able to restore a carious tooth before it becomes unrestorable is a priority. The different distribution pattern of this type of caries on cusp tips and smooth surfaces may make the lesion more amenable to access for restoration in the short-term, but there is rapid development and progression along the cemento-enamel junction. The pattern of caries also makes the use of adhesive restorative materials and minimally invasive operative techniques essential (Table 4). Air-abrasion or chemo-mechanical methods of excavating carious tissues could be used effectively in tandem with preventive, non-operative care regimes.

Trismus

Another factor that may limit minimally invasive operative dentistry and patient self-care is reduced oral access. There are several reasons why access to the oral cavity may be limited after surgery and radiotherapy. Pain may cause the patient to guard access, excess tissue (disease or post-treatment) may limit the space available.[33] Other causes include post-surgical malocclusion or reduction in oral aperture. The cause most widely discussed is trismus, a term which describes limitation in mouth opening. An alternative term is mandibular hypomobility. It is common after both surgical and radiotherapy treatment modalities as these can cause tissue fibrosis and tissue contraction. Although a recent systematic review reported the prevalence of trismus as 26%, this can vary from study to study.[33] The variation is likely to be due to some or all of the following:

- Differences in site of primary tumour;
- Extent of surgery;
- Radiotherapy field, radiotherapy dose, combination treatment (surgery and radiotherapy), type of radiotherapy (EBRT versus IMRT);
- Patient factors, motivation, early use of exercises; and
- Co-morbidities, including concurrent connective tissue disease.

There is a lack of recognized diagnostic criteria for trismus. Opening of less than 20 mm inter-incisal distance (or approximately two finger widths) is often quoted.[33] Limited access can be an issue for patients as it can have an impact on feeding, self maintenance and inserting removable prostheses. For the clinician, trismus can result in difficulties examining the patient for recurrences and providing dental treatment.[34] Unfortunately, trismus can be progressive and so patient motivation is very important at an early stage.

There has been some interest in the prevention of trismus. It has been suggested that the use of radiotherapy regimes to spare the muscles of mastication may be beneficial.[35] There is currently no evidence published to support the use of pre-treatment exercise regimes to prevent or reduce the risk of post-treatment trismus. The extraction of potentially inaccessible posterior teeth and the instigation of a good dental disease prevention regime should be encouraged. There are few data to support the use of a particular exercise regime to manage trismus once it has developed.[33] Anecdotally, patients under the care of the authors seem to benefit from regimes utilizing active exercise, ie the use

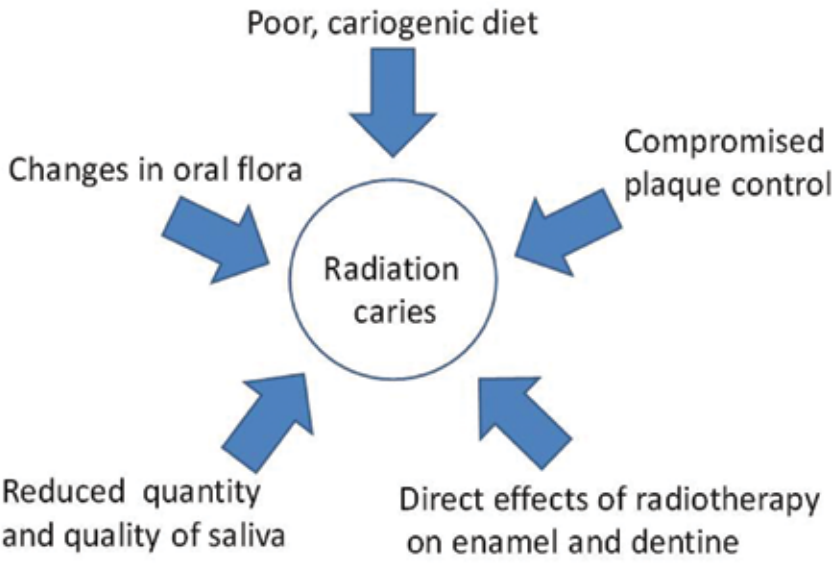

Figure 2. Aetiology of radiation-induced caries adapted from Aguiar *et al*.[28]

Figure 3. Photograph to demonstrate the use of wooden tongue depressors in anti-trismus exercises.

Figure 4. Photograph of a patient with osteoradionecrosis.

of an instrument to open the jaw actively. Examples include the *Therabite Jaw Motion Rehabilitation* system (Atos Medical, Sweden). At the KCL Dental Institute at Guy's Hospital, the authors have found a stack of wooden tongue depressors inserted between the upper and lower teeth, to which the patient can add, can also be of benefit (Figure 3).

As these exercises are patient-dependent, a well-motivated patient is essential and the GDP and dental team must play a role in encouraging the patient to continue with the exercises.

If dental intervention is required in a patient with trismus, it may be useful to employ certain treatment strategies. The patient should be encouraged to increase the use of his/her exercise regime to maximize opening during treatment. Appointment length should be as short as possible, with the patient given opportunities to rest. A mouth prop and short-shanked burs, coupled with paediatric handpieces, may be useful adjuncts. If the patient requires an impression,

Fluoride type/Concentration	Delivery	Advantages	Disadvantages
Stannous fluoride/0.4%	Gel/pre-formed tray	Cariostatic and antimicrobial Effective against incipient and root surface lesions	Metallic taste, staining/ sensitivity of teeth and gingivae. Limited availability in UK
Acidulated phosphate fluoride (APF)/1.23%	Gel/pre-formed tray	Effective against root surface lesions/erosive demineralization	Low pH, etches tooth surface, mucosal irritant, erodes GIC
Sodium fluoride/1.0% (4500ppm) 1.1% (5000ppm) 2% aqueous varnish	Gel/pre-formed tray Toothpaste Chairside varnish	Neutral, pleasant taste, No staining, effective against erosive demineralization	Not as effective as stannous fluoride Caries inhibition 30–38%
Sodium fluoride/0.05%, 0.1%, 0.2%	Mouthrinse, 1 min/1 or 2 x day, weekly	Neutral, pleasant taste, no staining, effective against erosive demineralization	Not as effective as stannous fluoride Caries inhibition 10–20%
Sodium fluoride/0.12 mg per day	Intra-oral fluoride releasing device (bonded to tooth)	Patient compliance not necessary, slow release	Not as effective as stannous fluoride Caries inhibition 10–20%

Table 3. Oral fluoride therapies with associated advantages and disadvantages.

Material	Clinical Issues	Advantages	Disadvantages
Conventional glass ionomer cements (GIC)	Acid-base reaction, setting reaction dependent on water, bonds to calcium ions	Simple to use, fluoride release /reservoir, adhesive, flexible	Desiccation, acid erosion, poor wear resistance and poor aesthetics
Resin-modified GIC/compomers	GIC + resin polymer, light-cured, water adsorption	Command set, fluoride release, improved resistance to erosion and desiccation	Polymerization, aesthetics
Resin composites	Hydrophobic, dependent on quality of dental substrate	Aesthetics, command set, wear resistance	Technique sensitive, polymerization shrinkage
Dentine-bonding agents (DBA)	Acid etch/self etch resin adhesives	Reduced sensitivity, improved bond strengths, Type IV DBAs simple to use	Technique and moisture sensitive
Amalgam	Ag-Sn-Cu based	Can be used for large restorations, bonded amalgam technique	Aesthetics, mechanical retention necessary
Cast restorations	Variation of materials, alloys and ceramics	Surface coverage, strength, aesthetics	Marginal caries, plaque control, removal of tooth substrate

Table 4. The range of adhesive dental materials that may be used with minimally invasive (MI) operative techniques to remove caries and restore function.

stock trays may be modified by the reduction and smoothing of the flange areas with cutters and acrylic burs. The fabrication of a custom-made tray may also be advantageous.

Osteoradionecrosis (ORN)

Following radiotherapy there is also the risk of the development of osteoradionecrosis (ORN). It describes the condition of exposed, devitalized bone for greater than three months in an area that has been irradiated[36] (Figure 4). It may be asymptomatic or cause pain, erythema, swelling, altered sensation, discharge, skin fistulae and fracture.[37] The current hypothesis is that infection is not the primary cause but rather that it occurs from the radiation-induced production of free radical species, endothelial changes, inflammation, fibrosis and necrosis.[38] The exposed bone may then become super-infected by oral micro-organisms.[39]

The risk of ORN is directly related to the dose of radiotherapy administered, but is less likely to occur when using IMRT because dose is delivered selectively.[40] Dental extractions are a potential cause of ORN, so it is important to avoid dental extractions wherever possible where the supporting bone has been included within the radiation field, particularly in the posterior mandible. Other contributory factors include:

- The wearing of removable prostheses that traumatize the mucosa;
- Uncontrolled periodontal disease;
- Further surgery;
- Malnourishment; and
- Chemotherapy.[41]

Osteoradionecrosis may also occur spontaneously. As the risk of ORN does not diminish clinically over time, it is recommended that a patient with a history of radiotherapy to the head and neck region should be referred to secondary care if dental extractions are required.[42]

The removal of teeth with unrestorable caries, periodontal disease, endodontic infections or heavily restored teeth before radiotherapy is performed may be considered as one of the most important prevention strategies.[39] If post-radiotherapy extractions are required, it has been advocated that the patient receive antioxidant medication, such as a combination of pentoxifylline 400 mg twice daily and tocopherol (vitamin E) 1000 units daily. There has been some debate as to the length of the regime but a minimum of eight weeks, with one week pre-operatively, has been advocated as a prophylactic measure.[37] A similar regime is advised if ORN develops, but the combination should be used for a longer time span, such as six months. However, the evidence to support these regimes of treatment is not conclusive. There has been some controversy concerning the use of hyperbaric oxygen (HBO) therapy and a randomized controlled trial demonstrated no difference in the healing of patients given placebo treatment versus HBO.[43] However, a more recent Cochrane review concluded that HBO may be associated with some improvement in outcomes in selected patients, but there are economic implications and the data lacks evidence for the optimum timing of therapy.[44]

Conclusions

The following points summarize the advice for the GDP and the dental team when managing patients with a history of head and neck cancer:

- Regular oral and dental examinations, checking both for dental health and also for the risk of cancer recurrence. Patients have a high risk of oral disease and should be seen a minimum of three times per year, until stabilized.
- Optimizing oral hygiene, tailored to the individual patient's dexterity and motivation. Utilize other members of the dental team to provide care, motivation and support (for example, include oral health educators, hygienists, therapists).
- Caries prevention regimes must be tailored to the individual patient. As high caries-risk individuals with non-modifiable aetiological factors (including xerostomia and changes in nutritional needs), annual caries screening radiographs are recommended.
- Non-operative care plans must be targeted and fluoride supplementation is essential (Table 3).
- Nutritional advice to minimize the cariogenic elements of the diet, whilst maintaining an energy-rich diet, must be offered. Suitably trained oral health educators can help provide this service. If necessary, take advice from dieticians and medical practitioners.
- Saliva substitution advice; this may include patients trying several different brands.
- Encouraging anti-trismus exercises in high-risk patients.
- If restorations are necessary, minimally invasive operative techniques with adhesive materials should be encouraged, ensure cleansability of the restoration margins (Table 4).
- If extractions are necessary, consider referral to a secondary care oral surgery service, especially if the patient has a history of radiotherapy treatment.
- If complex oral rehabilitation is necessary, consider referral to a specialist Prosthodontist/Restorative service. Care plans should err on the side of simplicity wherever possible, as long-term maintenance of complex prosthodontics can provide extra clinical and logistical problems for the patient, dentist and health service system.

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