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REVIEW ARTICLE

Soft tissue changes in the oral cavity in patients with oral cancer undergoing chemotherapy and radiotherapy

Cambios en los tejidos blandos de la cavidad oral en pacientes con cáncer oral sometidos a quimioterapia y radioterapia

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ABSTRACT

Introduction: Oral cancer includes tumors in various areas of the mouth and is treated with surgery, radiotherapy, chemotherapy, and combined approaches, which lead to changes in the surrounding tissues.
objective: to analyze changes in the soft tissues of the oral cavity in patients with oral cancer undergoing chemotherapy or radiotherapy.
Methods: to prepare this article, the PRISMA methodology was used to examine published studies. A total of 120 scientific articles obtained through a digital search of various databases were reviewed, with 33 selected for their quality and relevance to the topic.
Results: although these treatments are effective in fighting cancer cells, they also affect healthy tissues in the oral cavity, causing complications such as mucositis, xerostomia, and infections, which diminish patients' quality of life. Therefore, proper oral care and prevention and early management of side effects are crucial to ensure better outcomes. A multidisciplinary approach mitigates complications, improves treatment efficacy, and increases quality of life before, during, and after cancer treatment.
Conclusion: chemotherapy and radiotherapy have a significant impact on the soft tissues of the oral cavity in patients with oral cancer. These treatments can cause various complications and require appropriate monitoring by healthcare personnel.

Keywords: Mouth Neoplasms; Mouth Neoplasms; Chemotherapy; Radiotherapy; Soft Tissue.

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RESUMEN

Introducción: el cáncer bucal incluye tumores en diversas áreas de la boca y se trata mediante cirugía, radioterapia, quimioterapia y enfoques combinados, los cuales llevan a modificaciones a nivel de los tejidos circundantes.
Objetivo: analizar los cambios en los tejidos blandos de la cavidad oral en pacientes con cáncer oral sometidos a quimioterapia o radioterapia.
Métodos: para la realización de este artículo se empleó la metodología PRISMA para examinar los estudios publicados. Se revisaron 120 artículos científicos obtenidos a través de una búsqueda digital en diversas bases de datos, siendo seleccionados 33 por su calidad y relevancia sobre el tema.
Resultados: aunque estos tratamientos son efectivos para combatir las células cancerosas, también afectan los tejidos sanos de la cavidad oral, causando complicaciones como mucositis, xerostomía e infecciones, las cuales disminuyen la calidad de vida de los pacientes. Por ello, el cuidado bucal adecuado, la prevención y el manejo temprano de efectos secundarios son cruciales para garantizar mejores resultados. Un enfoque multidisciplinario permite mitigar las complicaciones, mejorar la eficacia de los tratamientos y aumentar la calidad de vida antes, durante y después del tratamiento oncológico.
Conclusión: la quimioterapia y la radioterapia tienen un impacto significativo en los tejidos blandos de la cavidad oral de los pacientes con cáncer oral. Estos tratamientos pueden causar diversas complicaciones, debiendo mantenerse un adecuado seguimiento por parte del personal sanitario.

Palabras claves: Cáncer Bucal; Cavidad Bucal; Quimioterapia; Radioterapia, Tejidos Blandos.

INTRODUCTION

Analysis of changes in the soft tissues of the oral cavity in patients with oral cancer undergoing chemotherapy and radiotherapy is key to detecting early complications, preventing pathologies, evaluating treatments, and maintaining oral health. Constant monitoring allows for the identification and treatment of problems such as mucositis, infections, or bleeding, minimizing their impact on quality of life and optimizing therapeutic outcomes.[1,2]

Radiation therapy uses ionizing radiation to destroy cancer cells and minimize damage to healthy cells. However, it complicates oral cancer treatment by causing mucositis, characterized by inflammation and ulceration of oral tissues. Analyzing these changes allows for early detection of complications, evaluation of therapeutic response, and adjustment of treatment plans, improving the patient's quality of life.[3]

Chemotherapy can weaken the immune system and increase the risk of infections and other oral diseases. Regular examination of the soft tissues of the oral cavity can identify signs of infection or oral disease, allowing for timely and appropriate treatment. Maintaining oral health during chemotherapy treatment is crucial to prevent further complications and ensure the patient's overall well-being.[4]

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Oncological treatments, such as surgery, chemotherapy and radiotherapy, destroy cancer cells but affect healthy tissues, including the oral cavity, causing variations in salivary pH, salivary pathologies and a higher risk of oral diseases.[5,6,7] The side effects of chemotherapy or radiotherapy in the mouth produce dry mouth that may be related to a decrease in saliva and a change in pH, which can lead to one of the most common complications, which is dental caries.[8] Therefore, this research is significant since the prevalence of side effects in patients with oral cancer is important and can reduce the quality of life.

Radiotherapy and chemotherapy are key treatments for oral cancer, used alone or in combination with surgery to treat tumors in various structures of the oral cavity.[9,10,11,12] Radiotherapy can preserve facial appearance, avoiding deformities associated with radical surgeries. However, both treatments generate side effects, such as mucositis, xerostomia, infections and bleeding, which affect the quality of life. Furthermore, changes in pH and salivary flow, caused by damage to glandular tissue, predispose to local complications such as caries, infections and halitosis. It is essential to investigate and manage these effects to optimize clinical outcomes and improve patients' quality of life.[13,14] Taking into account the above, this review was conducted, which aimed to analyze the changes in the soft tissues of the oral cavity in patients with oral cancer undergoing chemotherapy or radiotherapy.

METHODS

The literature review focused on providing a comprehensive update on oral soft tissue changes in patients with oral cancer undergoing chemotherapy and radiotherapy based on recent evidence. Initially, a thorough search of databases including PubMed, Scielo, Redalyc, and Google Scholar was conducted, ensuring coverage of the available literature.

During the information search, the titles and abstracts of the articles found were thoroughly reviewed for selection. The full texts of these articles were then evaluated to confirm their applicability and quality, ensuring that each selected source offered significant value to the review. This rigorous and structured methodology ensured that the literature review was not only comprehensive but also up-to-date and relevant, shedding light on current innovations in diagnosis and therapeutics, providing a solid foundation for understanding and effectively managing the disease.

The PRISMA methodology was used to conduct this review, enhancing the transparency of the collected information and its systematic analysis. The search criteria included the Boolean operators "AND" and "OR" using keywords and the publication date. A total of 120 articles were obtained, excluding 831 that did not meet the criteria. A total of 33 documents met the inclusion criteria for the research.

DEVELOPMENT

First of all, it is necessary to establish what saliva is, which will vary from one individual to another and even within the same individual, since there are different salivary flows depending on the case, unstimulated or stimulated under circumstances such as the proximity of food intake, chewing, among others. The plugging capacity of saliva is an important factor that influences the pH of saliva and tooth restoration; associated with salivation because any situation where salivation decreases tends to reduce capacity and increase the risk of caries, it plays an important role in defense and security.[12,13]

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Rev Ciencias Médicas. 2025; 29(2025): e6708

The pH of saliva starts at 6.7 and 7.5, and eating protein-rich foods can alter this value. This causes a decrease in carbohydrate metabolism by bacteria. The pH of saliva, which should be between 7 and 7.4, drops and stays there when we begin to see symptoms such as cervical caries, gingival recession, mucolysis, cervical demineralization, and white spots on enamel. [3,6] The buffering capacity of saliva is important; it influences salivary pH and the dental remineralization process. Furthermore, salivary pH creates oral ecological conditions that maintain environmental balance, preventing the onset of diseases such as caries. However, if this pH is altered, it can provide an environment conducive to the progression of pathologies.[8,9]

Cancer is a chronic non-communicable disease that is one of the leading causes of morbidity and mortality worldwide. It is known that a salivary pH below 7.0 usually indicates acidic saliva. Therefore, if a chronic condition exists, the oral complex is more vulnerable to dental caries and periodontitis. In contrast, a salivary pH above 7.0 usually indicates alkaline saliva, which can cause the same anaerobic conditions as acidemia, but is a rare condition.[14] It should be noted that the oral cavity is very sensitive to the direct and indirect toxic effects of cancer chemotherapy and ionizing radiation. This risk is caused by a combination of factors, including a high rate of mucosal cell turnover, a complex and diverse microbial community, and trauma to oral tissues during normal oral function.[6,15]

Oral cancer, after laryngeal cancer, is the second most common, where about 40% of intraoral squamous cell carcinomas begin in the floor of the mouth or on the lateral and ventral surfaces of the tongue. These tumors frequently develop from preexisting precancerous lesions of the leukoplakia, erythroplasia or erythroleukoplakia type and advanced lesions directed towards ulcerated or endophytic, exophytic or mixed lesions, which is why they require adequate monitoring and treatment.[16,17]

Risk factors for oral cancer are associated with eight factors, such as: heredity, smoking habits, alcohol consumption, environmental factors, ingestion of very hot or spicy foods, diets with low levels of nutrients, chronic trauma, and bacterial, fungal, and viral oral diseases.[18,19]

Chemotherapy or radiotherapy, and antineoplastic agents in general, produce side effects for two reasons: their physicochemical characteristics and their cytotoxic effect. The side and toxic effects of chemotherapy include the following: [5,6,8,12,13]

- Alopecia: This occurs when the growth of cells in the hair follicle roots is inhibited. Hair loss usually begins three weeks after the first dose and recovers after chemotherapy ends.
- Mucositis: Mucous membranes contain cells that are constantly reproducing, which is why they are affected by chemotherapy. A slightly painful erythema appears in the mouth four to seven days after chemotherapy administration. This rash can be lacerated by chewing food, causing ulcers or canker sores that last up to 14 to 21 days. It is often associated with Candida infection.
- Nausea and vomiting: Due to their action on the gastric mucosa or also on the vomiting centers of the CNS, most cytotoxics produce nausea and vomiting.
- Infections: Immunity impaired by myelosuppression, along with disruption of normal physiology, makes the body a favorable environment for the development of bacterial, fungal, and viral infections, which must be managed appropriately to prevent the complication from becoming widespread.
- Toxicity

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Radiation therapy, while an effective treatment for cancer and other medical conditions, can have side effects, as the radiation used to damage cancer cells can also affect surrounding normal cells. Radiation therapy side effects can vary in intensity and duration depending on several factors, including the location of treatment, the radiation dose, the length of treatment, and the patient's overall health.[20] The following are some of the common side effects of radiation therapy:

- Fatigue: This is one of the most common side effects of radiation therapy. Patients may feel very tired during treatment and for weeks afterward.
- Skin irritation: When applied to the skin, it can cause redness, dryness, itching, and peeling in the treated area. In more severe cases, blisters or ulcers may appear.
- Gastrointestinal problems: When performed on the abdomen or pelvic area, patients may experience nausea, vomiting, diarrhea, or constipation.
- Throat discomfort and difficulty swallowing: Application to the head and neck may lead to a sore throat, difficulty swallowing, and changes in taste.
- Dental problems: Radiation therapy to the head and neck can also cause damage to teeth and gums, which can increase the risk of cavities and gum disease.
- Skin changes: In some areas of the body, such as the breast, radiation therapy can cause permanent changes in the pigmentation of the skin and subcutaneous tissue.

During cancer treatment, bacterial plaque should be monitored, oral hygiene measures should be reinforced, periodontal checks should be performed, and attention should be paid to the management of oral pathologies secondary to chemotherapy. Forty percent of patients undergoing chemotherapy develop mucositis, depending on the type of chemotherapy agent used. In patients receiving radiotherapy to the head and neck, more than 90 % may develop this condition, which appears as an erythematous lesion that causes pain and develops into an ulcer or canker sore, which may appear four to seven days after starting treatment.[21]

In this context, it is important to clarify that the most frequent pathologies depend on the process or state of the chemotherapy or radiation, for example, during these, dental emergencies occur, in the secondary oral, oral mucositis, xerostomia, infections of the oral mucosa, oral bleeding, dental pain or sensitivity and osteonecrosis; while after oncological treatment the patient must be under constant control to avoid complications.[22]

In conditions requiring surgical removal of affected tissue, radiation therapy and chemotherapy can cause significant masticatory limitations in patients. Surgery to remove tumors in the oral cavity often involves resection of part of the mandible, tongue, or other structures, which can affect masticatory function and oral mobility. Furthermore, radiation therapy can cause fibrosis in the surrounding tissues, reducing the elasticity and mobility of the mandible. Side effects of chemotherapy, such as mucositis and dysgeusia, can also contribute to difficulty chewing food. These limitations can affect patients' quality of life, interfering with adequate nutrient intake and contributing to weight loss. A comprehensive approach to oral and nutritional rehabilitation, along with psychological support, is essential to improve masticatory function and quality of life in individuals who have faced oral cavity cancer and its associated treatments.[23,24]

A considerable proportion of patients undergoing chemotherapy or radiotherapy tend to experience xerostomia. It is worth noting that this condition, commonly known as dry mouth, is common among patients undergoing chemotherapy and radiotherapy, especially when directed at the head and neck region. These treatments can damage the salivary glands, significantly reducing saliva production. The decrease in saliva not only contributes to the uncomfortable sensation of dry mouth but also has implications for oral health, as saliva plays a crucial role in protecting the teeth and oral mucosa.[23]

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Similarly, the incidence of oral candidiasis in cancer patients, with a notable 55% being female, highlights a significant association between oral cancer and fungal infections. Oral candidiasis, a yeast infection of the genus Candida, is especially prevalent in individuals with compromised immune systems, such as those undergoing cancer treatment. In the context of oral cancer, candidiasis may arise as a secondary complication, exacerbated by disruption of the oral mucosa during the disease or as a side effect of therapies such as radiotherapy and chemotherapy.[25]

There is an increased risk of infection, as radiation therapy can weaken the immune system, increasing the risk of oral and general infections. It also increases the risk of dental problems, such as increased susceptibility to cavities, tooth loss, and gum problems due to dry mouth and radiation exposure. Osteonecrosis of the jaw may also occur; in rare cases, the death of bone tissue in the mandible or maxilla. Therefore, it is important to keep in mind that these effects may vary depending on the radiation therapy dose, duration of treatment, the patient's overall health, and other individual factors. The medical team usually offers strategies to mitigate these side effects and improve quality of life during and after treatment.[26]

Furthermore, patients receiving chemotherapy and radiotherapy for oral cancer need special care to manage side effects and maintain a good quality of life during treatment. The main precautions include good oral hygiene, with gentle brushing after each meal and rinsing with solutions recommended by the medical team to help prevent infections; controlling dry mouth with saliva stimulants, moisturizing mouthwashes, or sugar-free gum; and a soft or liquid diet. In some cases, a soft or liquid diet may be recommended to facilitate eating if swallowing is difficult.[27]

One aspect that is often neglected is nutrition in patients with oral cancer. Special care is required for these patients. Therefore, they require adequate nutrition. Maintaining a balanced and nutritionally dense diet is essential to help the body recover and maintain energy. They should also get enough rest, as fatigue is common. Therefore, it is important to spread out daily activities to avoid exhaustion and to communicate any pain or discomfort to the medical team so they can prescribe pain relievers or other appropriate treatments. [28,29,30]

Also, patients should take special care of their skin, since, if there is irritation or redness on the skin due to radiation therapy, follow the recommendations of the medical team for skin care in that area. Likewise, infection control is pertinent to maintain good hygiene, avoid crowds if the immune system is weakened and follow the recommended vaccination guidelines and an essential aspect, have emotional support since chemotherapy and radiation therapy can be emotionally challenging. And of course, attending all medical and follow-up appointments is vital to monitor the response to treatment and manage side effects and report any side effects or changes in health to the medical team to receive guidance and adjustments in treatment if necessary. [31,32,33]

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CONCLUSIONS

Oral cancer includes tumors in various areas of the mouth and is treated with surgery, radiation therapy, chemotherapy, and combined approaches. Although these treatments are effective in combating cancer cells, they also affect healthy tissues in the oral cavity, causing complications such as mucositis, dry mouth, and infections, which diminish patients' quality of life. Therefore, proper oral care, prevention, and early management of side effects are crucial to ensure better outcomes. A multidisciplinary approach mitigates complications, improves treatment efficacy, and enhances quality of life before, during, and after cancer treatment. Ongoing research and early detection are key to optimizing outcomes and combating this disease comprehensively.

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