

One-Hundred Day after Bone Marrow Transplantation: Oral and Dental Status in Children

Özlem Marti Akgün¹, Ceren Yıldırım², Başak Doğan Uçar³, Günseli Güven Polat⁴, Aybarshan Yılmaz², Feridun Başak⁴, Orhan Gürsel⁵, Vural Kesik⁶

¹Associate Professor, DDS, PhD, University of Health Sciences, Department of Pediatric Dentistry, Ankara, TURKEY

²Dr, DDS, PhD, Guvercinlik Dispensary, Ankara, TURKEY

³Dr, DDS, PhD, University of Health Sciences, Department of Pediatric Dentistry, Ankara, TURKEY

⁴Professor, DDS, PhD, University of Health Sciences, Department of Pediatric Dentistry, Ankara, TURKEY

⁵Associate Professor, MD, University of Health Sciences, Department of Pediatric Hematology, Ankara, TURKEY

⁶Associate Professor, MD, Anatolia Hospital, Alanya, TURKEY

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*Corresponding author: Ozlem Marti Akgun

Abstract

Original Research Article

Purpose: The infections such as gingivitis may increase due to immune suppression after BMT and can be life-threatening. Therefore, in these patients, the provision of effective oral care is an important strategy in reducing the number of decayed, missing, and filled teeth (DMFT) scores and preventing of periodontal and systemic infections. The aim of this study is to assess the DMFT, gingival health, and oral status of children after bone marrow transplantation (BMT). Methods: Thirty-one patients treated with BMT and 31 healthy children were selected. Dental examinations were performed 100 days after BMT in the study group. The DMFT, plaque index (PI), gingival index (GI), and bleeding on probing (BOP) values were recorded. Results: The differences between PI, GI, and BOP were not statistically significant in either group. Although the DMFT index values were lower in children treated with BMT than in children from the control group, the difference between the 2 groups was not statistically significant ($p=0.836$); however, dmft ($p=0.05$) and total DMFT scores were significantly different ($p=0.035$). Conclusion: Although the children in the study group are at high risk for dental caries and periodontal problems, there were no differences in the values of indexes between groups because a periodic oral examination was performed by a dentist before and after BMT.

Keywords: Bone Marrow Transplantation, Oral Health, Dental.

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INTRODUCTION

Bone marrow transplantation (BMT) is a procedure that is used for the treatment of certain cancers, aplastic anemia, congenital neutropenia, severe immunodeficiency syndromes, sickle cell anemia, and thalassemia as well as in patients after undergoing chemotherapy that destroys the bone marrow [1, 2]. In the BMT procedure, the damaged or destroyed bone marrow is replaced with healthy bone marrow stem cells. There are 3 types of BMT: autologous bone marrow transplant, allogeneic bone marrow transplant, and umbilical cord blood transplant [3].

The most serious complications of BMT include immune system suppression and the possibility of graft-versus-host-disease (GVHD) [4]. Patients may be susceptible to bacterial, viral, and fungal infections after BMT. Gastrointestinal problems, hepatitis B virus

infections, encephalitis, pneumonia, cytomegalovirus infections, and intraoral infections are also common [2, 5, 6]. The oral mucosal barrier is impaired in patients treated with BMT; hence, they are susceptible to severe oral infections, especially during the recovery period after BMT. Additionally, severe mucositis, gingivitis, and ulceration of the oral mucosa, as well as difficulties in nutrition, swallowing, and speech are common. While mucosal injury is primarily caused by chemotherapy and radiotherapy, epithelial desquamation is associated with the cytotoxic effects of cell proliferation blocking agents [7]. A pre-transplant evaluation of the patient will help eliminate any active infection and minimize possible infections in the post-transplant period [8].

The Decayed, Missing, Filled (DMF) index was introduced by Klein, Palmer and Knutson in 1938

and has been used for more than 70 years in dentistry to measure the prevalence of dental caries [9]. The DMFT Index is applied to the permanent dentition and is expressed as the total number of teeth that are decayed (D), missing (M), or filled (F) in an individual. The dmft index is used for primary teeth. This randomized controlled study aimed at assessing the number of DMFT and dmft, gingival health, and oral status of children after BMT.

MATERIAL AND METHODS

Thirty-one patients (13 girls, 18 boys; median age = 10.45 years) treated with allogeneic and autologous stem cell transplantation in the Pediatric Oncology and Hematology Department (study group) in years 2011-2013 and 31 healthy children (16 girls, 15 boys; median age = 9.18 years) admitted to the Pediatric Dentistry Department (control group) were selected for this randomized clinical study. The study protocol was approved by the research ethics committee. The study group received oral hygiene education prior to the BMT. The data for this study were obtained from the dental examinations and panoramic radiographs that were performed in the study group 100 days after BMT. The diseases in the study group before BMT and the number of patients are shown in Table-1. Gingival index (GI), plaque index (PI), and bleeding on probing (BOP) values, as well as the number of DMFT, and dmft scores were recorded for all teeth in the study and control groups by the same examiner, who was trained prior to the study.

Gingival index system as follows:

- Absence of gingival inflammation
- Mild gingival inflammation (slight change in color, slight edema, no bleeding on probing)
- Moderate inflammation (Moderate glazing, redness, edema, hypertrophy bleeding on probing)
- Severe inflammation (marked redness and hypertrophy, ulceration, spontaneous bleeding).

Calculation of GI for each individual: $GI = \frac{\text{Total scores}}{\text{Number of 4 surfaces examined (mesial, distal, buccal and lingual)}}$

Plaque Index (PI) is used together with GI and measures the thickness of plaque on the gingival one third as follows:

- No plaque
- A film of plaque adhering to the free gingival margin and adjacent area of the tooth, which can be seen only by using disclosing solution or by using probe.
- Moderate accumulation of deposits within the gingival pocket, on the gingival margin and/or adjacent tooth surface, which can be seen with the naked eye.

- Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin

Calculation of PI for each individual: $PI = \frac{\text{Total scores}}{\text{Number of 4 examined surfaces (mesial, distal, buccal and lingual)}}$

The BOP was considered positive if bleeding occurred between 30 seconds after probing. It was calculated for all surfaces of the teeth as a percentage.

DMFT and dmft index systems as follows;

D (d): Decayed tooth, filled tooth with secondary caries, only the root are left, and filled tooth surface with other surface decayed.

M (m): Missing teeth due to caries. (Tooth that extracted for reasons other than caries for example orthodontic treatment and loss of teeth due to trauma and congenitally missing teeth should be excluded).

F (f): Filled teeth due to caries (Teeth restored for reason other than dental caries for example hypoplasia and trauma should be excluded)

STATISTICAL ANALYSIS

None of variables exhibited a normal distribution; thus, median values (width between quarters) were used as descriptive statistics. The chi-square test was used to compare index values. Mann-Whitney non-parametric variance analyses were used to compare DMFT, dmft, and BOP values. All statistical analyses and calculations were performed using SPSS for Windows. Values of $p < 0.05$ were considered statistically significant.

RESULTS

The GI and PI values were quantified (Tables 2 & 3). There were no significant differences in GI between the study and control groups ($p > 0.05$). Similarly, PI values in the study and control groups did not differ significantly ($p > 0.05$). No significant differences between the study and control groups were evident with regard to DMFT or BOP scores ($p > 0.05$), but dmft and total DMFT scores differed significantly ($p < 0.05$) (Table-4).

Table-1: The diseases in the study group before BMT and the number of patients

Disease	N
Primitive neuroectodermal tumor	1
Falton aplastic anemia	2
Wiskott Aldrich	1
Juvenile myelomonocytic leukemia	1
Neuroblastoma	6
Thalassemia	4
Acute lymphoblastic leukemia	4
Severe combined immunodeficiency	1
Acute myeloid leukemia	2

Non-Hodgkin's lymphoma	4
Hodgkin's lymphoma	2
Chronic myelogenous leukemia	2

Aplastic anemia	1
Total	31

Table-2: The evaluation of Plaque Index values with Chi-square Test

Plaque index	BOP (n=31)	Control (n=31)	Total	P*
0	12 (38.71%)	10 (32.26 %)	22 (35.48%)	
1	17 (54.83%)	19 (61.29%)	36 (58.06%)	
2	1 (3.23%)	2 (6.45%)	3 (4.84%)	
3	1 (3.23%)	0 (0%)	1 (1.61%)	
				0.653
* Chi-square				

Table-3: The evaluation of Gingival Index values with Chi-square Test

Gingival index	BMT (n=31)	Control (n=31)	Total	P*
0	11 (35.48%)	10 (32.26%)	21 (33.87%)	
1	18 (58.06%)	18 (58.06%)	36 (58.06%)	
2	1 (3.23%)	3 (9.68%)	4 (6.45%)	
3	1 (3.23%)	0 (0%)	1 (1.61%)	
				0.563
* Chi-square				

Table-4: The evaluation of total DMFT, DMFT, dmft and BOP values with MannWhitney U Test

	BMT (n=31)	Control (n=31)	P*
	Median (Min-Max)	Median (Min-Max)	
DMFT	0 (0-9)	0 (0-4)	0.836
Dmft	0 (0-7)	2 (0-15)	0.005
BOP	0 (0-60)	0 (0-26)	0.666
DMFT total	1 (0-9)	2 (0-15)	0.035
*Mann-WhitneyU			

DISCUSSION

Dental and oral evaluations of all patients should be applied carefully before BMT. Teeth with periodontal disease that cannot be restored should be extracted. Devital teeth should be endodontically treated, and the teeth with active caries lesions should be restored. Application of preventive dentistry techniques including tooth brushing, flossing, diet modification, and the use of antimicrobial mouthwashes or topical fluoride should be initiated. Dentists should obtain information from the patient's doctor about the degree of immune system suppression [10, 12]. In our study, all of the patients in the study group were given oral hygiene education prior to BMT.

The immune defense of the oral cavity mucosal surface is provided by salivary immunoglobulins produced in the lymphoid tissue-mucosal relation [13]. Immunoglobulin concentrations decrease during the transplantation phase and rapidly increase in the post-transplant phase. During the BMT recovery period, routine dental treatments should be avoided. Oral hygiene procedures including antimicrobial mouthwashes should be continued. In general, only emergency situations should be treated at this time [12, 14]. In the present study, dental and periodontal examinations of the study group were

planned to be performed 100 days after BMT, as bleeding may occur during the examination of periodontal tissues. Such bleeding can be severe due to these patients' severe immunosuppressive conditions.

A number of studies evaluating oral and dental status in patients with childhood cancer have been published over the past decade, but very few studies of transplanted children have taken this issue into consideration [15, 16]. The study by Uderzo *et al.*, [15] evaluated the dental status of 27 long-term pediatric patients who underwent BMT. That study compared the mean DMFT scores of BMT patients and children who received chemotherapy alone and reported that the mean DMFT score was slightly higher in the BMT group than in children who received chemotherapy alone. In the same study, similar to our study, the incidence of periodontal disease in patients undergoing BMT was similar to that observed in the local healthy population.

Severe mucositis, gingivitis, and ulceration of the oral mucosa are common after BMT. Eating, swallowing, and speech can be negatively affected. According to our results, there were no differences in the PI, GI, and BOP values of the groups, but if periodontal examinations had been performed immediately after BMT, we believe that these results

would have been significantly higher than those in the control group.

CONCLUSION

Although the DMFT index values were lower in children treated with BMT than in children in the control group, the differences between groups was not statistically significant; however, dmft and total DMFT scores differed significantly. Dental caries develops over a long period of time. In particular, increased DMFT scores may be related to insufficient oral hygiene care before and after BMT.

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