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MEASUREMENT OF MACULAR THICKNESS AFTER PHACOEMULSIFICATION CATARACT SURGERY BY USING OPTICAL COHERENCE TOMOGRAPHY

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Abstract:

BACKGROUND: Cataract surgery often causes reduced visual acuity because of the cystoid macular edema. increased retinal thickness arises from breakdown of the blood–retinal barrier and subsequent accumulation of fluid with increased retinal thickness.
Macular edema might be seen, measured, and assessed with optical coherencetomography since it produces two- or three-dimensional pictures of the retinal tissue and assesses the treatment's effectiveness.
OBJECTIVE: to measure macular thickness after uneventful phacoemulsification cataract surgery using optical coherence tomography.
SUBJECTS AND METHODS: This study which is a cross sectional study is conducted at Alsaida Zainab Ophthalmology Specialty Centre in holy Karbala governorate , during the period from 1st December 2020 to the end of march 2021.40 patient with cataract who undergo uneventful phacoemulsification cataract surgery ,where assessed for macular thickness by optical coherence tomographypreoperatively and three months following surgery.
RESULTS: Data were analysed using SPSS program version 26, Categorical variables were presented as frequencies and percentages and pie charts ,while continuous variables were presented as mean and SD.
There is significant increase in 32 eyes, in overall mean macular thickness about **10.2%** after phacoemulsification cataract.There is about (16.7%) **(p-value= 0.0001)** ,(19.9%)**(p-value=0.003)** significant increase in average and central macular thickness consequently .
CONCLUSION: Cataract surgery may lead to vision problems because of cystoid macular edema. Cystoid macular edema development also occurs in normal eyes following uneventful phacoemulsification cataract surgery .

Keywords:

INTRODUCTION

Cystoid macular edema is a painless disease in which the central retina (macula) develops swelling or thickening. (1-3)

It is produced by fluid buildup in the perifoveal region's outer plexiform layer and inner retinal layers, whether in inflated and degenerating Muller cells or as extracellular cysts.(4)

It's a very common disease that's often linked to a variety of ocular issues: (5-7)

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- Cataract surgery ,which is a procedure that removes a cataract from the eye.
- Macular Degeneration Caused by Aging process (ARMD(
- Uveitis.
- An injury to the eye.
- Diabetes mellitus.
- Occlusion of a retinal vein.
- Toxicity of drugs.
- Post Yag Laser.

Irvine reported a condition of decreased central vision following intracapsular cataract removal in1953, which was the first time macular edema was recognized as a consequence of ocular surgery.(5(

Gass and Norton first reported the fluorescein angiographic characteristics of this disease in 1966.(6)

Patients with a postoperative Snellen visual acuity of 20/40 or better were formerly deemed successful after cataract surgery.(7-9)

1.4 Fluorescein Angiography:

A fundus fluorescein angiography (FFA) is a dye technique involving injecting sodium fluorescein into a vein in the arm or hand and taking pictures of the retina to detect circulatory and structural issues.(2)

The most commonly utilized technique for confirming the existence of CME is the FFA.(42)Although FFA is often used to assess vascular leakage subjectively, macular thickness is a stronger predictor of visual acuity loss.(43)

CME cases exhibit "petaloid" leak late in the angiography (approximately 10 minutes), which is often accompanied by disc hyperfluorescence. This characteristic may indicate a greater susceptibility to

CME Diagnosis in Clinical Practice:

Symptoms:

A patient with CME sometimes complains of hazy or reduced vision, and they typically believe that the initial benefit of surgery fades with time. This generally happens 2-8 weeks following cataract surgery and is painless. (2)

- Metamorphopsia.(38-40)
- Refractive shift to hyperopia.(20)

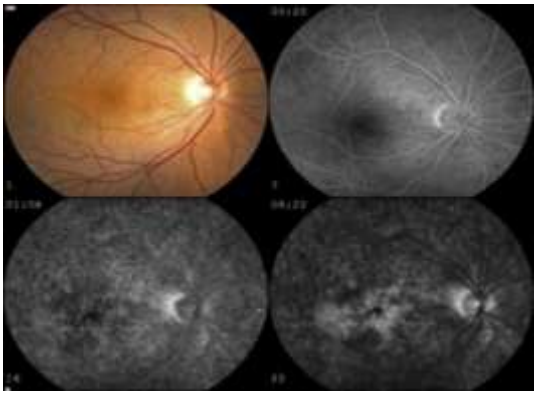
Signs:

A central yellow spot and lack of the usual foveal reflex are common findings during a dilated eye examination. Depending on the degree of fluid buildup, cystic alterations or spoke-like radial striae in the fovea may appear.(7, 12, 13)

anti-inflammatory drugs.(2) The quantity of clinical leakage, on the other hand, has no relation to visual acuity or visual loss.(43)

Reflections, synechiae, inadequately dilated pupils, vitreous cloudiness, and other factors prevent even experienced clinicians from reading up to 15% of these angiograms. It is feasible to use OCT in some of these situations.(8)

FFA is also an intrusive test, with side effects ranging from nausea (up to 20% of the time) to anaphylaxis and death, the most serious consequence. As a result, it's critical to have non-invasive alternatives like OCT.(42)



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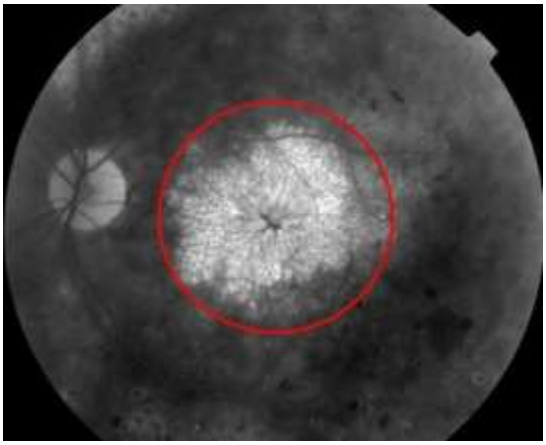
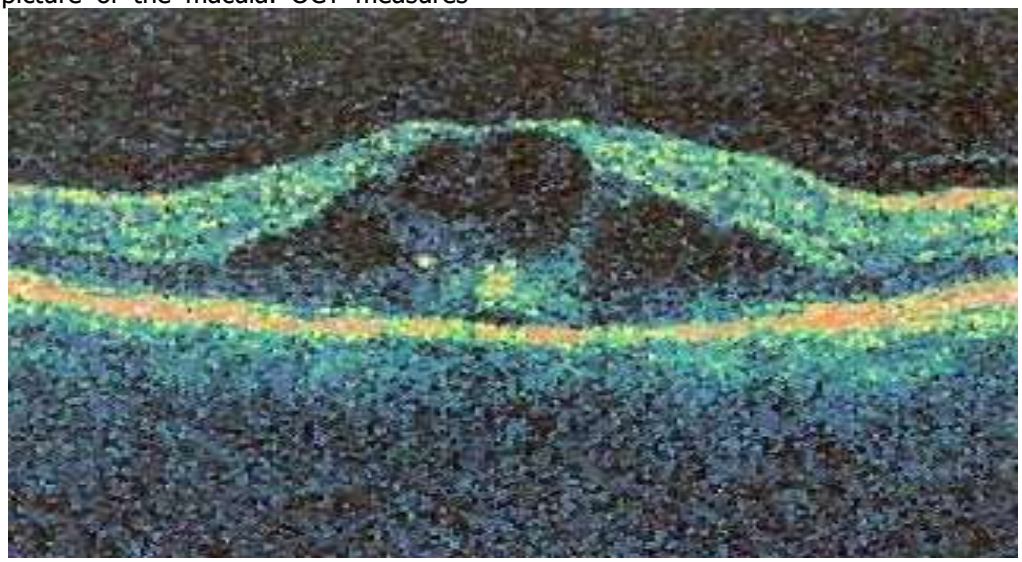


Figure (1): Fluorescein angiography of patient 8 weeks following phacoemulsification revealinglate leakage of dye in macular area in patelloid form

1.5 Optical Coherence Tomography

OCT is a non-invasive imaging method that produces a cross-sectional picture of the macula. OCT measures retinal thickness and can distinguish between eyes with and without macular edema.[2,8]



Figure(2): Optical Coherence Tomography of patient following uncomplicated phacoemulsification showing multiple cystoid spaces in macular area with an evidentincrease in macular thickness.(source : OCT of one the patient included in this study)

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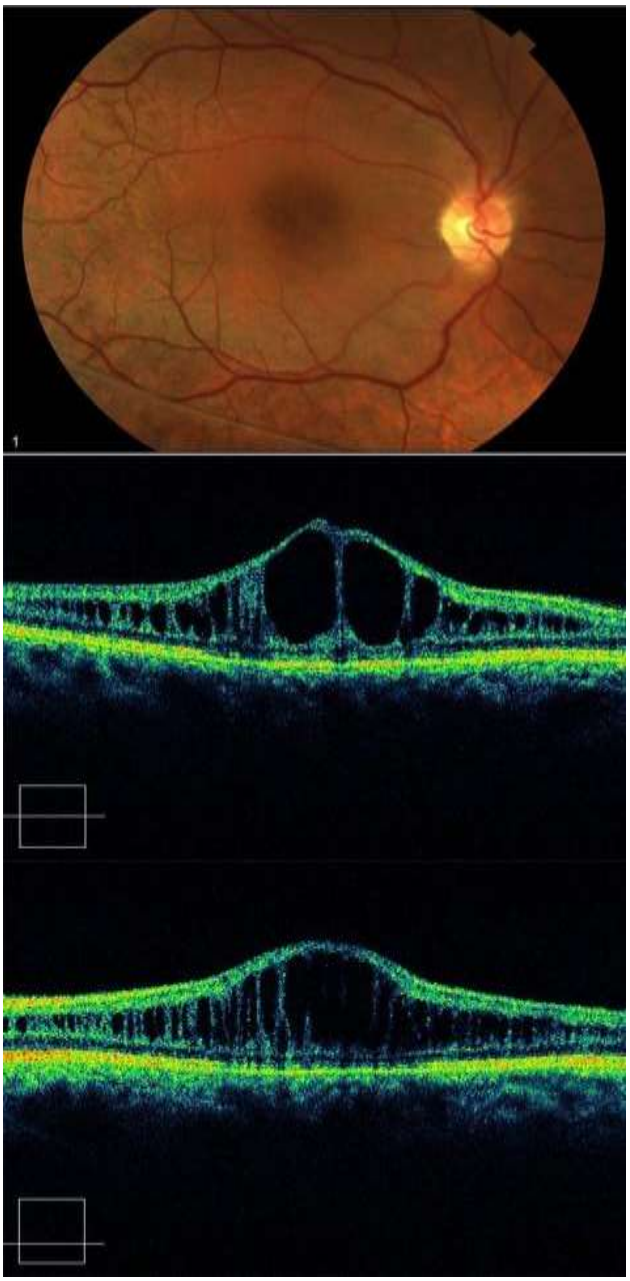

Figure (3): Optical Coherence Tomography of patient following uncomplicated phacoemulsification, showing multiple cystoid spaces in macular area with anevident increase in macular thickness.

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1.5.1 The changes in OCT often fall into one of three distinctpatterns:

- Most are cystoid malformations that alter the foveal pattern of the retina.
- Abnormalities of the foveal morphology, while common, do not show obvious cystoid deformities.
- Lastly, there may be a moderate amount of intraretinal cystoid tissue with no substantial increase in retinal thickness or loss of foveal shape.(45-48)

An OCT measurement of initial retinal thickness increased by 40% may be a useful and reliable way of determining if patients are experiencing clinically significant post-operative CME. This description is simple to comprehend.(34, 48, 51, 53)

1.5.2 Optical coherence tomography able to identify cystoid macular edema in the following timeframe:

In a study conducted by Von Jagow et al. , stated that moderate increase in macular thickness between the first and sixth week after surgery was observed, but there was no significant correlation between CMT and the best-corrected visual acuity (BCVA)When subjected to OCT, The cataract surgery is associated with the greatest occurrence of CME four weeks afterwards. This timing is perfect, since it corresponds with clinical follow-up schedule.(45)

A precise, objective, and continuing measure of postoperative CME may beprovided, thanks to the OCT technology.(57)

It is anticipated , because OCT is faster and less intrusive, it will most certainly become the preferred CME evaluation technique for the postsurgical population. The exclusion of other potential causes of CME, such as venous occlusion, diabetes, or vitreomacular interface disruption, are required.(58, 59)

Promoting regular routine ophthalmologic examination of patients at risk for CME, particularly those with very thin retinal layers, would lead to theidentification and treatment of CME earlier.(57)

1.5.3 The groundwork for interpreting OCT pictures :

There is a difference in optical reflectance between various tissue microstructures, which is essential to the creation of imaging. In determining the overall back-scattering of a tissue structure, the percentage of incoming light that is directly back dispersed by that structure is of critical importance.

1.5.4 Optical transmission of OCT signal of the tissue layer :

layer characteristics include absorption, reflectivity and scattering. The pictures of tissue reflectivity produced on this basis are cross-sectional and allow for differentiation of interior tissue structure.

1.5.5 Reasoning used to understand OCT scans :

In the medical imaging process, the difference in optical reflectance between various tissue microstructures provides the foundation for the imaging. An inversely proportional percentage of incoming light that is immediately backscattered by tissue determines the tissue's reflectivity.

A tissue layer has its reflectivity and absorption and scattering characteristics that combine to create the OCT signal. We use this technique to take cross-sectional pictures of tissue reflectivity, which helps to distinguish tissue structure

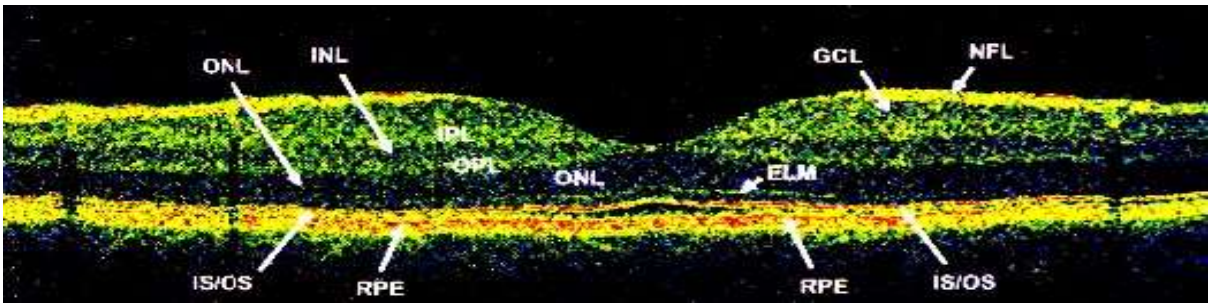

Figure (4): Layers of the retina using OCT

1.5.6 Clinical Applications of OCT:

- The pathophysiology of the illness is best understood after following theclinical course.
- To determine how effective treatment(medical, surgical and laser) is working
- The procedure for recording and communicating the prognosis of a certain illness.
- Validation for most pathological conditions affecting posterior part.

OCT has the greatest resolution of any non-invasive ocular imaging technique that is available commercially.

Due of their slower acquisition speed, conventional systems using time-domain detection have limitations.

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The patient's eye mobility limits the total time that takes to acquire pictures. To eliminate axial motion artifacts, the images are aligned via digital signal processing. This approach has the potential to provide a smoother outcome, but it may add mistakes in the form of irregularities in the image's retinal topography. Also, the number of cross-sectional pictures that may be collected in succession is limited by the acquisition speed. An ocular focal pathology may go undetected or missed . This, along with new optical coherence tomography (OCT) techniques, allow high-speed OCT scanning .

In the last several years, spectral domain / Fourier domain detection hasadvanced greatly and is now able to support imaging rates of 25,000 axial scans per second, which is about 50 times quicker than that time domain detection.

Light echoes may be detected utilizing low coherent interferometry with a spectrophotometer and a fast speed camera. Details that might be useful in axial scan imaging may be extracted by applying the Fourier transform to the interferencespectrum, and as a result, the interference spectrum contains oscillations with a frequency that is proportional to the echo time delay. Light measurement is done in the spectral or Fourier domain rather than sequentially, as in time domain measurement. This means that improved sensitivity and imaging speed are possible because of it. a number of benefits of high-speed data collection allow for the shift from 2D imaging to 3D imaging.

Due to spectrophotometer resolution limits, the sensitivities and resolutions of spectral/Fourier domain detection rely on scanning depths. Additional researches are done to explore the impact of this change on imaging.

The posterior border of the retina is marked by a reflecting red layer that correlates to RPE and choriocapillaries. the outer segment of retinal photoreceptors shows in a darker layer immediately prior to the choriocapillaries layer, indicating low reflectivity moderate backscattering is seen in the intermediate layers. Above choriocapillaries, lower scattering backscatter owing to deep choroid and sclera attenuation, and moderately strong scattering backscatter due to scattering and absorption in the sclera and choroid layers above. The retinal layers may be identified by the thinning of their thickness. The disc borders are set at the places where the ends of the choriocapillaries connect to the lamina cribrosa. retinal surface are extrapolated to provide a line segment that represents disc diameter.

Other than optic disc cupping, which should be taken into consideration in the diagnosis and treatment of glaucoma and other neurodegenerative illnesses, it is alsoessential to have a thorough understanding of the nerve fiber layer thickness and degeneration in the peripapillary area. Imaging the cylindrical tissue sections centered on the optic disc allows you to examine the RNFL in the peripapillary area. The front and posterior layers of the RNFL and RPE/choriocapillaries are imaged as strongly backscattering layers. There are two specialized nerve fiber bundles in the superotemporal and inferotemporal portions of the optic nerve that may be seen in retinal tomograms; a local thickening in the RNFL and in the retina.

Because a depression is seen on both anterior and posterior borders, RNFL thinning is known.

When retinal edema occurs, the retinal tissue increases in thickness, as well as changing the scattering characteristics. Cystic gaps in the retina may be used to distinguish retinal edema from retinal traction. They may also be seen in the posterior hyaloid, which has a tendency to stretch out, or the epiretinal membrane, which may cause traction. Focal or widespread retinal atrophy or scarring may cause a decreased retinal thickness.

1.5.7 Aberrant OCT imaging reading :

Absent data in the reflected scans may be interpreted as abnormal results ifthe Scan Reflectivity picture pattern is utilized.

- Hyper-reflectivity is a change in the composition of the retina due to an inflammatory infiltration, fibrosis, hard exudates, and hemorrhages. Smaller hemorrhages are hardly visible because they appear as highly reflective lines with little impact on underlying tissue. Distortion of light passing through hematomas fully absorbs the resulting reflections from underlying structures.
- Hypo-reflectivity: retinal edema, serous fluid, and hypopigmentation of RPE may result in decreased reflectivity It is critical to differentiate these morphological reasons of decreased back scattering from cataracts, clouds, astigmatism, and implantable lens disorder. poor alignment of OCT instrument at imaging.
- Nature of fluid: When discussing the various bodily fluids, one may make a distinction between blood, serous fluid, and exudates because of the level of reflectivity.
- Serous fluid is optically clear, while blood is not. OCT scans often show exudates as being between the blood and serous fluid.
- An optically clear gap between the retina and RPE appears as a shallow elevation of the retina, often referred to as neurosensory detachment. Fluid- retina border becomes more distinct with backscattering from the

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typical photoreceptors. Alternatively, it displays a reflecting band that corresponds to the RPE (central optically clear region), which is focally raised above a serous cavity. The RPE is more reflecting when detached, and this may be because of the choriocapillaries, which has a higher refractive index, or because the RPE cells have decreased function and morphological abnormalities.

- Attachment of RPE cells to the basement membrane at the border of the separation contributes to an increased fluid pressure, especially when thedetachment angle is more acute.

1.6 Management of CME:

Clinical progress is tracked closely with frequent follow-up visits for those patients undergoing CME.

1.6.1 Prevention:

Avoiding of posterior capsule rupture, vitreous loss, vitreous imprisoned in the incision, iris prolapse, or displaced lens may help to reduce the risk of CME. Pre-surgical non-steroidal anti-inflammatory drugs (NSAIDs) may reduce the risk of postoperative visual loss as a result of cataract surgery.[2, 12]

1.6.2 Pharmacological Medications (Drops)

The CME is generally considered to be a safe and painless , and more than90% of patients would have a quick and spontaneous recovery. Medication is usually administered in a progressive manner for individuals who do not. Since it is believed that prostaglandin-mediated inflammation is an important factor for the development of CME, current efforts are focused on trying to inhibit the formation of prostaglandins. Because NSAIDs and corticosteroids share sites of action in the prostaglandin pathways. Corticosteroids interfere with the production of prostaglandins via inhibiting phospholipase enzyme activity. Topical administration, or applying a corticosteroid externally, considered as primary treatment especially in CME associated Uveitis ; they may also be injected intravitreally or directly into the subTenon area. Ophthalmic and systemic side effects of corticosteroids are common, and some individuals develop an intolerance to them.[34, 87]

Aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs) block the enzyme cyclooxygenase, and therefore may be used to prevent and treat CME. Non-steroidal anti-inflammatory drugs (NSAIDs) are typically used topically for around3 to 4 months, and on a periodic basis as required. Carbonic anhydrase enzyme is found on the apical and basal cell membranes of the RPE. CAIs, like acetazolamide, improve the ocular blood flow, resulting in more fluid flow throughout the RPE.[88]

Following difficult surgical intervention, vitreous threads are breacked up the using YAG laser lysis with some success. Triamcinolone acetate injections may be done for those individuals with severe edema or edema that does not respond to 1-2 months of treatment with topical drops. The initial approach is to inject into the subconjunctival /subtenon area, depending on the cause of the edema. A direct intravitreal injection of steroids may be used for individuals who are poor responders to periocular steroids.

1.6.3 Surgical Management

Pars plana vitrectomy is part of surgical treatment (PPV). In many cases, the use of PPV is beneficial in the treatment of CME, as follows:

- After difficult eye surgery or injury, remove vitreous threads that access to the surgical incision or to the pupil.
- In chronic CME instances, when medical therapy has failed, there is an elevation of the posterior hyaloid face which is detached from the macula
- Peeling of epiretinal membranes from the surface of the macula when coupled with CME.
- Vitrectomy used to get rid of inflammatory mediators from the vitreous cavity.
- The removal of retained nuclear lens pieces.
- A displaced IOL being relocated.

A number of different studies have shown improved CME following PPV for those with aphakic, pseudophakic, or uveitis- associated CME.[3]

1.7 Complications Consequences:

the condition of repeated remissions and exacerbations combined with persistent macular edema may lead to photoreceptor disruption, resulting in irreversible loss of central vision.[3]

1.7.1 Prognosis

The outlook is difficult to predict. There is a 90% chance that pseudophakic CME will result in good to very good vision(20/40) or better in patients. Other instances of CME exist, such as the chronic kind that requires therapy over an extended period of time.[12]

AIM OF THE WORK

The purpose of this study is to measure the macular thickness after phacoemulsification cataract surgery using optical coherence tomography, paying more attention to this condition.

3.1 SUBJECTS AND METHODS

This study is conducted at Alsaida Zainab ophthalmology specialty Centre in Holy Karbala Governorate , during the period from 1st December 2020 to the end ofmarch 2021.

Forty patients with significant cataract who undergo uneventful phacoemulsification cataract surgery ,where

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assessed for macular thickness by OCT preoperatively and three months following surgery.
The patients selected randomly and the sample size determined according tothe online calculator.net

- All patients signed an informed consent to do the surgery and informed to be included in this study . The official agreement obtained from Karbala Health Directorate/ department of training and Human Development and ethical approval from kufa university/college of medicine/ Postgraduate Studies Division.

3.1.1 Exclusion Criteria:

1. Previous intraocular surgery (retinal detachment surgery, trabeculectomy and others like intraocular foreign body removal).
2. Iris incarceration post-surgery.
3. Use of other than posterior chamber intraocular lenses.
4. Active uveitis.
5. Diabetic retinopathy .
6. Macular lesions (age related macular degeneration, macular scar and others).
7. Baseline evidence of cystoid changes.
8. Abnormal retinal thickening is shown by optical coherence tomography.

1. Intraoperative complications as rupture of posterior capsule and vitreous loss.
2. Brunescent cataract.

Each of the included patients had been subjected to the following plan ofmanagement..

3.1.2 Items of Management Included the following:

- History.
- Examination.
- Pre-operative OCT.
- Phacoemulsification technique.
- Post-operative OCT.

3.1.3 History:

- Age of the patient.
- Gender.
- Concerned eye.
- Past ophthalmic history.
- Medical issues.

3.1.4 Examination:

- Use of a Snellen chart to evaluate a patient's visual acuity.
- Slit lamp bimicroscopy is used to do an anterior segment examination, as well as to evaluate intraocular pressure by applanation tonometry .
- Determination of the morphological features and hardness of cataract.
- Choosing cases with visually significant cataract.
- Slit lamp biomicroscopy supports clinical evaluation of the fundus (with aidinglenses) , utilized if the medium allows.

In order to give patients best results of the surgery, use topical antibiotics andtopical NSAIDs 48 hours prior to it.

3.1.5 Pre-surgical tests:

- Ultrasound examination of the axial length using A-scan.
- The power of the intraocular lens implant had been calculated (Biometry).
- Using direct observation of patient fixation as a method for acquiring images using Optical Coherence Tomography (The Zeiss-Cirrus HD-OCT Model 5000).

These OCT pictures are created using the HD5 line raster and macularcube 512x128 macular cube.

3.1.6 Procedure:

For this procedure, 40 eyeballs would undergo phacoemulsification using the same phaco machine, which will be done under local anesthesia as follows:

- an undisturbed corneal incision
- Capsulorhexis.
- Phacoemulsification.
- Intraocular lens insertion in the capsular bag is created by folding acrylic (hydrophilic) foldable lens.
- Making a note of the power setting and the time required to fully explain each instance with lengthy phaco time.

3.1.7 After-surgical therapy :

- Antibiotics used topically after a surgical procedure for 21 days.
- Low-dose topical steroids that are tapered gradually over one month.
- Ten days of topical NSAIDs.

3.1.8 Three months after the surgery:

Assessment includes the following:
A complete ophthalmological evaluation was done.
Post-operative best corrected visual acuity.
Optical coherence tomography (The Zeiss-Cirrus HD-OCT Model 5000)
performed with direct observation of patient fixation.

STATISTICAL ANALYSIS :

Data were analysed using SPSS program version 26,

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Categorical variables were presented as frequencies and percentages and pie charts ,while continuous variables were presented as mean and SD .
Paired **t test** used for comparison of the difference before and after phaco while independent **t test** used for comparison between gender and age groups.
• Statistical significance was regarded if **P value** equal or less than 0.05

RESULTS

This study included forty eyes having significant immature and mature senile cataract from patients attending the outpatient clinic at ophthalmology department of Alsaida Zainab Eye Specialist Centre in Holy Karbala Governorate.. twenty three cases were females and 17 were males.
Their age distribution was: 16 patients (40%) ages (36-59)y , and 24 patients (60%) ages (60-83)y,as shown in table (1).

		No.	%
Age group	**36-59**	**16**	**40**
	60-83	**24**	**60**
Gender	**Female**	**23**	**57.5**
	Male	**17**	**42.5**
Eye	**OD**	**22**	**55**
	OS	**18**	**45**

Table (1):The distribution of studied patients regarding evaluation of macular thicknessafter phacoemulsification surgery ,according to age group , gender and right(OD) or left(OS)

All patients have no pre-operative risk factors for CME. All patients undergo uncomplicated clear corneal incision phacoemulsification with foldable acrylic intraocular lens using the same phaco machine.
- 32 patient had significant incease in macular thickness about (70µm) 3 months after surgery

• One case came complaining two months after surgery from painless diminution of vision with metamorphopsia after initial improvement that was achieved by surgery. On fundus bimicroscopy, there was loss of the foveal reflex and spoke-like radial

• striae in the fovea were seen, poor visual acuity OD (6/36) OCT revealed significant CMO with as shown below:

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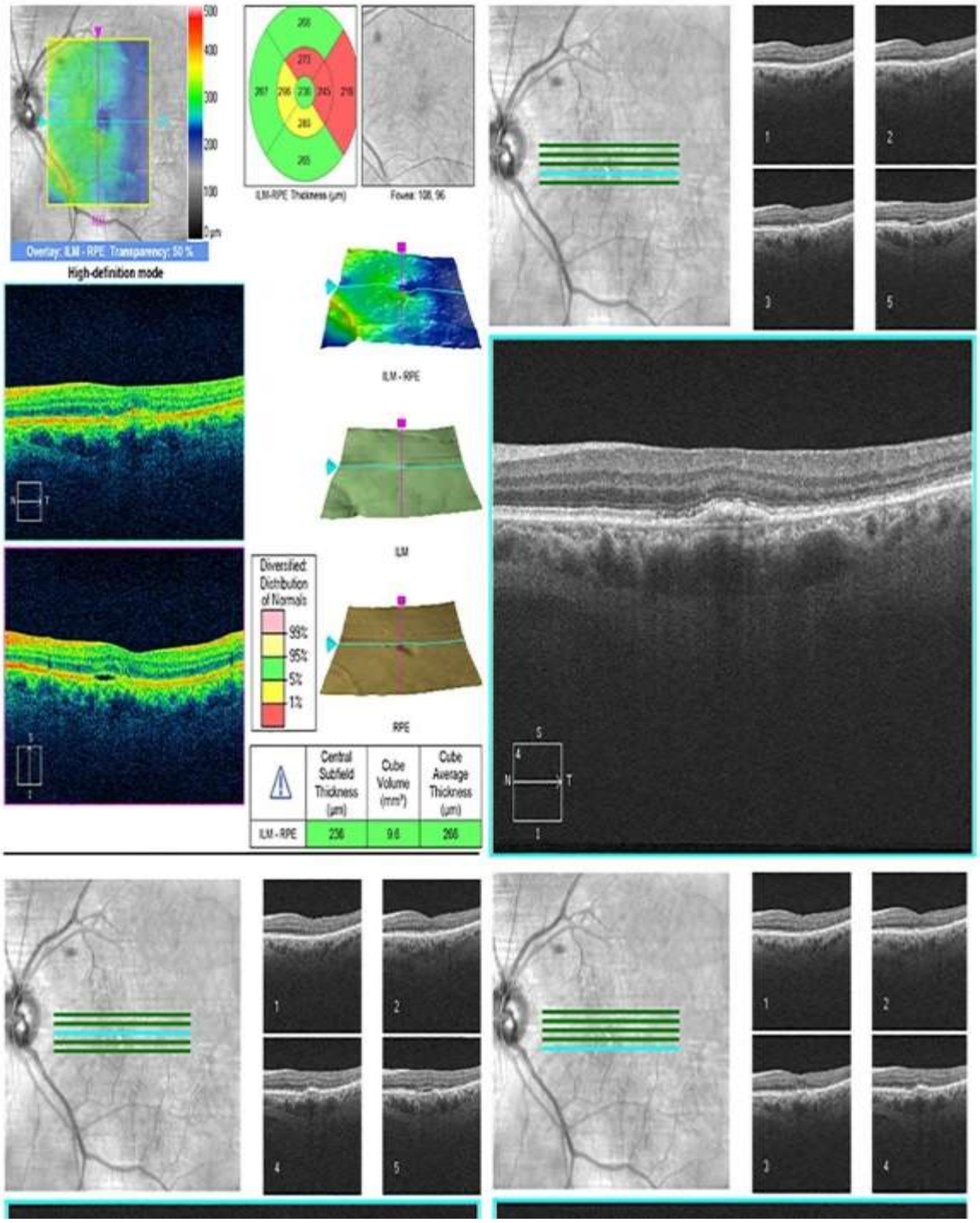

Figure(5): OCT picture of one of the patients included in the study.

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.OCT was done to all cases three months after surgery:There is no significant difference in the macular thickness pre and post-operation regarding age and gender shown in tables (2,3,4,5)

	Male mean±SD (n=17)	**Female mean±SD (n=23)**	**p-value**
Avearage macular Thickness	**241.4±51.5**	**244.7±30.8**	**0.8**
Central macular Thickness	**226.8±73.9**	**219.3±52.1**	**0.7**
Parafoveal macular thickness			
Superior	**298.8±82.7**	**298.6±62.2**	**0.9**
Inferior	**322.6±42.4**	**287±59.5**	**0.04**
Temporal	**305.5±73.9**	**287.4±52.5**	**0.4**
Nasal	**285.1±60.3**	**272.9±50.9**	**0.4**
Peripheral macular thickness			
Superior	**259.1±57.5**	**244±40.1**	**0.3**
Inferior	**266.7±32.4**	**262.7±46.8**	**0.8**
Temporal	**266.4±33.4**	**266.04±66.1**	**0.9**
Nasal	**256.1±64.4**	**261.7±46.6**	**0.8**

Table(2): comparison between males and females before phacoemulsification.

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	Male mean±SD (n=17)	Female mean±SD (n=23)	P - value
Avearage Macular Thickness	286.6±47.9	282±24.7	0.7
Central macular Thickness	288.6±134.6	250.9±37.6	0.2
Parafoveal macular thickness			
Superior	342.5±98.01	310.1±26.4	0.1
Inferior	348.1±66.1	310.3±26	0.02*
Temporal	333.1±95.7	301.04±23.1	0.1
Nasal	332.3±87.8	314.3±43.9	0.4
Peripheral macular thickness			
Superior	277.1±56.5	269.5±26.1	0.6
Inferior	280.6±38.2	271±22.4	0.3
Temporal	281.4±39.4	278.2±51.8	0.8
Nasal	295.4±66	284.5±41.8	0.5

Table(3): comparison between males and females after phacoemulsification.

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	30-59y mean±SD(n=16)	60+ y mean±SD(n=24)	p-value
Avearage macular Thickness	234.6±52.9	249.1±29.1	0.3
Central Macular Thickness	213.3±73.9	228.6±52.5	0.4
parafoveal macular thickness			
Superior	286.06±103.07	307.04±36.7	0.4
Inferior	296.9±45.9	305.6±61.4	0.6
Temporal	274.1±67.6	309.04±55.5	0.08
Nasal	263.2±73.1	288±36.5	0.2
Peripheral macular thickness			
Superior	236.3±63.9	259.8±32.4	0.1
Inferior	255.6±27.3	270.3±47.4	0.3
Temporal	280.1±56.8	257±51.4	0.2
Nasal	254.8±61.2	262.3±50.1	0.7

Table (4): comparison according to the age groups before phacoemulsification.

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	30-59 y mean±SD (n=16)	60+ y mean±SD (n=24)	p-value
Avearage Macular Thickness	273.6±39.1	290.8±32.7	0.1
Central Macular Thickness	250.7±63.5	277.8±107.8	0.4
parafoveal macular thickness			
Superior	314.2±80	330.3±59.3	0.5
Inferior	320.3±47.7	330.4±52.6	0.5
Temporal	294.8±67.8	327.9±62.2	0.1
Nasal	315±68.7	326.6±64.9	0.6
Peripheral macular thickness			
Superior	271.2±52.5	273.7±33.1	0.9
Inferior	272.8±29.6	276.6±31	0.7
Temporal	283.8±55.8	276.8±40.03	0.6
Nasal	281.4±62.6	294.3±46.03	0.5

Table(5):comparison according to the age groups after phacoemulsification

- There was significant increase in the mean of average and central macular thickness (**16.7%** , **19.9%** respectively) as shown in table (6).

	Before surgery mean±SD	After Surgery mean±SD	P value
Avearage macular thickness	243.3±40.4	283.95±35.9	0.0001*
Central macular Thickness	222.5±61.5	266.95±92.7	0.003*

Table (6) :comparison of the average thickness and central macular thickness before and 3 months after phacoemulsification.(n=40)

- There is about 8.43% signicant increase in the superior parafoveal macularthickness.
- There is about 8.04% significant increase in the inferior parafoveal macularthickness.
- There is about 6.64% signicant increase in the temporal parafoveal macularthickness. As shown in table (7):

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	Before Surgery mean±SD	After Surgery mean±SD	P value
Superior	**298.7±70.6**	**323.9±67.8**	**0.01***
Inferior	**302.1±55.3**	**326.4±50.3**	**0.004***
Temporal	**295.1±62.2**	**314.7±65.7**	**0.02***
Nasal	**278.1±54.7**	**321.95±65.8**	**0.0001***

Table(7): comparison of the parafoveal macular thickness before and 3 monthsafter phacoemulsification. (n=40)

- There is about 8.9% significant increase in the superior peripheral macularthickness.
- There is about 4.04% increase in the inferior peripheral macular thickness.
- There is about 5.03% increase in the temporal peripheral macular thickness
- There is about 11.49% significant increase in the nasal peripheral macularthickness. As shown in table (8):

	Before Surgery mean±SD	After Surgery mean±SD	P value
Superior	**250.4±48.2**	**272.7±41.3**	**0.0001***
Inferior	**264.4±40.9**	**275.1±30.1**	**0.1**
Temporal	**266.2±54.1**	**279.6±46.4**	**0.2**
Nasal	**259.3±54.2**	**289.1±52.9**	**0.0001***

Table(8): comparison of the peripheral macular thickness before and 3 months after phacoemulsification.(n=40)

- There is significant increase in overall macular thickness about **10.2%** after phaco. Surgery,
- There is about **15.7%** significant increase in the nasal parafoveal macularthickness. as shown in table (9)

	Macular thickness	
	Preoperative	**Three months post-operative**
Range	**30 - 476**	**45 – 732**
Mean	**268**	**295.5**
S.D.	**59.6**	**61.2**
P- value	**0.0001***	

Table (9) : comparison of overall macular thickness before and 3 monthsafter phacoemulsification. (n=40)

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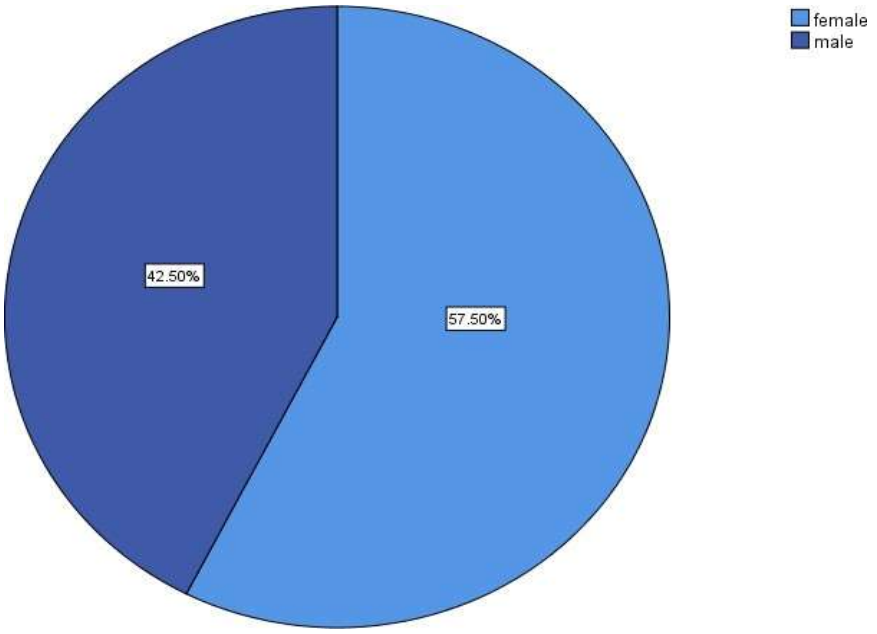

Figure (6) : percentage of femaleto male ratio in the study sample

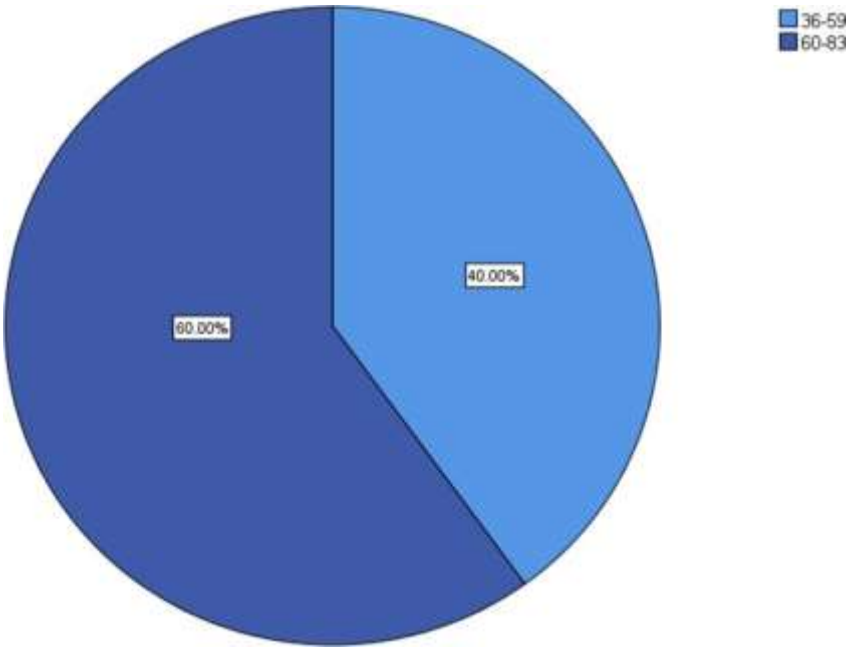

Figure (7) : percentage of age group(36-59)y to age group (60-83) ratio inthe study sample

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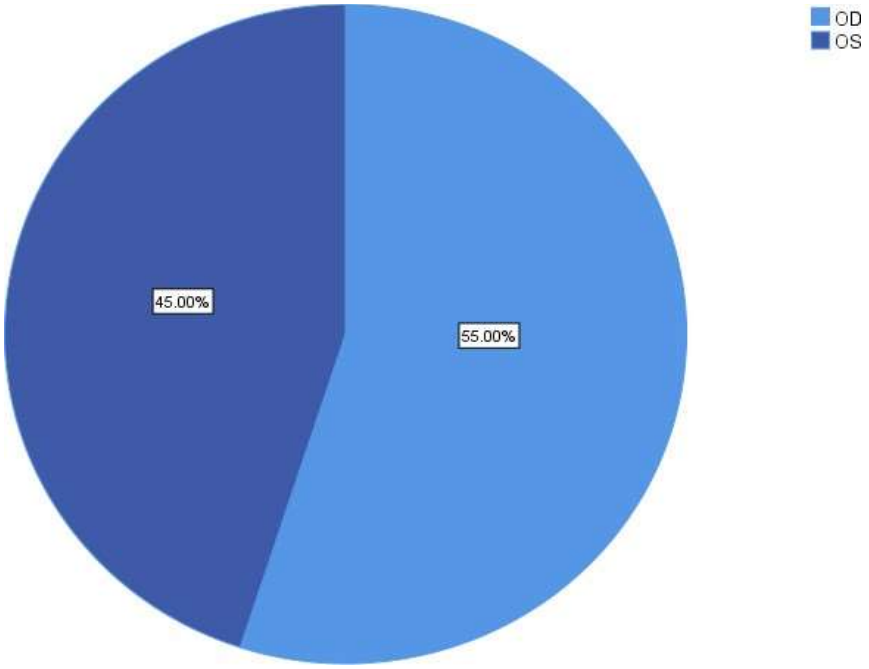

Figure (8) : percentage of right eye tothe left eye in the study sample

DISCUSSION

CME is a frequent ultimate process for reduced vision in individuals with a broad range of ocular conditions, including diabetic retinopathy, inflammation, infections, tumors, surgery, and retinal detachment. While clinical biomicroscopic examination or fluorescein angiography can both detect and measure cystoid macular edema, this disease is unexpectedly hard to properly assess.

To get a suitable technique for earlier identification and simpler identification of cases, a study aimed for assessing post phacoemulsification cystoid macular edema would be performed in the outpatient clinic of the ophthalmology department at Alsaida Zainab Eye Specialist Center.

In order to draw the ophthalmologist`s awareness to the fact that postoperative CME is prevalent, and to encourage them to put out a little effort to locate it, patients with persistent cystoid macular edema or repeated recurrences may incur destruction to the photoreceptors.

There is significant difference between the macular thickness before and after phaco surgery (p=0.0001). The macular thickness is slightly raised after the surgery and observed to lower down after 4 weeks of surgery. (45)

Another study which was conducted by the Decroos showed that the pre and post-operative macular thickness was statically significant (p=0.0001). This study also showed the same results. (46)

David R. Lally, et al , stated that currently no standardized protocol exists for the prophylaxis and management of pseudophakic CME because of a lack of prospective randomized clinical trials. Therapeutic interventions are based on the proposed pathogenesis of edema, mainly inflammation and vitreous traction.

Kemer Ati.B. et al.concluded that Exfoliation Syndrome has not been evaluated as a risk factor for an increase in macular thickness after uncomplicated cataract surgery.(47)

Fundus fluorescein angiography(FFA) is an invasive diagnostic procedure. Leakage from the perifoveal capillaries is seen earlier in the arteriovenous phase, followed by dye accumulation in petalloid pattern or a more diffuse hyper fluorescence in the later phases.(49)

OCT is a noninvasive, quick, and reproducible investigation that hasrevolutionized the imaging of posterior segment lesions. Correlation of individual layers involved on OCT with histopathology has brought us much closer to an accurate tissue diagnosis than ever before. Various combinations of findings onOCT and comparison with known OCT-based biomarkers have made disease identification and prognostication much simple.(50)

Claudia Perez-Straziota summarized that there is a weak association between angiographic and OCT evidence of CME and visual acuity and strong evidence

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suggesting that CME after cataract surgery in low-risk patients resolves spontaneously. Therefore, subclinical CME diagnosed by OCT or angiography in low-risk cases may be observed and only treated should it become visually significant. Conversely, in high-risk patients (who are more prone to recalcitrant edema and decline in vision), medical treatment can be initially considered followed by intravitreal anti-inflammatory, or anti-VEGF injections if there is no response.(51)

CONCLUSION

There is a significant increase in macular thickness after uneventful phacoemulsification cataract surgery in normal eyes . This means that subclinical CME and macular abnormalities are expected even in normal eyes after phacoemulsification.

RECOMENDATIONS

- Further study with larger sample size with long and frequent term follow-up period is recommended.
- Macular thickness with OCT is a good method to detect clinical and subclinical pseudo-phakic CME. This may be important for establishing treatment to avoid as far as possible the permanent damage to photoreceptors in those patients.
- Different treatment protocols should be studied in a randomized controlled fashion. The results suggest that long term follow-up of more than 4-week is needed to see whether CMT changes return to preoperative levels.

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