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Review Article

Orthodontic considerations in pediatric cancer survivors: An insight

Sumita Mishra[1]*, Ananya Panda[1], Shambhavi Jha[1]

[1]Dept. of Orthodontics, Siksha O Anusandhan Deemed to be University, Bhubaneswar, Odisha, India

Abstract

Every year, around 50-200 million children (0-19 years) worldwide are diagnosed with cancer. Efficient and successful patient support and assistance systems and the deterrence of complications significantly improve survival rates and limit long-term relapses. Orthodontic treatment of children who have suffered or are currently enduring cancer treatment is challenging for the Orthodontist and the family members. There are various oncological therapies. These include radio and chemotherapy, bone transplants. These modalities have helped increase the number of paediatric cancer survivors exponentially. But there is an ardent necessity of long term follow up, both in terms of medical and dental. The treatment timing and the nature of cancer dictate Orthodontic management in children with cancer. The children undergoing chemotherapy or radiotherapy must be dealt with cautiously and with the utmost care during the Orthodontic treatment. Various features like gingivitis, mucositis, xerostomia are typically seen in cancer survivors. These conditions affect the duration of the orthodontic treatment and adversely pose a threat to oral hygiene maintenance. Here, in this article, we provide our perspective on different Orthodontic considerations while dealing with pediatric patients who have already overcome cancer. Cancer therapy critically affects oral and dental health and demands conventional Orthodontic care alterations. This article also provides specific recommendations based on the prevailing practice and existing literature to help Orthodontists modify their treatment modality for pediatric cancer survivors.

Keywords: Cancer survivors, Neoplasm, Therapy, Malocclusion.

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1. Introduction

Orthodontic treatment is an explicit specialty that deals with patients of all ages, mainly children, adolescents, and young adults. The Orthodontist may come across children and adolescents who are long-term cancer survivors. Cancer will be second if we consider various reasons for death in children following post-accident trauma and poisoning. Among the prevalent diagnosed cancers, cancer cases in children represent 2% of them. Pediatric cancer survivors seeking Orthodontic treatment increase with the decrease in the mortality rates due to the ongoing advancement in finding treatment solutions for such cancer-affected children.[1] Undesirable effects of Orthodontic treatment, like various dental developmental problems and disorders in the growth of the craniofacial skeleton, are expected in long-term pediatric cancer survivors. Thus, Orthodontists need to make changes and modifications in their treatments considering the health condition of such children.

2. Cancer Treatment Modalities and their Effects

Oncological patients consulting an Orthodontist can be divided into three groups:

1. Cancer survivors.
2. Patients undergoing supportive treatment.
3. Patients undergoing active oncological treatment (primary cancer, relapses).

The basis of most oncological treatment in children is chemotherapy (medication), but when accompanied by radiotherapy and surgery, it forms a combined cancer treatment modality for them.

Oncological patients getting chemotherapy and radiation therapy during their growing phase have consequences on the growth of craniofacial structures and dental development, such as arrested root development, microdontia, enamel disturbances, premature apical closure, and aplasia. The

*Corresponding author: Sumita Mishra
Email: sumitamishra@soa.ac.in

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chances of carious teeth may also be increased due to reduced salivary function. Changes in taste perception are also evident.[2] In pediatrics, some cancer treatments can adversely affect the development of cranial bones, cervical vertebrae, and structures related to the oral cavity involving the teeth and jaws.[3,4] Common adverse effects of oncological treatment on dental development include arrested root development, microdontia, enamel disturbances, premature apical closure, and aplasia.[5,6] Kaste et al. documented that the patient's age during cancer treatment is a critical factor in the development and degree of these oral complications.[7-9]

3. Physiopathology of Cancer Therapy

Cells with an increased rate of cell division, like tumor cells, are targeted in Chemotherapy. Antineoplastic drugs do not differentiate between neoplastic cells and normal cells. The regular cells, such as the basal epithelial cells in the buccal mucosa possessing high mitotic activity, are also affected. Oral mucosal epithelium is thinning due to the continuous renewal of cells, leading to its increased susceptibility to microtrauma. Mucosal erosions or ulceration are often encountered during chemotherapy.[10]

A complete interpretation of the physiopathology of these tumor lesions is yet to be done. Mucositis is illustrated in five different biological phases (**Figure 1**).[11]

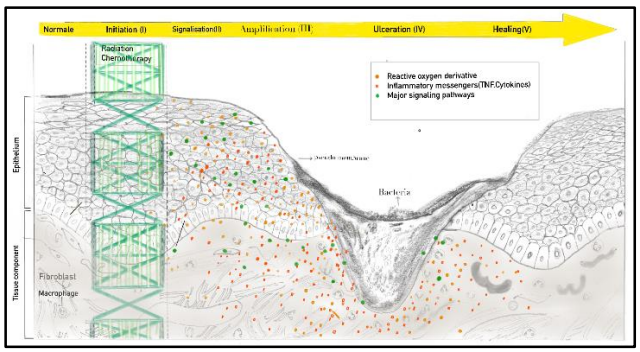

Figure 1: Stages of mucositis ("Reproduced from Boyer et al.[11]")

The regenerative function of the mucosa is often affected when chemotherapy and radiotherapy are combined, causing oral ulceration, signifying a significant risk factor for infections for the patients. Radio and chemotherapy negatively affect the salivary glands, leading to quantitative and qualitative alterations in salivary flow.

Secretions of a few drugs or metabolites (like methotrexate) are in saliva. The altered high viscosity of saliva, oral microflora, and plaque are affected by saliva's modified pH.[12] Corticosteroid administration during chemotherapy disrupts the metabolism of bone. It is found that there is a predominance of osteoclasts in patients under chemotherapy. The appointment duration and the number of visits to the Orthodontist should be minimal to reduce the chance of infection, as the patients are vulnerable to various infectious factors during dental visits.

4. The Role of an Orthodontist and the risks involved

Treatment planning done by Orthodontists for this group of patients includes simple mechanics that minimize the chance of root resorption, application of light force, terminating the treatment with the compromised outcome, and earlier than usual, excluding the mandibular arch. It is recommended that the commencement of orthodontic treatment be delayed for at least two years post-completion of cancer therapy.[13,14] According to the existing literature, it is estimated that delayed consequences of cancer therapy are seen in nearly 50% of all survivors. These delayed consequences may be caused by cancer or its treatment like chemotherapy, radiotherapy, surgery, or supportive care such as transfusions, antibiotics, immunosuppressive therapy, or a combination of these factors.

The after-effects depend on the extent, grade, intensity, and area the disease affects. The child's age and psychological and physical developmental status during the diagnosis and treatment are essential factors for the late adverse effects. Genetic or hereditary influence may play a role in aggravating the late effects.[15]

Late sequelae include organ failure, the secondary onset of malignancy, early mortality, decreased fertility, and adverse psychosocial problems. The following principles have to be taken care of by Orthodontists when treating oncological patients:[16]

1. Orthodontic treatment should commence after two years of completion of anticancer therapy. It is related to the chances of developing secondary malignancy in 2.6-12.1% of cases.
2. The treatment planning should be modified to consider the health condition of the patient and also should satisfy the patient's expectations.
3. The treatment mechanics should be simple and uncomplicated, with light force application that helps in reducing the chances of resorption of roots.
4. Esthetic brackets or clear aligners should be preferred instead of metal to avoid minor artifacts during imaging examinations.
5. The treatment duration should be reduced, and the appointments should be short.
6. Mostly, treatment will end without ideal finishing and detailing and a compromised outcome.
7. Treatment should only be restricted to the maxillary arch. As such, patients' growth period is limited due to decreased duration of pubertal growth. So, the mandibular growth becomes inhibited, making class II corrections difficult and growth modification nearly impossible.
8. Patients should always be motivated to maintain good oral hygiene. Due to salivary dysfunction, patients are more prone to caries. It is suggested that patients not use elastics, and they should be prescribed fluoride products and mouth moisturizers.[17,18]

Osteoradionecrosis increases in patients undergoing radiotherapy, mainly affecting the body of the mandible.[19]

Considering the risk factors, an undesirable effect was seen for advanced tumors, segmental resections of the mandible, and radiation therapy before or after the tooth extractions. Extraction of teeth needed for Orthodontic treatment was responsible for most of the osteoradionecrosis in patients. Healing post-extraction is also a problem in such children.[20] Extractions indicated for Orthodontic treatment should be deferred for two years post-cancer therapy when starting or resuming the Orthodontic treatment.

Patients undergoing anticancer therapy develop low resistance to microbial infections and degeneration of oral mucosa. Subsequently, they become at risk for complications associated with appliances that may irritate the oral mucosa. Thus, oral appliances for such patients should be chosen considering their risks. Patients should be advised to rinse their mouths frequently with artificial saliva and apply fluoride topically. Ulcerations may occur due to the decreased regenerative ability of the mucosa.

The appliances should be removed if the patient has to undergo supportive chemotherapy or radiotherapy during the active Orthodontic treatment to reduce the incidence of oral complications. Once the patient shows improvement and there is a diminution of the tumor with an improved prognosis, Orthodontic treatment can recommence. Though orthodontic treatment for such patients won't result in ideal finishing, it does not have harmful side effects.

Major risk factors to be considered before Orthodontic treatment

1. Age: Below eight years
2. Type: Solid tumor
3. Region: Craniofacial region, CNS
4. Therapy: Allogenic stem cell transplantation
5. Radiotherapy: Total body or head and neck area and more than 2400 cGy
6. Chemotherapy: Busulfan/ Cyclophosphamide
7. Years of disease-free: Less than two years
8. Sequalae: Hypothyroidism, Hypopituitarism, Prolonged Immunosuppression
9. Oral health- Agenesis of teeth, Microdontia, abnormal root development, decreased salivation

A study by Neill et al. mentions, though less in number, that pediatric cancer survivors do seek Orthodontic treatment. Most Orthodontists agreed to treat the cancer survivors, with expected complexity and complications. Thus, these cases should be managed with the knowledge of existing evidence and treatment modalities.

Most of the Orthodontists who participated in this study reported enquiring about the patient's medical history. A detailed medical history should be recorded for each patient, which becomes more significant in pediatric cancer patients.

There should be a proper follow-up of the patients, and verification of medical records should be done to ensure that the Orthodontic expectations are met without compromising the health and well-being of the patient. Seventy-two percent of the Orthodontists in this study came across dental complications in pediatric cancer survivors. Their treatment planning included a variety of Orthodontic treatment modifications. Commonly reported complications included malaligned teeth, microdontia, root stunting, and altered growth and development. Also frequently noted in this study was a need for longer treatment times and modifications to the treatment plan.

5. Long-Term Stability in Orthodontic Treatment for Cancer Survivors

Before resuming Orthodontic treatment, checking the completion date of cancer therapy and any ongoing supportive treatment is advisable. The risks of infection can be predicted if the patient is still on antibiotic prophylaxis and immunosuppressants. Two years post-HSCT (hematopoietic stem cell transplantation), Orthodontic treatment can commence or restart if stopped between cancer therapy. It is rare to find any acute complications as immunological efficiency is increased.[21] For chemotherapy without radiotherapy or surgery, Orthodontic treatment may commence after a few months of the treatment.

The long-term stability and retention of the results of Orthodontic treatment is challenging. Ten years post Orthodontic treatment showed stable results in only 30–50% of the patients.[22]

It must be noted that retention and stability are essential to Orthodontic treatment.[23] All other treatment goals, including ideal occlusal function and optimal aesthetics, may be disturbed without Orthodontic stability.[24,25]

In their study, Littlewood et al. and Woods et al. explored the causes of relapse post-Orthodontic treatment. Along with the gingival, periodontal, occlusal factors, and growth, the effect of mandibular muscles also has a role in maintaining occlusal stability. According to their research, the treatment stability worsened during the 3-year retention period in cancer survivors compared to healthy subjects.

6. Conclusion

Significant development is seen in pediatric cancers, allowing several children to survive into adulthood and often requiring Orthodontic treatment. According to the literature present, it is evident that pediatric cancer patients face the after-effects of cancer therapy, so Orthodontists need to modify their treatment. Strictly outlined Orthodontic protocols should be formed and evaluated by Orthodontists to treat these patients as effectively as possible. If required,

the guidelines and methods should be shared with cancer treatment centers to advise patients on elective treatment, such as orthodontics.

7. Ethics Approval

Not applicable

8. Author Contributions

Ananya Panda contributed to manuscript preparation, and Sumita Mishra and Shambhavi Jha contributed to data collection from various existing literature

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10. Conflict of Interest

None.

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References

1. Neill CC, Migliorati C, Trojan T, Kaste S, Karydis A, Rowland C, et al.. Experience and expertise regarding orthodontic management of childhood and adolescent cancer survivors. *Am J Orthod Dentofac Orthop*. 2015;148(5):765-70. https://doi.org/10.1016/j.ajodo.2015.05.027.
2. Psoter WJ, Shope ET. Some Cancer Chemotherapy (CH) Agents May Be Associated With Tooth Agenesis, Though CH Dose, Age of CH Exposure, and Dental Development at the Time of Treatment May Be Critical Determinants. *J Evid Based Dent Pract*. 2019;19(4):101352. https://doi.org/10.1016/j.jebdp.2019.101352.
3. Carrillo CM, Corrêa FNP, Lopes NNF, Fava M, Filho VO. Dental anomalies in children submitted to antineoplastic therapy. *Clinics*. 2014;69(6):433-7. https://doi.org/10.6061/clinics/2014(06)11.
4. Jaffe N, Toth BB, Hoar RE, Ried HL, Sullivan MP, McNeese MD. Dental and Maxillofacial Abnormalities in Long-Term Survivors of Childhood Cancer: Effects of Treatment with Chemotherapy and Radiation to the Head and Neck. *Pediatrics.* 1984;73(6):816-23. https://doi.org/10.1542/peds.73.6.816.
5. Kurt BA, Armstrong GT, Cash DK, Krasin MJ, Morris EB, Spunt SL, et al.. Primary Care Management of the Childhood Cancer Survivor. *J Pediatr.* 2008;152(4):458-66. https://doi.org/10.1016/j.jpeds.2007.10.002.
6. Leggott PJ. Oral complications of cancer therapies. Oral complications in the pediatric population. *NCI Monogr.* 1990;(9):129-32.
7. Kaste SC, Goodman P, Leisenring W, Stovall M, Hayashi RJ, Yeazel M, et al.. Impact of radiation and chemotherapy on risk of dental abnormalities. *Cancer.* 2009;115(24):5817-27. https://doi.org/10.1002/cncr.24670.
8. Kaste SC, Hopkins KP, Bowman LC, Santana VM. Dental abnormalities in children treated for neuroblastoma. *Med Pediatr Oncol*. 1998;30(1):22-7. https://doi.org/10.1002/(sici)1096-911x(199801)30:1<22::aid-mpo8>3.0.co;2-2.
9. Madeya ML. Oral complications from cancer therapy: Part 1--Pathophysiology and secondary complications. *Oncol Nurs Forum*. 1996;23(5):801-7.
10. Sonis ST. Mucositis: The impact, biology and therapeutic opportunities of oral mucositis. *Oral Oncol.* 2009;45(12):1015-20. https://doi.org/10.1016/j.oraloncology.2009.08.006.
11. Boyer É, Robert G, Gandemer V, Bonnaure-Mallet M. Orthodontic strategies in pediatric oncology. *J Dentofac Anom Orthod*. 2017; 20:104. https://doi.org/10.1051/odfen/2016035
12. Main B, Calman K, Ferguson M, Kaye S, MacFarlane T, Mairs R, et al. The effect of cytotoxic therapy on saliva and oral flora. *Oral Surg Oral Med Oral Pathol*. 1984;58(5):545-8. https://doi.org/10.1016/0030-4220(84)90077-x.
13. Dahllöf G, Huggare J. Orthodontic considerations in the pediatric cancer patient: A review. *Semin Orthod.* 2004;10(4):266-76. https://doi.org/10.1053/j.sodo.2004.09.007.
14. Burden D. Orthodontic treatment of patients with medical disorders. *Eur J Orthod.* 2001;23(4):363-72. https://doi.org/10.1093/ejo/23.4.363.
15. Oeffinger KC, Eshelman DA, Tomlinson GE, Buchanan GR. Programs for adult survivors of childhood cancer. *J Clin Oncol*. 1998;16(8):2864-7. https://doi.org/10.1200/jco.1998.16.8.2864.
16. American Academy of Pediatric Dentistry. Best practices for dental management of pediatric patients receiving immunosuppressive therapy and/or radiation therapy. *Pediatr Dent*. 2018;40(6):392-400.
17. Mitus-Kenig M, Derwich M, Czochrowska E, Pawlowska E. Cancer survivors present significantly lower long-term stability of orthodontic treatment: a prospective case–control study. *Eur J Orthod*. 2021;43(6):631-8. https://doi.org/10.1093/ejo/cjaa083.
18. Mishra S. Orthodontic Therapy for Paediatric Cancer Survivors: A Review. *J Clin Diagn Res.* 2017;11(3):ZE01-4. https://doi.org/10.7860/JCDR/2017/23916.9404.
19. Reuther T, Schuster T, Mende U, Kübler A. Osteoradionecrosis of the jaws as a side effect of radiotherapy of head and neck tumour patients--a report of a thirty year retrospective review. *Int J Oral Maxillofac Surg.* 2003;32(3):289-95. doi: 10.1054/ijom.2002.0332.
20. Dahllöf G, Jönsson A, Ulmner M, Huggare J. Orthodontic treatment in long-term survivors after pediatric bone marrow transplantation. Am J Orthod Dentofacial Orthop. 2001;120(5):459-65. https://doi.org/10.1067/mod.2001.118102.
21. Sheller B, Williams B. Orthodontic management of patients with hematologic malignancies. *Am J Orthod Dentofacial Orthop*. 1996;109(6):575-80. doi: 10.1016/s0889-5406(96)70068-9.
22. Knighting K, Kirton JA, Thorp N, Hayden J, Appleton L, Bray L. A study of childhood cancer survivors' engagement with long-term follow-up care: 'To attend or not to attend, that is the question'. *Eur J Oncol Nurs*. 2020;45:101728. https://doi.org/10.1016/j.ejon.2020.101728.
23. Yu Y, Sun J, Lai W, Wu T, Koshy S, Shi Z. Interventions for managing relapse of the lower front teeth after orthodontic treatment. *Cochrane Database Syst Rev*. 2013;2013(9):CD008734. https://doi.org/10.1002/14651858.CD008734.pub2.
24. Johnston CD, Littlewood SJ. Retention in orthodontics. *Br Dent J*. 2015;218(3):119-22. https://doi.org/10.1038/sj.bdj.2015.47.
25. Woods MG. The mandibular muscles in contemporary orthodontic practice: a review. *Aust Dent J.* 2017;62 Suppl 1:78-85. https://doi.org/10.1111/adj.12481.

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