Children Undergoing Chemotherapy: Is It Too Late for Dental Rehabilitation?

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Children undergoing cancer therapy encounter a diverse spectrum of oral changes that generally are attributed to immunosuppression and bleeding tendencies caused by the therapeutic agents. Therefore, providing oral health instructions and dental rehabilitation before the initiation of cancer therapy is encouraged. In this article, we discuss the general dental management of pediatric patients with cancer actively undergoing cancer therapy, or for whom it is planned. We also describe the dental rehabilitation performed on a child while he was undergoing chemotherapy for neuroblastoma, using an unconventional approach that varied from the standard management protocol used by King Abdulaziz University Hospital. The importance of close collaboration between the medical and dental teams is highlighted.

Key words: *Chemotherapy, dental rehabilitation, pediatric dentistry, pediatric oncology*

INTRODUCTION

In a well-structured hospital setting, the dental team plays an important role in improving patients' quality of life. Dentists, especially pediatric dentists, can offer education, consultations, and immediate management to both inpatients and outpatients. The pediatric dentistry team often is called upon to provide full-mouth rehabilitation to children undergoing non-dental surgeries, in order to take full advantage of the operating room (OR) opportunity. This article presents the general aspects of dental management of children with cancer, along with guidelines issued by the American Academy of Pediatric Dentistry (AAPD). It also introduces the modified protocol that King Abdulaziz University Hospital (KAUH) has adopted for the dental management of these children, and it describes the modified protocol as implemented in the case of a child with neuroblastoma (NB).

Dental Management for Pediatric Cancer Patients

Dental caries is the most prevalent childhood disease[1]. It is caused by tooth-adherent bacteria, most commonly the species *Streptococcus mutans,* followed by *Lactobacillus*[2]. Untreated caries can negatively affect quality of life by causing pain and loss of function, consequences that can have negative psychological effects[3]. Improved understanding of the importance of caries prevention has shifted the paradigm of pediatric dentistry from "treat as needed" to "educate and prevent."

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Recently, the AAPD has recommended that the first dental visit for children occur by no later than 12 months of age[4], with an emphasis on prevention rather than treatment. This is not always feasible, however, mainly due to a lack of education and proper parental perception of the importance of oral health. Children often are found to have advanced oral disease, mainly in the form of caries, at their first dental visit. This condition becomes even more complicated—and the management more challenging—for children with special health care needs (CSHCN) as pediatric patients with cancer.

In general, childhood malignancies do not have a direct effect on the oral cavity. However, cancer therapy, in the form of chemotherapy, radiotherapy, immunotherapy, and stem cell transplant, has both systemic and oral complications[5,6]. This article will emphasize on complications related to chemotherapy, the first line of treatment in many leukemias and NBs.

Fatigue, fever, nausea, vomiting, appetite changes, hair loss, growth retardation, anemia, thrombocytopenia, and neutropenia are among the systemic complications of chemotherapy. Thrombocytopenia, a decrease in the platelet count, increases the risk for prolonged or spontaneous bleeding. Neutropenia, a decrease in the neutrophil count, renders the patient immunocompromised, with a high risk for infections. Both thrombocytopenia and neutropenia have a negative impact on the patient's overall well-being, and can jeopardize dental treatment[7,8]. The AAPD recommends that routine dental treatment be performed when the absolute neutrophil count (ANC) is above 2,000/mm^3 and the platelet count is above 75,000/mm^3 [(9)]. When the ANC and platelet count are >1,000/mm^3 and >40,000/mm^3, respectively, only limited emergency treatment in a proper hospital setting, after consultation with the oncologist, is permitted[9].

Complications from chemotherapy can be manifested orally as well. Oral manifestations include oral mucositis; orofacial pain;

bacterial, fungal, and viral infections; hemorrhage; neurotoxicity; xerostomia; distortion in taste; and dental defects[5-6,10-14]. These complications have a negative impact on the patient's quality of life and present serious challenges in patient management. The two most prevalent of these are oral mucositis and opportunistic infections.

Oral mucositis—inflammation and ulceration of the oral mucosa—is considered the most severe complication of cancer therapy, affecting over 60% of patients undergoing chemotherapy[12]. Despite various mucositis prevention modalities, such as palifermin and cryotherapy, the condition cannot be prevented in most cases[6]. Drug therapy and palliative treatment can, however, improve the outcome of the condition and enhance the patient's quality of life.

Opportunistic oral infections are very common in patients receiving chemotherapy[6]. Early diagnosis and definitive treatment are crucial. The most common opportunistic oral pathogens in patients with chemotherapy-associated immunosuppression are *Candida* sp, organisms that are managed most commonly with troches containing anti-fungal agents such as nystatin and clotrimazole[6]. Prophylactic use of antifungal therapy for patients with severe neutropenia has been adopted by many oncologists[15].

The AAPD has published comprehensive guidelines for multidisciplinary dental management of pediatric patients undergoing cancer treatment, including management of both pre-existing oral findings and those that develop as a result of anticancer therapy (9). The objectives of these guidelines are to identify and eliminate sources of infection, provide treatment before the development of systemic chemotherapy side effects, emphasize the importance of oral health, and educate parents about the possible oral manifestations of chemotherapy. The guidelines provide recommendations for patient management before (e.g., fluoride application, restorative procedure), during (e.g., management of infections and xerostomia), and after (e.g., periodic evaluation, orthodontic treatment) anticancer therapy and encourage all dental treatment to be completed before the initiation of chemotherapy.

Many children with malignancies present with multiple carious lesions at the time of cancer diagnosis. Pediatric dentists play an important role as part of the multidisciplinary oncology team by providing treatment, education, and close follow-up. They not only manage dental caries in oncology patients but also often diagnose and manage oral adverse effects of chemotherapy and provide a customized follow-up plan.

The regular protocol is to provide dental rehabilitation before the initiation of cancer therapy; however, this is not always feasible. Obstacles include pre-booked OR sessions, long patient waiting lists, and the urgency to begin cancer therapy at the time of diagnosis. The following section includes a description of a recent case in which deviation from the regular protocol was necessary.

A five-year-old boy was brought to the University Hospital with a 4-month history of recurrent vomiting, abdominal pain, and fever. Upon first presentation, the child was terminally ill and in severe pain. The child was diagnosed with stage IV NB with metastasis to the liver, brain, bone, and distant lymph nodes. Chemotherapy was initiated promptly.

The dental team was called to evaluate the patient 8 weeks after NB diagnosis, because the child was complaining of dental pain. At the time of the initial dental visit, the child had completed three rounds of chemotherapy and had an ANC of 1,020/mm^3, a platelet count of 168,000/mm^3, and a hemoglobin value of 8.8 g/dL.

Upon examination, the child was febrile. The mouth opening was limited yet revealed inflamed mucosa, multiple deeply carious teeth, and a *Candida* infection that had been previously diagnosed by his oncology team. Given the child's presentation and treatment regimen that already included acetaminophen, a suggestion was made to shift the administration of acetaminophen from "as needed" to a regular schedule of 240 mg orally, every 4 to 6 h. The aim was to create a stable analgesic plasma level and minimize the chance of breakthrough pain, according to treatment goals described in the World Health Organization (WHO) analgesic ladder[16]. In an effort to stop further caries progression, the mother was given instructions on basic oral hygiene. The patient already was being treated with daily saline-peroxide mouthwashes and topical nystatin suspension for the mucositis and oral candida infection.

After a week, the pediatric dentistry team was called to re-evaluate the patient, who was still in pain but in a better condition than he was on the previous visit, and a tentative plan was formulated. Examination was more thorough and detailed and revealed that the mucosa was relatively moist and significantly less inflamed than it was previously. A diagnosis of severe early childhood caries was made, the extent of the caries was documented. The blood values at this visit were as follows: ANC 5,850/mm^3, platelets 254,000/mm^3, and hemoglobin 9.6 g/dL. On the basis of these values and the child's clinical presentation, it was clear that he was in the recovery stage from the chemotherapy-induced pancytopenia.

Because the child's medical status had improved, a decision was made to utilize this window of stability to provide dental rehabilitation. The general anesthesia team cleared the patient, and a tentative treatment plan was established and discussed with the parents. Oral hygiene instructions and dietary recommendations were given. The following morning, the dental team performed a 75-min full-mouth rehabilitation under general anesthesia. No complications occurred during or after the surgery. The treatment was invasive, with extraction of the five teeth requiring pulp therapy or having a questionable diagnosis.

After discharge, the child was returned to his room in the oncology ward. He was visited a week later for a follow-up examination. The child had no pain related to his teeth. The mother noted that the child was eating much better and sleeping through the night. Upon examination, the restorations were found to be intact and all extraction sites were healing normally. The remaining sutures were removed. The gingiva seemed healthier than it was during previous visits, and there was noticeably less halitosis. Oral hygiene instructions and dietary recommendations were re-emphasized.

The child resumed chemotherapy, with a round occurring 7 days after dental rehabilitation. Our pediatric dental team visited him again after 1 month. A thorough extra-oral and intra-oral examination was performed, and oral hygiene was assessed. The only significant finding was the presence of mucositis that occurred due to the chemotherapy. The patient was put on a 3-month recall schedule because of his high risk for dental disease. He was encouraged to page the dental team if any concerns arose or emergencies occurred.

DISCUSSION

Treatment usually is invasive in children receiving dental rehabilitation under general anesthesia. For CSHCN, the treatment often is radical; in order to prevent sepsis, extractions are performed for all teeth with pulp exposures or poor prognosis instead of administering pulp therapy. In this patient, the extracted teeth were all primary. All first permanent molars were partially erupted and sound, and received a glass ionomer fissure sealant to prevent future caries. The primary canines received glass ionomer restorations, as the caries was not very extensive. Absorbable sutures were used at all extraction sites to improve hemostasis. The child also received dental prophylaxis, and a 5% fluoride varnish was applied. Despite the improvement in the child's medical condition, his prognosis remained poor overall.

In this case, dental rehabilitation was initiated during active chemotherapy, which is an unconventional time for initiation of treatment. The decision to deviate from the usual protocol was taken for three reasons: first, to alleviate dental pain in an effort to improve quality of life; second, to utilize the short window of opportunity during which blood values were stable, as these were expected to worsen again with consecutive rounds of chemotherapy; and third, to eliminate oral infections that could have a more deleterious effect on the general health of this patient with cancer than on that of a healthier counterpart.

In the time since this child was treated, seventeen more children undergoing chemotherapy received dental rehabilitation in the OR according to the new protocol. These children otherwise would have had to wait for months until chemotherapy was concluded before they could utilize this service.

CONCLUSION

Cancer therapy usually is multidisciplinary, and dental rehabilitation for pediatric oncology patients is one of many channels of collaboration between the medical and dental teams. Although dental rehabilitation is best accomplished prior to the initiation of cancer therapy, this is not always feasible. This paper describes a new protocol that has allowed us to provide dental rehabilitation for pediatric oncology patients who are under active chemotherapy, when these patients' ANC and platelet counts have improved. This approach facilitates improved pain relief, allows intervention when blood readings are optimal or improved between treatment cycles, and minimizes risk of oral infections, which have the potential to be more serious in immunocompromised patients than in healthy ones.

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