

## A Cross-Sectional Study on the Frequency of Dry Eyes in Hyperthyroidism Patients

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### Abstract:

**Background:** Dry eye is the most prevalent cause of ocular irritation in patients with thyroid diseases. This study sought to determine the prevalence of dry eye syndrome in hyperthyroidism patients.

**Methods:** This cross-sectional study was conducted on 100 patients diagnosed with hyperthyroidism by Dept. of Ophthalmology, VSSIMSAR, Burla, Odisha during the study period over 2 years from December 2020 to November 2022.

**Results:** Out of 100 patients, highest number of patients [42 (42%)] were seen in the age group of 36 and the gender group of 58 (58%) males. Highest frequencies of dry eyes 62 (62%) were seen for severely decreased tear breakup time for both the right eye and left eye.

**Conclusion:** The frequency of dry eye disorder was found to be extremely high in the case of hyperthyroidism patients.

**Keywords:** Dry eye, Hyperthyroidism, Schirmer test.

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### Introduction

Thyroid-associated ophthalmopathy (TAO) is an autoimmune disorder of the extraocular muscles and surrounding orbital connective tissue, including the lacrimal gland, which is commonly accompanied by Graves' disease (GD) and infrequently by Hashimoto's thyroiditis [1]. Proptosis due to an increase in the retroorbital soft tissue, lid retraction, restrictive extraocular myopathy, optic neuropathy, and inflammatory ocular surface disorders are the characteristic clinical manifestations of TAO [2]. Dry eye is the most common cause of ocular irritation in TAO, being present in 85 percent of patients, but the etiopathogenesis is unknown [3]. Dry eye is a multifactorial disease of the tears and ocular surface that causes discomfort, visual disturbance, and instability of the tear film, as well as potential harm to the ocular surface. It is accompanied by increased tear film osmolarity and ocular surface inflammation [4]. Important factors in ocular surface dehydration [4, 5] include T-cell-dependent inflammation of the ocular surface and increased tear film evaporation and osmolarity due to lid retraction and exophthalmus. In addition, it has been demonstrated that the lacrimal gland is a target organ for thyroid hormones that express the thyroid hormone receptor  $\beta$ -1 (Thrb). In experimental studies, chronically reduced thyroid hormone levels

were found to modulate the expression of Thrb in the lacrimal gland, resulting in a decrease in tear production and subsequent dry eye [6, 7].

Hyperthyroidism is a condition in which the thyroid gland produces excessive amounts of the hormone thyroxine. Hyperthyroidism can significantly accelerate the body's metabolism, resulting in rapid weight loss, increased pulse rate, perspiration, and anxiety or irritability [7]. Dry eye is extremely prevalent among patients with various systemic diseases. Ocular alterations and associated symptoms such as irritation, pain, and a burning sensation are prevalent [8]. These symptoms are not typically associated with the specific components, but they are relevant to it. The dysfunction of the thyroid gland has an effect on the normal eye mechanism.

This condition is known as hyperthyroidism because the level of thyroid hormone is elevated [9, 10]. According to a recent study, hyperthyroidism initially effects the eyes and causes severe dryness due to a decrease in the normal tear break-up time. The production of thyroxine is linked to TAO [11]. This study aimed to ascertain the relationship between the thyroid and dry eye, as well as the

prevalence of dry eye disorder in hyperthyroid patients.

### Methods

A cross sectional study was conducted on 100 patients having history of hyperthyroidism with age range of 20-65 years. All patients were diagnosed with hyperthyroidism by Dept. of Ophthalmology, VSSIMSAR, Burla, Odisha during the study period over 2 years from December 2020 to November 2022.

**Inclusion and exclusion criteria:** Patients who were diagnosed with hyperthyroidism were included in this study. Patients who were younger than 20 years and older than 65 years, had any type of systemic disorder were excluded from this study.

**Data Collection:** The objective of the investigation was to determine the connection between hyperthyroidism and dry eye. Therefore, all patients underwent Schirmer test with slit lamp to measure tear production. The testing instruments were

fluorescein strips, a slit lamp, and a pen flame. To determine the sample size based on the prevalence of hyperthyroidism, convenient sampling techniques were employed.

### Statistical Analysis

The statistical analysis was conducted using version 13.0 of the Statistical Package for the Social Sciences (SPSS, Chicago, Illinois, United States). The Pearson Chi-square test was used to compare categorical variables between patients and controls, while the Student's t-test was used to compare continuous variables.

Lastly, a P value less than or equal to 0.05 was considered statistically significant. Additionally, a logistic regression analysis was used to identify the significant risk factors for dry eye.

### Results

**Table 1: Age and sex distribution**

<b>Age</b>		
Age groups	Frequency	Percentage
20-35	20	20%
36-50	42	42%
51-65	38	38%
<b>Sex</b>		
Sex	Frequency	Percentage
Male	58	58%
Female	42	42%
<b>Dry eyes in left eye</b>		
Breakup time	Frequency	Percentage
Normal	16	16%
Moderate	22	22%
Severe	62	62%
<b>Dry eyes in right eye</b>		
Breakup time	Frequency	Percentage
Normal	16	16%
Moderate	22	22%
Severe	62	62%

20 (20%) of the 100 patients were between the ages of 20 and 35, 42 (42%) were between the ages of 36 and 50, and 38 (38%) were between the ages of 51 and 65 (Table 1). In addition, there were 42 (42%) women and 58 (58%) men present.

In the left eye of 100 patients, 16 (16%) had normal tear film breakup time, 22 (22%) had moderate tear film breakup time, and the remaining 62 (62%) had drastically decreased tear film breakup time.

In the right eye of 100 patients, 16 (16%) had normal tear film breakdown time, 22 (22%) had moderate tear breakdown time, and the remaining 62 (62%) had significantly decreased tear breakdown time (Table 1).

### Discussion

Dry eye syndrome (DES) is a prevalent disease of the ocular surface that affects 10–30% of the population, particularly after the age of 40 [12].

According to various studies, the incidence of DES in thyroid disorders ranges between 45 and 85 percent. Exophthalmos, increased palpebral fissure height, lid latency, decreased tear production, and increased tear film evaporation may contribute to DES in these patients. Together, these factors disrupt the ocular surface and result in unstable tear film and high tear osmolarity. The ultimate result is inflammation, which worsens the dry eye condition [9]. In our investigation, both the left and right eyes of all participants were determined to be dry. This

value was greater than those reported by other studies (Table 1). In our study, patients' Schirmer tests were substantially reduced ( $6.7 \pm 4.2$ mm), which is consistent with the findings of other researchers. The results of Schirmer tests conducted by Syed et al. [13] ( $16.7 \pm 4.8$ ) were the highest, followed by Emrah et al. [14] ( $10.9 \pm 5.6$ ) and Eckstein et al. [15] ( $8.3 \pm 2.0$ ). Recent research has examined the impaired tear film functions in hyperthyroidism patients. Patients with hyperthyroidism tend to have decreased tear

disintegration time, resulting in a severe deficiency. In hyperthyroidism, a Schirmer value of less than 6 mm and dry eye syndrome are present [16]. The enlargement of the palpebral fissure, which results in evaporation of the tear film and an increase in the osmolarity of the tear film, is a further risk factor associated with protruding eyes [17]. Therefore, it is possible to conclude that the decrease in tear break-up time is due to the hyperosmolarity caused by eye protrusion [18].

**Table 2: Comparison with other studies**

Title	Journal	OSDI Score	Schirmer	TBUT	MMP9
<b>Current study</b>		<b>Not done</b>	<b>6.7±4.2</b>	<b>Not done</b>	<b>Not done</b>
Emrah et al- Presence of dry eye in patients with hashimoto's thyroiditis	Journal of Ophthalmology 2014	32.7±19.2	10.9±5.6	10.1±2.6	Not done
Syed Ali et al- Dry eye evaluation in thyroid associated orbitopathy	International Journal of ocular Oncology and Oculoplasty 2016	Not done	16.7±4.8	9.9±3.3	Not done
Eckstein et al- Dry eye syndrome in thyroid eye disease patients: the role of increased incomplete blinking and meibomian gland loss	Acta Ophthalmologica 2018	Not done	8.3±2.0	4.1±1.9	Not done

While other tests such as OSDI score, TBUT, and MMP9 were not administered in this study, Emrah et al. [14] had the highest TBUT score ( $10.1 \pm 2.6$ ) according to the findings of other studies (Table 2). In hyperthyroidism patients with a shorter tear breakup time and severe dry eye disorder, thyroxine hormone has been shown to be superior for normalising tears breakup time [19]. In addition, artificial tears and environmental modifications are recommended for these patients.

Another comparable study by Achtsidis et al demonstrated that as TBUT decreased in hyperthyroidism, eye dryness increased [19]. After a biopsy of the conjunctival tissues of hyperthyroidism patients, it was determined that the majority had orbitopathy [16, 20]. Another comparable study by Tomlinson and Khanal found that ptosis patients with myasthenia graves', an autoimmune condition, have a decreased tear breakup time incidence [21]. Therefore, the dry eye associated with hyperthyroidism is not solely the result of enlarged eyes.

The study by Emrah et al. revealed that 400,000 persons in the United Kingdom suffer from thyroid eye disorder [14]. The prevalence of Graves' disease is approximately 2% (estimated between 1% and 2.8%), and the incidence of thyroid eye disorder in Graves' disorder with reduced tear breakdown time and dry eye disorder is approximately 37.5 percent [20]. Thyroid eye disorder is an extremely annoying, excruciating, cosmetically taxing, dryness with

decreased tear break-up time and sporadic vision-threatening condition. In the previous two decades, medical management has advanced. New developments indicate that a discriminatory treatment for thyroid eye disorder should be practical [21, 22].

### Conclusion

It has been determined that hyperthyroidism is the cause of dry eye syndrome. The results indicate a significant correlation between dry eyes and hyperthyroidism, with a value of 0.002. As a result, it can be concluded that hyperthyroidism causes severe dry eye disorder, which is most commonly manifested as keratoconjunctivitis (KCS) and Sjogren syndrome.

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