Original Article

Outcome of Specular Microscopy in Emmetropic and Astigmatic Patients

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ABSTRACT

Objective: To assess difference in corneal parameters on specular microscopy in emmetropic and astigmatic eyes.
Study Design: Retrospective / Comparative study
Place and Duration of Study: This study was conducted at the Department of Ophthalmology, Unit-I, Dow University of Health Sciences, Karachi from January 2020 to February 2021.
Materials and Methods: The study included 112 eyes of 56 patients. 28 patients were emmetropes and 28 were astigmatic. Rexxam SPM-700 specular microscope was used. Endothelial cell count, and Central corneal thickness were measured. Differences were analyzed between the normal and astigmatic eyes.
Results: The Mean Central corneal thickness in the right eye in astigmatic patients came out to be 536.89 microns. That in the left eye was 539.61 microns. The Mean Central Corneal thickness in the right eye in non-astigmatic came out to be 553.64, whereas in the left eye it was 559 microns. The Mean Cell density in the right eye in astigmatic patients was 2060.36 per mm square. That in non-astigmatic patients it was 1942.18 per mm square. Mean Cell density in the left eye in astigmatic patients was 1974.50 per mm square and that in non-astigmatic patients was 1935.96 per mm square.
Conclusion: The Central corneal thickness in the non-astigmatic eyes on specular microscopy was found to be more as compared to the astigmatic eyes. The Cell density was more in astigmatic eyes in comparison to non-astigmatic eyes.

Key Words: Specular microscopy, astigmatism, central corneal thickness, corneal endothelium.

Citation of article: Ashraf NN, Khokar AR, Ashraf ES. Outcome of Specular Microscopy in Emmetropic and Astigmatic Patients. Med Forum 2023;34(4):33-35.

INTRODUCTION

The endothelial cells of cornea are vital for its functions and clear structure. Various investigative tools have been invented to study the cornea and its layers and cell components in detail. One such tool, the specular microscope has been particularly useful in detailed analysis of the structure of endothelium. There is adequate replication of endothelium in intrauterine life and the endothelial cell density is approximately 4,500 cells/mm square in a neonate. This replication however slows down considerably as aging occurs[1].

Other tools to examine corneal endothelium are confocal microscopes and non-contact specular microscopes. Previously contact specular microscopes were mostly used, as they caused discomfort, they were inconvenient.

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Received: November, 2022
Accepted: January, 2023
Printed: April, 2023

New non-contact versions of specular microscopes are easier to use and also provide ample magnification[2]. In our study we have analyzed corneal endothelium in normal patients and compared it to the findings in astigmatic patients on specular microscopy.

Central corneal thickness and endothelial cell count are imperative components of evaluation by specular microscopy. The basic principle of image formation in specular microscope is that light passes into the cornea at the same angle as the angle at which it is reflected to the observer's eye[3]. There are many disease conditions that can alter the morphology of cornea e.g. Fuch's endoithelial dystrophy, uveitis, glaucoma .Also changes are produced after surgical procedures of eye and contact lens use. Analysis of the corneal endothelium helps in devising management strategies[5]. Confocal microscopy is a technique which enables us to study corneal nerves. This can help in analyzing the role of corneal nerves in healing of corneal lesions and maintaining homeostasis[4].

MATERIALS AND METHODS

This retrospective study was conducted at Diagnostic section of Trauma centre, Eye unit 1, Dow University of health sciences. It spanned a time period of one year from January 2020 to February 2021. 112 eyes of 56 patients were included. First 28 Patients that were emmetropes and consecutive28 that were astigmatic were part of the study. These were selected from the ophthalmology out-patient department of Civil hospital

Karachi. Those coming for refraction to the outpatient department were screened for emmetropic and astigmatic patients.

They were then sent to the diagnostic department of ophthalmology in trauma centre for specular microscopy. Rexxam SPM-700 specular microscope was used. Endothelial cell count, cell, numbers, Coefficient of variation and Central corneal thickness were measured. Data was transferred to SPSS 23 and differences were analyzed between the normal and astigmatic eyes.

Astigmatic patients, emmetropes as controls were included in the study.

Postoperative patients of cataract surgery, postoperative patients of corneal grafting, patients of corneal trauma were not included in the study.

RESULTS

The mean age group in our study comprised of those of 31.18 age with a standard deviation of 11.029 in the non-astigmatic group. That in the non-astigmatic group was 29.25 with a standard deviation of 11.391.

The Central corneal thickness (CCT) in the right eye in the astigmatic eyes was:

> Mean CCT 536.89 microns, maximum CCT 598 microns and minimum 421 microns. The standard deviation was 40.803.

The CCT in the right eye of non- astigmatic patients was:

> Mean CCT 553.64 microns, maximum CCT 633 microns and minimum was 412 microns. The standard deviation was 43.893.

The Central corneal thickness in the left eye in the astigmatic eyes was:

> Mean CCT 539.61 microns, maximum CCT 600 microns and minimum 433 microns. The standard deviation was 37.999.

The Central corneal thickness in the left eye in non-astigmatic eyes was:

> Mean CCT 559 microns, maximum CCT 627 microns and minimum 430 microns. The standard deviation was 42.567.

The Cell density in the right eye in astigmatic patients was:

> Mean Cell Density 2060.36 per mm square, maximum cell density 2999 per mm square and minimum was 1776 per mm square.

The Cell density in the right eye in non-astigmatic patients was:

> Mean Cell Density 1942.18 per mm square, maximum cell density 2301 per mm square and minimum was 1711 per mm square.

The Cell density in the left eye in astigmatic patients was:

> Mean Cell Density 1974.50 per mm square, maximum cell density 2776 per mm square and minimum was 1039 per mm square.

The Cell density in the left eye in non-astigmatic patients was: Mean Cell Density 1935.96 per mm square, maximum cell density 2299 per mm square and minimum was 1759 per mm square.

Table No.1: Comparison of mean Cell Density and CCT

	Astigmatic		Non astigmatic	
	Male	Female	Male	Female
	Mean	Mean	Mean	Mean
OD cell density	2103.84	1957.44	1965.25	1924.88
OD CCT	537.74	535.11	546.92	558.50
OS cell density	2007.21	1905.44	1964.42	1914.63
OS CCT	542.53	533.44	554.75	562.38
Age	30.84	25.89	32.17	30.44

DISCUSSION

In the original study conducted in our department we measured the cell density and central corneal thickness of normal and astigmatic eyes on specular microscopy and compared them. We didn't find a similar study in local and international literature search, other parameters have been observed in studies like contact lens use, LASIK and association with diseases but effect of astigmatism on corneal cell density and central thickness is a first initiated by us. Normal endothelial cells are hexagon shaped. In order to observe maintenance of the vital corneal endothelial functions, it is essential that the posterior surface of cornea is intact[5]. Each year between 100 to 150 endothelial cells die causing defects in the layer and affect the functions. These defects are covered by the ability of endothelial cells to change their shape and join together, which is known as polymegethism[5]. The coefficient of variation CV, determines how much is the polymegethism. Normal CV being in the range of 0.22 to 0.31[6]. The normal endothelial cell density (ECD) required for normal functioning of cornea is approximately 300 to 500 cell / mm2[7]. Change in the normal six sided shape of corneal endothelial cells is called pleomorphism. This can be caused by use of contact lenses, ocular surface disorders and is also age related[8]. This becomes clinically significant when normal shape is altered so that less than 50% conform to it.[9]

In a research done in Pune, India by Magdum, Mutha and Maheshgauri in 2013, effect of soft contact lenses wear was observed on the corneal endothelium. Central corneal thickness, endothelial cell density and cellular shape were noted. Central corneal thickness of those using contact lens was increased. This however didn't correlate with any decrease in vision (3). In a study by A Lopez –Miguel et.al, central corneal thickness readings were taken on Orb scan and on specular microscopy of myopic patients. Difference was observed in the readings of both methods.[10] In another study central corneal thickness was measured by four methods in patients of keratoconus; specular microscopy, rotating Scheimpflug camera, optical low coherence reflectometry and ultrasonic pachymetry. Measurements with Scheimpflug camera and pachymetry were similar but on specular microscopy ,thickness of central cornea was more and decreased when measured with reflectometry-[11] The effect of

diabetes mellitus and smoking was observed in another study and they were seen to cause a decrease in the endothelial cells[12]. In our study central corneal thickness in non-astigmatic patients came out to be more than in astigmatic patients.

As the person ages, endothelial cell count decreases, it also decreases after injury because the endothelium is incapable of restoring its cells[13]. This is important when planning surgical manipulations on the anterior segment and affects the decision of which type of surgical method will be used. In diabetic patients we also have to consider the endothelial cell counts before surgery, as they may be already low and further decrease after surgical manipulation. This may lead to a need for corneal transplantation. Also during preparation of graft for DMEK, if the donor is diabetic, there are greater chances of problems during the procedure.[14]

In our study mean endothelial cell density came out to be less in emmetropes as compared to that in astigmatic patients.

The Cell density in the left eye in astigmatic patients was:

Mean Cell Density 1974.50 per mm square, maximum cell density 2776 per mm square and minimum was 1039 per mm square.

The Cell density in the left eye in non-astigmatic patients was: Mean Cell Density 1935.96 per mm square, maximum cell density 2299 per mm square and minimum was 1759 per mm square.

CONCLUSION

The Central corneal thickness in the non-astigmatic eyes on specular microscopy was found to be more as compared to the astigmatic eyes.

The Cell density was more in astigmatic eyes in comparison to non-astigmatic eyes.

This is an ongoing study in the Pakistani population and sample size will be further expanded and other parameters will also be taken into consideration in future studies.

Acknowledgement: Muhammad Ibrahim, BS (Hons) Clinical ophthalmology Technology (DUHS) for data collection for our study.

Author's Contribution:

Concept & Design of Study:	Nargis Nizam Ashraf
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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