The Oral & Dental Management of Patients Before, During and After Cancer Therapy

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Faculty of Dental Surgery February 2026 v.10/02/26

Contents

1. Introduction

This guideline presents the updated evidence regarding the oral and dental management of patients throughout their journey of cancer therapy. It draws on the best available evidence to make recommendations that will assist dental professionals in improving the outcomes and quality of life for this vulnerable patient cohort.

1.1 Relevance to dental professionals

Cancer prevalence

Cancer remains a leading cause of death worldwide. According to the World Health Organization (WHO), in 2022, there were an estimated 20 million new cancer cases and 9.7 million cancer-related deaths globally (1). The estimated number of people who were alive within 5 years following a cancer diagnosis is 53.5 million (2).

Strikingly, over 35 million new cancer cases are predicted by 2050. This rapidly growing global cancer burden reflects both population ageing and growth, as well as changes to people's exposure to risk factors, several of which are associated with socioeconomic development. Tobacco, alcohol and obesity remain key factors driving the increasing incidence of cancer, with air pollution still a key driver of environmental risk factors. Furthermore, an association between human papillomavirus in the development of oropharyngeal squamous cell carcinoma was recognised in 2007, by the International Agency for Research against Cancer (3).

Globally, approximately 1 in 5 people develop cancer in their lifetime, approximately 1 in 9 men and 1 in 12 women die from the disease. This lifetime risk varies from country to country largely due to socioeconomic factors. For example, it is estimated that nearly 1 in 2 people born in the UK in 1961 will be diagnosed with some form of cancer during their lifetime (4).

Cancers in adults

According to the International Agency for Research on Cancer Global Health Observatory, 10 types of cancer collectively account for approximately two-thirds of new cases and deaths globally in 2022 (5). Lung cancer was the most commonly occurring cancer worldwide with 2.5 million new cases accounting for 12.4% of the total new cases. Female breast cancer ranked second (2.3 million cases, 11.6%), followed by colorectal cancer (1.9 million cases, 9.6%), prostate cancer (1.5 million cases, 7.3%), and stomach cancer (970 000 cases, 4.9%).

Cancers in children

Global estimates indicate that approximately 400 000 children and adolescents (0–19 years old) develop cancer (6). The most common types

of cancer in this population include leukaemias, brain tumours, lymphomas, and solid tumours such as neuroblastoma and Wilms tumour.

In the U.K., childhood cancer accounts for 1% of annual cancer diagnoses, with approximately 1,900 cases diagnosed each year (7). Furthermore, there has been an increase in incidence of cancer in children and young people in the last two decades.

Childhood cancer has a high overall survival rate, with 84% of children surviving for five years or more (7). However, children and young people generally receive aggressive, multi-agent cancer treatments to cure their disease and many experience significant morbidity (8). Hence late effects are common in childhood cancer survivors with 60-90% of developing at least one adverse health-related outcome, and 20-80% experiencing serious or life-threatening complications during adulthood (9). This highlights the need for long-term screening of children and young adult cancer survivors.

Importance of oral/dental care

Oral complications related to cancer therapy are relatively common (10). Indeed, it has been reported in 90% to 100% of the patients receiving radiotherapy involving the oral cavity (11). These oral complications can be both acute and chronic as summarised in Tables 1 and 2. Despite the evolution of cancer therapies, oral complications remain a significant concern for cancer patients, affecting quality of life (12–16) and potentially impacting treatment outcomes and/or resulting in interruption of cancer treatment (15,17).

Hence, dental professionals are key stakeholders in cancer management pathways and play a crucial role in preventing and managing oral complications associated with cancer and its treatment. The key to this is optimisation of oral health prior to, during and post cancer therapy to deliver an improved quality of life and reduce the risk of interruption of cancer therapy (18–22). Collaborative care pathways between oncologists and dental professionals are essential to achieve these optimal patient outcomes. Emphasis on timely preventive oral care, early intervention, and supportive care is crucial.

1.2 Aim

The aim of this guideline is:

To improve the quality of life for patients receiving cancer therapy that has implications for oral comfort and function, by promoting consistent, evidence-based high standards of oral care through a co-ordinated team approach.

1.3 Scope

The scope of this guideline is to provide an overview of current recommendations to support the oral and dental care for patients receiving cancer therapy. The cancer therapy modalities included are:

- Chemotherapy
- Immunotherapy
- Radiotherapy to the head and neck region
- Surgery to the head and neck region
- Haematopoietic stem cell transplantation – involves chemotherapy +/- total body irradiation

It is important to note that haematopoietic stem cell transplants are increasingly utilised for non-malignant conditions, particularly in children (23), including thalassaemia, sickle cell anaemia, immunodeficiencies, and inborn errors of metabolisms. Although these patients do not have a diagnosis of cancer, they receive cancer treatments and are under the care of both the haematology and oncology teams. Hence, they are included in the scope of this guideline.

Readers are encouraged to consult complementary guidelines, including those specific to head and neck cancer patients (17,24–28).

The recommendations must be seen as a contribution to total patient care and as such should always be implemented in conjunction with the care priorities agreed with the oncology team.

1.4 Development of the guidance

Following initial publication in 1997 of the RCS England/BSDH Clinical Guideline on 'The Oral Management of Oncology Patients Requiring Radiotherapy, Chemotherapy and/or Bone Marrow Transplantation,' and subsequent updates in 2004, 2012 and 2018, this guideline has been widely utilised both nationally and internationally.

It is acknowledged that the scope of this guideline is extensive given that it covers multiple oral and dental complications and related management strategies for both children and adults. In view of this wide remit, this current update seeks to make the information presented more accessible to users, reflected in the change of the title, format and the production of a quick reference easy-read supplement.

The key recommendation(s) are presented at the start of each section in a table format. Where appropriate, a more detailed explanation of the evidence is presented after the key recommendation(s). An easy read version with the key recommendations is planned for release in 2026.

This update has involved stakeholders from multiple specialties including Special Care Dentistry, Dental Therapy, Oral Surgery, Paediatric Dentistry, Restorative Dentistry, and Oral Medicine.

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The British Society for Special Care Dentistry have also reviewed and approved the document for publication, with patient involvement sought to ensure the supplementary information in the patient information additional resource is appropriate for intended users.

The views and/or interests of any funding bodies have not influenced the final recommendations. All group members have declared that they have no competing interests

This guideline is due for further review in 2030.

1.5 Methodology

The Faculty of Dental Surgery Clinical Standards Committee Standard Operating Procedure for developing guidelines was followed when updating these guidelines. The search strategy utilised by the workstreams was based on the extension to the latest Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA- S 2020). "Key" or "seminal" papers were used to verify the final search strategy for each subgroup, before application of publication date restrictions. The searches were undertaken in January 2024 and included publications from 2017 onwards to identify additional evidence that has emerged since the 2018 version of these guidelines. A PRISMA flow diagram from the paediatric subgroup is included in appendix x. Search strategies are available on request.

Databases

- The following healthcare databases were searched: Ovid Embase; Ovid MEDLINE; CINAHL via EBSCOhost; Dentistry and Oral Sciences Source via EBSCOhost; and Scopus

- Reports published by relevant healthcare charities and non-commercial organisations were obtained from their websites
- Relevant theses were obtained via the British Library EThOS database, if available at the time of searching
- Supplementary searches included forward and backward citation searching against included studies and reports
- Exclusion: commentaries and editorials, conference abstracts study protocols, publications written in language other than English, articles published prior to 2017.

Grading of evidence:

- Content analysis of recommendations and outcomes and grading of the quality (or certainty) of evidence and strength of recommendations based on GRADE (Grading of Recommendations, Assessment, Development and Evaluations).
- This reflects the extent to which the Guideline Development Group is confident the statement/recommendation is appropriate for the range of patients for whom the recommendation is intended.
- Given the scope of this review, the GRADE levels of evidence are summarised in a supplement which accompanies this guideline.
- Within the recommendations in the guideline the terms 'should' or 'consider' typically indicate the intended strength of evidence (NICE reference: https://www.nice.org.uk/process/pmg20/chapter/interpreting-the-evidence-and-writing-the-guideline#wording-the-recommendations)

Outcomes:

- Conclusions or recommendations relevant to the prevention of adverse outcomes are reported

1.6 Sponsoring Body

- The Faculty of Dental Surgery of the Royal College of Surgeons of England

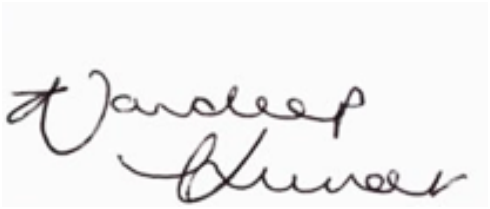
1.7 Associate Bodies

- British Society for Special Care Dentistry
- Children & Young People's Cancer Association (CCLG)
- Scottish Dental Clinical Effectiveness Programme (SDCEP)
- Mouth Cancer Foundation

The above associate bodies provided external review of the guidelines, and their feedback was incorporated into the final agreed version.

1.8 Supporting Tools

- An easy reference guide with the key recommendations available in 2026
- Patient information leaflets specific for:
  - Adults undergoing head and neck cancer therapy
  - Patients undergoing oncology/haematology care
- GRADE levels of evidence summary document for all the subgroups



Navdeep Kumar, Chair of the Guideline Development Group

2. Oral/Dental Care Pathways

It is recognised that not all cancer centres have a linked multi-disciplinary dental team and dental hygienist or dental therapist support within their established patient pathways. However, all patients diagnosed with cancer should have access to oral/dental care to help prevent or minimise oral complications during cancer therapy. This may include an NHS General Dental Practitioner, Community Dental Service and/or Hospital-based Dental Service, with the appropriate experience and use of skills mix to improve accessibility of dental treatment and/or advice (29).

Oral care should be seen as a contribution to total patient care pathway and implemented in conjunction with the care priorities agreed with the oncology team (30). A multispecialty, multidisciplinary and collaborative care approach is required to achieve best oral outcomes and an efficient oral care pathway (26,29,31). Use of specific 'Oral Care Guidance for the Oncology Nursing Team' as summarised in Table 1, can assist in ensuring this is formally established.

The pathway should include access to oral/dental care support, prior, during and after cancer therapy. Prior to cancer therapy, there should be an established referral pathways/forms for referral (32), including:

- Referral from the oncology/haematology team to the assessing dentist
- Referral to the specialist dentist from primary care
- Process to inform the oncology/haematology team of the patient's oral health status and recommended urgent dental treatment

The referral pathway should ensure that the oncology team liaises as early as possible with the dental team to provide details of the planned cancer therapy. In the case of patients with head and neck cancer, it is important to undertake the oral assessment when the cancer treatment plan is available. This will allow the dental team to be aware of areas in the mandible and maxilla that may be involved in surgery and/or radiotherapy. Whilst localised pathways vary, it has been suggested that dental teams should assess the patient approximately one month before cancer therapy involving radiotherapy to the head and neck region begins in order to allow urgent dental treatment to be arranged and to subsequently ensure adequate time for recovery from any required invasive dental procedures (33).

During cancer therapy, there should be established pathways for arranging urgent dental review for any acute oral/dental complications if required. After cancer therapy, a discharge oral care protocol should be in place which

includes a defined protocol for ensuring continuity of oral care post-discharge from a Hospital-based Dental Service.

3. Oral/Dental Care Protocols

There continues to be no universally accepted pre-cancer therapy dental protocol because of the lack of clinical trials evaluating the efficacy of a specific approach. Many of the proposed dental protocols are related to specific cancers only, such as head and neck cancer where the mouth may receive significant irradiation/chemoradiation (24–28). There are emerging studies starting to define pathways for haemato-oncology patients (18,34).

Nevertheless, the importance of optimisation of oral health in relation to all cancers is well established (29,35–37). This should be supported by good communication between the multidisciplinary team, including the oncology and dental teams (36). In addition to maintaining dental health, there should be specific consideration in relation to the numerous potential oral complications of cancer therapy and their management (Tables 2-3).

Time must be made available during the pre-treatment phase of cancer therapy for a dental assessment and necessary emergency care, especially when radiotherapy is planned and for those where dental treatment may be contraindicated once oncology intervention commences (24,27,29). Ideally, a comprehensive oral evaluation should take place as soon as practicable after cancer diagnosis to allow maximum time for dental treatment and subsequent healing (27,33,38).

4. Oral and dental management of children and young people with cancer

Treatment recommendations for adult patients with cancer are often not directly transferrable to children and young people (CYP). In view of this, specific recommendations for the CYP patient group are presented separately in this section. These have been made in line with Delivering Better Oral Health toolkit for prevention, the SDCEP Guidance for Prevention and Management of Dental Caries in Children, and the Children and Young People's Cancer Association (CCLG) recommendations for prevention and management of oral complications in CYP with cancer (39–41).

4.1 Access to dental care

General recommendations

- From the point of diagnosis, consideration should be made to **dental care access for CYP** for dental assessment, professional preventative intervention and advice, and dental recall during and after cancer therapies
- The gold standard is that all children and young people with a new cancer diagnosis should be **referred to a specialist paediatric dental team for assessment** (41)
- Children and young people should have access to a General Dental Practitioner, Community Dental Service and/or Hospital-based Paediatric Dental Service before, during and following cancer treatment
- For specialist paediatric dental units working with a cancer centre, there should be a mechanism of **notification for new patients**. Embedding this mechanism into work infrastructure supports timely dental assessment of these patients (42)
- The routine dental care provider in community or general dental practice should be notified of the cancer diagnosis and arrangements for care during cancer treatment as directed by the hospital dental team, in a **shared care arrangement**
- If there is no specialist paediatric dental unit liaising with the cancer centre, there should be clear communication between the cancer centre and routine dental care provider to support delivery of treatment

- Appropriate training in oral assessment should be available for the oncology nurses within the cancer centre, ideally in collaboration with a member of the dental team

Prior to Cancer Therapy

- All children should undergo a **dental assessment**, including radiographs where possible, **at the time of diagnosis**. Ideally, this should be before commencement of cancer therapy, or as soon as practicably possible
- Families should be made aware of the acute oral side effects of cancer therapies (including oral mucositis, opportunistic infections), and potential for late effects affecting oral health (including growth and development – see section 4.12).

During Cancer Therapy

- Protocols for accessing urgent dental care should be established
- Children and young people should be considered to be **high caries risk** throughout their cancer treatment, regardless of existing dental disease (see section 4.4). They should receive a dental examination **every three months during their cancer treatment** due to their high-risk status (43)

After Cancer Therapy

- The **recall interval** should be determined on an individual basis dependent on risk factors and the presence of active dental disease. Patients who persist with long-term energy-dense diets high in refined sugars and dietary supplements must be monitored closely for caries development (44). Children and young people with cancer treatment related enamel defects and/or xerostomia will be at particularly increased caries risk (45–47)
- It is recommended within **HSCT Late Effects Surveillance Guidance** that children with a history of stem cell transplant have a dental examination every six months as a minimum, with special consideration for those with a history of radiation treatment or chronic Graft versus Host Disease (GvHD) due to their increased risk of xerostomia and secondary malignancy (45)
- **Life-long follow up** for children and young people is advised due to the **late effects of cancer therapy** and their **increased risk of oral**

cancers, which has been demonstrated to be **5-fold** compared to the general population (48). Where appropriate, this can be completed by the **General Dental Practitioner**, in close liaison with secondary and tertiary specialist dental services as need arises based on complexity of dental care requirements and age

4.2 Dental treatment planning

General recommendations

- When treatment planning for CYP **at the point of cancer diagnosis**, consideration should be made for the **prognosis** of teeth, **time to exfoliation** (for primary teeth)**,** and the **likelihood of dental pain or infection** occurring during cancer therapy
- **General anaesthesia** may be indicated for the delivery of dental treatment for CYP due to potentially reduced co-operative ability, dental anxiety and/or the extent of dental treatment required (49)
- **Treatment planning** in paediatric oncology patients is therefore **often more radical**, with extraction of teeth of poor prognosis, to eliminate risk of subsequent dental infections during active cancer treatment and the risk of repeat general anaesthesia
- For these reasons, **pulp treatment of primary molar teeth is generally not recommended** in this immunocompromised population (50)
- A high-risk **preventative approach** should be adopted throughout cancer treatment from the point of diagnosis
- The **least invasive, feasible, permanent restorative approach** with the best supporting evidence-base should be selected
- Clinicians should carefully evaluate the **potential impact of metal restorations, including pre-formed metal crowns**, on the image quality and diagnostic accuracy of magnetic resonance imaging (**MRI**), particularly in cases where MRI will be used for long-term follow-up
- Where **extractions** are indicated, there should be consideration and discussion of the relevant risks of osteoradionecrosis and medication related osteonecrosis of the jaw (sections 4.7 and 4.8)

- Dental teams should seek to **combine** dental care with other planned medical and surgical procedures with general anaesthetic where possible (49)

Prior to Cancer Therapy

- Dental treatment should be **completed** prior to starting cancer therapy where this is feasible

During Cancer Therapy

- **Elective dental treatment should be avoided where possible** as the suppressive effect on the bone marrow may cause low platelets, low white cells, and anaemia
- When dental treatment is indicated during cancer treatment, special care needs to be taken and **timing** of dental treatment should be agreed in liaison with the haematology and/or the oncology team, with **relevant pre-operative blood counts** checked 24-48 hours before treatment (section 4.3)
- If the urgent dental treatment is **invasive** (involving manipulation of dento-gingival junction, the periapical region, or perforation of the oral mucosa (42)), this should be undertaken either by a **Consultant or Specialist in Paediatric Dentistry** where possible, in close liaison with the patient's oncology/haematology team
- Hospital-based dental teams should liaise with oncology teams regarding the suitability and feasibility of completing dental treatment at the **same time as any planned procedures under general anaesthesia** (e.g., lumbar punctures or placement of venous access devices) to reduce the number of general anaesthetics required
- Consideration should be made to management of **oral mucositis**, with specific treatment recommendations outlined in section 4.9

After Cancer Therapy

- Dental treatment should usually be provided in **primary care** following completion of cancer therapies
- Consideration should be made regarding the need for ongoing **specialist input** for CYP with oral late-effects or complex dental anomaly following completion of cancer therapy

4.3 Abnormal blood counts

General recommendations

- **Close liaison with the medical team** is required to plan appropriate timing of dental treatment around haematology/oncology treatment regimens and their relevant side effects
- Where the cancer and/or the cancer therapy may directly **impact on the patient's full blood count,** haematological support and/or antibiotic prophylaxis may be warranted
- **A full blood count**, and any other **blood tests** advised by the medical team, should be completed **24-48 hours** before invasive dental treatment and interpreted in liaison with oncology/haematology team (**see Table 4**)

4.4 Preventative oral health care

General recommendations

- Oral health education should be delivered by a designated member of the dental team or, in the absence of a dentally trained individual, a member of the medical or nursing team who has received **appropriate training**
- Children and young people should be considered to be **high caries risk throughout their cancer treatment**, regardless of existing dental disease, due to the potential implications of dental caries on their cancer treatment
- **Preventative advice and intervention** should be delivered in line with the Delivering Better Oral Health toolkit for children at high risk of dental caries (39)
- This should focus on **toothbrushing with appropriately fluoridated toothpaste two times per day** (including at nighttime), use of **fluoride mouthrinses** at a time separate to toothbrushing (where age appropriate) and professional **fluoride varnish** application at dental recall
- **Dietary advice** should be **tailored** to the child in accordance and **liaison with their wider dietitian led nutrition plan** where possible. Limiting the frequency of sugary foods and advising on the timing of sugar intake (i.e. at mealtimes) supports oral health.

Advising sugar-free between meal snacks, warning of hidden sugars in foods, and highlighting the high acid content of certain drinks may support dietary advice

- Where possible, **sugar free medication** should be considered, if available, in order to minimise cariogenic effects

Prior to Cancer Therapy

- Oral health education, encompassing toothbrushing instruction should be given to children and parents/guardians **prior to commencing cancer therapy,** supported with written information, as this approach has been shown to reduce the severity of complications such as oral mucositis (51)

During Cancer Therapy

- A **soft bristled toothbrush with a small head** can be a useful adjunct to oral hygiene
- There is **no strong evidence to support** the use of **medicated oral rinses and mouthwashes** during cancer treatment

After Cancer Therapy

- Families should be made aware of any **oral late effects** of cancer therapy that increases their child's caries risk (e.g. xerostomia)

4.5 Dental restorations

General recommendations

- For paediatric patients, the **least invasive restorative strategy** with the strongest supporting evidence should be selected (40)
- Teeth should be restored with **a definitive permanent restorative material**
- **Glass ionomer cements** should not be utilised as definitive restorations as they have been shown to have a **high failure rate**, particularly for proximal lesions in primary molars (52)

- **Preformed metal crowns** placed by the Hall Technique have a high success rate, coupled with a high level of acceptability for restoration of primary molars in the dental chair (53,54). However, they are associated with additional **distortion on magnetic resonance imaging** (MRI) when compared to composite restorations (55). These artefacts have been reported to be predominantly confined to the oral cavity and maxillary sinuses, rather than the brain, and were related to the number of restorations placed (55). The potential impact of placing multiple SSCs on the diagnostic quality of MRI should be considered when treatment planning for paediatric patients requiring regular MRI imaging as part of their long term follow up

4.6 Dental extractions

General recommendations

- Children and young people should have teeth of **questionable prognosis removed** in liaison with the oncology/haematology team, with consideration for abnormal blood counts (section 4.3)
- The **implications** of any dental extractions subsequent to radiotherapy must be sensitively explained to the patient and parents/guardians. See sections 4.7 and 4.8 regarding osteoradionecrosis (ORN) and medication related osteonecrosis of the jaw (MRONJ) risk in this population

4.7 Osteoradionecrosis of the jaw (ORN)

General recommendations

- The reported prevalence of ORN in CYP is low and specific recommendations cannot be made

- Although CYP are at high risk of long-term radiotherapy related toxicities, the prevalence of **ORN is relatively low**; this may be in part due to the relatively fewer number of patients receiving high dose radiotherapy for head and neck cancer in this population when compared to adults.
- There is an increased use of **proton beam therapy (PBT)** in paediatric patients, but there is a relative lack of evidence regarding the relationship between dosimetry and ORN incidence. Where ORN has

been reported, this was described in 1.7% (2 patients) in a cohort of 117 paediatric patients receiving PBT for head and neck cancer (56).

4.8 Medication related osteonecrosis of the jaw (MRONJ)

General recommendations

- MRONJ has been very rarely reported in CYP and hence specific recommendations cannot be made

- There is **very little evidence of incidence of MRONJ in children** following bisphosphonates, denosumab, or bevacizumab therapy (57,58).
- **A case of MRONJ** following **permanent tooth extraction** in a 9-year-old patient being treated with subcutaneous **denosumab** has recently been reported (59). Management and follow-up of this case was affected by the COVID-19 pandemic, but complete bony healing and symptom resolution was reported following a short course of doxycycline. This presents the first paediatric case report of MRONJ and demonstrates the potential for this treatment related side effect to occur in CYP.

4.9 Mucositis

General recommendations

- It is recommended that CYP are **closely monitored** for the development of mucositis, as they are **more likely** to experience mucositis when compared to adults due to the high cell turnover in this population (60)
- Consider the **complex negative impact** of oral mucositis on CYP during cancer treatment, including the likelihood of complex biopsychosocial impacts on eating, and a sense of removal from their normality (61)
- The **specific recommendations** below have been made following comprehensive literature review and with consideration of relevant international guidelines within paediatric oncology (41,62,63)

Intervention	Details for Paediatric Patients
Oral health education	• Mucositis **education** should be encompassed in the oral health education delivered to families at initial dental assessment (51,64) • **Written information** may support understanding and improved oral health

Cryotherapy	• Recommended for mucositis prevention in **older, co-operative patients**, receiving select short infusion chemotherapies such as melphalan or 5-fluorouracil (62) • **Sugar containing flavoured ice lollies should not be used** for cryotherapy due to the increased caries risk of holding these in the mouth for prolonged periods of time
Photobiomodulation – PBM (previously referred to as low-level laser treatment)	• Recommendations are made for use of photobiomodulation due to demonstrated **effectiveness** in reducing incidence of **severe oral mucositis** in paediatric populations (65–67) • Specifically, **intraoral PBM** treatment in the red-light spectrum (620-750nm) is recommended for children and young people receiving **haematopoietic stem cell transplantation (HSCT) or radiotherapy for head and neck carcinoma** (62) • There is a weaker recommendation for the use of photobiomodulation for other paediatric patients at high risk of developing mucositis during cancer therapy (63) • Photobiomodulation has been demonstrated to be highly acceptable to children and young people and healthcare teams in recent qualitative research (68) • It should be noted that photobiomodulation requires implementation of equipment and training and is **not routinely available** in all children's cancer centres (69)
Mouth rinses and mucoadhesive gels	• There is **insufficient evidence to support the use of mouth rinses and mucoadhesive gels in mucositis prevention** • However, they may support oral hygiene and oral clearance and maintaining patient comfort • Consideration should be made to children's ability to expectorate mouthwashes effectively based on their age • Additionally, qualitative research has shown that some children and young people dislike their sensation and taste and may struggle to cooperate with their use (61)
Chlorhexidine	• Recommendations are made **against** the use of chlorhexidine for mucositis prevention (64)

Keratinocyte growth factor (KGF) e.g. Palifermin	• Recommendations are made **against** the routine use of KGF in paediatric patients due to known short term adverse effects, potential for long term negative effects on cancer outcomes, high cost, and limited availability (44)
Granulocyte colony stimulating factor (GCSF)	• Recommendations are made **against** the use of these GCSFs for mucositis prevention in paediatric patients due to lack of clear benefit, adverse effects, and high cost (62)
Zinc	• A recently conducted randomised controlled trial found **no protective effect** of zinc supplementation in prevention of oral mucositis in CYP (70)
Honey	• A recent systematic review and meta-analysis of five included studies found **honey** to be **effective** in treatment of oral mucositis in paediatric patients (71) • However, this approach has a limited evidence base and is **not recommended due to the cariogenic effect** of regular, prolonged application of topical honey in this high caries risk population

4.10 Orthodontics

General recommendations

- Consideration should be made to the **potential impact of metal brackets and bonded retainers** on diagnostic quality of magnetic resonance imaging

Prior to Cancer Therapy

- **Removal of orthodontic appliances prior to cancer therapy** should be considered in liaison with the providing orthodontic team due to potential risks associated with oral health, oral mucositis, xerostomia, and increased caries risk during cancer treatment (72)

During Cancer Therapy

- Orthodontic treatment is **not recommended** due to increased associated oral health risks and treatment burden

After Cancer Therapy

- The decision to embark upon orthodontic treatment after cancer treatment must be taken carefully and **discussed with the patient's medical team in advance**. Recommendations may vary depending on the type of cancer treatment modality utilised (72).
- Use of **metal brackets and bonded retainers can result in artefacts** on **magnetic resonance imaging** (MRI) (73). The potential impact of metallic orthodontic components on the diagnostic quality of MRI should be considered when treatment planning for paediatric patients requiring regular MRI imaging as part of their long term follow up.
- **Overall health, susceptibility to dental caries, and response to oral health prevention** regimes should be carefully assessed prior to commencement of orthodontic treatment (74).
- Consideration should be made on the **magnitude and duration of orthodontic forces** applied in cases where root development has been affected by cancer treatment and the advantages and disadvantages of proposed treatment explained carefully to the patient (75).
- Consideration should be made on the **impact of oral bisphosphonates** in inhibiting orthodontic tooth movement, prolonging treatment time, and increasing the odds of poor space closure and poor root parallelism (76).
- Although it is unclear whether orthodontic treatment can precipitate MRONJ in patients taking antiresorptive therapy such as bisphosphonates (77), the general consensus is to **avoid orthodontic treatment when IV bisphosphonates are being administered and for a period after cessation (although there is currently no agreement on the duration of this period)**. If orthodontic intervention is deemed necessary, it should be approached with caution, involving multidisciplinary consultation and informed patient consent.
- The risk of ORN and MRONJ should be considered carefully if **orthodontic extractions** are anticipated

4.11 Growth and Development

General recommendations

- In children receiving cancer therapy, general growth, including facial growth and dental development should be **closely monitored**

Prior to Cancer Therapy

- Families should be made aware of the potential oral late effects of cancer therapies in relation to growth and development

During Cancer Therapy

- Growth and development should be closely monitored as part of regular dental assessment

After Cancer Therapy

- The **increased risk of dental developmental abnormalities** should be considered in survivors of childhood cancer who received radiotherapy, chemotherapy and total body irradiation or high-dose chemotherapy prior to stem cell transplant – these abnormalities include agenesis, microdontia, hypoplasia, arrested root development and enamel defects, in addition to xerostomia (45,46,78–81)
- It should be noted that the **risk** of dental abnormalities **increases with younger age** at treatment, higher doses of radiation and alkylating agents (e.g. cyclophosphamide), and use of multiple cancer treatment modalities (45,75,81)
- It should be noted that children and young people may also have **impaired vertical face growth**, particularly in the lower third region (82)
- **Orthopantomograms** should be used to evaluate potential dental anomalies and root development and are recommended in HSCT Late Effects Surveillance Guidance for children and young people after stem cell transplant, prior to dental treatment (45)

- **Referral to a specialist** for multi-disciplinary care should be considered for children and young people with **complex dental anomalies**

5. Oral and dental management of adults with cancer

5.1 Access to dental care

General recommendations

- All adults undergoing cancer therapy should have access to a General Dental Practitioner, Community Dental Service and/or Hospital-based Dental Service before, during and following cancer treatment
- For patients undergoing cancer therapy for **head and neck cancer**, it is essential that a **specialist hospital-based dental service** is an **integral** part of the multidisciplinary team (32)
- There should be a mechanism of **notification for new patients** to support timely dental assessment of these patients
- The routine dental care provider in community or general dental practice should be notified of the cancer diagnosis and arrangements for care during cancer treatment as directed by the hospital dental team, in a **shared care arrangement**
- Appropriate **training in oral assessment and appropriate referral** for dental input, should be available for the oncology nurses within the cancer centre, ideally in collaboration with a member of the dental team

Prior to Cancer Therapy

- All adults should undergo a **dental assessment**, including radiographs where possible, before commencement of cancer therapy, or as soon as practicably possible
- The dental assessment should be **scheduled as early as possible** after cancer diagnosis to allow time for any necessary dental treatment to be completed before cancer therapy commences. It has been suggested that this should ideally be **one month before cancer therapy** begins in order to allow urgent dental treatment to be arranged and to subsequently ensure adequate time for recovery from any required invasive dental procedures (33)
- The assessment should include a risk assessment for **potential odontogenic complications** during and/or after cancer therapy (34)
- The dental team should **liaise closely with the patient's oncology/haematology team**, in relation to the oral/dental findings, risk assessment and proposed dental treatment plan

During Cancer Therapy

- **Elective dental treatment** should be **avoided** during active cancer therapy where possible
- **Protocols** for accessing **urgent dental care** dental service should be established
- If any dental intervention is deemed urgent, close liaison with the oncology and/or haematology team is required regarding **timing** of treatment and **completion of relevant pre-operative blood** counts (24-48 hours before treatment)

After Cancer Therapy

- Patients should be reviewed at the earliest opportunity after the completion of cancer therapy, taking into account that the general cancer therapy side-effects may impact the feasibility of immediate post-treatment dental review
- For patients with **head and neck cancer** who have received cancer therapy:
  - Support and advice should be provided for the possible longer term side effects (Table 3) (83)
  - Consider the provision of specialist prosthodontic care, for example obturators
- Remote follow-up using **teledentistry** can effectively support patients with oral health improvement and can act as a safety net if patients cannot readily access other care providers (84)
- For patients receiving head and neck cancer therapy, there should an **agreed patient-specific minimum period of oral health monitoring by the specialist dentist** prior to discharge to primary care
- The discharge protocol should include a protocol for ensuring continuing oral care in an appropriate primary dental service
- **Life-long follow up** by the **General Dental Practitioner**, in close liaison with secondary/tertiary specialist dental services is recommended
- The **frequency of dental visits should be individualised**, often requiring more frequent visits.

5.2 Treatment planning

General recommendations

- **For all patients** receiving cancer therapy, the aims of dental treatment planning are to:
  - **Identify** existing oral disease and potential risk of oral disease
  - **Develop a plan** for preventative oral health care, smoking and alcohol cessation advice, and where required, periodontal care, restorations and dental extractions
  - **Confirm** if urgent dental intervention is required prior to commencement of cancer therapy
  - Ensure **close liaison** with oncology/haematology teams when **invasive dental treatment** such as those that involve manipulation of dento-gingival junction (including dental extractions), the periapical region, or perforation of the oral mucosa (85,86) is required
  - Where possible carious teeth should be **definitively restored** or stabilised with appropriate restorations
  - **Remove infectious oral foci** no less than 10 days before the start of cancer therapy. It should be borne in mind that permanent teeth with asymptomatic periapical lesions of <5mm are rarely exacerbated by cancer therapy (37). Hence clinical judgement needs to be made on the overall prognosis
  - **Ensure the patient is dentally fit before cancer therapy commences** (i.e. no active dental pathology, pain, or urgent treatment needs, and being in a stable oral health condition that poses no risk to cancer therapy)
- It should be recognised that extraction of teeth prior to cancer therapy can cause considerable distress to patients. In view of this, it is recommended that a **tier system** is used to facilitate discussions with the patient and the haematology/oncology team:
  - **Tier 1** – **current poor prognosis/infection risk** (e.g. direct association with the tumour, poor restorative, endodontic and/or periodontal status, non-vital teeth); highly recommend extraction(s)
  - **Tier 2** – **guarded prognosis** (e.g. reduced access post cancer treatment due to trismus, heavily restored, non-functional posterior teeth); can be retained but the patient should be aware of the potential risks in the future (e.g. ORN/MRONJ)

Prior to Cancer Therapy

- Patients should routinely receive a detailed **oral/dental examination, including dental radiographs prior to cancer therapy** to ensure that oral health is optimised and risks during and/or after cancer therapy are reduced (24,87)
- **Establish the necessary multidisciplinary collaboration** within the cancer team to reduce/alleviate oral symptoms and sequelae before, during and after cancer therapy
- **Advice and support** should be provided to the patients about the potential oral side effects of the planned cancer therapy (Tables 2,3) (see patient information leaflets)
- **Liaise closely** with the oncology/haematology teams to avoid **unscheduled interruptions to cancer treatment** where possible
- Patients who are due to undergo **surgery and/or radiotherapy to the head and neck region,** should be assessed by the **specialist dental team** that works with the head and neck surgeon and oncologist in the multidisciplinary team (24)
- **The specific additional aims** in this patient cohort are:
  - **Careful consideration** of the prognosis of teeth in light of an increased risk of caries post-treatment(88–90)
  - **Assess** for possible post-treatment access difficulties (e.g. heavily restored posterior teeth which may be problematic to maintain due to high dose radiotherapy and associated risk of trismus)
  - **Plan dental extractions** of teeth with doubtful prognosis or at risk of unrestorable dental disease and in an area of osteoradionecrosis risk. If these teeth are in the area of the mandible and/or maxilla intended for **surgical resection,** they should be highlighted to the cancer surgeon, reducing the need for the patient to have a separate surgical procedure for dental extractions
  - **Plan dental restorations** to ensure that teeth are stabilised prior to cancer therapy
  - **Adjust sharp teeth or restorations** to minimise soft tissue damage, ulceration, mucositis and attendant discomfort
  - **Undertake scaling and endodontic treatment at least 2 weeks before radiotherapy** where possible due to emerging evidence that this may reduce the development of ORN (91,92)
  - **Establish an adequate standard of oral hygiene** to meet the increasing challenges during and after cancer therapy
  - **Plan pre-prosthetic care and treatment** for patients undergoing surgery (e.g. obturators, osseointegrated implants)
  - **Plan replacement of missing teeth** post cancer therapy (93)
  - **Undertake impressions or intra-oral scans of the mouth** where possible – this will allow study casts to be made, enabling

the construction of applicator trays and, where appropriate, for intra-oral radiation stents and obturator planning
- **Counsel the patient about denture wear** during cancer therapy. The patient should be instructed not to wear the prosthesis during cancer therapy, if possible; or at least, **not to wear it at night** (17). If a removable prosthesis is worn, it is important to ensure that it is **clean and well adapted to the tissue** (16,94)

- Where the cancer and/or the cancer therapy may directly impact on the patient's **full blood count (FBC)**, close liaison with the oncologist/haematologist should take place and clinical judgement exercised before proceeding with invasive dental treatment (**Table 4**). **Haematological support and/or antibiotic prophylaxis** may be warranted
- In other cases involving **chemotherapy, radiotherapy and/or intravenous bisphosphonate treatment** taking advantage of normal bone healing capability and reducing the risk of delayed healing/infection of sockets, ORN and/or MRONJ is critical (33,88,95,96). Hence teeth of dubious prognosis should be **removed a minimum of 10 days prior to start of cancer therapy** (33,57,97,98)
- Ideally allow **14 to 21 days between dental extraction and commencement of radiotherapy** to allow for maximal healing time (33,88)

During Cancer Therapy

- **Dental treatment should be avoided where possible during the period of cancer therapy**

After Cancer Therapy

- Strenuous efforts should be made to **support oral health** and avoiding complications such as ORN, by careful oral health **monitoring** and ensuring prevention compliance, timely dental treatment and dealing promptly with oral trauma (24,99–101)
- More frequent **dental examinations, namely three monthly**, have been proposed for patients at risk of MRONJ (102)
- At each visit, the history should address head and neck, oral/dental symptoms, **tobacco/alcohol cessation**, and **surveillance** for

potential recurrence or second primary cancers (103), and late effects of cancer therapy
- Post-radiotherapy scaling or subgingival instrumentation, and oral surgery or exodontia after radiotherapy, could closely relate to ORN development in oral cancer patients (91,92)
- **Hence, where supra and sub gingival professional mechanical plaque removal (PMPR)** is required to remove plaque and calculus, it should be provided only where needed to prevent/manage periodontal disease, with close review advised (**see section 5.6**)
- When dental extractions are unavoidable after cancer therapy, the **risk of ORN/MRONJ** should be considered and appropriate precautions undertaken (**see sections 5.12-5.14**)
- For definitive restorations, where the choice is between glass ionomer and composite restorations, composite resin restorations may be preferable (52,90)
- **Tooth replacement options**, including dentures, should be considered to improve oral function and quality of life (94)

5.3 Abnormal blood counts

General recommendations

- Prior to invasive dental treatment, it is crucial that the medical team is consulted for those patients who may have an abnormal blood counts
- The following patients should be considered at high risk:
  - Patients with **haematological malignancies** (104)
  - Patients receiving **chemotherapy and some biological agents** (105,106)
  - Patients with **prolonged neutropenia** (increased risk of sepsis of oral origin) (107)
- Consideration should be given to the **risk of bleeding and/or infection** if **invasive dental treatment** is planned such as dental extractions, detailed six-point full periodontal examination, and subgingival professional mechanical plaque removal (85)
- In liaison with the oncology team, pre-procedure **blood tests (within 24-48 hours)** may be necessary where it is suspected that blood counts may be reduced
- These tests should include a **full blood count and differential** as a minimum to assess white blood cell counts (including neutrophils), as well as to identify platelet levels and any potential anaemia.

- **Further tests** may be potentially needed based on patient-specific factors (such as history of renal or hepatic impairment)
- Blood tests may be undertaken by oncology teams, dental teams with access to such tests, or primary care medical teams: results should be shared between services where possible.
- **Dental teams** caring for this patient cohort should be able to **interpret standard blood test results** and liaise with oncology/haematology teams to modify the dental treatment plan both in relation to timing and any required haematological support (Table 4)

5.4 Preventative oral health care

General recommendations

- A **collaborative, shared-care approach** between patients and the dental team should be encouraged, as patients value strong, supportive relationships with oral healthcare providers (108)
- Patients undergoing cancer therapy should be considered at **increased risk for dental caries**
- Dentate patients receiving **radiotherapy** to the head and neck region should be considered at particularly high risk for post-treatment dental caries and require close review (89,90,109)
- **Preventive strategies** must include effective biofilm removal, fluoride use, and tailored dietary management
- Patients, particularly those receiving radiotherapy, should be **closely monitored for an increased risk of oral diseases** such as radiation caries and osteoradionecrosis, which can impact their health and quality of life (83,108)
- Patients who have undergone **haemopoietic stem cell transplants** should be considered as high risk of developing significant oral symptoms (34)
- Both **short and long term oral side effects of chemotherapy and radiotherapy** should be carefully managed, as these treatments can adversely affect patients' oral health (24)
- Preventive oral health care **enhances patient outcomes** (110,111) and should start prior to cancer therapy to reduce the risk of oral diseases and side effects during cancer therapy (35).
- Given the complexity of side effects, a single preventive care protocol should not be applied to all post-cancer therapy patients - an **individualised oral health prevention and monitoring**

programme should be established for each patient, with frequent recall intervals based on the patient's oral disease risk assessment (112,113)

- There should be a focus on emphasising the **importance** of **home oral health care** throughout cancer therapy to reduce the risk and impact of side effects and oral diseases.
- **Chlorhexidine should not be recommended for the prevention of caries, gingivitis, or periodontal disease in patients with head and neck cancer**, as current evidence does not support its effectiveness (114) - furthermore, it does not reduce the clinical symptoms oral mucositis (64,115–117), with some evidence that in patients with neutropenia undergoing cancer chemotherapy it may induce more mucosal inflammation, and elevate symptoms of mucositis (118)
- The **risk of dental caries** following cancer therapy should be assessed based on the type of treatment received and any changes in oral health-related behaviours resulting from the therapy
- The dental team should actively support patients in maintaining **long-term adherence to oral hygiene routines** and assist them in adjusting to life after cancer treatment

Prior to Cancer Therapy

Professional oral health care support

- Take time to discuss the **side effects** and the **changes** that patients may experience, including dental caries risk, this will help patients to prepare (16,108) (Tables 2-3)
- **Advice** should be in line with the **Delivering Better Oral Health: an evidence-based toolkit for prevention**, noting that dental caries risk is likely to be high particularly where radiation therapy is involved (39)
- **Advice** should be tailored to **patients' needs**, adopting behaviour change approaches (39)
- **Professional application of fluoride varnish** 2.26% should be undertaken (36,39,112)
- A **dentist**, **dental hygienist**, **dental therapist** and/or **dental nurse** with **oral health education** training should be available to help patients optimise their oral hygiene routines

Home oral health care

- Home oral care should include the following:

- **Toothbrushing** last thing at night and another time in the day to effectively remove the dental biofilm with assistance from carer as required (39,119)
- **Interdental cleaning** daily in the presence of gingival inflammation (39,119)
- Use of **fluoride toothpaste** with a minimum of 1,350ppm depending on age and risk; may consider prescribing 2,800 or 5,000ppm for patients at high risk of radiation caries (35,39,113)
- **Don't rinse** the mouth after using the toothpaste (39)
- Consider using **fluoride mouthwash** (0.05%) without alcohol at a different time to brushing in line with risk of caries for individual patient (36,39,113)
- **Dietary advice** prior to cancer therapy should focus on **optimising nutrition and reducing caries risk** (39). Patients will likely be seeing a **dietician** so dental teams should work closely with them and the patient to balance risk with optimising nutrition

- Patients should be provided with written information to support this advice (see patient information leaflets)

During Cancer Therapy

Professional oral health care support

- Professional support during cancer therapy can help patients in managing their oral health and side effects and **potentially enhance adherence to oral hygiene routines and oral health outcomes** (35,36,120–122).

- Dentists, dental hygienists, dental therapists, dental nurses with oral health education training, clinical nurse specialists and other team members who are **appropriately trained** can provide support to patients aligned to their scope of practice.

- The support should be **tailored to patients' needs and risks** that are likely to change throughout cancer therapy

- This support could include:
  - **Assistance** with dental **biofilm removal** where possible
  - **Advice** on management of any **acute oral symptoms** and **side effects** of cancer therapy
  - Adaptations to oral hygiene routines using **alternative aids** and **products** – see section 'Home oral health care' below.
  - Adaptations to food and drink intake in liaison with dieticians
  - Close liaison and **collaboration** with the wider **multidisciplinary team** is recommended to support patients holistically

Home oral health care

- Oral hygiene should be **maintained as best as possible** to reduce the risks and impact of side effects and oral disease progression
- Depending on cancer therapy regimes, it is likely that patients' **capability to maintain optimal oral hygiene will reduce** and be driven by the side effects they experience for the duration of their therapy (Table 2)
- **Home oral care advice** during therapy:
  - Aim for effective and **atraumatic removal** of the **dental biofilm daily** during cancer therapy to prevent/reduce the onset and severity of gingival inflammation, mucositis, dental caries, oral infections and other side effects of cancer therapy
  - Adaptations to **oral hygiene aids** may be suitable to support patients to effectively and atraumatically remove the dental biofilm (16,108). For example, patients report using a **child's toothbrush** may help because it is generally **softer** and **smaller**
  - **Interdental cleaning** is still advisable to control periodontal disease but may be adapted to ensure there is no associated risk of trauma (e.g. using smaller interdental brushes)
  - **Foam sponge sticks** should be **avoided** as the foam head can become detached when the swab is left soaking in liquid and cause a serious choking hazard – for this reason they may be banned in some nations (123)
  - **Foam swabs** do **not** effectively remove plaque from the surface of teeth (124) – hence toothbrushing, even with a **soft toothbrush**, is preferred
  - Continued **topical fluoride use** through toothpastes, mouthwash or gels use should be encouraged where possible accounting for side effects of particular ingredients – see below (39,112,113)
  - **Toothpaste ingredients** such as sodium lauryl sulphate (SLS) (foaming agent) and/or strong flavours may irritate the soft tissues during cancer therapy (108,125). Hence **non-foaming SLS-free** and flavour-free/mildly flavoured toothpastes are recommended as long as they contain fluoride
  - In addition to fluoride, there is **weak** evidence that casein phosphopeptide-amorphous calcium phosphate topical paste (**CPP-ACP**) 10% used in conjunction with fluoride may reduce onset of radiation caries in the short-term during and after therapy (35,126,127)

- Additional over the counter **mouthwash** may be considered with careful assessment of the purpose, ingredients, risks and benefits in line with experience of side effects
- **Chlorhexidine** mouthrinse or gel is **not** recommended as standard

- It is recommended that **dental teams collaborate closely with dietitians** to address the increased caries risk associated with changes in dietary habits during cancer therapy (121) - as dietary advice from dental and dietetic teams can sometimes be inconsistent from the patient's perspective (108), coordinated care is essential to **ensure nutritional needs** are met **while minimising cariogenic risk**, particularly when high-sugar supplements are used

After Cancer Therapy

- Preventive oral care for post-cancer therapy patients should **focus on reducing the risk of oral diseases** by emphasizing daily biofilm removal, caries risk management (including fluoride), dietary advice, and long-term adherence to oral care routines
- Supportive care should be **tailored** to each patient's specific needs and risks following their cancer therapy
- General treatment side-effects of cancer therapy may impact the feasibility of immediate post-treatment dental review; nevertheless, they should be **seen as soon as feasibly possible** after completion of cancer therapy
- **More frequent follow-up appointments** are generally recommended due to the increased risk of dental disease in post-cancer therapy patients (89,128)
- However, recall should be **risk-based** rather than time-specific, as set recall intervals are of no benefit over risk-based approaches (129)
- Timings for follow-up care should also consider **patient's preferences** (130,131)
- Patients with **unstable oral health** will require more frequent monitoring (132)
- Patients should be **continuously educated** on the importance of lifelong regular dental care to monitor and manage oral health, prevent disease, and adhere to appropriate recall intervals for ongoing follow-up (133)
- In the absence of recurrent cancer disease, closer oral health monitoring should at least be **equivalent** to the period of monitoring by the oncology team (103,134)

- In circumstances of stable oral health, monitoring should be agreed with the primary care dentist with an appropriate procedure for urgent re-referral

Professional oral health care support

- Professional oral health care after therapy should include:
  - A **personalised care plan** and review at frequent intervals in line with their risk status, needs and evidence-based guidelines for prevention (39)
  - **Professional application** of **fluoride varnish** 2.26% at recall visits for patients who have received radiotherapy to the head and neck region (113) or are high risk of dental caries (39)
  - Advice on management of any chronic oral **symptoms** and **side effects** of cancer therapy
  - **Monitoring** the oral cavity for **changes** and **signs** of osteoradionecrosis and/or medication-related osteonecrosis
  - **Oral cancer surveillance**
  - **Regular risk-based recalls** (39)
  - The majority of patients can be discharged to the primary care dental team for long-term review (135).

Home oral health care

- Home oral care advice after therapy should include the following:
  - **Toothbrushing** last thing at night and another time in the day to effectively remove the dental biofilm with assistance from a carer as required (39,119)
  - **Interdental cleaning** daily in the presence of gingival inflammation (39,119)
  - Using **fluoride toothpaste** with a minimum of 1,350ppm depending on age and risk; consider prescribing 2,800 or 5,000ppm for patients at high risk of post-radiation caries (112)
  - **Don't rinse** after using the toothpaste (39)
- Consider using **fluoride mouthwash** (0.05%) without alcohol at a different time to brushing in line with dental caries risk
- In addition to fluoride, there is **weak** evidence that casein phosphopeptide-amorphous calcium phosphate topical paste (**CPP-ACP**) 10% used in conjunction with fluoride may reduce onset of radiation caries in the short-term during and after therapy (35,126,127).
- There is **weak** evidence that regular overnight application of a low-concentration fluoride gel loaded in a custom tray in patients who have

had radiotherapy for head and neck cancer may be of additional benefit after therapy (136)

- **Dietary analysis and advice** to reduce risk of dental caries and optimise nutrition ensuring discussion with dieticians if still involved so that the advice is not conflicting (108); non-compliance can lead to a significantly higher incidence of dental caries (121)
- **Risk factor management advice** including reducing the amount and frequency of sugar, smoking cessation advice and alcohol reduction advice (see section 5.5)

5.5 Smoking and alcohol cessation

General recommendations

- Patients should be advised that **quitting smoking at the time of cancer diagnosis** is likely to be associated with **improved survival outcomes and reduced treatment-related side effects**, including better tissue oxygenation, lower risk of acute toxicity, reduced need for gastrostomy or tracheostomy, and increased progression-free survival (137)
- Smoking cessation support should be **ongoing before, during and after cancer therapy** (138)
- Support to stop the use of **smokeless tobacco and betel quid** should also continue (139)
- For patients who do not want, or are not ready to stop using tobacco in one go, a **harm-reduction approach** is recommended (e.g. smoking less) (140)
- **Dental appointments** should be utilised as **key opportunities** to support tobacco cessation efforts (140)
- Sustained 6-month cessation counselling and free medication can increase the likelihood of smoking abstinence compared to short-term cessation counselling and medication advice (141).
- Patients should be encouraged to **cease/reduce alcohol consumption** (138)

5.6 Periodontal therapy

Prior to cancer therapy

Periodontal therapy needs should be determined by a **basic periodontal examination** (BPE) and periodontal diagnosis as per the Classification of Periodontal Diseases 2018 (142)

- When a **periodontal diagnosis** is confirmed, periodontal therapy should be commenced prior to cancer therapy where possible
- Due to time constraints with starting cancer therapy, it is likely to involve the **first step of therapy** including:

- All preventive oral health care advice outlined in section 5.4
- Professional mechanical plaque removal (PMPR) to remove plaque and calculus ideally at least 2 weeks prior to commencement of cancer therapy (supra and sub-gingival) (111,122,143)
- Mitigation of plaque retentive factors e.g. removal of overhangs on restorations
- Consideration of antimicrobial use in adjunct to mechanical plaque removal such as chlorhexidine for a short time only (119)

- For patients with periodontitis, **if time permits**, whilst being cognisant this should **not** delay onset of cancer therapy:
  - 6-point pocket chart
  - Sub-gingival instrumentation, where indicated

During cancer therapy

- **Periodontal therapy should be avoided during cancer therapy**
- Professional oral health support can be provided as outlined in section 5.4

After cancer therapy

- Periodontal health and treatment needs should be assessed and monitored in line with patients' periodontal diagnosis and risk status supported by the latest evidence-based guidance (119)

5.7 Dental Restorations

Prior to cancer therapy

- Where possible carious teeth should be definitively restored or stabilised with appropriate restorations
- Careful consideration should be given to the prognosis in light of an increased risk of caries post-treatment (88–90)
- For definitive restorations, where the choice is between glass ionomer and composite restorations, **composite resin restorations may be preferable** (52)

During cancer therapy

- Placement of routine dental restorations should be avoided during cancer therapy

After cancer therapy

- Routine restorative treatment must be **delayed** until the **patient is relatively stable/in remission post cancer therapy**
- Restorations should be kept **simple** ensuring acceptable aesthetic function, with avoidance of more advanced restorative work
- When considering restorative material, **definitive restorative material** should be used
- **Composite resin and amalgam are preferable**, as there is a higher failure rate for resin modified glass ionomer and conventional glass ionomer cement in patients treated with radiotherapy to the head and neck (37,52)
- **Fluoride gel application** with composite resin restorations may provide optimal restorative treatment in patients affected by radiation related caries (52)
- Dental caries can quickly progress around the margins of full/partial coverage crowns with the potential for eventual **'carious amputation'** of the crown. Should a full coverage restoration be indicated, the **patient's oral hygiene should be optimised** and consideration should be given to placing the margins of the crown subgingivally (144)

5.8 Dentures

Prior to cancer therapy

- **Dentures should be avoided if possible** as they may cause trauma to the oral tissues
- If they are worn, they should be left out at night
- Furthermore, given that partial dentures increase the risk of plaque retention a focus on effective toothbrushing is key (39)
- **Oral lubricants/artificial saliva** may be applied to the fit surface of the denture to improve comfort and retention when xerostomia is present. Acidic saliva substitutes (e.g. Glandosane®) should be used for **edentate patients only**
- Patients are advised that removable prostheses may become difficult to wear and may need to be left out. If there is any **discomfort** they should be examined by a member of the dental team and adjusted to ensure they are atraumatic (16)

During cancer therapy

- Removable prostheses may become difficult to wear and may need to be left out
- **Antifungals** are used if a candidal infection is diagnosed. These can be applied directly to the fit surface of the denture or incorporated into the soft lining. Microwave disinfection may also be used for maxillary complete dentures
- Advise patient to discontinue wearing their appliance if the mouth becomes painful; the dental team for further advice if required (16)

After cancer therapy

- Dentures may not fit comfortably after cancer therapy
- Review with the dental team is advised

5.9 Obturators

Prior to cancer therapy

- If the patient is having surgical resection to the maxilla/mid-face, obturators can be planned and fitted peri-operatively (27)
- Obturator devices and surgical reconstruction have similar effects on quality of life and health outcomes (145)
- **Close liaison with the head and neck cancer team** is required to determine the best approach

During cancer therapy

- A specialist restorative dental clinician can coordinate with the head and neck cancer team to either take impressions and/or fit an obturator peri-operatively

After cancer therapy

- **Obturators require specialist review log-term** to ensure that their fit remains adequate and there is no trauma or associated infection of the oral tissues

5.10 Dental implants

Prior to cancer therapy

- Ensure existing dental implants are stable with no evidence of peri-implantitis

During cancer therapy

- Implant stabilisation of prostheses and obturators may be feasible in some patients, including zygomatic implants (128) and implants placed at the time of surgery (146,147)

After cancer therapy

- Caution should be displayed when implants are placed into irradiated bone (148,149) or grafted bone due to the risk of ORN (150,151)

5.11 Orthodontics

General recommendations

- See section 4.10.
- Considerations should be made to the risks of orthodontic extractions in adults as outlined in section 5.12.

5.12 Dental Extractions

Prior to cancer therapy

- Close liaison with the oncology teams is recommended to ensure that dental extractions are undertaken at an appropriate time to allow for sufficient healing, and that this is balanced with the need to avoid delays in commencing radiotherapy, chemotherapy and/or intravenous bisphosphonates

- The general recommendation is that **teeth should be removed a minimum of 10 days prior to start of cancer therapy** to take advantage of normal bone healing capability and to **reduce the risk of delayed healing/infection of sockets, ORN and/or MRONJ**
- **Teeth should be removed with minimal trauma**
- Primary closure has been advocated but the evidence supporting this approach is not conclusive

During cancer therapy

- **Avoid dental extractions during cancer therapy**
- If these become unavoidable, close liaison with the oncologist/haematologist is required and clinical judgement exercised before proceeding with invasive dental treatment (**Table 4**).
- **Haematological support and/or antibiotic prophylaxis** may be warranted

After cancer therapy

- Discussion with the patient's oncology team is essential when considering dental extractions – it is essential to confirm the type, duration, dose and site of cancer therapy – this will inform the risk assessment
- Where possible, extraction of teeth from irradiated sites should be avoided due to the risk of ORN **(see section 5.13)**
- **Patients at particular risk of ORN include** (152–155):
  - Malignancy close to the oral cavity, large in size, and/or situated in the mandible
  - Considerable resective surgery is required as part of treatment, particularly in the mandible
  - Radiation dose higher than 50 Gray (Gy) (156), with a notably higher risk at doses of 60 Gy and above (155,157–159)
  - Concurrent chemotherapy (160)
  - Pre-radiotherapy dental extractions
  - Surgical extractions
  - The patient has significant co-morbidities and/or is immunocompromised
  - Poor oral health
  - Xerostomia
  - Smoker
  - High alcohol intake

- Cancer patients who have received bisphosphonates or other anti-resorptive drug therapy are also at risk of MRONJ and dental extractions should be avoided (98) **(see section 5.14)**
- Where there is a high risk of ORN/MRONJ, consideration should be made regarding the **feasibility of root canal therapy and restoration/crown amputation** (33,98,161)
- Where dental extractions are unavoidable, patients should receive verbal and written information of the risks
- Teeth should be removed with **minimal trauma**
- **Soft tissue primary closure** should be achieved where appropriate but is not mandatory, especially if it would require raising a flap (162)
- The benefits of hyperbaric oxygen, pentoxifylline-tocopherol or antibiotics, in reducing the incidence of ORN, compared with no adjunct, remain unclear (162,163)
- However, **the general consensus recommends antibiotic prophylaxis and continued antibiotics** until completion of healing. Although there is variability regarding the most suitable drug, route and duration, the majority of studies describe the use of preoperative antibiotics 3-10 days prior to the dental extraction(s), continued for 5-14 days after the procedure (162,164). Co-amoxiclav/amoxicillin (metronidazole or clindamycin in those allergic to penicillin) are generally the drugs of choice (98,162)
- The use of **alcohol-free chlorhexidine gluconate mouthwash** 0.2% prior to dental extractions to reduce the risk of developing ORN has also been advocated; however, the evidence for this approach is **unclear** (165)
- Insertion of **plasma rich in growth factor** (PRGF) into the dental socket post-extraction has also been proposed in patients at risk of MRONJ but the **evidence regarding its efficacy is limited** (166)

5.13 Osteoradionecrosis of the jaw

Incidence of ORN

- Although not consistently reported, the incidence of ORN with **pre-radiotherapy** dental extractions is estimated to be **2.2-4.85%**, compared to the **post-radiotherapy** dental extraction incidence to be **4.4-5.8%** (33,95)
- The relatively "**safe time frame**" for dental extractions carried out **post radiotherapy** has been proposed as **1 to 6 months**, based upon research of the pathogenesis of ORN (33,167). A **bimodal pattern** of **trauma-induced ORN** is suggested, peaking at **12 months** and again at **24–60 months after radiotherapy**
- With the advent of highly accurate **intensity modulated radiotherapy** (**IMRT), a marginal difference** in the associated risk of osteoradionecrosis after dental extractions prior to or after radiotherapy

treatment has been described (96). This finding is impacted by the standardised use of **pre-IMRT dental evaluation** which has reduced the risk of dental extractions being required after radiotherapy – hence pre-radiotherapy dental extractions remain the standard procedure to prevent dental complications from IMRT

- **PBT** is being increasingly used in the management of head and neck cancers with emerging evidence suggesting a high incidence of ORN in patients with oral and oropharyngeal cancers receiving this treatment modality (10.6%) (168). Until further evidence is available, this group of patients should be **treated as high risk for development of ORN** with a multimodal approach employed to manage risk

Pathophysiology of ORN

- **ORN is one of the most severe and debilitating** complications following radiation therapy for head and neck cancer patients and remains a major complicating factor in quality of life following surgery or trauma to a previously irradiated maxilla or more commonly, mandible.
- Radiation-induced fibrosis, endarteritis and periarteritis in the irradiated area create hypovascularity, hypoxia and hypocellularity.
- This results in tissue breakdown as collagen lysis and cell death are greater than cell replication in a process characterised by destruction of osteocytes, absence of osteoblasts and lack of newly formed osteoid tissue.
- It is evident that this described process, rather than infection, contributes to bone death (152,169–171).

Presentation of ORN

- ORN is characterised by deep-seated bone pain often with a purulent discharge that may include sequestrated bone and may result in significant bone loss.
- If treated inadequately or left untreated, it can be severely debilitating and significantly impair quality of life (172,173).

Staging of ORN

- **Several staging or scoring systems of ORN** have been proposed with over 9 published definitions and at least 16 diagnostic/staging systems (174)
- This **variability** has contributed to inaccurate estimation of incidence, reporting ambiguity, and likely under-diagnosis worldwide (175).
- An example of the basic criteria for staging of ORN is outlined below (176):

Stage of ORN	Description
Stage 0	• Mucosal defects only; bone exposed
Stage I	• Radiological evidence of necrotic bone, dento-alveolar region only
Stage II	• Positive radiographic findings above the ID canal with denuded bone intraorally
Stage III	• Clinically exposed radionecrotic bone, verified by imaging techniques below the level of the ID canal, along with possible skin fistulas and infection with addition of potential or actual pathological fracture. • Radiological evidence of bone necrosis within the radiation field, where tumour recurrence has been excluded

Management of ORN

General Recommendations

- There is currently **no effective treatment** for osteoradionecrosis and this can adversely affect the quality of life for patients
- It is critical to ensure that the bony changes are not due to **malignancy**
- Once this is confirmed, a clinical diagnosis of ORN can be established and the **staging** established
- Early intervention with **pharmacological methods**, combined with conservative surgical management, is suggested to improve the prognosis of ORN (177)
- **Key initial management strategies include:**
  - Minimisation of oral trauma by implementation of a soft diet and adjustment or removal of any denture that could be contributing to trauma
  - Ensuring a high standard of oral hygiene is maintained
  - Local measures are employed to relieve symptoms including topical/systemic analgesia
- **In addition:**
  - Initial results for the therapeutic use of **antioxidant medication** may be of significant benefit in ORN lesions identified early and the evidence base for this is still developing. Pentoxifylline and tocopherol with clodronate (**PENTOCLO**) is emerging as a

promising treatment option in ORN management and although the evidence base continues to develop, currently definitive recommendations cannot be made due to a lack of randomised controlled trials supporting the use of these drugs. Furthermore, PENTOCLO is unlikely to be available for use in a primary care setting and prescribing in secondary care may be restricted based on local prescribing guidelines and protocols

- High dose **systemic broad-spectrum antibiotics** should be prescribed if there are signs/symptoms of persistent infection
- **Sequestra and other debris** should be removed from intra-oral defects - this treatment also facilitates sampling of material for culture & histopathology to ensure the non-malignant nature of the tissue and the specificity and sensitivity of the microbial population to antimicrobial therapy
- **Localised surgical excision** of exposed necrotic bone, with possible primary mucosal coverage, should be considered where appropriate
- In advanced chronic cases, the extent of involvement of bone necrosis must be established via imaging **cone beam CT**, with the potential additional use of chemical markers, such as tetracycline (178)
- This is then followed by **radical ablative surgery** to remove all the necrotic bone and soft tissue, including hemi-mandibulectomy and reconstruction with either a pedicle or microvascular free flap (79,85,86)
- The evidence regarding the use of **hyperbaric oxygen** remains limited. Hence it is not possible to make a recommendation regarding its use
- **Further dental extractions** are to be avoided where possible, particularly in the mandible (87,88).

Antioxidants for the management of ORN

- **Pentoxifylline and tocopherol with or without clodronate** (PENTO/PENTOCLO) has emerged as a viable treatment option in the management of ORN (89,90)
- The evidence base for using these drugs is developing but at present there is a **lack of randomised controlled clinical trials** supporting their use of these drugs.
- The antioxidant agent pentoxifylline (PTX) facilitates microcirculation, inhibits inflammatory mechanisms and promotes fibroblast proliferation and formation of extracellular matrix.
- Tocopherol (vitamin E) protects the cell membrane against peroxidation. A synergic effect has been observed between PTX and tocopherol in the treatment of ORN.

- These are accessible, well-tolerated and considered safe drugs at a suggested daily dosage of: PTX 800mg/day and vitamin E 1000 IU/day.
- Any units using these drugs for the management or prevention of ORN should regularly **audit their patient outcomes** (91,92).

Antibiotics for the management of ORN

- **High dose, broad spectrum antibiotic regimes** such as amoxicillin with clavulanic acid (where the patient is not allergic to penicillin) should be instigated when symptomatic ORN is diagnosed and should be continued until a definitive treatment outcome or symptom relief is achieved.
- Persistent infections require a **microbiology swab** to aid antibiotic regime choice. In chronic cases, the presence of Actinomycoses must be considered as this will alter the dynamics of treatment protocols (93).
- It is recommended that antibiotic treatment is also initiated prior to surgery, continued through the surgical phase of ORN management and also post-surgery until mucosal integrity has been achieved (99,162,173)

Hyperbaric oxygen for the management of ORN

- Hyperbaric oxygen (HBOT) involves breathing oxygen under increased atmospheric pressure in a specially designed chamber. It is used as a treatment to improve oxygen supply to damaged tissue and stimulates healing.
- Although there is no clear evidence that HBOT reduces the chance of ORN following tooth extraction in an irradiated field (70), or patients with late radiation tissue injury (LRTI) affecting tissues of the head, & neck, HBOT may be associated with improved outcome (70,94)
- However, this should be balanced against a potentially increased risk of tumour recurrence in patients who receive HBOT (94,95)

5.14 Medication related osteonecrosis of the jaw

Incidence of MRONJ

- MRONJ can occur as a result of medications commonly used in the treatment of some cancers.
- The incidence of MRONJ in adults receiving these medications has been reported as between 1.6%-14.8%, including spontaneous cases and those following invasive dental procedures.
- The risk of MRONJ following dental extraction in patients who have received antiresorptive agents for cancer treatment has been estimated to be 2.9% (57), and most commonly accepted to be <5% (61).

Presentation of MRONJ

- MRONJ is an area of exposed bone or bone that can be probed through an intraoral or extraoral fistulae in the jaw, persisting for more than 8 weeks with no history of radiation therapy or metastatic disease to the jaw, while having current or previous antiresorptive therapy alone or in combination with immune modulators or antiangiogenic medications used in the management of some cancers, such as bone cancers, myeloma and metastases (61).
- As detailed in **section 2.8** there is **very little evidence of incidence of MRONJ in children** following bisphosphonates, denosumab, or bevacizumab therapy (57–59).

Staging of MRONJ

- A staging system should be used to classify the extent of existing MRONJ. The most commonly used system has been described by the American Association of Oral and Maxillofacial surgery (61)

Stage of MRONJ	Description
At Risk	• No apparent necrotic bone in patients who have been treated with oral or intravenous bisphosphonates
Stage 0	• No clinical evidence of necrotic bone but nonspecific clinical findings, radiographic changes, and symptoms. • It has been reported up to 50% of patient progress to stage 1 and therefore, it may be prudent to consider this stage a precursor to MRONJ.
Stage 1	• Exposed and necrotic bone or fistulas that probes to bone in patients who are asymptomatic and have no evidence of infection
Stage 2	• Exposed and necrotic bone or fistulas that probes to bone associated with infection as evidenced by pain and erythema in the region of exposed bone with or without purulent drainage

Stage 3	• Exposed and necrotic bone or a fistula that probes to bone in patients with pain, infection, and ≥ 1 of the following: - Exposed and necrotic bone extending beyond the region of alveolar bone (i.e. inferior border and ramus in mandible, maxillary sinus, and zygoma in maxilla) resulting in pathologic fracture, extraoral fistula, oral antral or oral nasal communication, or osteolysis extending to the inferior border of the mandible or sinus floor.

Management of MRONJ

General recommendations

- There is currently **no effective treatment** for MRONJ and this can adversely affect the quality of life for patients
- Various preventive and treatment strategies have been proposed but the evidence regarding their efficacy is currently low evidence (57)
- It is critical to ensure that the bony changes are not due to **malignancy**
- Once this is confirmed, a clinical diagnosis of MRONJ can be established and the **staging** established
- Suggested management for the treatment of MRONJ is stage specific and can be classified into non-surgical and surgical treatment
- **Non-surgical treatment** options include: antiseptic treatment (chlorhexidine mouthwash), antibiotics, drug treatment with teriparatide, pentoxifylline and α-tocopherol in combination with anti-microbial therapy, ozone therapy, hyperbaric oxygen, low level laser therapy and platelet rich plasma
- **Surgical treatment** options include: sequestrectomy, debridement, resection, immediate reconstruction and extraction of teeth within exposed necrotic bone. Autofluorescence-guided versus tetracycline fluorescence-guided bone surgery has also been described
- Adopting a **non-imperative approach to MRONJ** has been found to not uniformly result in sequestration of the exposed necrotic bone
- Thus, **early operative intervention for stage 1 and 2** should be explored and presented as a treatment option in an attempt to reduce progression of disease, with recognition that early surgical intervention can predict beneficial patient outcomes (61)
- Further dental extractions are to be avoided where possible, particularly in the mandible (87,88)

5.15 Viral Infections

General recommendations

- Patients receiving cancer therapy, particularly chemotherapy, may be at risk of viral infections
- Adults receiving **bone marrow transplants** often receive aciclovir as a **prophylaxis** if there is a high risk of viral infections
- **Anti-viral medication** is usually prescribed by the oncology team (190–192)
- Despite this, viral infections, such as those caused by **herpes simplex virus** (HSV-1; HSV-2) and **varicella-zoster virus** (VZV/HHV-3), can present in the **facial and oral tissues**
- These may be **primary** infections, or due to **reactivation** of latent virus when an individual is immunocompromised
- If there are **signs or symptoms** of possible viral infection in patients undergoing cancer therapy, the oncology/haematology team should be alerted so that they can **urgently review**
- **Herpes labialis** can be a chronic problem and requires timely management - topical acyclovir may be effective

Herpes simplex viral infections

- Prophylactic aciclovir and valaciclovir are equally effective (193,194).
- Higher oral and intravenous (IV) doses may be considered to improve efficacy (194).
- Valacyclovir may be more cost-effective compared to acyclovir prophylactic treatment due to its greater bioavailability, which means that fewer doses are needed to maintain adequate blood levels (193).
- Herpetic infection post-chemotherapy and stem cell transplantation can be managed effectively and safely with acyclovir with more limited evidence for valacyclovir (193).

Varicella-zoster viral infections

- Oral aciclovir (400 mg daily up to three times a day) is the preferred option for preventing VZV reactivation; IV aciclovir may be used for those unable to take via oral administration.
- Further research is needed to confirm the effectiveness of valaciclovir and determine the best IV dosing strategy (195).

Herpes labialis

- Whilst multiple treatment options have been proposed for herpes labialis, aciclovir and derivatives remain the gold standard for prevention and treatment, including for immunocompromised patients.
- For aciclovir resistance, cidofovir and foscarnet are alternatives to consider, although there is limited evidence on efficacy (196).
- Others management options include cryotherapy, lip moisturizers/barriers and low-level laser therapy
- Limited evidence for supplements (L-lysine, zinc, vitamin D, low arginine diet, probiotics), levamisole, penciclovir, famciclovir, foscarnet.
- Considerations should be given to lifestyle modifications, such as preventing long sun exposure, stress management, avoidance of harmful social habits and healthy diet (197).

5.16 Fungal infections

General recommendations

- There is **increased risk of oral fungal infection** in patients receiving chemotherapy and/or radiotherapy (198). Anti-fungal medication is used following detection of oral candida (199)
- **Denture hygiene is very important** if there is fungal infection - dentures should be cleaned with a toothbrush/nailbrush and soaked in chlorhexidine mouthwash or dilute sodium hypochlorite. Miconazole oral gel should be applied to the fit surface prior to re-insertion, provided it is not contraindicated (200)

- For novel modalities such as ivosidenib, lestaurtinib, quizartinib, and venetoclax, there is low evidence of the need of antifungal prophylaxis for acute myeloid leukaemia for adults. The recommendation is currently strictly based on individual context and conditional for cases in combination with intensive induction CT, showing relapsing or refractory infection present (201).
- Topical agents may be preferred to systemic agents due to lower risk of side effects (202).
- However, there are inconsistent results of efficacy of topical agents and some oncology centres advise that systemic antifungal agents are preferable, and each patient's risk should be identified before they are prescribed (198,203).
- Furthermore, nystatin is not recommended in immunodepressed patients as there is no evidence of its efficacy in this patient cohort (204).
- Systemic agents have more consistent efficacy and fluconazole is recommended for moderate or severe oropharyngeal candidiasis or unresponsive infection (199,203).
- The following antifungal regimes are recommended in adults (200,205):

*Antifungal treatment	Dose/duration
Nystatin (not suitable for immunodepressed patients)(204)	• 100,000 units per ml four times daily for at least 7 days and 48 hours after resolution (198,199) • Ideally sugar-free preparations should be used as nystatin to avoid an increased risk of dental caries
****Miconazole oromucosal gel**	• 20mg/g applied four times daily continued for 7 days or 48 hours after resolution is an alternative (200,202)
****Fluconazole**	• 200mg-400mg for 1 dose, then 100mg-200mg once daily for 7-21 days (206)

*For children appropriate recommended doses should be used as per the British National Formulary (205)

**Miconazole and fluconazole are contraindicated in patients taking warfarin and patients with acute porphyria. They should be used with caution in patients taking statins, due to risk of myopathy and rhabdomyolysis

5.17 Mucositis

General recommendations

- **Regular assessment** of the mouth should be undertaken to record the presence and severity of mucositis
- Every effort is made to **reduce the severity and control oral discomfort**
- It is recommended that clinicians use the World Health Organization (WHO) **oral mucositis grading scale** to assess severity, as it incorporates both subjective and objective measures (207–209)

WHO Grade	Clinical Features
0	No mucositis
1	Soreness/erythema
2	Erythema and ulcers but able to tolerate solid diet
3	Unable to tolerate solids but able to tolerate liquids
4	Unable to tolerate solids or liquids Oral alimentation is not possible

- There is currently **no consensus on a best protocol** for the prevention and management of mucositis, although several multiagent interventions have demonstrated some benefit (210) – hence for adult patients, potential interventions should be **selected based on the best available evidence and individual clinical needs**, as summarised below:

Intervention	Details
Mucosal shields/IMRT	• Decreases severity of mucositis (211)
Intensive oral hygiene	• Reduces mucositis (210–212)
Reduction of trauma	• Correction of poorly fitting dentures or sharp teeth may exacerbate symptoms and should be corrected (211)
Benzydamine hydrochloride 0.15% mouthwash	• Reduces the frequency and severity of mucositis and is recommended. • A regime of 15ml four to eight times daily starting before radiotherapy and or chemotherapy, and continuing during and for two to three weeks afterwards is recommended
Chlorhexidine 0.2% mouthwash	• Has not been shown effective and is not recommended for prevention or treatment of mucositis (64,115–118)

	• May help reduce secondary infection where the mucosal surface is not intact but can be poorly accepted due to discomfort
Lidocaine mouthwash 2mg in 1ml (0.2% w/v)/10% spray	• Palliative management: may reduce pain (212) • Relatively short action – used 4-6 times daily • Care not to anaesthetise the pharynx before meals due to the risk of choking
Morphine mouthrinse 2%/systemic morphine	• Mouthwash 2% may be helpful prior to eating • Topical morphine 0.2% can reduce mucositis severity (not pain) in head and neck cancer patients treated with radiotherapy and/or chemotherapy (213) • Systemic morphine can be helpful for pain control
Vitamins, minerals, and nutritional supplements	• Evidence against the use of parenteral glutamine for HSCT patients due to reported higher mortality (214) • Oral glutamine may be of benefit in head and neck cancer patients
Sucralfate	• Mucosal coating agent is not recommended for prevention of mucositis related to radiotherapy and/or chemotherapy (116,214)
Zinc	• No longer recommended following all modalities of cancer treatments (214).
Oral cooling/ Cryotherapy	• Recommended where mucositis inducing chemotherapeutic agents are used (e.g. 5-FU) • May be of benefit for patients undergoing autologous HSCT with high-dose melphalan conditioning protocols or patients receiving bolus 5-FU chemotherapy (116,215,216)
Other topical agents	• Antimicrobial pastes or lozenges, prostaglandins, corticosteroids, sucralfate, allopurinol, acyclovir, doxepin not recommended (213,217,218)

Fentanyl: patches or intranasal	• Not recommended for the treatment of mucositis-associated pain in H&N and haematological cancer patients (213)
Muco-adhesive oral rinses and gels (e.g. Gelclair®)	• Limited efficacy and not recommended (219,220)
Photobiomodulation – PBM **(previously referred to as low-level laser treatment)**	• Good quality evidence to support the use of PBM for the management of oral mucositis in both paediatric and adult populations (221–223) • Emerging evidence for the prevention and management of oral mucositis in paediatric and young patients with cancer or undergoing HSCT, improving risk, severity and pain (67). • Barriers due to lack of awareness, resources, training, environmental context, and healthcare professionals' concerns regarding patient acceptability (69)

5.18 Xerostomia

General recommendations

- Every effort should be made to reduce the effect of the xerostomia for quality of life and prevention of oral disease
- For patients who receive radiation therapy for head and neck cancer, tissue-sparing radiation modalities (e.g. IMRT) should be employed to reduce the risk of salivary gland hypofunction and xerostomia when possible (224)
- **After cancer therapy**: topical mucosal lubricants, saliva substitutes, and sugar-free lozenges or chewing gum may be of benefit, but there is no consensus of best protocol
- **For patients with head and neck cancer**, oral pilocarpine and oral cevimeline, acupuncture, or transcutaneous electrostimulation may be offered after radiation therapy (225)
- **Fluoride use is recommended** to minimise the risk of dental caries due to hyposalivation increases the risk of **dental caries** (see section 5.4)
- **Lubrication of the soft tissues is recommended:** oral gel or lubricants (e.g. petroleum jelly-based products (Vaseline) or emollients (e.g. Cetraben®) are useful to coat and protect the lips and soft tissues
- Multiple approaches have been suggested to reduce the severity of xerostomia but there is no consensus of best protocol. The following strategies and recommendations have been summarised by this guidance based on available evidence:

Intervention	Details
Reducing damage to the salivary glands:	
Minimising the dose of radiotherapy to the parotid glands	• The use of IMRT is encouraged as has been shown to improve xerostomia-related quality of life (14,224,226–228)
Bethanechol chloride	• During radiation therapy for head and neck cancer may reduce the risk of xerostomia (224,229)
Amifostine	• Given alongside radiotherapy has been shown to protect the salivary glands, with patients experiencing minor benefits; however there are significant side effects, and it is not routinely recommended (14,224,226,230)
Acupuncture	• During radiation therapy for head and neck cancer may reduce the risk of xerostomia (224,229)
Salivary stimulation:	
Sugar free chewing gum	• May be recommended where there is some salivary function although there is a limited evidence base (14,231)
Acidic pastilles	• Should be used with caution as these may cause tooth erosion and sensitivity (e.g. Salivix® (Provalia®); SST® (Medac) (232)
Oral pilocarpine, and cevimeline	• Where available, may be offered after radiation therapy in patients with head and neck cancer for transitory improvement of xerostomia and salivary gland hypofunction by stimulating residual capacity of salivary gland tissue • However, improvement of salivary gland hypofunction may be limited (224)
Acupuncture	• There is low quality evidence that results in a small increase in saliva/ reduction of post-

	radiotherapy subjective dry mouth (14,232–234) • It has minimal side effects and clinical trials are recommended
Sodium-hyaluronate mouthwash	• Limited reported improvement in subjective dry mouth scale, quality of life and patient satisfaction (235)
Natural enzyme mouthwash	• Whilst well-tolerated and safe, there is insufficient benefit on subjective dry mouth symptoms and high variability and non-clinically significant improvement of salivary flow measures with short term follow up (236). Hence not currently recommended
Photobiomodulation – PBM **(previously referred to as low-level laser treatment)**	• Limited evidence of impact of for post radiotherapy xerostomia in quality of life and insufficient evidence in improving objective salivary flow (237)
Saliva substitution:	
General principles	• For many patients, saliva replacement is the only option • However, saliva is difficult to replicate and there are several substitutes with little indication of which is most effective (238) • Many patients use frequent sips of water (ideally non-carbonated and without acidic flavouring) • There is some evidence that substitutes may improve patient's perception of xerostomia • Avoid formulations in dentate patients which are acidic e.g. Glandosane • Consideration should be given as to whether the substitutes contain fluoride • If a preparation without fluoride is used, a fluoride mouthwash should also be used daily in dentate patients • Gels may have longer duration of benefit

	• It is important to note that some products contain animal derived ingredients which need to be considered in the context of religion and allergies/intolerances • Patients may sample alternative therapies to assess which suits them best
Examples of substitutes	• Saliva orthana® (ASPharma) (contains porcine mucin; contains fluoride) • Biotène® Oral Balance Gel (GSK) (updated formulation is not acidic; contains milk, egg white) • BioXtra® products (RIS) contain milk, egg white; some contain fluoride) (239)

5.19 Trismus

General recommendations

- Despite better focused radiation dose and improved screening, progressive jaw stiffness and limitation of opening remain **common complications** after **radiotherapy and/or surgery to the head and neck region** and should be monitored (240)
- The team should be **vigilant that this is not due to a local recurrence, metastatic lesions in the head and neck region and/or a second malignant lesion** (241)
- There is no clear consensus as to optimal intervention for trismus (242)
- A variety of **exercise regimens and jaw rehabilitation devices have been proposed**
- Low-level laser therapy and low-intensity ultrasound coupled with exercise may be beneficial (242)
- **Starting therapy for trismus early and compliance** with exercises improves treatment outcome (243)
- Multiple approaches have been suggested as outlined below:

Intervention	Details
Physical Therapy	• This includes passive and active jaw stretching exercises, and the use of devices for stretching the muscles of mastication e.g. TheraBite® jaw motion rehabilitation system, Dynasplint Trismus System®, and stacked tongue depressors, are the mainstay of treatment (241)

	• There is conflicting evidence of the relative effectiveness each of these approaches (243,244) • A more recent study demonstrated better interincisal opening (MIO) using a jaw device compared to exercise only; however, it did not appear to prevent trismus (245) • Another systematic review demonstrated that the improvement of MIO with jaw exercise regimes (jaw device, stretching and mouth opening) is comparable to that achieved with approaches such as ultrasound, laser therapy and more frequent clinical follow up (245) • Wooden spatulas have not shown different mouth opening outcomes when compared to TheraBite® device (242)
Drug Therapy	• There is weak evidence that pentoxifylline may be effective by improving microcirculation and tissue oxygenation (246)
Botulinum toxin	• May reduce pain associated with trismus, although it does not improve mobility (247)
Coronoidectomy	• May be considered to increase the range of motion (248) • Increasing levels of trismus should be investigated for potential local recurrence (241)

Table 1: Oral Care Guidance for the Nursing Team

Prior to Cancer Therapy	**Nursing Action**
1. **Ensure all patients have a comprehensive dental assessment before starting cancer therapy**	• Advise patients on the importance of a dental assessment • Patients should be identified for dental assessment at the multidisciplinary meeting and an urgent dental assessment arranged • Liaise with the dental team to develop and implement an individual care plan • Importance of oral hygiene and prevention should be advised and patient supported as needed (35)
2. **Advise on the oral side effects of treatment**	• Provide written information on side effects of cancer treatments (patient information leaflets) • Give support and encouragement • Give information about support groups available*
3. **Preventive advice**	• Dietary advice in liaison with the dental team and Dietitian • Provide written information/resources to patient (patient information leaflets)
During Cancer Therapy	Nursing Action
1. Maintenance of oral hygiene	• Provide oral care advice and assistance where appropriate • If patient wears denture, follow denture care advice and assist patient as needed (57)
2. Inspection of the oral cavity should be carried out daily	• Complete an oral assessment daily as part of the patient's individual care plan; contact the dental team for guidance prior to completion if required • Document findings in the patient's individual care plan daily to monitor any changes, e.g. signs of mucositis, ulcers, viral infections (64) • Refer to the dental team when indicated
3. Monitor compliance in performing oral care	• Supervise and provide assistance; give instructions to carers where appropriate • Give support and encouragement

4. Pain control	• Give topical/systemic analgesia, as directed
5. Oral candida infections (Thrush)	• Give topical/systemic antifungal agents, as prescribed • If chlorhexidine mouthwash is used alongside topical nystatin stagger its use by 1 hour (note: nystatin is not effective in immunodepressed patients (204)) • Ensure patient is cleaning any removable appliances and advise removal at night (200)
6. Manage xerostomia (dry mouth)	• Give advice to help patients with a dry mouth • Confirm that a recommended saliva substitute is prescribed and refer for further management as appropriate (225)
After Cancer Therapy	**Nursing Action**
1. Arrange follow up visit to the dental team	• Provide the patient or carer with contact information for the dental team • Liaise with dental team to ensure a follow up appointment has been arranged • To ensure follow up occurs when the patient is discharged, an oral care entry should be made in the summary notes/discharge letter
2. Reinforce preventive messages	• Provide equipment for home care where appropriate • Continue to provide smoking cessation support (137) • Ensure patient has dental follow up arranged, use of fluoride-based treatments recommended to reduce risk of dental caries (113) • Ensure the patient information leaflet has been provided to support the advice given

***** Advise Support Groups examples: Cancer BACUP: Changing Faces: Let's Face It; Macmillan Cancer Support, National Cancer Institute: Support for People with Cancer

Table 2: Acute changes during cancer therapy

Acute Change	Explanatory Notes	Radiotherapy	Chemotherapy Immunotherapy Haematopoietic Stem Cell Transplant (HSCT)
1. Mucositis	• Acute inflammation of the mucosa • White/yellow fibrinous slough, often with ulceration • Painful to speak/eat/swallow • Portal for microbial entry • Healing complete around 2-3 weeks post cancer therapy • Important to correct any ill-fitting removable prosthesis to prevent mucosal trauma	• Onset 12-15 days after radiotherapy commencement	• Onset usually 1 week after start of cancer treatment • Ulceration often severe
2. Blood Changes	• Anaemia • Neutropenia • Thrombocytopenia • Present from commencement of cancer therapy until up to 4 weeks post therapy		• Spontaneous gingival/mucosal bleeding • Crusting of lips
3. Immuno-suppression	• Increases susceptibility to bacterial/candidal/viral disease • Exacerbates pre-existing periodontal disease		• Any infections in the mouth can spread and become a medical emergency
4. Changes in Salivary Flow/ Composition	• Saliva becomes thick, viscous, acidic • Xerostomia results but is less common in children • Onset within 14 hours of cancer therapy	• Xerostomia can be prolonged • Can last up to 2 years post therapy or be a permanent side effect	• Salivary flow usually returns to normal within 2 months

5. Acute Ascending Sialadenitis	• Occurs as a complication of xerostomia	• Has been described in children	
6. Altered Taste (Dysgeusia)	• Onset on treatment commencement • Related to xerostomia and direct damage to taste buds • Sense of taste often returns with an unpleasant interim period of altered taste • Important to seek advice from Dietitians as (1) the sense does not always return and (2) untreated dysgeusia can affect prognosis	• Can be profound due to xerostomia	• Chemotherapy: variable in relation to the cancer regime used • HSCT: due to chemotherapy and exacerbated by radiotherapy that involved the salivary glands
7. Difficulty Swallowing (Dysphagia)	• As a result of mucositis and xerostomia	• Can be very severe due to extensive ulceration	
8. Changes in Oral Flora	• Due to reduced antibacterial action of saliva • Increase in cariogenic organisms within 2 weeks of cancer therapy • Increased susceptibility to candidal/viral infections	• Oral candidiasis more likely • Implications for increased dental caries	• Oral candidiasis: pseudomembranous candidiasis with ulceration and acute herpetic gingivostomatitis may occur • Cytomegalovirus and Varicella zoster virus infections have also been described • If persistent, indicative of systemic involvement

9. Periodontal/ Gingival Disease	• Can be exacerbated by oral flora changes, mucositis, xerostomia and immunosuppression	• Acute gingivitis	• Chemotherapy can result in acute gingivitis and pericoronitis • Important to differentiate gingival changes from leukemic infiltrate and gingival hyperplasia in acute myeloblastic leukaemia
10. Tooth Sensitivity	• Increased risk of tooth wear observed due to bruxism, xerostomia and erosion due to vomiting	• Variably reported and more likely to be reported if there is pre-existing gingival recession	
11. Dental Pain	• Higher risk of pain due to advanced dental caries • May also be related to leukaemic infiltration of dental pulp tissue and direct jaw infiltration	• Higher dental caries risk due to xerostomia may result in dental abscesses	• Toothache-like pain has been described related to vincristine administration (249) • Low white cell counts can cause chronic dental infections to become acute and cause pain
12. Trismus	• Must exclude posterior invasion of carcinoma into pterygomasseteric muscles as a cause	• May be caused by severe mucositis	• May be caused by severe mucositis • Jaw pain may be related to vincristine administration (249)
13. Graft versus Host Disease	• Can occur in an acute form after bone marrow transplantation and be followed by a chronic form		• Can occur in an acute form after HSCT

Table 3: Chronic Changes Following Therapy

Chronic Change	Explanatory Notes	Radiotherapy	Chemotherapy Immunotherapy Haematopoietic Stem Cell Transplant (HSCT)
1. Progressive Endarteritis	• Occurs in irradiated bone, especially the mandible • Can occur in muscle and cause trismus 3-6 months post therapy • Uncommon in children	• Implications for dental extractions/surgery	• Implications for dental extractions/surgery (see Table 4)
2. Blood Changes	• Anaemia • Neutropenia • Thrombocytopenia • Prolonged by maintenance chemotherapy		• Risk of oral infection becoming an acute event when pancytopenia present • Implications for dental treatment
3. Trismus	• Must exclude posterior invasion of carcinoma into pterygomasseteric muscles as a cause • Predominantly due to fibrosis as a direct effect of radiotherapy, but also related to endarteritis	• Predominantly due to fibrosis as a direct effect of radiotherapy	
4. Prolonged Oral Flora Changes	• Increase in cariogenic organisms and candida • Important to correct any ill-fitting removable prosthesis to prevent trauma to mucosa	• Increased susceptibility to dental caries • Candidiasis more likely especially in denture wearers	• Viral infections and candidiasis more likely • Increased susceptibility to dental caries

5. Xerostomia	• Severity is subjective • Can be permanent • May affect wearing of a removable prosthesis • Predisposes to dental caries, halitosis, tooth wear and infection	• More prolonged if parotid glands are in the irradiation field • Salivary output can be maintained by ipsilateral parotid sparing during radiotherapy	
6. Tooth Erosion	• Due to prolonged xerostomia which removes protective action of saliva	• Linked to xerostomia	
7. Osteoradionecrosis	• Serious complication of radiotherapy where bone death occurs in areas irradiated	• Important for patients to have a dental assessment prior to starting treatment to discuss management of sources of dental infection foci	• Some chemotherapy drugs (e.g. cisplatin, fluorouracil, methotrexate, cyclophosphamide) can also cause a dry mouth • For some drugs such as cisplatin (neurotoxic), xerostomia can be longer-term/permanent
8. Periodontal/Gingival Disease	• Can continue to be exacerbated by xerostomia and oral flora changes • Gingival recession	• Rapid progression of periodontal disease	• Maintenance chemotherapy and targeted immunotherapies may increase the risk • Rapid progression of periodontal disease can occur in children
9. Adrenal Suppression	• Can occur as a result of corticosteroid therapy		• Can occur as a result of corticosteroid therapy

Table 4: Haematological Considerations for Invasive Dental Procedures

Venous access lines	
Patients with indwelling central venous access lines (e.g. PICC lines, implantable ports)	There is no clear evidence detailing infection risk for these lines following dental procedures.
Neutrophils: Determined from Full Blood Count within 24-48 hours of planned dental procedure *NB There is no evidence specifying absolute thresholds for neutrophil levels and the need for antibiotic prophylaxis in this population. Evidence-based guidance from the infective endocarditis literature (SDCEP* & AHA+ recommendations) may be transferrable to this population in relation to antibiotic prophylaxis against bacteraemia following invasive dental procedures. The below recommendations are therefore a combination of expert opinion and transferrable evidence-base.*	
Neutrophil level	**Recommendations**
>2.0 x 10^9/L	No antibiotic prophylaxis recommended
1.0-2.0 x 10^9/L	Low risk Liaise with the medical team regarding need for antibiotic prophylaxis Clinical judgment is critical. If infection is present or unclear, prescription of antibiotic prophylaxis may be necessitated.

<1.0 x10^9/L	Increased risk Liaise with the medical team regarding need for antibiotic prophylaxis Antibiotic regimen is guided by the medical team based on existing medications, and known or suspected causative organisms and sensitivities See SDCEP[*] and AHA[†] recommendations for antibiotic selection and dosing in adult and paediatric patients in UK and USA contexts respectively for single pre-operative doses, with evidence transferred from the bacteraemia prevention in the infective endocarditis literature Patients with anticipated chronic neutropenia may require a course of post-operative antibiotics to be prescribed in liaison with the medical team
Platelets: Determined from platelet count Full Blood Count within 24-48 hours of planned dental procedure (a coagulation screen may also be requested depending on advice of the medical team). *NB There is no evidence specifying absolute thresholds for platelet levels for haematological support in this population. The below thresholds and recommendations are based on expert opinion and the British Society for Haematology Guidance on Platelet Transfusion for adults[‡] and the British Committee for Standards in Haematology for paediatric patients[**]* *Recommendations assume that all other coagulation parameters are within normal limits and that platelet counts will be maintained at or above the specified level until initial stabilization/healing has occurred.*	
>50 x 10^9/L	Apply local haemostatic measures as needed Above this threshold, routine platelet transfusion before major dental surgery is **not** recommended
30-50 x 10^9/L	Liaise with the medical team regarding extent and timing of dental treatment and any need for haematological support

	Routinely apply local haemostatic measures (e.g. oxidised cellulose matrices, topical tranexamic acid, sutures) There is limited evidence that simple dental extractions may be controlled with local measures for platelet counts in this range, without the need for platelet transfusion (250)
<30 x 10^9/L	Liaise with the medical team regarding need and delivery of platelet transfusion prior to invasive dental treatment. The precise platelet threshold for platelet transfusion will vary on an individual basis and based on clinical risk factors Delay dental treatment where possible if thrombocytopenia should be transient (e.g. in cyclical chemotherapy) Routinely apply local haemostatic measures (e.g. oxidised cellulose matrices, topical tranexamic acid, sutures) in addition to any planned haematological measures Monitor extraction sites carefully in immediate post-operative period for primary haemostasis.

*Scottish Dental Clinical Effectiveness Programme. Antibiotic Prophylaxis Against Infective Endocarditis [Internet]. 2018 [cited 2025 Jun 9]. Available from: https://www.scottishdental.nhs.scot/sdcep-implementation-advice-on-antibiotic-prophylaxis-against-infective-endocarditis/

†Wilson WR, Gewitz M, Lockhart PB, Bolger AF, DeSimone DC, Kazi DS, et al. Prevention of Viridans Group Streptococcal Infective Endocarditis: A Scientific Statement From the American Heart Association. Circulation. 2021 May 18;143(20).

‡Estcourt LJ, Birchall J, Allard S, Bassey SJ, Hersey P, Kerr JP, Mumford AD, Stanworth SJ, Tinegate H; British Committee for Standards in Haematology. Guidelines for the use of platelet transfusions. Br J Haematol. 2017 Feb;176(3):365-394. Erratum in: Br J Haematol. 2017 Apr;177(1):157.

**New HV, Berryman J, Bolton-Maggs PH, Cantwell C, Chalmers EA, Davies T, Gottstein R, Kelleher A, Kumar S, Morley SL, Stanworth SJ; British Committee for Standards in Haematology. Guidelines on transfusion for fetuses, neonates and older children. Br J Haematol. 2016

References

1. World Health Organisation. Cancer [Internet]. 2025 [cited 2025 Apr 1]. Available from: https://www.who.int/news-room/fact-sheets/detail/cancer?utm_source=chatgpt.com
2. International Agency for Research on Cancer W. Global cancer burden growing, amidst mounting need for services [Internet]. 2022 [cited 2025 Apr 1]. Available from: https://www.who.int/news/item/01-02-2024-global-cancer-burden-growing--amidst-mounting-need-for-services
3. International Agency for Research on Cancer. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Human Papillomaviruses. Lyon (FR) [Internet]. 2007 [cited 2025 Jun 10]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK321760/
4. Cancer Research UK. Cancer risk statistics. [cited 2025 Apr 1]; Available from: https://www.cancerresearchuk.org/health-professional/cancer-statistics/risk
5. International Agency for Research on Cancer. Global Cancer Observatory [Internet]. 2022 [cited 2025 Apr 1]. Available from: https://www.who.int/news/item/01-02-2024-global-cancer-burden-growing--amidst-mounting-need-for-services
6. Steliarova-Foucher E, Colombet M, Ries LAG, Moreno F, Dolya A, Bray F, et al. International incidence of childhood cancer, 2001–10: a population-based registry study. Lancet Oncol. 2017 Jun;18(6):719–31.
7. Cancer Research UK. Children's and young people's cancers statistics. [cited 2025 Apr 2]; Available from: https://www.cancerresearchuk.org/health-professional/data-and-statistics/cancer-statistics/childrens-and-young-peoples-cancers-statistics
8. Robinson N, Casement J, Gunter MJ, Huybrechts I, Agudo A, Barranco MR, et al. Anti-cancer therapy is associated with long-term epigenomic changes in childhood cancer survivors. Br J Cancer. 2022 Jul 20;127(2):288–300.
9. Roganovic J. Late effects of the treatment of childhood cancer. World J Clin Cases. 2025 Mar 6;13(7).
10. Brennan MT, Elting LS, Spijkervet FKL. Systematic reviews of oral complications from cancer therapies, Oral Care Study Group, MASCC/ISOO: methodology and quality of the literature. Supportive Care in Cancer. 2010 Aug 20;18(8):979–84.
11. Herrstedt J. Prevention and management of mucositis in patients with cancer. Int J Antimicrob Agents. 2000 Oct;16(2):161–3.
12. Haag DG, Peres KG, Balasubramanian M, Brennan DS. Oral conditions and health-related quality of life: a systematic review. J Dent Res. 2017;96(8):864–74.
13. Saintrain MV de L, de Souza EHA. Impact of tooth loss on the quality of life. Gerodontology. 2012;29(2):e632–6.
14. Jensen SB, Pedersen AML, Vissink A, Andersen E, Brown CG, Davies AN, et al. A systematic review of salivary gland hypofunction and xerostomia induced by cancer therapies: prevalence, severity and impact on quality of life. Supportive Care in Cancer. 2010 Aug 17;18(8):1039–60.
15. Aguilar ML, Sandow P, Werning JW, Brenneman L, Psoter WJ. The Head and Neck Cancer Patient Concern Inventory © : Patient Concerns' Prevalence, Dental Concerns' Impact, and Relationships of Concerns with Quality of Life Measures. Journal of Prosthodontics. 2017 Apr 21;26(3):186–95.
16. Abed H, Reilly D, Burke M, Daly B. Patients with head and neck cancers' oral health knowledge, oral health-related quality of life, oral health status, and adherence to advice on discharge to primary dental care: A prospective observational study. Special Care in Dentistry. 2019 Nov 6;39(6):593–602.
17. PDQ Supportive and Palliative Care Editorial Board. Oral Complications of Cancer Therapies (PDQ®): Health Professional Version [Internet]. 2024 [cited 2025 Jun 9]. Available from: https://www.cancer.gov/about-cancer/treatment/side-effects/mouth-throat/oral-complications-hp-pdq#_1420

18. Olofsson R, Korytowska M, Almhöjd U, Almståhl A, Cevik-Aras H. Oral health, dental treatment, and medication related osteonecrosis of the jaw in multiple myeloma – a longitudinal cohort study. BMC Oral Health. 2024 Feb 5;24(1):184.
19. Kelly SL, Jackson JE, Hickey BE, Szallasi FG, Bond CA. Multidisciplinary clinic care improves adherence to best practice in head and neck cancer. Am J Otolaryngol. 2013 Jan;34(1):57–60.
20. Shiraz F, Rahtz E, Bhui K, Hutchison I, Korszun A. Quality of life, psychological wellbeing and treatment needs of trauma and head and neck cancer patients. British Journal of Oral and Maxillofacial Surgery. 2014 Jul;52(6):513–7.
21. Wells M, Cunningham M, Lang H, Swartzman S, Philp J, Taylor L, et al. Distress, concerns and unmet needs in survivors of head and neck cancer: a cross-sectional survey. Eur J Cancer Care (Engl). 2015 Sep;24(5):748–60.
22. Rathod S, Livergant J, Klein J, Witterick I, Ringash J. A systematic review of quality of life in head and neck cancer treated with surgery with or without adjuvant treatment. Oral Oncol. 2015 Oct;51(10):888–900.
23. UK Paediatric BMT Group. Indications for HSCT in Children- [Internet]. 2022 [cited 2025 Apr 2]. Available from: https://bsbmtct.org/wp-content/uploads/2023/02/Paeds-BMT-indications-2022.pdf
24. Butterworth C, McCaul L, Barclay C. Restorative dentistry and oral rehabilitation: United Kingdom National Multidisciplinary Guidelines. J Laryngol Otol. 2016 May 12;130(S2):S41–4.
25. Cocks H, Ah-See K, Capel M, Taylor P. Palliative and supportive care in head and neck cancer: United Kingdom National Multidisciplinary Guidelines. J Laryngol Otol. 2016 May 12;130(S2):S198–207.
26. Nekhlyudov L, Lacchetti C, Davis NB, Garvey TQ, Goldstein DP, Nunnink JC, et al. Head and Neck Cancer Survivorship Care Guideline: American Society of Clinical Oncology Clinical Practice Guideline Endorsement of the American Cancer Society Guideline. Journal of Clinical Oncology. 2017 May 10;35(14):1606–21.
27. McCaul LK, Barclay S, Nixon P, Yule PL, Trainor J, Stevenson B, et al. Oral prehabilitation for patients with head and neck cancer: getting it right - the Restorative Dentistry-UK consensus on a multidisciplinary approach to oral and dental assessment and planning prior to cancer treatment. Br Dent J. 2022 Nov 11;233(9):794–800.
28. Jawad H, Hodson NA, Nixon PJ. A review of dental treatment of head and neck cancer patients, before, during and after radiotherapy: part 2. Br Dent J. 2015 Jan 23;218(2):69–74.
29. Epstein JB, Güneri P, Barasch A. Appropriate and necessary oral care for people with cancer: guidance to obtain the right oral and dental care at the right time. Supportive Care in Cancer. 2014 Jul 28;22(7):1981–8.
30. Shaw MJ, Kumar NDK, Duggal M, Fiske J, Lewis DA, Kinsella T, et al. Oral management of patients following oncology treatment: literature review. British Journal of Oral and Maxillofacial Surgery. 2000 Oct;38(5):519–24.
31. Bertl K, Savvidis P, Kukla EB, Schneider S, Zauza K, Bruckmann C, et al. Including dental professionals in the multidisciplinary treatment team of head and neck cancer patients improves long-term oral health status. Clin Oral Investig. 2022 Mar 18;26(3):2937–48.
32. NHS England. Oral healthcare provision for cancer pathways. A guidance document of clinical and commissioning standards. [Internet]. 2024 [cited 2025 Jun 1]. Available from: https://www.england.nhs.uk/long-read/oral-healthcare-provision-for-cancer-pathways/
33. Beaumont S, Bhatia N, McDowell L, Fua T, McCullough M, Celentano A, et al. Timing of dental extractions in patients undergoing radiotherapy and the incidence of osteoradionecrosis: a systematic review and meta-analysis. British Journal of Oral and Maxillofacial Surgery. 2021 Jun;59(5):511–23.
34. Hansen HJ, Estilo C, Owosho A, Solano AK, Randazzo J, Huryn J, et al. Dental status and risk of odontogenic complication in patients undergoing hematopoietic stem cell transplant. Supportive Care in Cancer. 2021 Apr 8;29(4):2231–8.

35. Lanzetti J, Finotti F, Savarino M, Gassino G, Dell'Acqua A, Erovigni FM. Management of Oral Hygiene in Head-Neck Cancer Patients Undergoing Oncological Surgery and Radiotherapy: A Systematic Review. Dent J (Basel). 2023 Mar 16;11(3):83.
36. Lee HJ, Han DH, Kim JH, Wu HG. The effect of comprehensive oral care program on oral health and quality of life in patients undergoing radiotherapy for head and neck cancer. Medicine. 2021 Apr 23;100(16):e25540.
37. Hong CHL, Hu S, Haverman T, Stokman M, Napeñas JJ, Braber JB den, et al. A systematic review of dental disease management in cancer patients. Supportive Care in Cancer. 2018 Jan 22;26(1):155–74.
38. Aydin YA, Anderson W, Keys W. A Service Evaluation of Dental Assessments Prior to Treatment for Head and Neck Cancer in NHS Grampian. Eur J Prosthodont Restor Dent. 2022 May 29;30(2):121–5.
39. Office for Health Improvement and Disparities D of H and SCNE and NI. Delivering better oral health: an evidence-based toolkit for prevention [Internet]. 2021 Nov [cited 2025 Apr 2]. Available from: https://www.gov.uk/government/publications/delivering-better-oral-health-an-evidence-based-toolkit-for-prevention
40. Scottish Dental Clinical Effectiveness Programme. Prevention and Management of Dental Caries in Children [Internet]. 2025 Feb [cited 2025 Apr 2]. Available from: https://www.sdcep.org.uk/published-guidance/caries-in-children/
41. The Children & Young People's Cancer Association Supportive Care Group. Oral complications: Prevention & management in children and young people with cancer [Internet]. 2025 [cited 2025 Sep 10]. Available from: https://app.sheepcrm.com/cclg/treatment-guidelines/supportive-care/oral-complications/
42. Roocroft L, Dixon C, Shepherd A, Hood C. Oral health assessment of newly diagnosed oncology patients—Who are we missing? Int J Paediatr Dent. 2024 Sep 5;34(S1):59–62.
43. National Institute for Health and Care Excellence. Dental checks: intervals between oral health reviews Clinical guideline: CG19. 2004 Oct.
44. Public Health England. Delivering better oral health: an evidence-based toolkit for prevention [Internet]. 2021 Jun [cited 2022 Jul 28]. Available from: https://www.gov.uk/government/publications/delivering-better-oral-health-an-evidence-based-toolkit-for-prevention
45. Chow EJ, Anderson L, Baker KS, Bhatia S, Guilcher GMT, Huang JT, et al. Late Effects Surveillance Recommendations among Survivors of Childhood Hematopoietic Cell Transplantation: A Children's Oncology Group Report. Biology of Blood and Marrow Transplantation. 2016 May;22(5):782–95.
46. Busenhart DM, Erb J, Rigakos G, Eliades T, Papageorgiou SN. Adverse effects of chemotherapy on the teeth and surrounding tissues of children with cancer: A systematic review with meta-analysis. Oral Oncol. 2018 Aug;83:64–72.
47. Defabianis P, Bocca N, Romano F. Prevalence and association of dental anomalies and tooth decay in Italian childhood cancer survivors. Journal of Clinical Pediatric Dentistry. 2023 Sep;47(5):81–7.
48. Sunguc C, Hawkins MM, Winter DL, Dudley IM, Heymer EJ, Teepen JC, et al. Risk of subsequent primary oral cancer in a cohort of 69,460 5-year survivors of childhood and adolescent cancer in Europe: the PanCareSurFup study. Br J Cancer. 2023 Jan;128(1):80–90.
49. UK National Clinical Guidelines in Paediatric Dentistry RC of S of E. Guideline for the Use of General Anaesthesia (GA) in Paediatric Dentistry. 2008 May.
50. Rodd HD, Waterhouse PJ, Fuks AB, Fayle SA, Moffat MA. Pulp therapy for primary molars. Int J Paediatr Dent. 2006 Sep 16;16(s1):15–23.
51. Bezerra PMM, Vieira TI, dos Santos FG, Ribeiro ILA, de Sousa SA, Valença AMG. The impact of oral health education on the incidence and severity of oral mucositis in pediatric cancer patients: a systematic review and meta-analysis. Supportive Care in Cancer. 2022 Nov 1;30(11):8819–29.

52. Palmier NR, Madrid Troconis CC, Normando AGC, Guerra ENS, Araújo ALD, Arboleda LPA, et al. Impact of head and neck radiotherapy on the longevity of dental adhesive restorations: A systematic review and meta-analysis. J Prosthet Dent. 2022 Nov;128(5):886–96.
53. Chua DR, Tan BL, Nazzal H, Srinivasan N, Duggal MS, Tong HJ. Outcomes of preformed metal crowns placed with the conventional and Hall techniques: A systematic review and meta-analysis. Int J Paediatr Dent. 2023 Mar 17;33(2):141–57.
54. Chisini LA, Collares K, Cademartori MG, de Oliveira LJC, Conde MCM, Demarco FF, et al. Restorations in primary teeth: a systematic review on survival and reasons for failures. Int J Paediatr Dent. 2018 Mar 10;28(2):123–39.
55. Tunlayadechanont P, Tunlayadechanont P, Sriudomporn N, Wisetsathon P, Duangthip D, Jirarattanasopha V. Association between dental restorations and artefacts on head magnetic resonance images in paediatric patients. Int J Paediatr Dent. 2024 Sep 9;34(5):546–53.
56. Grippin AJ, Kim A, Liu Y, Copling S, Nalin AP, Crabtree K, et al. Osteoradionecrosis in Pediatric Patients Treated with Proton Therapy for Head and Neck Malignancies. International Journal of Radiation Oncology*Biology*Physics. 2024 Dec;
57. Scottish Dental Clinical Effectiveness Programme. Oral Health Management of Patients at Risk of Medication-related Osteonecrosis of the Jaw [Internet]. 2024 Mar [cited 2025 Apr 2]. Available from: https://www.sdcep.org.uk/published-guidance/medication-related-osteonecrosis-of-the-jaw/
58. Ngan KK, Bowe J, Goodger N. The risk of bisphosphonate-related osteonecrosis of the jaw in children. a case report and literature review. Dent Update. 2013 Nov 2;40(9):733–8.
59. Innes-Taylor D, Adams V. Medication-related osteonecrosis of the jaw in a paediatric patient taking denosumab: a case report. Br Dent J. 2024 Mar 22;236(6):453–6.
60. Sonis ST. Mucositis as a biological process: a new hypothesis for the development of chemotherapy-induced stomatotoxicity. Oral Oncol. 1998 Jan;34(1):39–43.
61. Heggie C, Chauhan A, Gray-Burrows K, Day PF, Phillips B. "It's like being chained up": the oral mucositis experiences of children and young people with cancer, their parents, and healthcare professionals– a qualitative study. Arch Dis Child. 2025 Apr;110(4):287–94.
62. Patel P, Robinson PD, Baggott C, Gibson P, Ljungman G, Massey N, et al. Clinical practice guideline for the prevention of oral and oropharyngeal mucositis in pediatric cancer and hematopoietic stem cell transplant patients: 2021 update. Eur J Cancer. 2021 Sep;154:92–101.
63. Sung L, Robinson P, Treister N, Baggott T, Gibson P, Tissing W, et al. Guideline for the prevention of oral and oropharyngeal mucositis in children receiving treatment for cancer or undergoing haematopoietic stem cell transplantation. BMJ Support Palliat Care. 2017 Mar;7(1):7–16.
64. Hong CHL, Gueiros LA, Fulton JS, Cheng KKF, Kandwal A, Galiti D, et al. Systematic review of basic oral care for the management of oral mucositis in cancer patients and clinical practice guidelines. Supportive Care in Cancer. 2019 Oct 8;27(10):3949–67.
65. Redman MG, Harris K, Phillips BS. Low-level laser therapy for oral mucositis in children with cancer. Arch Dis Child. 2022 Feb;107(2):128–33.
66. Gobbo M, Verzegnassi F, Ronfani L, Zanon D, Melchionda F, Bagattoni S, et al. Multicenter randomized, double-blind controlled trial to evaluate the efficacy of laser therapy for the treatment of severe oral mucositis induced by chemotherapy in children: laMPO RCT. Pediatr Blood Cancer. 2018 Aug 4;65(8).
67. He M, Zhang B, Shen N, Wu N, Sun J. A systematic review and meta-analysis of the effect of low-level laser therapy (LLLT) on chemotherapy-induced oral mucositis in pediatric and young patients. Eur J Pediatr. 2018 Jan 11;177(1):7–17.

68. Heggie C, Chauhan A, Gray-Burrows KA, Day PF, Phillips B. 'All I Had to Do Was Open My Mouth Wide'—A Qualitative Exploration of the Acceptability of Photobiomodulation for Oral Mucositis Management in Paediatric Supportive Care. Pediatr Blood Cancer. 2025 Aug 25;
69. Heggie C, Gray-Burrows KA, Day PF, Phillips B. An exploration of the use of photobiomodulation for management of oral mucositis in children and young people undergoing cancer treatment in the UK. Supportive Care in Cancer. 2022 Dec 9;30(12):10179–90.
70. Shah D, Gupta A, Meena JP, Kumar Gupta A, Velpandian T, Pandey RM, et al. Efficacy and safety of zinc in the prevention of oral mucositis in children with cancer receiving intensified chemotherapy: A randomized double-blind placebo-controlled trial. Pediatr Blood Cancer. 2023 Jul 14;70(7).
71. Hao S, Ji L, Wang Y. Effect of Honey on Pediatric Radio/Chemotherapy-Induced Oral Mucositis (R/CIOM): A Systematic Review and Meta-Analysis. Evidence-Based Complementary and Alternative Medicine. 2022 Mar 18;2022:1–9.
72. Boyer É, Robert G, Gandemer V, Bonnaure-Mallet M. Orthodontic strategies in pediatric oncology. Journal of Dentofacial Anomalies and Orthodontics. 2017 Apr 23;20(1):104.
73. Shivam R, Rogers S, Drage N. An Evidence-based Protocol for the Management of Orthodontic Patients Undergoing MRI Scans. Orthodontic Update. 2021 Jan 2;14(1):32–5.
74. Wishney M. Potential risks of orthodontic therapy: a critical review and conceptual framework. Aust Dent J. 2017 Mar 14;62(S1):86–96.
75. Gawade PL, Hudson MM, Kaste SC, Neglia JP, Constine LS, Robison LL, et al. A systematic review of dental late effects in survivors of childhood cancer. Pediatr Blood Cancer. 2014 Mar;61(3):407–16.
76. Lotwala RB, Greenlee GM, Ott SM, Hall SH, Huang GJ. Bisphosphonates as a risk factor for adverse orthodontic outcomes: A retrospective cohort study. American Journal of Orthodontics and Dentofacial Orthopedics. 2012 Nov;142(5):625-634.e3.
77. Woolley J, Akintola O, Yates J, Calasans-Maia MD, de Albuquerque Calasans-Maia J, Kocherhina I, et al. The risk of osteonecrosis of the jaw and adverse outcomes in patients using antiresorptive drugs undergoing orthodontic treatment: A systematic review. Heliyon. 2021 Jan;7(1):e05914.
78. Hsieh SG, Hibbert S, Shaw P, Ahern V, Arora M. Association of cyclophosphamide use with dental developmental defects and salivary gland dysfunction in recipients of childhood antineoplastic therapy. Cancer. 2011 May 15;117(10):2219–27.
79. Pedersen L, Clausen N, Schroder H, Schmidt M, Poulsen S. Microdontia and hypodontia of premolars and permanent molars in childhood cancer survivors after chemotherapy. Int J Paediatr Dent. 2012 Jul 17;22(4):239–43.
80. Cubukcu CE, Sevinir B, Ercan İ. Disturbed dental development of permanent teeth in children with solid tumors and lymphomas. Pediatr Blood Cancer. 2012 Jan 19;58(1):80–4.
81. Halperson E, Matalon V, Goldstein G, Saieg Spilberg S, Herzog K, Fux-Noy A, et al. The prevalence of dental developmental anomalies among childhood cancer survivors according to types of anticancer treatment. Sci Rep. 2022 Mar 16;12(1):4485.
82. Vesterbacka M, Ringdén O, Remberger M, Huggare J, Dahllöf G. Disturbances in dental development and craniofacial growth in children treated with hematopoietic stem cell transplantation. Orthod Craniofac Res. 2012 Feb 20;15(1):21–9.
83. Li E, Zeng J, Hong F, Chen P, Yu X. The prevalence of oral mucositis after radiotherapy in patients with Head and Neck Cancer and its associated factors: a meta-analysis. Clinical and Translational Oncology. 2024 Sep 14;
84. Al-Buhaisi D, Karami S, Gomaa N. The role of teledentistry in improving oral health outcomes and access to dental care: An umbrella review. J Oral Rehabil. 2024 Nov 13;51(11):2375–89.

85. Scottish Dental Clinical Effectiveness Programme. Management of Dental Patients Taking Anticoagulants or Antiplatelet Drugs - Bleeding risks for dental procedures [Internet]. 2022 [cited 2025 Jun 1]. Available from: https://www.sdcep.org.uk/published-guidance/anticoagulants-and-antiplatelets/
86. Scottish Dental Clinical Effectiveness Programme. Antibiotic Prophylaxis Against Infective Endocarditis [Internet]. 2018 [cited 2025 Jun 9]. Available from: https://www.scottishdental.nhs.scot/sdcep-implementation-advice-on-antibiotic-prophylaxis-against-infective-endocarditis/
87. Elad S, Raber-Durlacher JE, Brennan MT, Saunders DP, Mank AP, Zadik Y, et al. Basic oral care for hematology–oncology patients and hematopoietic stem cell transplantation recipients: a position paper from the joint task force of the Multinational Association of Supportive Care in Cancer/International Society of Oral Oncology (MASCC/ISOO) and the European Society for Blood and Marrow Transplantation (EBMT). Supportive Care in Cancer. 2015 Jan 5;23(1):223–36.
88. Normando AGC, Pérez-de-Oliveira ME, Guerra ENS, Lopes MA, Rocha AC, Brandão TB, et al. To extract or not extract teeth prior to head and neck radiotherapy? A systematic review and meta-analysis. Supportive Care in Cancer. 2022 Nov 17;30(11):8745–59.
89. Moore C, McLister C, Cardwell C, O'Neill C, Donnelly M, McKenna G. Dental caries following radiotherapy for head and neck cancer: A systematic review. Oral Oncol. 2020 Jan;100:104484.
90. Brennan MT, Treister NS, Sollecito TP, Schmidt BL, Patton LL, Lin A, et al. Dental Caries Postradiotherapy in Head and Neck Cancer. JDR Clin Trans Res. 2023 Jul;8(3):234–43.
91. Huang YF, Liu SP, Muo CH, Tsai CH, Chang CT. The association between dental therapy timelines and osteoradionecrosis: a nationwide population-based cohort study. Clin Oral Investig. 2020 Jan 20;24(1):455–63.
92. Chang CT, Liu SP, Muo CH, Tsai CH, Huang YF. Dental Prophylaxis and Osteoradionecrosis: A Population-Based Study. J Dent Res. 2017 May 17;96(5):531–8.
93. Abed H. National and international guidelines on the replacement of missing teeth with dentures for head and neck cancer patients post-radiotherapy: A rapid review. Saudi Dent J. 2023 Feb;35(2):125–32.
94. Abed H, Burke M, Fenlon MR, Scambler S, Scott SE. Use of dentures, receipt of information, quality of life, and oral function following radiotherapy for head and neck cancer. Special Care in Dentistry. 2020 Sep 10;40(5):475–87.
95. Lajolo C, Gioco G, Rupe C, Troiano G, Cordaro M, Lucchese A, et al. Tooth extraction before radiotherapy is a risk factor for developing osteoradionecrosis of the jaws: A systematic review. Oral Dis. 2021 Oct 7;27(7):1595–605.
96. Balermpas P, van Timmeren JE, Knierim DJ, Guckenberger M, Ciernik IF. Dental extraction, intensity-modulated radiotherapy of head and neck cancer, and osteoradionecrosis. Strahlentherapie und Onkologie. 2022 Mar 14;198(3):219–28.
97. Clayman L. Management of dental extractions in irradiated jaws: A protocol without hyperbaric oxygen therapy. Journal of Oral and Maxillofacial Surgery. 1997 Mar;55(3):275–81.
98. Ruggiero SL, Dodson TB, Aghaloo T, Carlson ER, Ward BB, Kademani D. American Association of Oral and Maxillofacial Surgeons' Position Paper on Medication-Related Osteonecrosis of the Jaws—2022 Update. Journal of Oral and Maxillofacial Surgery. 2022 May;80(5):920–43.
99. Kanatas AN, Rogers SN, Martin MV. A Practical Guide for Patients Undergoing Exodontia Following Radiotherapy to the Oral Cavity. Dent Update. 2002 Dec 2;29(10):498–503.
100. Chronopoulos A, Zarra T, Tröltzsch M, Mahaini S, Ehrenfeld M, Otto S. Osteoradionecrosis of the mandible: A ten year single-center retrospective study. Journal of Cranio-Maxillofacial Surgery. 2015 Jul;43(6):837–46.
101. Raguse JD, Hossamo J, Tinhofer I, Hoffmeister B, Budach V, Jamil B, et al. Patient and treatment-related risk factors for osteoradionecrosis of the jaw in patients

with head and neck cancer. Oral Surg Oral Med Oral Pathol Oral Radiol. 2016 Mar;121(3):215-221.e1.
102. Beth-Tasdogan NH, Mayer B, Hussein H, Zolk O, Peter JU. Interventions for managing medication-related osteonecrosis of the jaw. Cochrane Database of Systematic Reviews. 2022 Jul 12;2022(7).
103. Goyal N, Day A, Epstein J, Goodman J, Graboyes E, Jalisi S, et al. Head and neck cancer survivorship consensus statement from the American Head and Neck Society. Laryngoscope Investig Otolaryngol. 2022 Feb 30;7(1):70–92.
104. Sandhu S, Sankar V, Villa A. Bleeding risk in thrombocytopenic patients after dental extractions: a retrospective single-center study. Oral Surg Oral Med Oral Pathol Oral Radiol. 2020 May;129(5):478–83.
105. Shaw JL, Nielson CM, Park JK, Marongiu A, Soff GA. The incidence of thrombocytopenia in adult patients receiving chemotherapy for solid tumors or hematologic malignancies. Eur J Haematol. 2021 May 16;106(5):662–72.
106. Blayney DW, Schwartzberg L. Chemotherapy-induced neutropenia and emerging agents for prevention and treatment: A review. Cancer Treat Rev. 2022 Sep;109:102427.
107. Shimada Y, Shiko Y, Hangaishi A, Kawasaki Y, Maruoka Y. Prolonged neutropenia is a risk of oral adverse events-related sepsis but is not associated with prognosis of tooth extraction in hematopoietic stem cell transplant recipients: A retrospective study. J Oral Maxillofac Surg Med Pathol. 2023 May;35(3):288–95.
108. Moore C, Donnelly M, Semple C, O'Neill C, McKenna G. Compliance with oral hygiene and dietary advice for the prevention of post-radiotherapy dental disease among head and neck cancer patients – a qualitative study. J Dent. 2023 Nov;138:104720.
109. Breslin M, Taylor C. Incidence of new carious lesions and tooth loss in head and neck cancer patients: a retrospective case series from a single unit. Br Dent J. 2020 Oct 23;229(8):539–43.
110. Morais MO, Elias MRA, Leles CR, Dourado Pinezi JC, Mendonça EF. The effect of preventive oral care on treatment outcomes of a cohort of oral cancer patients. Supportive Care in Cancer. 2016 Apr 26;24(4):1663–70.
111. Morais MO, Martins AFL, de Jesus APG, de Sousa Neto SS, da Costa AWF, Pereira CH, et al. A prospective study on oral adverse effects in head and neck cancer patients submitted to a preventive oral care protocol. Supportive Care in Cancer. 2020 Sep 3;28(9):4263–73.
112. Luka B, Fiedler A, Ganss C, Soetedjo V, Vach K, Schlueter N. Preventing caries after radiotherapy to the head and neck region – a systematic review. Journal of Evidence-Based Dental Practice. 2024 Sep;24(3):101989.
113. Agarwal D, Purohit B, Ravi P, Priya H, Kumar V. Effectiveness of topical fluorides in prevention of radiation caries in adults: A systematic review and meta- analysis. Oral Oncol. 2022 Jun;129:105869.
114. Brookes ZLS, Bescos R, Belfield LA, Ali K, Roberts A. Current uses of chlorhexidine for management of oral disease: a narrative review. J Dent. 2020 Dec;103:103497.
115. Cardona A, Balouch A, Abdul MM, Sedghizadeh PP, Enciso R. Efficacy of chlorhexidine for the prevention and treatment of oral mucositis in cancer patients: a systematic review with meta-analyses. Journal of Oral Pathology & Medicine. 2017 Oct 8;46(9):680–8.
116. Elad S, Cheng KKF, Lalla R V., Yarom N, Hong C, Logan RM, et al. MASCC/ISOO clinical practice guidelines for the management of mucositis secondary to cancer therapy. Cancer. 2020 Oct 28;126(19):4423–31.
117. McGuire DB, Fulton JS, Park J, Brown CG, Correa MEP, Eilers J, et al. Systematic review of basic oral care for the management of oral mucositis in cancer patients. Supportive Care in Cancer. 2013 Nov 10;21(11):3165–77.
118. Pitten FA, Kiefer T, Buth C, Doelken G, Kramer A. Do cancer patients with chemotherapy-induced leukopenia benefit from an antiseptic chlorhexidine-based

oral rinse? A double-blind, block-randomized, controlled study. Journal of Hospital Infection. 2003 Apr;53(4):283–91.
119. West N, Chapple I, Claydon N, D'Aiuto F, Donos N, Ide M, et al. BSP implementation of European S3 - level evidence-based treatment guidelines for stage I-III periodontitis in UK clinical practice. J Dent. 2021 Mar;106:103562.
120. Morais MO, Martins AFL, de Jesus APG, de Sousa Neto SS, da Costa AWF, Pereira CH, et al. A prospective study on oral adverse effects in head and neck cancer patients submitted to a preventive oral care protocol. Supportive Care in Cancer. 2020 Sep 3;28(9):4263–73.
121. Frydrych A, Slack-Smith L, Parsons R. Compliance of post-radiation therapy head and neck cancer patients with caries preventive protocols. Aust Dent J. 2017 Jun 30;62(2):192–9.
122. Sohn HO, Park EY, Jung YS, Lee EK, Kim EK. Effects of professional oral hygiene care in patients with head-and-neck cancer during radiotherapy: A randomized clinical trial. Indian Journal of Dental Research. 2018;29(6):700.
123. Medicines and Healthcare products Regulatory Agency. Oral swabs with a foam head - heads may detach during use (All manufacturers) foam heads of oral swabs may detach from the stick during use, which may present a choking hazard for patients. (MDA/2012/020). 2014.
124. Marino PJ, Hannigan A, Haywood S, Cole JM, Palmer N, Emanuel C, et al. Comparison of foam swabs and toothbrushes as oral hygiene interventions in mechanically ventilated patients: a randomised split mouth study. BMJ Open Respir Res. 2016 Oct 14;3(1):e000150.
125. Kasi SR, Özcan M, Feilzer AJ. Side effects of sodium lauryl sulfate applied in toothpastes: A scoping review. Am J Dent. 2022 Apr;35(2):84–8.
126. Katsura K, Soga M, Abe E, Matsuyama H, Aoyama H, Hayashi T. Effects of casein phosphopeptide–amorphous calcium phosphate with sodium fluoride on root surface conditions in head and neck radiotherapy patients. Oral Radiol. 2016 May 30;32(2):105–10.
127. Sim C, Walker G, Manton D, Soong Y, Wee J, Adams G, et al. Anticariogenic efficacy of a saliva biomimetic in head-and-neck cancer patients undergoing radiotherapy. Aust Dent J. 2019 Mar 11;64(1):47–54.
128. Hackett S, El-Wazani B, Butterworth C. Zygomatic implant-based rehabilitation for patients with maxillary and mid-facial oncology defects: A review. Oral Dis. 2021 Jan 5;27(1):27–41.
129. Clarkson JE, Pitts NB, Fee PA, Goulao B, Boyers D, Ramsay CR, et al. Examining the effectiveness of different dental recall strategies on maintenance of optimum oral health: the INTERVAL dental recalls randomised controlled trial. Br Dent J. 2021;230(4):236–43.
130. Scott H, Cope AL, Wood F, Joseph-Williams N, Karki A, Roberts EM, et al. A qualitative exploration of decisions about dental recall intervals - part 2: perspectives of dentists and patients on the role of shared decision making in dental recall decisions. Br Dent J. 2022 Mar 18;
131. Clarkson JE, Pitts NB, Goulao B, Boyers D, Ramsay CR, Floate R, et al. Risk-based, 6-monthly and 24-monthly dental check-ups for adults: the INTERVAL three-arm RCT. Health Technol Assess. 2020;24(60):1.
132. Haukka A, Heikkinen AM, Haukka J, Kaila M. Oral health indices predict individualised recall interval. Clin Exp Dent Res. 2020 Dec 9;6(6):585–95.
133. Haukka A, Kaila M, Haukka J, Heikkinen AM. Adherence to individualized recall intervals for oral health examinations. Clin Exp Dent Res. 2023 Feb 2;9(1):177–85.
134. Bossi P, Chan AT, Licitra L, Trama A, Orlandi E, Hui EP, et al. Nasopharyngeal carcinoma: ESMO-EURACAN Clinical Practice Guidelines for diagnosis, treatment and follow-up†. Annals of Oncology. 2021 Apr;32(4):452–65.
135. Cho H, Kumar N. Dental management of a patient with head and neck cancer: a case report. Br Dent J. 2019 Jul 12;227(1):25–9.

136. Soutome S, Yanamoto S, Funahara M, Kawashita Y, Yoshimatsu M, Murata M, et al. Prevention of dental caries by regular overnight application of a low-concentration fluoride gel loaded in a custom tray in patients undergoing radiotherapy for head and neck cancer: A preliminary study. Indian Journal of Dental Research. 2020;31(6):963.
137. Chellappan S. Smoking Cessation after Cancer Diagnosis and Enhanced Therapy Response: Mechanisms and Significance. Current Oncology. 2022 Dec 17;29(12):9956–69.
138. Hashibe M, Brennan P, Chuang S chun, Boccia S, Castellsague X, Chen C, et al. Interaction between Tobacco and Alcohol Use and the Risk of Head and Neck Cancer: Pooled Analysis in the International Head and Neck Cancer Epidemiology Consortium. Cancer Epidemiology, Biomarkers & Prevention. 2009 Feb 1;18(2):541–50.
139. Gupta B, Johnson NW. Systematic Review and Meta-Analysis of Association of Smokeless Tobacco and of Betel Quid without Tobacco with Incidence of Oral Cancer in South Asia and the Pacific. PLoS One. 2014 Nov 20;9(11):e113385.
140. NICE. Tobacco: treating dependence: NICE Guideline [QS207] [Internet]. 2022 [cited 2025 May 30]. Available from: https://www.nice.org.uk/guidance/qs207
141. Park ER, Perez GK, Regan S, Muzikansky A, Levy DE, Temel JS, et al. Effect of Sustained Smoking Cessation Counseling and Provision of Medication vs Shorter-term Counseling and Medication Advice on Smoking Abstinence in Patients Recently Diagnosed With Cancer. JAMA. 2020 Oct 13;324(14):1406.
142. Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: Framework and proposal of a new classification and case definition. J Periodontol. 2018 Jun 21;89(S1).
143. Bhandari S, Wadhwa Soni B, Gupta A, Ghoshal S. Time required for prophylactic oral care in head and neck cancer patients scheduled for radiotherapy: A single center, prospective cohort study. Head Neck. 2023 Apr 16;45(4):913–20.
144. Chung EM, Sung EC. Dental management of chemoradiation patients. J Calif Dent Assoc. 2006 Sep;34(9):735–42.
145. König J, Kelemen K, Váncsa S, Szabó B, Varga G, Mikulás K, et al. Comparative analysis of surgical and prosthetic rehabilitation in maxillectomy: A systematic review and meta-analysis on quality-of-life scores and objective speech and masticatory measurements. J Prosthet Dent. 2025 Jan;133(1):305–14.
146. Woods B, Schenberg M, Chandu A. A Comparison of Immediate and Delayed Dental Implant Placement in Head and Neck Surgery Patients. Journal of Oral and Maxillofacial Surgery. 2019 Jun;77(6):1156–64.
147. Tumuluri V, Leinkram D, Froggatt C, Dunn M, Wykes J, Singh J, et al. Outcomes of immediate dental implants in vascularised bone flaps for mandibular reconstruction. ANZ J Surg. 2023 Jun 7;93(6):1682–7.
148. Toneatti DJ, Graf RR, Burkhard JP, Schaller B. Survival of dental implants and occurrence of osteoradionecrosis in irradiated head and neck cancer patients: a systematic review and meta-analysis. Clin Oral Investig. 2021 Oct 16;25(10):5579–93.
149. Shokouhi B, Cerajewska T. Radiotherapy and the survival of dental implants: a systematic review. British Journal of Oral and Maxillofacial Surgery. 2022 May;60(4):422–9.
150. Cotic J, Jamsek J, Kuhar M, Ihan Hren N, Kansky A, Özcan M, et al. Implant-prosthetic rehabilitation after radiation treatment in head and neck cancer patients: a case-series report of outcome. Radiol Oncol. 2016 Feb 7;51(1):94–100.
151. Flores-Ruiz R, Castellanos-Cosano L, Serrera-Figallo M, Cano-Diaz E, Torres-Lagares D, Gutierrez-Perez J. Implant survival in patients with oral cancer: A 5-year follow-up. J Clin Exp Dent. 2018;0–0.
152. Mendenhall WM, Suárez C, Genden EM, de Bree R, Strojan P, Langendijk JA, et al. Parameters Associated With Mandibular Osteoradionecrosis. Am J Clin Oncol. 2018 Dec;41(12):1276–80.

153. Aarup-Kristensen SFM, Hansen CR, Johansen J. Osteoradionecrosis after Radiotherapy for Head and Neck Cancer: Incidence, Risk Factors, and Mandibular Dose-Volume Effects. International Journal of Radiation Oncology*Biology*Physics. 2019 Sep;105(1):E400.
154. Lee IJ, Koom WS, Lee CG, Kim YB, Yoo SW, Keum KC, et al. Risk Factors and Dose–Effect Relationship for Mandibular Osteoradionecrosis in Oral and Oropharyngeal Cancer Patients. International Journal of Radiation Oncology*Biology*Physics. 2009 Nov;75(4):1084–91.
155. Khoo SC, Nabil S, Fauzi AA, Yunus SSM, Ngeow WC, Ramli R. Predictors of osteoradionecrosis following irradiated tooth extraction. Radiation Oncology. 2021 Dec 14;16(1):130.
156. Caparrotti F, Huang SH, Lu L, Bratman S V., Ringash J, Bayley A, et al. Osteoradionecrosis of the mandible in patients with oropharyngeal carcinoma treated with intensity-modulated radiotherapy. Cancer. 2017 Oct 13;123(19):3691–700.
157. Studer G, Bredell M, Studer S, Huber G, Glanzmann C. Risk profile for osteoradionecrosis of the mandible in the IMRT era. Strahlentherapie und Onkologie. 2016 Jan 12;192(1):32–9.
158. Thorn JJ, Hansen HS, Specht L, Bastholt L. Osteoradionecrosis of the jaws: Clinical characteristics and relation to the field of irradiation. Journal of Oral and Maxillofacial Surgery. 2000 Oct;58(10):1088–93.
159. Nabil S, Samman N. Incidence and prevention of osteoradionecrosis after dental extraction in irradiated patients: a systematic review. Int J Oral Maxillofac Surg. 2011 Mar;40(3):229–43.
160. Reuther T, Schuster T, Mende U, Kübler A. Osteoradionecrosis of the jaws as a side effect of radiotherapy of head and neck tumour patients—a report of a thirty year retrospective review. Int J Oral Maxillofac Surg. 2003 Jun;32(3):289–95.
161. Chung EM, Sung EC. Dental Management of Chemo-radiation Patients. J Calif Dent Assoc. 2006 Sep 1;34(9):735–42.
162. Quah B, Yong CW, Lai CWM, Islam I. Efficacy of adjunctive modalities during tooth extraction for the prevention of osteoradionecrosis: A systematic review and meta-analysis. Oral Dis. 2024 Sep 23;30(6):3732–44.
163. El-Rabbany M, Duchnay M, Raziee HR, Zych M, Tenenbaum H, Shah PS, et al. Interventions for preventing osteoradionecrosis of the jaws in adults receiving head and neck radiotherapy. Cochrane Database of Systematic Reviews. 2019 Nov 20;2019(11).
164. Palma LF, Marcucci M, Remondes CM, Chambrone L. Antibiotic therapy for the prevention of osteoradionecrosis following tooth extraction in head-and-neck cancer patients postradiotherapy: An 11-year retrospective study. Natl J Maxillofac Surg. 2021;12(3):333–8.
165. Koga D, Salvajoli J, Alves F. Dental extractions and radiotherapy in head and neck oncology: review of the literature. Oral Dis. 2008 Jan 18;14(1):40–4.
166. Nowak SM, Sacco R, Mitchell FL, Patel V, Gurzawska-Comis K. The effectiveness of autologous platelet concentrates in prevention and treatment of medication-related osteonecrosis of the jaws: A systematic review. Journal of Cranio-Maxillofacial Surgery. 2024 Jun;52(6):671–91.
167. Marx RE, Johnson RP. Studies in the radiobiology of osteoradionecrosis and their clinical significance. Oral Surgery, Oral Medicine, Oral Pathology. 1987 Oct;64(4):379–90.
168. Singh A, Kitpanit S, Neal B, Yorke E, White C, Yom SK, et al. Osteoradionecrosis of the Jaw Following Proton Radiation Therapy for Patients With Head and Neck Cancer. JAMA Otolaryngology–Head & Neck Surgery. 2023 Feb 1;149(2):151.
169. Lyons A, Ghazali N. Osteoradionecrosis of the jaws: current understanding of its pathophysiology and treatment. British Journal of Oral and Maxillofacial Surgery. 2008 Dec;46(8):653–60.

170. 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 Dec 10;14(4):891–901.
171. Costa DA, Costa TP, Netto EC, Joaquim N, Ventura I, Pratas AC, et al. New perspectives on the conservative management of osteoradionecrosis of the mandible: A literature review. Head Neck. 2016 Nov 30;38(11):1708–16.
172. Silvestre-Rangil J, Silvestre FJ. Clinico-therapeutic management of osteoradionecrosis: A literature review and update. Med Oral Patol Oral Cir Bucal. 2011;e900–4.
173. Rice N, Polyzois I, Ekanayake K, Omer O, Stassen LFA. The management of osteoradionecrosis of the jaws – A review. The Surgeon. 2015 Apr;13(2):101–9.
174. Chronopoulos A, Zarra T, Ehrenfeld M, Otto S. Osteoradionecrosis of the jaws: definition, epidemiology, staging and clinical and radiological findings. A concise review. Int Dent J. 2018 Feb;68(1):22–30.
175. Moreno AC, Watson EE, Humbert-Vidan L, Peterson DE, van Dijk L V, Urbano TG, et al. International Expert-Based Consensus Definition, Staging Criteria, and Minimum Data Elements for Osteoradionecrosis of the Jaw: An Inter-Disciplinary Modified Delphi Study. 2024.
176. Store G, Boysen M. Mandibular osteoradionecrosis: clinical behaviour and diagnostic aspects. Clin Otolaryngol Allied Sci. 2000 Oct;25(5):378–84.
177. Camolesi GC, Ortega KL, Medina JB, Campos L, Lorenzo Pouso AI, Gándara Vila P, et al. Therapeutic alternatives in the management of osteoradionecrosis of the jaws. Systematic review. Med Oral Patol Oral Cir Bucal. 2021;e195–207.
178. Pautke C, Bauer F, Bissinger O, Tischer T, Kreutzer K, Steiner T, et al. Tetracycline Bone Fluorescence: A Valuable Marker for Osteonecrosis Characterization and Therapy. Journal of Oral and Maxillofacial Surgery. 2010 Jan;68(1):125–9.
179. Baumann DP, Yu P, Hanasono MM, Skoracki RJ. Free flap reconstruction of osteoradionecrosis of the mandible: A 10-year review and defect classification. Head Neck. 2011 Jun 12;33(6):800–7.
180. Zaghi S, Danesh J, Hendizadeh L, Nabili V, Blackwell KE. Changing indications for maxillomandibular reconstruction with osseous free flaps: A 17-year experience with 620 consecutive cases at UCLA and the impact of osteoradionecrosis. Laryngoscope. 2014 Jun;124(6):1329–35.
181. Beech NM, Porceddu S, Batstone MD. Radiotherapy-associated dental extractions and osteoradionecrosis. Head Neck. 2017 Jan 30;39(1):128–32.
182. Wang T, Liu C, Chao T, Chen T, Hu Y. Risk factors for and the role of dental extractions in osteoradionecrosis of the jaws: A national-based cohort study. Head Neck. 2017 Jul 28;39(7):1313–21.
183. Patel V, Gadiwalla Y, Sassoon I, Sproat C, Kwok J, McGurk M. Use of pentoxifylline and tocopherol in the management of osteoradionecrosis. British Journal of Oral and Maxillofacial Surgery. 2016 Apr;54(3):342–5.
184. Patel S, Patel N, Sassoon I, Patel V. The use of pentoxifylline, tocopherol and clodronate in the management of osteoradionecrosis of the jaws. Radiotherapy and Oncology. 2021 Mar;156:209–16.
185. Samani M, Beheshti S, Cheng H, Sproat C, Kwok J, Patel V. Prophylactic pentoxifylline and vitamin E use for dental extractions in irradiated patients with head and neck cancer. Oral Surg Oral Med Oral Pathol Oral Radiol. 2022 Mar;133(3):e63–71.
186. Paiva GLA, de Campos WG, Rocha AC, Júnior CAL, Migliorati CA, dos Santos Silva AR. Can the prophylactic use of pentoxifylline and tocopherol before dental extractions prevent osteoradionecrosis? A systematic review. Oral Surg Oral Med Oral Pathol Oral Radiol. 2023 Jul;136(1):33–41.
187. Hall V. Actinomyces—Gathering evidence of human colonization and infection. Anaerobe. 2008 Feb;14(1):1–7.
188. Dieleman FJ, Phan TTT, van den Hoogen FJA, Kaanders JHAM, Merkx MAW. The efficacy of hyperbaric oxygen therapy related to the clinical stage of

osteoradionecrosis of the mandible. Int J Oral Maxillofac Surg. 2017 Apr;46(4):428–33.
189. Shaw RJ, Dhanda J. Hyperbaric oxygen in the management of late radiation injury to the head and neck. Part I: treatment. British Journal of Oral and Maxillofacial Surgery. 2011 Jan;49(1):2–8.
190. Glenny AM, Gibson F, Auld E, Coulson S, Clarkson JE, Craig JV, et al. The development of evidence-based guidelines on mouth care for children, teenagers and young adults treated for cancer. Eur J Cancer. 2010 May;46(8):1399–412.
191. Sandherr M, Hentrich M, von Lilienfeld-Toal M, Massenkeil G, Neumann S, Penack O, et al. Antiviral prophylaxis in patients with solid tumours and haematological malignancies—update of the Guidelines of the Infectious Diseases Working Party (AGIHO) of the German Society for Hematology and Medical Oncology (DGHO). Ann Hematol. 2015 Sep 21;94(9):1441–50.
192. Ullmann AJ, Schmidt-Hieber M, Bertz H, Heinz WJ, Kiehl M, Krüger W, et al. Infectious diseases in allogeneic haematopoietic stem cell transplantation: prevention and prophylaxis strategy guidelines 2016. Ann Hematol. 2016 Sep 24;95(9):1435–55.
193. Elad S, Ranna V, Ariyawardana A, Correa MEP, Tilly V, Nair RG, et al. A systematic review of oral herpetic viral infections in cancer patients: commonly used outcome measures and interventions. Supportive Care in Cancer. 2017 Feb 16;25(2):687–700.
194. Aribi Al-Zoobaee FW, Yee Shen L, Veettil SK, Gopinath D, Maharajan MK, Kunnath Menon R. Antiviral Agents for the Prevention and Treatment of Herpes Simplex Virus Type-1 Infection in Clinical Oncology: A Network Meta-Analysis. Int J Environ Res Public Health. 2020 Nov 30;17(23):8891.
195. Henze L, Buhl C, Sandherr M, Cornely OA, Heinz WJ, Khodamoradi Y, et al. Management of herpesvirus reactivations in patients with solid tumours and hematologic malignancies: update of the Guidelines of the Infectious Diseases Working Party (AGIHO) of the German Society for Hematology and Medical Oncology (DGHO) on herpes simplex virus type 1, herpes simplex virus type 2, and varicella zoster virus. Ann Hematol. 2022 Mar 7;101(3):491–511.
196. Piperi E, Papadopoulou E, Georgaki M, Dovrat S, Bar Illan M, Nikitakis NG, et al. Management of oral herpes simplex virus infections: The problem of resistance. A narrative review. Oral Dis. 2024 Apr 6;30(3):877–94.
197. Gopinath D, Koe KH, Maharajan MK, Panda S. A Comprehensive Overview of Epidemiology, Pathogenesis and the Management of Herpes Labialis. Viruses. 2023 Jan 13;15(1):225.
198. Lalla R V., Latortue MC, Hong CH, Ariyawardana A, D'Amato-Palumbo S, Fischer DJ, et al. A systematic review of oral fungal infections in patients receiving cancer therapy. Supportive Care in Cancer. 2010 Aug 8;18(8):985–92.
199. Pappas PG, Kauffman CA, Andes DR, Clancy CJ, Marr KA, Ostrosky-Zeichner L, et al. Clinical Practice Guideline for the Management of Candidiasis: 2016 Update by the Infectious Diseases Society of America. Clinical Infectious Diseases. 2016 Feb 15;62(4):e1–50.
200. Scottish Dental Clinical Effectiveness Programme. Drug Prescribing for Dentistry - Dental Clinical Guidance. Third Edition. [Internet]. 2016 [cited 2025 May 17]. Available from: https://www.sdcepdentalprescribing.nhs.scot/guidance/fungal-infections/denture-stomatitis/miconazole/
201. Stemler J, de Jonge N, Skoetz N, Sinkó J, Brüggemann RJ, Busca A, et al. Antifungal prophylaxis in adult patients with acute myeloid leukaemia treated with novel targeted therapies: a systematic review and expert consensus recommendation from the European Hematology Association. Lancet Haematol. 2022 May;9(5):e361–73.
202. Bensadoun RJ, Patton LL, Lalla R V., Epstein JB. Oropharyngeal candidiasis in head and neck cancer patients treated with radiation: update 2011. Supportive Care in Cancer. 2011 Jun 10;19(6):737–44.

203. Ramírez-Carmona W, Fernandes GLP, Díaz-Fabregat B, Oliveira EC, do Prado RL, Pessan JP, et al. Effectiveness of fluconazole as antifungal prophylaxis in cancer patients undergoing chemotherapy, radiotherapy, or immunotherapy: systematic review and meta-analysis. APMIS. 2023 Nov 18;131(11):668–84.
204. Gøtzsche PC, Johansen HK. Nystatin prophylaxis and treatment in severely immunodepressed patients [Internet]. 2014 Sep [cited 2025 Jun 3]. Available from: https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD002033.pub2/epdf/full
205. BNFC. British National Formulary for Children [Internet]. 2025 [cited 2025 May 17]. Available from: https://bnfc.nice.org.uk/
206. BNF. British National Formulary [Internet]. 2025 [cited 2025 May 17]. Available from: https://bnf.nice.org.uk/
207. Villa A, Vollemans M, De Moraes A, Sonis S. Concordance of the WHO, RTOG, and CTCAE v4.0 grading scales for the evaluation of oral mucositis associated with chemoradiation therapy for the treatment of oral and oropharyngeal cancers. Supportive Care in Cancer. 2021 Oct 31;29(10):6061–8.
208. Abdalla-Aslan R, Bonomo P, Keefe D, Blijlevens N, Cao K, Cheung YT, et al. Guidance on mucositis assessment from the MASCC Mucositis Study Group and ISOO: an international Delphi study. EClinicalMedicine. 2024 Jul;73:102675.
209. World Health Organisation. WHO handbook for reporting results of cancer treatment [Internet]. Geneva: World Health Organization; 1979. (WHO offset publication ; 48). Available from: https://iris.who.int/handle/10665/37200
210. Hong CHL, Gueiros LA, Fulton JS, Cheng KKF, Kandwal A, Galiti D, et al. Systematic review of basic oral care for the management of oral mucositis in cancer patients and clinical practice guidelines. Supportive Care in Cancer. 2019 Oct 8;27(10):3949–67.
211. Treister N, Sonis S. Mucositis: biology and management. Curr Opin Otolaryngol Head Neck Surg. 2007 Apr;15(2):123–9.
212. Stokman MA, Spijkervet FKL, Boezen HM, Schouten JP, Roodenburg JLN, de Vries EGE. Preventive Intervention Possibilities in Radiotherapy- and Chemotherapy-induced Oral Mucositis: Results of Meta-analyses. J Dent Res. 2006 Aug 1;85(8):690–700.
213. Saunders DP, Rouleau T, Cheng K, Yarom N, Kandwal A, Joy J, et al. Systematic review of antimicrobials, mucosal coating agents, anesthetics, and analgesics for the management of oral mucositis in cancer patients and clinical practice guidelines. Supportive Care in Cancer. 2020 May 12;28(5):2473–84.
214. Yarom N, Hovan A, Bossi P, Ariyawardana A, Jensen SB, Gobbo M, et al. Systematic review of natural and miscellaneous agents for the management of oral mucositis in cancer patients and clinical practice guidelines—part 1: vitamins, minerals, and nutritional supplements. Supportive Care in Cancer. 2019 Oct 1;27(10):3997–4010.
215. Correa MEP, Cheng KKF, Chiang K, Kandwal A, Loprinzi CL, Mori T, et al. Systematic review of oral cryotherapy for the management of oral mucositis in cancer patients and clinical practice guidelines. Supportive Care in Cancer. 2020 May 14;28(5):2449–56.
216. Peterson DE, Öhrn K, Bowen J, Fliedner M, Lees J, Loprinzi C, et al. Systematic review of oral cryotherapy for management of oral mucositis caused by cancer therapy. Supportive Care in Cancer. 2013 Jan 21;21(1):327–32.
217. Saunders DP, Epstein JB, Elad S, Allemano J, Bossi P, van de Wetering MD, et al. Systematic review of antimicrobials, mucosal coating agents, anesthetics, and analgesics for the management of oral mucositis in cancer patients. Supportive Care in Cancer. 2013 Nov 6;21(11):3191–207.
218. Stokman MA, Spijkervet FKL, Boezen HM, Schouten JP, Roodenburg JLN, de Vries EGE. Preventive Intervention Possibilities in Radiotherapy- and Chemotherapy-induced Oral Mucositis: Results of Meta-analyses. J Dent Res. 2006 Aug 1;85(8):690–700.

219. Barber C, Powell R, Ellis A, Hewett J. Comparing pain control and ability to eat and drink with standard therapy vs Gelclair: a preliminary, double centre, randomised controlled trial on patients with radiotherapy-induced oral mucositis. Supportive Care in Cancer. 2007 Apr 28;15(4):427–40.
220. Allison RR, Ambrad AA, Arshoun Y, Carmel RJ, Ciuba DF, Feldman E, et al. Multi-institutional, randomized, double-blind, placebo-controlled trial to assess the efficacy of a mucoadhesive hydrogel (MuGard) in mitigating oral mucositis symptoms in patients being treated with chemoradiation therapy for cancers of the head and neck. Cancer. 2014 May 11;120(9):1433–40.
221. NICE. Low-level laser therapy for preventing or treating oral mucositis caused by radiotherapy or chemotherapy. NICE Interventional procedures guidance [IPG615] [Internet]. 2018 May [cited 2025 May 29]. Available from: https://www.nice.org.uk/guidance/ipg615
222. Zadik Y, Arany PR, Fregnani ER, Bossi P, Antunes HS, Bensadoun RJ, et al. Systematic review of photobiomodulation for the management of oral mucositis in cancer patients and clinical practice guidelines. Supportive Care in Cancer. 2019 Oct 8;27(10):3969–83.
223. Robijns J, Nair RG, Lodewijckx J, Arany P, Barasch A, Bjordal JM, et al. Photobiomodulation therapy in management of cancer therapy-induced side effects: WALT position paper 2022. Front Oncol. 2022 Aug 30;12.
224. Mercadante V, Jensen SB, Smith DK, Bohlke K, Bauman J, Brennan MT, et al. Salivary Gland Hypofunction and/or Xerostomia Induced by Nonsurgical Cancer Therapies: ISOO/MASCC/ASCO Guideline. Journal of Clinical Oncology. 2021 Sep 1;39(25):2825–43.
225. Salimi F, Saavedra F, Andrews B, FitzGerald J, Winter SC. Trans-cutaneous electrical nerve stimulation to treat dry mouth (xerostomia) following radiotherapy for head and neck cancer. A systematic review. Annals of Medicine & Surgery. 2021 Mar;63.
226. Nathan CAO, Asarkar AA, Entezami P, Corry J, Strojan P, Poorten V Vander, et al. Current management of xerostomia in head and neck cancer patients. Am J Otolaryngol. 2023 Jul;44(4):103867.
227. Nutting CM, Morden JP, Harrington KJ, Urbano TG, Bhide SA, Clark C, et al. Parotid-sparing intensity modulated versus conventional radiotherapy in head and neck cancer (PARSPORT): a phase 3 multicentre randomised controlled trial. Lancet Oncol. 2011 Feb;12(2):127–36.
228. Zhang B, Mo Z, Du W, Wang Y, Liu L, Wei Y. Intensity-modulated radiation therapy versus 2D-RT or 3D-CRT for the treatment of nasopharyngeal carcinoma: A systematic review and meta-analysis. Oral Oncol. 2015 Nov;51(11):1041–6.
229. Moral Nakamura D, da Graça Pinto H, Baena Elchin C, Thomazotti Berard L, Abreu Alves F, Azeredo Alves Antunes L, et al. Efficacy of bethanechol chloride in the treatment of radiation-induced xerostomia in patients with head and neck cancer: A systematic review and meta-analysis. Radiotherapy and Oncology. 2023 Sep;186:109715.
230. Members of the Head and Neck Cancer Disease Site Group. Cancer Care Ontario - Evidence Based Series 5-8. 2012 [cited 2025 May 29]. The Role of Amifostine as a Radioprotectant in the Management of Patients with Squamous Cell Head and Neck Cancer. Available from: https://www.cancercareontario.ca/sites/ccocancercare/files/guidelines/full/pebc5-8f.pdf
231. Kaae JK, Stenfeldt L, Eriksen JG. Xerostomia after Radiotherapy for Oral and Oropharyngeal Cancer: Increasing Salivary Flow with Tasteless Sugar-free Chewing Gum. Front Oncol. 2016 May 3;6.
232. Khamdi S, Matangkasombut O, Lam-Ubol A. Non-pharmacologic interventions for management of radiation-induced dry mouth: A systematic review. Oral Dis. 2024 Jul 9;30(5):2876–93.
233. Furness S, Bryan G, McMillan R, Worthington H V. Interventions for the management of dry mouth: non-pharmacological interventions. In: Furness S,

editor. Cochrane Database of Systematic Reviews. Chichester, UK: John Wiley & Sons, Ltd; 2013.
234. Cohen L, Danhauer SC, Garcia MK, Dressler E V., Rosenthal DI, Chambers MS, et al. Acupuncture for Chronic Radiation-Induced Xerostomia in Head and Neck Cancer. JAMA Netw Open. 2024 May 13;7(5):e2410421.
235. Rupe C, Basco A, Gioco G, Patini R, Lucchese A, Micciché F, et al. Sodium-hyaluronate mouthwash on radiotherapy-induced xerostomia: a randomised clinical trial. Supportive Care in Cancer. 2023 Nov 18;31(11):644.
236. Chiam TL, Choo J, Ashar A, Hussaini HM, Rajandram RK, Nordin R. Efficacy of natural enzymes mouthwash: a randomised controlled trial. Clin Oral Investig. 2024 Apr 19;28(5):259.
237. Ribeiro LN, de Vasconcelos Carvalho M, de Oliveira Limirio JPJ, do Egito Vasconcelos BC, Moraes SLD, Pellizzer EP. Impact of low-level laser therapy on the quality of life of patients with xerostomia undergoing head and neck radiotherapy: a systematic review. Supportive Care in Cancer. 2024 Feb 20;32(2):118.
238. Porter SR, Fedele S, Habbab KM. Xerostomia in head and neck malignancy. Oral Oncol. 2010 Jun;46(6):460–3.
239. Shahdad SA, Taylor C, Barclay SC, Steen IN, Preshaw PM. A double-blind, crossover study of Biotene Oralbalance and BioXtra systems as salivary substitutes in patients with post-radiotherapy xerostomia. Eur J Cancer Care (Engl). 2005 Sep;14(4):319–26.
240. Gebre-Medhin M, Haghanegi M, Robért L, Kjellén E, Nilsson P. Dose-volume analysis of radiation-induced trismus in head and neck cancer patients. Acta Oncol (Madr). 2016 Nov 1;55(11):1313–7.
241. Rapidis AD, Dijkstra PU, Roodenburg JLN, Rodrigo JP, Rinaldo A, Strojan P, et al. Trismus in patients with head and neck cancer: etiopathogenesis, diagnosis and management. Clinical Otolaryngology. 2015 Dec 18;40(6):516–26.
242. Chee S, Byrnes YM, Chorath KT, Rajasekaran K, Deng J. Interventions for Trismus in Head and Neck Cancer Patients: A Systematic Review of Randomized Controlled Trials. Integr Cancer Ther. 2021 Jan 20;20.
243. Kamstra JI, Roodenburg JLN, Beurskens CHG, Reintsema H, Dijkstra PU. TheraBite exercises to treat trismus secondary to head and neck cancer. Supportive Care in Cancer. 2013 Apr 4;21(4):951–7.
244. Scherpenhuizen A, van Waes AMA, Janssen LM, Van Cann EM, Stegeman I. The effect of exercise therapy in head and neck cancer patients in the treatment of radiotherapy-induced trismus: A systematic review. Oral Oncol. 2015 Aug;51(8):745–50.
245. Shao CH, Chiang CC, Huang TW. Exercise therapy for cancer treatment-induced trismus in patients with head and neck cancer: A systematic review and meta-analysis of randomized controlled trials. Radiotherapy and Oncology. 2020 Oct;151:249–55.
246. Chua DTT, Lo C, Yuen J, Foo YC. A Pilot Study of Pentoxifylline in the Treatment of Radiation-Induced Trismus. Am J Clin Oncol. 2001 Aug;24(4):366–9.
247. Harti DM, Cohen M, Morbize J, Marandas P, Janot F, Bourhis J. Botulinum toxin for radiation-induced facial pain and trismus. Otolaryngology–Head and Neck Surgery. 2008 Apr;138(4):459–63.
248. Bhrany AD, Izzard M, Wood AJ, Futran ND. Coronoidectomy for the Treatment of Trismus in Head and Neck Cancer Patients. Laryngoscope. 2007 Nov 2;117(11):1952–6.
249. McCarthy GM, Skillings JR. A prospective cohort study of the orofacial effects of vincristine neurotoxicity. Journal of Oral Pathology & Medicine. 1991 Aug 28;20(7):345–9.
250. Perdigão JPV, de Almeida PC, Rocha TDS, Mota MRL, Soares ECS, Alves APNN, et al. Postoperative Bleeding After Dental Extraction in Liver Pretransplant Patients. Journal of Oral and Maxillofacial Surgery. 2012 Mar;70(3):e177–84.

Appendix 1: Referral for Oral Health Care Screening

<table>
<tr><td>Patient name</td><td></td><td>Hospital number</td><td colspan="2"></td></tr>
<tr><td>D.O.B</td><td></td><td>Oncology/haem consultant</td><td colspan="2"></td></tr>
<tr><td>Address</td><td rowspan="5"></td><td>Inpatient</td><td>Yes ☐</td><td>No ☐</td></tr>
<tr><td rowspan="4"></td><td>Ward location</td><td colspan="2"></td></tr>
<tr><td>Ward contact no.</td><td colspan="2"></td></tr>
<tr><td>Date admitted</td><td colspan="2"></td></tr>
<tr><td>Date expected for discharge</td><td colspan="2"></td></tr>
<tr><td>Cancer diagnosis including staging/grading</td><td colspan="4"></td></tr>
<tr><td>Treatment to date</td><td colspan="4"></td></tr>
<tr><td>Treatment proposed with dates</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Dose if radiotherapy planned (Gy)</td><td>RHS posterior maxilla</td><td>Anterior maxilla</td><td colspan="2">LHS posterior maxilla</td></tr>
<tr><td>RHS posterior mandible</td><td>Anterior mandible</td><td colspan="2">RHS posterior mandible</td></tr>
<tr><td>Overall survival</td><td>< 2 years ☐</td><td>> 2 years ☐</td><td colspan="2">Comments:</td></tr>
<tr><td>Other medical history</td><td colspan="4"></td></tr>
<tr><td>Medication(s)</td><td colspan="4"></td></tr>
<tr><td>Name/job role of referrer</td><td colspan="4"></td></tr>
<tr><td>Contact number</td><td colspan="4"></td></tr>
<tr><td>Date</td><td colspan="4"></td></tr>
</table>

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