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Oral Health Status and Oral Health-related Quality of Life According to Presence or Absence of Mucositis in Head and Neck Cancer Patients

ORIGINAL ARTICLE

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Background: Oral mucositis during radiotherapy which is harmful to the patients with head and neck is suggested to be related to the oral hygiene and health. Therefore, we evaluated the oral health status in relation to the occurrence of mucositis among patients with head and neck cancer during radiotherapy.
Methods: Tooth plaque index (PI), periodontal depth, and oral mucositis in 50 patients with head and neck cancer were examined by a dentist for 8 weeks after radiotherapy initiation. Cancer type and site were recorded based on the patients' medical records. In addition, we assessed oral health-related quality of life.
Results: The mean age of participants was 56.3 ± 11.6 years, with patients aged > 60 years comprising the largest proportion of the mucositis group. The median (range) of the PI index were 0 (0-3) and 1 (0-3) among participants with mucositis and those without, respectively, with no significant difference ($P = 0.761$). The median (range) of the total Oral Health Impact Profile score were 54 (42-58) and 41 (14-70) among participants without mucositis and those with mucositis, respectively ($P = 0.037$).
Conclusions: This study showed that patients who developed mucositis during radiotherapy had lower oral health-related quality of life than those who did not. However, there was no difference in oral health status according to mucositis.
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Key Words: Oral health, Head and neck neoplasms, Stomatitis

INTRODUCTION

Mucositis is a common side effect of chemotherapy and radiation therapy. The most important side effects of anticancer therapy in the past are vomiting and decreased immunity due to myelosuppression However, due to the use of antibiotics and the use of hematopoietic agents, vomiting and immune compromise were much reduced. Therefore, mucositis has recently emerged as one of the most serious side effects in treatment for cancer [1].

The mechanism of mucositis has been understood to be simple. The toxicity of radiation and anticancer agents causes damage to the basal epithelium layer, resulting in epithelial changes that lead to ulcers [2]. Recently, however, damage to the mucous membrane from radiation has been confirmed to be caused by microvascular injury owing to apoptosis of vascular endothelial cells [3], suggesting that vascular endothelial cells and platelets play a role in the pathogenesis of mucositis [4].

The most important risk factor for mucositis is the strength of chemotherapy and the type of medication used [5]. In addition, the risk of mucositis was related to body mass index [6]. Patients with salivary gland function disorders [7] and oral gingivitis are also at high risk [8].

When oral mucositis develops during cancer treatment, it can lead to dysphagia, pain, changes in taste, vomiting, nausea, declining food intake, fatigue, and weight loss [9,10]. Furthermore, discontinuation of treatment owing to mucositis

may lead to an extension of the treatment period, which may affect the outcome of cancer treatment [5,11]. In addition, quality of life deteriorates [12]. The goal of rehabilitation is to restore the patient to normal life by promoting recovery of physical, emotional, mental, and social function.

Although oral mucositis is suggested to be related to the oral bacteria and hygiene status, little research has been conducted on the association between oral health status and oral mucositis in Korea [13]. Therefore, this study aimed to investigate whether there is any difference in oral health status including oral health-related quality of life according to the incidence of mucositis during radiotherapy among patient with head and neck cancer (HNC).

MATERIALS AND METHODS

1. Participants

The participants in this study were patients who were diagnosed with HNC at Kyungpook National University Hospital and who visited a dental clinic for oral examination before radiotherapy. After explanation of the purpose of this study, consent was obtained from 68 participants. We excluded patients with fewer than three teeth or those with infectious diseases. In addition, subjects excluded who visited the dental clinic for less than 2 times. Finally, a total of 50 patients visited the dental clinic two times, for observation of mucositis development and assessment of oral health status. A total 16 patients also completed an oral health quality questionnaire. The data collection period was for 3 years between July 2015 and September 2018. This study was approved by the Institutional Review Board of Kyungpook National University Hospital (KNUMC 2015-05-133-001).

2. General and cancer characteristics of participants

The general characteristics such as sex, age, smoking, and alcohol consumption were surveyed. Characteristics related to cancer were investigated in terms of the type and location of cancer. The type of cancer was classified as squamous cell carcinoma (SCC) and others. The location of HNC was divided into the region of the head (for example, parotid, tongue, and so on), and the other locations were classified as the region of the neck.

3. Mucositis condition

One dentist assessed oral mucositis in participants according to World Health Organization criteria: 0, no symptoms; 1, sore

mouth, no ulcers; 2, sore mouth with ulcers; 3, liquid diet only; and 4, unable to eat or drink [14]. Oral mucositis was assessed during radiotherapy for 8 weeks. Patients were categorized into 2 groups ("No" for patients who have 0 or 1 score, "Yes" for those who have 2 or over scores). The assessment was more than two times when before radiotherapy and after radiotherapy. Patients with at least one score of mucositis during the period were classified as mucositis.

4. Oral health status

To assess oral health status, periodontal health and oral hygiene status were examined.

Oral examination was performed more than 2 times, and the maximum value was taken as the representative value during the period. Periodontal health was investigated using probing depth (PD). Oral hygiene status was assessed using the plaque index (PI). These indexes were measured at six representative teeth, i.e., the maxillary right first molar and central incisor, maxillary left first molar, mandibular left central incisor and left first molar, and mandibular right first molar. The PI was measured according to the Löe and Silness criteria, with a higher PI indicating more accumulation of plaque, as follows: 0 (no plaque), 1 (a film of plaque adhering to the free gingival margin and adjacent area of the tooth, which cannot be visualized with the naked eye, but only with use of a disclosing solution or probe), 2 (moderate accumulation of deposits within the gingival pocket, on the gingival margin and/or adjacent tooth surface, which can be visualized with the naked eye), and 3 (abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin) [15]. The PD was divided into 3 mm or less and 4 mm or more to the definition of periodontitis. The PI index was divided to 0 and 1 or more groups. The highest values of PD and PI among six representative teeth were considered to be representative values for each participant.

5. Assessment of oral health-related quality of life

We used the short-form of the Oral Health Impact Profile (OHIP-14) to assess oral health-related quality of life [15]. The OHIP-14 questionnaire is composed of 14 items querying how frequently the participant had experienced negative oral impacts during the past year under seven conceptual domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. Participants' responses were scored as 0, 1, 2, 3, and 4, which corresponded to a response of "very often", "fairly often", "occasionally", "hardly ever", and "never", respectively. Higher

scores indicate better oral health-related quality of life.

6. Statistical analysis

Statistical analysis was performed using SAS 9.4 (SAS institute Inc., Cary, NC, USA). We performed the chi-square test, Kruskal–Wallis test, and Mann–Whitney U-test to compare characteristics of oral status and oral health between the mucositis status groups. A P-value of < 0.05 was considered significant.

RESULTS

1. General and cancer characteristics of participants

The mean age of participants with HNC was 56.3 ± 11.6 years. Participants aged > 60 years comprised the largest proportion of the mucositis group, but with no significant difference (P = 0.556). Among participants, the proportion with SCC was 73.9%, the proportion with other cancers was 26.1%; the proportion with head cancer was 75.6%, and the proportion with neck cancer was 24.4%. There were more participants in the mucositis group who had cancer in the region of head than other regions, but this was not significant (Table 1).

2. Oral health status

The proportion of patients with PD of 3 mm or less was 74.0% and that with PD 4 mm or more was 26.0%. The median (range) of

PD values were 3 (2-8) and 3 (2-6) among participants with mucositis and those without mucositis, respectively. There was no difference in the PD between patients with or without mucositis (P = 0.437. Among participants, 52.0% had clean hygiene and 48.0% had existing plaque. The median (range) of the PI index were 0 (0-3) and 1 (0-3) among participants with mucositis and those without mucositis, respectively, with no significant difference (P = 0.761) (Table 2). The OHIP total score

Table 2. Periodontal and oral hygiene status according to mucositis

Variable	Total	Mucositis		P-value[a]
		No	Yes	
Periodonta status				
Pocket depth (mm)				0.346
≤ 3	37 (74.0)	14 (66.7)	23 (79.3)	
≥ 4	13 (26.0)	7 (33.3)	6 (20.7)	
Median (minimun-maximum)	3 (2-8)	3 (2-8)	3 (2-6)	0.437[b]
Oral hygiene status				
Existing of plaque				0.578
No	26 (52.0)	12 (57.1)	14 (48.3)	
Yes	24 (48.0)	9 (42.9)	15 (51.7)	
Median (minimum-maximum)	0 (0-3)	0 (0-3)	1 (0-3)	0.761[b]

Values are presented as number (%) or median (range). [a]P-values by Fisher's exact test. [b]P-values by Mann–Whitney U-test.

Table 1. The results of general and cancer characteristics of subjects

Characteristic	Total	Mucositis		P-value[b]
		No	Yes	
Total	50 (100)	21 (42.0)	29 (58.0)	
Sex				0.723
Male	40 (80.0)	16 (76.9)	24 (82.8)	
Female	10 (20.0)	5 (23.8)	5 (17.2)	
Age (yr)[a]	56.3 ± 11.6	58.8 ± 6.1	59.2 ± 9.5	0.556
≤ 59	28 (58.3)	13 (65.0)	15 (53.6)	
≥ 60	20 (41.7)	7 (35.0)	13 (46.4)	
Smoking				0.371
None or past	11 (47.8)	4 (66.7)	7 (41.2)	
Current	12 (52.2)	2 (33.3)	10 (58.8)	
Drinking				0.643
None or past	9 (39.1)	3 (50.0)	6 (35.3)	
Current	14 (60.9)	3 (50.0)	11 (64.7)	
Cancer type				0.314
Squamous cell carcinoma	34 (73.9)	11 (64.7)	23 (79.3)	
Others	12 (26.1)	6 (35.3)	6 (20.7)	
Cancer region				0.304
Head	34 (75.6)	12 (66.7)	22 (81.5)	
Neck	11 (24.4)	6 (33.3)	5 (18.5)	

Values are presented as number (%) or mean ± SD. [a]Range: 22-79. [b]P-values by Fisher's exact test.

Table 3. Oral heal related quality of life according to mucositis

| Variable | Total | Mucositis | | P-value[a] |
		No	Yes	
Functional limitation	6 (2-10)	7 (5-9)	6 (2-8)	0.136
Physical pain	6 (2-10)	7 (6-9)	5 (2-7)	0.059
Psychological discomfort	6 (2-10)	7 (5-10)	5 (2-9)	0.138
Physical disability	6 (2-10)	6 (4-8)	4 (2-9)	0.235
Psychological disability	8 (2-10)	8 (6-10)	6 (2-10)	0.081
Social disability	8 (2-10)	8 (8-10)	8 (2-10)	0.225
Handicap	8 (2-10)	8 (8-9)	7 (2-10)	0.162
Total score	48 (14-70)	54 (42-58)	41 (14-70)	0.037

Values are presented as median (range). [a]P-values by Mann–Whitney U-test.

ranged from 14 to 70 and the median score was 48. The physical pain scores were 7 (6-9) and 5 (2-7) among participants without mucositis and those with mucositis, respectively; however, this was not significantly different ($P = 0.059$). The median (range) of the psychological disability score were 8 (6-10) and 6 (2-10) among participants without mucositis and those with mucositis, respectively, with no significant difference ($P = 0.081$). The median (range) for total OHIP score was 54 (42-58) in participants without mucositis and 41 (14-70) in those with mucositis ($P = 0.037$). This result indicated that oral health-related quality of life in participants with mucositis was significantly worse (Table 3).

DISCUSSION

The purpose of this study was to investigate the difference in oral health status and quality of life related to oral mucositis among patients with HNC during cancer treatment. The results of the study showed that oral health-related quality of life of participants who developed mucositis during cancer treatment was lower than that of those who did not. However, there was no difference in oral health status according to the incidence of mucositis.

Previous studies have shown that oral-related factors are associated with higher risk, as in patients with tooth and gum disease and patients with salivary gland function disorders [7,8]. In this study, although not significant, participants with poorer oral hygiene status had mucositis.

Oral pain and dysphagia owing to mucositis may also be related to oral health-related quality of life. In fact, the results of the present study showed that OHIP scores in patients with mucositis were lower than that of those who with not. Decreased quality of life due to radiotherapy can reduce the desire to continue treatment. Even after ending, treatment can lead to

adverse effects such as emotional disorders, intensive disorders, impatience, fatigue, anxiety, and even death [16]. Research into the quality of life in cancer patients has been ongoing for some time. Patients with HNC affecting the oral area are more likely to have poor oral health-related quality of life, as confirmed by our study findings.

In this study, we found that oral health-related quality of life scores differed according to the incidence of mucositis among patients with HNC. However, this study has some limitations. First, we evaluated oral health in participants over a relatively short period of 8 weeks. It is necessary to conduct long-term studies over 6 months or 1 year. Second, this study was conducted among a small number of patients with HNC at Kyungpook National University Hospital; therefore, the results do not represent all patients with HNC. Further studies with a larger number of patients at multiple university hospitals located throughout various regions are needed. Third, we produced oral hygiene management for the subjects on an ethical, so would have effected on the subject's original condition. Finally, indices of oral health in patients, such as indicators of saliva secretion and microbial composition, in addition to clinical indicators, should be evaluated to increase study objectivity.

Despite these limitations, this study was important in that we assessed the oral health status of patients with HNC and the development of mucositis in association with their oral health-related quality of life. In particular, patients with mucositis had a significantly lower quality of life related to their oral health, suggesting that patients should be more careful with their oral health care and should be supported to understand its importance during the course of cancer treatment, to encourage continued treatment and improved quality of life.

CONFLICTS OF INTEREST

No potential conflicts of interest were disclosed.

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