Symptoms in temporomandibular joints dysfunction in adult patients with thyroid diseases

(Objawy dysfunkcji układu ruchowego narządu żucia u pacjentów dorosłych z chorobami tarczycy)

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Abstract – Introduction. Endocrine disorders have influence on the functioning of almost the whole body. Thyroid diseases affect 2-5% of society, more often in women and the elderly.

The aim of the study. The aim of the study was to present an impact of thyroid diseases on temporomanidbular disorders (TMD).

Materials and methods. **:** Research material was a retrospective medical records of 322 patients aged (40,2 ±10,6 years) with the Questionnaires of Manual Functional Analysis of masticatory system (MFA) due to DC/TMD of patients with TMD, who underwent physiotherapy for TMD in Dentists Clinic in Kraków, from November 2017 to April 2018. Fourty four (40,2 ±10,6 years) patients with TMD and co-occurring thyroid diseases was isolated and divided according to the diagnosis of thyroid disease into four groups: hypothyroidism (N_1=13), hyperthyroidism (N_2=11), Hashimoto's disease (N_3=11) thyroid nodules (N_4=9). A questionnaire of Manual Functional Analysis of masticatory system (MFA) and a questionnaire for palpation of head and neck muscles according to Festa were used. Statistical processing of the data was conducted considering significance at a p-value < 0.05.

Results. Study presents that hypomobility of temporomandibular joints (TMJ) was typical for patients with hypothyroidism (84,6%), and hypermobility of TMJ was more frequent in patients with hyperthyroidism (45,5%). Patients with Hashimoto's disease were often diagnosed with pain syndromes of masticatory system (90,9%). Tension headaches (58,8%) and tinnitus (52,3%) coexisted with TMJ disorders in thyroid diseases. However, no significant differences were found between group of thyroid diseases (p>0.05).

Conclusions. Thyroid diseases have some influence on signs and symptoms of TMD. However, there were no statistically significant differences between the types of thyroid diseases and the symptoms of TMD.

Key words – thyroid diseases, temporomandibular disorders (TMD), temporomandibular joints (TMJ), masticatory motor system.

Streszczenie – Wprowadzenie. Zaburzenia endokrynologiczne mają wpływ na funkcjonowanie niemalże całego organizmu. Choroby tarczycy dotyczą 2-5% społeczeństwa, częściej występują u kobiet i w wieku starszym.

Cel badań. Ukazanie wpływu chorób tarczycy na objawy dysfunkcji układu ruchowego narządu żucia (URNŻ).

Materiał i metodyka. Badania retrospektywne przeprowadzono na podstawie analizy 322 kart badań pacjentów Manualnej Funkcjonalnej Analizy URNŻ (MFA) w oparciu o kryteria DC/TMD, którzy poddali się fizjoterapii Stomatognatycznej na terenie Klinik Stomatologicznych w Krakowie. Grupę 44 pacjentów (40,2 ±10,6 lat) z zaburzeniami URNŻ i współwystępującymi chorobami tarczycy, podzielono na cztery podgrupy: niedoczynność tarczycy (N_1=13), nadczynność tarczycy (N_2=11), choroba Hashimoto (N_3=11), guzki tarczycy (N_4=9). Zastosowano kwestionariusz Manualnej Funkcjonalnej Analizy URNŻ (MFA) oraz kwestionariusz badania palpacyjnego mięśni głowy i szyi wg Festy. Dane zostały poddane analizie statystycznej z uwzględnieniem wskaźnika p-value <0.05.

Wyniki. Zaobserwowano, że objawy hypomobilności SSŻ występowały u pacjentów z niedoczynnością tarczycy (84,6%), a hypermobilność była częstsza u chorych z nadczynnością tarczycy (45,5%). U pacjentów z chorobą Hashimoto najczęściej diagnozowano zespoły bólowe URNŻ (90,9%). Napięciowe bóle głowy (58,8%) oraz szumy uszne (52,3%) współwystępowały z zaburzeniami URNŻ w chorobach tarczycy. Jednakże nie zauważono dominacji powyższych objawów w poszczególnych chorobach tarczycy (p>0.05).

Wnioski. Choroby tarczycy mają wpływ na objawy bezpośrednie i pośrednie dysfunkcji URNŻ. Aczkolwiek nie wykazano statystycznie istotnych różnic pomiędzy rodzajami chorób tarczycy a objawami dysfunkcji URNŻ.

Słowa kluczowe – choroby tarczycy, dysfunkcje stawów skroniowo-żuchwowych, układ ruchowy narządu żucia.

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I. INTRODUCTION

Due to the thyroid hormone production capacity, we distinguish endocrine disorders in the following areas: hypothyroidism and overactive thyroid gland [1]. An underactive thyroid (hypothyroidism) is a set of clinical symptoms that results from a deficiency of thyroid hormones in the blood, which in turn leads to disorders of the tissues and organs of the body [2]. In contrast, hyperthyroidism is a set of symptoms, caused by excessive production of thyroid hormones triiodothyronine (T3) and thyroxine (T4), leading to the occurrence of metabolic disorders and the activities of internal organs [3].

The population of thyroid disease relates to 2-5% of the population. The frequency of their occurrence increases with age and after the age of 75 is approx. 15% [4]. In Poland, hypothyroidism affects 4-10% of society [5]. Women are more often affected by hypothyroidism (80% of patients) [2], mainly older people over 60 years old [1]. Overactive thyroid concerns in the general population of 1,2% people [6]. Hyperthyroidism is five times more common in women than in men. One of the most common forms is Graves' disease (about 75% of hyperthyroidism) [7]. Hyperthyroidism affects the white race more than the black race, ten times more often [8].

Symptoms of thyroid gland diseases, especially in the early stages of the disease, are nonspecific (Table 1.). Thyroid hormones also affect the movement system. They have an essential influence on bone formation, growth, and remodeling, concerning the four central cells of bone tissue – osteocytes, osteoblasts, osteoclasts and chondrocytes [10, 11, 12]. In underactivity, bone formation processes are reduced by 50% and its resorption in 40% [13].

Table 1. The main symptoms of hypothyroidism and hyperthyroidism

Hypothyroidism	Hyperthyroidism
fatigue, loss of physical performance, drowsiness	hyperactivity, insomnia, nervousness
decrease in peristalsis constipation, bloating	increase in intestinal peristalsis frequent bowel movements, diarrhea
bradypnea	dyspnea, tachypnea
reduced cardiac output heart enlargement bradycardia coronary pain	arrhythmias, including atrial fibrillation tachycardia the decrease in diastolic blood pressure
concentration and memory disorders greater tendency to depression paresthesia Cretinism thyroid (children)	concentration disorders nervousness, crying shaking hands increase in neuromuscular excitability
menstrual disorders infertility	menstrual disorders infertility
dryness and pale skin cold intolerance swelling of the face and eyelids, thickening of the tongue, hair loss nail fragility	warm, smooth, moist skin, dermatography itchiness exophthalmos and swelling of orbital tissue hair loss nail fragility
weight gain	weight loss

Extending the bone growth time makes it challenging to remineralize the bone and maintain healthy bone mass [10]. Thyroid hypothyroidism is thought to contribute to a 2-3x increase in the risk of bone fractures over the next 10 years [11, 14, 15-18]. In hyperthyroidism, excessive osteoclast stimulation occurs, leading to bone demineralization. The bone quality and its ability to regenerate deteriorate [19, 20]. Osteopenia developing in bone increases the risk of fractures and osteoporosis. This risk is defined as 36% higher compared to people with normal thyroid hormone levels. Hyperthyroidism is one of the modifiable risk factors for osteoporosis, especially in postmenopausal women [19- 21]. Thyroid hormones also affect muscle contractility and metabolism. T3 also participates in the embryonic and later development of skeletal muscles through the activation of fibers for growth. The above action manifests itself in hypothyroidism as a delayed contraction and relaxation of the muscles, and in the case of the overactive thyroid gland as excessive shrinkage [22].

Painless forms of temporomandibular joint dysfunctions are the primary hypertonia of masticatory muscle muscles, muscle stiffness, asymmetry of their functioning, and paraesthesia [23]. Pain forms include pressure soreness and the presence of trigger points.

Also, hypothyroidism is characterized by muscular symptoms (Hoffman syndrome) of the nature of myopathy, i.e., pain, stiffness, spasms, fatigability, and weakness of muscle strength, which affect from 25% to 75% of patients [24]. However, in the hyperthyroidism, the symptoms of myopathy, i.e., muscle weakness occurring without the

growth of creatinine kinase [25], affect 62% of patients [24].

Until now, the literature has focused on linking thyroid diseases with osteoporosis [19-21], inflammatory and rheumatic diseases [26, 27]. Manifestation of thyroid diseases in the locomotor system suggests that they may influence the occurrence and dysfunction symptoms of the masticatory apparatus. Therefore, the aim of this study was to present the influence of thyroid endocrine disorders on the direct and indirect dysfunction symptoms of the masticatory apparatus.

1. Are there any changes in the mobility of the mandible in diseases of the thyroid coexisting with TNJ disorders?
2. Is there a relationship between the severity of pain and thyroid disease?
3. Is there a relationship between the occurrence of headaches in patients with TNJ dysfunctions and thyroid diseases?
4. Is there a relationship between the occurrence of tinnitus in patients with TNJ dysfunction in connection with thyroid diseases?

II. MATERIALS AND METHODS

Material

The study analyzed treatment cards of 322 patients who were treated for temporomandibular joint disorders at the Vita Medical Dentistry Institute, Dentist Dentistry and the Stomatognathic Clinic in Krakow were analyzed. After considering the inclusion and exclusion criteria from the studies (Figure 1, Table 2), a group of 44 people (14% of the respondents) in working age (average age was 40.2 ± 10.6 years) with symptoms of temporomandibular joint dysfunctions and thyroid disease was identified diagnosed by an endocrinologist.

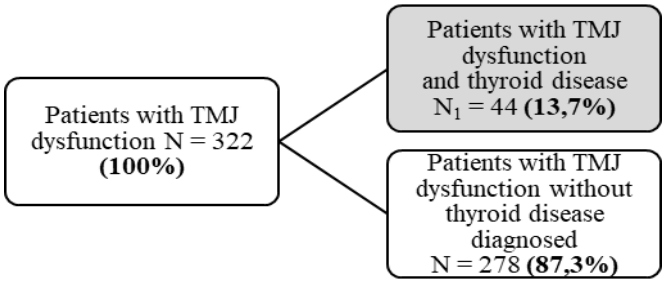

Figure 1. Division of the test group of patients with masticatory organ motor system dysfunction (TMJ)

Table 2. The criteria for inclusion and exclusion of studies

Inclusion criteria for the study:
1. occurrence of TMJ dysfunction
2. TMJ disorders coexisting with diagnosed thyroid diseases, i.e., hypothyroidism, hyperthyroidism, Hashimoto's disease, and thyroid nodules
3. consent to participate in the study
Exclusion criteria for the study:
1. no diagnosis of TMJ dysfunction
2. no coexistence of thyroid diseases with TMJ dysfunctions or lack of thyroid disease diagnosed by an endocrinologist (only suspicion of disorders - no treatment implemented)
rheumatic and inflammatory diseases
3. facial injuries, head, cervical spine
4. neuromuscular diseases,
5. central and peripheral nervous system diseases
6. post-operative condition within the cervical spine
7. pregnancy
8. no consent to participate in the study

Methodology

The results were obtained through a retrospective analysis of patients treatment cards, which included a TMJ (MFA) Manual Functional Analysis based on the DC / TMD criteria [26] and a Festa head and neck palpation questionnaire. The study card was filled in by a person specialized in stomatognathic physiotherapy and leading a patient's therapy. The results of the research were collected from November 2017 to April 2018.

MFA Questionnaire - Manual Functional Analysis TMJ consisted of patient's personal data, anamnesis about current and past symptoms of temporomandibular joints, headaches, tinnitus, diseases (including endocrine thyroid diseases) and a physical examination questionnaire, which included: assessment of the range of motion of the tempo-ro-mandibular joints (abduction, protrusion, lateral movements of the mandible). The measurement of mobility was made using a millimeter ruler. To determine the mobility of the mandible, the extent of its active dehydration was determined as the difference of measurement before therapy and measurement of individual patient functional norm (distance measured between interphalangeal joints further in mm). As a criterion qualifying the diagnosis of movement disorders, a difference of results greater than (-) 5 mm, hypermobility - difference of results above (+) 5 mm, proper range of movement - no deviations from functional norm was assumed for hypomobility.

According to Festy, head and neck examination con-

sisted in subjective assessment of pain intensity in a 10-point VAS scale, where: 0 - no pain, 1-3 - feeling of pressure, 4-6 - moderate pain, 7-8 - severe pain, 9-10 - the strongest pain possible. The palpation examination was carried out according to the protocol in the reference points for selected muscles, i.e.: temporal muscle, masseter muscle, sternocleidomastoid muscle and quadrangular muscle, which were examined symmetrically.

Statistical analysis was performed in the STATISTICA 13 program. The charts were prepared in Microsoft Excel. Fisher's exact test was performed to show the relationship between individual thyroid diseases and the symptoms of TMJ disorders. The significance level $\alpha = 0.05$ was assumed.

III. RESULTS

In the study group (N = 44) prevailed hypermobility of SSŻ and its features, which were found in 65.9% of subjects. Then, in terms of prevalence, SSR was hypermobility - 22.7% in total. Only 11.4% of respondents had the correct range of movement of the mandibular abduction.

The distribution of the incidence of motion disorders in SSV in thyroid diseases indicates a significant dominance of hypomobility in all types of dysfunction of the thyroid gland (Figure 2).

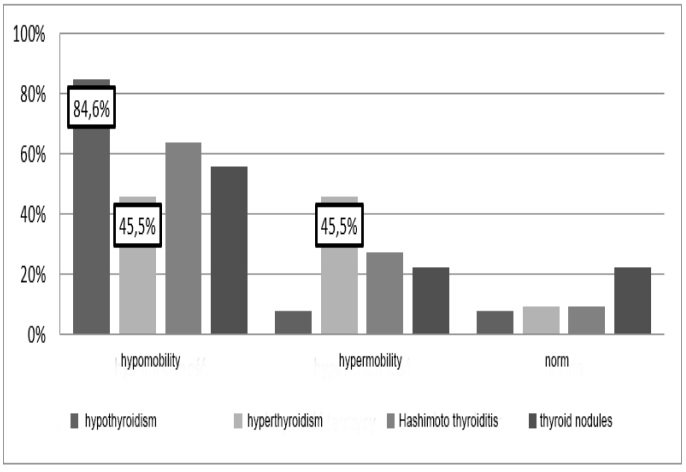

Figure 2. Layout of the incidence of motion disorders of Temporomandibular Joint Syndrome in thyroid diseases

It was noted that the greatest disproportion of these disorders occurred in the group of patients with hypothyroidism, where in 85% patients occured hypomobility. In contrast, hypermobility was most often observed in patients with hyperthyroidism (about 46%), but also as often as limitation of mobility in this group (about 46% of respondents). Statistical analysis did not show a significant relationship between the occurrence of motion disorders in the mandible in particular types of thyroid diseases ($p = 0.38$).

In terms of diagnosing dysfunctions within TMJ, a significant dominance of the TMJ pain was noticed, which occurred in 70.5% of the subjects. Most often in the case of Hashimoto's disease (90.9%), then thyroid nodules (77.8%) and subsequently hypothyroidism (69.2%) and hyperthyroidism (45.5%). The diagnosis of polyarticular laxity related to almost 1/5 of patients, similarly in the case of bruxism. The SSV joint instability was found only in 6.8% of cases. In addition, it was demonstrated that the polyarticular laxity was most common in hyperthyroidism (45.5%). However, in the group of people with hypothyroidism, no case of this dysfunction was demonstrated (Figure 3.).

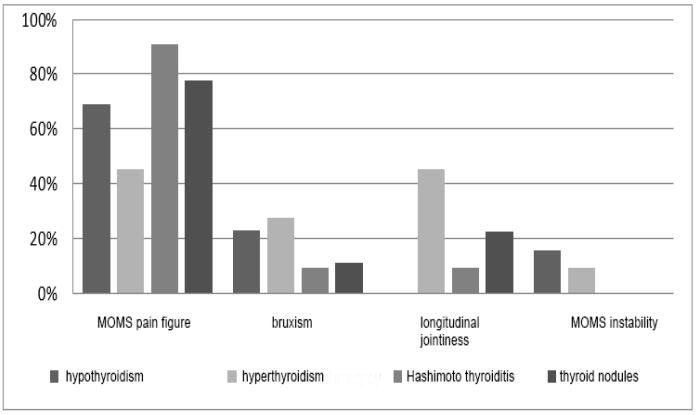

Figure 3. Layout of the incidence of TMJ dysfunction in thyroid disease groups

The examination of patients for myofascial pain showed that Hashimoto's disease (over 80%) and hyperthyroidism are the most pain-sensitive type of thyroid disease (about 73%) (Figure 4.).

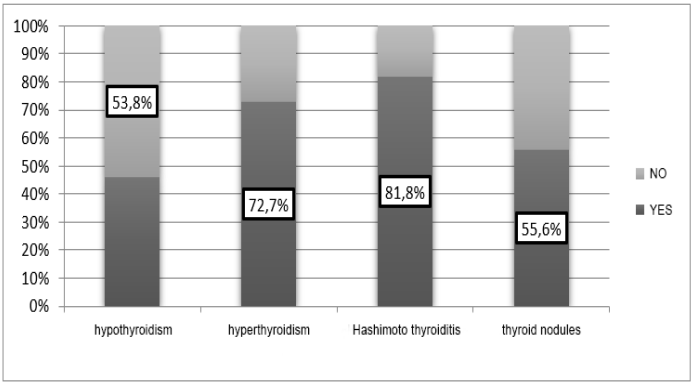

Figure 4. Layout of the incidence of fasciotomies pains in thyroid diseases

However, statistical analysis by Fisher's exact test did not show that the occurrence of myofascial pain is dependent on the type of thyroid disease ($p = 0.29$).

In the study group, the incidence of headache was 58.8%. In a detailed analysis, it was shown that they had a slight advantage in hypothyroidism (61.5%) and subsequently in the case of nodules of the thyroid gland (55.6%) and Hashimoto's disease (54.5%). The problem of occurrence of tinnitus was reported by 52.3% of patients. Both in the case of headaches and tinnitus, the dominance of these symptoms in individual thyroid diseases has not been demonstrated (successively $p = 0.97$, $p = 0.98$).

IV. DISCUSSION

The assessment of the direct impact of thyroid diseases on SSJ has been undertaken by few authors so far. Recent reports from Grozdinska *et al.* have shown that there is a risk of developing SSV dysfunction in patients with Hashimoto's disease, symptoms of which occurred in all subjects. It was also noticed in the increased painfulness of SSŻ (on average by 2.7x higher). Also, more often in these patients there was a pain during abduction of the mandible and diagnosis of the most painful forms of TMJ [29]. Own research also confirms the hypothesis that Hashimoto's disease is most often associated with the appearance of TMJ pain. Grenga *et al*. presented a case study of a patient with a malocclusion and inflammation of SSJ and Hashimoto's disease. The authors showed that only a combination of treatment of thyroid disorders with TMJ therapy allowed to reduce pain and dysfunctions within the SSŻ in the patient [30].

In the current literature, there are no direct links between the disabilities of SSŻ and thyroid disorders. Until now, the authors have shown the effect of thyroid disorders on the mobility of other joints, especially of the brachioral-scapular joint. Blonna *et al*. noticed that in the group of people with hypothyroidism, 75% developed postoperative joint stiffness, so called shoulder frozen. In addition, patients with hypothyroidism had a much more limited range of brachial articular mobility and increased postoperative pain, compared to postoperative patients without endocrine thyroid disorders [31]. Manske *et al*. also emphasize that the frozen shoulder is usually associated with hypothyroidism [32]. Radu *et al.*, on the other hand, characterized the discomforts of the musculoskeletal system in hypotyreose, stressing that muscle pain occurred in 83% and limited joint mobility in 16.7% of cases [33]. In the on-house research, it was noted that the most common was limitation of jaw mobility, while the most cases of this type were noted among patients with hypothyroidism. This result correlates with the thesis of the authors regarding the limitation of joint mobility in hypotyreose. However, further research is needed so that the above results can be included in the general population of patients with hypothyroidism. Until now, scientists have not dealt with the problem of the occurrence of polyarticular laxity and hypermobility in hyperthyroidism. In-house research has noticed these connections and forms the basis for wider observation of this phenomenon. In the studied group, hypermobility of SSŻ was the most frequent among people with hyperthyroidism. A large percentage of hypermobility in hyperthyroidism in these patients can be explained by the large occurrence of polyarticular laxity in this group. It is worth noting that there was no case of polyarticular laxity in the hypothyroidism in the study group. The above observations are an interesting phenomenon that should be examined in more patients to obtain binding conclusions.

Another problem that was raised at work was the relationship between the severity of pain in particular thyroid diseases. An experimental study in mice Yi *et al.*, showed that hypothyroidism is a predisposing factor for nociceptive hypersensitivity, especially in the case of thermal stimuli [34]. Similar results were found in the in-house study, hypothyroid patients struggled with pain in almost 70%. Suk found elevated levels of anti-thyroid peroxidase antibodies (anti-TPO) in 19% of patients with fibromyalgia [27]. In contrast, Bazzichi *et al.* noticed a connection between thyroid autoimmunity and an increased risk of developing fibromyalgia. In addition, they proved that patients with fibromyalgia and Hashimoto disease have higher values in the subjective assessment of VAS pain and are more likely to have fatigability compared to patients with fibromyalgia alone [27]. The authors also suggest that patients with Hashimoto's disease have a reduced threshold of pain and a significantly prolonged duration of pain symptoms [27, 28]. In addition, Corsalini *et al.* pointed out the need to include in the diagnosis of fibromyalgia pain located within the SSR, because in 67% of cases in patients with fibromyalgia, pain was localized in this area [35]. Ahmad *et al.* noticed that thyroid autoimmune diseases are often associated with the occurrence of pain syndromes [36]. It was demonstrated that among patients with rheumatoid arthritis and Hashimoto's disease as much as 40% had been diagnosed with fibromyalgia or chronic pain syndrome [37]. Our results confirm the fact that in Hashimoto's disease, nociceptive hypersensitivity was the highest, and the diagnosis of TMJ pain was most frequent.

The fact that hypothyroidism is associated with the coexistence of headaches and migraines is known in the literature. The International Classification of Headaches (ICDH-3 beta) distinguishes headaches occurring with hypothyroidism (HAH – Headache attributed to hypothyroidism) and reports their incidence at approx. 30% [38]. In addition, Lima Carvalho *et al.* studied patients with HAH and episodic, accompanied by nausea and vomiting, receding after treatment with levothyroxine [39]. The authors noticed the TTH and chronic migraine [40-42]. Attention is also given to the fact that hypothyroidism may be predisposing to the occurrence of tension headaches [43-45]. In addition, studies have shown more patients with migraines than patients with hypothyroidism [44]. The results of the observations also lead to the thesis that headaches most often occur in hypothyroidism. However, the tinnitus problem appeared in almost all cases of thyroid disease. Analogous results can be found in the literature on thyroid diseases, including the occurrence of deafness and tinnitus. However, they are a phenomenon of dominance in a given thyroid disease [46] (Corti's auditory cells [47].). In turn, Santosh *et al.* observed the relationship between hypotyreosis and Meniere's disease, which is a disfunction of the inner ear, manifesting itself with tinnitus. The authors suggest that patients with Meniere's disease should be examined for thyroid disease [48].

In conclusion, the issue of own research was discussed in the literature as separate issues. Attention was drawn to the relationship between the occurrence of thyroid diseases and symptoms such as movement disorders, feeling of pain, occurrence of headaches or tinnitus. However, until now, these dependencies in the context of SSŻ disorders have not been studied. The combination of these initially non-obvious factors will allow for a comprehensive assessment of the patient's condition. In-house research highlights the impact of systemic diseases on the human body and on the symptoms of dysfunction of the masticatory system. This confirms the validity of the patient's examination and assessment as a whole to solve the local problem. The authors recognize the need for further research in this area on a larger study group, which will allow drawing binding conclusions.

V. CONCLUSION

- Patients with hyperthyroidism show symptoms of hypovobility of SSŻ. In the case of patients with hypothyroidism, however, hypomobility of SSŻ is more common. In addition, in the case of hyperthyroidism, the most frequent occurrence of polyarticular laxity was noted.
- Patients with Hashimoto's disease have an increased sensitivity to fasciocomial pain and the most often diagnosed in their case are TMJ pain syndromes.
- Tension headaches and tinnitus co-occur with TMJ disorders in thyroid diseases.
- However, there were no differences between the occurrence of the above features in individual dysfunctions of the thyroid gland.

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