



A review on the incidence of malocclusion after radiotherapy

Dr. Simran Naresh Verma^{1*}, Dr. Deepa Das²

¹ Resident, Department of Oral Medicine and Maxillofacial Radiology, Dr. G.D. Pol Foundations YMT Dental College and Hospital, Navi, Mumbai, Maharashtra, India

² Professor, Head Department of Oral Medicine and Maxillofacial Radiology, Dr. G.D. Pol Foundations YMT Dental College and Hospital, Navi, Mumbai, Maharashtra, India

Abstract

There is lack of data related to dental occlusion amongst patients cured from radiotherapy. The aim of our review was to highlight the long-term effects of radiotherapy on the craniofacial skeleton and dentition. The complication of malocclusion following radiotherapy in paediatric population has been well documented but a similar incidence in adults has not been given any importance in the present literature. It is important to understand the fundamental disease, its treatment protocols, effects on growing skeleton, dental development, bone, and tooth movement.

Keywords: radiotherapy, malocclusion, cancer survivor, dental age, tongue function

Introduction

Radiotherapy (RT) is defined as the use of high energy radiation from X rays, gamma rays, neutrons, protons, and other sources to kill cancer cells and shrink tumours. (National Cancer institute dictionaries) By the Dental Practice Board, UK, malocclusion has been defined as 'an abnormal occlusion in which teeth are not in a normal position in relation to adjacent teeth in the same jaw and or the opposing teeth when the jaws are closed ^[1]. Long term effects of radiotherapy on the developing dentition in childhood cancer survivors is not very well documented. To bridge this gap our review aims to understand the possible complications of radiotherapy in the development of craniofacial defects.

Paediatric cancer includes children of ages 0 to 14 years. It affects approximately 12 in 1,00,000 children ^[2, 3]. The types of cancer most commonly diagnosed in children include - acute lymphoblastic leukaemia (26%), brain & CNS tumour (21%), neuroblastoma (7%). The 5-year survival rate is as high as 93.5% with improved therapeutics, including radiotherapy, chemotherapy, and surgery. These therapies have adverse effects on the craniofacial skeleton and dentition as discussed below ^[4, 5, 7].

Disturbances in dental development

Radiotherapy treated cases are presented with-

- a. Arrested root development
- b. Short v shaped roots with premature apical closure
- c. Microdontia
- d. Increased incidence of aplasia
- e. Malocclusion
- f. Reduction in tooth size
- g. Significant deterioration in the mobility and sensory function of the tongue ^[8, 4, 9]

Radiation doses

When 24 Gy cranial radiation was given to children at ages between 3- 13 years in a study, there was decrease in cranial

base 5 yrs. after treatment ^[10, 11]. Radiation doses of 4 Gy has been reported to result in dental defects. Nearly, 10 Gy of radiation exposure can permanently damage mature ameloblasts. Greater than 20 Gy radiations can significantly increase incidence of one or more dental anomaly ^[12].

Dental anomalies occur when tooth development is occurring or near the vicinity of the radiation beam. Direct high dose radiation to dentoalveolar complex during very early phases of tooth development may destroy non-proliferating odontogenic precursor cells and result in complete agenesis of the tooth ^[13, 14]. Radiation at a later stage of dental development or at a lower dose result in less drastic defects ranging from microdontia, enamel hypoplasia and incomplete calcification to arrested root development ^[15]. Maria *et al* in their study concluded that RT has impact on the development of crown and roots of the teeth, while root defects occur more commonly. The most common root defect was impaired root growth whereas the most common crown defect was microdontia ^[16, 17].

Higher radiation dose, longer radiation schedules, and younger age at time of treatment are associated with more pronounced defects and significant facial asymmetry because of damage to the growing bones – in particular, the growth centre in the mandibular condyle. Damage to the thyroid gland and pituitary axis also indirectly exacerbates the severity of skeletal discrepancy because of overall growth retardation ^[18, 20].

In adults, owing to pre-RT prophylaxis protocol, some patients undergo extraction which later causes mesial/ distal tipping, supra-eruption and results in malocclusion. Proc *et al* ^[19] in their study found the most common malocclusions in patients between 5 – 7 years to be class II (31.8%), class III (15.4%), crowding (47.2%), reduced overjet (11.4%), excessive overbite (23.4%) and posterior crossbite (9.4%). They attributed this to the significant deterioration in the mobility and sensory function of the tongue. Also tooth loss and subsequent need of dental prosthesis were found to alter masticatory function.

Conclusion

The fundamental disease needs to be understood by the dental professional before initiating treatment. The highest risk of the development of dental abnormalities occurs when children receive anti-cancer treatment before the age of 5 years. From this review, it could be concluded that radiotherapy can alter the development of dental occlusion. The crossbite type of occlusion in patients with history of cancer treatment, was related to the presence of teeth with short roots. It is imperative, therefore, that all dental professionals become knowledgeable about these consequences to provide dental care in a safe manner and to restore the oral cavity to health. Evidence based methodology needs to be followed in such circumstances.

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