

# Corneal Endothelial Cell Changes with the Age in Normal Iraqi Population Using Em-3000 Tomey Specular Microscope

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## Abstract

"Background: The cornea consists of the following layers, each of which is critical to normal function: 1. Epithelium. 2. Bowman layer. 3. Stroma. 4. Descemnts membrane. 5. Endothelium. The corneal endothelium is composed of a single layer, mostly of hexagonal cells. Approximately 500,000 cells are present, with a density of about 3000 cells/mm<sup>2</sup>. The size, shape, and morphology of the endothelial cells can be observed by specular microscopy at the slit lamp".

"Patients and methods: 400 eyes of 200 patients who attended the ophthalmology department in Al-Zahraa teaching hospital were included in the study. Patients were grouped into five groups according to age: [G1] less than 20 years. [G2] 20-30 years. [G3] 31-40 years. [G4] 41-50 years. [G5] more than 50 years so, we have five age groups.

Patients with history of intraocular surgery or ocular trauma, increased intraocular pressure, uveitis, corneal opacity, evidence of endothelial dystrophy on slit-lamp bio microscopy, diabetes mellitus and contact lens wearer were excluded from the study. After routine ophthalmic examination, all patients underwent specular microscopy using a noncontact specular microscopy [EM-3000 tomey specular microscope]".

"Results: The ECD of population  $2718.34 \pm 320.38$  cell/mm<sup>2</sup> [range, 1551 to 3376]. The Avg. / $\mu\text{m}^2$   $370.03 \pm 46.99$  [range, 232 to 566]. The C.V.  $39.3 \pm 7.66$  [range, 25 to 73] and the hexagonal cell per cent  $0.507 \pm 0.112$  [range 0.00 to 0.91]. There were no statistically significant differences in ECD, Avg., C.V. and hexagonal cell per cent between right and left eyes [P= 0.846, P=0.951, P= 0.290, P= 0.419 respectively]. Also there were no statistically significant differences in ECD, Avg., C.V. and hexagonal cell per cent between genders [P= 0.483, P= 0.237, P= 0.258 and P= 0.439 respectively]. There were a statistical significant decrease in ECD and hexagonal cell per cent with increase in the age [r= -0.84 and r= -0.72 respectively]. The rate of cell loss was 0.8% per year".

Aim of the study: To evaluate the corneal endothelial layer changes in normal Iraqi population with age by using EM-3000 tomey specular microscope.

**Keywords:** cell, IRAQI POPULATION, TOMEY SPECULER, CORNEAL ENDOTHELIAL

## 1. Introduction

The cornea consists of the following layers, each of which is critical to normal function:

1. Epithelium.
2. Bowman layer.
3. Stroma.
4. Descemnts membrane.
5. Endothelium. [1]

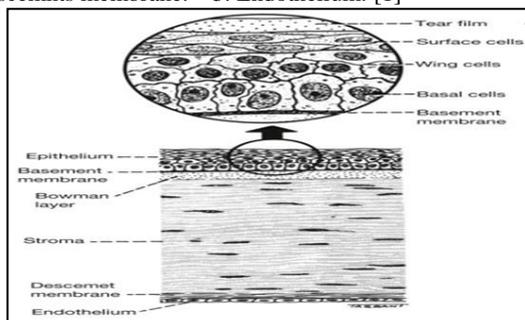


Fig. 1: corneal layers [2].

## 2. The Corneal Endothelium

### 2.1 Embryology:

In early embryogenesis, the posterior cornea is lined with a neural crest-derived monolayer of orderly arranged cuboidal cells. By the 78mm stage, the cells become flattened and tightly abut one another. At this stage, immediately anterior to the flattened layer is a discontinuous, homogeneous a cellular layer, which in time becomes Descemet's membrane. By the 120mm and 165mm stages of development, the endothelial monolayer is uniform in thickness, spans the entire posterior corneal surface, and fuses with the cells of the trabecular meshwork. Similarly, Descemet's membrane becomes continuous and uniform, fusing peripherally with the trabecular beams. The fusion site, known as Schwalbe's line, is a gonioscopic landmark that defines the end of Descemet's membrane and the start of the trabecular meshwork. At birth, the endothelium is approximately 10  $\mu\text{m}$  thick [3]

### 2.2 Anatomy and physiology:

The corneal endothelium is composed of a single layer, mostly of hexagonal cells. Approximately 500,000 cells are present, with a density of about 3000 cells/mm<sup>2</sup>[4]. The size, shape, and morphology of the endothelial cells can be observed by specular microscopy at the slit lamp. The apical surfaces of these cells face the anterior chamber; their basal surfaces abut Descemet's membrane.

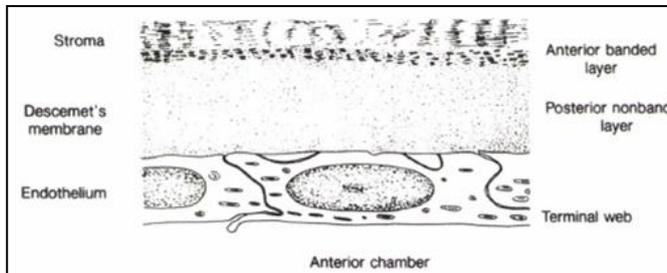


Fig. 3: Corneal endothelium and decrements membrane.

Typically, young endothelial cells have a large nucleus and abundant mitochondria. The active transport of ions by these cells leads to the transfer of water from the corneal stroma and the maintenance of stromal deturgescence and transparency. Adjacent endothelial cells interdigitate in a complex way and form a variety of adherent junctions, but desmosomes are never seen between normal cells. In cross section, pinocytotic vesicles and a *terminal web* [a meshwork of fine fibrils that increases the density of the cytoplasm] can be seen toward the apical surface of the cells. *Junctional complexes* are present at the overlapping apicolateral boundaries of contiguous cells. They form a significant but lesser barrier to ion and water flow than the tight junctions of the epithelium. Corneal endothelial cells are normally lost throughout life at an estimated rate of 0.6% per year, although higher rates of cell loss occur in the settings of trauma [both surgical and nonsurgical] and primary endotheliopathies.

Endothelial cell dysfunction and loss-through surgical injury, inflammation, or inherited disease [e.g., Fuchs endothelial dystrophy] may cause endothelial de-compensation, stromal edema, and visual failure as shown in [fig. 3]. In humans, endothelial mitosis is limited, and destruction of cells causes cell density to decrease and residual cells to spread and enlarge-[5][6].

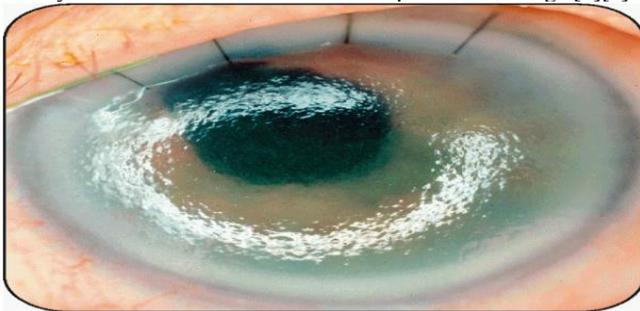


Fig.4: Hydrus, CEC injury after cataract surgery[7].

Progressive corneal edema developing during the first few postnatal days, accompanied by vertical or oblique posterior striae, may be caused by birth trauma. Ruptures occur in Descemet's membrane and the endothelium. Healing usually takes place, leaving a hypertrophic ridge of Descemet's membrane. The edema may or may not clear; if it does clear, the cornea can again become edematous at any time later in life. High astigmatism and amblyopia may be associated[8].

The corneal endothelial cell layer cannot regenerate after injury. Repair processes involve enlargement of residual cells, amitotic nucleus division, migration, and the rosette phenomenon, which leads to a reduction in cell density, a proportional increase in mean cell size, and disruption of the normal hexagonal cell pattern.

**Corneal endothelium morphology status is usually described by three aspects:-**

• **Endothelial cell density [ECD]:** is the number of corneal endothelial cells per square millimeter. Normally exceeds 3500 cells/mm<sup>2</sup> in children and gradually declines with age to about 2000 cells/mm<sup>2</sup> in older eyes. An average value for adults is 2400 cells/mm<sup>2</sup> [1500-3500], with a mean cell area of 150-350µm<sup>2</sup>.

• **Coefficient of variation [C.V.]:** is the mean cell area divided by standard deviation of the mean cell area, a unit less number normally less than 0.30 and greater than 0.40 is considered significant. Polymegethism is increased variation in individual cell areas.

• **Percentage of six-sided or hexagonal cells [% Hex]:** ideally should approach 100%. Lower percentage indicates a diminishing state of health of the endothelium. Polymorphism is increased variability in cell shape-[9].

Corneal hydration depends on the following factors:-

- Stromal swelling pressure.
- Barrier function of the epithelium and endothelium.
- The endothelial pump.
- Evaporation from the corneal surface.
- Intraocular pressure.

The operate of the epithelium becomes compromised once the cec density falls beneath a necessary threshold vary of five hundred to 1 thousand cells/mm<sup>2</sup>. This outcomes in stromal puffiness, membrane vaporization, loss of sight, and will finally lead to membrane sightlessness. In such instances, the most effective different left to repair ingenious and discerning is to update the ineffective epithelium with healthful, purposeful donor membrane epithelium through membrane transplantation[10].

normal membrane association represents a balance between the leak throughout the epithelium and also the motion of water through the metabolic pump. As a minimum three particle shipping pumps were diagnosed. they are as follows: atomic number 11-potassium pump that moves atomic number 11 particle out of the cells and depends at the na/okay-atpase; atomic number 11 atomic number 1 pump that actions sodium ions into the cells; hydrogen carbonate pump that transports hydrogen carbonate ions from the tissue layer into the liquid body substance. These particle shipping pumps paintings jointly to take care of the Corneal transparency whereas epithelium perform fails, aqueous humour diffuses into the membrane stoma and produces membrane swelling. so membrane association manage is that the most vital index of membrane epithelium mobile characteristic.

Recently, it's been expressed that ribonucleic acid and proteins of human animal tissue glycoprotein [MUC1], that is a glycoprotein found in several human cells, is expressed among the human membrane epithelium. This discloses that different mechanisms, any to the pumps on the membrane epithelium, could also be concerned in maintaining the transparency of the membrane and dominant the stoma hydration[11].

### 2.3 parts touching membrane epithelial tissue morphology

polymegethism and pleomorphism were 1st discovered on corneas of bit lens wearers. equally to the touch lens wear, some various factors have additionally been studied and determined related to membrane epithelial tissue morphology changes. beneath could be a outline of the factors that are verified to steer the membrane epithelial tissue morphology:

#### 2.3.1 lens system wear.

Pmma lens placed on or soft lens wear are shown to motive epithelial tissue cell density lower, ploymegethism, and pleomorphism [12][13].

In most analysis of membrane epithelial tissue modifications caused by approach of bit lens wear, epithelial tissue cell density lower became not set while polymegethism or pleomorphosim were determined[14].

At the alternative, terribly latest analysis set that there is also epithelial tissue mobile density decrease additional to polymegethism and pleomorphism in while lens system wearers. an improved observe records from these analysis well-known shows that the excellence within the effects of these analysis could be as a results of varied elements:

- the pattern size: analysis that determined epithelial tissue cellular density changes have a terribly larger pattern size than the studies that failed to find epithelial tissue mobile density changes.
- experimental instruments and ikon analysis methods: earlier studies that failed to find epithelial tissue mobile density decreases primarily used guide cellular rely at an equivalent time as terribly latest studies that found epithelial tissue cell density decreases usually used semi-automated analysis.
- years of bit lens wear: subjects in later analysis in wellknown have a extended soft lens placed on records than subjects within the earlier analysis.
- type of bit lens: subjects within the analysis of lens system precipitated membrane morphology trade accommodates lens system development, from pmma on the terribly beginning, to rgp lenses, to soft lenses with low chemical element transmission, to low tide content material when that tender lenses with high chemical element transmission and high water content, and disposable sleek lenses. variations up-to-date lens kind will be another element that cause the particular outcomes[15].

### 2.3.2. Age

one or two of issue of tissue layer epithelium cell morphology has been situated to be related to age. Bourne et al. during a ten-12 months longitudinal take a glance at of forty 2 person topics found that there was zero.6%  $\pm$  zero.5% tissue layer epithelium mobile loss per yr[16].

The share of polygon cells conjointly decreases as a operate getting on.

different researchers conjointly discovered that obtaining older is related to tissue layer epithelium morphology. as a result of age is expounded to tissue layer epithelium morphology, there ought to be interactions among age and different factors inclusive of lens system placed on in inflicting tissue layer epithelium cellular morphology exchange.

Researchers have to be compelled to typically retrieve age as a unsupportive facet while coming up with studies on tissue layer epithelium morphology alternate[17].

### 2.3.3. Intraocular surgical procedure

several analysis have situated that cataract surgery and lens implantation will motive tissue layer epithelium morphology trade[18]. despite the fact that cataract surgical procedure has been advanced greatly and fashionable phacoemulsification surgery has been wide used, the tissue layer epithelium cell morphology alternate might want to still be found, and in normal, there could also be a lot of exchange in epithelium cellular density than in constant of version and share of polygon cells .

different ocular surgical procedures, which has eye disease evacuation and surgical procedure contraptions sterilized by victimisation plasma fuel also can purpose tissue layer epithelium mobile damage[19][20].

### 2.3.4. Refractive surgery

optical device in place keratomileusis [LASIK] has been accustomed correct shortsightedness. Acute tissue layer epithelium morphology changes like pleomorphism and loss of hexagonality are situated once optical device in place keratomileusis while future tissue layer epithelium morphology changes haven't been discovered[21].

### 2.3.5 tissue layer epithelium problems

some tissue layer epithelium problems, inclusive of fuchs' epithelium dystrophy, proliferative endotheliopathies, and posterior polymorphous dystrophy, were associated with alternate in tissue layer epithelium morphology[22].

### 2.3.6 eye disorder

analysis have determined eye sicknesses inclusive of eye disease, and eye trauma will cause tissue layer epithelium morphology trade. In eye disease sufferers, there ar considerably less tissue layer epithelium cells than management topics[23].

### 2.3.7 general illness

some general diseases at the side of diabetes and chronic nephrosis will cause tissue layer epithelium mobile morphology modifications[24].

## 2.4 the connection between morphological exchange and purposeful alternate:

on the far side studies have shown that tissue layer epithelium morphology is that the fantabulous indicator of tissue layer epithelium stress or instability. epithelium morphology has been confirmed to be the most sensitive degree of tissue layer epithelium stability in pseudophakic bullous keratopathy, diabetes, and build contact with lens sporting. tissue layer epithelium morphology changes ar the primary signs of epithelium pressure. But, now not all three aspects of tissue layer epithelium morphology alternate reply to pressure within constant manner, because of the actual fact there ar analysis that discovered p.c of polygon cells and constant of variant modifications however while not epithelium cell density change[25][26].

purposeful changes typically associate with morphological changes within the human frame. Consequently, it's miles possible that once tissue layer epithelium cell morphological abnormalities [endothelial cell density decrease, polymegethism, and pleomorphism] are often determined, tissue layer helpful abnormalities [corneal swelling] could also be measured too. moreover, a definite geological dating might exist among the tissue layer epithelium morphology and characteristic, i.E. High sensible stage corresponds to excessive tissue layer epithelium cell density and low purposeful level corresponds to low tissue layer epithelium cellular density. If this relationship might be determined, the extent of tissue layer epithelium mobile density, polymegethism, and pleomorphism, which can be directly concentrated from the tissue layer epithelium measure, would provide an excellent deal bigger records regarding the purposeful level of the tissue layer epithelium for the scientific staff, specifically whereas the patient is older and ocular surgery is being taken into thought.

For sufferers UN agency have epithelium morphological abnormalities that ar ensuing from lengthy-term lens system placed on, diabetes, or tissue layer epithelium disorders, the underlying tissue layer feature abnormalities also can exist already. but because of the actual fact final tissue layer epithelium or the epithelium reserve will still operate to keep up the transparency of the membrane, no everyday medical checkup inclusive of slit lamp examination or vision check ought to notice any purposeful abnormality of the membrane. Potential tissue layer decompensation exists once triggered by stresses at the side of cataract surgical procedure or different ocular surgery. Consequently completely different tissue Layer epithelial tissue feature analysis approaches ar terribly crucial.

Sufferers who've low membrane epithelium cellular density ar impressive on a number of factors:

- polygenic disorder and excessive ametropia patients have a stronger likelihood of developing cataracts.
- cataract surgery turned into determined to be associated with excessive ametropia and diabetes[27].

- a number of ametropia subjects who're former bit lens wearers could to boot opt for different ways of vision correction that embrace implantable bit lens [ICL] or intrastromal membrane ring segments [INTACS].

## 2.5. measurement of membrane epithelium morphology

membrane epithelium morphology could also be measured with distinctive gadgets, together with contact reflective microscopes, non-contact reflective microscopes, and confocal microscopes. Early variations of reflective microscopes are bit types that needed the water immersion objective lens and dipping cone to lie straight off at the membrane surface to get higher magnification and better resolution. Consequently, sufferers' tolerance become a problem while taking a size. With enhancements in era, contemporary variations of the huge-discipline reflective microscopes ar non-touch; they are further affected person friendly and may acquire equally excessive magnification. Extensive-field reflective magnifier has been extensively employed in studies of membrane epithelium cellular changes when lens system placed on, cataract surgery, or different membrane or intraocular surgery, and eye disease[28][29]

however, there ar however a number of limitations in mistreatment reflective research to seize

Corneal epithelium pictures: the membrane epithelium snap shots of sufferers with Emil Klaus Julius Fuchs 'dystrophy have several dark areas wherever no cells may be recognized on the images taken by method of reflective research, but, confocal research will overcome this problem and notice the cells[30].

In confocal research dimension of the membrane, lightweight is shipped from Associate in Nursing illumination supply when that passes through a slit Associate in Nursingingd is targeted on a spot among the membrane with the help of an goal lens. gentle meditated lower back from the membrane is filtered by another slit that blocks the out-of-attention lightweight. A detector then gets the targeted gentle. as a result of this optical layout, the image taken by mistreatment confocal research encompasses a superior call than reflective research. However, confocal microscopes activity of the membrane epithelium mobile imply contact between the instrument so the{and also the} cornea; therefore, topical anaesthesia is required.

These days, laser-based interferometric techniques to objectively live intraocular distances in vivo were advanced. These cover twin-beam partial coherence interferometry[31][32] low-coherence reflectometry [OLCR],[33][34] and optical coherence pictorial representation [OCT], which will degree distances among systems of the anterior and posterior eye segments. the employment of the Gregorian calendar month era, specific move-sectional morphometric measurements of the membrane in experimental settings are viable[35][36]. Modifications of the Gregorian calendar month machine change the noncontact illustration of the anterior eye section and membrane the usage of a slit lamp[37][38]. The olcr makes use of Associate in Nursinging optical technique to degree the membrane thickness on the premise of the temporal separation of a low-coherent infrared ray contemplated from the anterior and posterior surfaces of the membrane [39].

The orbscan ii topography convenience [Orbtek, Bausch & Lomb Surgical] makes use of the lateral displacement of two slit beams and a video camera. It takes varied snap shots of varied membrane sections for three-dimensional reconstruction of membrane tissue, mapping the anterior and posterior membrane surfaces also because the entire membrane thickness.

The pentacam [Oculus, Inc.], a rotating scheinpflug digicam, turned into delivered to the world marketplace, providing an extra noninvasive thanks to have a glance at the anterior section. The scheinpflug precept has been established among the analysis of lens thickness and densitometry[40] membrane transparency, thickness, and curvature [41] and anterior chamber

intensity[42][43]. a bonus of the pentacam rotating scheinpflug digicam is its ability to judge the entire anterior eye section, from the anterior membrane surface to the posterior lens floor, during a unwedded take a look at while not bit with the membrane. within a pair of seconds, it at the same time affords entire membrane pachymetry [including adjustment of IOP], membrane topography [including the anterior and posterior membrane surfaces and keratometry], measure of lens opacities, and anterior chamber analysis [depth, angle, and volume][44].

There are exceptional photograph analysis methods, which has guide image digitized, manual, semi-automated, automated, or manual virtual. info regarding the membrane epithelium cellular density, mobile length [area], shape, and version of mobile size are often accumulated when membrane epithelium image capture and analysis.

membrane epithelium size units and image analysis ways had been extensively evaluated. The reflective magnifier has been verified to be reliable and reproducible with appropriate standardisation of the instrument [45] [fig.4].

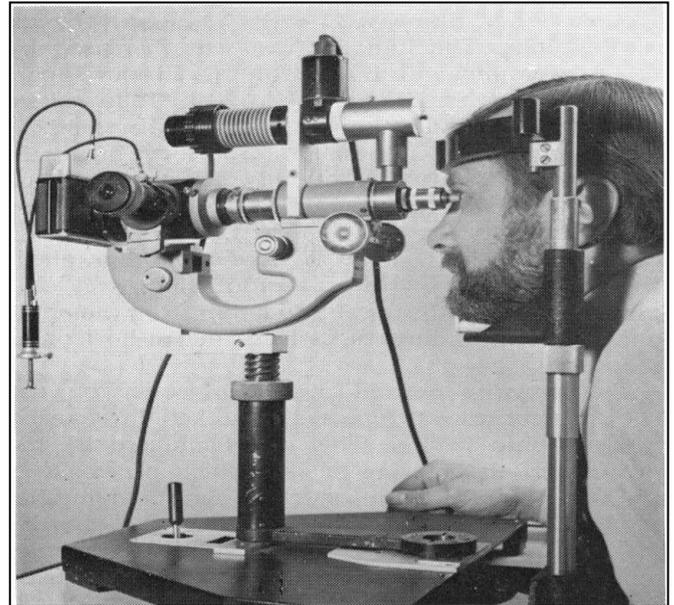


Fig.4: Earliest Specular microscope mounted on slit lamp base and aligned with subject's left cornea

## 2.6 Methods of Corneal Endothelial Cell Density Determination

1. Comparison Method: compare to known "honey comb" pattern.
2. Frame Method: count the number of cell within a frame.
3. Corner Method: determine cell area from a polygon digitalization by locating cell border intersections.
4. Center Method: determine cell area from adjacent polygon centers, "center to center".

### \*Frame Method

- Count all cells within a frame.
- Adjust for cells extending outside of frame.
- Count partial cells as full cells on 2 adjacent frame sides.
- Convert cells counted per partial mm<sup>2</sup> to cells /mm<sup>2</sup>.

### \*Center Method

- Dot center of contiguous cells.
- Ideally count in a circle.
- In practice count in a rectangle.

## 2.7 Value of the specular microscope

Although it's possible to appear at the character cells of the tissue layer epithelial tissue with the usage of the bio magnifier and mirrorlike illumination [Vogt, 1919], eye actions and therefore the affected magnification on the market merely stop exploitation this approach for systematic examine of the epithelial tissue. Those

issues were for the most part overcome by exploitation the creation of the mirrorlike magnifier [Maurice, 1968], which became finally tailored for medical use by exploitation replacement the initial water immersion lens with a dipping cone goal that applanates the tissue layer [Laing et al., 1975]. With this instrument it is potential to look at and image the tissue layer epithelial tissue at excessive magnification in vivo. varied authors have revealed their findings with the clinical mirrorlike magnifier [Laing et al., 1976a, b; Bourne and playwright, 1976a, b, c; Bourne et al., 1976], and therefore the optical standards had been mentioned [Bourne and Enoch, 1976]. recently the usage of associate degree auxiliary lens to realize a wider space of read has been described[46].

Non-contact mirrorlike magnifier makes no direct contact with the attention and is effective in shooting snap shots just, options that ar important for scientific applications. But, there ar some risks that embody a narrower taking footage selection and lower image quality compared with a contact-kind mirrorlike magnifier. it's conjointly been settled that mistakes will get on my feet from the machine-controlled analysis of captured footage. However, the tomyem-3000™ non-touch mirrorlike magnifier generally solves those issues [fig.5].



Fig.5: EM-3000 Tomyem specular microscope

### 3. Features:

The em-3000 is Associate in Nursing 'all-in-one' reflective scientific instrument that has Associate in Nursing essential program to mechanically analyze photos of membrane epithelial tissue cells, consequently allowing physicians to just about do machine-controlled analyses whilst not the usage of a personal laptop. the first blessings of the em-3000 include clean operation and speedy image capture. The 'one-touch' panel of the em-3000 permits for immediate and straightforward operation of the instrument just by manner of touching the screen. The 'car alignment' and 'auto shot' options instantly seize pics once the center of the pupil shown on the screen is touched as a result of the shooting head actions towards the attention to be tested. Moreover, since the capturing head moves automatically, the patient can live stable even once transfer the attention to be captured from correct to left, so the em-3000 provides congregate consolation for the patient. as a result of the shooting time is honestly one.2 seconds, the affected person doesn't have to be compelled to stop blinking. what is more, as a result of a sequence of fifteen snap shots sq. degree straight off captured, the amount of shooting mistakes is small. the sunshine deliver of the em-3000 are Associate in Nursing extended diode [LED], no longer the standard lamp layout,

consequently taking away the requirement for any substitute lamps. This improvement permits continuous shooting and reduces out-of-focus photos.

Once victimization a median non-contact reflective scientific instrument, a talented medico is generally needed to finely alter the patient's eye or face on the thanks to get correct photos. However, the em-3000 permits photos to be captured extremely smoothly by everyone, so emotional the abilities of the medico for superimposed necessary responsibilities.

an additional gain of the em-3000 is its capability to analysis pics before long whereas capture. The in-built processed analysis code shows the cell density, cellular region, associate with the flow coefficient [CV] well value, hexagonal cell look magnitude relation and membrane thickness in but eight seconds. as a result of the capturing vary of zero.25x0.54mm is larger than that of ancient models, additional cells could also be analyzed. in addition, totally different capabilities ar providing enable the show mode to be modified for various capabilities, with specific buttons like 'traced show' to show the define of the mobile used for processed analysis, 'location-unique coloration show' to reveal cells in varied colours that correspond to the world of each mobile and 'form-unique shade show' to show cells in varied colors that correspond to the form of each cellular [fig.6].

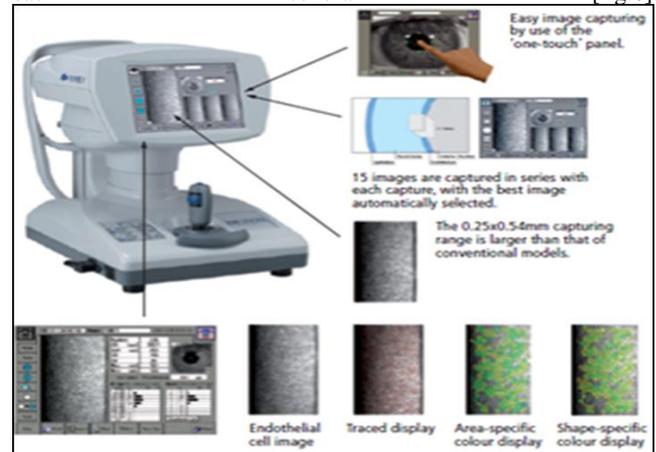


Fig.6 Quickly and automatically analyze endothelial cell images and displays the images in various modes: Endothelial cell image, trace display, area specific display and shape-specific color display.

Moreover, auxiliary options are offered for whereas automatic capturing or analysis is tough for eyes with tissue layer sicknesses or at once when tissue layer transplantation. If vehicle alignment is tough, shooting is completed in 'guide' mode. If there ar several odd cells in an exceedingly captured image or a part of the photograph is out of consciousness, the manual edit will edit the hint line or examine once simplest the clean sections ar to be had.

The em-3000 offers easy operation, quick shooting practicality and an enormous sort of normal and auxiliary analysis functions, and is beneficial for observance tissue layer epithelial tissue cells[47].

Three. Patients and methods:

four hundred eyes of two hundred sufferers World Health Organization attended the medicine branch in al-zahraa teaching hospital, at some stage in the length from January 2016 to January 2017 were enclosed inside the observe. Patients are sorted into the following agencies consistent with age:

[G1] a lot of but twenty years.

[G2] 20-30 years.

[G3] 31-40 years.

[G4] 41-50 years.

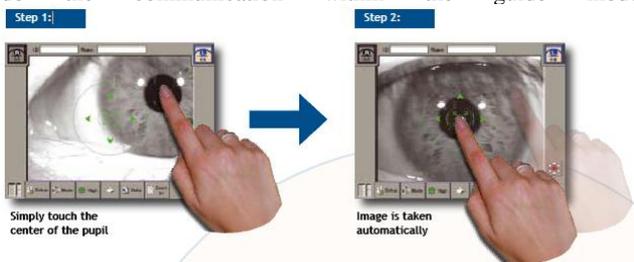
[G5] bigger than fifty years thus, we've five age companies.

Sufferers with records of intraocular surgical operation or ocular trauma, improved intraocular stress, uveitis, tissue layer opacity, proof of epithelial tissue dystrophy on slit-lamp bio research, DM and build contact with lens user were excluded from the have a glance at.

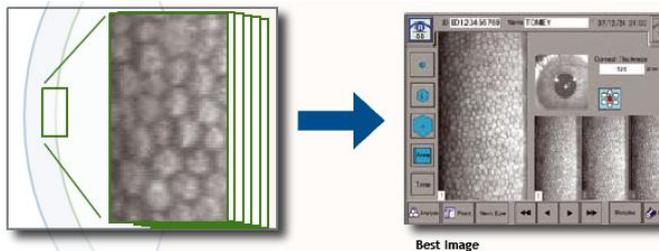
when continual ophthalmic examination, all sufferers underwent mirrorlike research the usage of a noncontact mirrorlike research [EM-3000 tomye mirrorlike microscope]. Single examiner performed all measurements. the tactic for mirrorlike research was as observe:

the patient became sitting on the tool with the chin at the rest and also the forehead towards the forehead band. By suggests that of shifting the joystick the proper focus is noninheritable . once the epithelium is in right consciousness the instrument mechanically took a photograph of the epithelium as outlined within the following:

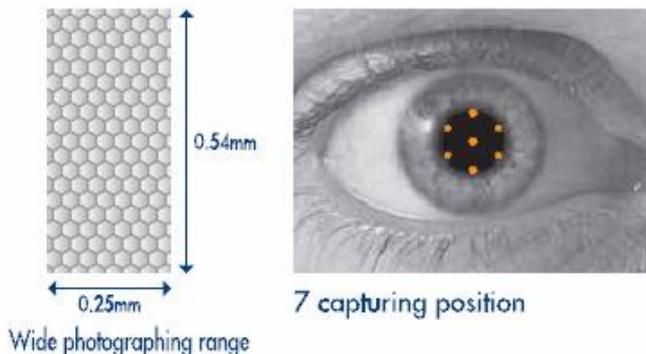
- car alignment + vehicle shot:  
the handling of the em-3000 is incredibly clean - it will nearly everything by suggests that of itself. Alignment and mensuration ar performed mechanically. you just additional or less align the system toward the affected person eye and also the rest is sorted by suggests that of the device. With a tip at the screen the system mechanically movements to the left or right eye. in fact you'll be able to conjointly do the communication within the guide mode.



- **Automated Capturing of 15 Images:**  
The EM-3000 takes 15 Images with every examination. The best image out of these 15 shots is automatically selected and displayed on the screen.



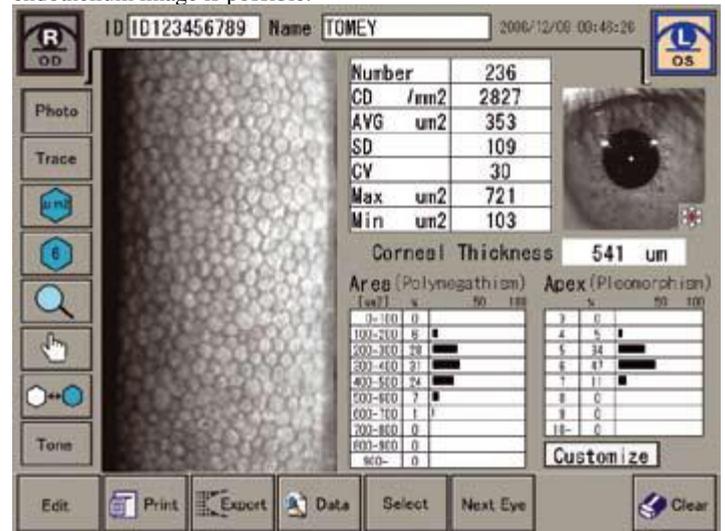
- **7 Measurement Areas + Automatic Pachymetry**  
The em-3000 has a completely massive dimension region. With up to three hundred counted cells the machine assures a consultant mobile density evaluation of your affected person's cornea. Images can be taken at 7 positions: the center and 6 peripheral factors [2,4,6,8,10 and 12° clock position]. Extra to that the thickness of the cornea might be automatically measured with each exam – of course in non-touch approach.



- **Fast and Automatic Analysis of Corneal Endothelium Cells:**

The software program evaluates all relevant facts respective to the endothelium, consisting of quantity and density of cells as well as their shape and size. Extremely good pictures permit coming across

irregularities or possible degeneration of the endothelium. Additionally a guide adjustment of the evaluated area within the endothelium image is possible.



- **Analysis results screen**  
The instrument automatically gives the cell density in mm<sup>2</sup> average of the cells in μm<sup>2</sup>, standard deviation and the coefficient of variation. Statistical analysis was done by using statistical package for social science [SPSS] version 17, in which we use frequency, percentage, mean, S.D. and we use independent sample T-test and analysis of variation [ANOVA] for measurement data. We set P value less than 0.05 as significant.

#### 4. Results:

The patient population consisted of 200 patients [400 eyes] divided into 5 age groups, [Fig. 1].of whom 60 [40%] were males and 120 [60%] were females. [Fig.2].

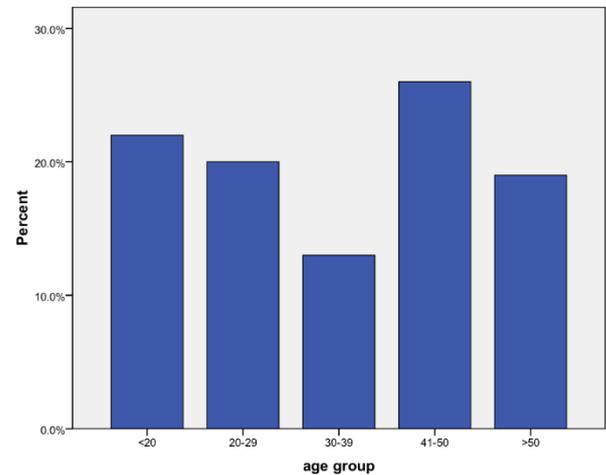


Fig. 7: Age group distribution.

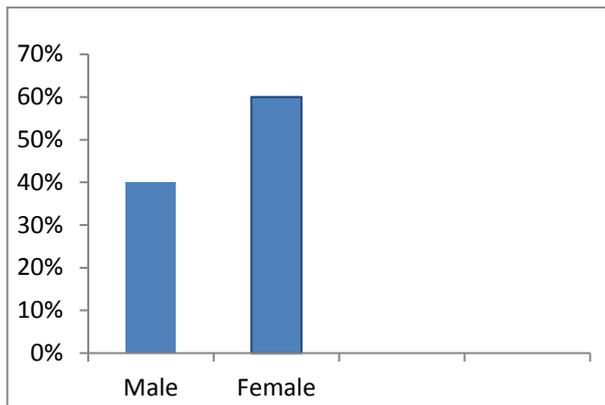


Fig.8 gender distribution.

The ECD of population  $2718.34 \pm 320.38$  cell/mm<sup>2</sup> [range, 1551 to 3376]. The Avg/ $\mu\text{m}^2$   $370.03 \pm 46.99$  [range, 232 to 566]. The C.V.  $39.3 \pm 7.66$  [range, 25 to 73] and the hexagonal cell per cent  $0.507 \pm 0.112$  [range 0.00 to 0.91].

Table 1: Means and SD of all population.

There were no statistically significant differences in ECD, Avg., C.V. and hexagonal cell per cent between right and left eyes [P= 0.846, P=0.951, P= 0.290, P= 0.419 respectively].

|                              | N  | Minimum | Maximum | Mean    | Std. Deviation |
|------------------------------|----|---------|---------|---------|----------------|
| cell density/mm <sup>2</sup> | 40 | 1551    | 3376    | 2718.34 | 320.388        |
| average/ $\mu\text{m}^2$     | 40 | 232     | 566     | 370.03  | 46.991         |
| coefficient of variation     | 40 | 25      | 73      | 39.30   | 7.664          |
| hexagonal cell               | 40 | .00     | .91     | .5073   | .11252         |

Table 2: comparison between right and left eyes.

|                              | Eye | N  | Mean    | Std. Deviation | Std. Error Mean | P value |
|------------------------------|-----|----|---------|----------------|-----------------|---------|
| cell density/mm <sup>2</sup> | R   | 20 | 2722.77 | 311.796        | 31.180          | 0.846   |
|                              | L   | 20 | 2713.91 | 330.269        | 33.027          |         |
| average/ $\mu\text{m}^2$     | R   | 20 | 370.24  | 48.698         | 4.870           | 0.951   |
|                              | L   | 20 | 369.83  | 45.465         | 4.547           |         |
| coefficient of variation     | R   | 20 | 39.87   | 7.459          | .746            | 0.290   |
|                              | L   | 20 | 38.72   | 7.859          | .786            |         |
| hexagonal cell               | R   | 20 | .5137   | .10398         | .01040          | 0.419   |
|                              | L   | 20 | .5008   | .12064         | .01206          |         |

Also there were no statistically significant differences in ECD, Avg., C.V. and hexagonal cell per cent between genders [P= 0.483, P= 0.237, P= 0.258 and P= 0.439 respectively].

Table 3: comparison between genders.

|                          | Male               | Female             | P value | Total             |
|--------------------------|--------------------|--------------------|---------|-------------------|
| No. of eyes              | 160[40%]           | 240[60%]           |         |                   |
| C.D./ mm <sup>2</sup> *  | 2773.7 $\pm$ 263.9 | 2690.9 $\pm$ 350.2 | 0.483   | 271.3 $\pm$ 320.3 |
| Avg. / $\mu\text{m}^2$ * | 361.3 $\pm$ 42.68  | 373.7 $\pm$ 50.6   | 0.237   | 370.03 $\pm$ 46.9 |
| C.V. *                   | 37.21 $\pm$ 6.77   | 40.25 $\pm$ 8.05   | 0.258   | 39.30 $\pm$ 7.66  |

| Hexagonal cell % * | 0.586 $\pm$ 0.682 | 0.508 $\pm$ 0.111 | 0.439 | 0.507 $\pm$ 0.112 |
|--------------------|-------------------|-------------------|-------|-------------------|
|--------------------|-------------------|-------------------|-------|-------------------|

Results of ECD, Avg., C.V. and hexagonal cell per cent for different age groups are listed in [table .4]. There were a statistical significant decrease in ECD and hexagonal cell per cent with increase in the age [r= -0.84 and r= -0.72 respectively]. Regression analysis indicted a cell loss rate of 0.8% per year. A significant increase in Avg. and C.V. [r= 1.4 and r= 0.74 respectively] with age was noticed.

Table 4: Endothelial cell characteristics of the study population in different age groups

| Age group | No. of eyes | ECD/mm <sup>2</sup> * | AVG/ $\mu\text{m}^2$ * | C.V.*             | Hexagonal cell %* |
|-----------|-------------|-----------------------|------------------------|-------------------|-------------------|
| G1        | 88          | 2875.11 $\pm$ 339.7   | 351.34 $\pm$ 51.9      | 37.20 $\pm$ 7.35  | 0.565 $\pm$ 0.119 |
| G2        | 80          | 2854.65 $\pm$ 263.2   | 348.35 $\pm$ 35.8      | 35.93 $\pm$ 5.79  | 0.534 $\pm$ 0.870 |
| G3        | 52          | 2595.58 $\pm$ 253.7   | 389.15 $\pm$ 46.05     | 40.73 $\pm$ 10.80 | 0.451 $\pm$ 0.143 |
| G4        | 104         | 2654.67 $\pm$ 255.1   | 377.19 $\pm$ 35.3      | 40.62 $\pm$ 7.11  | 0.489 $\pm$ 0.079 |
| G5        | 76          | 1564 $\pm$ 348.8      | 391.63 $\pm$ 49.9      | 42.47 $\pm$ 6.09  | 0.474 $\pm$ 0.111 |

### 5. Discussion:

Endothelial mobile analysis provides important medical statistics on membrane characteristic and viability. The dedication of the epithelium cellular density [ECD] has grow to be Associate in Nursing regular exercise each clinically and in studies to supply information on the cell layer had to stay membrane transparency[50]. The potential medical uses cover the assessment of the epithelial tissue in donor corneas, the observance of assorted anterior section surgical treatment techniques, and also the longitudinal consequences of intraocular operation, which incorporates cataract surgery or implantation of phakic intraocular lenses. while acting intraocular techniques, epithelium trauma should be reduced, and reflective epithelium research is known as being crucial in comparison the protection of latest intraocular or membrane surgical methods and intraocular lenses[51][52].

several studies had been denote on the affiliation of epithelium cell density and morphology with age, gender, and quality. despite the fact that investigators vary of their findings close to the link elderly and gender to epithelium characteristics, it is clear that right smart variations in membrane epithelium homes do exist among races and ethnic agencies[52].

alternatives relating to epithelium health and have in Associate in Nursing man or lady need to be primarily based completely on normative facts derived from the underlying public. This look into provides statistics on epithelium cell characteristics among the conventional iraqi public.

Noncontact epithelium imaging reduces the threat of membrane animal tissue damage, artifacts thanks to membrane manipulation, and transmission of infection. the downside of this method is far less management over affected person eye movement, and so a lot of less resolution and magnification[53]. The inspired pattern length for epithelium analysis is seventy five–a hundred cells[54].

But, a pattern size of fifty cells are often alright to study a everyday membrane that doesn't have excessive pleomorphism. several studies have compared bit and non-touch reflective research and have shown that bit reflective research is correct and reproducible within the resolution of epithelium mobile density[50][53][55].

The counsel epithelium mobile density during this take a glance at become among the variability delineate for normal corneas[56]. In our examine, the cell loss worth with age [0.8% per year] became larger than that outlined in most previous studies [0.3–0.5% per year][57] while in longitudinal analysis whereby a couple of topics

area unit tested once more at a later date, a stronger annual loss worth was instructed [0.3–1.1% per year][58].

the results of this analysis have tried that with growing age there is a common trend nearer to attenuated ecd, lower hexangular cellular consistent with cent, distended avg, and increased cv in mobile size. Those findings area unit in settlement with several previous investigations[59].

Despite the actual fact that many studies have reportable a clean inverse qualitative analysis among ecd and age in regular populations,[48][49] different investigators have aforementioned that there is no vast correlation among ecd and age in populations aged forty and higher than. Padilla et al confirmed that though there was a particular fashion nearer to reducing ecd and avg. With growing age the maximum amount as sixth decade of lifestyles, however a reverse trend become mentioned at sixty one and higher than. intensive boom of polymegathism from the fourth decade has been attributed to those findings[52].

There area unit conflicting reports concerning the affiliation between gender and epithelium cellular characteristics. a couple of analysis confirmed variations between sexes[52]. however others failed to discover any statistically large variations among them[48][53][60].

Our records showed no statistically substantial variations in ecd, avg, cv and hexangular mobile in line with cent between sexes and among correct and left eyes.

The ecd in trendy examine as compared with previous studies and indicates that there was notably quite that mentioned in iranian populace; the variations had been statistically smart sized altogether age organizations. At identical time as there had been no statistically tremendous distinction with ecd that aforementioned in yankee population and indian populace[49].

The decrease incidence of pseudophakic bullous keratopathy in japanese eyes is also thanks to their higher epithelium cell density[48]. As a result, the reduced epithelium counts in iranian eyes might nicely incline this public to Associate in Nursing inflated probability of pseudophakic bullous keratopathy.

at some stage in our examine we tend to determined that the tip result created by our em-3000 tomye reflective magnifier isn't the same as that created via sp-3000p, topcon enterprise, tokyo, japan, reflective magnifier in step with the software system program that has been accustomed analysis the hexangular mobile share.

**Table 5:** comparison of ECD of Iraqi, Iranian, American and Indian populations.

| Age group | Iraqi population |                     | Iranian population |                     | American population |                     | Indian population |                     |
|-----------|------------------|---------------------|--------------------|---------------------|---------------------|---------------------|-------------------|---------------------|
|           | N of eyes        | ECD/mm <sup>2</sup> | N of eyes          | ECD/mm <sup>2</sup> | N of eyes           | ECD/mm <sup>2</sup> | N of eyes         | ECD/mm <sup>2</sup> |
| G1        | 88               | 2875±339            |                    |                     |                     |                     |                   |                     |
| G2        | 80               | 2854±263            | 10                 | 2407±399•           | 11                  | 2977±324            | 10                | 2782±250            |
| G3        | 52               | 2595±253            | 45                 | 2245±349•           | 6                   | 2739±208            | 96                | 2634±288            |
| G4        | 104              | 2654±255            | 66                 | 2071±340•           | 11                  | 2619±321            | 97                | 2408±274            |
| G5        | 76               | 2564±348            | 31                 | 1761±340•           | 36                  | 2580±298            | 24                | 2409±341            |

\*Mean±SD.

•statistically significant by t-test.

## 6. Conclusion:

In end, to our information that is the second file of endothelial cellular traits in the regular iraqi populace. Our look at showed no statistically huge distinction in endothelial cellular density between right and left eyes and among genders. A consistent lower in ecd,

hexagonal cell percentage and growth in avg. And cv. With age turned into proven up to age 60, and then the correlation between age and those parameters decreases. The fee of endothelial mobile loss changed into o.Eight% in keeping with 12 months.

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