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ARTIGO DE REVISÃO

Endodontic treatment in patients previously subjected to head and neck radiotherapy: a literature review

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Abstract:

The head and neck region is an expressive site of malignant neoplasms. Radiation therapy is a type of cancer treatment that can be used before or after surgical procedures, or in contraindicated surgery cases. Radiotherapy can cause various side effects in the patient's mouth, including xerostomia, mucositis, radiation cavities, and osteoradionecrosis. Due to the risk of osteoradionecrosis after dental extractions, endodontic treatment ends up being the best preventive and therapeutic method. The purpose of this study is to review the literature on endodontic treatment in cancer patients undergoing radiotherapy.

Keywords: Radiotherapy, Osteoradionecrosis, Endodontic treatment

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INTRODUCTION

The survival rate and quality of life increase for oncologic patients is based on many resources that are available nowadays. These means may even contribute for the patient's definite healing. The most frequent therapies for cancer treatment are surgical excision (resection of the tumoral mass and surrounding tissues) and chemotherapy and/or radiotherapy. The two latter methods aim the destruction and/or growth inhibition of neoplastic cells by interfering in cell division and acting on the the metabolism of cells that bear a large mitotic activity[1].

The radiation received during the radiotherapeutic treatment may result in several alterations at the maxillofacial complex. Thus, a multidisciplinary approach thas includes a dental treatment plan should always precede radiotherapy in order to minimize the radiation effects on the patient[2].

Endodontic treatment plays an important role as far as maxillofacial pre and post irradiation treatment. Head and neck radiation therapy side effects include severe caries lesions. Teeth extractions are not recommended due to the risk of osteonecrosis, hence the importance of endodontic therapy as treatment of choice for these patients[3].

Other side effects associated with radiation therapy may also interfere with the patient's treatment. The objective of this review was to analyze all information available in the literature with respect to endodontic treatment in patients that had been previously submitted to radiotherapy and guidelines to turn endodontic sessions more comfortable for these patients.

RADIATION THERAPY

Radiation therapy has been employed since 1895 as an adjuvant treatment for malignant neoplasms. It may be applied before or after the surgical procedure, or may be adopted when a surgical procedure is not recommended[4].

Exposure during radiotherapy affects both neoplastic and healthy cells, which invariably induces toxicity in tissues adjacent to the tumor bed, such as skin, oral mucosa, maxillary bones, teeth, salivary glands, temporomandibular joints and facial muscles[5,6].

Radiation therapy side effects may be classified according to the time frame in which they occur: acute effects or late effects. Acute effects occur at the same period that the patient is subjected to the therapy and is usually associated with high rates of cell renewal. Among the most frequent, one may notice xerostomia, pH alterations, mucositis, trismus, oportunistic infections (oral candidiasis), dermatitis, dysphasia and dysgeusia[7]. Late effects may occur months or years after the treatment and include periodontitis, radiation-induced dental caries, xerostomia and osteoradionecrosis. The complications may be temporary and disappear by the end of the treatment period, or permanent. Chronic complications need follow-up by the dental clinician[8].

Total doses of absorbed radiation, type of radiation therapy, frequency of application, tissues involved, tumor stage, age and the patient's overall health condition influence the intensity of the effects[9,10].

Radiation applied in oncologic patients induces considerable changes in the bone homeostasis, hence resulting in decreased osteoblastic activity, osteocytes destruction, bone marrow fibrosis and reduction of blood irrigation. These alterations affect the bone by increasing the vulnerability to infections and reducing its capacity of repair[11].

Osteoradionecrosis is a late side effect that affects up to fifty percent of all patients subjected to radiotherapy[12]. Some factors may promote the development of osteoradionecrosis, such as immunesupressions, trauma, exposure to chemical substances and infections (extensive caries, severe periodontitis and periapical lesions). In the absence of predisposing factors, osteoradionecrosis may still occur[13,14].

Some authors mentioned that osteoradionecrosis risk might fluctuate from the first 3-7 months after the end of the radiation therapy to 10 years[15,16]. Marx (1983) pointed that after the irradiation, bone tissue becomes hypoxic, hypovascular and hypocellularized. All these factors interfere with bone repair and this situation may endure for long periods of time.

In general, the risk of developing osteoradionecrosis will accompany the irradiated patient throughout his entire life. The treatment is extremely complex, teeth extractions must be avoided at all costs, and all efforts must be made to prevent extractions. Consequently, endodontic treatment assumes an important role as an alternative treatment in this group of patients[17].

ENDODONTIC TREATMENT

Patients with head and neck malignant neoplasms that will be subjected to radiotherapy treatment should preferably receive dental and endodontic treatment prior to radiation sessions in order to eliminate any form of

disease present on the teeth and mucosa. During or after radiotherapy, infections foci evolve more aggressively[18].

Occasionally, the tumor growth is so severe that it is not recommended to delay radiation therapy because of pre-radiotherapy dental treatment[19]. In those cases, endodontic treatment with proper root canal sealing is essential in oral health maintenance and side effects prevention[13].

Endodontic treatment should never be performed during the radiation therapy period. However, when the patient is having pain associated with an endodontic acute process, a treatment session must be performed, with medical consent, to relieve the patient's symptomatology[20].

A considerable variety of oral alterations may occur by reason of irradiation, so numerous procedures must be cared for from the initial diagnosis until the endodontic procedures follow-up. Endodontic sessions should be short because the patient might feel uncomfortable with keeping the mouth open for long periods. This situation may develop as a result of trismus in the muscles of mastication[21].

Diagnosis

Diagnosis is obtained via a thorough clinical examination that aims to analyze signals and symptoms collected by means of subjective, objective and complementary exams[10].

Anamnesis must be comprehensive, enclosing previous and current medical history, radiotherapy beginning and timeframe, dosage (Gy) and number of therapy sessions. If necessary, the dental clinician has to contact the patient's oncologist[9].

The physical exam must include tooth mobility, horizontal and vertical percussion tests, temperature pulpal tests and presence of cavities in all teeth with suggestion of lesions that involve the pulp. While performing pulpal vitality tests, teeth may present exaggerated response due to post-radiotherapy pulpal hyperemia. After radiation caries are established, most teeth do not respond normally to temperature pulpal tests. They present weak and late responses due to a reduced pulpal blood supply that is related to fibrosis of the inner layer of the blood vessels. This fibrosis occurs after radiation and may be responsible for producing calcifications or irregular dentin[1]. At this phase, a periapical radiography is recommended, to verify alterations in the dentin or thickening of the pericemental membrane[15].

Complementary imaging exams (e.g. panoramic radiography and periapical radiographies) may be performed before the first dental visit, so that endodontic treatment prescribed[22].

When performing a periapical radiograph in irradiated patients, it is recommended to protect the corners of the radiographic film with utility wax to possible trauma in the oral mucosa, thus avoiding to transform dormant bone necrosis into more severe bone necroses[22,23].

According to Rosales (2009), approximately 41% of patients that did not have a dental evaluation performed before radiotherapy were in need of endodontic treatment. On the other hand, only 10.8% who had dental evaluation prior to radiotherapy had to undergo canal treatment in the post-radiotherapy period[24].

There are few studies that proposed to establish a safe time for initiation of endodontic therapy after radiotherapy. Shafer (1987) stated that the ideal period for endodontic treatment would be from 60 to 120 days after radiotherapy ends, at which time any bone alterations would be less present. According to these authors, the professional, however, had to an evaluate the conditions of the oral cavity and the patient's systemic health[20].

Several studies have shown that radiation therapy does not induce pulpal damage. Hutton (1974) and Nickens (1977) noted no histological differences in pulp tissue after being submitted to 70 Gy of irradiation[25,26].

Knowles (1986) observed that decreased pulpal sensitivity was noticed only in teeth within or adjacent to an irradiated field, while Kataoka (2011) noted a time-dependent decrease in oxygen saturation levels in pulpal tissues submitted to radiation[27,28].

Cox (1976) stated that these complications may be reduced by dose fractionation, use of radiation protection devices, as well as the assessment and dental treatment previously to radiation therapy[4].

Anesthetic technique, rubber dam isolation, endodontic access opening and odontometry

The anesthetic technique should be as atraumatic as possible and appropriate to the area to be treated. The patient presents a natural vasoconstriction of his/her blood vessels associated with radiotherapy. Therefore, it is recommended to use local anesthetics without vasoconstrictor especially in the region of the mandible. The incidence of osteoradionecrosis is about seven times

greater in the mandible when compared to the maxilla. In addition, the clinician should avoid the intraligamentary anesthetic technique to prevent trauma and possible periodontal ligament necrosis[22].

Because of the loss of dental tissue caused by dental caries, it is difficult to isolate these patients. In those cases, the practitioner must use several devices to avoid the promotion of gum trauma associated to the placement of clamps. Physical aggression to the periodontium may lead to alveolus necrosis and subsequent osteorradionecrosis[29].

One of the techniques consists of anchoring the rubber sheet to neighboring teeth by wrapping several teeth under the rubber dam, and use of dental floss around the damaged teeth instead of using metal clamps. When necessary, the clinician may rebuild the dental crown with restorative materials as composite resin[30]. Crown lengthening surgical procedures should be avoided because of the high risk of developing osteorradionecrosis[31].

Since these patients may present decreased salivary flow and / or dry mouth (xerostomia), the use of artificial saliva and creams are recommended. The application should occur prior to rubber dam isolation, reducing the discomfort during endodontic therapy[22].

Montgomery (1977) suggested that endodontic treatment for patients that had previously been submitted to radiotherapy should begin several months after the end of the treatment[21]. Due to trismus associated with radiation therapy, he recommended that the patient exercised his muscles by opening his mouth to the maximum for 20 times each morning, afternoon and evening, and did not use mouth opener. In extraordinary situations, Seto (1985) proposed that endodontic access openings could occur in unusual locations such as buccal aspect of inferior incisors[32].

Root canal length measurements should preferably be performed with the aid of an electronic apex locator and confirmed by periapical radiography. Due to the difficulties in the radiographic acquisition, as the film may injure the mucosa, the radiographic confirmation can be excused if the professional has experience over the electronic device[33].

Patients irradiated in the head and neck region generally present hyposalivation. Thus, it is important that it be the lip hook of the electronic apex locator and the mucosa around it are moistened with saline or artificial saliva, in order to promote the necessary conductivity between the electrodes and thus increasing the reliability of the results obtained by the electronic apex locator[22].

A well performed odontometry is critical for these patients. The professional may always work before the apical foramen or cement-dentin junction limit, hindering later accidents of instruments or obturator materials trespassing, overflow of chemical substances and irrigating materials to the periapical tissues, in order to avoid osteorradionecrosis[33].

Root canal instrumentation, medication, obturation and follow-up

The mechanical chemical preparation phase is decisive for the success of endodontic treatment and must be performed with great care and skill. The clinician must perform this step within the working length. In these patients, working length must always be before the apical limit (on average, the working length is one millimeter in cases of necropulpectomy and two millimeters in cases of biopulpectomies[22].

During the irrigation phase, it is essential to maintain some reflux space for the chemical substance. Some authors recommend the use of a fine needle coupled with a measuring ring; the ring must be regulated between the middle and apical thirds of the dental canal. This will avoid the overflow of the irrigation solution, hence preventing an inflammatory response at the periapical region[34,35].

According to Montgomery, head and neck radiation therapy patients may present facial muscles trismus and ankylosis of the TMJ. These factors may limit the patient mouth opening and also result in a painful posture to the patient. Therefore, treatment should be performed in short sessions[21]. The instrumentation with rotary or reciprocating endodontic motors is strongly recommended for irradiated patients, because the automated technique makes the treatment faster, more comfortable and provides a very good cleaning efficiency and canal shaping[36].

Since the irradiated patient is vulnerable to the development of osteoradionecrosis and different levels of depression of the immune state, some authors recommend the use of prophylactic antibiotics during endodontic treatment. As a first choice, semisynthetic derivatives of penicillins such as amoxiline and ampicillin may be prescribed. If the patient is allergic to these drugs, the patient may use clindamycin. There are no major contraindications for the use of other drug groups in these patients[37]. However, according to Andrade

(2003) the use of antibiotic therapy during endodontic treatment in irradiated patients is questionable[3]. He suggested that there is a reduced penetration of the antibiotic at the bone tissue as a result of the local ischemia.

In a study of primary teeth in irradiated children, Kielbassa (1995) advocated that calcium hydroxide appears to be an acceptable method in this situation, especially when compared to other medications[38].

The endodontic filling step should be performed with the least irritating materials and extra care should be applied in order to not overfill the canal. Because of the frailty of the dentin structure of irradiated patients, the compression performed during vertical and lateral condensation should be delicate[22].

Bodrumlu (2009) conducted a study with 90 extracted teeth. His results demonstrated that it is safe to use resin-based materials in patients that received radiotherapy. The apical sealing capacity of resin-based root fillers (e.g. AH Plus) decreased slightly when radiotherapy was administered, but there was no statistically significant difference[40].

The tooth must be permanently restored as soon as possible with resin or glass ionomer based materials and the use of fiberglass or carbon posts is recommended in those cases with large coronary destruction. In more severe cases, root retainment in the alveolus is advised[1].

The follow-up of these patients should be permanent. The professional should observe the bone repair at the affected area and especially be aware of the possible recontamination and installation of pathological processes. The patient must be oriented in terms of hygiene control, eating habits and sequels from radiation. The return of these patients varies according to each case, with a mean of three-month follow-up[3].

In a retrospective analysis with 22 cases, Lilly (1998) classified 20 (91%) of them as being were successful[40]. Both failures were associated with pulpal necrosis. He did not observe occurrences of osteoradionecrosis in a mean follow-up period of 19 months, evidencing that endodontic treatment in previously irradiated patients may be successful.

CONCLUSION

The literature demonstrates the importance that endodontic treatment plays in maintaining the oral condition of patients submitted to radiotherapy, both for the control of pain symptoms in teeth with acute pulpitis, and for the prevention of osteoradionecrosis lesions development[41]. Endodontic treatment hinders tooth extractions, rehabilitates the patient with both aesthetic and functional restoration of the teeth and improves their quality of life[42].

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