

ORIGINAL RESEARCH

Dry eye syndrome in patients with thyroid disorder: A prospective observational cross-sectional study

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ABSTRACT

Objective: The purpose of this study was to determine the prevalence of dry eye in thyroid disorder patients. **Methods:** 100 thyroid disorder patients were enrolled in a prospective observational cross-sectional study conducted over a period of two years. Each patient's thyroid status was meticulously documented, and ophthalmological tests were conducted to quantify dry eye symptoms.

Results: The prevalence of dry eye in thyroid disorders was determined to be 63%. 52% of patients were hyperthyroid, 31% were hypothyroid, and 17% were euthyroid. Dry eye was associated with exophthalmos and lid retraction ($p < 0.05$).

Conclusion: Thyroid disorder patients are at a higher risk for developing ocular surface complications.

Keywords: blinking, dry eye, thyroid eye disease, hyperthyroidism, hypothyroidism, euthyroidism

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Introduction

Thyroid disorders, including hyperthyroidism and hypothyroidism, are prevalent worldwide and affect females more frequently than males [1, 2]. Thyroid disorders are frequently accompanied by ophthalmic manifestations, known as thyroid eye disease (TED) or thyroid-associated ophthalmopathy (TAO) [3]. Thyroid eye disease (TED) is an autoimmune inflammatory disorder that affects orbital fat, extraocular muscles, and the lacrimal gland, causing tissue expansion due to glycosaminoglycan deposition and oedema, and in some cases fibrosis due to collagen production [4, 5]. The prevalence of TED in hypothyroidism ranges from 0.2% to 8.6%, whereas it can reach 50% in hyperthyroid patients [6]. Approximately 18 months pass between the onset of thyroid disease and the clinical manifestation of TED [7]. Although symptoms and signs such as eyelid retraction, oedema, exposure keratitis, and extraocular movement limitation are significant concerns in patients with TED, 30 to 45 per cent of TED patients exhibit obvious ocular symptoms, and 5 to 10 per cent of patients have orbitopathy [8]. Instead, the most prevalent cause of ocular discomfort in TED patients is dry eye [9, 10]. To enhance the quality of life of

patients with TED, we must identify the cause of dry eye. Dry-eye disease is a condition characterised by vision impairment, ocular irritation, and unstable tear film. Aqueous tear deficiency and evaporative dry eye are the two most common forms of dry eye [11]. Aqueous tear deficient dry eye is caused by a lack of lacrimal secretion and a failure of the conjunctiva to secrete water, whereas evaporative dry eye is caused by internal and external factors that accelerate tear evaporation [12]. There exists a close relationship between dry eye and thyroid disorders. Thyroid associated orbitopathy (TAO), Thyroid eye disease, and Graves ophthalmopathy are examples of orbital inflammatory disorders frequently associated with dry eye [13]. TAO is prevalent in Graves' disease patients (80%), but it is not uncommon in hypothyroid patients. Studies indicate that 45-85 percent of TAO patients suffer from dry eye syndrome. The underlying mechanisms of their association suggest that mechanical impairment of orbital muscles and immune-mediated dysfunction of the lacrimal gland are the causes of dry eye in patients with thyroid disease [14]. Studies indicate that fifty percent of asymptomatic patients exhibit clinical indicators of dry eye [15, 16]. In order to prevent discomfort,

decreased vision, corneal injury, and all other symptoms associated with dry eye, it is essential to examine dry-eye patients on a regular basis. In order to detect potential tear film abnormalities, the present study evaluated the integrity of tear film and the condition of the ocular surface in patients with thyroid disorders.

Methods

This cross-sectional observational study was conducted between December 2020 and November 2022 in the Department of Ophthalmology at VSSIMSAR in Burla, Odisha. The presence of dry eye was evaluated in a total of 200 eyes from 100 patients with thyroid disorders. The patient's age, gender, thyroid status type, presenting symptoms, and coexisting conditions were scrupulously documented. Each participant gave his or her informed assent.

Inclusion criteria: Informed consent was obtained from patients with hyperthyroidism, hypothyroidism, and euthyroid ophthalmopathy who were willing and able to comply with test administration.

Exclusion criteria: Patients with systemic diseases known to cause dry eye diseases, such as Stevens-Johnson syndrome, pemphigoid, rheumatoid arthritis, SLE, Sjogren syndrome, previous chemical, thermal or radiational injury to eye, a history of ocular surgery or medications, risk factors for eye dryness such as Diabetics and smokers, contact lens wearers, and patients who did not provide informed consent were excluded from this study.

Statistical analysis

Statistical Package for the Social Sciences, version 21.0 (SPSS Inc., Chicago, IL) was used to analyse the data. The right eye was analysed statistically when both pupils met the study's inclusion criteria. Student's t-test and Mann-Whitney test were utilised to compare the mean of variables between the two groups, X2 test was utilised to compare the ratio between the two groups, and Pearson's correlation analysis and multiple regression analysis were utilised to estimate the linear relationship between continuous variables. At or below 0.05, the p-value was statistically significant.

Results

Table : 1 Distribution of demographics, dry eye and thyroid disorder

Age distribution		
Age group	Frequency	Percentage
21-30	19	19%
31-40	28	28%
41-50	40	40%
51-60	10	10%
60<	3	3%
Sex distribution		
Sex	Frequency	Percentage
Male	31	31%
Female	69	69%
Dry eye prevalence		
Prevalent	63	63%
Not Prevalent	37	37%
Thyroid disorder types		
Hyperthyroid	52	52%
Hypothyroid	31	31%
Euthyroid	17	17%

The age group most commonly affected was 41-50 years, which accounted for 40 patients (40%) in Table 1, followed by 28 patients in the 31-40 years age group (28%), 19 patients in the 21-30 years age group (19%), 10 patients in the 51-60 years age group (10%), and 3 patients in the >60 years age group with a mean age of 40.96 9.70 years. The ratio of females to males was 2.2:1, with 69% of those afflicted being females and 31% of those affected being males.

Based on positive results from at least two of four tests, 63 of 100 patients with a thyroid disorder exhibited evidence of dry eye in either one or both eyes. In this study, the prevalence of dry eye in thyroid disorders was reported to be 63%.

Table: 2 Dry eye and thyroid disorder, OSDI, TBUT

Thyroid disorder and dry eye					
Thyroid disorder	Number of participants	Dry eye present		Dry eye absent	
		Frequency	Percentage	Frequency	Percentage
Hyperthyroid	52	37	71.15%	15	28.85%
Hypothyroid	31	19	61.29%	12	38.71%

Euthyroid	17	7	41.18%	10	58.82%
OSDI and dry eye					
OSDI	Number of participants	Dry eye present		Dry eye absent	
		Frequency	Percentage	Frequency	Percentage
Positive	38	32	84.21%	06	15.79%
Negative	62	31	50%	31	50%
TBUT and dry eye					
TBUT	Number of participants	Dry eye present		Dry eye absent	
		Frequency	Percentage	Frequency	Percentage
Positive	62	55	88.71%	07	11.29%
Negative	38	08	21%	30	78.95%

The prevalence of dry eyes was highest among hyperthyroid patients (37,71.11%), followed by hypothyroid patients (19,61.29%) and euthyroid patients (7). In 38% of patients, the OSDI score was aberrant, i.e. more than 12. Based on predetermined diagnostic criteria, 32% of these individuals were confirmed to have dry eye. OSDI demonstrated a sensitivity of 50.79 percent and a specificity of 83.78 percent. The test was found to have an 84.21% positive predictive value and a 50% negative predictive value. In 62 subjects, the TBUT was positive, or less than 10 seconds. On the basis of predetermined diagnostic criteria, 55 (88.71%) of these individuals were found to have dry eye. The TBUT demonstrated 87.3% sensitivity and 81.8% specificity. The test was found to have a positive predictive value of 88.71% and a negative predictive value of 78.95%.

Discussion

Using diagnostic tests such as ocular surface disease index (OSDI) and tear film break up time (TBUT), 100 cases of thyroid disorder were evaluated for the presence of dry eye in this study. These findings indicate that dry eye is a significant cause of ocular surface disease in patients with thyroid disorders. In this study, patients spanned in age from 24 to 62 years. The mean age was 40.96 years with a standard deviation of 9.70 years. Takahashi et al. (41.2 ± 13.4), Sonya et al. (40.31 ± 13.26), Muralidhar et al. (41.30 ± 14.76), and Sabita et al. (39.7 years) [17, 18, 19, 20] found comparable values. In the present study, 69% of patients were females, while 31% were males. The ratio of women to men was 2.2:1. In their investigation, Lim et al. [21] reported a similar ratio of 1.76:1 in a Southeast Asian population. The female-to-male ratio was highlighted by Khurana et al., who found it to be 1.5:1 in their study [22]. Several investigations, including those by Takahashi Y et al (2:1) and Paharia N et al (3:1) [17, 23], found a higher female to male ratio. Unknown is the precise cause for the high prevalence among women. It is believed, however, that the effects of female gonadal hormones (prolactin and oestrogen) and X chromosome inactivation on the thyroid gland and immune system contribute significantly to the female predilection for thyroid disorder. In the present study,

52% of patients are hyperthyroid, followed by 31% who are hypothyroid and 17% who are euthyroid, similar to Lavaju et al's [24] study in which 56% of patients were hyperthyroid, 41.4% were hypothyroid, and 2.32% were euthyroid. Patients with hyperthyroidism are more likely to have dehydrated eyes, according to our research. Among 52 cases of hyperthyroidism, 37 patients (71.15%) exhibited dry eye, followed by 61.29% of hypothyroid patients and 41.15% of euthyroid patients. In the study by Sabita et al., 75% of 117 cases were hyperthyroid, 16.7% were hypothyroid, and 8.3% were euthyroid [20]. Zubair et al. reported a higher prevalence of dry eye in hyperthyroid patients, as well as a reduction in TBUT in 86.4% of cases [25]. Similarly, in the study by Nazir et al. [26], dry eyes were observed in 83.3% of hyperthyroidism cases. Multiple studies examining Graves ophthalmopathy indicate that approximately 65-85 percent of GO patients also experience dry eye symptoms [27, 28, 29].

In 38% of cases in our study, the OSDI score was aberrant. Tirakunwichcha et al. [4] discovered that 27% of cases had an abnormal OSDI score. In a study by Sonya et al. [18], the OSDI score for patients with thyroid disorders was higher than the score for the control group (24.99 ± 20.03). Allam et al. found that the median average OSDI score was greater in the active TED group than in the inactive TED group [30]. Xu et al. [31] also discovered that the mean OSDI score was considerably greater in thyroid patients than in controls.

In 62% of cases in the present investigation, TBUT was positive. Tirakunwichcha S et al. [4] found that in 96% of cases, TBUT was positive. In a study by Alanazi et al. [32], the mean TBUT test scores for the study group were considerably lower (4.9 ± 1.6 and 4.2 ± 1.9 s) than those of the control group (13.2 ± 2.6 and 12.3 ± 2.2 s) for both eyes. Nowak et al. discovered that the tear break-up time in thyroid disorder patients with dry eye (5.84 ± 3.31 s) was substantially lower than in controls (11.4 ± 3.71 s), indicating an unstable tear film [33]. 31% of Gupta et al.'s patients exhibited a decreased tear break-up time (TBUT of less than 10 seconds) [34]. In a study by Paharia et al. [23], the tear break up time (TBUT) was substantially decreased in both hyperthyroid and hypothyroid patients, suggesting an unstable tear film.

Conclusion

The prevalence of dry eye in patients with thyroid disorders was confirmed by our research. Consequently, ocular symptoms and signs should also be thoroughly evaluated when monitoring patients with a thyroid disorder. Dry eye progression is influenced by multiple factors. The mechanism by which such eye dryness occurs is still unclear, although several factors have been identified, such as low tear production, excessive tear evaporation, tear instability, and tear film lipid layer disturbances. Despite the absence of clinically detectable symptoms of thyroid ophthalmopathy, ocular surface damage is present in the earliest phases of thyroid dysfunction. It can cause severe ocular complications if left untreated, so early detection and management are essential.

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