

# Study of association of hyperthyroidism with intraocular pressure, dry eye and central corneal thickness

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## Abstract

**Purpose:** To study the association of Hyperthyroidism on intra ocular pressure, dry eye and central corneal thickness. **Materials and method:** Study design: Case-control study. In our study we have included 100 hyperthyroid patients and 100 healthy individuals of either sex came to our hospital. All these patients were carefully examined for dry eye, IOP, central corneal thickness. In all cases visual acuity, TBUT, Schirmer's test, pachymetry, applanation tonometry were performed. Slit lamp examination, fundus examination also done in our OPD. Results were compared with healthy control group. **Results:** Mean age in hyperthyroid patients was 45±12 years and in healthy individuals mean age was 43±11 years. In thyroid patients TBUT was 6.6±2.3 seconds, Schirmer's test reading was 10.56±5.1 mm, mean IOP was 16.70±3.20 mmHg, and CCT was 538.9±14.9 µm. In healthy individuals TBUT was 12.9±3.1 seconds, Schirmer's test reading was 16.95±6.2 mm, mean IOP was 15.98±2.74mmHg, CCT 541.9±13.7 µm. Dry eye was present in 55 smokers and in 19 non smokers in hyperthyroid patients. **Conclusion:** Our study shows that Schirmer's test and TBUT were lower in hyperthyroid patients and has a definite association with dry eye. There was no significant change in IOP and CCT in hyperthyroid patients. Smoking was found a risk factor for development of dry eye in hyperthyroidism. As we all know that smoking also aggravates thyroid eye disease so smoking should be avoided to prevent dry eye and its serious consequences in hyperthyroid patients.

**Key Word:** Dry eye, IOP, Hyperthyroidism, Central corneal thickness. Abbreviation: IOP – Intraocular pressure, TBUT- Tear film break up time, CCT- central corneal thickness.

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## INTRODUCTION

Hyperthyroidism is a condition involving excessive secretion of thyroid hormone. Grave's disease, the most common subtype of hyperthyroidism, is an autoimmune disorder in which IgG antibodies bind to thyroid stimulating hormone (TSH) receptors in the thyroid gland and stimulate secretion of thyroid hormones. It is more

common in females and may be associated with other autoimmune disorders. It is common in 3<sup>rd</sup> to 4<sup>th</sup> decade of life<sup>1</sup>. Clinical signs include lid retraction, conjunctival chemosis, inequality of dilatation of pupils, ocular motility defects, exophthalmos, exposure keratitis and symptoms of ocular surface discomfort, optic neuropathy.<sup>2</sup> Dry eye is more common in patients suffering from hashimoto's thyroiditis.<sup>3,4,5</sup> Increased palpebral fissure width and increased blink rate were both significant predictors of ocular surface damage. The tear film osmolarity is abnormally high in graves ophthalmopathy, thus contributes higher rates of tear film evaporation.<sup>6</sup> Auto antibodies formed in graves ophthalmopathy potentially target the lacrimal gland thyroid stimulating hormone receptors resulting in lacrimal gland dysfunction and thus causing aqueous deficiency dry eye.<sup>7</sup> Conofocal microscopy shows reduced number of corneal nerve fibers hence resulted in decreased corneal sensitivity in turns results in decreased

tear production.<sup>8</sup> Some studies suggest that there is association of thyroid disease with glaucoma and some other studies suggest there is no association of glaucoma.<sup>8,10</sup> Some studies were also conducted to see correlation of CCT and Thyroid disease. The normal range of CCT in most studies was between 427-620  $\mu\text{m}$ .<sup>11,12,13</sup> Inflammation of extrocular muscles characterized by pleomorphic cellular infiltration, associated with increased secretion of glycosaminoglycan and osmotic imbibitions of water, the muscle become enlarged, sometimes up to 8 times their normal size and may compress the optic nerve subsequent degeneration of muscle fibres eventually leads to fibrosis, which exerts a tethering effect on the involved muscle, resulting in restrictive myopathy and diplopia. Inflammatory cellular infiltration of interstitial tissues, orbital fat and lacrimal glands with accumulation of glycosaminoglycans and retention of fluid. This causes an increase in volume of orbital contents and secondary elevation of intraorbital pressure, which may itself cause further fluid retention within the orbit.<sup>14</sup> Once a patient has Grave's disease, the major clinical risk factor for developing thyroid eye disease is smoking.<sup>15,16</sup> The greater the number of cigarettes smoked per day, the greater the risk and giving up smoking seems to reduce the risk.

**Table 1: NO SPECS modified classification**<sup>17</sup>

Class	Grade Suggestions for grading
0	No physical signs or symptoms
I	Only signs
II	Soft tissue involvement
0	Absent
a	Minimal
b	Moderate
c	Marked
III	Proptosis (3 mm or more of normal upper limits with or without symptoms)
0	Absent
a	3 or 4 mm over upper normal
b	5 to 7 mm increase
c	8 mm increase
IV	Extraocular muscle involvement (usually with diplopia)
0	Absent
a	Limitation of motion at extremes of gaze
b	Evident restriction of motion
c	Fixation of a globe or globes
v	Corneal involvement (primarily due to lagophthalmos)
0	Absent
a	Stippling of cornea
b	Ulceration
c	Clouding, necrosis, and perforation
VI	Sight loss (due to optic nerve involvement)
0	Absent
a	Disc pallor or choking, or visual field defect, vision 20/20-20/60
b	The same, but vision 20/70-20/200
c	Blidness, vision less than 20/200

## MATERIAL AND METHODS

**Study design:** An institution based case- control study conducted at ophthalmology department of JNUIMSRC. In our study we have included 100 hyperthyroid patients and 100 healthy individuals of either sex came to our hospital from January 2017 to March 2018. The study was conducted after approval from institutional ethics committee. Informed consent was obtained from all the participants included in our study. All these patients were examined for visual acuity, central corneal thickness, TBUT, Schirmer's test, pachymetry, applanation tonometry were performed. Slit lamp examination, fundus examination also done in our OPD. Detailed systemic history was obtained. TBUT under 10 seconds was considered as abnormal. The normal value of Schirmer's type 1 test is more than 15mm after 5 minutes. Less than 15 mm was considered abnormal. **Inclusion criteria:** Patients suffering from hyperthyroidism attended to our OPD and referred cases from medicine OPD for eye check up were included in the study along with control group consists of healthy individuals. **Exclusion criteria:** Patient having history of trauma, surgery, other ocular diseases like glaucoma, retinal detachment, infective, allergic diseases and other systemic disorders like diabetes, hypertension, asthma.

## RESULTS

Results are expressed as Mean $\pm$ SD. Data were analysed with the help of Microsoft Excel 2014, odd ration was used to find out the association. A p-value <0.05 was considered as statistically significant. In our study 100 hyperthyroid and 100 healthy individuals were included. Mean age in hyperthyroid patients was 45 $\pm$ 12 years and in healthy individuals mean age was 43 $\pm$ 11years. In hyperthyroid patients male were 12 and females were 88. In control group males were 19 and females were 81. In thyroid patients TBUT (seconds) was 6.6 $\pm$  2.3and Schirmer's test (mm) reading was 10.56 $\pm$ 5.1 mean IOP (mmHg) was 16.70 $\pm$ 3.20, CCT was 538.9 $\pm$ 14.9  $\mu\text{m}$ . In healthy individuals TBUT (seconds) was 12.9 $\pm$ 3.1 and Schirmer's test (mm) reading was 16.95 $\pm$ 6.2 mean IOP(mmHg) was 15.98 $\pm$ 2.74. CCT was 541.9 $\pm$ 13.7  $\mu\text{m}$ . Dry eye was present in 55 smokers and in 19 non smokers in hyperthyroid patients. Table 2 shows definite association of dry eye with hyperthyroidism and table 3 shows definite association of dry eye with smokers in hyperthyroid patients. Table 4 shows NOSPECS classification in study group. 5% patients have no signs and symptoms, 85% patients have upper eye lid retraction, 28% patients have soft tissue involvement and 52% patients have proptosis.

**Table 1:** Comparison of Hyperthyroid and Healthy control group.

Variables	Group A (100)	Group B(100)	P value	T value
Age (years)				
Mean	45±12	43±11	-----	-----
Sex				
Male	12	19	-----	-----
Female	88	81		
<b>IOP</b>	16.70±3.20	15.98±2.74	0.08 Not statistically significant	1.7
<b>CCT</b>	538.9±14.9	541.9±13.7	0.13 Not statistically significant	1.4
<b>Schirmers test (Mean±SD)</b>	10.56±5.1	16.95±6.2	0.0001 Statistically significant	7.95
<b>TBUT (Mean±SD)</b>	6.6±2.3	12.9±3.1	0.0001 Statistically significant	8.5

**Table 2:** Odds Ratio: => Association Of Dry Eye With Hyperthyroidism

Variable	Dry eye-present	Dry eye-absent	Total
Hyperthyroid	74(a)	26(b)	<b>100</b>
Non-hyperthyroid	10(c)	90(d)	<b>100</b>
	84	116	200

Odds ratio = ad/bc

$$74 \times 90 / 26 \times 10 = 25.61$$

Interpretation:-

**MORE THAN 1 => DEFINITE ASSOCIATION BETWEEN DISEASE AND RISK FACTOR**  
**EQUAL TO 1 => NO ASSOCIATION BETWEEN DISEASE AND RISK FACTOR**  
**LESS THAN 1 => FACTOR HAS PROTECTIVE ROLE IN DISEASE**

(A) ODDS OF HYPERTHYROID AMONGST DRY EYE PATIENTS

$$\frac{\text{Dry eye cases with hyperthyroid status}}{\text{Dry eye cases without hyperthyroid status}} \Rightarrow a/c = 74/10 = 7.4$$

(B) ODDS OF HYPERTHYROID AMONGST NON-DRY EYE PATIENT

$$\frac{\text{NON-DRY EYE SUBJECT WITH HYPERTHYROID STATUS}}{\text{NON-DRY EYE SUBJECT WITHOUT HYPERTHYROID STATUS}} \Rightarrow 26/90 = 0.28$$

$$\text{OR} = \frac{\text{ODDS OF HYPERTHYROID IN DRY EYE SUBJECTS}}{\text{ODDS OF HYPERTHYROID IN NON-DRY EYE SUBJECTS}} \Rightarrow ad/bc = 74 \times 90 / 26 \times 10$$

$$\text{OR} = 25.61$$

>1 = SUBJECTS WITH HYPERTHYROID IS MORE LIKELY TO HAVE A DRY EYE THAN THOSE NORMAL THYROID STATUS. (WITHOUT HYPERTHYROID STATUS).

<1 = SUBJECTS WITH HYPERTHYROID IS LESS LIKELY TO HAVE A DRY EYE THAN THOSE NORMAL THYROID STATUS. (WITHOUT HYPERTHYROID STATUS).

1 = NO EFFECT OF STUDIED FACTOR ON DISEASE DEVELOPMENT

**Table 3: Odds Ratio :=> Association Of Dry Eye With Smoking In Hyperthyroidism**

Variable	Dry eye-present	Dry eye-absent	Total
Smokers	55(a)	10(b)	65
Non-smokers	19(c)	16(d)	35
	74	26	100

**ODDS RATIO=>**

$$OR = \frac{\text{ODDS OF SMOKING IN DRY EYE SUBJECTS}}{\text{ODDS OF SMOKING IN NON-DRY EYE SUBJECTS}} \quad \Rightarrow \quad ad/bc = 4.63$$

**INTERPRETATION:**

>1 = Subjects with smoking habit is more likely to have a dry eye.

Smoking (tobacco) has been established a risk factor in the disease of concerned in our study.

**Table 4: Thyroid orbitopathy in study group.**

Nospecks classification grades	Percent of individuals affected ( multiple sings in same individual)
0	05
1	85
2	28
3	52
4	0
5	0
6	0

**DISCUSSION**

In our study mean age (years) in group A was 45±12 and in group B was 43±11. In group A males 12 and females were 88, in group B 19 were males and 81 were females. Similar results were obtained by Emran kan, elif kilic kan *et al*<sup>3</sup> conducted their study on presence of dry eye in patients with Hashimoto’s thyroiditis and concluded that dry eye is more common in females (males were 7 and females were 103). Mean age (years) was in group A 41±11 and in group B was 43±13. They also concluded that females are affected more than males and Schirmers and TBUT values were lower in Hashimoto’s thyroiditis. Mark P.J. vanderpumb<sup>15</sup> conducted their study on the epidemiology of thyroid disease and concluded the peak age specific incidence of Grave’s disease is between 20 to 49 years. Dange N S, Thakur A S *et al*<sup>19</sup> conducted their study on spectrum of thyroid dysfunction in bastar, chhatisgarh-A hospital based study, concluded that Thyroid disease is more common in 20 to 40 years of age and more in females (68.72%) In group A IOP was 16.70±3.20 and in group B 15.98±2.74. IOP was higher in hyperthyroid patients but p value was not significant. JM Crossed,C.A Girtein *et al*<sup>9</sup> conducted their study on the association between thyroid problem and glaucoma, and found that thyroid disease may increase the risk of glaucoma. Ritu jain, surabhi sinha *et al*,<sup>10</sup> conducted their clinical study-A clinical study to evaluate correlation between thyroid problem and glaucoma. They concluded that POAG has same prevalence in general population as in Grave’s ophthalmopathy sub groups. In our study CCT

was not found statistically significant in both groups. Konuk O *et al*<sup>12</sup> conducted their study on the effect of hyperthyroidism and severity of orbital disease on CCT and concluded that there is no association of CCT with Grave’s disease and Grave’s ophthalmopathy. Gamze ozturk,karabulut *et al*<sup>13</sup> conducted their study on corneal biomechanical properties in thyroid eye disease and concluded that there is no correlation of CCT and thyroid disease. In our study Schirme’r test and TBUT were found significantly low in hyperthyroid patients. Similar results were also reported by Emran kan, elif kilic kan *et al*.<sup>3</sup> Nowak M, *et al*<sup>20</sup> conducted their study on Tear film profile in patients with active thyroid orbitopathy and concluded that dry eye symptoms were present in 85% of patients, TBUT and Schirme’r test were significantly lower in graves disease. In our study dry eye was more in smokers than in non smokers. Similar results were obtained by Prummel MF,*et al*<sup>16</sup> conducted their study on smoking and risk of Grave’s disease and concluded that smoking greatly increased the risk of thyroid eye disease. Wiersinga WM, *et al*<sup>18</sup> conducted their study on epidemiology and prevention of Grave’s ophthalmopathy and concluded that cigarette smoking plays an important role in occurrence in ophthalmopathy. In our study group 85% of patients had upper eye lid retraction, 52% patients had proptosis and 28% of patients had soft tissue involvement. Similar results were obtained by Bartley GB *et al*<sup>21</sup> they conducted their study on clinical features of graves ophthalmopathy in an incidence cohort and concluded 90 % patients had eye lid retraction, 62%



patients had proptosis and 32% of patients had eye lid edema.

## CONCLUSION

Our study shows that Schirmer's test and TBUT were lower in hyperthyroid patients and has a definite association with dry eye. There was no significant change in IOP and CCT in hyperthyroid patients. Smoking was found a risk factor for development of dry eye in hyperthyroidism. As we all know that smoking also aggravates thyroid eye disease so smoking should be avoided to prevent dry eye and its serious consequences in hyperthyroid patients.

## REFERENCES

1. Jack J Kanski. Clinical ophthalmology, A systematic approach. Orbit. year 2011; 7 th edition: page 122.
2. A.K khurana. Comprehensive ophthalmology. diseases of orbit. 2007; 4th edition: page 391.
3. Emran kan, elif kilic kan *et al.* Presence of Dry eye in patients with Hashimotos thyroiditis. Journal of ophthalmology. year dec 2014;vol 2014:page7-9
4. Vasilis Achtsidis,Nicholas Tenloulouris *et al.* Dry eye in graves ophthalmopathy and concluded that dry eye is more common in G. O. European ophthalmic review, 2014; 8(1):17-22
5. Selter J,Gire A, Sikder S. The relationship between Grave's ophthalmopathy and dry eye syndrome. Clin Ophthalmol. 2015; 9: 57–62.
6. Jeffrey p. Gilbard M D *et al.* Ocular surface drying and Tear film osmolarity in thyroid eye disease. Acta ophthalmologica. February 1983; volume 61, issue 1: page 108-116.
7. Eckstein AK, Finkenrath A, Heiligenhaus A, Renzing-ko K. Dry eye syndrome in thyroid-associated ophthalmopathy: lacrimal expression of TSH receptor suggests involvement of TSHR-specific autoantibodies. Acta Ophthalmol Scand. 2004; 82: 291–297.
8. Achtsidis V, Tentolouris N, Theodoropoulou S, *et al.* Dry eye in Graves ophthalmopathy: correlation with corneal hypoesthesia. Eur J Ophthalmol. 2013;23(4):473–479.
9. JM Crossed,C.A Girtein *et al.* The association between thyroid problem and glaucoma, Br J Ophthalmol. 2008 Nov; 92(11): 1503–1505.
10. Ritu jain,surabhi sinha *et al.* A clinical study to evaluate correlation between thyroid problem and glaucoma . International Journal of Contemporary Medical Research. August 2017; Volume 4 , Issue 8: page 1694-1696.
11. Wolfs RC, Klaver CC, Vingerling JR, Grobbee DE, Hofman A, de Jong PT. Distribution of central corneal thickness and its association with intraocular pressure: The Rotterdam study. Am J Ophthalmol. 1997; 123: 767–72. [PubMed]
12. Konuk O *et al.* Hyperthyroidism and severity of orbital disease do not change the CCT in Grave's ophthalmopathy. Europian journal of ophthalmology. 2008 Jan-feb; 18(1):125-7.
13. Gamez ozturk, karabulut *et al.* Corneal biomechanical properties in thyroid dry eye disease. Kaohsiung J Med Sci. 2014 jun ; 30 (6):299-304
14. Jack J Kanski. Clinical ophthalmology, A systematic approach. Orbit. year 2011; 7 th edition: page 123.
15. Mark P J vanderpumb.The epidemiology of thyroid disease. British medical Bulletin. 1 September 2011; vol 99, issue 1: page 39-51
16. Prummel MF,*et al.* Smoking and risk of graves disease.JAMA.1993jan ;27,269(4):479-82.
17. S. C. Werner, "Modification of the classification of the eye changes of Graves' disease," American Journal of Ophthalmology, vol. 83, no. 5, pp. 725–727, 1977. View at Publisher · View at Google Scholar · View at Scopus
18. Wiersinga WM *et al.* Epidemiology and prevention of graves ophthalmopathy; Thyroid.2002 oct (10):855-60.
19. Dange N S, Thakur A S *et al.* Spectrum of thyroid dysfunction in bastar, chhatisgarh-A hospital based study. J cont Med A Dent; sep – dec 2015; vol 3; issue 3: page 19-23.
20. Nowak M,*et al.* Tear film profile in patients with active thyroid orbithopathy. Klin oczna.2005; 107(7-9): 479-82.
21. Bartely GB,Fatoureichi Vetal.Clinical features of Geaves ophthalmopathy in an incident cohort. Am J ophthalmol; 1996 march; 121(3):284-90.

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