

The Effect of Artificial Tear Treatment on Central Corneal Thickness in Dry Eyes

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ABSTRACT

Objective: To evaluate the role of artificial tear treatment on central corneal thickness in patients with dry eyes coming to a tertiary care eye hospital.

Study Design: Quasi-experimental study.

Place and Duration of Study: Tertiary Care Eye Center, Armed Forces Institute of Ophthalmology, Rawalpindi Pakistan, from May to Nov 2022.

Methodology: The study included central corneal thickness of 210 eyes (n=210) of 110 patients with dry eye disease measured before and after treatment with continuous use of artificial tear drops one month apart, patients were diagnosed on the presence of symptoms such as burning, dryness, pain, irritation, grittiness followed by slit lamp examination for marginal tear meniscus (<0.25mm) or absent, tear film BUT of <10 seconds, Schirmer test 2 of <6mm after 5 minutes and ocular surface staining score of >1 with fluorescein. Central corneal thickness was measured using corneal topography (Galleli G6 Ziemer).

Results: A total of two hundred and twenty eyes of 110 individuals having dry eyes were included in our study. Median CCT before treatment with artificial tears was 522(75) μ m while median CCT after 1 month treatment with artificial tears was 547(22.25) μ m this showed a percentage increase of 3.79% in central corneal thickness after one month treatment with artificial tears (*p*-value <0.001) therefore treatment with artificial tears was significantly associated with an increase in central corneal thickness in dry eye disease.

Conclusion: Central corneal thickness is substantially related to dry eyes.

Keywords: Artificial tear, Central corneal thickness, Dry eyes.

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INTRODUCTION

Normal human tear is composed up of three layers; outermost layer of lipid, middle layer of aqueous and inner layer of mucus. It is around approximately 3–5 μ m thick.¹ Outermost layer of lipid which is produced mainly through Meibomian glands,² and it acts to stabilize the aqueous layer by reducing its evaporation and maintain tear's thickness.³ The middle layer of aqueous is produced mainly through lacrimal gland,⁴ and the accessory lacrimal glands of Krause & Wolfring.⁵ The inner layer of mucus is produced mainly through the Goblet cells present in the conjunctiva. Tear film lubricates the eye and protects the eye from external damage from small particles and chemicals, removes debris from eye, provides innate immunity via lysozyme and lactoferrin,⁶ provides corneal epithelial cells with oxygen and glucose, maintains smooth surface for refraction of light.⁷

Dry eye occurs when there is inadequate tear film or when there is excessive evaporation of tears, leading to an unstable tear film causing ocular surface disease.⁸

It is an extremely common condition, particularly in post-menopausal women and elderly. Dry eyes and external eye disease are among the most common diseases with which patients report in eye OPD. Patients present with the symptoms of burning, pain, heaviness, irritation, and grittiness in the eyes.⁹ The diagnosis is made by slit lamp examination for measurement of marginal tear meniscus, Meibomian gland dysfunction, tear film breakup time and Schirmer's test.¹⁰

The purpose of our study is to determine the effect of artificial tear treatment in dry eyes on corneal thickness comparing pre-treatment and post-treatment CCT using Galleli G6 Ziemer corneal tomography.

METHODOLOGY

The quasi-experimental study was conducted at Armed Forces Institute of Ophthalmology (AFIO), Rawalpindi Pakistan, from May 2022 to November 2022. Sample size of 73 was calculated using OpenEPI Software online keeping reference mean pre treatment CCT as 545 \pm 10.5 μ m and post treatment CCT as 571 \pm 11.3 μ m (for dry eye disease) and confidence level of 95%, published by Ahmad Anas *et al.*¹¹ Hospital Ethical Review Committee (ERC No. 285/ERC/AFIO)

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approved the study protocols and found no objection or ethical concerns in the study. We included 220 eyes of 110 patients by consecutive sampling technique.

Inclusion Criteria: Patients aged between 21 to 75 years, without any other ocular condition besides dry eyes, and not using any topical treatment for dry eyes or any other ocular disease were included. Patients were diagnosed to have dry eyes on the basis of symptoms of pain, heaviness, burning, grittiness and irritation followed by examination for marginal tear meniscus (<0.25 mm or absent tear film BUT of less than 10 seconds, Schirmer's test 2 of less than 6mm after 5 minutes and ocular surface staining score of > 1 with fluorescein and examination for any other ocular disease.

Exclusion Criteria: Patients with allergic conjunctivitis, history of previous refractive or cataract surgery, patients using anti-glaucoma medication, patients who were planned for any ocular intervention were excluded from the study.

Once the diagnosis of dry eye disease was confirmed, central corneal thickness was measured using Galleli G6 Ziemer and patients were given artificial tears (sodium hyaluronate 0.2%) 4 times a day for one month. Galleli G6 Ziemer,¹¹ is a non-invasive device which is used for corneal tomography it incorporates three principles of Placido-disc-based topography, Scheimpflug tomography,¹² and optical biometry, by Placido-disc topography.¹³ Galleli G6 scan anterior corneal curvature for abnormalities of corneal surface, and abnormalities of the tear-film while Scheimpflug tomography calculates corneal thickness and elevation data and principle of optical biometry is used for measuring axial length and lens thickness. Patients were re-examined after one month for any changes in their initial symptoms and slit lamp examination was done for margin tear meniscus, Tear film BUT and Schirmer's test 2 was done to look for improvement in disease condition. Central corneal thickness was rechecked in patients showing improvement in signs and symptoms.

Data were collected on the Microsoft Excel Sheet by the investigator. Statistical Package for Social Sciences (SPSS) version 24.0 was used for the data analysis. Kolmogorov-Smirnov test and the Shapiro-Wilk test were applied to check the normality of the data. Data were found to be not normally distributed. Therefore, median and interquartile ranges were reported for quantitative variables and qualitative variables were expressed as frequency and percentages.

Wilcoxon test was applied for inferential statistics at *p*-value value lower than or up to 0.05 considered statistically significant.

RESULTS

A total of two hundred and twenty eyes of 110 individuals having dry eyes were included in our study. Out of 110 patients 75(68.2%) patients were males and 35(31.8%) patients were females. Median age of participants was 51(14)years. Median CCT before treatment with artificial tears was 522(75) μ m while median CCT after 1 month treatment with artificial tears was 547(22.25) μ m this showed a percentage increase of 3.79% in central corneal thickness after one month treatment with artificial tears (*p*-value <0.001) therefore treatment with artificial tears was significantly associated with an increase in central corneal thickness in dry eye disease (Table).

Table: Comparison of pre-treatment and post-treatment central corneal thickness (n=110)

Baseline Characteristics	Pre-treatment	Post-treatment	<i>p</i> -value
Central Corneal Thickness (median, Interquartile range)	522(75) μ m	547(22.25) μ m	<0.001

DISCUSSION

Patients with dry eyes comprise a significant chunk of any eye OPD as it is an extremely common yet under diagnosed disease because no gold standard lab investigation is available to diagnose dry eyes with certainty and diagnosis is usually made on the basis of symptoms and slit-lamp examination. Very limited investigations are available to confirm the diagnosis of dry eyes. One of them is tear film osmolarity which ranges from 305-316mOsm/L. In dry eyes, tear film osmolarity is increased. CCT is an important parameter in patients on anti-glaucoma medication and patients undergoing refractive surgery. Dry eye disease effects central corneal thickness because of change in tear film osmolarity. The prevalence of dry eyes among Pakistani population was found to be 18.7%.¹⁴

This study included both male and female patients of ages between 21 and 75 years. Average age of patients included in our study was 49.77 \pm 10.67 years which is comparable to a study published by Noora Mauwafak Ali *et al.* (43.84years).¹⁵

This study showed that there is significant relation between dry eyes and CCT. Mean CCT before treatment with artificial tears was 527.90 \pm 15.42 μ m while mean CCT after 1 month treatment with artificial tears was

547.92±15.46 µm this showed a mean increase of 3.79%, these findings are similar to a study published in Journal Français d'Ophthalmologie by Cakır *et al.*¹⁶

A similar study was also done by Seo SG *et al.* and published in the Journal of Korean Ophthalmological Society showed increase of 5.28% (27.1±9.2 µm, $p<0.01$) of CCT in dry eye disease after 2 weeks treatment with artificial tears.¹⁷

Another study done by Al Ahmad *et al.* and published in International Journal of ophthalmology showed an increase of 4.7% in central corneal thickness from baseline ($p=0.000$),¹⁸ which is comparable to an increase of 3.79% in our study.

This showed that regular use of artificial tears brought a significant change in most of the patients' central corneal thickness when they were re-examined on follow up visit to OPD.

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LIMITATION OF STUDY:

A limitation in this study was selection bias as patients were selected from a single hospital OPD. Patients only with known dry eyes were selected in our research, they were evaluated and given treatment on the basis of this diagnosis.

CONCLUSION

Central corneal thickness is substantially related to dry eyes. Central corneal thickness measurement in follow up of patients under treatment for dry eyes can be used as a tool for assessment of response to artificial tears treatment. Moreover, CCT is effects IOP measurement and in planning of refractive procedure. Therefore, dry eyes should be treated in patients using anti-glaucoma medication and patients requiring refractive surgery while keeping an eye on central corneal thickness on each follow up visit.

Conflict of Interest: None

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

UNK & FH: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

SN & WRB: Conception, study design, approval of the final version to be published.

TAK & AQ: Data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of

any part of the work are appropriately investigated and resolved.

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