

Risk of Oral Mucositis Induced by Radiotherapy: A SCOPING Review

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ABSTRACT

The purpose of this assessment was to evaluate research in basic oral care interventions to update evidence-based practice guidelines for preventing and treating oral mucositis (OM) in cancer patients undergoing radiotherapy.

A systematic review of available literature was conducted using the database aggregator platform EBSCOhost, a search was carried out in the CINAHL databases Plus with Full Text and MEDLINE with Full Text in order to extract the words in natural language that alluded to the inclusion criteria.

Within the research carried out in the CINAHL 62 studies were found. Applying the time interval between 2010-2018, the existence of full-text availability and the age of the participants (≥ 19 years) as limiting the research, resulted in 9 studies. By reading the title and summary of the 9 studies found, 4 met the inclusion criteria and integrated the review. Oral mucositis is an adverse effect associated with great morbidity and with a great impact on the quality of life of cancer patients, interfering with basic human needs.

The implementation of evidence-based practices involves the integration of the patient's values and preferences in relation to their care, in an individualized care plan.

KEYWORDS: Cancer Patient; Multidisciplinary Team; Oral Mucositis; Radiotherapy

Date of Submission: 13-10-2022

Date of Acceptance: 28-10-2022

I. INTRODUCTION

Oral mucositis (OM) is defined as a toxic inflammation of the oral mucosa that results from the action of cytostatic agents and ionizing radiation and is characterized by erythema or ulceration, which can be exacerbated by local factors, such as secondary infections and trauma [1]. It is referred to as the most frequent and most morbid acute effect in cancer patients undergoing head and neck radiotherapy (RT) or chemotherapy (CT) [2,3].

OM is characterized by a cascade of biological, progressive events, which can be divided into five stages [4]: initiation, immediately after exposure to RT or CT, in which there is production of a free radical that initiates the cascade of biological events and tissue damage; regulation and creation of message, there is a transcription of factors that regulate the genes that control the synthesis of cytokines and that are activated in the epithelium, vessel wall and mucosal connective tissue, increasing the occurrence of cell apoptosis, which leads to a mucosa thinner, erythematous and painful; amplification and signalling, in which feedback mechanisms are generated that amplify the process and lead to stimulation of pro-inflammatory cytokines, leading to the appearance of the next phase; ulceration, resulting from the previous phases, in which there is an exposure of nerve endings, colonization of the surface by micro organisms that produce toxins, increasing the production of cytokines, which leads to stimulation of inflammatory cells; and, finally, healing, the cure comes from the molecules of the ulcer epithelium that are released from the extra cellular matrix, with cell division, migration and differentiation occurring in a healthy mucosa.

Some risk factors, related to the person and the antineoplastic treatment, influence the appearance, duration and intensity of OM. Risk factors related to people with head and neck cancer at risk of OM are age, gender, the pre-existence of dental disease, careless oral hygiene and smoking and alcoholic habits [5]. Risk factors related to treatment are head and neck RT, the location of the irradiation field, high-dose CT and QRT protocols [5].

OM is a dose-limiting factor for RT in the head and neck. When the irradiation field encompasses the salivary glands and the oral mucosa, the risk of developing mucositis is increased [3], due to the fact that the cells of the oral mucosa, larynx and pharynx have high mitotic activity are, therefore, more sensitive ionizing radiation than cells with low turnover, as radiation cannot distinguish neoplastic cells from healthy ones [6,7].

OM is one of the first adverse effects of curative RT in patients with head and neck cancer, manifesting itself in the first two weeks of treatment and may disappear slowly between two to three weeks after its end, with a prevalence of around 80% to 100% of patients undergoing RT [8,9,10]. When severe, it may compromise the planned antineoplastic treatment (CT and / or RT), leading to its partial or complete interruption and thus increasing the risk of tumour cell proliferation, which has an impact on disease control and patient survival [11, 4].

OM is caused by direct cellular damage secondary to RT, ranging from erythematous areas, to ulcerations, exposing the patient to infections by opportunistic micro organisms, causing dry mouth, burning sensation and severe pain [10,12]. These damages compromise food, due to dysphagia and odynophagia, causing dehydration, anorexia, weight loss and even cachexia [2,12,13]. They also influence oral hygiene and communication, which results in social isolation and risk of depression [1,11,12].

The early detection of potential and current problems of the person with oncological disease, a correct assessment and a treatment plan with active interventions are essential, as they aim to avoid or minimize oral problems, prevent delays or interruptions in antineoplastic treatments and maximize the person's comfort [14]. Nursing teams have the ability to assess the person at risk of OM and to implement preventive and therapeutic management programs for mucositis, namely educational programs [15], which can contribute substantially to improving patient comfort, which is seriously affected by aspects , not only physical, such as xerostomia, pain or the inability to communicate and eat, but also psycho-spiritual, socio-cultural and environmental [13,14,16,17,18].

Although there is a variety of literature on the strategies for the assessment, prevention and management of OM, the nursing intervention for people with PCC at risk of OM is dispersed and the one that exists is not systematized. Thus, there is a need to conduct a scoping review, which aims to map the existing knowledge about nursing interventions in people with PCC (Population, Concept and Context) at risk of OM induced by radiotherapy, assessing the extent of the body of literature on this topic [19]. However, its inherent limitation is the fact that it does not make recommendations for practice, making available only existing information.

The methodological procedure used was that proposed in the Joanna Briggs Institute's scoping review manual [19].

II. METHODS

REVIEW QUESTION

The question of this review was constructed according to the mnemonic “PCC” (Population, Concept and Context). The population (in the CINAHL and MEDLINE databases, "all adults" are defined as persons aged 19 years or older) is represented by the person with head and neck cancer, the concept refers to nursing interventions in the person with cancer disease at risk of oral mucositis and the context includes the treatment of radiotherapy and chemo-radiotherapy. This mnemonic translates into the following research question: What are the nursing interventions in the person with head and neck cancer at risk of oral mucositis induced by radiotherapy?

GOALS

The present scoping review is oriented towards mapping nursing interventions that promote the comfort of people with oncological disease at risk of oral mucositis induced by radiotherapy, and to identify future research areas on this topic.

INCLUSION AND EXCLUSION CRITERIA

Table 1 shows the inclusion and exclusion criteria used for the selection of the review texts. These concern the participants; concept; context; type of text; publication date; language of publication and availability of the text.

Selection Criteria		
	Inclusion Criteria	Exclusion Criteria
PARTICIPANTS	Person of adult age (age ≥ 19 years) with cancer of the head and neck; (In the CINAHL and MEDLINE databases, “all adults” are defined as persons aged 19 years or older.)	Person with cancer disease who is not of adult age.
CONCEPT	Nursing interventions to the person with HNC at risk of oral mucositis	Documents that do not identify nursing interventions.
CONTEXT	Outpatient radiotherapy; Ambulatory chemo-radiotherapy	All contexts other than ambulatory.

TYPE OF TEXT	All types of existing literature (literature reviews; qualitative, quantitative or mixed studies published or unpublished; master's and doctoral theses; expert opinions; critical reflections; guidelines; reports; case studies, others).	
PUBLICATION DATE	Between January 2010 and January 2018.	Previous to January 2010.
PUBLISHING DIOMA	Portuguese and English	Documents whose language is not Portuguese and English.
AVAILABILITY OF TEXT	Full text.	Absence of full text.

Table 1: Inclusion and exclusion criteria for the selection of review texts.

RESEARCH STRATEGY

The research strategy adopted was intended to find published documents [Appendices I and II]. Using the database aggregator platform EBSCOhost, a search was carried out in the CINAHL databases Plus with Full Text and MEDLINE with Full Text in order to extract the words in natural language that alluded to the inclusion criteria. Taking into account the degree of relevance in the title and summary of each document, the following keywords or search terms were identified: “mucositis”, “radiotherapy”, “oncology” and “nurse”.

Regarding the published documents, with regard to the search carried out in the CINAHL database, CINAHL Headings was used to find the terms indexed to each keyword. Using the Boolean expressions OR and AND, 62 studies were found. Applying the time interval between 2010-2018 (this last decade), the existence of full-text availability and the age of the participants (≥ 19 years) as limiting the research, resulted in 9 studies [Appendix I]. By reading the title and summary of the 9 studies found, 4 met the inclusion criteria and integrated the review.

The research carried out in the MEDLINE database followed the same methodological procedure. As such, MeSH2015 was used in order to find the terms indexed to each keyword. Using the Boolean expressions OR and AND, 35 studies were found. Applying the time interval between 2010-2018, the existence of full-text availability and the age of the participants (≥ 19 years) as limitation of the research, resulted in 4 studies [Appendix II]. By reading the title and abstract, and excluding 2 repeated studies, 2 results met the inclusion criteria and integrated the review.

DATA EXTRACTION

The six documents selected after applying the inclusion and exclusion criteria were read in full. This reading was done in order to obtain a global understanding of each one. Tables 2, 3, 4, 5, 6 and 7 below show the characteristics of the documents included in the present scoping review. The tables present the data for each document analyzed (in chronological order of publication of the document) with the following extraction fields: the author / year of publication; the type of text / methodology; the goals; the participants and the results.

Authors and year of publication	Gondim, F; Gomes, I; Firmino, F. (2010) ^[14]
Document Type	Bibliographic review with a time limit between 1993 and 2007.
Methodology	The authors consulted the following databases: Latin American and Caribbean Literature in Health Sciences, Medical Literature Analysis and Retrieval System Online, Cochrane Library and Scientific Electronic Library Online, obtaining 38 articles containing, definitions, characteristics and care with oral mucositis .
Goals	Identify the evidence on the prevention and treatment actions for oral mucositis induced by chemotherapy and / or radiation that supports nursing care.
Participants	Nurses who provide care to patients at risk of or with oral mucositis.
Results	Evidence has shown that oral mucositis is a common toxicity in patients undergoing RT for head and neck cancer (HNC). Knowledge about this adverse effect and prevention and treatment methods are essential for the daily practice of oncology nursing, due to the high incidence of OM and impaired patients' quality of life. The nurse's performance is like this essential throughout the treatment, since its practice aims at the general well-being of the patient. It is necessary to know the classification of this symptom in terms of its severity so that nursing can design effective interventions for patient care. Regardless of the classification of mucositis, effective oral hygiene is essential, considering tooth brushing after each meal, using a soft toothbrush, non-abrasive toothpaste and mouthwash with hydrogen peroxide or alkaline saline (with bicarbonate) sodium). Tobacco, alcohol, drinks or extremely hot or cold foods should be avoided. It is also recommended to increase your water intake, keep your mouth moist, avoid acidic foods and avoid prolonged fasting. The nursing intervention focuses on systematic monitoring of the oral cavity and mucositis symptoms, diagnosing the risk and its degree early, and meeting the individual characteristics and needs affected

by each patient. The planning of interventions should be extended to the patients' relatives, namely health education and encouraging self-care. In addition, nurses can and should be involved in planning and developing oral care protocols; assessment of the patient with oral mucositis; and also use the scales to assess the degree of impairment of the oral cavity from mucositis, to monitor and implement interventions before and during treatment.

Table 2: Presentation of the data from the document “Prevention and treatment of oral mucositis”.

Authors and year of publication	Eilers, J. & Million, R. (2011) ^[13]
Document Type	Literature revision.
Methodology	Studies, review articles, evidence-based guides, web-based materials and clinical experiences were analyzed.
Goals	To present the most up-to-date clinical evidence that can be applied in the development of a nursing care plan for the prevention and treatment of oral mucositis related to cytotoxic therapy.
Participants	Multidisciplinary team.
Results	<p>The document addresses the risk factors and symptoms of oral mucositis, the most appropriate nursing interventions, as well as the implications that the symptoms have on patients' quality of life. Oral cavity care and pain control are highlighted in the article, as they mobilize nursing interventions in the area of education / promotion for health and self-care management.</p> <p>The most common complaints related to OM include changes in sensation, difficulty in speaking and swallowing, the presence of sores in the mouth and, sometimes, dryness. Patients often experience a set of signs and symptoms, which include pain, bleeding, infection, ulceration, dry mouth, changes in taste and changes in nutritional status.</p> <p>Proper assessment of the oral cavity is essential in the prevention and treatment of OM, being the most important nursing intervention in the care of patients with OM. For this, a valid and reliable instrument must be used that provides critical information to guide nursing interventions. The assessment includes identifying risk factors, determining the person's oral care practices, assessing the person's ability to perform oral care and assessing the person's ability to understand the importance of oral care during antineoplastic treatment.</p> <p>Recommendations for oral care include:</p> <ul style="list-style-type: none"> - Collaborate with the multidisciplinary team in all stages of treatment: - Brush, at least twice a day, the entire surface of the teeth for at least 90 seconds, using a soft toothbrush; - Dry the toothbrush before storing it; - Floss at least once a day or according to clinical indication; - Rinse your mouth 4 times a day with a mild mouthwash solution; - Avoid the use of tobacco, alcohol and irritating foods (acidic, hot, raw or spicy); - Use water-based lip balm; - Maintain adequate hydration; - Provide written educational material to patients about the items described above. <p>As there is no universally effective agent for the prevention of OM, the treatment of problems experienced by patients with OM is an area of nursing intervention, which focuses on three focuses of attention: pain management, xerostomia and ulceration.</p>

Table 3: Presentation of the data from the document “Clinical update: prevention and management of oral mucositis in patients with cancer”.

Authors and year of publication	Eilers, J.; Harris, D.; Henry, K.; Johnson, L. (2014) ^[15]
Document Type	Literature revision.
Methodology	The research was carried out in the PubMed and CINHALL® databases, with a time limit between May 2008 and December 2013. After the application of the search limiters, in order to meet the inclusion criteria, 104 publications.
Goals	The purpose of this article is to review evidence-based interventions for oral mucositis and provide clinicians with guidelines for nursing interventions.
Participants	Nurses
Results	<p>The results obtained were classified into 4 categories:</p> <ul style="list-style-type: none"> - Recommendations for practice: this category includes interventions for which effectiveness has been demonstrated by strong evidence from studies, meta-analyses or rigorously designed systematic reviews and for which the expectation of harm is small compared to the benefits. In this category, complementary therapies were included, such as: cryotherapy, low-level laser therapy, oral care protocols, mouthwash with sodium bicarbonate; - It is likely to be effective: these interventions include evidence from a single strictly conducted control test, consistent evidence from well-designed controlled trials using small samples, evidence from meta-analyses or systematic reviews using small samples, or evidence from guidelines developed from evidence and supported by expert advice. New recommendations in this category include prophylactic mouthwashes of chlorhexidine, mouthwashes with benzidamine and lactobacillus lozenges; - Effectiveness not established: This category includes interventions for which data are insufficient or need adequate quality. Numerous topical and systemic pharmacological and non-pharmacological interventions have been studied for effectiveness in preventing and managing oral mucositis or managing associated pain. The evidence for interventions is limited due to inconsistent research results, small studies and study designs. As a result, this category includes the largest number of agents: mouthwashes of allopurinol, aloe vera, amifostine IV, mouthwashes of calcium phosphate, mouthwashes of marigold affinalis, honey,

	<p>high-dose laser therapy, glutamine, hyaluronic acid, epithelial growth factors, propolis, zinc or zinc supplements, vitamin E, among others;</p> <p>- Improbable effectiveness: these are interventions for which the lack of effectiveness has been demonstrated by negative evidence from a single tightly controlled trial, consistent negative evidence from well-designed controlled trials using small samples, small samples within meta-analysis or systematic reviews, or ineffective guidelines developed by expert consensus or opinion. Three agents are in this classification: iseganan (a peptine), traumeel (homeopathic substance) and wobe-mugos (mixture of proteolytic enzymes).</p> <p>This review provides recommendations for practice in the context of oral care in the prevention and treatment of OM:</p> <ol style="list-style-type: none"> 1) Evaluate oral mucositis with a valid and reliable instrument as an initial step for the prevention and management of OM; 2) Develop evidence-based oral care protocols as a basis for the treatment of OM; 3) Teach OM self-management techniques to patients and caregivers.
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Table 4: Presentation of the data from the document “Evidence-based interventions for cancer treatment-related mucositis: putting evidence into practice”.

Authors and year of publication	Araújo, S.; Luz, M.; Silva, G.; Andrade, E.; Nunes, L.; Moura, R. (2015) ^[1]
Document Type	Descriptive, cross-sectional and quantitative exploratory study.
Methodology	The study was carried out in two services specialized in oncology, one public and the other private and was carried out with 213 patients undergoing chemotherapy and / or radiotherapy. Data collection took place between August 2011 and January 2012 in 3 stages: the first consisted of applying a form referring to the patients' sociodemographic and clinical data and whether or not they received nursing assistance; the 2nd step was to identify which interventions in the nursing process were performed and whether they were directed at the patient with oral mucositis; the 3rd stage consisted of observing the oral mucosa and applying the WHO oral mucositis scale.
Goals	Analyze nursing care for cancer patients with oral mucositis.
Participants	213 patients diagnosed with oral mucositis or who developed this complication during the data collection period.
Results	The patients were mostly female, with an average age of 45.8 years, with up to 11 years of schooling. The severe forms of mucositis detected were related to chemo-radiotherapy. Only 25.3% of patients reported having received guidance from nurses during treatment and, according to the patients' perception, there was a significant difference in the quality of nursing care between public and private services. The main affected areas mentioned by patients were related to comfort, food and hygiene. From this, a Nursing Protocol was outlined formulating diagnoses, interventions and expected results, in order to establish an ideal, but individualized, standard of nursing care for these patients.

Table 5: Presentation of data from the document “The cancer patient with oral mucositis: challenges for nursing care”.

Authors and year of publication	Cullen, L.; Baumler, S.; Farrington, M.; Dawson, C.; Folkmann, P.; Brenner, L. (2018) ^[20]
Document Type	Pilot study
Methodology	It is the implementation of an evidence-based oral care project, following the Iowa model, first identifying the need for changes in practice, then designing and directing the intervention, and finally, integrating and sustaining the change in practice.
Goals	Change of evidence-based practice at a radiotherapy oncology centre in a major academic medical centre, with the aim of reducing the severity of oral mucositis in adults who received RT treatment for head and neck cancer.
Participants	Adults with head and neck cancer undergoing outpatient radiotherapy, with or without concomitant chemotherapy.
Results	In the described intervention, patients received newly created oral care kits and educational materials to improve their oral hygiene. Evaluations were performed at three points during the project (before RT treatment, during week 4 to 5 of treatment and one month after treatment). In weeks 4 to 5 - when the severity of oral mucositis is expected, patients reported better oral hygiene practices and reduced severity of oral mucositis.

Table 6: Presentation of the data from the document “Oral care for head and neck cancer symptom management - piloting an evidence-based practice change at a radiation oncology centre”.

III. RESULTS AND DISCUSSION

From the analysis of the selected documents, three central areas for the nursing intervention emerged: evaluation, prevention and management of OM.

Gondim et al. (2010) [14] describe OM as a lesion that occurs on the surface of the oral mucosa caused by chemotherapy or radiotherapy. Eilers et al. (2011) [13] and Araújo et al. (2015) [1] add that it is a toxic inflammatory reaction that involves the mucous membrane of the oral cavity. Eilers et al. (2014) [15] mention OM as a complex process involving different factors, such as an inflammatory process, cell apoptosis, cytokines, cytotoxicity of treatments and microorganisms of the oral cavity. Thus, OM develops on a continuum, from inflammatory changes to ulcerative lesions [20]. All documents describe OM as one of the

adverse effects of RT with the highest incidence, occurring in all patients with head and neck cancer, and which compromises the patient's quality of life. OM interferes with comfort, eating and drinking, communication, increases the risk of developing infection and influences the patient's general well-being [13,20]. Araújo et al. (2015) [1] and Cullen et al. (2018) [20] add intense pain to these symptoms. In this sense, oral mucositis is painful, increases the risk of infection and affects the patient's quality of life [20].

Patients with head and neck cancer who have been undergoing radiation therapy, with or without concomitant chemotherapy, report that OM is the adverse effect that causes greater distress [13]. In addition, Cullen et al. (2018) [20] mention that 93% of patients undergoing RT have xerostomia and their presence can make patients more likely to experience more significant and severe effects of OM.

The nurse, an essential element of the multidisciplinary team, plays a fundamental role of support and guidance to the person, throughout the treatment, in decision making [20]. Thus, knowledge about OM and strategies for the prevention and management of OM are essential in nursing intervention, in the sense of acting in line with the needs of the person, minimizing the severity of OM [1,11,13,15, 20].

PATIENT ASSESSMENT

Eilers & Million (2011) [15] refer that the assessment of the patient affects the identification of risk factors, since it is known that the interaction of several factors influences the appearance of OM. Thus, the risk factors that are identified as having the potential to influence OM are classified into two categories: related to the patient and related to treatment [13,14,15]. The factors and risk related to the patient are: age (children, due to the increase in cell turnover, and elderly people because of the decrease in the cure rate) [13,14,15], gender (women have a higher risk of OM due to hormonal factor), [13] poor nutritional status [13], dental problems and pre-existing oral lesions [13]; poor oral hygiene habits [13,14], decreased salivary function [13,15], genetic factors (some people seem to have a significantly lower risk of developing mucositis than others exposed to the same mucotoxic agents) [13,15], BMI (malnourished people have a longer healing time) [13], renal function (the increase in creatinine potentially leads to an increase in mucotoxicity) [13] and a history of OM resulting from previous antineoplastic treatments [13]. Other factors that can increase or worsen the incidence of OM are the consumption of tobacco and alcohol, drinks or hot or cold foods and the presence of infections [13,14,15].

Factors related to the treatment of RT for head and neck cancer, such as type of radiation, planning techniques, area of irradiated tissue, daily and total doses and fractionation schemes, interfere with the alteration of normal irradiated tissue [14]. In addition to these, the combination of CT with RT is added by Eilers et al. (2014) [15].

Araújo et al. (2015) [1] state that in welcoming the cancer patient at risk of OM, the nurse establishes a risk classification based on the risk factors.

PREVENTION OF OM

Oral health is essential for well-being and begins with proper oral hygiene. This is especially important in head and neck cancer patients.

Clinical practice guidelines and systematic reviews consistently support oral care, but include insufficient evidence on educational oral care protocols, including mouthwash, except for advice against the use of chlorhexidine and misoprostol and products containing alcohol [13,15,20]. Araújo et al. (2015) [1] and Eilers et al. (2014) [15] recognize that an oral care program is important in the prevention of OM. Eilers & Million (2011) [13] identified benzidamine, calcium phosphate, honey, hydrolytic enzymes, povidone-iodine and zinc sulfate as agents that act in the prevention of OM induced by antineoplastic treatment. Eilers et al. (2014) [15] recommend low-power laser therapy and mouthwash with sodium bicarbonate to manage OM and categorize mouthwashes with benzidamine as possible. In contrast, Eilers & Million (2011) [13] report that sucralfate, chlorhexidine and antimicrobial lozenges are not recommended for the prevention of RT-induced OM in people with head and neck cancer.

The nurse has a primary role in the implementation and supervision of oral care, always considering the information given to the patient as a priority, making it the focus of the health education process, facilitating therapeutic adherence and the success of nursing interventions [1,15].

Cullen et al. (2018) [20] show us a project of changing practices, based on the evidence, in which the project leaders worked with the coordinating team of the RT centre - which included the head nurse and the clinical director - when designing and pilot this change in practice. The change in practices has seen patients receiving newly created oral care kits and educational materials to improve their oral hygiene. These oral care kits, which were placed in a bag containing educational material, were composed of:

- ◆ Toothbrushes with soft bristles
- ◆ Biotene® dentifrice
- ◆ Lanolin products for lip care

- ◆ Waxed dental floss
- ◆ Prepackaged packages of salt and baking soda
- ◆ Denture cup and other small cups (to mix and mouthwash when away from home)
- ◆ A timer, to encourage complete brushing, for 2 minutes.

Packets of salt and bicarbonate facilitated the performance of non-irritating oral mouthwashes when patients were away from home. It was considered important that the nurse had an oral care kit for demonstration during patient education, showing and explaining each article, helped to reinforce the importance of these specific products [20]. The results showed that there was an improvement in oral hygiene practices by patients and a reduction in the severity of OM, as well as patients knew how to prevent OM, they felt prepared to perform good oral care and were aware that the paste of Biotene® tooth and oral mouthwashes were useful [20].

The nursing team plays a key role in planning and guiding oral care in patients receiving RT treatment of the head and neck. This includes collaboration with the patient / family and other professionals involved in the treatment of the patient [1,13,14,15,20]. In this sense, the following nursing interventions for the oral care of the patient were identified:

- Collaborate with the multidisciplinary team in all phases of treatment [13];
- Observe the oral cavity, using scales to assess the degree of toxicity of the oral cavity, such as the WHO scale [1];
- Create oral care programs, and apply according to the particularities of each person [1];
- Brush, at least twice a day, the entire surface of the teeth for at least 90 seconds, using a soft toothbrush [13,20]. Araújo et al. (2015) [1] suggests tooth brushing after meals, using a soft brush and fluoride toothpaste;
- Educate how to clean the toothbrush with sodium hypochlorite1 and dry the toothbrush before storing it [13];
- Educate about the correct use of dental floss, at least once a day or according to clinical indication [1,13];
- Rinse 4 times a day with a mild mouthwash solution [13];
- Avoid the use of tobacco, alcohol and irritating foods (acidic, hot, raw or spicy) [1,13,14,15];
- Use water-based lip balm [1,20];
- Maintain adequate hydration [1,13,14];
- Guide the person to the cleaning of dental prostheses and their abandonment when poorly adjusted, during the presence of OM [1];
- Provide educational material written to patients about the items described above [1,13].

The use of low-power laser therapy is identified by the documents as an effective interdisciplinary intervention in reducing intent OM, which requires specific equipment and a trained professional [1,13,14,15]. OM is considered an inevitable consequence of treatment. Thus, although the use of natural products is not stabilized, the preventive identification of patients at risk and professional dental care are known to help prevent and reduce this adverse effect. Therefore, the nurse plays an important role in improving oral care for people with PCC [11,13,20].

OM MANAGEMENT

Araújo et al. (2015) [1] allude that the continuous assessment and monitoring are fundamental for an effective management and an adequate identification of nursing diagnoses of OM, in order to define specific interventions, as well as, the current knowledge about the temporal aspects of clinical manifestations, evidence-based, and standardized approaches to assessment, provide an important means of improving patient outcomes.

An adequate assessment of the oral cavity is essential to prevent OM, providing information for an early and individualized intervention, decreasing the risk of secondary problems, such as septicemia and pain [13]. Oral assessment is thus a continuous process, which guides the development of a care plan that is implemented and evaluated on a continuous basis [13].

The literature identifies the need to select instruments, which provide accurate information about the oral cavity, to guide nursing intervention. These instruments help to identify changes in the oral mucosa with OM, compared to a normal mucosa, making it possible to identify the toxicity of the oral mucosa of antineoplastic treatments and allow to evaluate the effectiveness of the interventions that were used in the management of OM [13]. However, when analyzing the documents, it appears that there is no consensus on the use of an instrument to assess the oral cavity, being the most referenced: the WHO Toxicity Scale (developed by the World Health Organization), the Common Terminology Criteria (CTC) - version 4.03, developed by the National Cancer Institute (NCI) and the Radiation Therapy Oncology Group Score Criteria (RTOG).

Research shows that oral care can reduce the severity of OM. Likewise, education about the importance of oral treatment before antineoplastic treatment (dentist / stomatologist) can reduce the pain and severity of OM [20]. The management of OM thus requires interventions to reduce its severity, as well as associated symptoms, such as pain [1,13,14,15,20].

Pain is a symptom associated with OM, often referred by patients as a complaint that makes it difficult to speak and swallow, which negatively influences nutritional status and communication [13]. In addition, comfort and hygiene needs may be affected by your presence [1]. The pain becomes more severe the greater the extent and intensity of OM [14].

The intensity of pain and anguish experienced by patients is related to the highly sensitive nature of neurons located in the oral cavity [13]. However, although pain is a component of the OM experience, it is important to keep the pain assessment as a separate element because this adequacy of treatment depends on this classification and not only on the severity of the existing OM [15]. Thus, for pain control, the following nursing interventions were identified:

- ◆ Inform the patient about the cause of the pain, the expected duration of the pain, in order to minimize their anxiety [1];
- ◆ Value the patient's pain complaints [1];
- ◆ Provide pain relief, with prescribed analgesia [1.13] (administration of opioids and non-opioids, as well as the combination of agents [13]);
- ◆ Evaluate, after administration, the efficacy of the analgesic [1];
- ◆ Encourage methods of distraction during acute pain [1];
- ◆ To advise on non-invasive pain relief techniques¹, such as soft and alcohol-free mouthwashes / mouthwashes [13,20];
- ◆ Apply pain assessment scales [1];
- ◆ Observe non-verbal signs of pain and discomfort [1,13];
- ◆ Consult a doctor or specialist nurse about oral pain relief solutions [1].

IV. CONCLUSIONS

Scoping reviews aim to be comprehensive and provide an overview of existing evidence, as they aim to provide a map of the evidence produced, rather than the best available evidence. Thus, there was no formal assessment of the methodological quality or the level of evidence of the studies included in the review, which is why the present scoping does not allow providing recommendations for practice, but only providing information that can guide the practice.

The review mainly integrated literature reviews that revealed information about the definition of oral mucositis, characteristics, clinics, incidence, associated morbidity and interventions in the prevention and treatment of this severe adverse effect. Centered on this approach, the results reveal that nurses have an important role in the prevention and treatment of oral mucositis, where education about adequate and effective oral care is the cornerstone of their intervention. The nursing interventions present in the analyzed documents are poorly systematized and in most of their conclusions, the need for a consensus on which interventions are most effective for each intervention area (assessment, prevention and management) is mentioned. For this reason, studies should be developed that address the nursing intervention in people with OM and that reveal indicators of care and results obtained.

Oral mucositis is a adverse effect associated with great morbidity and with a great impact on the quality of life of cancer patients, interfering with basic human needs. In this sense, the nurse has an active, dynamic and individualized role in the scope of the prevention and treatment of OM, where he develops an individualized care plan, with the implementation of evidence-based interventions. The implementation of evidence-based practices involves the integration of the patient's values and preferences in relation to their care, in an individualized care plan; however, it must be based on theoretical support, which guides the data collection, in the establishment of diagnoses, planning interventions and evaluation of the results obtained.

Health education, in the context of oral hygiene care, is an extremely important intervention, in the sense that it is an essential primary measure in the prevention of symptoms caused by mucositis.

Pain associated with OM is a frequent symptom and an important focus of care for nurses.

Declarations:

- i. **Funding** (None)
- ii. **Conflicts of interest/Competing interests** (The authors declare that they have no conflict of interest)
- iii. **Ethics approval** (The manuscript has the University and Hospital's approval. Being a systematic review article, it has no participating patients)
- iv. **Consent to participate** (The manuscript has University and Hospital's approval)

- v. **Consent for publication** (Not applicable)
- vi. **Availability of data and material** (Data is available in the CINAHL databases Plus with Full Text and MEDLINE)
- vii. **Code availability** (Not applicable)
- viii. **Authors' contributions** (All authors (TV, ED, and MF) shared the collection of published data, analyzing the results, manuscript writing, and final revision. All authors have read and approved the manuscript)

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APPENDIX I - Search history in the CINAHL database (Scoping review)

Search ID #	Search Terms	Search Options	Last Run Via	Results
S5	S1 AND S2 AND S3	Limiters - Full Text; Published Date: 20100101-20181231 Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Plus with Full Text	9
S4	S1 AND S2 AND S3	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Plus with Full Text	62
S3	(MM "Radiation Oncology Nursing") OR OR (MH "Oncologic Nursing+") OR (MM "Oncology Nursing Society") OR (MM "Cancer Nurses Society of Australia")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Plus	29,924

S2	(MH "Practical Nurses") OR (MH "Nurse Attitudes") OR (MH "Nurse-Patient Relations") OR (MH "Nurse-Practice Acts") OR (MH "Nurse Practitioners+") OR (MH ">Expert Nurses") OR (MH "National Association of Clinical Nurse Specialists") OR (MH "Nursing Assistants") OR (MH "American Nurses Association") OR (MH "Nurses+") OR (MH "International Council of Nurses") OR (MH "Nursing Organizations+") OR (MH "Nursing Skills") OR (MH "Nursing Organizations, International+") OR (MH "Practical Nursing") OR (MH "Nursing Protocols+") OR (MH "Nursing Practice, Evidence-Based+") OR (MH "Nursing Outcomes") OR (MH "Nursing Interventions") OR (MH "Nursing Care Plans+") OR (MH "Oncology Nursing Society") OR (MH "Oncologic Nursing+") OR (MH "Nursing Role") OR (MH "Nursing Practice+") OR (MH "Nursing Management") OR (MH "Nursing Care+")	Search modes - Boolean/Phrase	with Full Text Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Plus with Full Text	49,211
S1	(MH "Mucositis+") OR (MH "Stomatitis+")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Plus with Full Text	3,453

APPENDIX II - Search history in the MEDLINE database (Scoping review)

Search ID #	Search Terms	Search Options	Last Run Via	Results
S10	S1 AND S3 AND S5 AND S7	Limiters - Full Text; Date of Publication: 20100101-20181231 Search modes - Boolean/Phrase		4
S9	S1 AND S3 AND S5 AND S7	Narrow by SubjectAge: - all adult: 19+ years Search modes - Boolean/Phrase		12
S8	S1 AND S3 AND S5 AND S7	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - MEDLINE with Full Text	35
S7	(MH "Nurse Specialists+") OR (MH "Nurse	Search modes -	Interface - EBSCOhost	467,567

	Practitioners+") OR (MH "Nurse-Patient Relations") OR (MH "Nurses, Community Health") OR (MH "Nursing, Supervisory") OR (MH "Nurses+") OR (MH "Nurse's Role") OR (MH "Nursing+") OR (MH "Oncology Nursing") OR (MH "Nursing Assessment+") OR (MH "Specialties, Nursing+") OR (MH "Societies, Nursing+") OR (MH "Nursing, Practical") OR (MH "Nursing Diagnosis") OR (MH "Nursing Care+") OR (MH "Education, Nursing+") OR (MH "Holistic Nursing") OR (MH "Clinical Nursing Research") OR (MH "American Nurses' Association") OR (MH "Evidence-Based Nursing") OR (MH "Critical Care Nursing") OR (MH "International Council of Nurses") OR (MH "Patient Care Planning+")	Boolean/Phrase	Research Databases Search Screen - Basic Search Database - MEDLINE with Full Text	
S6	S1 AND S3 AND S5	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - MEDLINE with Full Text	1,552
S5	S2 OR S4	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - MEDLINE with Full Text	716,571
S4	(MH "Radiation+") OR (MH "Radiation Effects+") OR (MH "Radiation Oncology") OR (MH "Radiotherapy+") OR (MH "Radiotherapy, Conformal+") OR (MH "Radiotherapy Dosage+") OR (MH "Oncologists+") OR (MH "Mucositis")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - MEDLINE with Full Text	574,191
S3	(MM "Oncology Nursing") OR (MM "Radiation Oncology") OR "oncology"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - MEDLINE with Full Text	460,629
S2	(MH "Radiotherapy+") OR "radiotherapy" OR (MH "Radiotherapy, Conformal+") OR (MH "Radiotherapy Dosage+") OR (MM "Radiotherapy, Adjuvant") OR (MM "Radiotherapy, Intensity-Modulated") OR (MH "Dose Fractionation+") OR (MH "Radiation Tolerance+") OR (MM "Radiation Oncology") OR (MM "Radiation Oncologists") OR (MM "Mucositis") OR (MM "Chemoradiotherapy, Adjuvant") OR (MH "Chemoradiotherapy+")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - MEDLINE with Full Text	355,585
S1	(MM "Mucositis") OR "mucositis" OR (MH "Stomatitis+")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - MEDLINE with Full Text	22,248

T. Vitoriano. "Risk of Oral Mucositis Induced by Radiotherapy: A SCOPING Review." *The International Journal of Engineering and Science (IJES)*, 11(10), (2022): pp. 28-38.