

# Corneal Thickness is Reduced in Dry Eyes

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**Abstract:** Dry eye disease, is a multifactorial pathology that affects tears and ocular surface resulting in symptoms of discomfort and visual disturbance that injures the conjunctiva and corneal epithelium. Environmental factors often implicated in dry eye includes exposure to pollutants, UV radiation, ozone and use of preservative eye drops. These factors often cause dry eye which increase oxidative stress causing ocular surface inflammation where corneal epithelium usually gets injured. Here, various studies were reviewed that points to the affect of dry eye on corneal thickness and showing thinning of cornea among dry eyes associated with other factors. And these studies reported to have found reduced thickness in dry eyes and different studies reported decrease in corneal thickness in dry eye showing the relationship of corneal thickness present in dry eyes present with other factors including diabetes, menopause etc. This review is mainly done from the studies collected from the Pubmed and Google scholar. The main purpose of this review is to investigate the effect on corneal thickness by reviewing the studies that has compared the thickness in normal and dry cornea.

**Keywords:** Dry eye; corneal thickness; Diabetes; Hyperosmolarity; Pachymetry

## 1. Introduction

The tear film is a thin multi layered interface of the ocular surface with the environment that helps in maintaining health of ocular surface. It has an essential relationship with the superficial epithelial layers of cornea and conjunctiva. The innermost layer of tear film is called as mucus layer which contains mucin, salts, immunoglobulins, glucose, leukocytes, cellular debris and enzymes. Overlying this layer there is a aqueous layer that contains water, electrolytes, proteins, immunoglobulins, peptide growth factors, cytokines, vitamins and antimicrobials. And the superficial layer is a lipid layer which is composed of oil secreted by meibomian glands that acts as the major barrier of evaporation from the ocular surface. The main role of pre corneal tear film is to protect the cornea from drying, maintaining refractive power of cornea, protecting against eye infection and permitting oxygen to enter cornea.<sup>4</sup>

## 2. Corneal Thickness

Corneal thickness is a corneal health indicator which is also an important parameter for the characterization of corneal disease. The corneal thickness measure gives valuable information on the physiological status of the cornea and its changes are associated with any disease. The maintenance of corneal thickness depends on an intact barrier function and a healthy endothelium. The corneal thickness gets change if this function are disturbed by injury or any disease. The investigation of corneal thickness provides useful information regarding corneal health which can be used as diagnostic parameter for many eye disease. The measurement of corneal thickness is helpful for finding out the outcomes of refractive surgery, corneal transplantation, and contact lens prescription. Central corneal thickness independently acts as a risk factor for glaucoma. Many studies have shown that dry eye co occurs in patient that had underwent cataract surgery, glaucoma treatment and also due to risk factors including ageing and long term use of preserved eye drops. Therefore the assessment of corneal thickness in various eye disease is becoming important.<sup>5, 6</sup> Several imaging techniques such as Ultrasound pachymetry, invivo confocal microscopy and several other tests such as

impression cytology can be used to reveal any damage to cornea. Anterior segment Optical coherence tomography (AS-OCT) is also preferred for evaluating corneal epithelium in many studies.<sup>1</sup>

### Dry Eye Disease

Dry eye disease is a multifactorial pathology affecting tears and ocular surface either due to insufficient tear production or excess tear evaporation that results to tear film instability, tearhyperos molarity and ocular surface inflammation. Conjunctival and corneal epithelial cells may get damaged due to inflammation or poor tear quality and damage to the corneal epithelium may cause signs of dry eye such as dryness, burning, foreign body sensation, ocular discomfort, soreness and visual disturbance.<sup>1</sup> Several environmental factors are also involved that may cause dry eye such as exposure to pollutants, UV radiation and ozone as well as chronic use of preserved eyedrops.<sup>2</sup> Some population based studies have shown that the prevalence of dry eye is higher among elderly groups. The most common risk factors of dry eye disease are increasing age, female gender, menopause, hormone replacement therapy, smoking autoimmune disorder, contact lens wear, medications, eyelid disorders and environmental factors.<sup>4</sup> Most of the moderate cases of dry eye subjects may complaint of slight ocular discomfort which widely impact on work and leisure activities. The severe form of dry eye can be characterized by permanent corneal damages such as corneal ulcer with more or less severe loss of vision.<sup>3</sup> There are various tests available for diagnosing dry eye like Tear film break up time (TBUT), Schirmer test, Rose Bengal Score etc.

### 2.1 Relevance of Corneal Thickness In Dry Eye

With the advancement of various refractive surgery techniques and diagnosing of various ocular disease corneal thickness measurement has become an important consideration in eyecare. Dry eye is associated with several risk factors including ageing, female gender, smoking. Several studies have shown that corneal thickness gets reduced in patient with dry eye. In one such study patients with normal and dry eyes were enrolled for the study. Dry eye patients were subdivided into four groups based on the severity and corneal epithelial thickness were measured for

all the patients using fourier domain Optical Coherence Tomography .It was found that dry eye patients have thinner corneal thickness when compared to healthy eyes.7In other such study,both control groups and dry eye group were enrolled for corneal thickness measurement. The measurement was taken with the use of Orbscan corneal topography at nine locations in the central and peripheral (superior, superonasal, nasal, inferonasal, inferior, inferotemporal, temporal, superotemporal). The data in this study revealed reduced corneal thickness in dry eye patients when compared to normal eyes group and superior cornea were found to be thickest and center of cornea were found to be thinnest in both groups.5A similar type of study was done among normal and trachomatous dry eyes which revealed reduced thickness of central and mid peripheral cornea in patients with dry eye .8 Another study done in Norway among control and dry eye groups resulted to have shown highly statistically significant central corneal thinning in dry eye groups.10Various studies of dry eye have shown reduced corneal thickness in dry eye patients associated with other factors. A population based study among Iraqi population was done to investigate the effect of dry eye on corneal thickness by comparing the findings with those of normal age matched individuals which showed significantly reduced corneal thickness in dry eyes and were found to be more common among females than males. Similarly few other studies have recorded reduced corneal thickness in dry eyes and have also reported reduced corneal density in dry eye patient.4 Dry eye can be associated with multiple factors where in an observational study among French population was found to have high prevalence of dry eye among elderly groups and affecting mostly women. In another study post menopausal women with and without dry eye were enrolled for comparing the corneal thickness by Orbscan topography and reported reduced corneal thickness among postmenopausal women with dry eye when compared to postmenopausal women without dry eye. A study among Saudi population were done to investigate the profile of corneal thickness among diabetics with and without dry eye. The study concluded that dry eye affects the corneal thickness among diabetic subjects showing lower values in those with dry eye and also supported that diabetics tends to present with higher corneal thickness values when compared with non diabetic patients.9

### 3. Future Studies and Challenges

Studies are required to evaluate the role of environmental factors on dry eye affecting the corneal thickness. More studies to be conducted on the mediators of dry eye. Based on a study done in Turkey among dry eye patients the corneal thickness were found significantly higher after a month of treatment with artificial tears.1 Another study found to have lower serum Vitamin D level in dry eye and Vitamin D deficiency was found to be associated with an increase in symptoms of dry eye and decrease in tear production.11 Further studies are required to investigate the other factors causing reduced corneal thickness in dry eyes. Studies to be done for comparing the corneal thickness among control healthy groups and dry eye groups without the associated factors causing increased thickness. More studies to be conducted to study the relationship of environmental and other systemic factors with thinning of

corneal thickness in dry eye. Further studies can be conducted for evaluation of oxidative stress and inflammation in the ocular surface that can be caused due to chronic use of preserved eye drops such as in glaucoma. Studies can be conducted for finding out the accuracy by comparing different techniques which is to be used for measuring corneal thickness. Certain factors to be considered in further studies which is likely to have an increase impact in coming years.

### 4. Conclusion

This review demonstrated an association or impact of dry eye on corneal thickness. And after reviewing different studies thinner corneal thickness were found in dry eyes but still requires more study on dry eye to assess the affect in corneal thickness keeping the other factors into consideration which will give a clinically significant outcomes. This area of research is likely to expand in coming future that will help in diagnosing disease and dry eye to be considered and assessed before any refractive surgery.

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