Effects of Professional Oral Hygiene Care in Patients with Head-and-Neck Cancer During Radiotherapy: A Randomized Clinical Trial

Abstract

Aim: The aim of this study is to assess the effects of professional oral hygiene care in patients with head-and-neck cancer during radiotherapy, a clinical trial was done. Subjects and Methods: Forty patients were randomly assigned to either the experimental or the control group. For the experimental group, professional oral hygiene care, toothbrushing education, and fluoride varnish application were done once per a week, and for control group, only fluoride varnish application was done once per a week for 8 weeks during radiotherapy. Oral examination including plaque and gingival index was done at baseline and after 8 weeks. Results: The results demonstrated that plaque index was improved in the experimental group, but there was no significant difference between groups (P > 0.05). Plaque and gingival status were significantly improved in both groups after 8 weeks compared to those of baseline (P < 0.05). Conclusion: Regular dental visit and professional oral hygiene care during radiotherapy were effective in oral hygiene and health among patients with head-and-neck cancer.

Keywords: Oral health, oral hygiene, periodontal disease

Introduction

Head-and-neck cancers arise in the soft and hard tissues of the head and neck, including the oral cavity.[1] Approximately 90% of all head-and-neck cancers are squamous cell carcinomas (SCC).[2] SCCs often have a poor prognosis; treatment options include surgical treatment, chemotherapy, or radiotherapy, which are administered independently or in combination.[3] Head-and-neck radiation has been reported to cause oral mucositis, dysphagia, and various levels of pain in the short term and can lead to long-term complications such as dental caries, dry mouth, trismus, and osteoradionecrosis.[4]

It has been reported that saliva secretion decreases from the 1st week after head-and-neck radiation begins. In particular, saliva secretion is known to rapidly decrease when the parotid gland is included in the affected radiation field.[5,6] Decreased salivary flow weaken the buffering capacity of saliva, controlling pH of plaque, which can be risk factor of radiation-induced dental caries.[7,8] Furthermore, decrease in saliva secretion affects the oral microflora and decreases oral self-cleaning action.[5,9] Therefore, good oral hygiene care cannot be overemphasized to patients with head-and-neck cancer who receive radiotherapy.[10]

In particular, more thorough oral hygiene care is needed because the risk of developing oral inflammation is high during radiotherapy.[11] However, patients experience severe pain during radiotherapy due to oral mucositis and systemic fatigue due to chemotherapy, and are mentally unstable; they often lose their willingness to perform oral hygiene self-care.[12]

According to a previous study by Kerstin et al., participants reported significant worsening of ability to perform oral hygiene care at the end of radiotherapy compared with the baseline. Considering this, they suggested the need for professional oral hygiene care by dental staff.[13]

Therefore, professional oral hygiene care and education by dental professionals are very important for patients with head-and-neck cancer receiving radiotherapy. However, there were a few studies about oral hygiene care during radiotherapy. Therefore, this study aimed to evaluate the effects of regular oral hygiene care and education by dental professionals in patients with head-and-neck cancer receiving radiotherapy.

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Subjects and Methods

Subjects

Participants were recruited among patients diagnosed with head-and-neck cancer at the Department of Otolaryngology of a university hospital located in a metropolitan city, and then visited the Department of Dentistry at the hospital for dental examinations before the initiation of radiation therapy. Patients were included if they were receiving radiotherapy for the first time, had good systemic and mental conditions for oral examination and education, and had four or more natural teeth. The purpose and methods of the present study were explained to each patient. Subsequently, a total of 40 patients who agreed to participate were randomly assigned to either the experimental group or the control group and were provided with a description of the purpose and methods of the present study and precautions. However, 13 participants dropped out because of transferring to other hospital or withdrawing their consents. Finally, 27 patients who voluntarily provided consent to participate in this study were ultimately included. This study was approved by the Institutional Review Board at a university hospital (KNUMC 2015-05-133-001) before initiation. This trial is registered with the Clinical Research Information Service Registry, one of the primary registries in the World Health Organization International Clinical Trials Registry Platform, number = KCT0002807.

Methods

A survey, medical records inspection, and oral examinations were performed in patients with head-and-neck cancer who visited the dental department. Examinations were performed by dentists before initiation of radiotherapy. A survey was conducted to investigate age, smoking status, drinking status, average frequency of daily toothbrushing, and subjective oral health status. Smoking and drinking status were classified as “none experienced,” “did in the past, but not now,” and “currently doing.” The average frequency of daily toothbrushing was classified based on brushing twice daily. The subjective oral health status was classified as “healthy,” “normal,” or “not healthy.”

Survey

Participants were educated about survey completion by dental hygienists. The survey was conducted to evaluate participants’ smoking status, drinking status, average frequency of daily toothbrushing, and subjective oral health status. Smoking and drinking status were classified as “none experienced,” “did in the past, but not now,” and “currently doing.” The average frequency of daily toothbrushing was classified based on brushing twice daily. The subjective oral health status was classified as “healthy,” “normal,” or “not healthy.”

Medical record investigation

The type of head-and-neck cancer and the radiotherapy regimen were determined from participants’ medical records. The cancer type was classified as SCC, adenoid cystic carcinoma, pleomorphic adenoma, or other, based on the pathologic findings. The frequency of radiotherapy was classified into two groups based on a frequency of 30 sessions, and the dose was classified into two groups based on a dose of 70 Gy.

Oral examination

Participants were seated in a dental chair during examination; all oral examinations were performed by the same dentist. All teeth except third molars were examined for tooth decay and missing teeth. In addition, the plaque and gingival index of six-index teeth were measured, including the maxillary right first molar and central incisor, the maxillary left first molar, the mandibular left central incisor and left first molar, and the mandibular right first molar in each participant. If the target tooth had been lost, adjacent teeth were examined. If the adjacent teeth had also been lost, the corresponding area was excluded. Plaque and gingival index were measured at mesiobuccal, midbuccal, and distobuccal surfaces of six selected teeth according to Loe and Silness criteria. The highest value among three scores of tooth surface was recorded and used as the representative value of each tooth. The highest value among the representative values of indexed teeth was used as the representative value of each participant. There was no scores’ calculation. The plaque and gingival indices were scored on a 4-point scale ranging from 0 to 3 points. A higher score indicated increased plaque or poorer gingival health, as follows: plaque index: 0 (no plaque), 1 (a film of plaque adhering to the free gingival margin and adjacent area of the tooth, which cannot be seen with the naked eye. But only using disclosing solution or using probe), 2 (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), and 3 (abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin) and gingival index: 0 (no inflammation), 1 (mild inflammation, slight change in color, slight edema, no bleeding on probing), 2 (moderate...
inflammation, moderate glazing, redness, bleeding on probing), and 3 (severe inflammation, marked redness and hypertrophy, ulceration, tendency to spontaneous bleeding).

**Professional oral hygiene care**

Professional oral hygiene care program consisted of mechanical tooth cleaning with low-speed handpiece, a rubber cup, and prophylaxis paste containing fluoride by skilled dental hygienist. After professional oral hygiene care, toothbrushing education was done to the participants by dental hygienist.

**Statistical analysis**

Statistical analysis was performed using SPSS for Windows Version 20.0 (IBM Corp., Armonk, NY, USA). Chi-square test and Mann–Whitney U-test were performed to compare characteristics between groups before radiotherapy. Differences before and after professional oral hygiene care and between the groups were compared with a repeated measures t-test. \( P < 0.05 \) was considered significant.

**Results**

**General and medical characteristics of study subjects**

Among 27 participants, 15 were aged 60 years or older and 24 were male, accounting for the majority of the participants. Fifteen participants had no other comorbid systemic disease and were current drinkers; 14 participants were current smokers, and 18 participants had SCCs. There was no difference in these variables between the two groups. There was no difference in frequency of radiotherapy between the groups; the experimental group had 32.63 ± 2.97 sessions and the control group had 32.00 ± 2.95. There was also no difference in dosage of radiotherapy between the groups; the average dosage was 65.68 ± 5.20 Gy in the experimental group and 66.67 ± 4.37 Gy in the control group. There was no difference in plaque index, gingival index, or subjective oral health status between the groups [Tables 1 and 2].

**Changes in oral health and health-related variables according to professional oral hygiene care**

The plaque indices before professional oral hygiene care were 1.80 ± 0.79 in the control group and 1.23 ± 1.07 in the experimental group, whereas the plaque indices after oral hygiene care were 1.60 ± 0.52 in the control group and 0.71 ± 1.07 in the experimental group; the plaque index was significantly improved in both groups after care (\( P < 0.05 \)). However, there was no difference in the degree of improvement between the groups. There was no difference in subjective oral health before and after professional oral hygiene care based on professional oral hygiene care [Table 3].

**Discussion**

The present study aimed to evaluate the effects of professional oral hygiene care performed once per week for 8 weeks in patients who were diagnosed with head-and-neck cancer at the Department of Otolaryngology in a university hospital, and then visited the Department of Dentistry on the same day as scheduled radiotherapy. The final examination revealed that the experimental group receiving continued brushing education and plaque care

| Table 1: Baseline characteristics of the study population |
|---------------------------------------------------------|
| \( n \) | Control, \( n(\%) \) | Case, \( n(\%) \) | \( P \) |
| Total | 27 | 10 (100.0) | 17 (100.0) | 0.722 |
| Age (years) | 59 | 12 | 4 (40.0) | 8 (47.1) | 0.722 |
| \( \geq 60 \) | 15 | 6 (60.0) | 9 (52.9) | 0.573 |
| Gender | Male | 24 | 9 (90.0) | 15 (88.2) | 0.888 |
| Female | 3 | 1 (10.0) | 2 (11.8) | 0.036 |
| General disease | No | 15 | 5 (50.0) | 10 (58.8) | 0.656 |
| Yes | 12 | 5 (50.0) | 7 (41.2) | 0.345 |
| Smoking | None or past | 13 | 6 (60.0) | 7 (41.2) | 0.722 |
| Current | 14 | 4 (40.0) | 10 (58.8) | 0.345 |
| Drinking | None or past | 12 | 4 (40.0) | 8 (47.1) | 0.722 |
| Current | 15 | 6 (60.0) | 9 (52.9) | 0.573 |

\( P \)-values were calculated using a Chi-square test or Mann–Whitney U-test.

| Table 2: Radiotherapy and oral characteristics of the study population |
|---------------------------------------------------------------|
| \( n \) | Control, \( n(\%) \) | Case, \( n(\%) \) | \( P \) |
| Cancer type | Squamous-cell carcinoma | 18 | 6 (60.0) | 12 (70.6) | 0.573 |
| Others | 9 | 4 (40.0) | 5 (29.4) | 0.098 |
| Frequency of radiotherapy (sessions), mean±SD | 27 | 32.63±2.97 | 32.00±2.95 | 0.598 |
| Dosage of radiotherapy (Gy), mean±SD | 27 | 65.68±5.20 | 66.67±4.37 | 0.584 |
| Plaque index, mean±SD | 27 | 1.80±0.79 | 1.23±1.07 | 0.134 |
| Gingival index, mean±SD | 27 | 1.80±0.92 | 1.50±0.82 | 0.337 |
| Subjective oral status, mean±SD | 27 | 3.60±0.97 | 3.40±1.00 | 0.858 |

\( P \)-values were calculated using a Chi-square test or Mann–Whitney U-test. SD=Standard deviation
by dental professional along with fluoride application, showed improvement in plaque index compared to the control group receiving fluoride application alone, but the difference was not significant. However, both groups showed significant improvements in plaque status and gingival status aftercare compared to before care. These results are thought to be due to the improved oral hygiene status in both groups. Patients with head-and-neck cancer receiving radiotherapy are at high risk of fatal deterioration of oral health.\footnote{17} Considering the ethical aspects, participants in the control group received fluoride treatment once a week in addition to a single session of brushing education and scaling at the time of their first visit to the Department of Dentistry. Although detailed brushing education was not provided to the participants in the control group at that time, researchers may have unintentionally emphasized the necessity of brushing due to ethical considerations. In addition, patients might have been motivated to brush well due to weekly visits to receive fluoride applications.

According to the previous study, since patients with head-and-neck cancer have poor prognoses and are affected by various treatments for cancer, they are often mentally unstable and have lower interest in oral health than systemic health.\footnote{17} Also because the incidence of oral mucositis is high during radiotherapy, oral pain or discomfort becomes severe, which makes it difficult for individuals to perform oral care by themselves.\footnote{18} Therefore, we thought that during radiotherapy, it was necessary for dental staff to perform professional oral hygiene care and toothbrushing instruction repeatedly for patients to improve oral hygiene status.

To increase participants’ adherence to visits to the department of dentistry in the present study, the participants were instructed to visit the dental department once weekly, on the same day as a radiotherapy session.

There are few studies related to this topic.\footnote{19} Therefore, this study aimed to contribute to improvement of oral health in patients with head-and-neck cancer receiving radiotherapy. However, this study has limitations. First, the study 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 with a small number of patients with head-and-neck cancer in a university hospital; the results do not represent all patients with head-and-neck cancer. Therefore, further studies with a larger number of patients in multiple university hospitals located in various regions are necessary. Finally, the 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, the present study is the first to evaluate the effects of professional oral hygiene care during radiotherapy in patients with head-and-neck cancer in Korea. Collaborative systems between dental and medical fields should be systematically established to enhance interest in oral health among patients with head-and-neck cancer and to prevent oral diseases.

**Conclusion**

Our study showed that periodic dental visit, oral hygiene care, and toothbrush instruction were effective in improvement in oral health of patients with head-and-neck cancer during radiotherapy.

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Nil.

**Conflicts of interest**

There are no conflicts of interest.

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**Table 3: Change of oral hygiene and health in the study population according to professional oral hygiene care**

| Group        | Baseline | Follow-up | Source | F      | P    |
|--------------|----------|-----------|--------|--------|------|
| Plaque index |          |           |        |        |      |
| Control      | 1.80±0.79| 1.60±0.52 | Group  | 3.748  | 0.064|
| Case         | 1.23±1.07| 0.71±1.07 | Group × time | 2.036 | 0.166 |
| Gingival index |        |           |        |        |      |
| Control      | 1.80±0.92| 1.30±0.82 | Time   | 4.274  | 0.049|
| Case         | 1.50±0.82| 1.00±1.00 | Group × time | 0.040 | 0.843 |
| Subjective oral status | | | |  | |
| Control      | 3.67±1.00| 2.89±0.60 | Time   | 1.795  | 0.193|
| Case         | 3.31±1.01| 3.56±0.81 | Group × time | 6.808 | 0.016 |

F and P were calculated using a repeated measures t-test. SD=Standard deviation.
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