

Evaluation of Radiation-induced Class V Dental Caries in Patients with Head and Neck Cancers Undergoing Radiotherapy

Narmin Mohammadi^{1*} • Farshad Seyednejad² • Parnian Alizadeh Oskoee³ • Siavash Savadi Oskoee³ • Mohammad Esmaeil Ebrahimi Chaharom¹

¹Assistant Professor, Department of Operative Dentistry, Faculty of Dentistry, Tabriz University of Medical Science, Tabriz, Iran

²Assistant Professor, Department of Radiation Oncology, Tabriz University of Medical Science, Tabriz, Iran

³Associate Professor, Department of Operative Dentistry, Faculty of Dentistry, Tabriz University of Medical Science, Tabriz, Iran

*Corresponding author; E-mail: narmin_mohammadi@yahoo.com

Abstract

Background and aims. Salivary glands are very susceptible to radiation and any disturbances in their function are detrimental to the hard tissues in the oral cavity. The aim of this study was to evaluate posterior class V dental caries in patients with head and neck cancers undergoing radiotherapy.

Materials and methods. In this study, twenty seven patients undergoing conventional radiotherapy were included. Class V dental caries of posterior teeth in these patients were evaluated in three intervals: before treatment, 3 weeks after the initiation of the treatment, and at the end of the treatment. Differences of mean caries activity between intervals were evaluated using paired sample t-test.

Results. There were no class V decays prior to radiotherapy. Mean percentage of class V caries three weeks after radiotherapy and at the end of radiotherapy were $28.42\% \pm 14.41$ and $67.05\% \pm 19.02$, respectively. There were statistically significant differences in mean values among three stages ($P = 0.00025$).

Conclusion. The results of the present study revealed that radiotherapy in patients with head and neck cancers causes class V dental caries on posterior teeth.

Key words: Class V caries, radiotherapy, xerostomia.

Introduction

Saliva in the oral cavity protects hard tissues against acid attacks and demineralization. Dysfunction in the quality and the quantity of saliva has deleterious effects on the oral ecological system.^{1,2} A total amount of 1 L to 1.5 L of saliva is produced each day by 3 major paired glands—the parotid, the submandibular, and the sublingual glands.¹ The parotid glands are composed primarily of serous acini and produce a watery like secretion, whereas the sublingual and submandibular glands are composed of both serous and mucous acini. Serous acini are considered more sensitive and immediately degenerate after radiation.^{1,2} Because of this, as soon as radiation therapy is begun, the patient's saliva will become

thicker. However, as radiation therapy continues, mucous cells are also affected and the quantity of saliva also decreases.^{2,3}

The severity of xerostomia is related to the radiation dose, dose rate and amount of salivary tissue irradiated. During radiotherapy of a salivary gland tumor, if the salivary glands of the opposite side are not in the direct field of the radiation beam, the xerostomia will not be severe.^{2,3,4} In patients undergoing radiation therapy, decreased secretion of saliva and the change in the oral micro flora may increase the risk of dental caries. Therefore, it is important that dentists be aware of the potential oral problems that may occur following head and neck radiation therapy since appropriate

treatment will minimize or eliminate complications.^{2,5}

It is reported that the initial caries usually occur around the third week of treatment.⁶ Since there is no definite treatment modalities introduced to prevent dental caries in patients receiving radiation therapy, we sought to determine the prevalence of posterior class V caries in these patients on the third week of the radiation therapy.

Materials and Methods

The present study was a clinical trial carried out in Imam Khomeini Hospital, Tabriz, Iran. Twenty-seven patients with head and neck malignancies referring to the Department of Radiotherapy from December 2005 to December 2006, with caries-free intact posterior teeth were included in this study, after they granted an informed written consent. The exclusion criteria were as follow: (1) edentulism; (2) history of drug abuse; (3) history of saliva-reducing medications use; and (4) uptake of substances decreasing the pH of saliva. Patients who deceased before the follow-ups were also excluded from the study. A questionnaire was filled out for each patient. There were no class V decays prior to radiotherapy. The radiotherapy of these patients was a conventional external procedure, in which the nasopharynx and lymph nodes of the neck received Cobalt 60 (≈ 4 MV) radiation with two lateral fields, which consisted of initial dose of 4400-4500 cGY in 25 fractions, comprising 180-200 cGY daily. The patients received the dose five days a week. Then, after a ten-day interval, the radiation field was tapered and the treatment continued until the dose reached to 6500-6700 cGY. Finally, based on their condition, patients received a booster dose.

Dental examination was carried out in three stages: before treatment, 3 weeks after the initiation of the treatment, and at the end of treatment. The condition of posterior class V decays was evaluated using an explorer under artificial light based on the color and the consistency of the lesion. Data were presented using descriptive statistics (mean \pm standard deviation). Paired sample *t*-test was used to compare mean percentage of decayed teeth between 3 weeks after the initiation of the treatment and the end of radiotherapy. Pearson's correlation coefficient was used to evaluate the association between age and the rate of radiation caries. SPSS 14.0 was used for data analysis

and *P*-values < 0.05 was considered statistically significant.

Results

A total of 27 patients (male: 16 [59.3%], female: 11 [40.7%]; mean age: 45.2 ± 11.4) participated in this study. The youngest participant was 25 and the oldest was 66 years old. Mean percentages of class V decayed teeth for all patients are presented in Table 1. The results of the paired sample *t*-test indicated that the differences in the mean percentage of class V decays in patients between 3 weeks after the initiation of the treatment and at the end of the treatment was statistically significant ($P < 0.05$, $df = 26$, $t = 9$). Based on the results of Pearson's correlation coefficient analysis, there was no statistically significant association between the patients' age and the increase of posterior class V caries in 3 weeks after beginning of the treatment ($P = 0.18$, $n = 21$, $r = 0.37$). However, a statistically significant association between age and increase in posterior class V was seen at the end of the treatment ($P < 0.05$, $n = 82$, $r = 0.61$).

Discussion

Malfunction of salivary glands subsequent to radiation therapy of head and neck malignancies is a major problem. The majority of patients experience severe xerostomia.⁷ The present study addressed the radiotherapy-induced dental caries in patients with head and neck malignancies, in whom the salivary glands were in the radiation field. The results showed that the rate of dental caries 3 weeks after the initiation of treatment and at the end of treatment was statistically higher than the rate before treatment. The rate of caries at the end of treatment was also significantly higher than the rate 3 weeks after the beginning of the radiotherapy. These findings are in accordance with the results of other studies.⁸⁻¹¹

Radiation caries is mainly an indirect effect of irradiation-induced changes in salivary gland tissue that result in hyposalivation.⁸ Therefore, prevention of hyposalivation will invariably contribute to the prevention of radiation caries. Hyposalivation lead to accelerated dental caries through changes in salivary composition, a shift in oral flora toward cariogenic bacteria and dietary changes.⁹ Decrease in salivary flow rate has been attributed to the destruction of cells in serous acini

Table 1. Mean (\pm SD) percentage of posterior class V caries

Evaluation period	Mean \pm SD	Min	Max	Range
3 weeks after radiotherapy	28.42 \pm 14.41	0	66.66	66.66
At the end of radiotherapy	67.01 \pm 19.07	47.85	100	57.15

in a recent study by Yee et al.¹¹ They introduced the received radiation dose as the most important factor involved in radiotherapy-induced xerostomia. Nagler³ stated that the complications of radiotherapy manifested in the salivary glands secondary to oropharyngeal syndrome. The syndrome consists of transient severe mucositis, resulting in dehydration, malnutrition and inadequate chewing of food due to intense pain. In accordance with this, another study attributed the noticeable decrease in salivation to the death of cells in serous acini.¹ It has been shown severe demineralization of enamel with dentinoenamel junction involvement occurs in patients with radiation-induced xerostomia.¹⁰ In addition, a study on radiation caries indicated that caries appear in all tooth surfaces rather than proximal surfaces.¹² Regarding the use of similar doses, we consider the same mechanisms to be involved in our study.

There is controversy over the role of age in salivary flow rate. Researchers have attributed the inconsistent results to differences in the case selection and also inclusion of patients taking medications that influence salivation.¹³ The results of the present study regarding the effect of age on the salivary flow rate and also the posterior class V dental caries, was similar to the results of another study.¹¹ Some studies demonstrated structural changes in human submandibular salivary glands due to senescence. Unstimulated salivary flow rate decreases with age, which can be attributed to the destruction of the parenchyma of the glands.^{14,15}

Further studies are warranted to evaluate the effects of new techniques such as modulated intensity radiotherapy on occurrence of dental caries, in which a higher dose is beamed at the tumor site without increased received dose of the surrounding tissues.

Conclusion

The results of the present study revealed that patients with head and neck malignancies will experience class V dental caries on their posterior teeth subsequent to radiation therapy. Differences are seen in the progression of the decay in different ages.

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