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ABSTRACT

Cancer is the second leading cause of death in our society. Cancer patients, from the moment of diagnosis to the end of treatment and subsequent follow-up, have diverse care needs, both from the systemic and local points of view. The oral cavity is often a target for complications secondary to the many treatments to which patients are subjected. Therefore, a series of approaches to these care needs is required for all aspects related to the treatment process: before and during any type of cancer therapy and after in the case of head and neck tumors. Managing any adverse effects and acting early can avoid after-effects for which morbidity can be disabling for patients.

KEYWORDS: caries; mucositis; prevention; treatment; xerostomia.

INTRODUCTION

Cancer is the second leading cause of death in our society [1]. Current figures suggest that cancer deaths will increase in the coming years. The ageing of the population, the increase in environmental pollutants and the presence of biological agents, which increasingly affect our body [2], are the main architects of this increase [3, 4].

Numerous cancer treatments, including surgery, chemotherapy (CT) and radiotherapy (RT), are notably improving patient survival and the chronification of the disease. This does imply an increase in the side effects of these treatments and their after-effects [5]. The oral cavity is one of the most affected sites, not only because it is the primary site of the seventh most frequent type of tumor in men and the eleventh in women (for whom the effects are more severe) but also because it is the place where many of the adverse effects of systemic cancer treatments and RT of the head and neck cancer (HNC) occur. These complications occur both in the buccal mucosa and in the maxillary bones and salivary glands, either acutely or chronically [6-8].

Based on these observations, a group of experts from the Spanish Oncology Nursing Society (SEEO), the Spanish Society of Oral Medicine (SEMO), the Spanish Society of Medical Oncology (SEOM) and the Spanish Society of Radiation Oncology (SEOR) has proposed developing a consensus document for all health professionals in which clearly, systematically, and following coherent and updated criteria supported by the literature, are provided a series of recommendations to optimize the control and follow-up of cancer patients from the odontostomatological point of view.

The information presented here has been organized chronologically according to treatment progression.

1. BEFORE CANCER TREATMENT

It is important that cancer patients begin treatment with good oral health to minimize oral complications. Therefore, patients should engage with the type of treatment they will receive and be aware of side effects that can occur. This information should be conveyed in a way that motivates patients to maintain care of their oral cavity during treatment and should be clear regarding the hygiene measures that should be performed. The type of care may vary depending on patient characteristics and the type of treatment to be received.

1.1. Assessment of the oral cavity

Any patient with cancer who requires systemic treatment with CT requires a healthy oral cavity, specifically the mucosa and dentogingival unit. The absence of plaque and the control of caries and infections of the oral cavity minimize the intensity of mucositis [9].

Before starting any cancer treatment an oral examination along with a panoramic x-ray should be performed. In addition, periapical x-rays may be necessary, both to determine active and symptomatic foci of infection, and teeth with poor prognosis and nonacute pathologies that, if left untreated, could compromise the health of the patient during and after cancer treatment (Figure 1).

Patients who will receive CT exclusively, require prior assessment to detect and treat symptomatic teeth at the least [10], especially when CT includes the administration of an antiresorptive treatment, antiangiogenic drugs or certain immunomodulators due to the risk that any dental manipulation that includes dentoalveolar surgery can trigger osteochemonecrosis (medication-related osteonecrosis [MRONJ]) [11-13].

1.2. Hygiene guidelines

It is important to teach proper brushing techniques, such as the modified Bass technique with a soft toothbrush (Figure 2), and the use of interdental brushes, dental floss, tongue scrapers and chlorhexidine mouth rinse. These approaches can be complemented with the topical administration of fluoride (mouthwash), ideally after meals [14, 10].

1.3. Habit management

Tobacco and alcohol influences the progression of any neoplastic process and the overall survival (OS) of patients with HNC [15], relapses and the appearance of further primary tumors [16]. Discontinuing the consumption of these toxic agents prevents the clinical overexpression of mucositis. Other habits such as a healthy diet or regular physical exercise should be recommended.

1.4. Treatment

It is necessary to eliminate bacterial plaque and tartar and control the factors that can contribute to a higher bacterial load. This

reduces the risk of inflammation, oral complications, and the substrate on which mucositis can cause symptoms [17].

In patients with HNC who are going to receive RT, dental treatment should be performed before onset to treat existing caries and periodontal disease and to extract teeth that do not have a good prognosis, either due to the extent of decay or possible complications with restorative therapy. Likewise, when infection occurs, timely treatment should be administered. Conservative treatment should not be a reason to delay the start of RT.

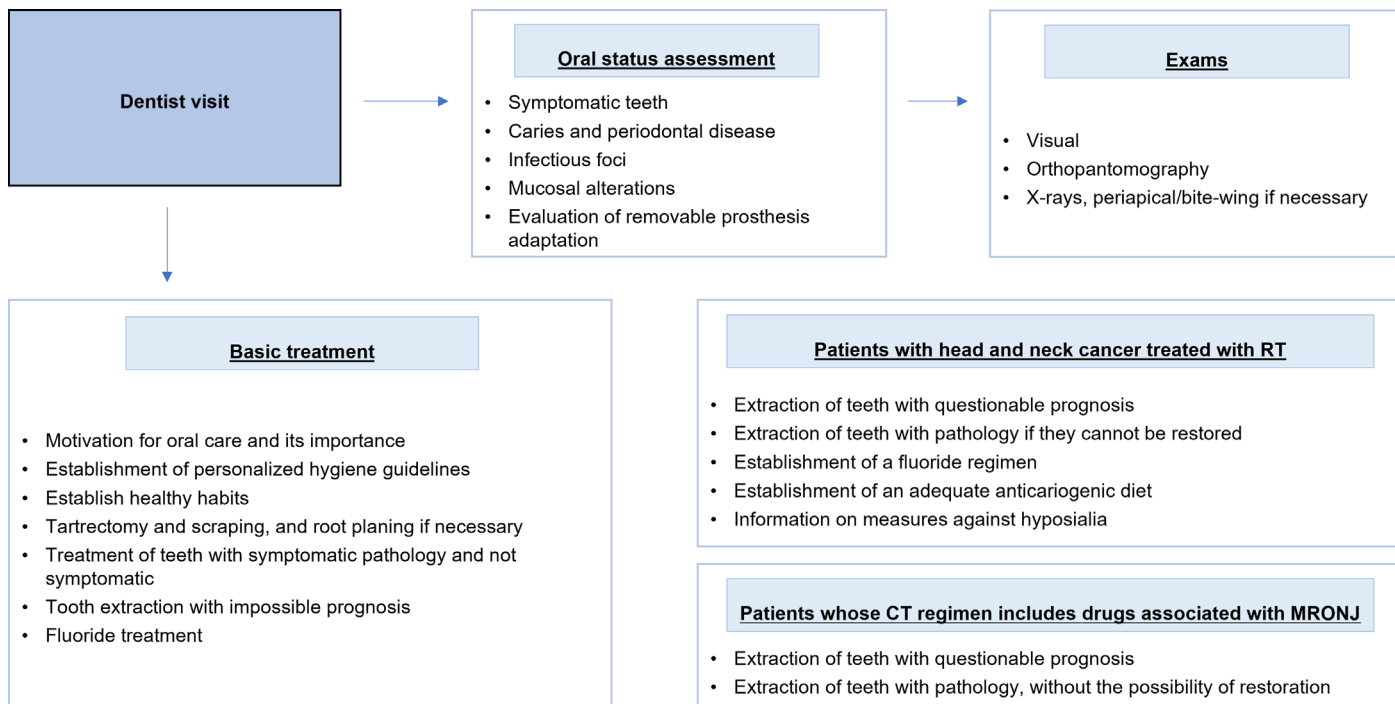


Figure 1. Review of toothed cancer patients before treatment.

MRONJ: drug-related osteonecrosis; CT: chemotherapy; RT: radiotherapy.

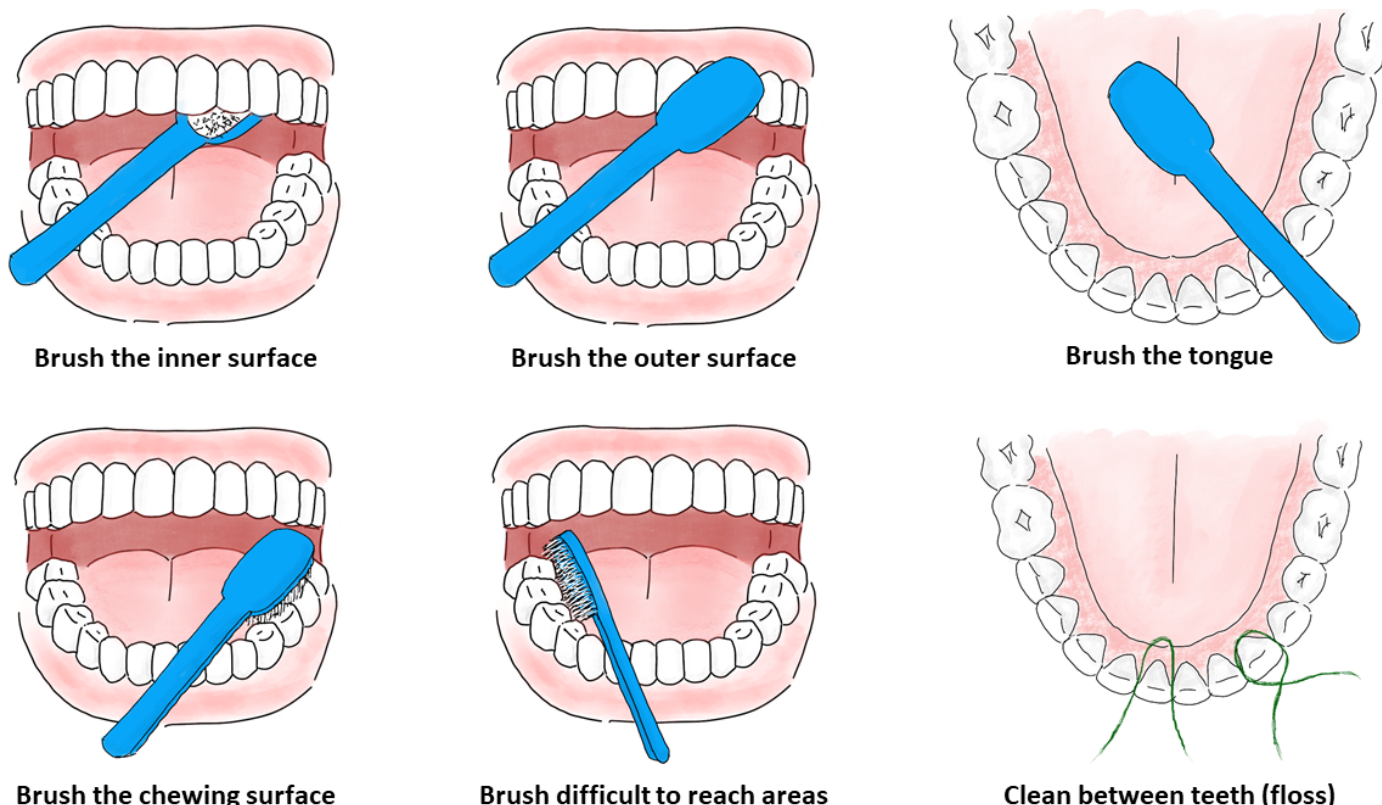


Figure 2. Modified Bass technique.

If necessary, extractions should be performed curing the remaining alveolar bed to achieve rapid healing and closing the tissue with independent sutures. It is advisable to perform these procedures at least 3 weeks before the start of RT in symptomatic retained teeth [17, 10], between 10 and 14 days before the start of RT if the tooth to be extracted is considered uncomplicated and is in the area to be irradiated, or within a shorter time if the tooth to be extracted is outside the area affected by RT. Regarding conservative treatment, the use of glass ionomer-based restoration systems is recommended, in addition to fluoride, which can be added to the usual hygiene protocol [10]. Ideally, fillings made with silver amalgam should be replaced to reduce radiation beam distortion. In patients with HNC who will receive CT without RT or for those with tumors in other locations that will be treated with CT or RT, symptomatic teeth should be treated, and those with severe periodontal disease or considered nonrestorable should be removed [10, 18].

In patients who are going to receive intravenous bisphosphonates or denosumab at an oncological dose for bone metastases, teeth that may cause pain or future infection should be treated, and those with a poor prognosis removed. The Multinational Association of Supportive Care in Cancer (MASCC), the International Society of Oral Oncology (ISOO) and the American Society of Clinical Oncology (ASCO) compiled in their clinical guidelines the prioritization of dental pathologies for such patients [19]. Patients treated with anti-vascular endothelial growth factor (anti-VEGF) and tyrosine kinase inhibitors (TKIs), should be evaluated in the same way [13].

In patients with central venous access (port-a-cath), there is little evidence of the appearance of bacteremia following dental procedures; therefore, the American Heart Association (AHA) considers such patients to be at low risk of infection. Thus, the need for antibiotic prophylaxis must be individually assessed [20]. In patients with a poor prognosis, it is necessary to focus on achieving pain-free adequate function of the stomatognathic system through treatments that are not overly aggressive.

1.5. Fluoridation

The use of fluorides prevents caries. There are certain pharmaceutical forms that must be applied by a professional in a dental office using trays, in the form of a gel or varnish. Application is recommended on a monthly basis during the 12 months following the start of therapy and can be extended over time according to evolution and response [10]. Other preparations, such as 5,000 ppm fluoride toothpaste, can be used daily by patients over 16 years of age. Some preparations, such as stannous fluoride, have also been shown to have a bactericidal effect [21].

1.6. RT splints

Although scientific evidence is scarce due to the low number of studies, splints may reduce the adverse effects caused by RT, in particular mucositis, xerostomia, trismus and osteoradionecrosis. Although the distorting effect on the radiation beam complicates the use of splints, a review by Alves et al. suggests their usefulness [22].

1.7. Quality of life and oral health

Oral health-related quality of life questionnaires allow dentists to assess the needs of patients. An example is the OHIP-14 questionnaire, an abbreviated version of the OHIP-49, which identifies the main oral concerns of patients [23]. It is necessary to employ a questionnaire prior to the start of cancer therapy to objectively measure the effects produced by the treatment.

2. DURING CANCER TREATMENT

2.1. Control of oral hygiene

It is useful to work on motivation and personalize hygiene guidelines with soft toothbrushes and irritant-free toothpastes. During RT in patients with HNC, some professionals recommend weekly examinations of the oral cavity [24]. Hygiene can be difficult for patients due to high oral sensitivity. It may be necessary to use low irritating elements. Simultaneously, the use of mouthwashes with chlorhexidine may be useful, but if this is not well tolerated, rinses with saturated bicarbonate solutions or with herbal infusions [25, 26].

2.2. Caries prevention

For patients who are being irradiated for HNC, chlorhexidine mouthwashes are available at concentrations ranging from 0.12 to 0.20%, with a recommended use of 1-2 times a day to reduce colony-forming units of *Streptococcus mutans* [10]. Treatments with sealants or resin applications can be used to control occlusal and proximal caries, respectively, combined with 5% sodium fluoride varnish and 38% diamine silver fluoride to control root caries [27, 28].

2.3. Oral mucositis

The antitumor drugs that cause stomatitis most frequently are alkylating agents; antibiotics; antimetabolites; vinca alkaloids; anthracyclines; taxanes and other agents (Table 1 and Table 2) [29].

The frequency of follow-up visits during treatment should depend on the risk of toxicity. The objective is early detection and accurate assessment to adapt treatment and avoid complications, interruptions or delays between treatment cycles. During these visits, the following should be carried out: i) inspection of the oral cavity; ii) questions about symptoms; iii) reinforcement of oral hygiene and oral self-examination instructions; iv) empowerment of self-care and instructions to patients and caregivers on the early detection of signs and symptoms for intermediate or immediate consultation; v) assessment of nutritional tolerance and weight control; vi) assessment to detect, grade and manage toxicities or, if necessary, refer patients to relevant professionals of a multidisciplinary team; vii) establishment of hygienic-dietary recommendations adapted to toxicities or reinforcement of those recommendations already established; and viii) establishment of recommendations for care and support in stopping smoking or drinking alcohol.

To control and improve mucositis, it is essential to maintain oral health [30, 31]. Mucositis can prevent patients from maintaining proper hygiene due to mucosa sensitivity. Soft brushes and swabs and saline or sodium bicarbonate rinses are preferable for the removal of detritus [26]. The use of removable prostheses at this time can cause discomfort and must be properly sanitized. This type of prosthesis should be avoided during the treatment period if CT causes mucositis [32, 33].

CT stomatitis should be treated from the initial stages to avoid complications and superinfections that may require stopping treatment and may compromise proper nutrition [29, 34].

Therapeutic measures for mucositis are aimed at reducing pain, avoiding bacterial or fungal colonization in the injured mucosa and promoting the healing process. Currently, there is no standard treatment for oral mucositis, but it is important to consider the following measures: i) maintaining oral hygiene; ii) using sterile solutions; additionally, there is limited evidence that honey successfully reduces the intensity and duration of mucositis symptoms [35]; iii) using cryotherapy or rapid cooling of the oral cavity [36]; there are studies that

support cryotherapy as an economical and effective method in this respect, but its effectiveness when administered with continuous infusions has not been demonstrated [37]; iv) currently, there is no evidence to support the use of povidone iodine or hydrogen peroxide as a mouthwash [38, 39]; v) hyaluronic acid and sucralfate can protect the surface of oral mucous membranes in patients at risk of develop-

ing mucositis, but the available evidence does not support their use [40]; kaolin-pectin acts as a protective film, however, its efficacy has not been proven in clinical trials; vi) in terms of cytoprotectors, glutamine is an important source of energy for mucosal epithelial cells, as it stimulates their growth and repair; although the evidence is limited, it is believed that it can reduce the duration of mucositis [41].

Table 1. Mechanism and management of oral toxicity produced by chemotherapy *.

Mucositis	Hyposialia	Dysgeusia	Neuropathic pain
<ul style="list-style-type: none"> Caused by direct cytotoxicity Increases when concomitant radiotherapy is administered Produces painful ulcers <p><u>Management:</u></p> <ul style="list-style-type: none"> Frequently inspect the oral cavity Ask about symptoms Reinforce oral hygiene instructions and self-examination Assess nutritional tolerance and weight control Detect, grade and manage toxicities or refer the patient if necessary Provide hygienic-dietary recommendations adapted to toxicity or reinforce existing ones Use soft brushes and sterile solutions Provide local cryotherapy during chemotherapy infusion (questionable efficacy) Use glutamine as a cytoprotector (limited evidence) Treat with topical or systemic antifungals if a candidiasis superinfection is present 	<ul style="list-style-type: none"> Described in patients treated with cyclophosphamide, 5-fluorouracil, methotrexate and epirubicin It is common with radiotherapy <p><u>Management:</u></p> <ul style="list-style-type: none"> Provide hydration Conduct oral surveillance to prevent oral infections Use saliva substitutes Treat with salivary stimulants such as pilocarpine 	<ul style="list-style-type: none"> Caused by neurotoxicity in the taste buds Appears during infusion and can last several weeks It is usually reversible <p><u>Management:</u></p> <ul style="list-style-type: none"> Provide zinc-containing supplements (found to be useful in some studies) 	<ul style="list-style-type: none"> Caused by neurotoxicity in the mouth Described with vinca alkaloids due to direct toxicity of the innervation of the mouth <p><u>Management:</u></p> <ul style="list-style-type: none"> Provide analgesia Study the vitality of the dental pulp Resolution should occur one week after stopping chemotherapy

* Alkylating agents such as busulfan, carboplatin, cyclophosphamide, cisplatin, ifosfamide, melphalan, procarbazine, and thiotepa; antimetabolites such as capecitabine, cytarabine, fludarabine, 5-fluoracil, gemcitabine, hydroxyurea, 6-mercaptopurine, methotrexate, pemetrexed, and thioguanine; anthracyclines such as daunorubicin, doxorubicin, epirubicin, idarubicin and mitoxantrone; vinca alkaloids such as vinblastine, vincristine and vinorelbine; antitumor antibiotics such as bleomycin, dactinomycin and mitomycin; taxanes such as docetaxel and paclitaxel; and topoisomerase inhibitors such as etoposide, irinotecan and topotecan.

Table 2. Mechanism and management of oral toxicity produced by targeted therapies *.

Mucositis	Dysgeusia
<ul style="list-style-type: none"> Antiangiogenics and multikinases: These agents cause moderate erythema and painful inflammation, especially if the drug inhibits multiple targets. They do not cause frequent ulcerations. BRAF inhibitors: These agents cause verrucous and papillary lesions, in some cases keratinizing. Cyclin inhibitors: These agents produce mild aphthous mucositis. Gastrointestinal mucositis is more common than oral mucositis. EGFR inhibitors: In very few cases, mucositis is intense. The intensity is greater if multiple kinases are inhibited. They usually cause erythema and canker sores. They usually appear early. M-TOR inhibitors: These agents cause superficial mucositis, but this is very painful and early, with lesions with a necrotic center and an erythematous halo. <p><u>Management:</u></p> <ul style="list-style-type: none"> Conduct daily rinses with nonalcoholic sodium bicarbonate solution 6-8 times a day Use saliva stimulants, sugar-free candy or gum Provide appropriate topical analgesic treatment with lidocaine or systemic treatment Topical corticosteroids and, if needed, systemic corticosteroids if ulcers appear Evaluate stopping or decreasing the dose of the targeted therapy used For m-TOR inhibitors, conduct rinses with dexamethasone 4 times a day for 8 weeks 	<ul style="list-style-type: none"> Possible damage to neural transmission or taste receptors Possible decreased turnover of taste receptors Antiangiogenic and multikinase: all have the potential to produce dysgeusia EGFR inhibitors: erlotinib, osimertinib and gefitinib produce dysgeusia <p><u>Management:</u></p> <ul style="list-style-type: none"> No treatment has high evidence There is some data regarding zinc supplements and acupuncture

EGFR: epidermal growth factor receptor; mTOR: mammalian target of rapamycin.

* Antiangiogenics and multikinases, such as axitinib, cabozantinib, dasatinib, imatinib, lenvatinib, pazopanib, regorafenib, sorafenib, sunitinib and tivozanib; BRAF inhibitors, such as dabrafenib and vemurafenib; cyclin inhibitors, such as abemaciclib, palbociclib and ribociclib; EGFR inhibitors, such as afatinib, cetuximab, dacomitinib, erlotinib, gefitinib, lapatinib, osimertinib and panitumumab; and m-TOR inhibitors, such as everolimus and temsirolimus.

In oral mucositis caused by RT, the first signs are erythema of the mucosa, followed by thinning of the epithelium, which usually begins 2-3 weeks after the start of treatment. Subsequently, an ulceration phase occurs, and the ulcer becomes covered with a fibrin pseudomembrane. Stomatitis severity depends on the dose received and begins at 20-30 Gy. Lesions usually heal within 2-4 weeks after RT ends [42, 43]. The assessment of the degree of mucositis is usually performed using the National Cancer Institute-Common Terminology Criteria for Adverse Events (NCI-CTCAE) scale, although there are others, such as the Radiation Therapy Oncology Group (RTOG). For the prevention and treatment of RT-induced mucositis, the options are almost the same as those used in drug-induced mucositis [38].

The usual recommendation for all patients is the use of mouthwashes, with the combination of saline, salt and bicarbonate, to which corticosteroids and analgesics can be added depending on the intensity of the mucositis. A widely used combination uses 2% lidocaine with dexamethasone or methylprednisolone in a saline solution. Most of the published studies highlight the benefit of rinses with benzydamine [44]. When topical treatment is not sufficient, systemic treatment should be administered in accordance with the analgesic scale developed by the World Health Organization (WHO). In the specific case of mucositis caused by RT, fentanyl administration via the transdermal or transmucosal route can be used instead of oral administration [34, 45].

2.4. Control and treatment of hyposialia

Hyposialia can be observed in patients with irradiated HNC receiving CT with the assumption that the hyposialia will be reversible. Hyposialia by RT can progressively cause asialia, with a very pronounced clinical xerostomia. The available evidence regarding the prevention of this adverse effect via pharmacological treatment or photobiostimulation is still insufficient [46-50]. Therefore, patients should incorporate measures that reduce the feeling of dryness, such as increased water intake, the use of humidifiers to counteract environmental dryness or the use of salivary stimulants and salivary substitutes [51, 52].

2.5. Acute infections

Acute odontogenic infections should preferably be treated pharmacologically in patients with HNC who are receiving RT and in those treated with systemic CT. Due to location, oral cavity and oropharyngeal tumors are high risk for infections, with the risk being lower for nasopharyngeal and sinus tumors [53]. Special care must be taken if these infections appear in patients treated with drugs that can cause MRONJ. In patients with HNC without RT but who present hematological changes after CT, the level of platelets and neutrophils must be considered. When the neutrophil count is $<500/\text{mm}^3$, any procedure is strictly discouraged [10]. Immunotherapy can also cause changes in the oral mucosa due to myelosuppression and possible reactivation of herpes simplex virus [53, 51].

The most frequent fungal infection related to RT and CT administered together in patients with HNC or with the exclusive administration of CT is caused by *Candida albicans*, and its most common presentation is the pseudomembranous form, followed by erythematous and angular cheilitis. Its diagnosis is usually clinical by oral examination. The prevention of fungal infections with topical treatment is not clearly supported. The most commonly used drugs are nystatin, fluconazole and ketoconazole for a minimum of 15 days, as long as there is no onset of liver toxicity [54].

2.6. Neuropathic pain

Neuropathic pain constitutes only 6% of oral complications and is caused by cytostatic drugs of the vinca alkaloid family. It usually disappears 1 week after completing CT, although tooth hypersensitivity may persist for months. It is recommended to perform a thorough dental examination and a radiological study to differentiate pain due to toxicity from that of pulp origin. If tooth sensitivity persists, topical fluoridations can be performed, and the use of desensitizing dentifrices are recommended [55].

3. AFTER CANCER TREATMENT

3.1. Control and oral hygiene instructions

Patients with hyposialia have a high risk of developing oral pathologies; therefore, education and motivation should be emphasized to maintain good oral hygiene and a noncariogenic diet. Brushing using the modified Bass technique (Figure 2) is the most recommended procedure, and interdental brushes, dental floss or dental tape and mouthwashes are the most appropriate to use [43]. Additionally, the use of alcohol-free chlorhexidine mouthwash for one week per month can help reduce the load of *Streptococcus mutans* and be effective [56, 57].

3.2. Reassessment of oral status and dental treatment

Restorations with glass ionomer-modified resins are recommended for patients with HNC who have received RT and do not use fluoride [58]. For patients with repeated infections due to post-RT pulpitis, to reduce the risk of osteoradionecrosis (ORN) in the first months after treatment, endodontics are advised instead of extractions, even if the tooth is not restorable [59]. Tooth-supported fixed prostheses in patients with hyposialia are recommended only if strict oral hygiene measures are followed [60]. The placement of dental implants in these patients can present multifactorial risks, which should be evaluated by the oncological team. It is not possible to establish in detail the most appropriate time for implants [61], and it does not seem that the application of hyperbaric oxygen increases survival [62]. There is no clear evidence regarding the placement of removable prostheses and ORN, but it is certain that the absence of irritation in mucous membranes and the correct fit of such prostheses can prevent ORN [63]. It is appropriate to wait at least 6 months post-exodontia for adequate bone healing before starting preparation for implants and at least 18 months to evaluate the possibility of placing osseointegrated implants, with the radiation oncologist approval [60].

In patients who have been treated with antiresorptive or antiangiogenic drugs, the risk of MRONJ before implant placement is higher; therefore, cases should be evaluated on an individual basis in conjunction with the medical oncologist [24].

3.3. Control of hyposialia

Hyposialia is one of the most frequent complications of RT for HNC. To assess severity, sialometry should be performed on both unstimulated and stimulated saliva. Hyposialia is defined as a rate of saliva production below 0.2 ml/min or 0.4-0.7 ml/min in unstimulated and stimulated, respectively [64]. It is important to assess the degree of possible reversibility bearing in mind that when the salivary parenchyma receives more than 40 Gy, recovery is limited if not null. Currently, owing to new RT techniques, the universalization of forms of intensity-modulated radiotherapy (IMRT) (Figure 3) and the future application of proton accelerators. The measures that can alleviate hyposialia are forced hydration, adequate nutrition accounting for the degree of saliva present, maintenance of oral hygiene, use of specific toothpastes and moisturizing mouthwashes. Pilocarpine and cevimeline may be useful, except for asialia [65].

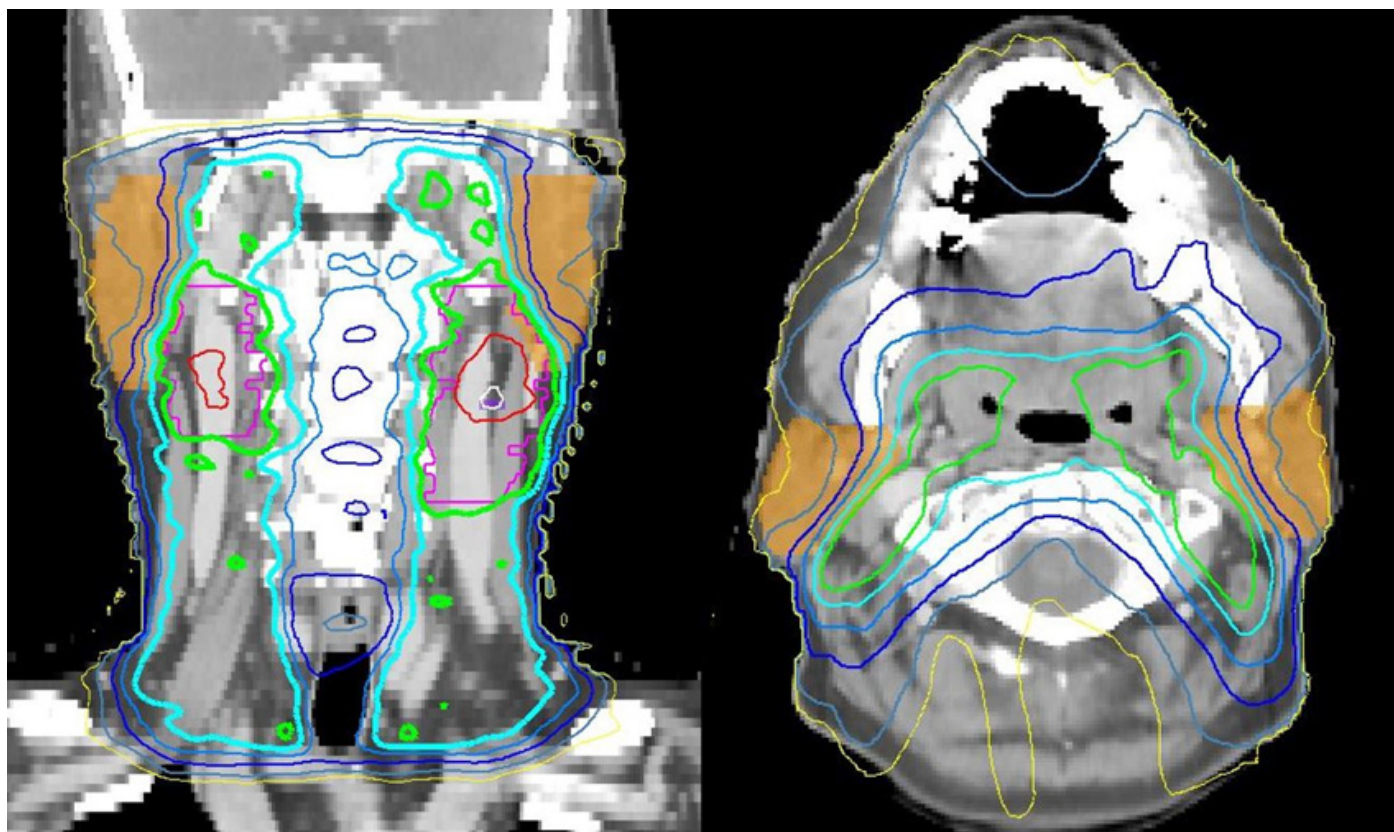


Figure 3. Isodose curves of a patient diagnosed with an oropharyngeal tumor with protection of both parotids (in orange)*.

*The treatment isodose (green) does not include the parotids, allowing them to receive an average dose of less than 26 Gy.

3.4. Control of mucositis

For patients with irradiated HNC, mucositis can last 2-4 weeks after completing RT, and for those who receive CT and RT, it may be prolonged by the combined effect and may persist as post-RT chronic mucositis [31]. Regarding management, the MASCC/ISOO 2019-2020 guidelines cite, among other measures, oral care, the use of anti-inflammatories and photobiomodulation [43, 66]. Chronic mucositis can persist in 8-11% of patients, is associated with hypo/asialia and will decrease patient quality of life. In these cases, topical treatments for mucositis and xerostomia should be combined.

Dental treatment in cancer patients can be performed without issues; the only limitations are those derived from the treatment of the neoplastic process, once hematological values have normalized and chronic drugs are controlled.

3.5. Risk assessment for osteonecrosis

The incidence of ORN and MRONJ ranges from 5 to 30% and has been significantly reduced with the use of IMRT. It is much more frequent in the mandible than in the maxilla, probably due to different vascularization. One of its most frequent causes is dental extractions after RT [66, 67]; therefore, if extraction cannot be delayed, it must be performed carefully and with primary closure of the wound by suture. Once established and depending on degree, ORN is initially treated using conservative measures but may require surgical treatment to remove necrotic bone [68].

To assess the risk of ORN in patients with HNC, factors related to the tumour must be considered, as well as of the patient. ORN is usually related to dental procedures, in particular extractions [67]. In patients with repeated infections or irreversible pulpitis endodontics is recommended, even if the tooth is not restorable. If extraction is not avoidable, at least 6 months must be allowed from the end of treatment, except in exceptional cases [59, 67].

The most commonly used assessment for MRONJ risk is that developed by Ruggiero et al., which classifies risk by stages and proposes a specific treatment for MRONJ for each stage. MASCC/ISOO/ASCO reviewed MRONJ in 2019 [11, 12]. For patients receiving zoledronate or antiangiogenic agents, endodontics and coronectomy of no restorable symptomatic teeth should be evaluated [12]. Dentoalveolar surgery is not recommended in patients who have received these drugs at oncological doses, but if performed, preventive therapies should be used [11].

3.6. Control of trismus

Several factors are involved in the occurrence of trismus, especially surgery and postoperative RT. It is important to reduce the doses of RT received in the temporomandibular joint (TMJ) and the masticatory muscles [69]. Preoperative physiotherapy has been used with mixed results and, although improvement is not significant, raising the patient's awareness of the problem improves its recognition.

An objective measurement of the degree of interincisal opening is required to determine if trismus exists. No one specific exercise or device has been shown to be more effective than another, and the exercises themselves may not result in improvements [56, 69, 70].

3.7. Assessment of dysgeusia

The recovery of sense of taste in patients with HNC who have received RT can take from 3 to 6 months or longer. Cisplatin can cause an unpleasant metallic taste, also described as salty or bitter. There is general agreement that the cause of dysgeusia is damage to sensory receptors and neuronal activity, but the mechanism by which it is produced is not known. Its presence deteriorates patient quality of life.

There is no clear evidence on the measures that can solve this problem. Referral to a nutrition service is recommended to im-

prove the taste experience and caloric intake [53], and the efficacy of zinc supplements can also be assessed [71, 72].

3.8. Periodic dental check-up

In the case of adverse effects such as hyposialia, trismus, caries or chronic graft-versus-host disease with oral involvement follow-ups should be conducted every 3 months during the first year [73]. These follow-ups should consist of a complete anamnesis, sialometry, thorough examination of the oral cavity, repair of caries or cavities that may have arisen, reinforcement of oral hygiene instructions and fluoride trays.

In patients at risk of MRONJ, once treatment is started, evaluations should be performed every 3-6 months for the early detection of possible oral metastases [19].

3.9. Assessment of quality of life associated with oral health

Oral health questionnaires (OHIP-49 [74] or OHIP-14 [23]) or other questionnaires more specifically directed to cancer patients can be used to assess quality of life. Some, specifically those for patients with HNC, include questions focused on the oral cavity and adjacent structures that more directly influence the limitations generated by the disease at the oral level (EO-RTC-HN35, FACT HN and UW-QOL, among others) [75].

CONCLUSIONS

Oral health is an essential aspect in the well-being and quality of life of cancer patients; therefore, its preservation and care should be a priority objective for healthcare teams when patients are to receive cancer treatments that may alter it. In response to this objective, this document defines a series of recommendations that should be applied before, during and after cancer treatments (Table 3).

Before treatment, it is essential to establish a systematic dental review in patients because they may limit the effectiveness of the planned treatment and the quality of life of the patient.

During cancer treatment, the minimum possible dental intervention should occur; only emergency treatments should be considered, with the preferred actions being pharmacological.

After treatment, patient rehabilitation should be assessed, considering the treatments received and the possible after-effects that may occur. For patients treated for other neoplasms, there should be no limitation in the type of intervention to be performed, except for those who received bisphosphonates.

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Conflicts of interest

The authors declare that they do not have any conflict of interest related with this project.

Authors' contributions

All authors contributed to the study conception and design. All authors participated in the writing of the first draft of the manuscript, commented on following draft versions and approved the final version of the manuscript.

Table 3. General and specific care of the oral cavity in cancer patients.

General	
❖	Brush teeth, gums and tongue after each meal (modified Bass brushing technique recommended)
❖	Use a soft toothbrush when the state of the mucous membranes does not allow for medium hardness bristles
❖	Replace the toothbrush when it shows signs of deterioration or is dirty
❖	Use toothpaste with a high fluoride content and without irritating agents; a children's prescription toothpaste is ideal
❖	Use dental floss/tape and/or interdental brushing daily if there are no contraindications
❖	Rinse with 0.9% saline solution or sodium bicarbonate
❖	Maintain good hydration, both general and of the oral cavity and lips
❖	Maintain good hygiene of removable dental prostheses
❖	Monitor for warning signs: inflammation, bleeding, dyspnea, dysphagia, hyperthermia, etc.
❖	In the event of any complication, the patient should know who to call (reference telephone number)
❖	Eat a balanced diet, adapted to oncological disease and comorbidities, taking into account the side effects that may occur at each phase of treatment (nausea, vomiting, diarrhea, mucositis)
❖	Perform physical exercise adapted to the state of health (disease, treatment phase, comorbidities, physical state, etc.)
Avoid:	
❖	Mouth rinses with alcohol or a high content of excipients
❖	Tobacco or alcohol consumption
❖	Food irritants (spicy, acidic, hard or very hot (temperature) foods)
Specific	
Before cancer treatment	
❖	Conduct a comprehensive dental review, provide oral hygiene instructions and administer urgent treatments for teeth that can cause immediate or intermediate problems. Remove poorly fitting removable prostheses
❖	Provide information on the effect of cancer treatment in the oral cavity
During cancer treatment	
❖	Control and treat mucositis and hyposialia and prevent trismus in the case of radiotherapy in the head and neck region
❖	Avoid invasive dental procedures
❖	Provide symptomatic treatment for complications that appear
After cancer treatment	
❖	Dental check-ups should be performed quarterly during the first year after cancer treatment, enhancing oral hygiene and topical fluoride supplements
❖	If dental treatment is needed, postpone it until 6 months after the end of treatment
❖	Provide physiotherapy of the temporomandibular joint if necessary, and use salivary substitutes or sialogogues in case of xerostomia

Availability of data and material

Not applicable

Code availability

Not applicable

Ethics approval

Not applicable

Consent to participate

Not applicable

Consent for publication

Not applicable

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RUNNING TITLE

Oral care in cancer patients

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