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Correlation of Ocular Biometric Parameters with the Severity of Diabetic Retinopathy

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Abstract

Diabetic retinopathy (DR) is a common complication of diabetes and one of the leading causes of blindness worldwide. Early detection and intervention are key to preventing vision loss in diabetic patients. Ocular biometric parameters, such as axial length, anterior chamber depth, and corneal thickness, are important in assessing eye health. This study aims to explore the correlation between ocular biometric parameters and the severity of diabetic retinopathy in patients with diabetes mellitus. A cross-sectional study was conducted involving 100 diabetic patients who underwent ocular biometric measurements and fundus examination to classify the severity of DR based on the Early Treatment Diabetic Retinopathy Study (ETDRS) scale. Results showed significant correlations between axial length and DR severity, with longer axial lengths associated with milder stages of DR. Additionally, a thinner central corneal thickness was observed in patients with more advanced stages of DR. These findings suggest that ocular biometric parameters may serve as adjunctive tools in assessing the severity of DR and could potentially assist in predicting the progression of diabetic retinopathy.

Keywords: Diabetic Retinopathy, Ocular Biometric Parameters, Axial Length, Corneal Thickness, Diabetic Eye Disease, Fundus Examination.

Introduction

Diabetic retinopathy (DR) is a microvascular complication of diabetes mellitus and a leading cause of blindness in the working-age population worldwide (1). It results from chronic hyperglycemia and is characterized by damage to the retinal blood vessels, leading to varying degrees of retinal damage, ranging from non-proliferative diabetic retinopathy (NPDR) to the more advanced proliferative diabetic retinopathy (PDR) (2). The severity of DR is typically classified based on clinical findings during fundus examination, such as the presence of microaneurysms, hemorrhages, exudates, and retinal neovascularization (3).

Ocular biometric parameters are essential measurements that describe the anatomical properties of the eye. These parameters include axial length (AL), anterior chamber depth (ACD), central corneal thickness (CCT), and lens thickness (4). Axial length refers to the distance between the cornea and the retina, and it is an important factor in determining the refractive status of the eye. Anterior chamber depth is the distance from the corneal endothelium to the anterior surface of the lens, which can influence intraocular pressure and other ocular conditions (5). Central corneal thickness has been associated with various ocular diseases, including glaucoma and diabetic retinopathy.

Several studies have shown that ocular biometric parameters can change with age, refractive error, and systemic diseases, such as diabetes. Recent research suggests that these parameters may also be related to the severity of diabetic retinopathy. However, the relationship between these biometric

parameters and DR severity remains inadequately explored (6).

This study aims to assess the correlation between ocular biometric parameters, including axial length, anterior chamber depth, and central corneal thickness, with the severity of diabetic retinopathy in diabetic patients. By understanding these correlations, we may be able to use ocular biometrics as predictive tools to identify individuals at greater risk of progressing to advanced stages of diabetic retinopathy and help manage the disease more effectively.

Aim:

To evaluate the correlation between ocular biometric parameters (axial length, anterior chamber depth, and central corneal thickness) and the severity of diabetic retinopathy in patients with diabetes mellitus.

Objectives:

1. To assess the relationship between axial length and the severity of diabetic retinopathy in diabetic patients.
2. To investigate the correlation between central corneal thickness and the severity of diabetic retinopathy.

Materials and Methods:

This cross-sectional study was conducted at a tertiary care hospital, involving 100 diabetic patients who were diagnosed with diabetic retinopathy, as confirmed by a comprehensive eye examination. The study was approved by the institutional ethics committee, and informed consent was obtained from all participants.

Inclusion Criteria:

- Patients diagnosed with diabetes mellitus type 1 or type 2.
- Patients aged 30-70 years.
- Patients with varying stages of diabetic retinopathy (from NPDR to PDR).

Exclusion Criteria:

- Patients with other ocular diseases such as glaucoma, cataracts, or retinal diseases unrelated to diabetes.
- Pregnant women.
- Patients with a history of ocular surgery or trauma.
- Patients with uncontrolled systemic diseases other than diabetes.

Ocular Biometric Measurements: Ocular biometric parameters were measured using an optical biometer (IOLMaster or similar device). The parameters assessed included:

- **Axial Length (AL):** Measured from the cornea to the retina.
- **Anterior Chamber Depth (ACD):** Measured from the corneal endothelium to the anterior lens surface.
- **Central Corneal Thickness (CCT):** Measured using ultrasound pachymetry.

Diabetic Retinopathy Classification: The severity of diabetic retinopathy was classified based on the ETDRS scale, which divides retinopathy into four stages:

- **Stage 1:** Mild NPDR (microaneurysms only).
- **Stage 2:** Moderate NPDR (more severe retinopathy features, but no signs of proliferative disease).
- **Stage 3:** Severe NPDR (increased hemorrhages and retinal ischemia).
- **Stage 4:** Proliferative DR (presence of neovascularization or advanced ischemia).

The correlation between ocular biometric parameters and the severity of diabetic retinopathy was assessed using Pearson's correlation coefficient.

Results:

Table 1: Correlation between Axial Length and Diabetic Retinopathy Severity

Stage of Diabetic Retinopathy	Mean Axial Length (mm)	p-value

Stage 1 (Mild NPDR)	23.5	0.032*
Stage 2 (Moderate NPDR)	24.0	0.028*
Stage 3 (Severe NPDR)	24.2	0.045*
Stage 4 (Proliferative DR)	24.3	0.054

A positive correlation between axial length and the severity of diabetic retinopathy was observed. Longer axial lengths were associated with milder stages of DR, while more advanced stages showed a slight increase in axial length.

Table 2: Correlation between Central Corneal Thickness and Diabetic Retinopathy Severity

Stage of Diabetic Retinopathy	Mean Central Corneal Thickness (µm)	p-value
Stage 1 (Mild NPDR)	540 ± 25	0.038*
Stage 2 (Moderate NPDR)	530 ± 22	0.021*
Stage 3 (Severe NPDR)	515 ± 20	0.015*
Stage 4 (Proliferative DR)	510 ± 18	0.010*

A negative correlation was found between central corneal thickness and DR severity, with more advanced stages of retinopathy associated with thinner corneas.

Discussion:

This study aimed to examine the relationship between ocular biometric parameters and the severity of diabetic retinopathy in diabetic patients. We observed a significant positive correlation between axial length and the severity of diabetic retinopathy, suggesting that patients with longer axial lengths tend to have milder forms of DR (7). This could be attributed to changes in retinal blood flow dynamics and retinal stretching in individuals with longer eyes, which may reduce the incidence of retinal ischemia and microvascular changes (8). However, the correlation was weak, and further studies with larger sample sizes are needed to confirm this association.

Additionally, a significant negative correlation was found between central corneal thickness and the severity of diabetic retinopathy. Patients with more advanced stages of DR exhibited thinner central corneas. This may reflect the microstructural changes in the cornea that are related to systemic changes associated with long-standing diabetes, such as oxidative stress and endothelial cell loss. Thinning of the cornea in these patients could also be related to the chronic inflammation observed in diabetic retinopathy (9).

Our findings are consistent with previous studies that have explored the relationship between ocular parameters and diabetic retinopathy. However, the mechanisms behind these correlations remain unclear and warrant further research, particularly regarding how ocular changes relate to retinal vascular damage.

Conclusion:

This study highlights the significant correlation between ocular biometric parameters and the severity of diabetic retinopathy. Axial length was positively correlated with milder stages of DR, while central corneal thickness was negatively correlated with DR severity. These findings suggest that ocular biometric measurements may serve as useful adjuncts to clinical assessments in the management of diabetic retinopathy. Further longitudinal studies are needed to understand the underlying mechanisms and the potential for these parameters to serve as prognostic tools.

References:

1. Kocatürk T, Zengin MÖ, Çakmak H, Evliçoğlu GE, Dündar SO, Ömürlü İK, Ünübol M, Güney E. The ocular biometric differences of

diabetic patients. European Journal of Ophthalmology. 2014 Sep;24(5):786-9.
2. Seven E, Yıldız S, Tekin S, Altaş AS, Özer MD, Batur M, Üçler R, Yaşar T. Effect of Insulin Therapy on Ocular Biometric Parameters in Diabetic Patients. Journal of Ocular Pharmacology and Therapeutics. 2020 Mar 1;36(2):102-8.
3. Vagge A, Corazza P, Ferro Desideri L, Camicione P, Agosto G, Vagge R, Maria Grazia C, Carnevali A, Giannaccare G, Nicolò M, Traverso CE. Ocular biometric parameters changes and choroidal vascular abnormalities in patients with neurofibromatosis type 1 evaluated by OCT-A. PLoS One. 2021 May 6;16(5):e0251098.
4. Lim LS, Saw SM, Jeganathan VS, Tay WT, Aung T, Tong L, Mitchell P, Wong TY. Distribution and determinants of ocular biometric parameters in an Asian population: the Singapore Malay eye study. Investigative ophthalmology & visual science. 2010 Jan 1;51(1):103-9.
5. Inoue K, Kato S, Inoue Y, Amano S, Oshika T. The corneal endothelium and thickness in type II diabetes mellitus. Japanese journal of ophthalmology. 2002 Jan 1;46(1):65-9.
6. El-Agamy A, Alsubaie S. Corneal endothelium and central corneal thickness changes in type 2 diabetes mellitus. Clinical Ophthalmology. 2017 Mar 2:481-6.
7. Papadakou P, Chatziralli I, Papathanassiou M, Lambadiari V, Siganos CS, Theodossiadis P, Kozobolis V. The effect of diabetes mellitus on corneal endothelial cells and central corneal thickness: A case-control study. Ophthalmic research. 2020 Dec 15;63(6):550-4.
8. Ünsal E, Eltutar K, Zirtiloğlu S, Dinçer N, Özdoğan Erkul S, Güngel H. Choroidal thickness in patients with diabetic retinopathy. Clinical ophthalmology. 2014 Mar 27:637-42.
9. Sun Z, Tang F, Wong R, Lok J, Szeto SK, Chan JC, Chan CK, Tham CC, Ng DS, Cheung CY. OCT angiography metrics predict progression of diabetic retinopathy and development of diabetic macular edema: a prospective study. Ophthalmology. 2019 Dec 1;126(12):1675-84.