Available online at www.medicinescience.org

ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2024;13(4):847-53

The investigation of vestibulary system in patients with thyroid dysfunctions

Cigdem Firat Koca[1], Lezan Keskin[2], Mehmet Kelles[3], Turgut Celik[4], Sukru Aydin[1], Seyma Yasar[5]

[1]İnönü University, Faculty of Medicine, Department of Otolaryngology Head and Neck Surgery, Malatya, Türkiye
[2]Malatya Turgut Özal University, Faculty of Medicine, Department of Endocrinology, Malatya, Türkiye
[3]Malatya Turgut Özal University, Faculty of Medicine, Department of Otolaryngology Head and Neck Surgery, Malatya, Türkiye
[4]Battalgazi State Hospital, Department of Otolaryngology Head and Neck Surgery, Malatya, Türkiye
[5]İnönü University, Faculty of Medicine, Department of Biostatistics and Medical Informatics, Malatya, Türkiye

Received 26 July 2024; Accepted 05 September 2024
Available online 01 December 2024 with doi: 10.5455/medscience.2024.07.085

Abstract

A relationship has been detected among thyroid dysfunctions and vestibular pathologies. Our aim was to evaluate the vestibular system in cases with thyroid dysfunctions. Totally 71 patients between the ages of 20-50 with thyroid dysfunctions (35 hypothyroidic and 36 hyperthyroidic) and 36 participants with normal thyroid functions were included. Patients were also allocated as two groups based on antibody positivity. Pure tone audiometry and Vestibular Evoked Myogenic Potential tests were performed for all participants. In the left ear there was a numerically significance in the hypothyroids at 4000 and 8000 Hz (p=0.020 and p=0.014). In the right ear p13 and n23 latencies differed among the groups, (p=0.004 and p=0.001). The p13-n23 and n10-p15 amplitudes were decreased in both patient groups (p<0.001) (p=0.015). For the left ear, the p13 an n23 latencies was prolonged in both patient groups (p=0.044) (p=0.002). The p13-n23 amplitude value was distincted numerically significant (p<0.001). The n10-p15 amplitude was longer in the patients (p=0.004). We can not observe a numerically significance among groups according to antibody positivity (p>0.005). Thyroid dysfunctions may lead to subclinical changes on the vestibular system and the saccular and utriculer impairment may be an early indicator of endolymphatic hydrops.

Keywords: Vestibular-evoked myogenic potentials, thyroid dysfunction, vestibular system

Introduction

Thyroid hormone has several critical physiologic influences that covering protein production, cell development and maturation, regulation of cardiovascular system, heat generation, and development of central nervous. musculoskeletal and as well as epidermal mechanisms. Beside the functions mentioned above, the hormone is vital for normal growth of the auditory structures. The complete development of the corti organ in the course of the late prenatal term in humans is increasingly delicate to thyroid hormone, and its deficit may induce irreversible hearing impairments. Psaltakos et al. studied a 54-patient grup, that experienced total thyroidectomy due to thyroid carcinoma. They showed that in severe alterations in both hearing thresholds and otoacoustic emission amplitudes in their patient group [1]. Arduç et al. reported a numerically important rise in hearing levels of cases with euthyroid Hashimoto at the 250, 500 and 6000 Hz frequencies in the comparison between controls [2]. In recent years, concomitant autoimmune thyroid pathologies have been demonstrated in various cases diagnosed with vestibular pathologies, including Meniere's disease (MD) or benign paroxysmal positional vertigo (BPPV) [3-8]. The probable link among thyroid dysfunctions and vestibular pathologies may base an impaired and insufficient blood flow in the inner ear due to autoimmune procedures [9,10]. The studies may indicate an exact relation among vestibular pathologies and thyroid autoimmune clinical situations irrelevant from thyroid functional process [4-8,11]. Based on these scientific data, we planned to assess the vestibular mechanism of patients with thyroid dysfunction with the Vestibular-evoked myogenic potential (VEMP) tests.

CITATION
Firat Koca C, Keskin L, Kelles M, et al. The investigation of vestibulary system in patients with thyroid dysfunctions. Med Science. 2024;13(4):847-53.

Corresponding Author: Cigdem Firat Koca, İnönü University, Faculty of Medicine, Department of Otolaryngology Head and Neck Surgery, Malatya, Türkiye
Email: cifirat@hotmail.com

DOI: 10.5455/medscience.2024.07.085

VEMP test has an important task as a part of vestibulometry and is utilized to evaluate the utricular and saccular functionality. The ocular VEMP (o- VEMP) evaluates the completeness of both utricle and superior vestibular nerve. The cervical VEMP (c-VEMP) test measures the stability of the saccule and the inferior vestibular nerve [12].

Material and Methods

We carried out the present study after ethical affirmation from the Clinical Research Ethics Committee of Malatya Turgut Özal University (ethical number: 2021/22). In this clinical study. our main objective was to analyze the audiovestibular system of cases with thyroid dysfunctions via pure tone audiometry, c and o-VEMP test batteries and to clarify probable sequelae in comparison with the controls. Totally 71 cases age between 20-50 years with thyroid dysfunctions and who applied to Malatya Turgut Özal University Training and Research Hospital Endocrinology and Otolaryngology outpatients clinics between 20.05.2021 and 20.11.2022 were included in the research. Following an overnight fasting period, blood samples were taken for the analysis serum thyroid-stimulating hormone (TSH), free triodothyronine (fT3) and free thyroxine (fT4), anti thyroid peroxidase (TPO) and anti thyroglobulin (TG) antibody levels in the Endocrinology outpatient clinic, (The consecutive parameters were accepted as normal: TSH — 0.27–4.20 mU/L, fT3 —2.04-4.4 pg/ml, fT4 — 0.8–1.71 ng/mL, anti-TPO— 0.0–34 IU/mL, and anti-TG 0.0 —115 IU/mL). Cases were evaluated with hyperthyroidism and hypothyroidism by the same experienced endocrinologist and referred to the Otolaryngology outpatient clinic for detailed examination and audiolovestibular tests. Pure tone audiometry and VEMP tests were performed on all patients. Patients with thyroid dysfunctions were divided into two groups with hypothyroidism and hyperthyroidic cases. A total of 36 healthy participants in the same age range, who applied to the Otolaryngology outpatient clinic with normal thyroid function levels and accepted to participate in the study were also designed as the control group. After the analysis of the three groups, the patients were regrouped as antibody positive and negative, and we investigated the effect of antibody positivity. Patients who were twice as high as the upper limit for at least one of the antibodies were considered antibody positive. A written consent form was signed by all of our patients who agreed to participate in our clinical trial. Cases with tinnitus.vertigo, prior otologic surgeries and auditory impairment and neurologic pathologies, prior neck traumas or surgeries. orbital surgeries, or ocular pathologies were deported from the research. Audiological measurements and assessment were achieved and analyzed by the same practised audiologist and otolaryngologist. The test batteries were actualized via Interacoustics AC40 instrument (Middelfart, Denmark) to measure certain distinct frequencies (250 Hertz (Hz), 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz) in an appropriate soundproof special cabin. The entire processes carried out within this clinical trial were performed in pursuant of the Declaration of Helsinki.

Cervical VEMP Test Process

The test process was achieved via Interacoustics Eclipse EP25 (Middelfart, Denmark). The tone burst stimulus were conducted to the ear via IP30 insert earphones (RadioEar, Middelfart, Denmark). Electromyography (EMG) signals were raised and bandpass-strained in the range of 30 and 2000 Hz frequencies. The tone burst stimulus (105 dB nHL, 500 Hz, characteristically each stimuli possess a 2 ms rising drop and a 0-ms plateau period, stimulus at a consistency of 5.1/second) were transferred to each ear. The c-VEMP outcomes were enrolled when the density of muscle contraction was among 100 microvolt (μV) root mean square (RMS) and 150 μV RMS. Both the peak-to-peak amplitudes and as well as peak and interpeak latencies of the p13 and n23 waves were recorded for left and right ears. The asymmetric range was gained through the definition developed by Murofushi et al. (Asymmetry range: 100 (Au_Aa)/(Au + Aa) Au: p13 – n23 (the peak-to-peak amplitude of the impacted ear), Aa: p13 – n23 (the peak-to-peak amplitude of the impacted ear) among the left and right ears). Based on our standard datum, an asymmetric valuation of bigger than 32% was approved as anomalous and evaluated as a sign of saccule impairments of the ear presenting a declined amplitude reaction [13].

Ocular VEMP Test Process

The test process was achieved via an Interacoustics Eclipse EP25 instrument (Middelfart, Denmark). The EMG signals were strengthen and bandpass-strained in the range of 1 and 1000 Hz frequencies. Sound stimulus were conducted to the contralateral part of the effectual electrode with an consistensity of 105 dB nHL. Both the and peak-to-peak amplitudes and as well as peak latencies of n10 and p15 were recorded for each side measurement. The asymmetric range was found by utilizing the definition developed by Murofushi et al. among the different sides. Basis on our standard datum, we described asymmetric ratios more than 40%, as asymmetric presented among the two sides [13].

Results

Totally 107 participants were involved in the research. Demografics involving age, gender and thyroid hormone levels (TSH, FT4, FT3) were demonstrated in Table 1. The average age was 42.82±11.64 years in the hypothyroid group, 43.75±9.51 in the hyperthyroidics and 36.77±8.06 in the controls. There was a numerically significance among the three groups between age ($p=0.003$) and thyroid hormone levels ($p<0.001$). In pure tone audiometric assessment, there was no numerically difference in any frequency for the right ear for any of the three groups, while a statistically significance was observed between the hypothyroid group and the controls for the left ear at frequencies of 4000 and 8000 Hz ($p=0.020$ and $p=0.014$) (Table 2 and 3). In the right side VEMP outcomes, the

DOI: 10.5455/medscience.2024.07.085

p13 and n23 latencies differed between the groups (p=0.004 and p=0.001). The mean p13 latency was 16.21±3.55 in the hypothyroid group, 17.48±4.32 in the hyperthyroid cases, and 14.62±1.56 in the controls. While the value was prolonged in both patient groups, this difference was more evident in the hyperthyroidic group (p=0.004). The average n23 latency was 24.58±3.63 in the hypothyroid group, 26.31±4.21 in the hyperthyroid patients and 22.26±4.33 in the controls. Similar to p13 latency. while n23 latency was prolonged in both patient groups, this difference was greater in the hyperthyroidic group (p=0.001). The p13-n23 amplitude was measured to be importanttly declined in both patient groups (p<0.001). Similarly, the n10-p15 amplitude was significantly declined in the two patient groups (p=0.015) (Table 4). In the left ear c and o-VEMP results the p13 latency differed among the groups, and we found that this value was prolonged in both patient groups and this prolongation was higher in the hyperthyroidics (p=0.044). While the n23 latency was similarly longer in the two patient groups, this prolongation was more apparent in the hyperthyroidic cases (p=0.002). The p13-n23 amplitude value was numerically significant among the patients and the controls (p<0.001). The n10-p15 amplitude was statistically longer in the patient groups (p=0.004) (Table 5). Antibody values of the groups are given in Table 6. We could not obtain a statistically significance in pure tone audiometry and VEMP tests for the right and left ears in the groups we divided according to antibody positivity (p>0.005) (Tables 7 and 8). In the anaysis according to the antibody negative group, the asymmetric ratio for c-VEMP was 41%. while this value was 57% for o-VEMP, according to the formula described by Murofushi [13].

Statistical Analysis

Datum were presented as mean±standard deviation, median (min-max), and number (percent). Compability to the standard dispersion was done using the Shapiro-Wilk test. Both Pearson chi-square and Kruskal Wallis tests were utilized in convenient in numerical analyses. The Conover test was utilized for Kruskal Wallis test. The p result of <0.05 was accepted numerically significative. IBM SPSS Statistics 26.0 program was utilized in the numerically analysis.

Table 1. Demographics and thyroid hormone levels

		Group						p-value
		Hypothyroidism		Hyperthyroidism		Control		
		Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	
Age		42.829a±11.645	43a (21-67)	43.75a±9.518	45a (22-61)	36.778b±8.061	36.5b (20-50)	**0.003***
TSH		31.294a±29.249	19.5a (5.08-100)	0.021b±0.03	0.006b (0.005-0.158)	1.88b±0.771	1.9b (0.49-3.88)	**<0.001***
FT4		0.928a±0.409	0.95a (0.124-2)	2.244b±1.391	1.835b (0.74-7.77)	1.179a±0.156	1.185a (0.888-1.5)	**<0.001***
FT3		1.932a±0.848	1.8a (0.8-3.71)	5.929b±5.333	4.005b (1.31-26.3)	2.935a±0.515	3.06a (0.972-3.84)	**<0.001***
		Count	Percent	Count	Percent	Count	Percent	
Sex	**Female**	25a	33.3%	28a	37.3%	22a	29.3%	0.297**
	Male	10a	31.3%	8a	25.0%	14a	43.8%	

*: Kruskal-Wallis (Mann-Whitney-U with Bonferroni Correction in pairwise comparison); **: Pearson Chi-Square

Table 2. Pure tone audiometry results of right ears

	Group (right)						p-value
	Hypothyroidism		Hyperthyroidism		Control		
	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	
Right/250	15.857a±5.621	15a (5-30)	13.611a±5.293	15a (5-25)	13.472a±6.304	10a (5-25)	0.955*
Right/500	14±5a.531	15a (5-25)	13.611a±6.166	10a (5-30)	11.944a±5.11	10a (5-25)	0.492*
Right/1000	13.143a±6.311	15a (0-25)	12.778a±6.146	10a (5-40)	10.833a±6.036	10a (5-25)	0.909*
Right/2000	14.143a±7.716	15a (5-35)	12.222a±5.662	10a (5-35)	12.222a±6.375	10a (5-30)	0.879*
Right4000	18.429a±13.546	15a (5-60)	17.5a±14.066	15a (5-85)	13.056a±6.791	10a (5-35)	0.674*
Right/8000	22.286a±18.839	20a (5-80)	21.25a±15.37	20a (5-80)	14.306a±7.285	15a (5-35)	0.719*

*: Mann-Whitney-U with Bonferroni Correction in pairwise comparison)

DOI: 10.5455/medscience.2024.07.085

Table 3. Pure tone audiometry results of left ears

	Group (left)						p-value
	Hypothyroidism		Hyperthyroidism		Control		
	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	
Left/250	15.857a±5.071	15a (10-25)	14.861a±6.151	15a (10-40)	11.806a±4.653	10a (5-25)	1.000*
Left/500	14.429a±6.505	15a (5-25)	13.056a±7.099	10a (0-35)	11.667a±4.928	10a (5-25)	0.334*
Left/1000	13.429a±5.254	15a (5-25)	12.778a±4.847	10a (5-25)	10.833a±5.669	10a (5-25)	0.699*
Left/2000	14.571a±7.8	15a (5-35)	11.667a±6.437	10a (0-30)	11.528a±5.185	10a (5-20)	0.105*
Left/4000	19.571a.b±14.213	20a.b (5-65)	21.389a±17.428	15a (5-95)	12.639b±5.139	10b (5-25)	**0.020***
Left/8000	24.429a±19.165	20a (5-80)	18.75a.b±16.141	15a.b (5-80)	12.778b±5.133	10b (5-25)	**0.014***

*: Kruskal-Wallis (Mann-Whitney-U with Bonferroni Correction in pairwise comparison)

Table 4. The c and o-vemp results of right ears

	Group (right)						p-value
	Hypothyroidism		Hyperthyroidism		Control		
	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	
c-vemp p13	16.21a.b±3.559	16a.b (8.67-24.33)	17.481a±4.322	16.33a (12-31.33)	14.621b±1.569	14.5b (12.33-19.33)	**0.004***
c-vemp n23	24.58a.b±3.639	24.33a.b (17.33-33)	26.314a±4.213	25a (19.67-40)	22.268b±4.331	23b (9.33-27.67)	**0.001***
p13 n23 latency	8.143a±2.059	8.33a (4.33-13)	8.834a±2.182	8.5a (4.33-14.67)	8.371a±2.09	8.67a (4-12.67)	0.428*
p13 n23 amplitude	78.456a±59.227	65.98a (10.42-210)	99.90a±69.716	96.40a (15.56-256.3)	146.703b±58.946	161.8b (5.69-259)	**<0.001***
o-vemp n10	9.468a±0.83	9.67a (6.67-10.67)	10.564a±2.743	10a (8.67-22)	10.842a±3.856	9.67a (7.33-24.67)	0.109*
o-vemp p15	14.487a±1.294	14.67a (10.67-16.67)	15.048a±1.195	14.835a (12.67-18)	14.361a±1.692	14.5a (9-18.33)	0.112*
n10 p15 latency	5.019a±0.889	5a (3.33-7.33)	5.037a±0.887	5a (3-7)	5.111a±1.279	5a (2.67-8.33)	0.961*
n10 p15 amplitude	8.439a±6.921	5.6a (0.98-25.37)	9.267a±6.848	7.21a (1.77-31.66)	17.014b±17.512	11.82b (1.84-74.6)	**0.015**

*: Kruskal-Wallis (Mann-Whitney-U with Bonferroni Correction in pairwise comparison)

Table 5. The c and o-vemp results of left ears

	Group (left)						p-value
	Hypothyroidism		Hyperthyroidism		Control		
	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	
c-vemp p13	16.457a.b±3.449	15.67a.b (12-29)	18.602a±6.042	16.835a (11.67-42.67)	15.473b±2.123	15.335b (12.67-19.67)	**0.044***
c-vemp n23	23.599a±4.813	23.33a (4.33-35.67)	26.833b±6.476	25.335b (16.67-54.67)	22.287a±4.641	22.67a (9-28.33)	**0.002***
p13 n23 latency	7.687a±1.957	7.67a (4.33-11.67)	8.232a±2.378	8.5a (4.67-13.33)	7.649a±2.06	7.835a (4.33-14)	0.482*
p13 n23 amplitude	78.806a±64.308	58.44a (6.63-271.8)	87.17a±61.636	70.62a (20.55-217.5)	137.527b±67.18	133.9b (10.53-271.8)	**<0.001***
o-vemp n10	9.851a±0.648	9.76a (8-11.33)	10.056a±3.174	9.67a (0-20.67)	10.759a±4.158	9.67a (9-26.33)	0.287*
o-vemp p15	15.163a±1.007	15.33a (13-17.33)	14.917a±2.214	14.835a (4.67-20)	14.852a±0.85	14.67a (13-17.33)	0.322*
n10 p15 latency	5.314a±0.964	5.33a (4-8)	5.899a±4.172	5.33a (3-29.67)	6.004a±3.831	5.33a (3.67-27.48)	0.882*
n10 p15 amplitüde	10.489a±8.939	7.69a (0.42-45.27)	11.204a±8.017	9.56a (2.36-32.01)	19.523b±20.923	16.585b (3.04-125.4)	**0.004***

*: Kruskal-Wallis (Mann-Whitney-U with Bonferroni Correction in pairwise comparison)

DOI: 10.5455/medscience.2024.07.085

Table 6. Demograhics and thyroid antibody levels

	Groups				p-value
	Positive		Negative		
	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	
Anti TPO	264.96±143.69	257.55 (10.6-600)	16.32±11.35	12.95 (6-56.7)	**<0.001***
Anti TG	576.26±1110.12	170.5 (20.31-4000)	27.39±37.38	15.12 (8-173.3)	**<0.001***
Age	42.82±11.05	42.5 (21-67)	43.73±10.21	44 (22-62)	0.645*
TSH	19.7±29.54	7.55 (0.005-100)	11.52±21.38	0.041 (0.005-100)	0.165*
fT4	1.61±1.54	1.165 (0.124-7.77)	1.58±0.84	1.3 (0.4-4.2)	0.264*
fT3	3.88±4.79	2.225 (0.9-26.3)	4.03±3.89	3.03 (0.8-19.33)	0.444*

*: Mann-Whitney-U test

Table 7. Left ear VEMP results according to thyroid antibody positivity

	Group (Left ear)				p-value
	Positive		Negative		
	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	
c-vemp p13	18.37±6	16.5 (13-42.67)	16.78±3.84	15.67 (11.67-28)	0.313*
c-vemp n23	25.78±7.57	24 (4.33-54.67)	24.74±3.84	24.33 (16.33-36.67)	0.890*
p13- n23 latency	8.06±2.03	8 (4.67-12)	7.87±2.34	8.67 (4.33-13.33)	0.624*
p13- n23 amplitude	83.7±69.24	59.14 (6.63-271.8)	82.44±56.91	65.98 (11.13-217.5)	0.743*
o-vemp n10	10.02±3.24	9.67 (0-20.67)	9.89±0.75	10 (9-13)	0.318*
o-vemp p15	14.79±2.06	15 (4.67-17.33)	15.26±1.32	15.33 (13-20)	0.582*
n10 p15 latency	5.3±1.02	5.33 (4-8)	5.89±4.1	5.33 (3-29.67)	0.698*
n10 p15 amplitude	11.71±9.49	9.03 (2.25-45.27)	10.07±7.38	9.42 (0.42-32.01)	0.617*

*: Mann-Whitney-U test

Table 8. Right ear VEMP results according to thyroid antibody positivity

	Group (right)				p-value
	Positive		Negative		
	Mean±SD	Median (Min-Max)	Mean±SD	Median (Min-Max)	
c-vemp p13	17.58±4.39	17 (10-31.33)	16.19±3.51	15.67 (8.67-26.67)	0.176*
c-vemp n23	26.09±4.15	24.835 (20.33-40)	24.88±3.84	24.33 (17.33-36)	0.342*
p13 n23 latency	8.27±1.95	8.33 (4.33-13)	8.69±2.3	8.67 (4.33-14.67)	0.433*
p13 n23 amplitude	75.24±57.95	54.56 (12.7-201.7)	102.27±69.48	96.53 (10.42-256.3)	0.116*
o-vemp n10	10.28±2.85	9.67 (7.33-22)	9.78±0.99	9.67 (6.67-12.33)	0.815*
o-vemp p15	14.76±1.28	14.67 (10.67-16.67)	14.79±1.27	14.67 (12-18)	0.776*
n10 p15 latency	5.06±0.84	5 (3.33-7)	5±0.93	5 (3-7.33)	0.821*
n10 p15 amplitude	9.22±6.61	7.76 (0.98-25.37)	8.53±7.14	5.77 (1.58-31.66)	0.391*

*: Mann-Whitney-U test

DOI: 10.5455/medscience.2024.07.085

Discussion

Our present study suggests that thyroid dysfunctions may effect vestibular system. Many of our c and o-VEMP results were statistically significant compared to the controls regardless of the type of thyroid dysfunction. The analysis of right side c-VEMP outcomes, we detected that p13 and n23 latencies were prolonged especially in the hyperthyroidic group (p=0.004 and p=0.001). The p13-n23 amplitude was declined in the two patient groups (p<0.001). Our left ear c-VEMP results were similar to the right side, and the p13-n23 latencies were prolonged in the two patient groups, particularly in the hyperthyroid cases (p=0.044 and p=0.002). The p13-n23 amplitude was decreased in the two patient groups, as in the results of the right side (p<0.001). Analysis of the o-VEMP results showed that the n10-p15 amplitude in the right ear was decreased in patient groups (p=0.015) and for the left side this value was prolonged in two patient groups (p=0.004). Although we did not include patients with hearing impairment, a statistically significance was observed between the hypothyroid group and the controls for the left ear at frequencies of 4000 and 8000 Hz (p=0.020 and p=0.014). We could not find a statistically significance in both VEMP and pure tone audiometry test results between antibody positive and negative groups (p>0.005).

The probable relationship among thyroid pathologies and MD has been demonstrated for nearly 30 years, however it is yet remains contentious. House and Pulec declared that 3% of MD cases had a previously hyperthyroidism, and additionally Powers et al. reported a high incidence of hypothyroidism in MD patients [14,15]. Evans et al demonstrated 17 % of serum of MD cases including anti-thyroid-microsome antibody titres [3]. On the otherhand, an association among variable thyroid functions and Meniere disease was originally eliminated by Kinney and by Meyerhoff et al. [16,17]. Modungo et al. reported the flow of the immune accumulation to the inner structures of ear rised the prevalance of BPPV. This migration via the blood vessels to the saccular area and the inner parts of the ear may cause distorted endolymph flow, that may effect vestibular sensory structures and induce vertigo [6].

Additionally, thyroid dysfunction rises the cardiovascular disease risk and a systemic ischemic process, it was indicated that thyroid dysfunctions may decrease blood flux to the inner structures of ear and this may rise the vestibular pathologies [10,18].

The tasks of the vestibulary mechanisms can be evaluated by measuring the reflex arches of both cervical and as well as extraoculary muscles via o and c-VEMP instruments. The c-VEMP test analyze the vestibulo-collic reflex arch and, additionally o-VEMP test evaluates the tasks of the vestibulo-ocular reflex arches. Pathologic VEMP results, covering amplitude and as well as latency, might demonstrate impairment of the both vestibulocollic or vestibulo-ocular reflex arches. The absence of VEMP responses may indicate the vestibular injury. Centric and/ or vestibular nerve demyelinating pathologies can induce retarded latencies of both vestibulo-collic and ocular reflex arches. The prolongation of the positive peaks, the rise in latencies, and/or the lower amplitudes are the markers of pathologic c-VEMPs and these all indicate saccular pathologies [19]. Conductive auditory impairments may induce the pathologic VEMP results due to inefficient transfer to the sound consistency in the area of oval window [20]. Additionally, sensorineural auditory impairments do not effect VEMP results. In the elderly VEMP replies may demonstrate variations [21,22]. To avoid inaccuracy, we excluded patients with both type hearing impairments.

Chirella et al. found that a significant association among euthyroid Hashimoto's thyroiditis and vestibulary subclinical changes, indicating that free antithyroid autoantibodies may demonstrate a disadvantage for vestibular impairment occurrence. VEMPs are sensitive instrument for determining preclinical vestibulary impairments. Chirella et al. reported that the saccular impairment obtained by VEMPs may based on initial endolymphatic hidrops in their study. Additionally, they showed 53.6% of their cases with a change of VEMPs demonstrated also labyrinthine pathology, a presentation of root canal injury possible due to the hydrops diffused to the whole endolymphatic mechanism [11]. On the otherhand Sari et al. did not affirm an association among the development and seriousness of symptoms and anti-TPO existence or increased TSH values BPPV in cases [23].

Despite the statistically significant VEMP results we found. none of our cases had any vestibular symptoms. We already excluded cases with a history of vertigo and/or dizziness at the beginning of the study. Additionally we examined the effect of antibody positivity on VEMP and pure tone audiometry results, but we could not detect a numerically significance (p>0.005). Although we could not reach an absolute conclusion as antibody positivity had no effect on the vestibular system, we could not detect a significant effect.

Limitations

We could not evaluate whether the saccular and utricular effects of thyroid dysfunctions are permanent. The inability to perform control VEMP tests after thyroid replacement therapy was one of the limiting features of our study. We know that it is not possible to evaluate the entire vestibular system with VEMP tests. We were able to use all the vestibular system tests available in our clinic, which was a limitation of our study.

Conclusion

We believe that thyroid dysfunctions may lead to subclinical changes on the vestibular system and the saccular and utriculer impairment detected by VEMPs and may be an early indicator of endolymphatic hydrops. In this respect, it would be appropriate to complete the necessary otolaryngological consultations in terms of possible vestibular instability in these patients by working cooperatively by Endocrinology clinics, where patient groups with thyroid dysfunction are evaluated.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
This research was carried out following the approval from the Clinical Research Ethics Committee of Malatya Turgut Özal University (number: 2021/22).

References

1. Psaltakos V, Balatsouras DG, Sengas I, et al. Cochlear dysfunction in patients with acute hypothyroidism. Eur Arch Otorhinolaryngol. 2013;270:2839-48.
2. Arduc A, Isık S, Allusoglu S, et al. Evaluation of hearing functions in patients with euthyroid Hashimoto's thyroiditis, Endocrine. 2015;50:708-14.
3. Evans KL, Baldwin DL, Bainbridge D, Morrison AW. Immune status in patients with Menière's disease. Arch Otorhinolaryngol. 1988;245:287-92
4. Fattori B, Nacci A, Dardano A, et al. Possible association between thyroid autoimmunity and Menière's disease. Clin Exp Immunol. 2008;152:28-32.
5. Nacci A, Dallan I, Monzani F, et al. Elevated antithyroid peroxidase and antinuclear autoantibody titers in Ménière's disease patients: more than a chance association?. Audiol Neurootol. 2010;15:1-6.
6. Modugno GC, Pirodda A, Ferri GG, et al. A relationship between autoimmune thyroiditis and benign paroxysmal positional vertigo?. Med Hypotheses. 2000;54:614-5.
7. Papi G, Corsello SM, Milite MT, et al. Association between benign paroxysmal positional vertigo and autoimmune chronic thyroiditis. Clin Endocrinol (Oxf). 2009;70:169-70.
8. Papi G, Guidetti G, Corsello SM, et al. The association between benign paroxysmal positional vertigo and autoimmune chronic thyroiditis is not related to thyroid status. Thyroid. 2010;20:237-8.
9. Kim SY, Song YS, Wee JH, et al. Association between Ménière's disease and thyroid diseases: a nested case-control study, Sci Rep. 2020;10:18224.
10. Miśkiewicz-Orczyk K, Vlaykov A, Lisowska G, et al. Does thyroid hormone metabolism correlate with the objective assessment of the vestibular organ in patients with vertigo?. J Clin Med. 2022;11:6771.
11. Chiarella G, Tognini S, Nacci A, et al. Vestibular disorders in euthyroid patients with Hashimoto's thyroiditis: role of thyroid autoimmunity. Clin Endocrinol (Oxf). 2014;81:600-5.
12. Godha S, Upadhyay Mundra A, Mundra RK, et al. VEMP: An objective test for diagnosing the cases of BPPV. Indian J Otolaryngol Head Neck Surg. 2020;72:251-6,
13. Murofushi T, Iwasaki S, Ushio M. Recovery of vestibular evoked myogenic potentials after a vertigo attack due to vestibular neuritis. Acta Otolaryngol. 2006;126:364-7.
14. Pulec L, House WF. Meniere's disease study: three-year progress report. Int J Equilib Res. 1973;3:156-65.
15. Powers WH. Metabolic aspects of Meniere's disease. Laryngoscope. 1978;88:122–9.
16. Kinney SE. The metabolic evaluation in Meniere's disease. Otolaryngol Head Neck Surg. 1980;88:594-8.
17. Meyerhoff WL, Paparella MM, Gudbrandsson FK. Clinical evaluation of Menière's disease. Laryngoscope. 1981;91:1663-8.
18. Jabbar A, Pingitore A, Pearce SHS, et al. Thyroid hormones and cardiovascular disease. Nat Rev Cardiol. 2017;14:39-55.
19. Berkiten G, Tutar B, Saltürk Z, et al. Vestibular-evoked myogenic potential findings in patients with unilateral idiopathic sudden sensorineural hearing loss. Journal of Ear Nose Throat and Head Neck Surgery. 2020;28:240-46.
20. Han P, Zhang R, Chen Z, et al.Evaluation of ocular and cervical vestibular evoked myogenic potentials in a conductive hearing loss model. J Otol. 2016;11:192-7.
21. Fife TD, Colebatch JG, Kerber KA, et al. Practice guideline: cervical and ocular vestibular evoked myogenic potential testing: report of the guideline development, dissemination, and implementation subcommittee of the American Academy of Neurology. Neurology. 2017;89:2288-96.
22. Bayram A. Vestibular evoked myogenic potentials in patients with diabetes mellitus. J Otol. 2019;14:89-93. Erratum in: J Otol. 2020;15:180.
23. Sari K, Yildirim T, Borekci H, et al. The relationship between benign paroxysmal positional vertigo and thyroid autoimmunity. Acta Otolaryngol. 2015;135:754-7.