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| ORIGINAL

Oral complications of head and neck radiotherapy: the importance of the dental surgeon

Complicações orais da radioterapia de cabeça e pescoço: a importância do cirurgião-dentista

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ABSTRACT

Objective: radiotherapy can lead to different adverse effects in the oral epithelial cells. This article aimed to address the main oral manifestations associated with radiotherapy of head and neck neoplasms, highlighting the importance of the dental practitioners' participation within the skilled multidisciplinary personnel to treatment. **Methods**: Research was conducted in the PubMed, Lilacs, SciELO, and Google Scholar databases using the keywords "head and neck radiotherapy", "oral manifestations", and "head and neck neoplasm". Eighteen out of 533 articles published between 2015 and 2022 were selected after duplicates removal and eligibility criteria application. **Result**: xerostomia, hyposalivation, trismus, dysgeusia, dysphagia, dentin hypersensitivity, fungal and viral infections, radiation caries, osteoradionecrosis, mucositis, periodontal alterations, and tooth development abnormalities were the most frequently reported oral effects of radiotherapy. **Conclusion**: The participation of dentists in the multidisciplinary team that treats patients with head and neck cancers is fundamental since several oral complications of radiotherapy are observed. Dentists can prevent, reduce and treat some detrimental effects whether the patient is followed-up since the beginning of radiotherapy.

Indexing terms: Head and neck neoplasm. Oral manifestations. Radiotherapy.

RESUMO

***Objetivo**: A radioterapia pode levar a diferentes efeitos adversos nas células epiteliais orais. Este artigo teve como objetivo abordar as principais manifestações bucais associadas à radioterapia de neoplasias de cabeça e pescoço, destacando a importância da participação do cirurgião-dentista na equipe multidisciplinar apta ao tratamento. **Métodos**: foi realizada uma busca nas bases de dados PubMed, Lilacs, SciELO e Google Acadêmico utilizando as palavras-chave "radioterapia cabeça e pescoço", "manifestações orais" e "neoplasma*

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de cabeça e pescoço". Dezoito dos 533 artigos publicados entre 2015 e 2022 foram selecionados após a remoção das duplicatas e aplicação dos critérios de elegibilidade. ***Resultado****: xerostomia, hipossalivação, trismo, disgeusia, disfagia, hipersensibilidade dentinária, infecções fúngicas e virais, cárie de radiação, osteorradionecrose, mucosite, alterações periodontais, e anormalidades do desenvolvimento dentário foram os efeitos orais da radioterapia mais relatados.* ***Conclusão****: A participação dos dentistas na equipe multidisciplinar que atende pacientes com câncer de cabeça e pescoço é fundamental, pois são observadas diversas complicações bucais da radioterapia. Os dentistas podem prevenir, reduzir e tratar alguns efeitos deletérios se o paciente for acompanhado desde o início da radioterapia.*

Termos de Indexação: *Neoplasias de cabeça e pescoço. Manifestações bucais. Radioterapia.*

INTRODUCTION

Cancer is an abnormal proliferation of malignant neoplastic cells during mitosis, and it is commonly determined by environmental factors such as solar radiation, alcohol, and tobacco consumption [1-3]. The National Cancer Institute reports malignant neoplasms as the third cause of death in Brazil (fifth and thirteenth cause in men and women, respectively) [4]. Lips, gingiva, hard palate, tongue, and mouth floor present the highest occurrence of oral cancer.

Radiotherapy, chemotherapy, and surgery have been the most effective treatments used for head and neck cancers [2]. Variations in some factors such as radiation technique, total dose, fractionation, and device type may lead to different adverse effects in the oral epithelial cells of patients who have been submitted to head and neck radiotherapy [3]. Xerostomia, hyposalivation, trismus, dysgeusia, dysphagia, dentin hypersensitivity, fungal and bacterial infections, radiation caries, osteoradionecrosis, mucositis, periodontal alterations, and tooth development abnormalities are the most frequently reported oral manifestations associated with head and neck radiotherapy [3,5,6]. This article aimed at addressing the main oral manifestations associated with radiotherapy of both head and neck neoplasms.

METHODS

Research was conducted in the PubMed, Lilacs, SciELO, and Google Scholar databases using keywords such as "head and neck radiotherapy", "oral manifestations", and "head and neck neoplasm". Eighteen out of 533 articles published between 2015 and 2022 were selected after duplicates removal and eligibility criteria application, as it can be observed in figure 1. The inclusion criteria established were publication on the proposed article's theme of the last eight years; scientific articles written in English and Portuguese languages and institutional site of extreme relevance to the subject in question. The exclusion criteria used were articles that did not address to the subject in a clear way. During the research, 14 scientific articles were consulted and selected, 3 of them were outside the selection curve because they were published before the period established previously, however, these were chosen due to their content relevance for familiarizing with the theme, as well as for their development, for this reason they have been incorporated in this review. In addition, 1 institutional site was consulted and incorporated in this article: National Cancer Institute (INCA). Therefore, totaling 18 surveys included in this study, 5 in English and 13 in Portuguese language.

RESULTS

Radiotherapy combined, or not, with surgery and/or chemotherapy in order to treat head and neck cancers is possible [1,2]. Aforementioned, this therapy uses corpuscular or electromagnetic ionizing radiation that inhibits or undermines tumor cells [1]; however, this non-selective radiation may harm healthy cells and lead to systemic and oral detrimental effects [1,7]. Damage to salivary glands and mucositis have already been observed among patients who have received doses between 20 - 30 Gy [8,9]. Head and neck radiotherapy may lead to both intense and tardily oral manifestations. Commonly observed, mucositis appears to be the most frequent acute effect after seven days [of treatment] [6,9]; in spite of, its intensity, duration, and chronology have been related to irradiation parameters and/or the cytotoxicity of drugs (in cases of combined chemotherapy) [7,9]. The irradiation causes cell death, inhibits the tissue

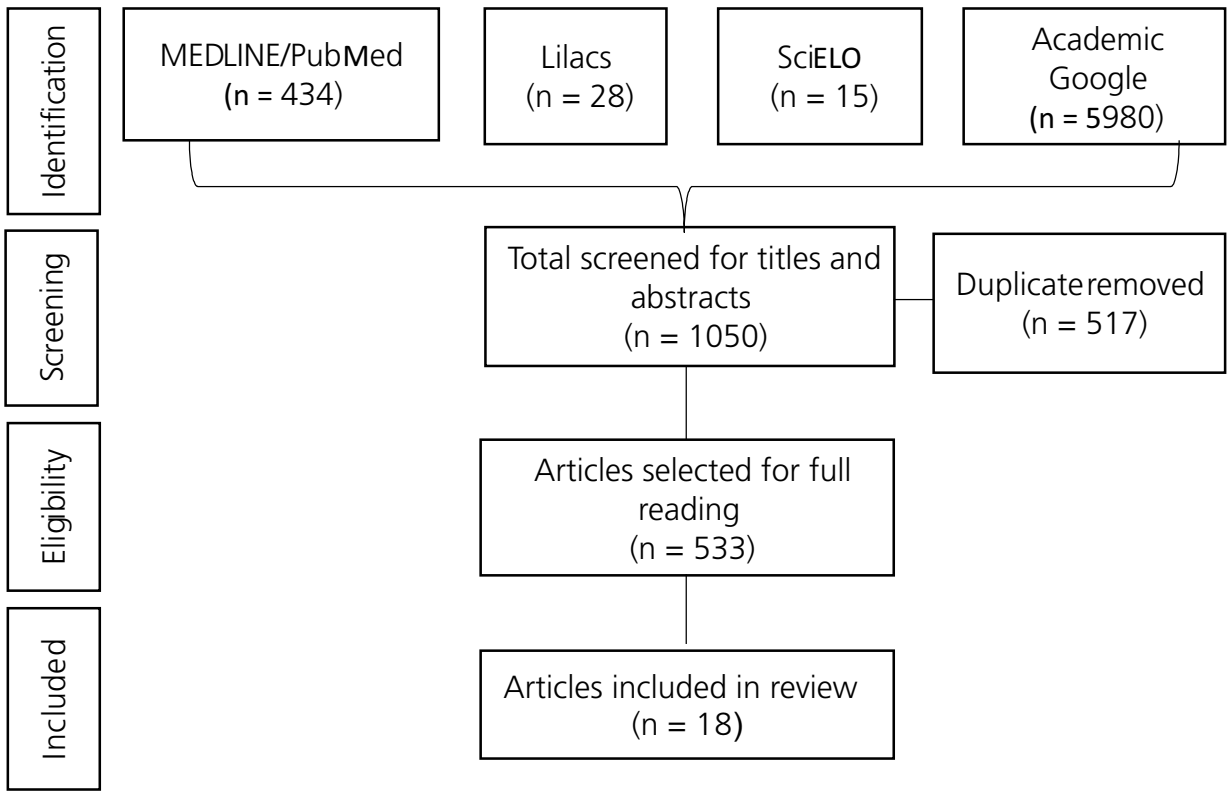

Figure 1. Flowchart of the study.

recovery, and totally or partially exposes the oral mucosa [1,7]; in addition, multiple ulcerated fibrinous lesions covered by pseudomembranes, erythema, edema, pain, dysphagia, and nutrition deficiency might be observed [5,7].

Moreover, exposure to radiation doses between 40 to 65 Gy drives to inflammation and consequently atrophy of salivary glands. Therefore, reduction of salivary flow may result in xerostomia (dry mouth sensation), labial commissures fissures, lip dryness, and dysgeusia (taste alteration) [1,3,6,7]. Furthermore, radiation caries (secondary caries) may occur from three weeks up to one year [2]. The patient may lose appetite and present psychological disorders [6].

Periodontal alterations may be observed in patients who have been submitted to head and neck radiotherapy subordinated to the radiation dose [5]. The periodontal ligament is a non-mineralized tissue that connects the cementum and alveolar bone; however, it is fragile and susceptible to morpho-histological changes induced by radiotherapy that may result in tissue destruction, premature tooth loss, and bone infections. Additionally, ionizing radiations higher than 60 Gy may result in a late and certanly severe complication known as osteoradionecrosis, which occurs more often in the lower jaw due to its high bone density and its reduced vascularization [5,10]. The osteoradionecrosis is characterized by bone ischemia and surrounding tissues that reduces the number of osteocytes and osteoblasts; thus, bone healing and remodeling can be jeopardized, and the affected site becomes necrotic [3,5]. Soft tissues edema and erythema, exposure of necrotic bone, trismus, ulcers, lymphadenopathy, suppuration, pain, paresthesia, pathological fracture, fistula, mobility, periapical and periodontal pathologies are signs and symptoms that indicate osteoradionecrosis [3,5,7]. Poor oral hygiene, alcohol, and tobacco excessively, tooth extractions after radiotherapy, previous bone surgeries, bone inflammation, and systemic diseases can be risk factors for osteoradionecrosis [5].

Trismus is a late manifestation that frequently occurs three to six weeks after the completion of radiotherapy. The limited mouth opening impairs eating and oral cleaning [11]. This condition is often related to malignant lesions in the soft palate and retromolar region since the exposure of the temporomandibular joint and masticatory muscles to radiation result in muscular fibrosis and reduced vascularization [6, 11].

Considering deciduous teeth are sensitive to morphological and structural changes, pediatric patients and pregnant women submitted to head and neck radiotherapy may show abnormalities such as root deformation, dwarfism, or dilaceration, incomplete tooth calcification, premature root canal closure, microdontia, and hypodontia [6,12].

Head and neck radiotherapy can also induce fungal and viral infections due to depression of the patient's immune system that does not fight against opportunistic oral microorganisms effectively [7,13,14]. Candidiasis is the most prevalent fungal infection, which is associated to salivary reduction flow and poor oral hygiene [7,11,14]. The proliferation of the Candida Albicans fungus forms white pseudomembranous or erythematous plaques ("cottage cheese" appearance) that can be removed by scraping [technique] [11].

Herpes simplex virus and zoster are more likely to affect the oral cavity and lead to the occurrence of grouped erythematous and ulcerated lesions in the palate, labial commissure, and nose base, and systemic manifestations such as lymphadenopathy and fever [3, 8].

Oral manifestations previously mentioned can be treated, controlled, or even prevented by the addition of the dental surgeon to the multidisciplinary oncology personnel, as this professional caries enough knowledge, not only about the common oral manifestations that affect the ionized patient, but also about the care service protocol and the resources that can be used to improve the patient's quality of life [11,15].

The dentist's performance is based upon the elimination of the infectious, inflammatory focus and pain episode [16]. Therefore, it is important that the oncological patients begin dental treatment before radiotherapy to be given oral hygiene instruction and non-traumatic dental extractions which may prevent the development of osteoradionecrosis [6, 7].

During the cancer treatment as issued, the dental surgeon may offer treatment for mucositis by prescribing amifostine or laser therapy sessions for pain relief. In addition to treating candidiasis by antimicrobials, such as chlorhexidine and nystatin mouthwash [7,16]. Subsequently antineoplastic therapy, the dental surgeon remains essential concerning the patient's health, since he controls, treats, or even prevents the beginning of persistent and/or late oral manifestations, enabling quality of life by reducing or remedying symptoms caused by radiation therapy complications [7].

The content previously approached has been verified from the reading of the articles that supported this study, and can be summarized as follows in table 1, which presents the authors, the type of study carried out by them, the objectives of their research and the conclusions conferred.

Table 1. Characteristics of researched studies.

1 of 2

Study	Type of study	Objective	Conclusion
Conceição et al. [1]	Literature and narrative review	Address radiotherapy and its main acute oral manifestations.	Radiotherapy results in devastating side effects.
Ferreira et al. [2]	Literature review	Identify the main oral manifestations of radiotherapy, dosage, and dental care service.	Preventive dental treatment in cancer patients is important to diagnose and treat diseases during and after radiotherapy.
Paiva et al. [3]	Literature review	Present oral complications resulting from radiotherapy and highlight the importance of DS.	DS should accompany before, during and after anticancer treatment to prevent or control complications.
Brasil [4]	Not informed	Support SUS management, with emphasis on oral health coordination, during oral cancer control actions planning and concerning service offerings organization.	Oral cavity cancer may have a favorable prognosis for the patient's quality of life once treatment starts with small tumors. For this reason, it is essential that information about risk factors and signs, as well as symptoms of the disease be shared to start treatment.
Sroussi et al. [5]	Literature review	Present considerations and recommendations to patients before, during, and after radiotherapy in order to maintain oral health, treat effects, and improve life quality.	Ionized patients need oral health, for this reason, it is necessary to have in the oncology personnel, trained professionals. In order to provide treatment or support before, during and after therapy.

Table 1. Characteristics of researched studies.

Study	Type of study	Objective	Conclusion
Jawad et al. [6]	Literature review	Review regarding oral manifestations which occur during and after radiotherapy, in addition to describing dental care before, during and after the therapy in question.	Head and neck radiotherapy interferes with life quality. This interference happens with early or late effects, requiring planned personnel to reduce or prevent them.
Sen et al. [7]	integrated review	Present the importance of oral health care during and after radiotherapy, emphasizing the role of the DS in improving life quality by treating the manifested consequences after the therapy.	Complications during and after radiotherapy require special care. It must have been treated and prevented by palliative care by specialized dental surgeons.
Fernandes et al. [8]	Narrative review	Highlight the role of DS at managing cancer patients in order to achieve a better and/or precise diagnose as well as adapt the oral cavity.	Dental accompaniment is important to prevent and reduce the incidence of oral complications.
Kawashita et al. [9]	Literature review	Show that oral health care strategies before, during and after radiotherapy can avoid the effects.	It is important that the DS encourages patients to control dental plaque, prescribe medications to increase salivary flow, in addition, to refer them to nutritional monitoring, aiming at improving the patient's quality of life.
Santos et al. [10]	Literature review	Demonstrate the importance of oral health care before, during and after radiotherapy treatment and its effect on life quality.	Some oral manifestations can compromise the quality of life of the ionized patient if the necessary care assistance is not performed.
Borges et al. [11]	Case related	Present a clinical case to discuss dental care of a patient irradiated in the head and in the neck, highlighting oral complications, dental management and the importance of the DS performing with the oncological personnel.	Dental accompaniment before, during and after therapy controls and prevents oral manifestations, improving quality of life.
Lima et al. [12]	Literature review	Present the main dental developmental anomalies, pointing out changes in number, size, structure, and shape of the tooth, emphasizing the importance of the DS throughout the diagnosis.	Developmental dental alterations are discovered by the DS due to aesthetic dissatisfaction or detection in routine consultation, and it is the professional responsibility to diagnose and outline a treatment proposal.
Gabe et al. [13]	Data analysis	Describe the frequency of leukemia and infectious opportunistic events in children and adolescents in a specific region.	Opportunistic diseases or infections are susceptible on a certain type of leukemia, population, antineoplastic therapy, ethnicity, and a clinical picture other than immunosuppression.
Sena et al. [14]	Systematic Review	Investigate interventions for oropharyngeal candidiasis treatment in patients with head and neck cancer.	Fluconazole is more effective to treat oropharyngeal candidiasis, but attention should be paid to the resistance of certain strains of candida to the drug.
Lima et al. [16]	Integrative Literature review	Characterize oral implications and contribution of odontology to the life quality of patients in palliative care.	It is necessary the DS's presence in order to promote health, prevent disease and recovery from any damage rehabilitation to maintain life quality.
Rapoport et al. [17]	Not informed	Reconciling information from the medical field to standardize behaviors that assist in the physician's reasoning and decision-making.	Even though it presents guidelines to advise the physician in his/her evaluation, the information contained in the document must be submitted to the physicians' evaluation and criticism.
Silva et al. [18]	Literature review	Highlight the importance of the DS performing with the oncological personnel.	The DS's role in the personnel provides quality of life.

DISCUSSION

Oral cancer represents a therapeutic challenge. This pathology can be treated by surgical modality, chemotherapy or radiotherapy, these methods can be combined or performed in isolated procedures [1,2].

Radiotherapy is one of the most applicable therapeutic methods for the treatment of oral cancer, especially to treat initial lesions, it has had good results and indications [18]. Such therapy is based on the application of

corpuscular or electromagnetic ionizing radiation at a specific local to inhibit or destroy neoplastic cells in the body [1,7].

Nevertheless, as radiation is not selective, there are aggressiveness towards healthy cells of the human organism, allowing manifestation of signs and systemic symptoms, and oral. The side effects of this specific modality issued are dose-dependent, that is, they are manifested from the administration of a certain dose in the head and neck region, such as, for example, 20-30 Gy, damaging the salivary glands and causing the presence of mucositis in the oral cavity [8,9].

Encompassed by the oral manifestations, emerging from the main side effects of head and neck radiotherapy, it is observed: xerostomia, hyposalivation, trismus, dysgeusia, dysphagia, dentin hypersensitivity, fungal and viral infections, radiation caries, osteoradionecrosis, mucositis, periodontal changes, and abnormalities in the structural development of teeth [3,5,6].

Oral complications such as these, resulting from radiotherapy can be treated, controlled and/or prevented through dental care service provided to the oncology personnel by the dental surgeon. This professional performs pre-, trans-, and post-radiation therapy treatments in order to assist preparation of the oral cavity to receive radiation, in addition, such expert treat and relieve signs and symptoms, respectively [7,15].

The professional quoted promotes guidance on the use of medication, takes actions to minimize painful symptoms in the patient to restore function and quality of life [7,15-18]. Among these issues, it is possible to mention the prescription of mouthwash and laser therapy in the region of pain [7,15,17].

CONCLUSION

The participation of dental surgeons in the multidisciplinary personnel that treats patients with head and neck cancers is fundamental since several oral complications of radiotherapy have been observed. Dentists can prevent, reduce, and treat some detrimental effects whether the patient has been accompanied since the beginning of radiotherapy.

Collaborators

FCP Quaresma, data curation (lead), methodology (lead), writing – original draft (lead), writing – review & editing (lead). TG Mateus, data curation (supporting), investigation (supporting), writing – review & editing (supporting). JBG Pedreira, data curation (equal), writing – review & editing (equal). APR Couto, writing – review & editing (equal). EM Pedreira, supervision (lead), writing – review & editing (supporting).

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