

Research Article

Dental Management of Head and Neck Radiotherapy: A Literature Review

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Received: 06 April 2020; **Accepted:** 20 April 2020; **Published:** 04 May 2020

Citation: Dr. Anthony Challita, Dr. Raymond Challita, Dr. Ronald Challita, Dr. Sayde Sokhn, Dr. Mona Zeitouny. Dental Management of Head and Neck Radiotherapy: A Literature Review. Dental Research and Oral Health 3 (2020): 052-061.

Abstract

Objective: To reveal the importance of dental care for Head and Neck Cancer (HNC) patients and the dentist role in treating these patients.

Data source and selection: Two online databases (PubMed and Google Scholar) were searched (June 2019). All studies that were analyzed with access to full text in English language were included.

Data synthesis: The selected articles shows the importance of the dentist intervention pre, per and post radiation therapy that helps to ease the symptoms which appear due to radiation and may delay their appearance. The dentist's knowledge in the physiology of cancer and radiation treatment is essential and really important for the success of the whole treatment and amelioration of patient's quality of life.

Conclusion: A good knowledge by the dentist and a caring, cooperant patient improves the patient's quality of life and reduces the severity of the side effects.

Keywords: Radiotherapy; Head and Neck Cancer; Dental Management Pre/Per/Post Radiotherapy

1. Introduction

Cancer, a multicellular and multigenic disease, has a multifactorial etiology and can arise from all types of organs and cells. This disease persists the outstanding cause of global death [1, 2]. There are many modalities to treat cancer including radiotherapy, chemotherapy, surgery, hormonal therapy, immunotherapy and a combination of two of these modalities. Radiation therapy (RT), an important component of cancer treatment, contributes towards 40% of the curative treatment of the disease [3]. The target of radiotherapy is to divest these cells from their dividing (cell division) potential [4]. It can be given as an adequate modality of reassuring treatment to ease the patients from cancer causing symptoms as well as being used for the intent of cure [5]. Depending on the location of the disease; inevitably, oral mucosa, salivary glands and jaws will be built in the radiation treatment portals. Therefore, radiation will induce changes to these tissues [6]. Another name for this radiation is ionizing radiation because it deposits energy in the cells and forms ions (electrically charged particles). Other indication for RT is its merging with different treatments such as chemotherapy [7]. Two types of radiation therapy exist: internal and external beam radiation therapy. The unit of measurement for the amount of radiation is called Gray (Gy). Usually the dose is expressed in centigray (cGy). In external beam radiation, the total dose is divided into

fractions. The latter is several smaller doses that are given and results in the least damage to normal tissues. For irradiations of curative aspect, the dose is generally 1.8 to 2 Gy by session. Most of the times, the treatment is given 5 days a week, for about 5 to 8 weeks. In certain types of cancer patients, the treatment may be done more often than once a day. The total dose varies according to the case and varies between 30 to 70 Gy [8].

Hyperfractionated radiation splits the dose into two sessions of treatment without affecting the duration of the treatment; therefore, the patient would be treated twice a day for several weeks. There is also the accelerated radiation in which the total dose is delivered over a shorter period of time and keeping the same radiation dose. The disadvantage of it is that the undesirable effects are seen sooner and may be worse [9]. In addition, the necessary dose to treat a tumor depends on several points:

- Histology of the tumor and its radiosensitivity.
- The size of the tumor: the more voluminous, the more radiosensitive
- Macroscopic aspect of the tumor: the budding tumors are much more sensible than infiltrating tumors [10].

Although radiotherapy saves many people from cancer, it also has many side effects such as: Hyposalivation and xerostomia, radiation caries, dysgeusia, mucositis, oropharyngeal candidiasis, periodontal disease, odynophagia, osteoradionecrosis (ORN) and trismus. For that, we will see how the practitioner should deal with HNC patients treated by radiotherapy [11]. Side effects of radiotherapy appear through the same

mechanism that damages normal cells specially the cells that divide rapidly or the ones that are less able of rehabilitating the damage caused by radiation and high energy. Most of these effects, affect the buccal mucosa, muscles and temporomandibular joint, hard tissue, bone and hematologic consequences arising in distinctive radiation symptoms [12]. Radiation therapy is an outgrowing treatment for HNC. Nowadays, most dentists have a fear of treating such patients with the persistence of the controversy of treating or not. So, we conducted this literature review to reveal the importance of dental care for HNC patients in the pre, per, and post radiation treatment and to emphasize on the importance of the dentist role to hinder the presence of the undesirable effects of the treatment.

2. Materials and Methods

Two online databases (PubMed and Google Scholar) were searched (June 2019). The selected articles were published between the years 2001 and 2018. The search was based on several keyword related to head and neck radiotherapy, cancer, and dental management. All studies that were analyzed with access to full text in English language were included. Around sixty articles were read. Twenty-eight of them were used to accomplish the review. The eliminated articles are those including chemotherapy treatment, were published in year 2000 or earlier, and radiotherapy treatment for regions other than the head and neck. The selected articles showed the importance of the dentist intervention pre, per and post radiation therapy which helps to ease the symptoms that appear due to radiation and may delay their appearance. The dentist's knowledge in the physiology of cancer and radiation treatment is essential and really important for the

success of the whole treatment and amelioration of patient's quality of life.

3. Results

After analyzing around sixty articles and studying only twenty-eight of them, they showed that dental management is essential for head and neck cancer patients. A full oral and dental examination is recommended before starting the radiation treatment. Moreover, several prophylactic measures should be done to reduce the severity of the undesirable effects resulting from radiotherapy. During radiotherapy, no dental treatment is to be considered. Post-radiation treatment, a life-time follow up should be maintained. When a surgical procedure is to be done, a strict operative control is to be followed. The cooperation between the dentist, the radiologist, and the patient is an essential key for the success of any dental treatment and helps in easing the side effects of radiotherapy. Finally, the most important factor that should be maintained is the good oral hygiene.

4. Discussion

4.1 Pre-Radiotherapy management

A well-organized management may prevent or attenuate the problems in the oral cavity due to radiotherapy. A bad oral hygiene, broken tooth, defective restorations and periodontal problems may cause complications during and after the radiotherapy (Table 1). Consulting a dental team that have an experience in treating HNC patients is imposed before the beginning of the treatment [13]. Before the start of radiotherapy, a complete oral and dental examination (clinical examination and full mouth radiographs), diagnosis, and treatment should be done. The complete radiographic

examination is imposed to determine the presence of periapical inflammatory anomalies, periodontal disease, other oral diseases, and invasional tumor of bone. Panoramic radiograph and selective periapicals or bite-wings should be done after the evaluation of the oral cavity and before starting radiotherapy [14]. Table 2 shows the essential elements to assess in pre-radiotherapy. Prophylactic treatment should be done. Restoration of carious lesion, recontouring of restorations, and endodontic therapy should be done before starting radiotherapy to avoid any negative outcome due to the treatment. Unrestorable teeth should be extracted in the preradiation phase to reduce the risk of osteoradionecrosis [16].

4.1.1 Precautions regarding anesthesia: The anesthetic procedure, associated or not to vasoconstrictors, can be used for local or loco-regional techniques. We should avoid intraseptal anesthesia since it may provoke necrosis [17].

4.1.2 Precaution regarding extractions: Dental extractions should be realized as soon as possible in an atraumatic way before starting radiotherapy, in order to allow the necessary period of time needed for healing. The time between the dental extractions and beginning of radiotherapy should not affect the scheduled time for radiotherapy. The delay is in function of the surgical gesture (simple extraction = 14 days, impacted tooth = 21 days) and the dose of irradiation. It is indispensable to clinically control the mucosal healing. Every surgical site should heal as fast as possible in an appropriate way before starting radiotherapy to reduce the risk of ORN. Table 3 shows the criteria that leads to dental extractions before RT [13, 18].

4.1.3 Precaution regarding periodontal disease:

Before starting the radiation treatment, only scaling, root planning and some gingivectomies are acceptable. Periodontal surgeries are contra-indicated since the delay of healing available before irradiation is usually not sufficient [19].

4.2 Per-Radiotherapy management

It is indispensable to follow the patients during radiotherapy to:

- Observe the evolution of the oral cavity state, evaluate the motivation, renovate the oral hygiene advices, and effectuate necessary dental treatment.
- Take charge of side effects, which can appear during the beginning of radiotherapy.

The dentist may equally be consulted in emergency by the patient during the course of radiotherapy to treat an acute infection. In emergency cases, the treatment will be discussed with the radiologist. In all cases the most conservative possible [20]. In general, no surgical act is acceptable during radiotherapy. If extractions are imposed, the dentist may complete the act if it is outside the irradiated area. On the other hand, if the tooth is in the irradiated zone, the treatment should be limited to a conservative treatment to treat the emergency, and the extractions will be postponed until the end of radiotherapy [21].

4.3 Post-Radiotherapy management

After the treatment, at the level of oral cavity, the patient presents several complications. Extensive caries risk increases simultaneously with the risk of pulpal involvement. Irradiation may alter pulp vascularity and therefore its capacity for repair. Endodontic treatment

for teeth having caries reaching the pulp is preferred to extraction in an irradiated field. In addition, unrestorable teeth may be endodontically treated to control infection and symptoms while reducing the risk of ORN. However, trismus and poor access may obscure endodontic treatment. Placing a rubber dam may be challenging, and preventing an ideal canal access may be due to the lack of inter-occlusal space. Limited attention was given to the success rate of root canal therapy in irradiated patients, but it seemed to be acceptable. That's why, practitioners should observe and take charge of the patient for a life time [22].

4.3.1 Precaution regarding xerostomia: Management of xerostomia starts with the same approach as other radiotherapy side effects which is good oral hygiene. Maintaining a good oral hygiene decreases the severity of xerostomia in addition to preventing secondary undesirable effects such as caries. Sialogogues as well as regular non-medicated mouth wash should be used for symptom relief. Sialogogues and cholinergic agonist may offer some dental protection and may be used for relief of symptoms. However, side effects of pilocarpine such as bronchospasm, diarrhea and bronchospasm may limit its use [12]. Administration of drugs and the use of contemporary techniques in delivery of RT selectively protect healthy tissues, can decrease significantly the undesirable radiation effects on salivary glands. Nonetheless, many HNC patients still experience severe xerostomia [23].

4.3.2 Precaution regarding anesthesia: The use of vasoconstrictors is contra-indicated in irradiated areas. The locoregional anesthesia is preferred when compared

to periapical. Intraligamentary and intraseptal anesthesia is banned [24].

4.3.3 Precaution regarding extractions: The decision to make an extraction is based on the location of the tooth to be extracted (49). If the tooth is in a non-irradiated area, the act can be done without any risk. No particular precaution is necessary. The practitioner extracts the tooth under local or loco-regional anesthesia, with or without vasoconstrictor [24]. On the other hand, despite the recommendations of the oral state before the start of radiotherapy, it is sometimes necessary to extract the tooth located in the irradiated area. This decision has heavy consequences, since whatever the operatory technique, the risk of developing ORN is always present, even if the irradiation was done tens of years before. That's why, practitioners should try to conserve the teeth to the maximum, but sometimes extraction is crucial. This act should be done in a specific environment, with a surgical technique adapted to the situation [25]. An antibioprophylaxis of large spectrum is a rule for covering infectious risk: this prescription should start at minimum one hour before the gesture and be continued until the total healing of the mucosa (15 days of minimum are generally necessary) [24, 25].

The extractions should be done according to a strict protocol:

- Thorough disinfection of the operatory chamber, chlorhexidine irrigation.
- Local or loco-regional anesthesia without vasoconstrictors.
- Atraumatic extraction, followed by regularization of alveolar crest with a thorough curettage.

- Placement of hemostatic sponge.
- Utilization of biological glue that permits mechanical protection of the extraction site and formation of blood clot.

Post-operative advices are then given to the patient:

- Continuing the antibiotic until healing.
- Chlorhexidine based mouth wash for tens of days.
- Strict oral hygiene.
- Mixed and cold alimentation.
- Avoiding all exogenous irritants. (alcohol and tobacco)

A strict post-operative surveillance is established until obtaining complete healing. Some practitioners give hyperbaric oxygen therapy sessions pre and post-operatively to limit the risk of ORN after the extractions, but this technique is expensive and its beneficence is still a controversy [24,25]. With all the precautions, we hence limit the risk of ORN but this risk will never be eliminated [26].

4.3.4 Precaution regarding periodontal disease and conservation of implants:

In the irradiated area, scaling, superficial root planning and polishing may be done. Infragingival surfaces and periodontal surgeries are to be proscribed. Implant placement is desirable in the case of prosthetic failures due to post-surgical scars and post-radiotherapy preventing the retention and stability of the prosthesis [27]. In non-irradiated zones, there is no contra-indication for the placement of implants. In irradiated zones, implantology for long time is proscribed. However, clinical studies of implants

in irradiated zones gave positive results and is henceforth a positive act. The decision of implant placement is done according to each case, by a multidisciplinary committee and with the consent of the patient. It considers many parameters:

- Benefit/risk ratio: favorable
- Delivered dose: from 40 – 50 Gy the risk increases.
- Individual factors: absence of comorbidity, severe alcohol-tobacco intoxications, excellent oral hygiene.
- Radiotherapy/implantology delay: globally, once radiotherapy is done, it is preferable to wait between 6 to 18 months before placing the implant.

The patient should be informed of the risk present as well as inherent constraints to the surgical technique, but also to the beneficence it has. The surgical technique for implant placement should follow the same precautions as those done for the realization of an extraction:

- Under antibiotic coverage: it is started 48 hours before the intervention and continued until healing (15 days).
- Thorough disinfection and chlorhexidine irrigation.
- Atraumatic surgery: osseous drilling with a low speed with abundant physiological serum irrigation.
- Good suturing of the operative site.

A regular radiographic surveillance of the implant site is needed to search for infectious signs [28].

Intervention	Observation
Formal diagnosis	Size and type of tumor
Knowledge in OH	Dental check-ups
Medical history	History of cancer, factors and risk
Dental Examination	Moccus, dentition, periodontium, TMJ
Radiological examination	Panoramic, periapicals, bite-wings
Salivary rate	At rest >0.1 ml\min, provoked>1 ml\min
Type of recommended RT	Programming, dose, field

Table 1: Strategies for oral cavity treatment of a RT for HNC before starting RT (13).

<p>CANCER FACTOR</p> <p>Advanced Stage Cancer Requiring RT</p> <p>Nasopharyngeal and Oropharyngeal Tumors</p> <p>Tongue Cancer</p>
<p>RADIATION FACTORS</p> <p>>26 Gy to Parotid Glands</p> <p>>50 Gy to Mandible</p> <p>>40 Gy (mean); >70 Gy (max.) to Mandible</p> <p>3DRT or Conventional RT</p>
<p>PATIENT FACTORS</p> <p>Poor History of Dental Compliance</p> <p>Oral Hygiene Status</p> <p>Low Socioeconomic Status (without insurance)</p> <p>Without Home Support-Network</p>
<p>TOOTH FACTORS</p> <p>Endodontic Disease</p> <p>Periodontal Disease</p> <p>Periapical Pathosis</p> <p>Prosthetic Factor</p>

Table 2: Summary of high-risk factors with poor oral health prognosis [15].

Decay (non-restorable tooth)
Active periapical infection
Periodontal affection
Absence of antagonist tooth, limited hygiene
Uncomplete eruption of tooth
Multiple periapical lesions

Table3: Criteria relative to dental extractions pre-radiotherapy (13)

5. Conclusion

Until now, with the fight of cancer, the therapeutic arsenal is more and more getting larger and varied. Despite the better comprehension of physiopathological mechanisms in cancerology and developing anti-cancerous treatment more targeted and performing, some of its secondary effects at the level of the oral cavity is inevitable. Hence, the dentist has a primordial role in the prevention and/or the treatment of the oral cavity occurring effects secondary to anti-neoplastic therapeutics, where the importance is seen in taking charge of the patient by his dentist before, during, and after his carcinogenic treatment. The principle objective is to avoid the apparition of complications related to some treatments, and hence ameliorating the patient's quality of life. All dentists can treat, without fear, HNC patients, starting from the moment where they have the specific knowledge relative to the management and apply scrupulously the management and precautions for this kind of patients. That's why, it is necessary to have contact between the oncologist, surgeon, radiologist and the dentist. A multidisciplinary collaboration permits good management of the patient. Even though there is no international consensus concerning the management of

certain pathologies, there exist some specific references detailing the odontologic management of HNC patients. All these notions should be now provided largely and the importance of treatment modality of dental management should be known by all the practitioners, who have clear and precise information that they should undertake as treatment modalities for HNC patients.

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