

## Evaluation of Effect of Pterygium on the Endothelial Cell Density of the Cornea by Specular Microscopy

E.S.Ahmed, A.A.El Shayeb and R.M. Uosry

Ophthalmology Dept., Faculty of Medicine, Benha Univ., Benha, Egypt  
E-Mail:Rehab11@gmail.com

### Abstract

Pterygium were reported to induce changes much deeper and to result in a decrease in the corneal endothelial cell density. Past investigations demonstrated the injurious impact of pterygium on corneal endothelium proposes that pterygium is identified with an abatement in corneal endothelial cell thickness. The point of the current examination is to research the progressions of corneal endothelial cell thickness in patients with pterygium. Forty eyes with pterygium of patients speak to the objective patients of this investigation; they were ordered into two equivalent gatherings every one of 20 eyes: Group (I): 20 eyes with beginning time pterygium. Gathering (II): 20 eyes with full created pterygium. Gathering (III) 40 contralateral typical eyes. There was measurably critical contrast among three contemplated bunches as respect mean corneal force (KM), endothelial cell thickness (ECD) and corneal astigmatism (AST). The mean of KM was higher in bunch III ( $44.4 \pm 0.22$ ,  $2498 \pm 100.6$  separately) than bunch I ( $43.4 \pm 0.29$ ,  $2496.7 \pm 92.1$  individually) and II ( $42.7 \pm 0.33$ ,  $2156.2 \pm 138.9$ ). The mean of ECD was lower in bunch II ( $2156.2 \pm 138.9$ ) than bunch I ( $2496.7 \pm 92.1$ ) and III ( $2498 \pm 100.6$ ). The mean of AST was higher in bunch II ( $- 6.2 \pm 0.77$ ) than bunch I ( $- 1.2 \pm 0.41$ ) and III ( $- 0.61 \pm 0.21$ ). Careful mediation ought to be considered in patients with broad pterygium included the cornea or creating a noteworthy increment in astigmatism Watchwords: Pterygium; Endothelial Cell Density; Cornea; Specular Microscopy.

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### 1. Introduction

Pterygium is a wing-formed visual surface sore depicted as an attack of the bulbar conjunctiva onto the cornea [1].

Pterygium can impact the structure and capacity of the visual surface. At the point when the augmentation to the cornea surpasses 2.2 mm, evident corneal astigmatism happens, and visual capacity would be clearly impeded. Schirmer's test and tear film separation time are known to be fundamentally decreased in instances of pterygium demonstrating the insufficiency of tear film in these patients [2].

Histologically, pterygium is a hyperplastic, cen-tripetally coordinated development of adjusted limbal epithelial cells joined by BL disintegration, epithelial mesenchymal progress, and enactment of fibroblastic stroma related with irritation, neovascularization, and grid renovating, which are all interceded through the consolidated activities of cytokines, development components, and network metalloproteinases [3].

The regularly referred to factors recommended to have a job in the pathogenesis of pterygium are hereditary elements, proinflammatory cytokines, and ultra-violet (UV) light. UV light in the cornea has been appeared to initiate changes in TP53 tumor silencer qualities in limbal basal cells and to upregulate numerous cytokines, angiogenic, and fibrogenic development factors, for example, interleukin (IL)- 1, IL-6,

IL-8, and tumor corruption factor- $\alpha$  creation [4].

Furthermore, the outflow of proteases, for example, framework metalloproteinases (MMPs), that corrupt storm cellar layer and BL have been seen as raised in the main edges of pterygia. These proteases discharged by pterygium cells encourage attack by corrupting cellar layer segments, and dissolving BL and adjoining stromal framework [4].

Pterygium were accounted for to incite changes a lot further and to bring about a reduction in the corneal endothelial cell thickness (ECD) [5]. With regards to the component, it is as yet hazy up until this point. It was hypothesized that the harm to the corneal endothelium might be related with the emission of some fiery components or the mechanical injury incited by the strange disfigurement of the cornea brought about by pterygium during eye development [6].

As indicated by Hsu et al. [5], the means in the development of a pterygium could likewise instigate changes even in the more profound layers of the cornea, for example, the Descemet film and endothelium. Current proof distributed in 2014 with respect to the injurious impact of pterygium on corneal endothelium recommends that pterygium is identified with a lessening in corneal ECD. Be that as it may, just one paper has been distributed regarding this matter. The essential point of this examination was to research the impacts of pterygium on corneal ECD.

Then, the corneal endothelial cells are truly vulnerable to UV radiation. Mooren et al., [7] assumed that inordinate UV presentation may halfway record for the reduction of corneal ECD in pterygium eyes. Ebb and flow looks into couldn't affirm the impact of UV presentation on the lessening of ECD.

The point of this examination was to research the progressions of corneal endothelial cell thickness in patients with pterygium.

## 2. Patients and methods

This prospective highly selected study involved 80 eyes of 40 patients diagnosed to have primary unilateral pterygia, they were divided into two equal groups, each of 20 eyes. Group (I) 20 eyes with pterygium in early stage, group (II) 20 eyes with full developed pterygium. Group (III) 40 contralateral normal eyes of the 40 patients. All subjects had age and sex matched and they are collected from the Ophthalmology Department, Zagazig University Hospital at the period from September 2018 to March 2019.

Forty eyes with pterygium of patients represent the target patients of this study; they were classified into two equal groups each of 20 eyes:

- **Group (I):** 20 eyes with early stage pterygium.
- **Group (II):** 20 eyes with full developed pterygium.
- **Group (III)** 40 contralateral normal eyes.

### 2.1 Inclusion criteria

- Both sexes were included in the study. All cases in this study between age 20-50 years
- Patients with primary pterygium and that cross the corneal limbus.
- The patients must be able to understand instructions and provide informed consent.

### Exclusion criteria

- Recurrent pterygium .
- Patients with symblepharon or conjunctival scar .
- Glaucomatous patients and raised intraocular pressure (IOP) .
- Patients who had history of a resistant fiery sickness .
- History of visual injury or puncturing .
- Contact focal point wearers are prohibited from the investigation .
- Patients with past intraocular or visual surface medical procedure .

- Patients with any front fragment illness which causes watering, stinging or agony as dryness, blepharitis, and corneal scraped area ... and so on .
- Patients with foundational handicapping ailment like rheumatoid joint inflammation .
- Uncooperative patients .
- Inability to give educated assent .
- All patients were exposed to full history taking, total clinical assessment, Full neighborhood assessment including :
- Uncorrected and Best rectified visual sharpness (BCVA) estimated by Snellens diagram .
- The pterygia extension from limbus to cornea was estimated by a cut light pillar and calibrated scale to decide organizing of pterygium
- Early stage (limble) pterygium pinnacle at 1.5mm from limbus
- Advanced stage pterygium 4mm length around at student edge
- Intraocular pressure estimation: Applanation tonometer .
- Anterior fragment assessment by cut light biomicroscopy .
- Posterior fragment assessment by roundabout ophthalmoscopy and cut light biomicroscopy with non-contact +78D or +90 D focal point .
- Specular microscopy (SM) examination of endothelial cell thickness by specular microscopy NIDEK CEM-530 .
- Before the start of the investigation and as per the neighborhood guideline followed, the convention and every relating archive were declared for Ethical and Research endorsement by the Ophthalmology Department, Benha University Hospital.

### 2.2 Statistical analysis

Data were analyzed using IBM SPSS 23.0 for windows (SPSS Inc., Chicago, IL, USA) and NCSS 11 for windows (NCSS LCC., Kaysville, UT, USA). Quantitative data were expressed as mean  $\pm$  standard deviation (SD). Qualitative data were expressed as frequency and percentage. The following tests were done: Independent sample t- test of significance was used when comparing between two means. Mann-whitney test was used when comparing two means of not normally distributed data. Chi-square ( $\chi^2$ ) test of significance was used in order to compare proportions between two qualitative parameters. Analysis of variance (ANOVA) F test of significance was used when comparing between more than two means.

### 3. Results

Studied group was 40 patients with unilateral pterygium (20 early & 20 late stage), 40 eyes studied as diseased group and other

40conteralateral eyes as healthy controls. Demographic data in Table (1).

**Table (1)** Demographic characteristics of the studied groups.

Variables	Group I N=20		Group II N=20		t-test	P-value
<b>Age/years</b>						
<b>Mean ±SD</b>	34.5 ± 5.1		37.9 ± 5.6		2.02	0.06
<b>Range</b>	30 - 41		33 - 48			NS
	N	%	N	%	X <sup>2</sup>	P
<b>Gender</b>						
Male	13	65.0	11	55.0	0.42	0.52
Female	7	35.0	9	45.0		NS
<b>Occupation</b>						
Farmers	12	60.0	11	55.0	0.186	0.911
Indoor workers	3	15.0	4	20.0		NS
Petroleum Engineers	5	25.0	5	25.0		

Table (2) shows statistically significant increase in disease duration and pterygium percent among patients with late pterygium (67.2 ± 17.7 and 44.4 ± 1.57% respectively) than those with early stage (8.8 ± 2.97 and

10.4 ± 1.18% respectively), while best corrected visual acuity was significantly higher among patients with early stage of disease (1.0 ± 0.00).

**Table (2)** Relation between clinical data of the patients and stage of pterygium.

Variables	Group I N=20		Group II N=20		t- test\ MW*	P- value
<b>Disease duration/months</b>						
<b>Mean ±SD</b>	8.8 ± 2.97		67.2 ± 17.7		5.46*	<0.001
<b>Range</b>	4 - 12		48 - 96			HS
<b>Median</b>	8.5		60			
<b>BCVA</b>						
<b>Mean ± SD</b>	1.0 ± 0.00		0.33 ± 0.09		32.5	<0.001
<b>Range</b>	1		0.3 - 0.6			HS
<b>Pterygiumpercent</b>						
<b>Mean ± SD</b>	10.4 ± 1.18		44.4 ± 1.57		77.5	<0.001
<b>Range</b>	10 - 15		40 - 45			HS
	N	%	N	%	X <sup>2</sup>	P
<b>Side of affected eye</b>						
<b>Right</b>	8	40.0	10	50.0	0.404	0.53
<b>Left</b>	12	60.0	10	50.0		NS

Table (3) shows statistically significant difference among three studied groups as regard mean corneal power (KM), endothelial cell density (ECD) and corneal astigmatism (AST). The mean of KM was higher in group III (44.4 ± 0.22, 2498 ± 100.6 respectively) than group I (43.4 ± 0.29, 2496.7 ± 92.1

respectively) and II (42.7 ± 0.33, 2156.2 ± 138.9). The mean of ECD was lower in group II (2156.2 ± 138.9) than group I (2496.7 ± 92.1) and III (2498 ± 100.6). The mean of AST was higher in group II (-6.2 ± 0.77) than group I (-1.2 ± 0.41) and III (-0.61 ± 0.21).

**Table (3)** Difference in outcome measures between studied patients and their controls.

Variables	Group I N=20	Group II N=20	Group III N=40	F test	P-value
<b>KM</b>					
<b>Mean ±SD</b>	43.4 ± 0.29	42.7 ± 0.33	44.4 ± 0.22	283.9	<0.001
<b>Range</b>	43 - 43.75	42.3 - 43	44 - 44.75		HS
<b>ECD</b>					
<b>Mean ±SD</b>	2496.7 ± 92.1	2156.2 ± 138.9	2498 ± 100.6	72.9	0.001

Rang	2407 - 2711	1897 - 2385	2340 - 2700		HS
<b>CV</b>					
Mean ±SD	28.4 ± 3.6	28.2 ± 4.2	28 ± 3.04	0.088	0.92
Range	25 - 36	24 - 40	22 - 36		NS
<b>6A</b>					
Mean ±SD	64.3 ± 4.6	67.6 ± 7.03	65.95 ± 6.1	1.5	0.23
Range	60 - 71	54 - 80	54 - 80		NS
<b>CCT</b>					
Mean ±SD	537.9 ± 10.2	540.5 ± 9.6	536.9 ± 10.4	0.85	0.44
Range	502 - 550	520 - 555	510 - 550		NS
<b>AST</b>					
Mean ± SD	-1.2 ± 0.41	-6.2 ± 0.77	-0.61 ± 0.21	1051	<0.001
Range	(-2) - (-1)	(-7) - (-5)	(-1) - (-0.5)		HS

Table (4) shows that as regard endothelial cell density, there was no significant difference between healthy eyes and eyes with early pterygium while there was statistically

significant difference between early and late pterygium. Regarding KM and AST there was statistical significant difference in between three groups.

Table (4) LSD in outcome measures among all studied groups.

Variables	Mean differenceGroup IWith		Mean differenceGroup IIWith	
<b>KM</b>	Group II=0.7	<0.001	Group III=-2-1.7	<0.001
	Group III=-0.98	<0.001		
<b>ECD</b>	Group II=340.5	<0.001	Group III=-341	<0.001
	Group III=-1.3	0.966		
<b>AST</b>	Group II=5	<0.001	Group III=-5.6	<0.001
	Group III=-0.59	<0.001		

Table (5) shows that ECD statistically significant negatively correlated with age of patients, disease duration and pterygium percent, and it positively correlated with KM, CV and AST while there was no statistically significant correlation between ECD and each

of CV, CCT and 6A. Pterygium percent statistically significant negatively correlated with KM, BCVA and AST, and positively correlated with disease duration while here was no statistically significant correlation with age, CV, CCT and 6A.

Table (5) Correlation of ECD and pterygium percent with other clinical parameters of the studied patients.

	ECD		Pterygium percent	
	r	P value	r	P value
<b>Age</b>	-0.254	0.02 S	0.169	0.133 NS
<b>Disease duration</b>	-0.729	<0.001 HS	0.915	<0.001 HS
<b>KM</b>	0.683	<0.001 HS	-0.824	<0.001 HS
<b>CV</b>	0.019	0.828 NS	0.013	0.912 NS
<b>BCVA</b>	0.759	<0.001 HS	-0.945	<0.001 HS
<b>CCT</b>	-0.108	0.323 NS	0.153	0.174 NS
<b>6 A</b>	-0.033	0.712 NS	0.134	0.254 NS
<b>AST</b>	0.786	<0.001 HS	-0.975	<0.001 HS
<b>Pterygium percent</b>	-0.782	<0.001 HS		

4. Discussion

In the current investigation there was no measurably huge contrast between patients with ahead of schedule and late pterygium as respect age and sex. Thirteen (65%) were men and 7 (35%) were ladies. The mean period of patients in early gathering was 34.5 ± 5.1 and 37.9 ± 5.6 in late gathering with all patients had one-sided pterygium. This came in

concurrency with Hsu . (2014) who found that among ninety patients with one-sided essential pterygium, 56 patients (62.2%) were men and 34 patients were ladies (37.8%). The ages ran from 29 to 88 years, with a middle age of 69 years.

Sousa [4] found that Twenty-nine (47.5%) were men and 32 (52.5%) were ladies. The

mean age of the patients was 50.84 years (run, 25-77 years; SD,  $\pm 13.8$  years).

In the current investigation all of patients were outside laborers (57.5 % ranchers, 17.5% fighters and 25% oil engineers.

This came in concurrence with Hsu . [5] who found that pterygium happens mostly in patients who have outside occupations and is believed to be because of over the top presentation to daylight.

In the current examination pterygium percent was gone somewhere in the range of 10 and 45% in all cases. Sousa . [4] found that the level of pterygium that attacked the cornea ran from 4.87% to 24.59%. Hsu . [5] found that the level of pterygium to cornea went from 3.5% to 65.2%.

In the current examination the mean corneal ECD (cells/mm) was lower in the early and late pterygium eyes (cases) than in the controls with a factually critical contrast ( $2496.7 \pm 92.1$ ,  $2156.2 \pm 138.9$ ,  $2498 \pm 100.6$ ; individually  $p=0.001$ ). This came in concurrence with Sousa . (2017) who found that the mean corneal ECD (cells/mm) was lower in the pterygium eyes (cases) than in the controls ( $2451.83 \pm 284.96$  versus  $2549.95 \pm 268.94$ ;  $p=0.04$ ).

Additionally, Hu . [8] found that the mean ECD in the pterygium gathering ( $2453 \pm 306$  cells/mm<sup>2</sup>) was measurably fundamentally lower than those in the non-ptyerygium gathering ( $2529 \pm 313$  cells/mm<sup>2</sup>,  $P < 0.0001$ ).

In the current investigation there was measurably noteworthy contrast between the early and late pterygium eyes (cases) and the controls in regards to the KM ( $P > 0.001$ ). This came in concurrence with Sousa . (2017) who found similar outcomes with  $P = 0.018$ .

In the current examination there was no factually noteworthy contrast between ahead of schedule, late the pterygium eyes and the controls with respect to CV of cell size, hexagonality and CCT. This came in concurrence with Sousa . [4] who found that there was no differences were seen among cases and controls as to the mean CV of cell size, hexagonality, and focal corneal thickness.

Additionally, Hu . [8] found that The ECC hexagonality was not altogether extraordinary between the 154 pterygium eyes ( $52.8\% \pm 7.1\%$ ) and the contralateral eyes ( $51.4\% \pm 6.9\%$ ,  $P = 0.10$ ). The ECV was likewise comparable between the pterygium eyes ( $36.3\% \pm 4.2\%$ ) and the contralateral eyes ( $37.0\% \pm 4.6\%$ ,  $P = 0.15$ ).

Past research exhibited that the CCT was not influenced by the presence of pterygium [9].

In the present investigation there was measurably noteworthy contrast between the early and late pterygium eyes (cases) and the controls with respect to AST.

Studies have been directed to evaluate corneal astigmatism instigated by pterygium [10]. In another cross-sectional investigation, Mohammad-Salih . [11] considered the connection between pterygium size and corneal astigmatism in eyes with one-sided essential pterygium. As in our examination, the creators saw that the mean estimation of corneal astigmatism was fundamentally higher in the pterygium bunch than in the benchmark group ( $p < 0.001$ ). Prompted astigmatism is as a rule portrayed as "with-the-rule astigmatism" coming about because of restricted leveling of the cornea brought about by the contractile impact applied by the pterygium.

In the current investigation there was huge positive relationship between's the term of the malady and the reduction of ECD. This came in concurrence with Li . [12] who found that a positive relationship between's the term of the malady and the reduction of ECD, which could assume a job in deciding when careful intercession is required.

In the current investigation there was no critical relationship among's CV and level of pterygium. This came in concurrence with Hsu . [5] who found that there was no critical distinction in the coefficient of variety was found between eyes with pterygium and control eyes.

In the current investigation there was huge positive connection among's AST and ECD. This came in concurrence with Hsu . (2014) who discovered positive straight relationship between's an expansion in the measure of astigmatism and a diminishing in the level of ECD in pterygium-influenced eyes.

In conflict with our investigation, Li . [12] didn't discover any relationship with the astigmatism and the level of pterygium to the cornea. We guessed that the contrast between our outcomes and the consequences of Li may be come about because of the various examples.

It is broadly realized that astigmatism brought about by pterygium relates with the degree of its intrusion on the cornea. Accordingly, notwithstanding the region of cornea included, astigmatic changes might be another boundary that speaks to a decline in the corneal ECD brought about by pterygium. The outcomes were altogether corresponded and demonstrated that patients with clearly expanded astigmatism in eyes with pterygium were at high danger of endothelial cell misfortune in the cornea [13].

Irritation in the conjunctiva can be activated by antigenic incitement from natural components, for example, bright radiation and aggravations. Bright light is known to be mutagenic for P53, which prompts apoptosis in corneal endothelial cells after oxidative pressure and results in endothelial cell harm [14]. Furthermore, central changes that happen in the cornea might be related with the emission of TGF- $\beta$  and articulation of framework metalloproteinase [6]. Another chance is mechanical injury prompted by eye development with tying of the cornea in eyes with pterygium. This may bring about corneal ECD misfortune in eyes with broad pterygium inclusion.

Albeit bright radiation presentation related harm to the corneal endothelium could happen if adequate brilliant vitality arrived at this cell layer, rehashed word related bright radiation introduction through welding isn't related with any undeniable contrasts in corneal endothelial cells, ECD, or cell polymorphism. This implies a lessening in the ECD in eyes with pterygium might be brought about by pterygium intrusion, and not by bright radiation. This is steady with the finding that the nearness of pterygium can be related with profound corneal changes at the degree of the endothelium and Descemet layer, and the ECD might be diminished in influenced eyes [15].

The essential careful sign for pterygium expulsion is diminished visual sharpness, which can result from infringement of pterygium into the visual pivot, or sporadic astigmatism incited by such development. Pterygium inclusion in a bigger degree of the cornea or astigmatism expanding by 2 D or more might be related with an abatement in the corneal ECD. This finding could assume a job in the presurgical choice with respect to the utilization of mitomycin C, which may prompt endothelial cell misfortune. The clinician needs to decide when careful mediation is required.

In the present examination there was a negative noteworthy relationship between's the corneal ECD and the level of pterygium attack of the cornea ( $P > 0.001$ ). This came in concurrence with Sousa . (2017), Hsu . [5] who found a negative connection between's the corneal ECD and the level of pterygium attack of the cornea.

In conflict with our investigation, Hu . [8] found that essential 247 pterygium probably won't be related with ECD decline. This distinction may be because of adaption of the cornea endothelial cells to UV light radiation and interminable stromal aggravation in their examination.

Proof that the nearness of pterygia is related with profound corneal changes at the degree of the endothelium and Descemet layer was first depicted by Mootha . [16]. They discovered profound corneal checks in long-standing nasal pterygium in seven old patients. The creators around then guessed a lower ECD in eyes with pterygium.

In a review relative examination performed by Hsu . [5], an investigation of 90 patients with one-sided pterygium uncovered a huge between-bunch distinction, with a reduction in the corneal ECD in eyes with pterygium contribution. In our examination, the corneal ECD was additionally adversely connected with pterygium intrusion. These discoveries strengthen the proposal that pterygium intrusion applies conceivable profound layer changes in the cornea.

Diverse corneal estimations could directly affect the investigation of ECD values at the focal corneal surface [17]. The corneal boundary that has most ordinarily been evaluated for its effect on ECD is corneal thickness. In certain investigations, a lower ECD esteem was normal in more slender corneas. In our examination, there was no factually huge contrast in pachy-metric outcomes between eyes with pterygium and control eyes.

## 5. Conclusion

Pterygium may result in a decrease in the corneal ECD. Surgical intervention should be considered in patients with extensive pterygium involved the cornea or producing a significant increase in astigmatism.

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