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Alterations in Thickness of Macula after Uncomplicated Cataract Surgery

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Abstract:-

➢ ***Purpose***

Evaluate alterations in thickness of macula after uncomplicated cataract surgery, to clarify the optical tomographic characteristics of thickness of macula after uncomplicated cataract surgery, and also compare the changes in thickness of macula after uncomplicated phacoemulsification and manual small incision cataract surgery.

➢ ***Patients and Methodology***

The study included a cohort of fifty patients, consisting of 28 males and 22 females. The age range of the participants was between 35 and 78 years, with a mean age of 58.6 years. Out of the total, 25 individuals (50%) underwent small incision cataract surgery (SICS) in one eye with "in the bag" method of intraocular lens (IOL) made up of polymethylmethacrylate implantation, while the other 25 participants (50%) underwent phacoemulsification in one eye with "in the bag" method of foldable IOL made up of acrylic.

The exclusion criteria included cataracts that were too mature for pre-surgical OCT, pathology involving the retina, traumatic or complex cataracts, and complications during surgery. The measurement of best corrected visual acuity was conducted, and optical coherence tomography (OCT) was performed before and after the surgery to assess macular thickness. The patients were reviewed at one week, two week, and four weeks post-surgery, as well as three months post-surgery.

➢ ***Outcome***

Among the 50 participants who had undergone cataract surgery, subclinical macular edema was observed at the first week, second week , and fourth week evaluations. The highest level of subclinical macular edema was observed during the first week evaluation. However, during the third month evaluation, the macular edema had diminished. Statistically significant differences (P<0.01) were observed between the mean thickness of macula values before and after surgery at the 1st, 2nd, and 4th week post-operation. Within the SICS group Statistically significant differences (P<0.01) were observed between the mean macular thickness values before and after surgery in the first, second, and fourth weeks. Within the Phaco group Statistically significant differences (P<0.05) were observed between the mean values of macular thickness before surgery and during the first week after surgery, before surgery and during the second week after surgery, and during the first week after surgery and the fourth week after surgery. A notable subclinical alteration occurred in the thickness of the macula, without any impact on visual acuity. None of the participants in the current research exhibited cystoid macular edema. Upon comparing both groups, it was observed that the SICS group exhibited a prolonged subclinical macular edema until the fourth week review. Conversely, in patients who underwent phacoemulsification, an increase in retinal thickness was observed until the second week review. However, there were no statistically significant differences in the average macular thickness values between the two groups before surgery (t (d.f.=46) = 0.98; P>0.05), at review of 1 week (t (d.f.=46) = 1.08; P>0.05),review at 2 weeks (t (d.f.=46) = 0.74; P>0.05), review at 4 weeks (t (d.f.=46) = 0.64; P>0.05), and review at 3 months (t (d.f.=46) = 0.23; P>0.05) after surgery.

➢ ***Conclusion***

Subclinical macular edema develops following uncomplicated cataract surgery, reaching its highest point one week after the procedure and persisting for a maximum of four weeks. The optical coherence tomography (OCT) scan revealed the presence of macular edema, which did not cause any changes to the macular structure . The period of subclinical macular edema is extended in eyes that undergo manual small incision cataract surgery (SICS) compared to those that undergo phacoemulsification. This edema does not have any impact on visual acuity.

Keywords:- *Manual Small Incision Cataract Surgery(SICS) , Phaco Emulsification , Optical Coherence Tomography(OCT), Polymethyl Methacrylate(PMMA) , Intraocular Lenses (Iols).*

I. INTRODUCTION

Optical coherence tomography (OCT) is a medical imaging technique that can produce high-resolution, cross-sectional or tomographic images of biological tissues at the microlevel. Optical Coherence Tomography (OCT) utilizes low coherence or white light-interferometry to conduct precise calculations and imaging with a high level of

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resolution. Macular thickness undergoes post-operative alterations after cataract surgery. OCT can be used to evaluate subclinical alterations in macular thickness that do not impact visual acuity. Pseudophakic cystoid macular edema (PCME) is a prevalent complication that arises postoperatively and intraocular lens (IOL) implantation . It is characterized by the leakage of fluid from the capillaries. Multiple Cystoid spaces develop in the macula as a result of the buildup of serous type of fluid in the outer plexiform layer. This problem typically resolves on its own, but in certain cases, it can cause significant damage to the central vision, which may persist or permanant loss of vision.

➢ *The Structure Of The Macula*

The macula is an elliptical region located in close proximity to the central portion of the retina. The fovea is located at the center of the macula. The fovea is the region of the eye that enables the highest level of visual acuity[2]. The object consists of a substantial quantity of cones, which are nerve cells that function as photoreceptors with exceptional acuity. The macular area exhibits a modest disparity in size between the vertical and horizontal directions[3]. The width of the highly colored middle part is around 3mm[4]. The central region have been subdivided into three distinct areas: the core fovea and the two concentric bands encircling it, known as the parafovea and the perifovea[6]. The fovea is a concave and rounded depression. The fovea centralis is located on the most temporal part of the optic disc and has a diameter of around 0.8mm[5].

➢ *Etiopathogenesis.*

The primary etiology of PCME has been identified as a disruption in the blood-aqueous barrier[10].The presence of cystoid macular edema (CME) is associated with the production of prostaglandins and other inflammatory mediators.[7,8] The occurrence of surgical trauma results in the liberation of prostaglandins Prostaglandins traverse the vitreous humor and enter the posterior segment, causing the seepage of serous fluid into the Henle's layer[9] .The main factor leading to CME is the escape of fluid with low lipid and protein levels from the capillaries around the fovea into the regions outside the cells, caused by the disruption of the blood-aqueous barrier[10].

Fundus fluorescein angiography has traditionally been considered the most reliable method for diagnosing subclinical PCME[11]. However, non-invasive cross-sectional imaging of the retina using OCT can also efficiently identify the illness. In addition, OCT offers the benefit of quantification and the ability to obtain repeatable results. Therefore, the current study aims to investigate these characteristics of PCME.

➢ *Study Objectives:*

- To measure the alterations in thickness of macula after uncomplicated cataract surgery.
- To evaluate the optical coherence tomographic changes of thickness in macula after an uncomplicated cataract surgery .
- To compare the variations in thickness of macula after phacoemulsification and manual small incision cataract surgery

II. MATERIALS AND METHODOLOGY

The current research aims to evaluate the OCT features of the macula and assess changes in thickness of macula following the relatively uneventful cataract surgery using phacoemulsification and SICS. The study included fifty individuals in total who had cataract surgery (28 men and 22 women), with an average age of 58.6 years and a range of ages from 35 to 78.

A. INCLUSION CRITERIA:

Patients who met the following requirements were included in the study:

- Patients without macular or retinal pathologies
- Cataracts that permit preoperative OCT
- Individuals who had a smooth cataract surgery procedure

B. EXCLUSION CRITERIA :

Patients who have any of the following were not allowed to participate in the study:

- Mature cataract
- Cataract following trauma
- Complicated cataract
- Complications during surgery.
- Retinal pathology.

C. STUDY PERIOD : 12 months i.e (from 2022 august to 2023 august)

D. CONFLICT OF INTEREST : Nil

E. STUDY PARTICIPANTS

Fifty participants were enrolled in the study, with 28 [56%] males and 22 [54%] females, based on the established inclusion and exclusion criteria. The patients' ages varied from 35 to 78 years old, with a average age of 58.36 ±10.23 years.

F. EXAMINATION OF PATIENTS :

- Every patient had a thorough examination of their eyes done.
- Pre-, during-, and post-operative examinations were conducted.

➢ The pre-operative assessment includes:

- Evaluation of best corrected visual acuity using Snellen's chart.
- Assessment of the anterior segment with slit lamp;
- Fundus examination using + 90D lens ;
- Fundus photography; and
- OCT scan, analysis of retinal thickness, and analysis of retinal map

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➢ Additional standard tests includes measuring the following:
- Intraocular pressure (IOP) using goldmann applanation tonometry;
- Naso-lacrimal duct patency using syringing;
- A Scan / Axial length measurement using the IOL master; and
- General physical assessment

➢ The intra-operative assessment involved recording the following information:
- The kind of surgery, namely SICS or phacoemulsification;
- The overall length of the procedure, including the time spent on phacoemulsification; and
- The absence of surgical complications.

➢ The following was examined during the post-operative phase:
- The best corrected visual acuity of the patient was determined;
- The anterior segment was examined using a slit lamp;
- The fundus was biomicroscopically examined using a +90D lens;
- Fundus photography was conducted; and
- An OCT scan was performed.

III. SURGICAL PROCEDURE

Using a divide and conquer strategy, patients received phacoemulsification through a 2.8 mm superotemporal or superior clear corneal incision[12]. At the end of the procedure, a foldable intraocular lens made of acrylic was placed inside the capsular bag.

A superotemporal or superior scleral tunnel incision of 6.0 or 6.5 mm was used for manual small incision cataract surgery on the patients. Nucleus was extracted by means of the sandwich method. At the end of the procedure, a 6.0 mm rigid intraocular lens made of polymethylmethacrylate was placed inside the bag[13].

Patients were followed up with at one week, two week , and four weeks following surgery, as well as three months later.

➢ *OCT examination*

Before taking the picture, 1% tropicamide with 5% phenylephrine hydrochloride were used to dilate each subject's eyes. The patient was instructed to focus on the fixation target while they were comfortably sitting with their chin resting on the chin rest in front of the OCT machine. The most widely used fixation target was the internal fixation target, which was shown by a green light. Following fixation, the operator positioned the device, chose the appropriate scan, and the fundus picture and scan beam appeared on the screen[14]. Rotating the dioptre can help people with substantial refractive problems. The distance between the anterior most limit of the red, reflective layer, which corresponds to the retinal pigment epithelium and choriocapillaries, and the first reflection of it at the vitreous and retinal interface was used by the computer to measure retinal thickness for each scan in the image[15]. In addition to retinal thickness, particular attention was paid to the retinal architecture, including multiple cystoid spaces, multiple hard exudates, sub-retinal fluid, and any retinal edema.

IV. RESULTS

The study was conducted for 12 months i.e (from 2022 August to 2023 August). Fifty participants were enrolled in the study, with 28 [56%] males and 22 [54%] females, based on the established inclusion and exclusion criteria. The patients (average age 58.45 ±10.32 years {95% confidence interval (C.I.) = 55.54 to 61.73 years}) ranged in age from 35 to 78 years (Fig. 1a). Of these, 25 (50% of the total) had undergone phacoemulsification with a foldable acrylic IOL that was "in the bag" after undergoing small incision cataract surgery (SICS) with a polymethacrylate intraocular lens (PMMA) implantation. Three skilled surgeons performed the operations on these patients.

➢ *PATIENT'S AGE:*

The 25 patients who had the SICS surgery had a mean age of 57.04 ± 8.25 [95% C.I.= 53.35 to 60.98] years (Fig. 1b), whereas the 25 patients who had the phacoemulsification process had a mean age of 59.68 ± 12.56 [95% C.I.= 54.87 to 64.88] years (Fig. 1c); Based on the degree of freedom ({d.f.}=46) = 0.9340 and P = 0.37, the difference was not statistically significant.

➢ *PATIENT'S GENDER:*

There were 10 men and 15 females in the SICS group and 12 males and 13 females in the phacoemulsification group; however, this difference was statistically not significant (χ^2 (d.f.=1) = 0.35; P > 0.05) (Fig. 2).

➢ *Comorbidities associated with development cataract in the participants and laterality of the operated eye:*

Out of the 50 patients, 43 (86%) had no systemic disease. Among the 50 patients, seven (14%) had hypertension; of these, one received SICs and the other six underwent phacoemulsification.

Of the 50 participants, 25 had surgery on their right eye, and the remaining 25 had surgery on their left eye. In the SICs group, 11 patients underwent surgery for the right eye and 14 for the left, whereas in the phacoemulsification group, 14 underwent surgery for the right eye and 11 for the left. This difference was statistically not as significant (ς^2 (d.f.=1)= 0.65; P > 0.05) (Fig. 3).

➢ *The two patient groups' total duration for ocular surgery*

Summing up, the mean surgery time for the 50 patients was 10.25 ± 1.65 (95% C.I. = 9.64 to 10.65) minutes (Fig. 4a). The mean surgical time in the 25 patients who underwent SICS was 10.0 ± 0.65 (95 % C.I. = 9.43 to 10.54) minutes (Fig. 4b), that was comparatively less than the average surgical time in the 25 patients who had undergone phacoemulsification (10.35 ± 1.20 [95 % C.I. = 9.65 to 10.75]) minutes (Fig. 4c); however, the difference was statistically not significant ({t' [d.f.= 46]= 1.20 ; P=0.28).

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Phacoemulsification took an average of 1.28 ± 0.4 minutes for the 25 individuals who had it done (Fig. 4d).

➢ *The patients' visual acuity after undergoing cataract surgery*

The 50 participants had average pre-surgical visual acuity of 0.42 ± 0.2 (95% C.I. = 0.32 to 0.42) decimals (approx 6/18p); average post-surgical visual acuity was 0.75 ± 0.2 (95% C.I. = 0.58 to 0.63) decimals (approx 6/9) (Fig. 5a); the difference was statistically very significant (<t' [d.f.= 96]= 9.32; P <0.0001).

Fascinatingly, the average pre-surgical visual acuity in the 25 participants who undergone SICS was 0.31 ± 0.15 (95% C.I. = 0.23 to 0.31) decimals, while in the 25 participants who received phacoemulsification, it was 0.48 ± 0.17 (95% C.I. = 0.36 to 0.49) decimals. This difference was statistically very significant ({t' [d.f.=46]= 4.30; P=0.0001). Nonetheless, there was statistically no significant difference ({t'[d.f.=46]= 0.87; P=0.33) between the average post-surgical visual acuity in the participants who undergone phacoemulsification (0.70 ± 0.19 [95% C.I. = 0.68 to 0.79] decimals) and the participants who undergone SICS (0.67 ± 0.17 [95% C.I. = 0.58 to 0.76] decimals).

➢ *The macular thickness of patients who had cataract surgery in their operative eyes*

172±27µ was the pre-surgical thickness of macula measured in the 50 individuals who had cataract surgery. As illustrated in Figure 6a, the average pre-surgical macular thickness was 162.87 ± 14.56 (95% C.I.=158.65 to 166.67) µ.

The following measurements were recorded after surgery:

- Macular thickness at the review at first week was 186 ± 34 µ, with a mean of 173.43 µ ± 13.54 (95% C.I.=169.52 to 177.20) µ;
- In the review at second week, thickness of the macula was 179 ±28µ, and the , the average macular thickness was 171.78µ ± 12.68 (95% C.I.=168.26 to 175.54) µ;
- In the review at fourth week, thickness of the macula was 184± 23µ, and the average thickness of macula was 168.78 µ ± 14.52 (95% C.I.=164.54 to 172.66) µ; in the review at third month, the thickness of macula was 184±45 µ and the average thickness of macula was 166.42 ± 13.76 (95% C.I.=162.43 to 170.19) µ (Fig. 7a).

Using one-way analysis of variance (ANOVA), the differences between the five mean values (pre-surgical, postsurgical 1 week , 2 week , and 4th week, and post-surgical 3rd month) were statistically analysed. The differences were statistically very significant (Fisher {f' value= 4.792; P=0.001).

Tukey's method was used for post-hoc testing to assess the significance between group differences. There were substantial (P<0.05) and highly significant (P<0.01) differences between the average value before the surgery and post surgery first week average value and the post surgery second week average value, between the post surgery first week average value and the post surgery third week average value, and the pre surgical average value and the post surgery fourth week mean value, as well as the thickness of macula mean values after surgery in the second and third weeks[16].

Subclinical macular edema was observed in the first week, second week , and fourth week reviews of the 50 participants who had undergone cataract surgery; the first week assessment showed the highest level of subclinical macular oedema. On the other hand, the macular edema had decreased at the third monthly review (Fig. 6b).

The 25 participants who had SICS had baseline (preoperative) macular thickness measurements of 163±54 µ, and the average thickness was about 160.84 µ ± 10.54 (95% C.I.= 156.32 to 165.21) (Fig. 7a). Following surgery, the following measurements were recorded:

- The macular thickness was 175±18µ during the first week review, and the average thickness of macula was 171.25 µ ± 10.54 (95% C.I.=166.78 to 175.89) µ.
- The thickness of macula was 170 ± 23 µ at the review after the second week, and the average thickness of macula was about 170.54 µ ± 11.32 (95% C.I.=165.64 to 175.32) µ;
- Macular thickness measurements were taken at the fourth week review (Fig. 7a) and the average was 167.33 µ ± 15.12 (95% C.I.=161.6 to 173.5) µ. At review of patient at third month , the macular thickness measured 180 ± 23 µ, and the average was 165.56 ± 15.21 (95% C.I.=159.32 to 171.41) µ.
- The five average values (pre-surgical, post surgical, first, second, and fourth weeks, and post-surgical third month) in the participants who had undergone SICS were compared statistically using one-way ANOVA, and the results showed that the differences were statistically very significant (Fisher {f' value = 2.776; P = 0.03). Tukey's method was then used for post-hoc testing to assess the significance of intergroup differences. There were significant (P<0.05) and highly significant (P<0.01) differences in the mean values of macular thickness between the pre surgical and post-surgical 1st week, 2nd week, and 4th week.

Subclinical macular edema was detected at the first week, second week, and fourth week assessments in 25 participants who had SICS. Figure 7b.

The pre-operative thickness of macula in the 25 participants who had phacoemulsification was 172±54 µ, with a average value of 17.43 ± 164.65 (95 % C.I. = 157.43 to 171.84) µ. Following surgery, the measurements were recorded:

- The thickness of macula was 182 ± 32 µ at the first week review;
- At the review at second week , it was 175 ± 25 µ and the average thickness of macula was 173.16 ± 14.23 (95% C.I.=167.32 to 179.65) µ;

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- At the review at fourth week, it was 172 ± 32 μ and the average thickness of macula was 169.43 ± 13.59 (95% C.I.=164.21 to 175.56) μ;

Comparing the five average values (pre-surgical, post surgical , first, second, and fourth weeks, and post-surgical third) statistically

One-way ANOVA was used to analyse the differences (month) between the patients who had undergone phacoemulsification; the results showed that the differences were statistically not significant (Fisher `f' value = 2.18; P = 0.075). Tukey's method was then used for post-hoc testing to ascertain the significance of intergroup differences. The pre surgical mean value and the post surgical mean value at 1st week, the pre surgical mean value and the post surgical mean value at 2nd week, and the post surgical mean value at 1st week and the postoperative mean value at 4th week of macular thickness were found to differ significantly (P<0.05).

On evaluation at first week and second week follow-up, there was a very significant subclinical change in the thickness of macula in the 25 patients who had phacoemulsification (Fig. 8b) not affecting visual acuity. When the two participant groups—partricipants who had undergone phacoemulsification cataract surgery and those who had undergone SICS—were compared, it was discovered that the SICS group had a prolonged subclinical macular oedema that persisted until the review at fourth week, while the phacoemulsification group's participants had increased macular thickness until the second week review (Fig. 9), (Fig. 10a and b) Nonetheless, variations in the mean macular thickness values were seen between the two groups.

The results did not show statistical significance before surgery (~t' (d.f.=48)= 0.96; P>0.05), at one week (~t' (d.f.=46)= 1.12; P>0.05), at two weeks (~t' (d.f.=46)= 0.65; P>0.05), at four weeks (~t' (d.f.=46)= 0.65; P>0.05), or three months (~t' (d.f.=46)= 0.28; P>0.05).

In this current investigation, no patient had any signs of cystoid macular edema.

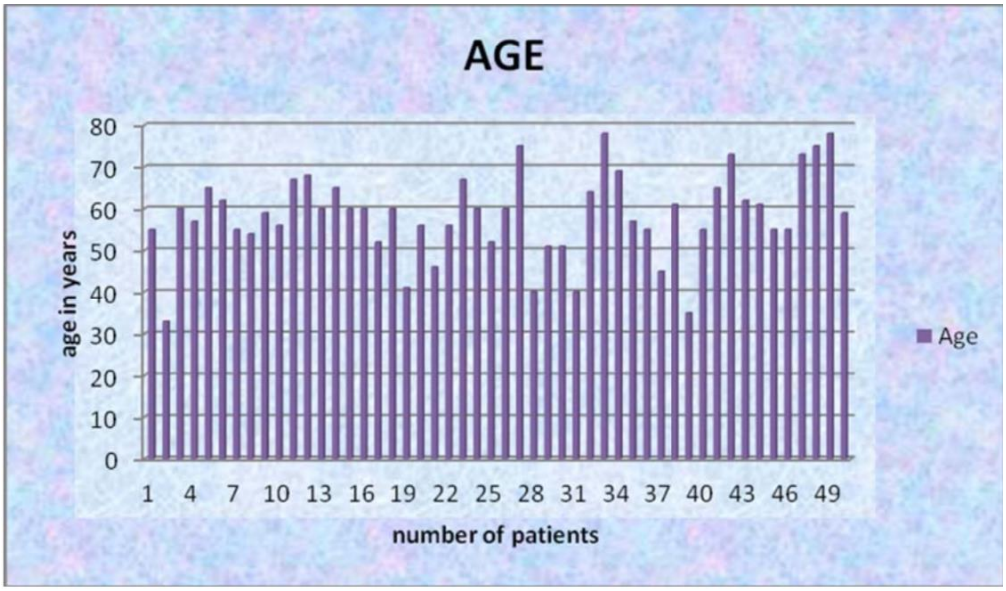

Fig 1a. Age of the 50 participants (in years) enrolled in study

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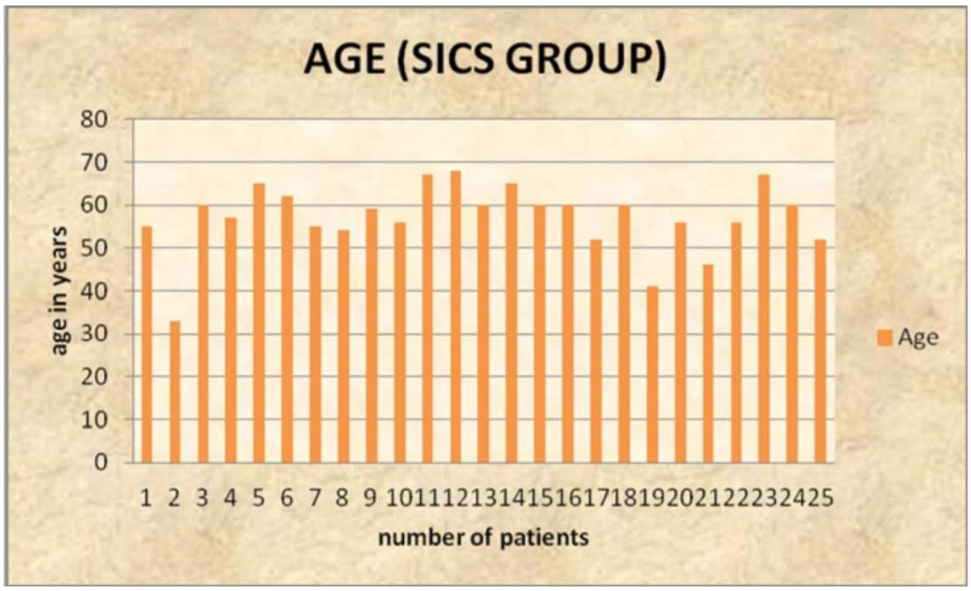

Fig 1b. Age of the 25 participants (in years) who underwent small incision cataract surgery

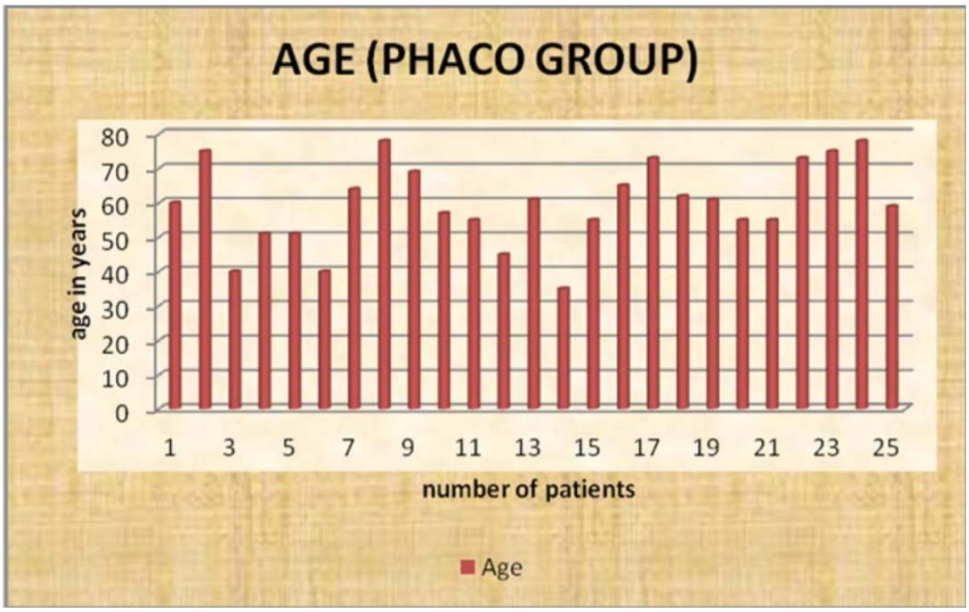

Fig 1c shows the age of the 25 participants (in years) who had cataract surgery using phacoemulsification.

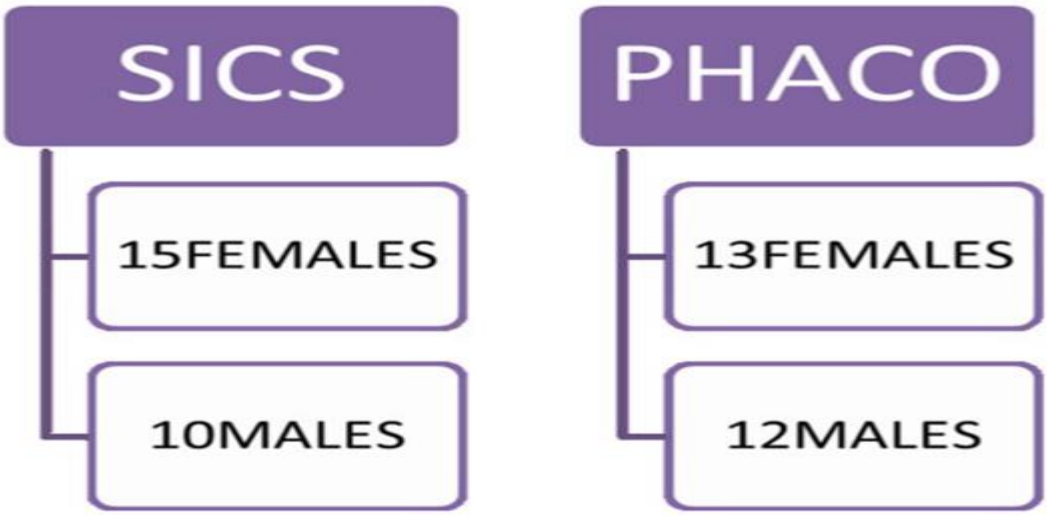

Fig 2 shows the gender distribution among research participants.

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Fig 3: Lateralization of the eye subjected to various surgical procedures

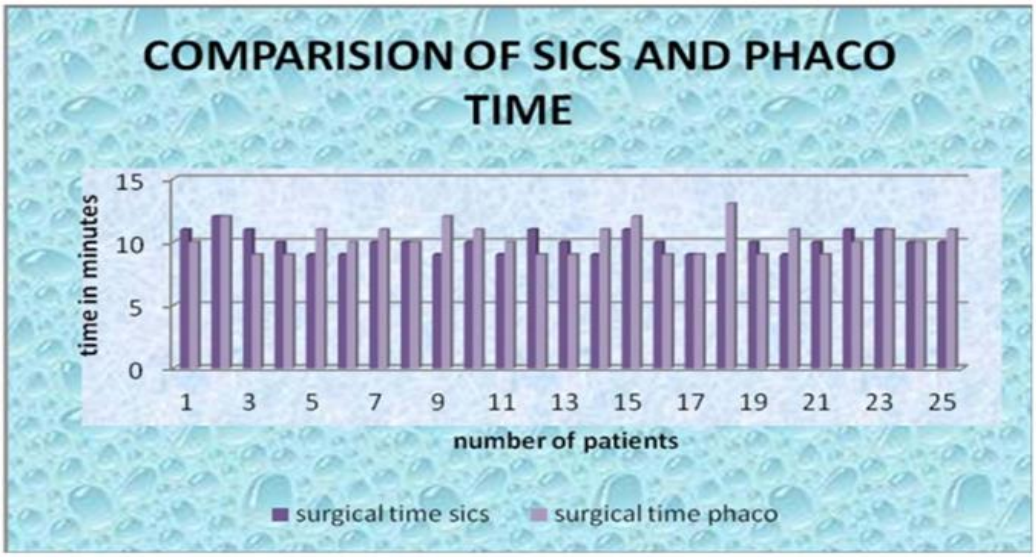

Fig 4a. Duration of the procedure (surgical time) in 50 patients who had undergone cataract surgery

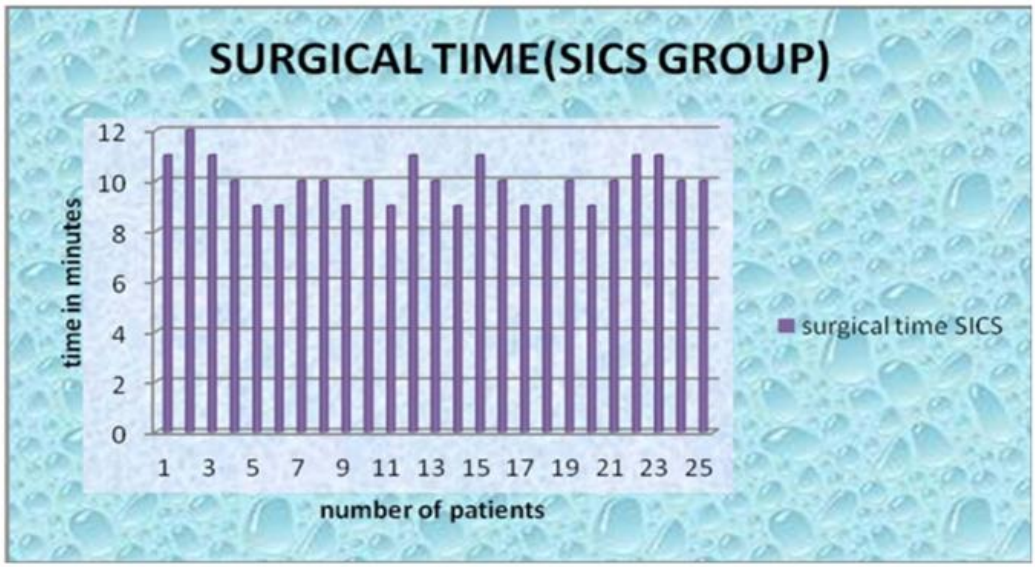

Fig 4b. Duration of the procedure (surgical time) in 25 patients who had undergone small incision cataract surgery (SICS)

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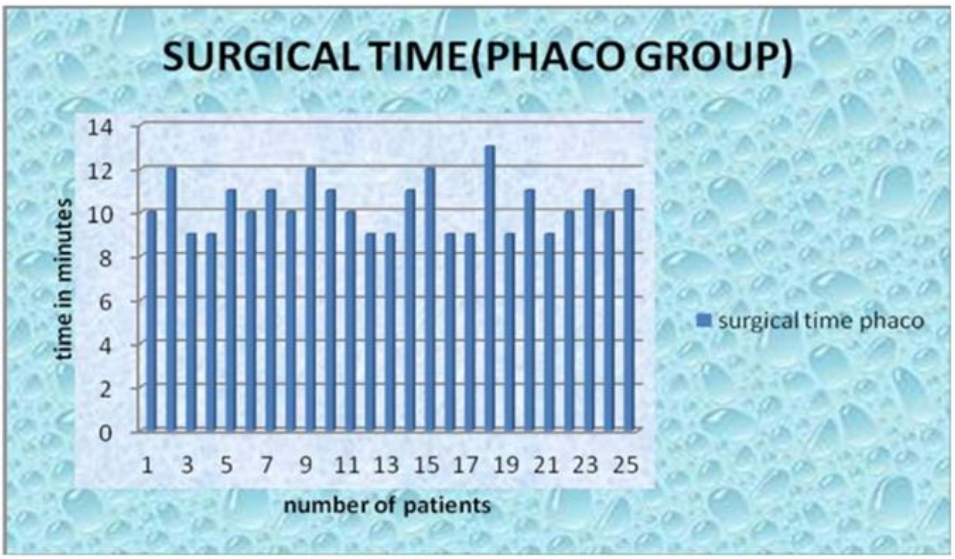

Fig 4c. Duration of the procedure (surgical time) in 25 patients who had undergone phacoemulsification cataract surgery

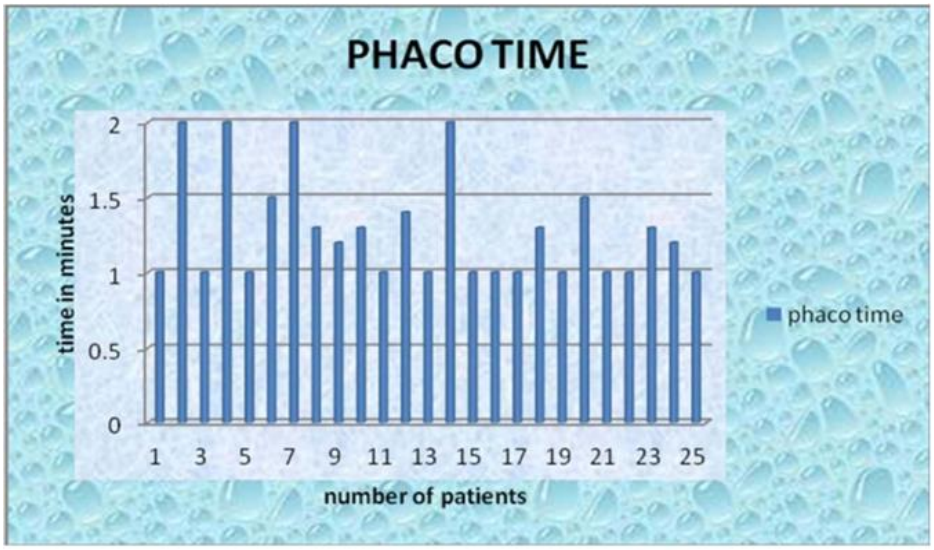

Fig 4d. Duration of phaco emulsification (phaco time) in 25 patients who had undergone phacoemulsification cataract surgery

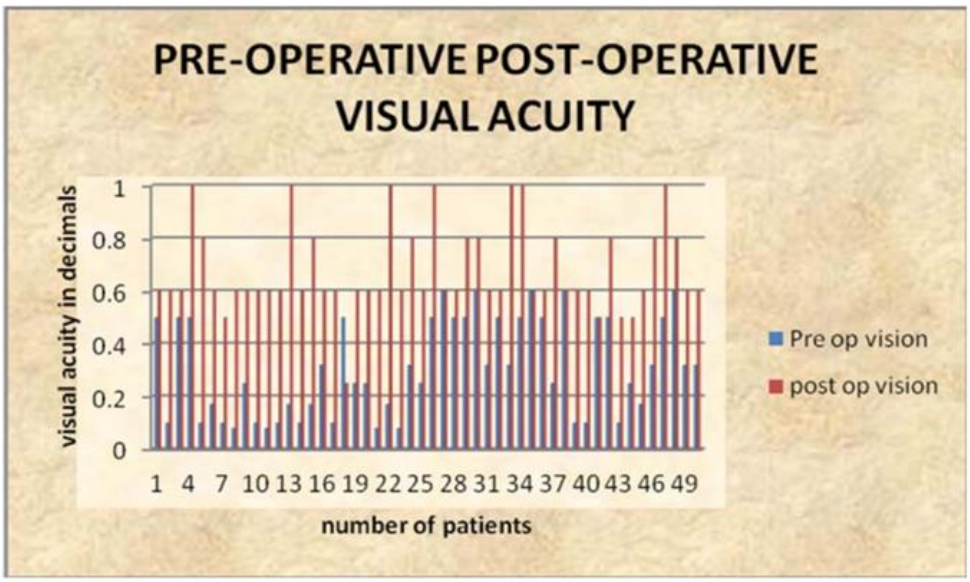

Fig 5a. Pre-operative and post-surgical visual acuity in 50 participants who had undergone cataract surgery

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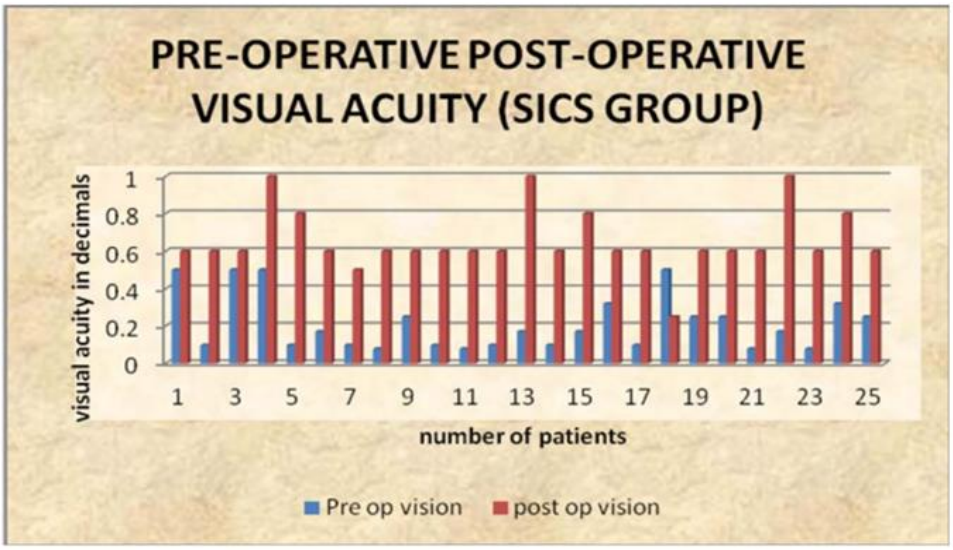

Fig 5b. Pre-operative and post-surgical visual acuity in 25 participants who had undergone small incision cataract surgery

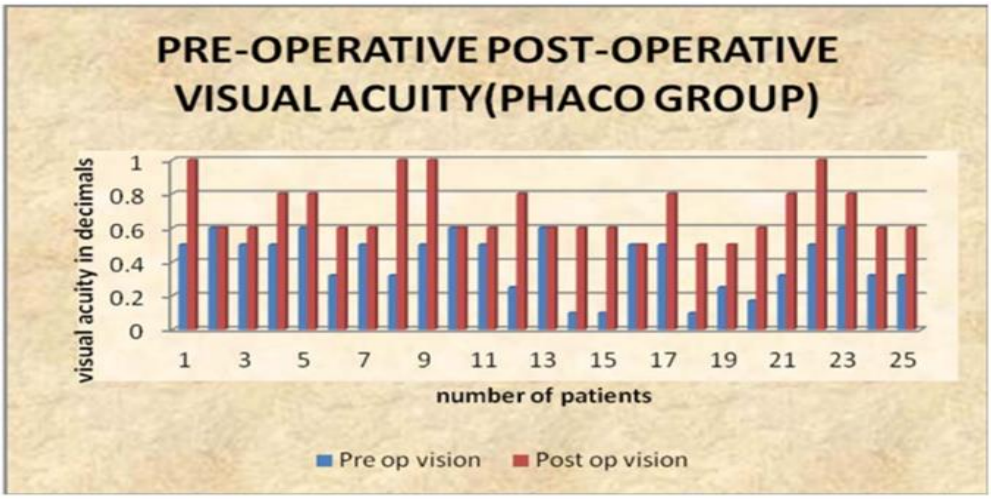

Fig 5c. Pre-operative and post-surgical visual acuity in 25 participants who had undergone phacoemulsification cataract surgery

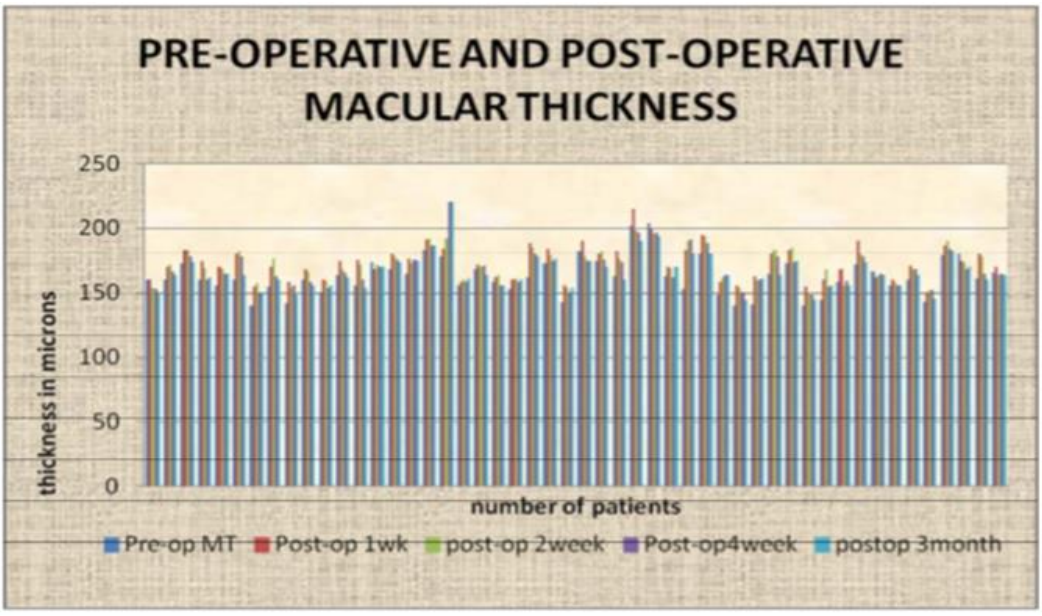

Fig 6a. Preoperative and post-surgical thickness of macula in 50 participants who had undergone cataract surgery

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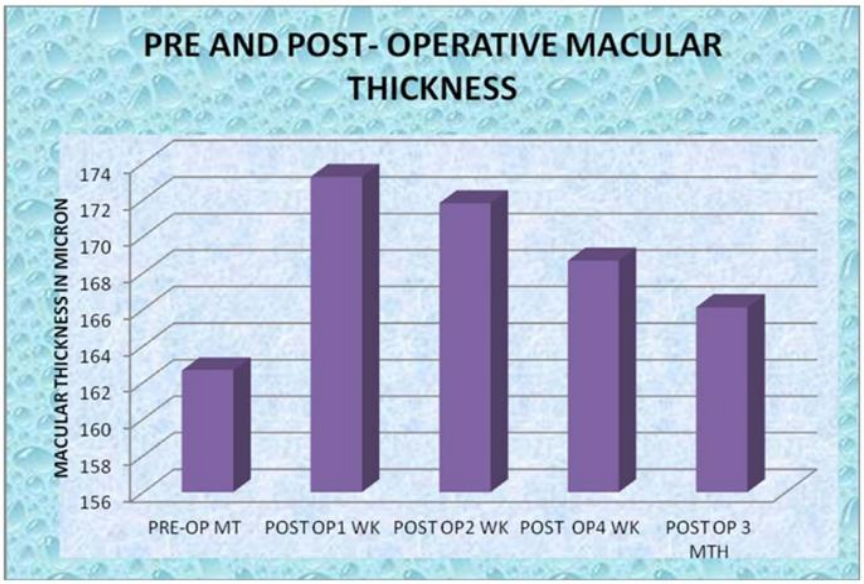

Fig 6b. Preoperative and post-surgical average thickness of macula in 50 participants who had undergone cataract surgery

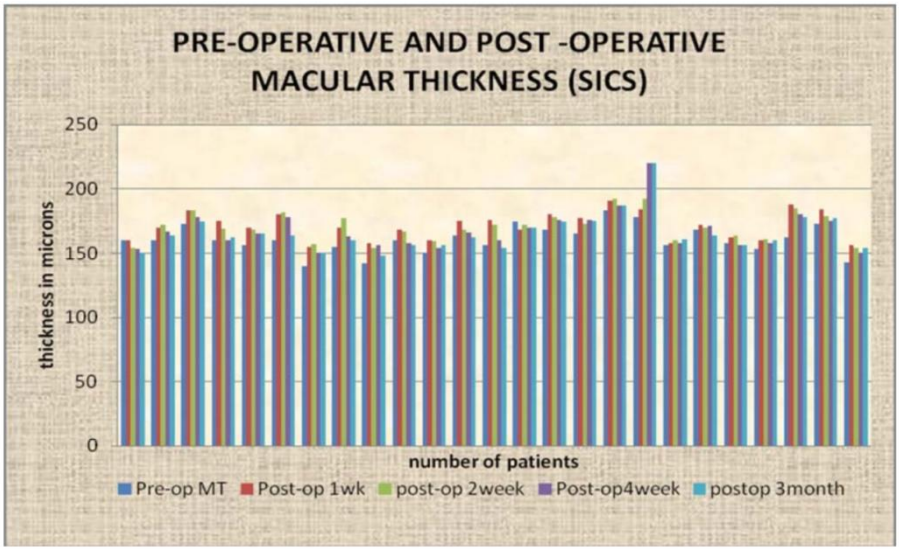

Fig 7a. Preoperative and post-surgical thickness of macula in 25 participants who had undergone small incision cataract surgery

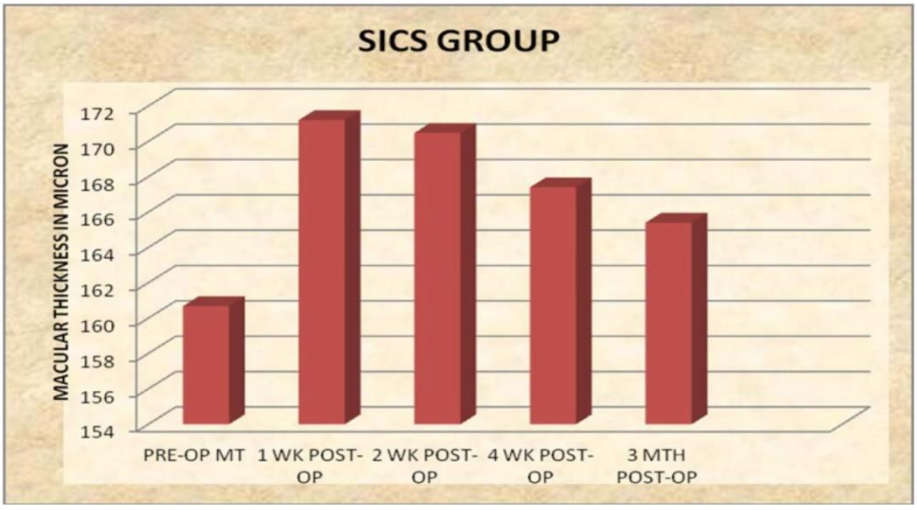

Fig 7b. Preoperative and postsurgical average thickness of macula in 25 participants who had undergone small incision cataract surgery

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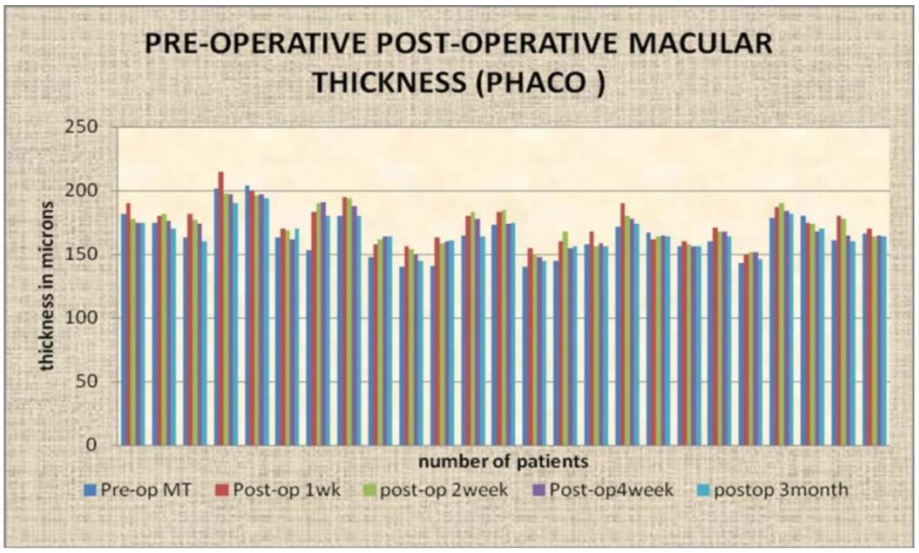

Fig 8a. Preoperative and post-surgical thickness of macula in 25 participants who had undergone phacoemulsification cataract surgery

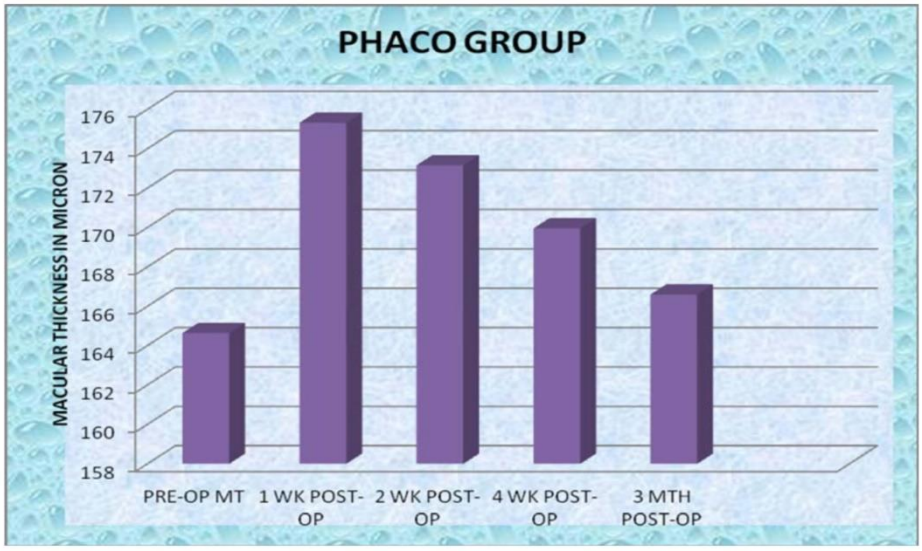

Fig 8b. Preoperative and post-surgical average thickness of macula in 25 participants who had undergone phacoemulsification

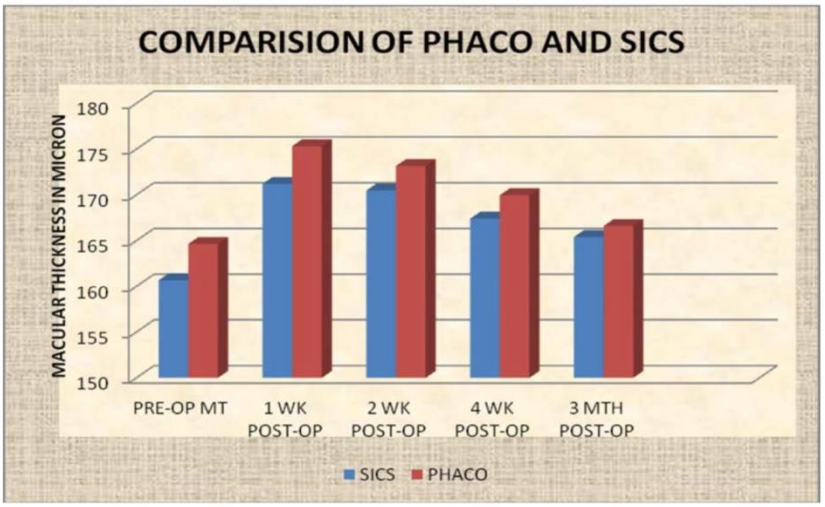

Fig 9: Average thickness of macula before and after surgery for participants undergoing small-incision cataract surgery and participants undergoing phacoemulsification cataract surgery

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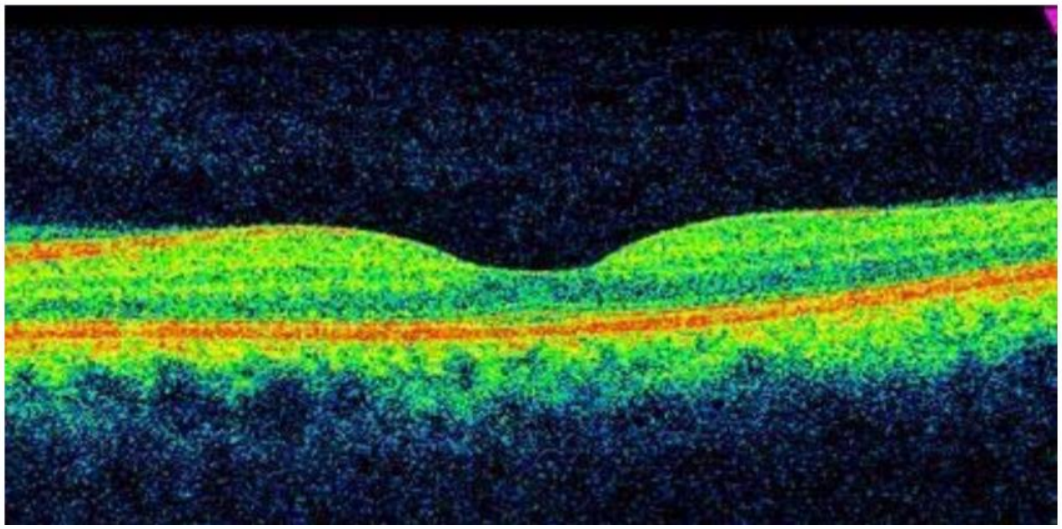

Fig 10a. OpticalCoherenceTomography image displaying the 152 micron thick preoperative macular region.

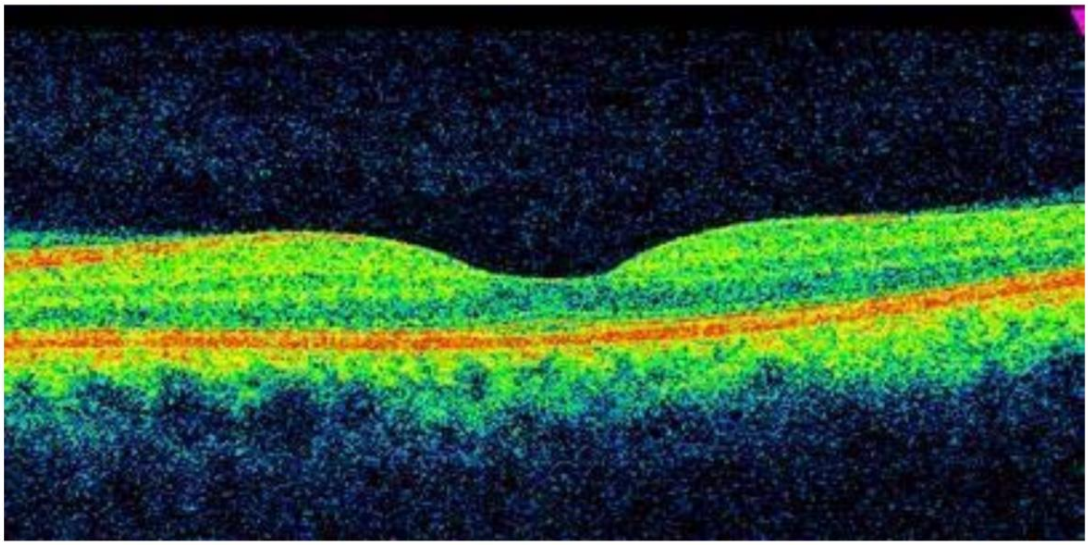

Fig 10b The Optical Coherence Tomography image displaying the 184 micron-thick postsurgical subclinical macular edema.

V. DISCUSSION

A known side effect of intraocular lens (IOL) and cataract surgery is pseudophakic cystoid macular edema (PCME), which appears as a fluid effusion from the capillaries. Even though this phenomena usually resolves on its own and is self-limiting, it can occasionally cause a noticeable impairment in central vision that could last a lifetime. An investigation of thickness of macula after SICS and phacoemulsification cataract surgery was conducted prospectively and randomizedly by Sambuddha Ghosh et al.[29]. Patients in the SICS and the phacoemulsification groups had mean ages of 62 ± 6 years and 61 ± 6 years, respectively. 58% of the patients in the SICS were male and for 53.5% of the patients in the second group receiving phacoemulsification. Age or gender differences between both the groups were negligible. 49.1% of patients in the SICS group and 50.9% of patients in the phacoemulsification group underwent surgery on their right eye, while the difference was statistically not significant[29].

The patients who underwent SICS procedure had an average age of 57.04 ± 8.05 [95% confidence interval [CI] = 53.72 to 60.36] years, whereas the patients who had undergone phacoemulsification procedure had an average age of 59.68 ± 12.05 [CI = 54.81 to 64.45] years; this difference did not reach statistical significance (\t' test [degree of freedom {d.f.}=46] = 0.9145 ; P = 0.37). Ten males and fifteen females made up the SICS group, whereas the phacoemulsification group had twelve males and thirteen females; this difference was statistically not significant (λ2 (d.f.=1)= 0.38; P > 0.05).

Of the fifty patients, twenty-five had surgery on their right eye, and the remaining twenty-five patients had surgery on their left. .. In the SICs group, 11 patients had surgery on their right eye and 14 on their left, whereas in the phacoemulsification group, 14 patients had surgery on their right eye and 11 on their left; this difference was statistically not significant (λ2 (d.f.=1)= 0.72; significance level > 0.05). Up till now, it seems that only this study and the one by

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Ghosh et al.[29] have examined the changes in thickness of macula following uneventful SICS and phacoemulsification cataract surgery.

According to Nakayama et al. [27], diabetic eyes showed significant macular thickness and a rise in aqueous flare and anterior chamber cells after cataract surgery. Within six months, these mild alterations in non-diabetic patients improved progressively and went back to almost normal. Of the 50 individuals in the current study, 43 (86%) had no systemic disease. Out of the 50 patients, seven cases (14%) had hypertension; six of these patients underwent phacoemulsification and one of these patients had SICS.

According to Jurecka et al. [28], in the first week and next two months after surgery, there was a positive statistical link between the true phacoemulsification procedural time and the growth in volume of the macula and retinal thickness in the fovea and the inner macular area.

In the present study, For all 50 patients, the average surgery time was 10.23 ± 1.04 (95 % confidence interval = 9.87 to 10.76) minutes. The mean surgical time for the 25 patients undergoing SICS was 10.0 ± 0.67 (95 % C.I. = 9.74 to 10.64) minutes. This was less than the average surgical time of 10.32 ± 1.23 [95 % C.I. = 9.76 to 10.45] minutes for the 25 participants undergoing phacoemulsification; however, this difference was statistically not significant ({t' [d.f.= 46]= 1.12 ; P=0.28).

The average duration for phacoemulsification among the 25 patients was 1.28 ± 0.4 minutes. The increase in retinal thickness did not positively correlate with either the actual phacoemulsification time or the total amount of time spent performing the surgery in the current investigation.

Von Jagow et al [23]. There was no discernible relationship between macular thickening, visual acuity, and some surgical and biometrical characteristics.

There was no correlation found between the degree of macular thickness and surgical or biometric characteristics, such as axial length, phacoemulsification time and energy.

In research conducted by Gogate et al. [30], Ruit et al. [31] and Sambuddha Ghosh et al. [29], the visual results remained consistent at the six-month mark. Up to the third month, the visual acuity in every evaluation in the current study was the same.The quick macular thickness map methodology, which offers strong repeatability and reproducibility, was extensively utilised to measure macular thickness in the investigations by Polito et al. [32] and Danis et al. [33]. The 'rapid macular thickness' map procedure was employed in this experiment to measure macular thickness.

Sourdille et al. [22] used OCT to assess changes in macular thickness after a rough cataract operation and compared the results with flare and cell measurements. While 11 eyes had a slight rise in macular thickness following surgery, this did not correspond with a greater postoperative flare, and the visual implications were also commensurate with the macular thickness.

Brio et al. [24] examined changes in the thickness of the fovea and perifovea as assessed by Optical Coherence Tomography following phacoemulsification cataract surgery that included IOL implantation. When the macular thickness was either computed independently or averaged along with the foveal values, these authors observed a noteworthy variation in the thickness of macula on post-operative days 1, day 30, and day 60 in the perifoveal 3.0 and 6.0 mm sectors.

172±32µ was the preoperative macular thickness, and 164.64 ± 17.64 (95 % C.I. = 157.23 to 171.63) µ was the mean value. In the initial week of assessment, the thickness of macula had risen to 182 ± 75 µ, with an average thickness of macula of 175.32 ± 15.23 (95% C.I.=168.54 to 181.65) µ. 172±20µ and 169.32µ ± 13.43 (95% C.I.=164.19to 175.87) µ were the thickness of macula and mean macular thickness at the second week review, respectively, and 173.16µ ± 14.44 (95% C.I.=167.72 to 179.12) µ at the fourth week review. 169 ± 24 µ was the macular thickness at the final evaluation, which took place three months after surgery, and 166.6 ± 12.86 (95% C.I.=161.29 to 171.91) µ was the mean macular thickness. One-way ANOVA statistical analysis states that the differences between these five average values were statistically not significant. Significant ($P<0.05$) differences were found when post-hoc testing was performed between the preoperative mean value and the post-operative 1st week mean value, the preoperative average value and the post-operative 2nd week average value, and the postoperative 1st week average value and the post-operative 4th week the macular thickness average. At the first week of follow-up, there was a notable subclinical change in the macular thickness in the 25 patients who had phacoemulsification in the current experiment; nevertheless, this did not influence visual acuity.

A constraint of the current investigation was the very brief period following surgery during which individuals were evaluated. Patients' perception that they did not need to present for review in the absence of significant problems was a major contributing factor in this. Had the follow-up period been extended, it's feasible that the outcomes would have been different.

The fact that fewer patients were eventually enrolled in the study groups than was necessary to achieve the sample size calculation is another study drawback. Further research is necessary to validate the preliminary findings of this study.

VI. CONCLUSIONS

- Subclinical macular edema might last up to four weeks following simple cataract surgery, peaking one week following the procedure.
- OCT revealed macular edema without changing the macular architecture.

- When comparing eyes receiving phacoemulsification with those undergoing manual SICS, the duration of the subclinical edema is longer in the former.
- This edema has no impact on visual acuity.

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