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Effect of corneal thickness between different degrees of refractive errors

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ABSTRACT

Background and Objectives: Eyes are the most important organ of human body which is responsible for the vision. enable individual to see, the ability to perceive image which provides information about vision, and enables many photo response functions that are not dependent on vision. The aim of this study is to compare the effect of central corneal thickness on myopic, hyperopic, astigmatic and emmetropes of different age groups. The study involves 60 subjects i.e myopia more than (<-8.0 D), hyperopia more than (< +4.0 D), and astigmatism more than (<-3 D).

METHODOLOGY: TThe central corneal thickness was measured with pachymeter and keratometer than all the data entered in Microsoft excel for statistical analysis. Study design will be descriptive cross sectional study design and use proposive sampling technique. Age group will be taken between 15 to 30 years. Exclusion criteria are keratoconus,mentally retared patients, nystagmus, corneal wrapage and wrinkling. Duration of study includes Oct 2020 to May 2021.This study is conducted in Madinah teaching Hospital and Allied Hospital FSD.

RESULTS: There was no significant difference between the myopic and hyperopic and emmetropic eyes of different age groups.

CONCLUSION: We assume that there is no correlation was found of central corneal thickness on different types of refractive error.

KEYWORDS: Degrees of astigmatism, LASIK and LASEK surgery, Refractive errors,

INTRODUCTION

The corneal refractive index approximately 1.376 D. Light of rays coming from cornea in the water like substance aqueous humor that has an refractive index of almost 1.336 D, so refracting process take place at level of interface of cornea and air(1).

The cells of the retina are works in the sunlight vision that enable an individual to see color in day time. The three different types of cones, each responding on different wavelength of light: blue, red, green. The cone enables the images in color and detail. Rods are the cells of retina which are responsible for the vision at night time. Retina is very light sensitive but does not show any sensitivity to color. The cones not perform their function in darkness at all. The lens is a clear just light mirror and biconvex part that enables the light converge on retina. It helps in elasticity of lens structure and contains two groups of muscles like sphincter and dilated muscles known as ciliary muscle. These muscles change the shape of lens and enable an individual to converge on different target positioned at various distances. (2) The converging power of lens is uncontrolled reflexive response which is not control by brain of human body. Focused image that is formed on retina, which converts light into nerve impulses. Through the optic nerve cells, nerve impulses may transmit this picture information to the brain (3).

Cornea is main refractive part of eye it provides about 2/3rd of refraction. In normal cornea, CCT varies. An average central corneal thickness is between 540 micro meter and 560 micro meter. Cornea is made of different kind of layers. They contribute in the thickness of cornea. Corneal epithelium total thickness measures about 50 to 60 µm. Bowman's layer measures about 8 to 12 µm in thickness. Stroma comprises most of the part of cornea.(4) Decrement's membrane measures about 10µm in thickness. A very thick

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cornea is 565 µm or greater, with thickercornea's higher than 600 µm. Corneal thickness increases with time because both the degree, symmetry and enantiomorphism automatically decreases. Corneal topography: A technique to monitor and determine the change that occurs to shape and structure of cornea of eye. (5)

Corneal thickness of 485 may beconsidered as normal, which was earlier thought to be a cut off for LASIK, you will be considered suitable for LASIK only in the absence of keratoconus, skew deviation, or readings of keratometer higher than 47.00 Diopters.

People with thin corneas, or those whose corneas are not shaped normally, are not good LASIK candidates. The same holds true for anyone with an especially strong eyeglass or contact lens prescription. That is because the LASIK procedure would remove too much of the cornea's thickness for vision correction (6-10).

The corneal consist of five layers, each layer of has important functions. Following layers are:

Topography can assist and recognize patients with irregular corneal surface related to ocular disease. Corneal topography provides a detailed, visual description and knowledge of the structure and power of the cornea. This type of information helps practioner with very minor details regarding the the corneal surface condition. These minor/fine details are useful to diagnose, monitor, and treat various eye conditions like corneal thinning, wrapage. Corneal topography is known a sphotokeratoscopy or videokeratography, is non-invasive painless imaging technique for plotting the anterior curvature of the cornea, the outer structure of the eye. This device will not touch your eye during the measurement. The practice of graphic delineation in detail usually on maps of natural and man-made features of a place or region especially in a way to show their relative positions and elevation

There are mainly two kinds of keratometers which is known as single position Helmholtz keratometers, which is more common and is able to adjust image size; and Javal-Schiotzkeratometers, two-position machines that able to adjust size of an object (11-14).

METHODOLOGY

Complete history of patients was taken like which type of refractive error patient have such as near sightedness or far sightedness, than clinically examine the patient with auto-refractometer and assess the degree of refractive errors they have like mild, moderate severe. Than readings were recorded on self structured performa, after note down the readings topography was performed. Procedure of topography involves the is patient to sit on the stool in front of the lighted bowl so topography can be performed .This lighted bowl contains the pattern of rings and rest patients head against the bar. During topography ask the patient to focus and place the chin on the chin rest and forehead against the forehead rest. Adjust the knob that is located on the topographic machine. Assure that patient open his eyes adequately. The video camera is hooked up to a computer that generates a topographic map of corneal curvature based on the measure distance between the rings reflected from the cornea. The accuracy of corneal curvature data processing depends a lot on the software editing features.Corneal topography utilizes 31 projected rings providing 7000 data points. The cornea coverge is 0.02-11.00mm with an accuracy of 0.10 Diopters .A 3-D corneal topography with enhanced resolution is formed.

Corneal topography provides intuitive maps and numerical data for the corneal surface and provides neural network assisted detection of corneal thickness and pathology. After analysis, the graphic picture of patient's topography is displayed in various forms. A series of points was collected and a color coded image of corneal shape was generated on computer screen Colour coded counter maps of the cornea are the most useful and most commonly used display formation. While interpreting colour coded counter maps of the cornea following points should be considerd.

The steep parts of the cornea are represented by hot colours such as red and its many tints. The flat parts of the cornea are represented by cool colours such as blue and its many tints. As a result, the colours red, orange, yellow, green, purple, and blue signify decreasing refractive power. The colour intensity is relative, which means that a 45 D region is less red than a 46 D area. it is very important to know about the scale which is used in corneal topography before interpreting a color coded map. The normal cornea flattened progressively from center to periphery by 2-4 diopters with the nasal area flattening more than the temporal area. The topographic pattern of the two corneas of an individual often shows mirror image symmetry, and small variations in pattern are unique for the individual. After comparing or analyzing both corneal pictures assess the central and peripheral corneal thickness Readings was recorded and then analyzed the thickness of cornea in different degrees of myopia, hypermetropia and astigmatism.

This cross sectional descriptive is carried out in Madinah Teaching Hospital Faisalabad. Patient with different refractive errors (Mild moderate severe) was

analyzed.

60 sample size was selected. Purposive sampling technique is used. Patient with nystagmus and kertoconus were excluded.

RESULTS

Total sample of 120 eyes were taken having different degrees of refractive errors at Madinah Teaching hospital Faisalabad. Refractive errors divided into three categories such as myopia,hypermetropia and astigmatism. Each refractive error is further divided into mild, moderate and severe.

Table 1:Distribution of central corneal thickness in myopes.

Corneal thickness of myopia		central corneal thickness			Total
		450-500	500-550	550-600	
degree of myopia	Mild (2-4)	12	10	0	22
	Moderate (4-8)	0	1	10	11
	Severe (<8)	0	0	7	7
Total		12	11	17	40

Table 2: Distribution of peripheral corneal thickness in myopes.

Peripheral corneal thickness myopia		periphral corneal thickness				Total
		550-600	600-650	650-700	< 700	
degree of myopia	Mild (2-4)	13	1	0	8	22
	Moderate (4-8)	0	1	3	7	11
	Severe (<8)	0	0	4	3	7
Total		13	2	7	18	40

Table 3:Distribution of central corneal thickness in hyperopes.

central corneal thickness of hyperopia		central corneal thickness			Total
		450-500	500-550	550-600	
degree of hyper-metropia	Mild (<2D)	9	6	3	18
	Moderate (2.25-5.00)	0	6	4	10
	Severe (<5.50)	0	5	7	12
Total		9	17	14	40

Table 4: Distribution of peripheral corneal thickness in hyperopes.

Peripheral corneal thickness of hypermetropia		periphral corneal thickness				Total
		550-600	600-650	650-700	above 700	
degree of hyper metropia	Mild (<2D)	9	6	3	0	18
	Moderate (2.25-5.00)	0	0	4	6	10
	Severe (<5.50)	0	3	2	7	12
Total		9	9	9	13	40

Table 5: Distribution of central corneal thickness

Central corneal thickness of astigmatism		central corneal thickness			Total
		450-500	500-550	550-600	
degree of astigmatism	Mild (0.6-2)	2	9	3	14
	Moderate (2-4)	0	2	10	12
	Severe (<4)	0	4	10	14
Total		2	15	23	40

Table 6: Distribution of peripheral corneal thickness.

Peripheral corneal thickness of astigmatism		peripheral corneal thickness				Total
		550-600	600-650	650-700	above 700	
degree of astigmatism	Mild (0.6-2)	0	2	3	9	14
	Moderate (2-4)	5	2	0	5	12
	severe(<4)	0	0	4	10	14
Total		5	4	7	24	40

DISCUSSION

The cornea is the most important refractive component of the eye, accounting for around two-thirds of optical refraction. The Central Corneal Thickness (CCT) of a healthy cornea ranges from 0.49 mm to 0.57 mm. In glaucoma, CCT plays a critical function.The real Intraocular Pressure (IOP) is underestimated when the average CCT is thin, while the true IOP is overestimated when the average CCT is thick. Patients with uneven corneal shape due to ocular surface disease might benefit from topography. Corneal topography creates a precise visual representation of the cornea's shape and power. This form of examination gives practitioners with extremely precise details on the state of the cornea

l surface. These details are utilised to diagnose, track, and treat a variety of eye diseases such as corneal thinning, wrapage, and so on. During the measurement, this gadget will not come into contact with your eye. The art or practise of graphically delineating natural and man-made features of a location or region in detail, generally on maps or charts, in order to indicate their relative positions and height (15)

The corneal topography apparatus comprises of a computer connected to an illuminated bowl with a ring pattern. The patient sits in front of the bowl with his or her head placed against a bar as a series of data points are collected during a diagnostic test.

Corneal topography generates understandable maps and numerical data for the corneal surface, as well as neural network-assisted thickness and disease identification. The graphic representation of the patient's topography is shown in several formats after analysis. (16-17) On a computer screen, a colour coded picture of corneal form was created from a sequence of points. The thickness of the cornea in myopia, hypermetropia, and astigmatism was meas At Ibn Al-Haitham Teaching Eye Hospital a cross sectional study was carried. A total of 418 eyes out of 209 healthy persons among the age range from 20 - 75 years were considered. Ultrasound pachymeter were used to measure CCT. Refraction was measured using an auto-refractor and confirmed by trial lenses and retinoscopy to calculate the spherical equivalent. An auto-refractokeratometer used to measure corneal curvature to calculate the average corneal curvature (AVK).The patients were divided into five age groups (10 years interval). The patients were classified according to refraction into three major groups: emmetropia (SE +0.25D to −0.25D), myopia (SE <−0.25D), and hypermetropia (SE >+0.25D). Then further sub classification of myopia into three groups: mild myopia (myopia <−3D), moderate myopia (myopia from −3D to <−6D), and severe myopia (myopia = or >−6D). Hypermetropia sub classified into two groups: mild–moderate hypermetropia (<+3D) and moderate–severe hypermetropia (≥ +3D).And mean CCT was 543.95±32.58 micrometer was the result of this study with a range from 422 to 636 micrometer. CCT was not affected by gender. CCT significantly negatively correlated with age and AVK. CCT significantly positively correlated with the spherical equivalence.Statistical analysis was performed using SPSS version 20. Discrete variables presented as numbers and percentages and continuous variables presented as mean ± standard deviation. Pearson's correlation coefficient was used to test the correlations. Independent sample t-test was used to test the mean difference between two independent samples, and analysis of variance test with post hoc Tukey's test for >2 independent samples; P-value of <0.05 was considered statistically significant (18).

Same relationship reported by francis who discovered that CCT has relation with refractive error and myopes have the thinnest CCT (449.65±39.27 micrometer), followed by emmetropes (542.66±46.35 micrometer) and hyperopes (557.67±41.83 micrometer). This is compatible with the findings of Nemesure et al who discovered that CCT was direct in relation with refractive error. No significant difference in the mean CCT was found in this study when the myopia subclassifications were compared (18-20).

Other studies have opposite results. Price et al found no relation between CCT and refraction. Similarly, Ortiz et al, in 175 myopic eyes found the relationship between the CCT and the degree of myopia. Among the myopic groups in their study, they did not find statistically important differences in CCT. In contact no wearers and wearers, Liu and Pflugfelder found no relationship between CCT and the degree of myopia in corneal thickness. Among emmetropes and myopes, Pederson et al come to an end that there was no statistical difference in CCT (21-22).

CONCLUSION

The result of this research shows that is strong relation between different degree of refractive errors such as myopia hypermetropia and astigmatism and it is necessary to check the effect of corneal thickness before prior to any kind of refractive surgery such as LASIK and LASE K because it involves corneal ablation which ultimately leads to changes in corneal thickness.

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