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The effect of age on the severity of dry mouth occurring in patients receiving high dose radioactive iodine treatment

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ABSTRACT

Aims: Dry mouth of individuals causes many oral discomforts and undesirable conditions. In order to prevent such an undesirable situation from occurring, it is aimed to complete the Radioactive Iodine Therapy (RAI) treatment with less damage by mastering all possible factors. In our study, we aimed to find the level of the effect of the age factor.

Methods: In this study, we included patients who received high-dose radioactive iodine treatment after total thyroidectomy for differentiated thyroid cancer and were hospitalized in our clinic. These patients were selected among the patients who applied to our hospital between 2021-2022. We specifically focused on patients who reported dry mouth and obtained salivary gland scintigraphies of their submandibular glands. Afterwards, we looked at the ratio of the age of the patients with the level of dry mouth. We analyzed the collected data using statistical methods.

Results: The data analysis was performed using the Chi-square ($\chi 2$) test and the Spearman correlation test to examine the relationship between age and the severity of dry mouth in patients undergoing high-dose RAI treatment for thyroid cancer. Our hypotheses were two-sided, and statistical significance was considered at p-values ≤ 0.05. The results of our analysis revealed that there was no significant direct correlation between age and the severity of dry mouth in the patients. This suggests that age is not a determining factor for the occurrence or severity of dry mouth in individuals receiving high-dose RAI treatment.

Conclusion: In our study, it was concluded that the age factor alone was not a determining factor in terms of the severity of dry mouth. Therefore, it is important to consider additional factors and potential underlying causes when evaluating and managing dry mouth in patients receiving high-dose RAI therapy for thyroid cancer.

Keywords: Dentistry, dry mouth, age

INTRODUCTION

High-dose radioactive iodine treatment is a medical procedure used to destroy cancer cells or reduce the size of a thyroid nodule by administering a high dose of radioactive iodine. This type of treatment is most commonly used for people with thyroid cancer or an overactive thyroid (hyperthyroidism). The radioactive iodine accumulates in the thyroid gland and destroys the gland cells or reduces the size of the nodule.[1,2] During treatment, a high dose of radioactive iodine is given to the patient to destroy the thyroid tissue. While this treatment can be effective in controlling the disease, it can also cause a side effect known as dry mouth.[3] This is because the treatment can damage the salivary glands that produce saliva. The degree and duration of dry mouth after radioiodine treatment depends on several factors, including the dose of radioactive iodine administered, the patient's general health, and the presence of other medical conditions.[4]

Apart from radioactive iodine treatment, there are various factors that cause dry mouth. It is important to know these factors in the studies conducted and to form the study group. Some of these factors are:

Medications, medical conditions, dehydration, aging, tobacco and alcohol use, nerve damage and radiation therapy.[7]

Knowing these factors is important in terms of eliminating external factors in the research to be done. There are many methods to determine the presence

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of dry mouth in patients. These investigating changes in parotid gland function caused by dry mouth such as salivary flow rate test, salivary gland scintigraphy, sialometry, biopsy, medical history and physical examination procedures to determine the cause and extent of parotid gland dysfunction due to dry mouth and to establish an appropriate treatment plan.[8]

Saliva plays a crucial role in maintaining oral health and comfort by moisturizing the mouth, neutralizing acids produced by bacteria, and aiding in the digestion of food.[5] Oral health in patients with dry mouth may encounter many problems, for example; tooth decay, oral infections, It can have a negative effect, such as difficulty speaking and swallowing, taste changes, mouth discomfort, and poor quality of life.[9]

Dry mouth can be an important problem in patients receiving high-dose radioactive iodine therapy and may negatively affect the overall quality of life.[10] Therefore, it is important that healthcare professionals and patients are aware of the potential for dry mouth after high-dose radioiodine treatment and take steps to manage and prevent its effects. Therefore, it is important for healthcare providers and patients to be aware of the potential for dry mouth after high-dose radioactive iodine treatment and to take steps to manage and prevent its effects.

The body's reactions to external factors or diseases change with age changes. The human body's defense mechanism and cell renewal rate differ with age. Investigating the effects of age, which affects many mechanisms in humans, or the responses to diseases is an important step in planning many treatments. As in many diseases, it is important to know the relationship between age and high-dose RAI treatment when determining the appropriate treatment plan for Thyroid patients. Age may affect the efficacy and potential side effects of treatment.[11]

It is an important issue whether the salivary glands of patients of different ages will be at higher risk for radiation-related side effects. In our study, we will investigate how the salivary glands are affected in patients who received different doses of radioactive iodine at different ages.

METHODS

The study was carried out with the permission of Batman University Clinical Researches Ethics Committee (Date: 16.02.2022, Decision No: 2022-02-08). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

We conducted a retrospective study on patients with thyroid cancer who applied to our thyroid polyclinic in the nuclear medicine department of the training and research hospital between 2021-2022. The study included patients who developed dry mouth after receiving high-dose radioactive iodine (RAI) 131 treatment for thyroid cancer. Patients who underwent total thyroidectomy for differentiated thyroid cancer and received high-dose (>30 mCI) RAI from patients hospitalized in our clinic were included in the study. For the study, salivary gland scintigraphy was examined.

Patients who had previously had head and neck cancer and received chemotherapy or radiotherapy in their treatment and patients who developed dry mouth after using any drug were not included in the study. We examined the salivary gland scintigraphy of these patients.

Patient Preparation

When the patient arrived, a paper cup with a straw and a lemon were provided.

Shooting Protocol

The patient was positioned in a horizontal position, and the neck was hyperextended. Low-energy and high-resolution SPECT imaging was performed using a parallel collimator, with a peak of 140 keV and a 20% window width adjustment. Dynamic imaging was performed for 30 minutes. For imaging of the salivary glands, 10 mCi (370 MBq) of 99m Tc pertechnetate was injected intravenously through the cubital vein. Imaging was conducted for 30 minutes, and after 15 minutes, the patient drank 5 ml of freshly squeezed lemon juice from the paper cup using a pipette. During the imaging, the patient was instructed not to move or speak.

Evaluation Criteria

All images were evaluated by the same 2 nuclear medicine specialists. ROI (Regions of Interest) was drawn to penetrate the parotid and submandibular glands in bilateral patients. We performed a semi-quantitative analysis of salivary gland scintigraphy using the Salivary Gland Scintigraphy with Quantitative Analysis program located on the workstation. The program allowed us to measure the filling and emptying functions of the salivary glands, which are classified according to the curves as mild, moderate or severe impairment. The results were evaluated with the scoring method.

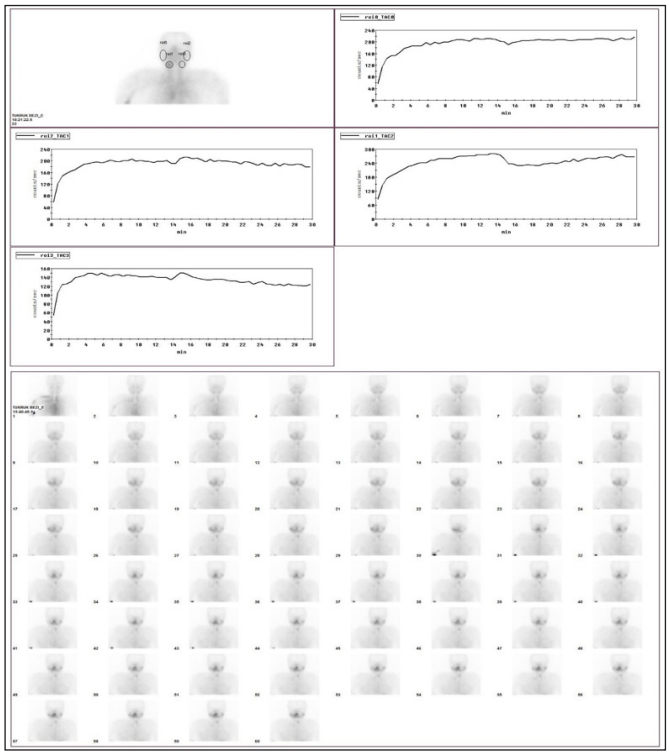

Figure 1: A 66-year-old patient received RAI. It was observed that the functions of the parotid gland and left submandibular gland were severely reduced (roi0, roi2 and roi3), and the right submandibular gland function was mildly affected (roi1)

RESULTS

Table 1: Data table of severity of dry mouth occurring in patients with scintigraphy

	Age	Right Parotis	Left Parotis	Right Submandibular	Left Submandibular
Patient 1	44	0	0	0	0
Patient 2	62	0	0	0	0
Patient 3	43	0	0	0	0
Patient 4	44	0	0	0	0
Patient 5	66	3	3	1	3
Patient 6	36	0	0	0	0
Patient 7	73	1	1	0	1
Patient 8	64	0	0	0	0
Patient 9	43	0	0	0	0
Patient 10	56	1	1	2	3
Patient 11	57	0	0	1	1
Patient 12	50	0	0	0	0
Patient 13	47	1	1	1	1
Patient 14	53	0	0	0	0
Patient 15	40	1	1	0	0
Patient 16	27	0	0	0	0
Patient 17	25	0	2	3	3
Patient 18	42	0	0	0	0
Patient 19	54	0	0	0	0
Patient 20	47	0	0	0	0
Patient 21	71	0	0	0	0
Patient 22	44	0	0	0	0

The following dial indicates the degree of degradation:

0= Normal
1= mild degradation
2= Moderate Degradation
3= Severe Degradation

The statistical analysis of our research data was carried out using the IBM SPSS 21.0 for Windows statistical package program. Mean±standard deviation (SD) was used to present the measured variables, while numbers and percentages (%) were used for categorical variables. To compare qualitative variables between groups, we employed the Chi-square ($\chi 2$) test analysis. Additionally, the Spearman correlation test was used to determine the relationships between variables. Our hypotheses were two-sided, and we considered results statistically significant if $p \leq 0.05$.

Table 2: Statistical analysis results

AGE	R	P
Right Parotis	0.293	0.186
Left Parotis	0.085	0.708
Right Submandibular	0.089	0.694
Left Submandibular	0.265	0.233

R: Correlation coefficient P: Significance value

There was no correlation found between age and the right parotid, left parotid, right submandibular, and left submandibular glands. This means that age did not have an effect on these glands. In our study, it was observed that dry mouth, which occurs after radioactive iodine treatment, did not increase proportionally with age. As age increased, dry mouth did not increase at the same rate.

DISCUSSION

In 2001, Solans R, et al.[12] In a study called salivary and lacrimal gland dysfunction after radioiodine treatment Salivary gland scintigraphy can be used to determine the functionality of the salivary glands, and scintigraphy from the high-activity RAI treatment is a method that allows early detection of glandular dysfunction. we also did our research by using salivary gland scintigraphy in our study.

In their 2018 publication, Park KW et al.[13] noted that the use of radioactive iodine (RAI) treatment in patients with thyroid cancer dates back to the 1940s. The authors specifically included patients who had undergone RAI treatment in their study.

In their 2020 publication, Singer MC et al.[14] emphasized the importance of acknowledging the

potential negative consequences of RAI treatment in patients with thyroid cancer. While it is widely accepted that RAI may have an adverse impact on salivary glands, the relationship between the degree of salivary gland dysfunction and its incidence, as well as the impact of patient age, has not been extensively studied. In our study, we aim to address this knowledge gap by observing the impact of age on salivary gland dysfunction in RAI treatment, with the goal of eliminating this deficiency.

In the Conclusion section of the same study,[14] while investigating the factors affecting RAI treatment, it was found that age, interval between RAI treatments, secondary tumors, pre-existing salivary gland diseases, systemic diseases, and medications used, among other factors, affect the risk of complications associated with RAI. The risk-benefit calculation of RAI treatment for individual patients generally takes all these factors into account together, and age alone should not be the sole consideration.

A 2013 study by Jeong SY et al.[15,16] found that serous salivary cells are better at concentrating iodide than mucinous acini, and the highest concentration of serous cells is found in the parotid glands. As a result, although all salivary glands transport RAI into saliva, the parotid glands are most negatively affected by RAI due to their high concentration of serous cells. Additionally, while sodium iodide symporters in submandibular glands continuously transport RAI from parenchymal cells to ducts, symporter function in the parotid glands is less consistent. This results in a longer transit time in the parotid glands, which exposes the parotid parenchyma to greater amounts of RAI. Consequently, these glands are particularly susceptible to the adverse effects of RAI. We included the two most sensitive salivary glands, the parotid and submandibular glands.

In a 2015 study, Kim et al.[15] noted that the parotid glands have the highest concentration of serous cells among all salivary glands. Due to this, they are particularly susceptible to the adverse effects of radioactive iodine (RAI) transport. The authors also included analysis of both the parotid and submandibular glands to better observe the effects of RAI on these glands.

In the study Eratilla[5] performed on 15 patients who received RAI treatment in 2021The rate of involvement of the parotid glands was examined by the scintigraphy method. Author reported that Dry mouth complication was observed in all of these patients. In our study, we found that patients were affected.

In a study conducted by Caglar et al.[17] in 2002, it was reported that age and gender had an impact on salivary gland function. They also noted an increased risk of salivary gland dysfunction after RAI treatment in women and individuals over the age of 45. However, in our study, when examining a wide range of age groups, we found that age alone did not significantly affect salivary gland dysfunction, and it should be considered in conjunction with other factors.

In their 2011 study, Van Nostrand et al.[18] did not include age as a variable when listing the factors contributing to the incidence and severity of sialadenitis resulting from RAI. In our study, we found that age did not have a significant effect on the rates of involvement of the parotid and submandibular glands. In a study titled "Early sialadenitis after radioactive iodine treatment for differentiated thyroid cancer: Prevalence and determinants," conducted by Riachy et al.[19] the occurrence of salivary gland infection (sialadenitis) following treatment was investigated. The results of their study showed that age alone is not associated with the development of salivary gland infection after radioactive iodine treatment, which supports our findings.[19]

CONCLUSION

Age may be a factor in terms of the severity and frequency of dry mouth, but it is not considered to be the sole or even the most important factor. Other factors that can contribute to dry mouth after RAI treatment include the dose of radioactive iodine received, the time elapsed since the treatment, the individual's overall health, and any pre-existing medical conditions or medications being taken.

Additionally, some individuals may be more prone to dry mouth due to poor habits or inadequate oral hygiene. While these factors may be associated with age, they are not solely dependent on age.

Overall, age is just one of several factors that can contribute to dry mouth after RAI treatment, and the severity and duration of dry mouth can vary significantly from person to person.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Batman University Clinical Researches Ethics Committee (Date: 16.02.2022, Decision No: 2022-02-08).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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