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Endothelial Cells Loss in the Anterior Uveitis

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Abstract:
Purpose: *To investigate a possible effect of ocular inflammation during active anterior uveitis on the corneal endothelium by describing corneal endothelial cell density and morphologic variables in eyes with anterior uveitis, and to study factors that may influence these outcomes.*
Methods*: Prospective study of 43 patients with anterior uveitis. Endothelial cell density and morphologic variables in both eyes of all study participants were determined by specular microscopy, and central corneal thickness was determined by ultrasound pachymetry.*
Results: *Central ECD was lower in eyes with uveitis than in control eyes for all groups and in eyes that had undergone cataract or glaucoma surgery or both. Among patients with unilateral uveitis who had not undergone surgery, central ECD was lower in eyes with uveitis than in contralateral eyes, and percent hexagonality was lower in eyes with uveitis than in contralateral eyes. There was no significant difference in central corneal thickness between eyes with and without uveitis.*
Conclusion: *The observed relationships suggest that anterior segment inflammation adversely affects the corneal endothelium. Longitudinal studies are warranted to determine whether long-standing anterior uveitis increases the risk of endothelial dysfunction, particularly in the setting of intraocular surgery.*
Key words*: cornea - endothelium - non-contact - specular microscopy – uveitis – endothelial cells density*

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I. Introduction:

The corneal endothelium maintains a normal stromal hydration state ensuring corneal transparency and stable corneal thickness. Cell density, polymorphism, and polymegatism are markers of proper corneal endothelial function (1). Inflammation of the uveal apparatus is well known to have concomitant effects on the cornea. It leads to a loss of these cells between 2 and 23% of adults. While the physiological loss is estimated at 0.5% per year. Anterior uveitis directly affects the corneal endothelium among other ocular structures. Persistent or severe intraocular inflammation is often associated with other complications, such as secondary cataract or uveitic glaucoma, which require intraocular surgery. These patients may be at increased risk for corneal decompensation as a complication of surgery if the corneal endothelium is already compromised (2). To address this question we evaluated endothelial cell density (ECD) and morphologic characteristics in a heterogeneous group of patients with a history of anterior segment intraocular inflammation.

II. Materials And Methods

We conducted a prospective cross-sectional study of corneal endothelial cell variables in individuals with anterior intraocular inflammation in one or both eyes and managed in the adult ophthalmology department of the August 20 hospital in Casablanca from January 2021 to January 2022. Excluded were individuals with other ocular diseases known to affect the corneal endothelium (for example, endothelial dystrophies), those with a history of contact lens wear, and those with conditions that prevent the performance of specular microscopy. The diagnosis of active anterior chamber (AC) inflammation was defined according to the Standardization of Uveitis Nomenclature (SUN) Working Group criteria by the presence of cellular tyndall in the anterior chamber [3]. Only patients with visual symptoms less than 3 months old were included. A complete ophthalmologic examination with measurement of corrected visual acuity of all patients was performed by the same ophthalmologist, as well as an anterior segment examination with quantification of cellular and protein tyndall in the aqueous humor according to the SUN Working Group classification [11], a flare measurement and a specular microscopy. The classification of uveitis used is that the SUN Working Group's one established in 2005 [3].

III. Results

We included 43 individuals with a history of uveitis involving the anterior segment (17 with unilateral disease, 26 with bilateral disease, 69 eyes involved). The mean age of the patients was 35 years (extremes: 14-75 years) with 24 men and 19 women. Participants and eyes were heterogeneous in terms of diagnosis, interval since diagnosis of uveitis, duration of active inflammation, and severity of uveitis (as reflected by cells and maximum observed flares).

For the active uveitis group at inclusion, the cell tyndall in the anterior chamber was less than 2+ in 46 eyes (73%) and greater than 2+ in 17 eyes (27%). The mean intraocular pressure was 12 ± 1.4 mmHg. The clinical and demographic characteristics of the patients are summarized in Table 1. Age and sex had no significant effect on the different parameters of specular microscopy and CTA.

Table 1 : Clinical and demographic characteristics of patients.

Study period	**From January 2021 to January 2022**
Total number of patients (eyes)	43 (69)
Average age (years)	35 years
Bilateral involvement **Unilateral disease**	26 patients (60%) 17 patients (40%)
Pathological type of uveitis: number of eyes (%) **Granulomatous** **Non-granulomatous**	 30 eyes (41%) 13 eyes (59%)
Cellular tyndall of AC: number of eyes (%) **0,5 +** **1+** **2+** **3+** **4+**	 25 eyes (36.3%) 21 eyes (30%) 17 eyes (24.7%) 5 eyes (7.2%) 1 eye (1.8%)
Etiologies : number of patients (%) Idiopathic Behcet disease Tuberculosis Toxoplasmosis Herpetic anterior uveitis Viral acute retinal necrosis Fuchs Uveitis Vogt Koyanagi Harada Sarcoidosis HLA B27 associated uveitis Sympathetic ophthalmia	 11 (28,9 %) 7 (18,5 %) 7 (18,5 %) 4 (10,5 %) 2 (5,3 %) 2 (5,3 %) 1 (2,6 %) 1 (2,6 %) 1 (2,6 %) 1 (2,6 %) 1 (2,6 %)

A significant number of patients had idiopathic disease. The distribution of corneal thickness values for the affected eyes of our study participants was symmetrical, with the majority of points between 500 and 600 mm. No patient had clinically apparent corneal edema. the age was a significant risk factor for lower central ECD for eyes with uveitis that had not undergone surgery. The mean central ECD was lower in eyes with uveitis than in control eyes for each age range.

In none of the 17 patients did uveitis alternate between eyes. The median central ECD and the percentage of hexagonality were significantly lower in eyes with uveitis than in contralateral eyes. There was no statistical difference between eyes for corneal thickness.

Of the 69 eyes with uveitis, 9 (13%) had undergone previous cataract surgery as their only intraocular procedure, 5 (7%) had undergone glaucoma surgery as their only intraocular procedure. There was no difference in corneal thickness between eyes with uveitis that had surgery and those that had not.

IV. Discussion

We found that eyes with uveitis have a statistically a lower central ECD than eyes without uveitis. Olsen (4) studied corneal endothelial cells in individuals with unilateral anterior uveitis and found that only 2 of 13 patients (15%) had lower endothelial cell counts in affected eyes (compared with unaffected eyes) than would be expected from normal variation between eyes.

In contrast, our data suggest a greater effect of uveitis in individuals with unilateral disease, perhaps because many of our patients had disease of longer duration. We attempted to address the issue of chronicity by examining the estimated duration of active inflammation as a risk factor for lower central ECD. We found a significant negative correlation between central ECD and duration of active inflammation. In addition, a study by Agra et al (5) showed that corneal thickness decreases with anti-inflammatory treatment of acute anterior uveitis, suggesting that inflammation exerts stress on endothelial cell function even during these episodes.

The normal corneal endothelium is composed of regular hexagonal cells that are relatively uniform in size. In stressful situations, endothelial cells lose their uniform hexagonal shape. This phenomenon is reflected

in the variable "percentage of hexagonal cells" (pleomorphism). (6) We found that eyes with uveitis had a significantly reduced percentage of hexagonality compared to unaffected eyes. Endothelial cell potential in patients with anterior uveitis include direct damage due to contact with inflammatory cells or the effect of proteins, such as cytokines, in the aqueous humor.

We found that peak photometric values of laser flare (a reflection of increased protein levels) were significantly associated with lower central ECD, although the correlation was only moderate. With respect to aqueous humor proteins, the laser flare photometry values increased with increasing protein concentration and molecular weight, but the technique did not identify specific proteins that were present in the aqueous humor (7). In contrast, a previous study found no relationship between the flare in eyes with uveitis and ECD (8).

Cataract and glaucoma are common complications of uveitis, and both can result from corticosteroid treatment. As a result, many patients with uveitis have elevated IOP, and many require intraocular surgical procedures. We found that the decrease in central ECD was related to the maximum IOP. In support of the fact that a reduction in ECD is specifically associated with elevated IOP in patients with uveitis. Specifically to elevated IOP in patients with glaucoma, Cho et al (9) found that lower ECD was associated with progressive open-angle glaucoma but not normal-tension glaucoma. Other studies have shown that the duration of IOP elevation is an important factor (10); However, we were not able to examine the duration of IOP elevation in our study.

Cataract surgery has also been shown to cause temporary changes in the morphological characteristics of endothelial cells (Coefficient of Variability, percentage of hexagonality), but these changes usually disappear within 3 months after surgery (11,12).

Changes in endothelial cell values did not appear to have a substantial impact on corneal function in our patients, as reflected by corneal thickness or clarity. Although corneal thickness measurements may vary between different measuring devices (13), corneal thickness was greater than normal in a study of individuals without uveitis using a similar ultrasound device (14).

In our study, corneal thickness was similar between eyes with uveitis and contralateral, unaffected eyes of patients with unilateral uveitis, indicating normal endothelial cell function despite a history of intraocular inflammation

Although low central ECD was strongly associated with the interval since the diagnosis of uveitis, its association with the duration of active inflammation was weak; this result may be due to the imprecision with which the duration of active inflammation was determined, but it may also be due to the fact that the estimation of duration was based solely on the presence of anterior chamber cells, and we could not confirm that the anterior chamber cells are themselves related to variations in central ECD.

V. Conclusion

Anterior uveitis not only causes specific slit lamp changes. such as retrodescemetid precipitates, multiple corneal guttae, or corneal edema, but also other important morphologic changes in the corneal endothelium such as loss of ECD, pleomorphism, and polymegathism, thus compromising endothelial and visual function. (15)

Early local anti-inflammatory treatment is essential because it can modulate the extent of inflammatory phenomena from the anterior pole and thus limit the intensity and progression of endothelial damage.

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