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Original Article

The effect of periodontal status on the TSH and FT4 levels

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Abstract

Background: Some bacteria and viruses cause thyroid gland inflammation. Periodontal diseases lead to the production of numerous bacteria in the mouth that spread to other tissues and organs, causing infection in those sites. This investigation's goal was to the correlation between thyroid abnormalities with periodontal disorders.

Methods: The research study was carried out on 96 patients who provided blood samples from the total of 1012 applicants who enrolled to the periodontology clinic. The patients were categorized into 4 categories based on their age: (*i*) ages ranging 0-20, (*ii*) ages ranging 21-40, (*iii*) ages ranging 41–60, and (*iv*) ages over 61. In addition, they were additionally divided into three groups according to both TSH and FT4 levels: The TSHa and FT4a group included patients with below-normal values, the TSHb and FT4b group included patients with normal TSH and FT4 values, and the TSHc and FT4c group included patients with above-normal TSH and FT4 values. The statistical analysis was performed using SPSS 21. Frequency analysis and the Mann-Whitney U Analyses were utilized for statistical analysis., and the level of significance was set at $P<0.05$.

Results: The median TSH and FT4 levels of the patients were 1.98±1.28 mIU/L and 1.19±0.32 mIU/L, in that order there were no significant statistical differences seen in TSH and FT4 levels between genders or age groups. According to their FT4 and TSH levels, 7.3% of the patients had subclinical hypothyroidism and 4.2% had subclinical hyperthyroidism. In total, 11.5% of the patients had thyroid dysfunction.

Conclusion: The results indicated that thyroid dysfunction was present in a remarkably high proportion of patients (11.5%).

Keywords: Thyroid dysfunction, Gingivitis, Periodontitis, Periodontal health

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Introduction

The thyroid gland a distinctive butterfly form, consisting of two lobes on the both of two sides, which are merged in the center by a thin structure known as the 'isthmus'.[1,2] The gland is located corresponding to the vertebral levels C5-T1 and is wrapped around the trachea anteriorly.[2] In reaction to thyroid stimulating hormone (TSH), the thyroid gland releases free thyroxine hormone (FT4). The secreted FT4 is converted to triiodothyronine (FT3), which is a stronger hormone, by deiodinase enzymes.[3] Hyper- or hypo-thyroidism is just one of many physical and mental health issues that can develop from various thyroid diseases, which also include benign, functional, inflammatory, autoimmune, and neoplastic disorders.[4-7] TSH and FT4 are highly sensitive indicators of thyroid function and management of hypo- and hyper-thyroidism.[8] In healthy individuals, normal TSH values vary between 0.4 and 4.0 mcU/mL[9] and normal FT4 values vary between 0.9 and 1.592 ng/dL.[10] Abnormal TSH and FT4 levels result in hyperthyroidism, subclinical hyperthyroidism, hypothyroidism, and subclinical hypothyroidism, which are generally referred to as thyroid dysfunction.[11]

Periodontitis is an infectious condition that is defined by specific characteristics by the spread of inflammation.[12] The correlation between periodontal disorders and numerous systemic issues have been documented in the literature.[13,14]

Acute suppurative thyroiditis (AST), an infection in the thyroid gland, is a rare infectious disease characterized by high FT4 and low TSH values, primarily responsible by bacteria for example *Streptococcus aureus*, *Streptococcus pyogenes*, *Streptococcus epidermidis*, and *Streptococcus pneumoniae*.[15] *Streptococcus anginosus*, a type of bacteria causing head and neck abscesses, is frequently seen in the oral region and also causes acute suppurative thyroiditis.[15,16] In a 2013 study, Kumagai et al detected *S. anginosus* in 28 (75.6%) out of 37 periodontitis patients and only in three (15%) out of 20 healthy patients.[17] The present investigation was conducted to examine in the event TSH and FT4 levels of patients with oral infection.

Methods

Patient selection

This study evaluated the blood test results of patients who provided the results of a blood test up to 30 days prior to the diagnosis of gingivitis or periodontitis in Harran University Faculty of Dentistry Periodontology Clinic

between 2017 and 2020. The patients were selected without regard to the severity of periodontitis or gingivitis. Among the patients whose blood tests were accessed via hospital databases, the patients whose TSH and FT4 values were quantified in their blood tests were utilized in research. The study participants were categorized into four age groups: (*i*) ages ranging 0-20, (*ii*) ages ranging 21-40, (*iii*) ages ranging 41–60, and (*iv*) ages over 61.

The patients were assessed in three distinct groups: The TSHa and FT4a group included patients with below-normal values, the TSHb and FT4b group included patients with normal TSH and FT4 values, and the TSHc and FT4c group included patients with above-normal TSH and FT4 values.

Statistical analysis

The data were examined utilizing SPSS statistical software for Windows edition 22.0, developed by IBM Corp. and located in Armonk, NY. The data underwent evaluation for normal distribution via the Kolmogorov-Smirnov test, while the homogeneity of variance was assessed through Levene's test. The Mann-Whitney U test was used to compare variables that have a distribution that is not normal. A P-value below 0.05 was deemed statistically significant.

Results

Out of the total of 1012 patients who applied to our periodontology clinic, 96 provided blood test results for the assessment of thyroid function. All the 96 patients had a TSH value in the hospital databases, while only 84 of them had a FT4 value.

The 96 patients whose TSH values were available in the hospital databases comprised 50 males and 46 females with an average age of 42.74 ± 16.27 for males and 38.07 ± 12.79 for females. In these patients, the median TSH value was 1.55 mIU/L with a range, 0.35–4.48 mIU/L for men and 1.90 mIU/L with a range, 0.23–6.88 mIU/L for women, and there is no discernible disparity was observed among the genders (Figure 1). By contrast, median FT4 value was 1.17 mIU/L with a range, 0.77–3.67 mIU/L for female and 1.11 mIU/L with a range, 0.83–1.77 mIU/L for female, and there is no discernible disparity was noticed in the context of the genders (Figure 2). In the analysis of TSH values with regard to age groups, the median TSH value was 1.55 mIU/L with a range, 1.27–4.48 mIU/L in group I, 1.78 mIU/L with a range, 0.23–6.86 mIU/L in group II, 1.93 mIU/L with a range, 0.27–6.88 mIU/L in group III, and 1.17 mIU/L with a range, 0.28–3.44 mIU/L in group IV. As for FT4 values, the median FT4 value was 1.18 mIU/L with a range, 1.10–1.27 mIU/L in group I, 1.14 mIU/L with a range, 0.83-3.67 mIU/L in group II, 1.17 mIU/L with a

Table 1. Age-dependent distribution of TSH and FT4 concentrations

Group		TSH	FT4
1	N	8	8
	Median	1.55	1.18
	Minimum	1.27	1.10
	Maximum	4.48	1.27
2	N	39	32
	Median	1.78	1.14
	Minimum	0.23	0.83
	Maximum	6.86	3.67
3	N	39	36
	Median	1.93	1.17
	Minimum	0.27	0.80
	Maximum	6.88	1.77
4	N	10	8
	Median	1.17	1.07
	Minimum	0.28	0.77
	Maximum	3.44	1.20
Total	N	96	84
	Median	1.76	1.15
	Minimum	0.23	0.77
	Maximum	6.88	3.67

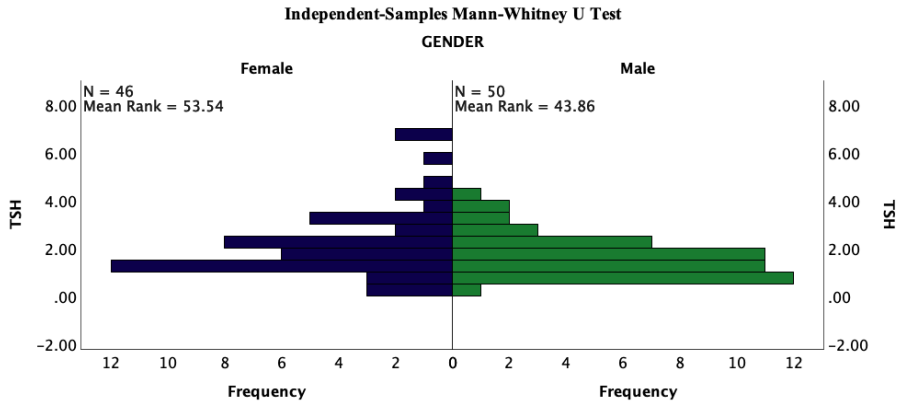

Figure 1. TSH levels according to genders

range, 0.80-1.77 mIU/L in group III, and 1.07 mIU/L with a range, 0.77-1.20 mIU/L in group IV (Table 1). As a result of the analysis, the P value was calculated as 0.401 for TSH and 0.69 for FT4. The analyses confirmed that there was not a noticeable variation in the TSH and FT4 levels. (Figure 3). Furthermore, in all patients, the mean TSH value was 1.98 ± 1.28 mIU/L and the mean FT4 value was 1.19 ± 0.32 mIU/L. Based on their TSH values, 4 (4.2%) out of 96 patients were classified into the TSHb group, 85 (88.5%) were assigned to the TSHb group, and 7 (7.3%) were assigned to the TSHc group (Table 2). In contrast, based on their FT4 values, 7 (8.3%) patients were assigned to the FT4a group, 76 (90.5%) were assigned to the FT4b group, and 1 (1.12%) patient were assigned to the FT4c group (Table 3).

Discussion

The present study evaluated individuals who applied to our periodontology clinic and were diagnosed with gingivitis or periodontitis and whose serum TSH and FT4 values that had been obtained within the last one month were available in hospital databases. In the analysis, the median TSH and FT4 levels were 1.98 ± 1.28 mIU/L and 1.19 ± 0.32 mIU/L, respectively. Additionally, there was no discernible disparity observed between genders and among age groups with regard to TSH and FT4 levels. According to their FT4 and TSH levels, 7.3% of the patients were subclinical hypothyroidism, 4.2% of them had subclinical hyperthyroidism, and 11.5% of them had thyroid dysfunction.

Assessing the TSH level is the optimal method for evaluating thyroid function. Approximately 95% of the healthy population have a serum TSH value ranging from 0.4 to 2.5 mU/L.[18,19] The thyroid gland becomes dysfunctional along with aging, particularly in women. Additionally, several studies indicated that the amounts of TSH in the blood rise with aging.[20,21] Of note, Lee et al. found no significant difference among individuals aged below 60 years with regard to serum TSH values.[22] Conversely, several research have demonstrated that gender, age, and race exert an influence on serum TSH levels.[23-25] There was no statistically significant variation observed in serum TSH and FT4 levels across age categories in our research.

The relationship among serum TSH and FT4 levels and systemic diseases and other medical disorders has been the subject of several researches.[14,22,26-30] Albrecht et al. evaluated the association among focus lack hyperactivity condition and FT3 in 2020 and reported a positive relationship. [31] In addition, some other studies reported body mass index (BMI) is positively correlated with TSH levels and also noted that TSH levels were significantly higher in obese kids compared to kids that are of a healthy weight.[32,33] On the other hand, given that thyroid hormones act a crucial function on the neurological progress during the fetal period, several research have examined the correlation between psychiatric condition and thyroid hormones and reported that patients with hyperthyroidism had a higher hospitalization rate for psychiatric treatment compared to healthy individuals.[6] Moreover, Bauer et al. found that hip and vertebral fractures were observed more frequently in women aged over 65 years with low levels of TSH in the blood.[34]

Thyroiditis can cause homeostatic imbalance and affect the healing capacity of tissues.[35,36] Nevertheless, the majority of these research have evaluated the association among thyroid disorders with oral lichen planus, and only a minority of them have investigated the correlation between periodontal

Table 2. Patients' distribution in accordance with TSH categories

	Frequency	%
TSHa	4	4.2
TSHb	85	88.5
TSHc	7	7.3
Total	96	100

Table 3. Patients' distribution in accordance with FT4 categories

	Frequency	%
FT4a	7	8.3
FT4b	76	90.5
FT4c	1	1.2
Total	84	100

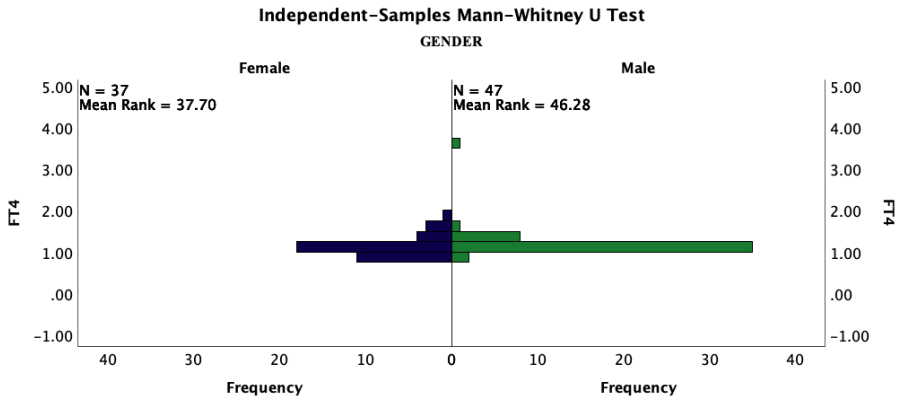

Figure 2. Distribution of FT4 levels according to genders

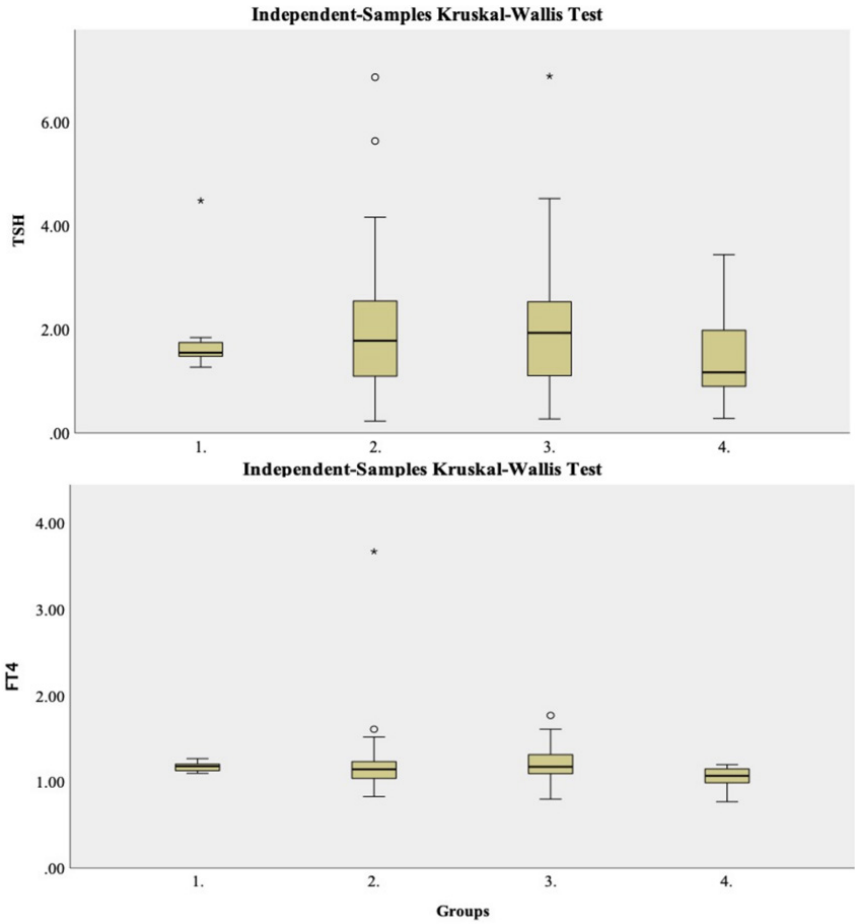

Figure 3. Average values of TSH-FT4 levels 1: Ages ranging 0-20, 2: Ages ranging 21-40, 3: Ages ranging 41-60, 4: Ages over 61

status and thyroid diseases.[14,37-40] In a 2017 review, Li et al demonstrated the incidence of thyroid disorders was greater among individuals having oral lichen planus.[37] In another review, Aldulaijan et al reported on a relationship between periodontitis and hypothyroidism. [14] Additionally, there have been reports that uncontrolled thyroid diseases result in periodontal destruction.[41] Another study suggested that non-surgical periodontal treatment affects serum levels of thyroid hormones.[42] Conversely, Tüysüz and Beker stated that the occurrence of subclinical hypothyroidism in grown-ups with Down syndrome was 25.3%.[43] In some other studies, hyperthyroidism was detected in approximately 4.4% among those diagnosed with type 2 DM, while subclinical hyperthyroidism was detected in 2–4% of the individuals. [44] Conversely, a separate study found that the occurrence of thyroid malfunction in patients have type 2 diabetes was 16.2%.[45]

The patient ratio in our research who provided a blood specimen for the assessment of serum TSH and FT4 values one month before gingival examination was 9.48% among the total patients who were examined. The median TSH value was 1.98 ± 1.28 mIU/L and the median FT4 value was 1.19 ± 0.32 mIU/L. Additionally, when the TSH results of the subjects in the research were analyzed, it was concluded that four (4.2%) patients whose TSH levels were below the usual range had normal FT4 levels and these individuals were categorized as having subclinical hypothyroidism. However, it was observed that seven (7.3%) patients whose TSH levels exceeded the upper bound had normal FT4 levels. Overall, these findings indicate that thyroid dysfunction was observed in 11.5% (4.2% ± 7.3%) of our patients.

Strengths and Limitations

Although this study explains the relationship between thyroid diseases and periodontal diseases, there are certain constraints associated with it. The primary constraint is that the change in the systemic status of the patients whose blood tests were obtained in the last month is not known exactly.

Conclusion

The results indicated a remarkably high prevalence of thyroid dysfunction (11.5%) in periodontal problems.

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Authors' Contribution

Conceptualization: Devrim Deniz Üner, Bozan Serhat Izol.

Data curation: Devrim Deniz Üner, Bozan Serhat Izol.
Investigation: Devrim Deniz Üner, Bozan Serhat Izol.
Formal analysis: Devrim Deniz Üner, Bozan Serhat Izol.
Methodology: Devrim Deniz Üner.
Project administration: Devrim Deniz Üner, Bozan Serhat Izol.
Supervision: Devrim Deniz Üner.
Software: Devrim Deniz Üner
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Validation: Devrim Deniz Üner, Bozan Serhat Izol.
Visualization: Devrim Deniz Üner, Bozan Serhat Izol.
Writing-original draft: Devrim Deniz Üner.
Writing-review & editing: Devrim Deniz Üner.

Competing Interests

The writers of this work have clearly stated that they have no conflicts of interest.

Data Availability Statement

Nil.

Ethical Approval

The Harran University Clinical Research Ethics Committee granted clearance for this study with the number 15271 on March 1, 2021.

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