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The Impact of Hypothyroidism on Tear Production and Dry Eye Symptoms: Implications for Optometric Care

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CONFLICT OF INTEREST
None declared.

GRANT SUPPORT
None declared.

ARTICLE TYPE
Original Research

ABSTRACT

BACKGROUND: Dry eye symptoms that impair visual comfort and day-to-day functioning are frequently caused by hypothyroidism, which also results in decreased tear production and an unstable tear film.

OBJECTIVE: To evaluate the impact of hypothyroidism on tear production and dry eye symptoms: implications for optometric care.

METHODOLOGY: This analytical cross-sectional study was conducted at DHQ Hospital, Dera Ghazi Khan, over six months. A total of 64 hypothyroid patients aged 20-60 years were selected using consecutive sampling. data collection uses the OSDI (ocular surface disease index) questionnaire, Schirmer 1 test, and tear break-up time test TBUT to assess tear production and stability. Inclusion and exclusion criteria were applied to minimize confounding factors.

RESULTS: Among 64 hypothyroid patients, 40 (62.5%) reported dry eye symptoms based on OSDI scores. Schirmer 1 test showed reduced tear production (≤10mm) in 30 patients (46.9%), with a mean value of 9.1 ±3.5 mm. Tear break-up time (TBUT) was <10 seconds in 38 patients (59.4%), indicating tear film instability, with a mean TBUT of 8.4±2.7 seconds. The Chi-square test showed a statistically significant association between hypothyroidism and dry eye (p=0.012). Females were more affected, comprising 81,2% (n=52) of the sample. These findings suggest a strong link between hypothyroidism and dry eye.

CONCLUSION: Dry eye symptoms are common in hypothyroid patients and are closely associated with decreased tear production. For efficient, individualized treatment, a thorough evaluation that goes beyond tear film stability is necessary.

KEYWORDS Dry eye, Hypothyroidism, Tear film, TBUT test, Schirmer's test

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INTRODUCTION

Thyroid surgery, autoimmune thyroiditis, or iodine shortage are the main causes of hypothyroidism, which affects 3.8% to 4.6% of people worldwide. Iodine deficiency is prevalent in Pakistan, where hypothyroidism and subclinical hypothyroidism are found to be 4.1% and 5.45% prevalent, respectively. Levothyroxine is the usual treatment; however, prolonged symptoms might damage quality of life. The cardiovascular system is most commonly impacted. (1-3) There are four forms of hypothyroidism: primary, secondary, tertiary, and peripheral. The most prevalent type, primary hypothyroidism, is brought on by insufficient T4 production. TSH or TRH shortages cause secondary and tertiary forms of hypothyroidism, which are together referred to as central hypothyroidism. Rarely, peripheral hypothyroidism results from compromised thyroid hormone function. Only a small percentage of people have central or peripheral types, which provide difficulties in diagnosis and treatment. (4, 5)

Low free thyroxine (FT4) and low or abnormally normal TSH levels are the hallmarks of central hypothyroidism; on occasion, TSH may be slightly raised because of decreased bioactivity. Consumptive hypothyroidism is an uncommon condition caused by increased activity of the deiodinase 3 enzyme in some tumors, which renders thyroid hormone inactive. This is rare but has been documented in neonates with hepatic haemangiomatosis, fibrotic tumors, gastrointestinal, and vascular conditions.(5, 6)

Age, sex, race, genetics, and environmental factors all have an impact on hypothyroidism. Iodine deficiency, radiation, congenital abnormalities, lithium use, immunotherapies, thyroid hormone resistance, overtreatment, goitrogen consumption, and subacute thyroiditis are common causes. It is more common in elderly persons, women, and people with autoimmune diseases such as celiac disease or type 1 diabetes. While moderate drinking and tobacco usage are linked to lower occurrence, syndromes including Turner's and Down syndrome significantly raise the risk. (1, 7) Due to decreased tear production, hypothyroidism can result in dry eyes, which can cause symptoms like dryness, irritation, and a grainy feeling. Additionally, discomfort and visual problems may arise from structural changes and swelling of the eyelids. (8, 9) Tear film is a dynamic interface made up of proteins, lipids, mucin, water, and electrolytes. It develops into a coating of wet mucin that is coated in lipids throughout time. In order to preserve ocular comfort, avoid infection, manage inflammation, promote healing, remove debris, and guarantee clear vision, tears are essential. (10) The tear film preserves visual clarity, lubricates, and protects the ocular surface. It spans 3-10 µL, has a thickness of /;3µm, and secretes 1-2µL/min. the pH of tears is 7.45 on average, with seasonal and temporal variations. (11, 12) Tear film disruption and decreased secretion are caused by inflammation of the conjunctival and lacrimal glands. Lagophthalmos increases tear evaporation and osmolarity, which exacerbates dryness. 13-20% of patients suffer from dry eye, with 1-8% developing exposure keratopathy and 0.9% exhibiting superior limbic keratoconjunctivitis.(13) Hormonal alterations from menopause, PCOS, contraception, and androgen resistance are all associated with dry eye. Tear production is influenced by sex hormones, as well as thyroid conditions and insulin treatments. (14) Fatigue, dry skin, and dry eyes are symptoms of hypothyroidism that are frequently associated with autoimmune diseases. Enhancing tear function tests to direct lubricant therapy in hypothyroid individuals is the goal of this study. (15)

MATERIAL AND METHODS

This analytical cross-sectional study was conducted at DHQ Hospital, Dera Ghazi Khan, over 6 months following synopsis approval. A total of 71 participants were recruited using a consecutive sampling technique, based on a calculated sample size with G-Power 3.1.9.7 of 64 with adjustments for a 10% dropout rate (95% confidence level, 80% power). Inclusion Criteria: Patients aged 20-60 years with a confirmed diagnosis of hypothyroidism and no prior ocular pathology or surgery were included. Exclusion criteria were systemic conditions or medications affecting tear production, ocular trauma, active infection, contact lens use, smoking, alcohol use, pregnancy, and lactation. After obtaining informed consent, demographic and clinical histories were recorded. Tear production was assessed using the Schirmer I test, and tear film stability was evaluated via Tear Break-Up Time (TBUT) using fluorescein dye and slit-lamp examination. Symptom severity was measured using the Ocular Surface Disease Index (OSDI). Additional assessments included tear osmolarity and ocular surface staining. Data were analyzed to determine the relationship between hypothyroidism and dry eye parameters.

RESULTS

Normality of data was assessed through the Shapiro-Wilk test. Results indicated that data were not normally distributed ($P < 0.05$). The present study was conducted on 64 patients, of whom 36(56.3%) were male and 28(43.8%) were female, as shown in Figure 1.

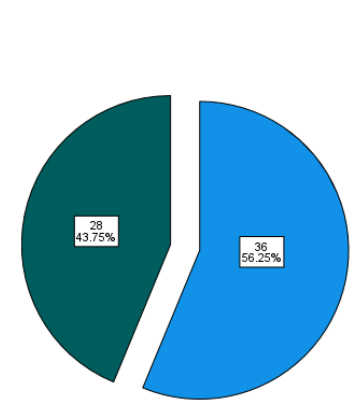

Figure No. 1: Gender Distribution of Study Participants

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The Average age of study participants was 39.19±11.84 years, ranging from 21-59 years, as shown in Figure No. 2.

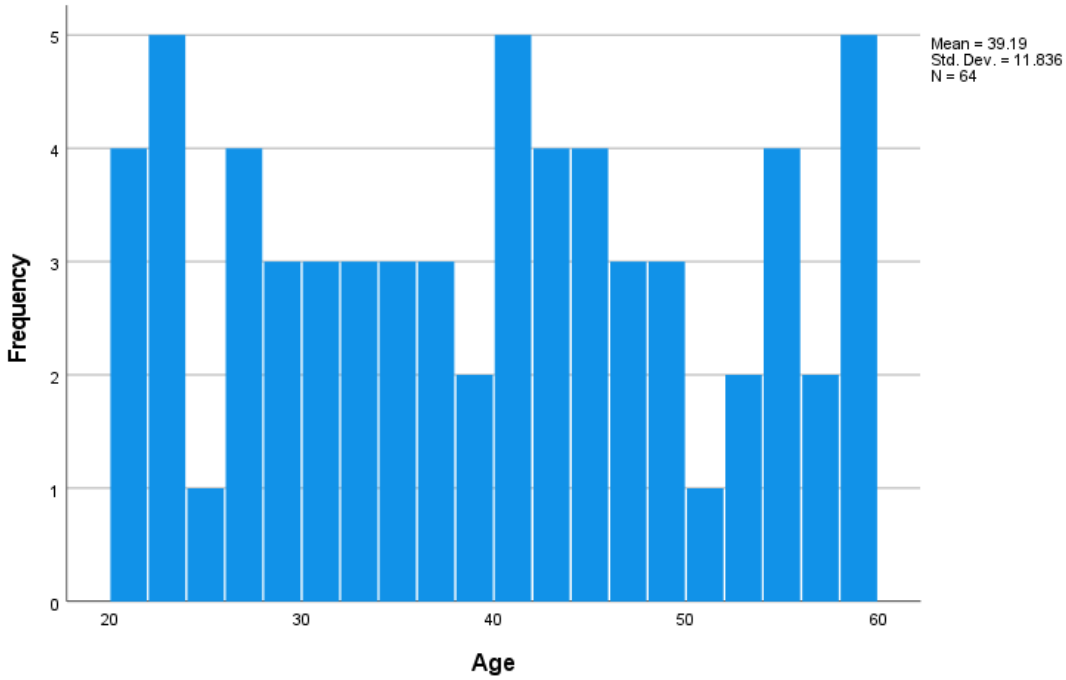

Figure No. 2: Age Distribution of Study Participants

The duration of hypothyroidism was 7.6±4.255 years among patients, as shown in Figure No. 3.

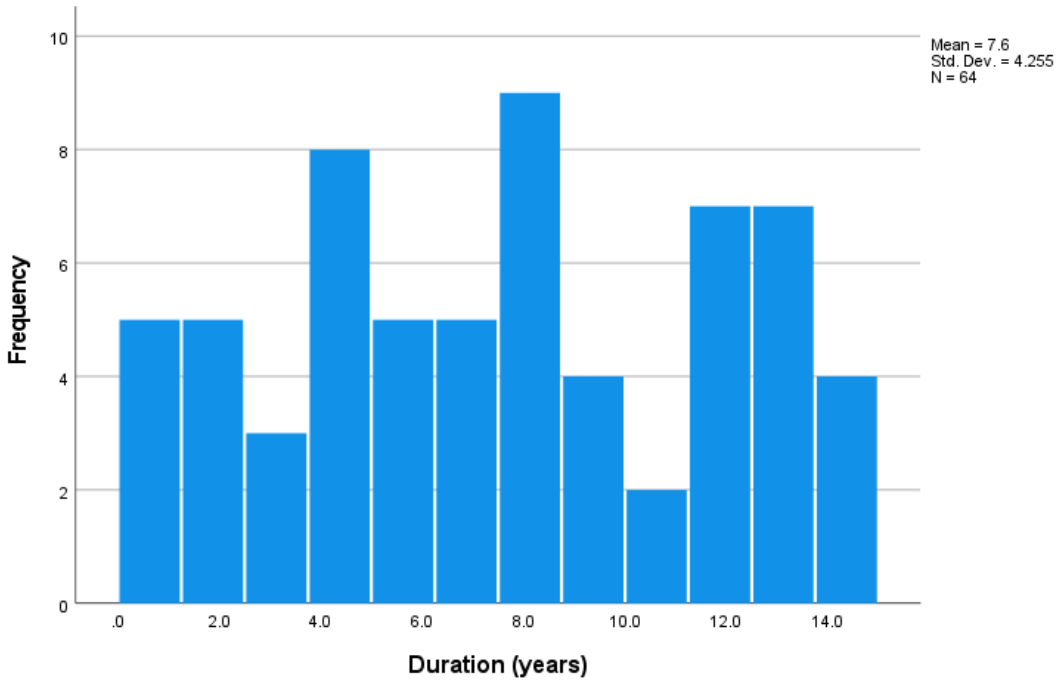

Figure No. 3: Hypothyroidism Duration in Patient

Table No. 1: Ocular Symptoms in Hypothyroidism Patients

Symptoms	Never n (%)	Rarely n (%)	Sometimes n (%)	Often n (%)	Always n (%)	P-value
Dry Eye	6 (9.4)	18 (28.1)	20 (31.3)	11 (17.2)	9 (14.1)	0.025
Gritty/Sandy	5 (7.8)	17 (26.6)	19 (29.7)	12 (18.8)	11 (17.2)	0.051
Painful/Sour Eyes	8 (12.5)	15 (23.4)	13 (20.3)	21 (32.8)	7 (10.9)	0.039
Blurred Vision	5 (7.8)	18 (28.1)	22 (34.4)	10 (15.6)	9 (14.1)	0.004

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Light Sensitivity	7 (10.9)	16 (25.0)	20 (31.3)	16 (25.0)	5 (7.8)	0.011
Reading Difficulty	9 (14.1)	12 (18.8)	25 (39.1)	14 (21.9)	4 (6.3)	<0.001
Driving at night	7 (10.9)	10 (15.6)	19 (29.7)	23 (35.9)	5 (7.8)	<0.001
Computer use	8 (12.5)	19 (29.7)	19 (29.7)	14 (21.9)	4 (6.3)	0.007
Watching TV	6 (9.4)	16 (25.0)	21 (32.8)	13 (20.3)	8 (12.5)	0.022
Windy Conditions	3 (4.7)	15 (23.4)	23 (35.9)	12 (18.8)	11 (17.2)	0.003
Low Humidity	3 (4.7)	9 (14.1)	27 (42.2)	20 (31.3)	5 (7.8)	<0.001
Air Pollution	6 (9.4)	14 (21.9)	24 (37.5)	12 (18.8)	08 (12.5)	0.004

Results showed that a considerable proportion of hypothyroidism patients experienced dry eye symptoms affecting various aspects of daily life. For instance, 62.5% of participants reported a dry eye sensation at least "sometimes," while 65.6% experienced a gritty or sandy feeling with similar frequency. Painful eyes were reported "often" by 32.8% of participants, and 64.1% experienced blurred vision at least "sometimes." Reading difficulty was particularly notable, with 67.2% reporting symptoms at least "sometimes," and difficulties driving at night affected 73.4% of participants. Environmental factors further contributed to discomfort: 81.3% of participants reported symptoms related to low humidity, while 71.9% noted increased symptoms in windy conditions. These findings demonstrate that dry eye symptoms are highly prevalent among patients with hypothyroidism, with significant impacts on visual comfort, daily activities, and quality of life, underscoring the importance of early detection and comprehensive management in optometric practice. All of these ocular symptoms were found to be statistically significant, indicating a strong association between hypothyroidism and the prevalence of dry eye symptoms across various activities and environmental conditions.

Table No. 2: Ocular Symptoms Across Schirmer Test

	Right Eye		Left Eye	
Schirmer Test	n	Mean Rank	n	Mean Rank
Normal	11	27.55	10	23.70
Mild	19	39.29	21	40.74
Moderate	26	25.90	26	26.63
Severe	08	44.63	07	42.14
P-value	0.018		0.012	

A Kruskal–Wallis test was applied to compare dry eye symptoms score across different Schirmer test groups for both eyes. The results for the right eye showed a statistically significant difference ($p = 0.018$), with the highest symptom scores observed in the severe dry eye group (mean rank = 44.63). Similarly, the left eye showed a significant difference ($p = 0.012$), with the severe category again having the highest mean rank of symptoms (mean rank = 42.14). These findings indicate that lower tear production in both eyes is strongly associated with higher symptom severity among hypothyroidism patients.

Table No. 3: Ocular Symptoms Across TBUT

	Right Eye		Left Eye	
TBUT	n	Mean Rank	n	Mean Rank
Normal	17	34.62	16	35.94
Marginal	27	28.52	28	27.98
Dry Eye	20	36.08	20	36.08
P-value	0.331		0.228	

A Kruskal–Wallis test was applied to compare dry eye symptom scores across TBUT-defined categories for both eyes. For the right eye, the differences were not statistically significant ($p = 0.331$), although the dry eye group had a slightly higher mean rank (36.08) compared to the normal group (34.62). Similarly, in the left eye, no significant differences were found ($p = 0.228$), despite the dry eye group again showing a higher mean rank of 36.08. These results suggest that while patients with shorter TBUT tended to report higher symptom scores, the differences across TBUT groups were not statistically significant in this sample.

DISCUSSION

This study revealed a high prevalence of dry eye symptoms among hypothyroidism patients. Notably, 62.5% reported dryness at least "sometimes," and 65.6% experienced a gritty or sandy sensation. Blurred vision affected 64.1% of participants, while 67.2% reported reading difficulties. Driving at night was problematic for 73.4% of patients, indicating a significant impact on daily activities.

The Schirmer test showed a statistically significant association with symptom severity in both eyes ($p=0.018$ right, $p=0.012$ left), with the highest symptom scores observed in patients with severe dry eye (mean rank=44.63 in right eye). In contrast, TBUT results were not statistically significant ($p>0.05$), though symptom scores were slightly higher in those with shorter tear film stability.

These findings emphasize the burden of ocular surface discomfort in hypothyroidism and highlight the need for routine screening and timely management.

Karla Randelovic et al in 2025 studied 150 individuals who were split into three groups for the study: 50 HT patients, 50 without-HT patients, and 50 control subjects. The Schirmer test, lid-parallel conjunctival folds (LIPCOF), (OSDI), (TBUT), and ocular surface staining were among the diagnostic procedures. More than half of the HT patients (27/50) had DED, according to the results, and

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48.15% of them had severe symptoms. The HT DED group had considerably higher IL-6 levels (p=0.010), indicating a particular connection to HT-related DED-MMP-9 had little selectivity for HT but was increased in both DED groups (p<0.001). (16)
The investigation aimed to evaluate the tear function tests for the diagnosis of dry eye in patients with hypothyroidism. The study, which was carried out at the ophthalmic technology centre in Bogota from May to December 2019, had 59 individuals who had hypothyroidism and Dry Eye Disease (DED). OSDI, Schirmer type I, tear meniscus height, NiBUT, osmolarity, Fern ing, and Lissamine Green staining were among the tests that were employed. According to the results, meniscometry and Lissamine Green staining were more in line with normal, although Schirmer type I and NiBUT tests had the highest severity. (15) Moreover, in the current investigation, the Schirmer test also showed a statistically significant association with symptom severity in both eyes, with the increased symptom scores observed in patients with severe dry eye.
Hao Zhe Yu et al in 2022 the effect of hypothyroidism (HT) on the ocular surface in patients with primary Sjogren's syndrome-related DED (pSS-DED) was examined in this study. A control group of 24 subjects with basic (DED) and 36 individuals with pSS-DED were included, 12 of whom had HT. The findings suggested a more severe impairment in tear film stability and secretion, as patients with both pSS-DED and HT had significantly lower TBUT, Schirmer scores, and TMH than those with only pSS-DED or DED. (17) In contrast to this research, TBUT values showed a trend toward higher symptom scores in patients with shorter tear film break-up times, but the differences were not statistically significant. This may be attributed to the multifactorial nature of tear film instability, where evaporative dry eye symptoms do not always correlate linearly with TBUT values. Additionally, TBUT can be more variable and less sensitive compared to Schirmer test results in identifying aqueous-deficient dry eye in hypothyroid populations.
Muhammad Zubair et al in 2018 determining the frequency was the goal of this cross-sectional study, which was carried out at the University of Lahore Teaching Hospital between February and May 2017. Using the Schirmer test on a slit lamp, 44 individuals (aged 20-65) had their tear film breakup time (TBUT) evaluated. The findings showed that people with hyperthyroidism had a greater predominance of DE. According to TBUT analysis, only 13.6% of the right and left eyes had normal TBUT, 20.4% had moderate TBUT decrease, and 65.95% had substantially reduced tear breakdown time. Sugni was confirmed by statistical analysis utilizing the Chi-Square test (p=0.00002). (18)

CONCLUSION

This study revealed that patients with hypothyroidism experienced a high burden of dry eye symptoms affecting their daily activities and environmental exposures. Statistically significant differences in symptom severity were observed across Schirmer test categories for both eyes, indicating a strong relationship between reduced tear production and symptom burden. However, TBUT categories did not show significant differences in symptom scores, signifying that tear film stability alone may not fully explain patient-reported symptoms. Overall, these findings highlight the need for comprehensive assessment and individualized dry eye management strategies in hypothyroidism patients within optometric care.

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