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Investigation of Parotid Gland Function Changes Caused by Dry Mouth in Patients Receiving High-Dose Radioactive Iodine Treatment

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Abstract

When the dry mouth of individuals is not controlled, oral-dental health problems arise. However, their diet and activities of daily living are disrupted, and their quality of life is adversely affected. It is among the duties of dentists to know the level of dry mouth and the functions of the salivary glands in patients using radioactive iodine. In this study, we aimed to investigate the functional status of the parotid gland of the patients who received radioactive iodine.

Among the patients who applied to the nuclear medicine unit of the training and research hospital in 2021, patients who received high-dose (100 mCI RAİ) RAİ after total thyroidectomy due to differentiated thyroid cancer and were hospitalized in our clinic were included. Parotid gland examination was performed by taking salivary gland scintigraphy of patients with dry mouth.

In this study, 15 patients who received 100 mCI were identified and the conditions of the parotid glands were examined by scintigraphy. Dry mouth was observed in all of these patients. Parotid gland function was found to be normal in 9 of 15 patients. In 6 patients, varying degrees of loss of function were detected. There is a significant difference between the right and left parotid ($p<0.001$). Intergroup comparison of qualitative variables Chi-square ($\chi 2$) test analysis was used. Spearman correlation test was used to determine the relationships

It was determined that dry mouth developed in patients who received high-dose Radioactive Iodine (RAI) 131 treatment for thyroid ca. Loss of parotid gland function was observed in 6 of the patients.

Key words: dentistry, dry mouth, parotid gland

Introduction

Saliva is an important body fluid that plays a role in facilitating digestion, speaking, and swallowing processes and protecting oral tissues with its antimicrobial and lubricating effect. Many systemic diseases, drugs, and oncological treatments can reduce the amount of salivary flow, negatively affecting oral health (1). Dry mouth causes subjective discomfort for

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the patient, as well as a significant increase in dental caries with the disappearance of the physiological washing effect of saliva and changes in the oral flora (2).

Dry mouth can be short- or long-term. There are many causes of long-term dry mouth, but drug-related is quite common (3).

IATROGENIC	DISEASES OF SALIVARY GLANDS	OTHER RARE DISEASES
•Medicines •Local Radiation •Chemotherapy •Chronic Graft Versus Host Disease	•Sjörgen Syndrome •Sarcoidoisis •HIV Disease •Hepatitis C Virus •Infection Cystic Fibrosis •Diabetes Mellitus	•Amyloidosis •Hemochromatosis •Wegener's Disease •Others

Table 1: Causes of Long-Term Dry Mouth

The prolonged dry mouth shows some oral manifestations. These; an increase in the incidence of caries can be observed (especially in cervical caries).
- Tendency to acute gingivitis increases
- Dysarthria knew as stuttering due to joint dysfunction
- Dysphagia called difficulty in swallowing
- Taste disorder, metallic taste sensation Dysgeusia
- Tendency to candidal infection increases. acute pseudomembranous candidiasis, median rhomboid glossitis, prosthetic stomatitis, angular cheilitis are examples.
- Burning sensation in the tongue
- Reduction of tongue papillae
- Pain in the oral mucosa
- Dry, chapped lips
- Enlargement of the salivary glands may be observed.

However, patients may express that they have difficulty speaking, chewing, and swallowing. Especially avoidance of dry food intake is the main complaint of these patients. The feeling of pain, especially during the intake of spicy foods, negatively affects the diets of the patients. In patients with severe xerostomia, the salivary glands may be swollen intermittently or continuously. Patients using removable prostheses are mostly not satisfied with the retention of the prosthesis. They complain that injuries occur frequently in the oral mucosa (4,5).

During the clinical examination of the patient due to salivary gland hypofunction, dryness in the oral mucosa is the most obvious finding. The lips may be chapped, peeled, and atrophic. Due to the loss of papillae, the tongue becomes flattened and appears bright red. Erosion and dental caries, especially in the gingival margins, are typical oral findings. It usually occurs in areas such as the cole region of dental caries, tubercle crests, and restoration

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edges. In addition, even if these patients have good oral care, the formation of dental caries can be very rapid (6).

Radiation therapy, which is an important treatment method in cases with head and neck tumors, has complications affecting the salivary glands. In this case, activity involvement, that is, loss of function is generally reduced or completely disappeared in the scintigraphy. Radioactive iodine accumulates in the salivary glands. RAI produces an undesirable effect with major radiation doses in the early and late periods after treatment. These undesirable effects are sialoadenitis (TB inflammation), xerostomia (dry mouth), salivary duct obstruction, and TB tumor formation (7,8).

In this study, we aimed to examine the effects of high-dose radioactive iodine treatment that causes dry mouth and the changes in parotid gland function of the patients.

Material and Method

Thyroid cancer (ca) patients who applied to our Thyroid Outpatient Clinic between January 2021 and December 2021 in the Nuclear Medicine Department of Gazi Yaşargil TRAIning and Research Hospital were included in the study. The salivary gland scintigraphies of patients who received high-dose Radioactive İodine (RAI) 131 treatment for thyroid ca and who developed dry mouth in the controls after discharge were analyzed retrospectively. The inclusion criteria of the patients were that they received high-dose 100mCI RAI after total thyroidectomy due to differentiated thyroid cancer and were hospitalized in our clinic. Patients with a dry mouth who had salivary gland scintigraphy were included in the study. In this study, patients who had previously received chemotherapy or radiotherapy for head and neck cancer, and patients with dry mouth due to disease or drug use were excluded from the study.

While the scintigraphy of the patients was taken, the patients were imaged in the supine position, with the neck hyperextension, low-energy high-resolution parallel collimator, peak 140 keV, and a SPECT device with a window width of 20%. 30 minutes of dynamic imaging was performed with 256x256 matrix and 2 times magnification. For imaging of the salivary glands, 10 mCi (370 MBq) 99mTc pertechnetate was administered intravenously from the cubital vein. At the 15th minute of the 30-minute imaging, 5 ml of lemon juice squeezed into a pet glass was given to the patient with the help of a pipette. It was ensured that the patient did not move or speak during the imaging.

Evaluation Criteria:

Evaluation of the images was done by 2 nuclear medicine specialists. ROİs (regions of interest) were drawn in such a way that the patients entered the bilateral parotid glands. Then, semi-quantitative measurements were made with the program available for salivary gland scintigraphy at the workstation. The functions of the salivary glands were classified as mild, moderate, and severe reductions according to the filling-emptying curves after the measurements.

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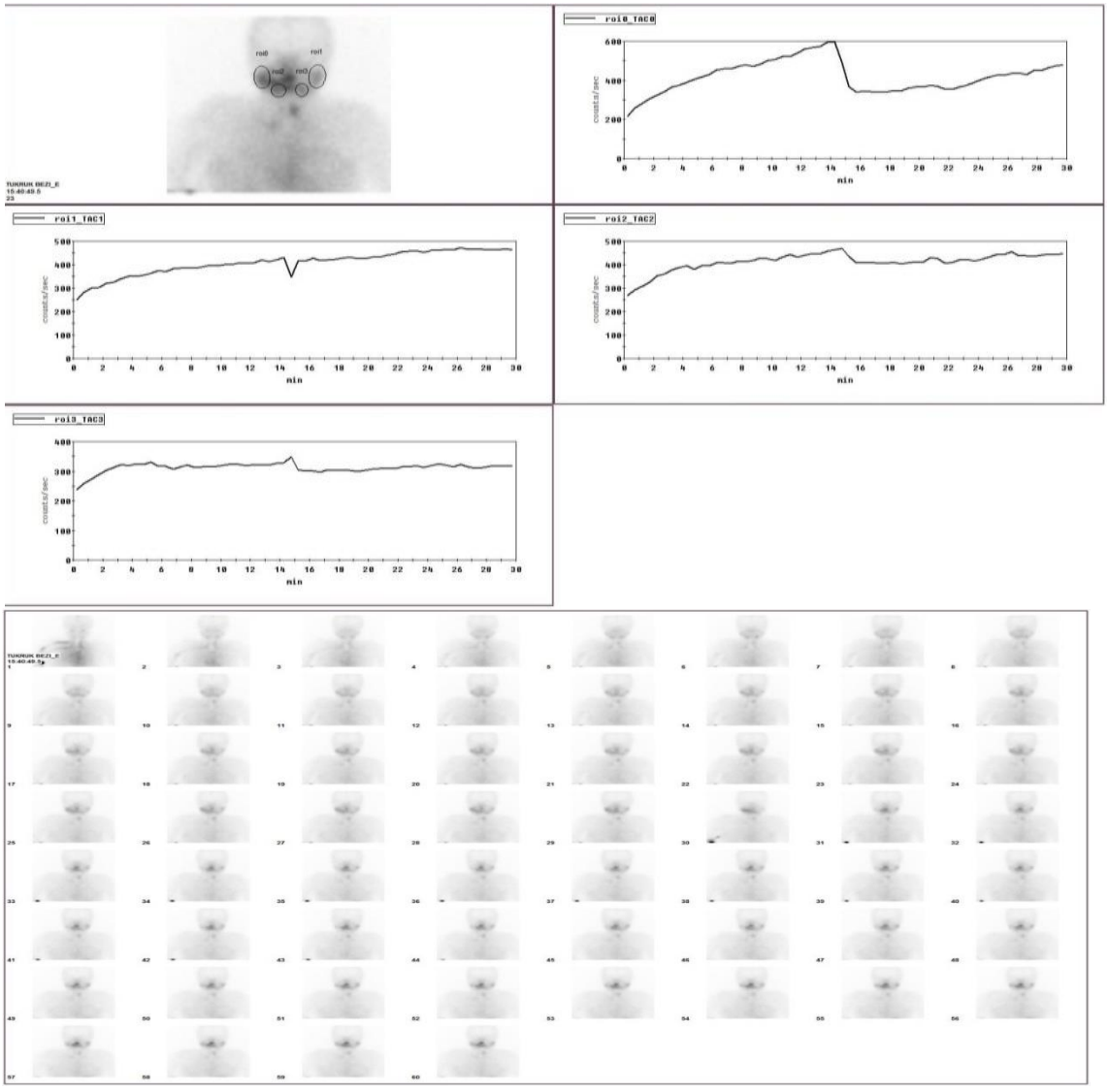
Figure 1: A 25-year-old female patient received 100 mCi RAI 6 months ago, in the salivary gland scintigraphy performed in the patient with the complaint of dry mouth; Right parotid gland functions normal (roi0), left parotid gland functions moderately decreased (roi1)



Statistical Analaysis

IBM SPSS 21.0 for windows statistical package program was used for the statistical evaluation of our research data. Measured variables were presented as mean ± standard deviation (SD), and categorical variables were presented as numbers and percentages (%). Intergroup comparison of qualitative variables Chi-square ($\chi 2$) test analysis was used.

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Spearman correlation test was used to determine the relationships between the variables. The hypotheses were two-sided, and a statistically significant result was accepted if $p \leq 0.05$.

Results

Data were evaluated according to Table 2.

Table 2: Evaluation of the functions of the salivary glands according to the filling-emptying curves after the measurements

	Received RAI Dose Mci	Left Parotid	Right Parotid
1. Patient	100 mCİ	0	0
2. Patient	100 mCİ	0	0
3. Patient	100 mCİ	3	3
4. Patient	100 mCİ	0	0
5. Patient	100 mCİ	1	1
6. Patient	100 mCİ	0	0
7. Patient	100 mCİ	0	0
8. Patient	100 mCİ	0	0
9. Patient	100 mCİ	0	2
10. Patient	100 mCİ	0	0
11. Patient	100 mCİ	0	0
12. Patient	100 mCİ	1	1
13. Patient	100 mCİ	0	0
14. Patient	100 mCİ	0	2
15. Patient	100 mCİ	0	0

0= Parotid Normal
1= Slight reduction of parotid
2= Parotid Moderate Reduction
3= Severe Reduction of Parotid

Intergroup comparison of qualitative variables Chi-square ($\chi 2$) test analysis was used. Spearman correlation test was used to determine the relationships between the variables.

In our study, 15 patients who received 100 MCI were identified and the conditions of the parotid glands were examined by scintigraphy. Dry mouth was observed in all of these patients. Parotid gland function was found to be normal in 9 of 15 patients. In 6 patients, varying degrees of loss of function were detected. Severe reduction in bilateral parotid was

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observed in 1 patient. A slight bilateral reduction was observed in 2 patients. While the unilateral right parotid change was observed in 2 patients, it was not observed in the left parotid. A moderate reduction in the right parotid was observed in these 2 patients.

There is a significant difference between the right and left parotid ($p<0.001$). There is a positive relationship between the right and left parotid. That is, as the left parotid increases, the right parotid also increases ($r=0.662$, $p=0.007$)

Discussion

In a study by Stevenson et al., in which patients with nasopharyngeal cancer were examined, dry mouth was found in 80% of patients after radiotherapy. It has been reported that the parotid gland is the most damaged (9,10).

Oral carcinoma treatments at doses of sixty Gy-70 Gy can cause a rapid decrease in salivary flow in the first week of radiation, resulting in a 95% reduction in salivary secretion. It is almost completely cut off by the 5th week of radiation and rarely heals completely. Both resting and stimulating flow are inhibited, however, compensatory hypertrophy in irradiated salivary gland tissue begins after a few weeks and persists throughout the year. It has a very limited effect in reducing dry mouth. In the study of Porter et al., perioral radiation application can reduce salivary flow by 30-40%, unilaterally by 50-60%, and bilaterally by 80 % (11).

Singh et al. reported that other radiation sources such as radioactive iodine used in thyroid diseases may also cause salivary damage (12).

In a study by Pow Et Al, various malignancies are treated with chemotherapy or a combination of both radiation and chemotherapy. In a study conducted in 127 patients with advanced cancer, dry mouth was found to be the fourth most common symptom (78% of patients), and the degree of dry mouth was reported to be associated with total chemotherapeutic drug use (13,14).

Torun reported that because the normal biodistribution of patients receiving high-dose radioactive iodine treatment is effective in the salivary glands, stomach, and urinary system, these organs also received radiation during the treatment (15). Although radiological techniques have become dominant in the diagnosis of space-occupying lesions of the salivary glands, scintigraphic methods still play an important role in the diagnosis of functional disorders. The clinician often encounters patients who have an association with the salivary glands and do not have clear symptoms. In such cases, sialography may not be preferred due to the discomfort and distress it will cause to the patient, CT due to excessive radiation exposure, and MRI due to its expensive price. Scintigraphic studies constitute a valuable and reliable alternative at this stage. In their study, Caglar et al. reported that Salivary Gland Scintigraphy (TBS) not only provides useful information about major salivary glands (parotid and SM gland) but also can show minor disruptions in glandular function (16).

In a study, Nostrand et al. reported that there may be narrowing in the salivary ducts after radioactive iodine treatment, however, secondary scarring and changes in saliva quality

and quantity occur. They reported that ductal narrowing and acute partial obstruction may occur with normal saliva. They reported that reduction and thickening of salivary flow, mucus precipitation, and plaque formation may cause obstruction (17).

Luster et al., in their study in 2008, found sialadenitis with an incidence of 30% and dry mouth, which rarely occurs at high doses, since it accumulates in the salivary glands physiologically; reported that temporary taste and smell disorders may occur (18).

Early and late sialadenitis is the most common complication of radioiodine therapy and is usually bilateral. They reported that although all salivary glands are affected depending on the radiation dose, the parotid is most affected by radiation damage (19).

Albrecht et al. In their study reported that the salivary gland function decreased in 80% of the patients (20). Another study showed that salivary clearance rates were reduced by approximately 40% in 75% of patients. Although both major and minor salivary glands are affected, they reported that most parotid gland damage is symptomatic (21).

Walter et al. In his study, an increase in dental problems was found in patients who received high doses of radioiodine treatment, especially in patients who developed xerostomia (22).

Bushnell et al. reported that xerostomia and poor oral hygiene paved the way for oral bacterial, viral, or fungal infections, especially in patients receiving high-activity radioiodine therapy (23).

Conclusion

Mouthwashes, gel-form washing agents, lozenges, and toothpaste are also among the methods used to relieve the symptom of dry mouth. Moisturizers containing sage, gels to balance the mouth, mouthwashes with chlorhexidine and fluorine are recommended to prevent dry mouth (24). It is stated that oral care with oral pilocarpine solution increases the saliva flow rate and reduces dry mouth and thirst (25).

As a strategy to manage dry mouth; Limitation of salt intake, use of ice chips, daily weight monitoring, consumption of vegetables and fruits, Artificial saliva preparations containing lemon sugar, sorbitol, calcium, and phosphorus can be used to alleviate dry mouth. It is seen that the use of complementary and integrated methods without side effects has a significant effect on alleviating the symptoms and increasing the quality of life of the patients.

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