

Literature Review: Relationship between Radiotherapy and Orthodontics

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Abstract: *In Mexico, cancer is the third cause of death and according to estimates by the Union for International Cancer Control, each year more than 128,000 cases of Mexicans are added. Patients who have recovered from cancer, especially during childhood, have an association of dental complications such as caries, dental development abnormalities including agenesis, microdontia, short roots or enamel defects, which can occur in different stages of cancer or once the treatment is completed. In the ages when orthodontic treatment should start, between 5 and 14 years, it is shown that leukemia (26%), tumors of the central nervous system (27.8%) and lymphomas (17%) predominate among cancers. That is why the orthodontist must have communication not only with the patient and his parents but with the entire medical team.*

Keywords: *Cancer Effect • Radiotherapy • Orthodontic Care • Dentistry • Dental Effects*

Date of Submission: 08-11-2020

Date of Acceptance: 21-11-2020

I. Introduction

The American Cancer Association estimates that 10,590 children under the age of 15 in the United States (Ritwik 2018) were diagnosed with cancer in 2018 and in France (Boyer et al. 2017) each year approximately 1,700 children under the age of 15 and 800 adolescents between 15 and 19 years of age are diagnosed with cancer. In Mexico, cancer is the third cause of death and according to estimates by the Union for International Cancer Control, more than 128,000 Mexican cases are added each year, although the International Agency for Research on Cancer raises this figure to 140,000. (SMeO 2016)

Patients can take different treatments such as chemotherapy, immunotherapy, radiotherapy, surgery and/or hematopoietic cell transplantation. Likewise, breast cancer is the second cause of cancer-related deaths in both developed and developing countries, due to advances in treatments in recent decades, the minimum 5-year survival rate is 83-90%. (Boyer et al. 2017; Willershausen et al. 2019)

Despite the fact that with advances in medicine there are still side effects to these treatments and the orthodontist can resolve some of them.

Patients who have recovered from cancer, especially during childhood, have an association of dental complications such as caries, dental development abnormalities including agenesis, microdontia, short roots or enamel defects, which can occur in different stages of cancer or once the treatment is completed. (Busenhart et al. 2018; Çetiner et al. 2019; Gawade et al. 2014; Javed et al. 2010; Ritwik 2018)

II. Materials And Methods

Studies from the last 10 years (2010 to 2020) were obtained to collect the information using the UABC (Autonomous University of Baja California) metasearch engine administered by EBSCOhost in Spanish or English using the keywords of "chemotherapy and orthodontics or dentistry" and "quimioterapia AND ortodoncia OR odontología". Once compiled, analysis and writing of the current article began.

Pediatric and adolescent patients

Treatment at an early age shows to be associated with an increased risk of dental agenesis, xerostomia, microdontia, root changes and enamel hypoplasia. (Gawade et al. 2014; Ritwik 2018) The severity and intensity depend on the age of the patient and the dental stage of development at the time of chemotherapy. (Ritwik 2018) They can present other complications such as mucositis, infections, neurological, bleeding tendency and development of osteonecrosis. (López, Esteve, and Pérez 2011; Willershausen et al. 2019)

A Busenhart (Busenhart et al. 2018) meta-analysis collected 741 studies, only 16 were eligible to verify the adverse effects of chemotherapy in the mouth of children, the most common adverse effect showed to be agenesis, then in order was microdontia, premature apical closure, caries, high rates of dentobacterial plaque, enamel hypoplasia, modified root development, dental discoloration, reduced salivary capacity and increased *Streptococcus mutans* count.

Preventing these dental complications, especially carious lesions, is essential in these patients to reduce the risk of cardiac damage(Gawade et al. 2014), a radiographic examination must be carried out to establish prevention strategies, the dentist together with the oncology team must assess the state of health of the patient as well as the severity of carious lesions and the presence of pathological lesions.(Ritwik 2018)

A systematic analysis(Gawade et al. 2014) shows the problems that were generated dentally in patients who received chemotherapy treatment, with a minimum follow-up of 2 years after finishing therapy in childhood, adolescence or young adults. Twenty-five studies were analyzed, however in several studies chemotherapy was accompanied by radiotherapy. Vincristine and the alkylating agents were associated with dental abnormalities, since it affects the mature secretion of odontoblasts and ameloblasts.(Çetiner et al. 2019; Gawade et al. 2014) Suggesting the use of preventive dental treatments to improve dental results after chemotherapy.

Breast Cancer

A Willershausen(Willershausen et al. 2019) study in patients who were successfully treated for breast cancer was compared with healthy individuals of approximately the same age (average of 60.5 years and 60.3 respectively) showed a higher rate of dental loss, periapical injuries and carious lesions in those who underwent to a chemotherapy and radiotherapy treatment.

Orthodontic Care

At the ages when orthodontic treatment should start, between 5 and 14 years, it is shown that leukemia (26%), tumors of the central nervous system (27.8%) and lymphomas (17%) predominate among cancers and depending on the risk of immunosuppression, infections and thrombocytopenia limit the possibilities of treatment.(Boyer et al. 2017) That is why the orthodontist must have communication not only with the patient and their parents but with the entire medical team, in addition to being informed of the phases through which they undergo these patients. Depending on the phase or situation the patient is in, Boyer(Boyer et al. 2017) et al developed a timeline and suggested protocols to follow.

One of the most important aspects for the orthodontist is the craniofacial development of patients to achieve a prognosis for treatment. In 2019, Çetiner(Çetiner et al. 2019) et al carried out a study with 31 children who would receive treatment to combat cancer and compared them with 26 healthy children who coincided in age and sex, a cephalometric analysis was performed that did not yield statistically significant values. Thus, it was concluded that chemotherapy does not cause modifications in craniofacial development, and that it does not interfere with the structures of the temporomandibular joint (TMJ).

Those who present long-term, non-preventable risks such as agenesis and microdontia should visit their dentist or orthodontist experienced in these cases regularly.(Gawade et al. 2014) Xerostomia and enamel hypoplasia are commonly seen 10 years later, in addition to root changes, they can complicate the treatment management or limit it, the use of light forces and compromises in the results must be discussed with the patients and their parents.(Ritwik 2018)

Osteonecrosis of the jaw

Another side effect of chemotherapy is the suppression of the bone marrow, causing leukopenia, thrombocytopenia and anemia. These gradually disappear at the end of the treatment.(López, Esteve, and Pérez 2011) We must consider that within the dental movement we need a bone in the most favorable conditions possible. One of the worst oral side effects within orthodontics is osteonecrosis of the jaw (ONJ). A review by Javed et al.(Javed et al. 2010) found 97.6% and 99.1% success in osseointegration studies of dental implants in patients who underwent chemotherapy treatment. They suggest that the osseointegration and functionality of dental implants have a high success rate that does not limit treatments.

However, ONJ is observed in patients treated with bisphosphonates, these inhibit bone resorption and are administered intravenously in cases with bone metastases.(López, Esteve, and Pérez 2011)

The incidence of ONJ is not exact since the literature differs between 0.8% and 12%. 2009 studies suggest an incidence of 1-3%. Typically it is characterized by progressive and prolonged pain but in initial stages the patient may be asymptomatic. Since the manifestations are usually sufficient to establish a diagnosis, in cases where there is doubt, a differential diagnosis should be made between ONJ and bone metastases with a biopsy, diagnostic aids could be a panoramic radiograph and CBCT.(López, Esteve, and Pérez 2011)

The average life of bisphosphonates ranges from 1 to 10 years.(López, Esteve, and Pérez 2011)So there must be a time in consideration for those patients who require orthodontic treatment.

III. Conclusion

The diagnosis of these patients at any stage of their chemotherapy treatment must be capable as dentists or orthodontists of knowing the limitations and the objectives to be achieved.

Multiple studies agree that the work of the dentist is essential in preventive and corrective care in these patients, provide them with a better lifestyle and elevate their state of mind to overcome their fight against the disease, as a health professional we should help them on this journey to recovery.

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Rubén D. Pérez, et. al. "A review of literature about the relationship between radiotherapy and orthodontics". *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(11), 2020, pp. 53-55.