A COMPARATIVE LONGITUDINAL STUDY TO EVALUATE THE CHANGES IN INTRA OCULAR PRESSURE, AFTER MANUAL SMALL INCISION CATARACT SURGERY BETWEEN PRE-OPERATIVE AND POST-OPERATIVE PERIOD

By

REG. NO: BK0122004

Dissertation

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In partial fulfilment of the requirements for the degree of

MASTER OF SURGERY

IN

OPHTHALMOLOGY

DEPARTMENT OF OPHTHALMOLOGY,

JAWAHARLAL NEHRU MEDICAL COLLEGE,

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ABBREVIATIONS

OVDs	Ophthalmic viscoelastic devices
IOP	Intraocular pressure
MSICS	Manual small incision cataract surgery
Pre-op	Pre-operative
Post-op	Post-operative
HPMC	Hydroxy propyl methyl cellulose
ACA	Anterior chamber angle
AH	Aqueous humour
AHD	Aqueous humour dynamics
GAT	Goldman Applanation tonometry
CCT	Central corneal thickness
NCT	Non-contact tonometer
CH	Corneal hysteresis
IOPg	Corrected intraocular pressure
IOPcc	Corneal-compensated measurement
ORA	Ocular-Response Analyser
FLACS	Femtosecond Laser-assisted cataract surgery
ICCE	Intracapsular cataract extraction
DCT	Dynamic contour tonometry
I/A	Irrigation and aspiration
DMD	Descemet membrane detachment
TASS	Toxic anterior segment syndrome
UCVA	Uncorrected distance visual acuity
BCVA	Best corrected visual acuity
ACD	Anterior Chamber Depth
AL	Axial Length
IOL	Intraocular lens
PCIOL	Posterior chamber intraocular lens

ABSTRACT

A COMPARATIVE LONGITUDINAL STUDY TO EVALUATE THE CHANGES IN INTRA OCULAR PRESSURE, AFTER MANUAL SMALL INCISION CATARACT SURGERY BETWEEN PRE-OPERATIVE AND POST-OPERATIVE PERIOD

Aim : To evaluate the effect of manual small incision cataract surgery (MSICS) on intraocular pressure (IOP) by comparing preoperative values with postoperative values at different time intervals. Additionally, to assess the impact of different ophthalmic viscoelastic devices (OVDs), specifically hydroxypropyl methylcellulose 2% (HPMC) and sodium hyaluronate 1.4%, on postoperative IOP. Ophthalmic viscoelastic devices (OVDs) are essential in ophthalmic surgeries including cataract surgeries for corneal endothelium protection, maintaining the anterior chamber, and facilitation of intraocular lens implantation. However, their retention postoperatively can cause transient IOP (intraocular pressure) elevation. The impact of different OVDs on IOP varies based on their rheological properties (viscosity, cohesion, dispersion). Present study evaluated and compared the value of intraocular pressure before and after manual small incision cataract surgery.

Methods :A comparative longitudinal study was performed at a tertiary care center. The present study included 120 eyes of 120 individuals who underwent manual small incision cataract surgery by single surgeon. Patients above 40 years of age and having clear cornea were included and results were compared.

Results : The mean intraocular pressure value of study participants before the surgery were 15.36 ± 2.81. The follow-up values of mean IOP at post-op Day 1, post-op week 1, post-op week 6 and post-op 3 months were 18.52 ± 3.92, 15.98 ± 2.81, 15.18 ± 2.85 and 14.79 ± 3.07 respectively. The mean IOP when compared to the pre-op had increased in the post-op Day 1 and reduced subsequently in the next follow-ups. However, the post-op week 1 values were slightly higher than the pre-op values. The post-op week 6 and post – op 3-months values were lower than the pre-op value. All the follow-up values were statistically significant when compared with pre-op IOP ($p=0.000$ each). The mean IOP values showed significant reductions in IOP in 6 weeks after the cataract surgery.

The pre-op IOP value of study participants in HPMC and sodium hyaluronate groups were 15.41 ± 3.11 and 15.3 ± 2.49 respectively ($p=0.776$). The post-op IOP value at Day 1, week 1, week 6 and 3 months in HPMC group were 19.46 ± 4.42, 16.13 ± 3.24, 15.25 ± 3.30 and 14.85 ± 3.56 respectively. The post-op IOP value at Day 1, week 1, week 6 and 3 months in sodium hyaluronate group were 17.56 ± 3.10, 15.81 ± 2.31, 15.10 ± 2.34 and 14.73 ± 2.50 respectively. The post-Op Day 1 values of HPMC and sodium hyaluronate groups were statistically significant ($p=0.049$). The mean IOP value in both the groups had higher values in the post-op day 1 and post-op 1 week when compared to the pre-op mean IOP values. The reduction in IOP values when compared to the pre-op values were reported in the post-op 6 weeks and 3 months. The post-Op Day 1 values of HPMC and sodium hyaluronate groups were statistically significant ($p=0.049$). The hydroxypropyl methyl cellulose and sodium hyaluronate group both showed significant reduction in the IOP in the follow-ups. Reduction of IOP when compared to the baseline was recorded in the 6 week and 3 month follow-up .

Conclusion : This study aimed to assess the change in intraocular pressure after manual small incision cataract surgery by comparing preoperative values with postoperative values measurements at different time intervals. The findings provide valuable insights into the changes in IOP at the post-operative day 1, week 1, week 6 and 3 months. Understanding these variations can aid in optimizing postoperative care, minimizing complications, and improving surgical outcomes for patients undergoing cataract surgery.

Keywords: MSICS, cataract, intraocular pressure, viscoelastic substances

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INTRODUCTION

Cataract, characterized by a clouding of a normally clear lens, leads to changes in refractive properties and increased light scattering, ultimately resulting in hazy vision or blindness. Cataract is the chief reason for blindness globally. Prevalence of cataracts rises significantly with age, affecting approximately 3.9% of people between 55 years and 64 years and escalating to 92.6% in people of 80 years or above (1).

Cataract surgery is one of the most frequently conducted surgery in ophthalmology globally. Manual Small Incision Cataract Surgery is a safe and economical approach to addressing substantial pending cataract cases. Popularity of MSICS can be attributed to its early rehabilitation benefits, easy learning curve and versatility for various cataract types (2).

Ophthalmic viscoelastic devices (OVDs) are essential in ophthalmic surgeries including cataract surgeries for corneal endothelium protection, maintaining the anterior chamber, and facilitation of intraocular lens implantation (3). However, their retention postoperatively can cause transient IOP elevation. The impact of different OVDs on IOP varies based on their rheological properties (viscosity, cohesion, dispersion) (4)

Fluctuations in the intraocular pressure (IOP) after the cataract surgery have been substantially studied, with both increased and decreased IOP beyond normative values being potentially detrimental to ocular health. (5)

Sustained elevations in intraocular pressure can cause optical nerve head injury. Increased IOP is recognized as a modifiable risk factor for glaucomatous optic atrophy, which often progresses aggressively. Previous studies examining IOP fluctuations post-cataract surgery have yielded conflicting results, underscoring the need for further investigation in this area to optimize postoperative care, minimize complications, and improve surgical outcomes for patients undergoing cataract surgery. (6)

AIMS AND OBJECTIVES

Aim

To evaluate the effect of manual small incision cataract surgery on intraocular pressure by comparing it to pre-operative values and subsequent post- operative values.

Objectives

1. To evaluate the changes in intraocular pressure after manual small incision cataract surgery at 1st day, 1st week, 6th week and 3rd month of post-operative period, as compared to pre- operative values.
2. To study the effects of viscoelastic agents hydroxypropyl methyl cellulose 2% and sodium hyaluronate 1.4% on post -operative value of intra-ocular pressures.

REVIEW OF LITERATURE

The review of literature shall be discussed under the following headings:

- Relevant Anatomy of Eye
- Aqueous Humour and its formation and drainage
- Intraocular Pressure and Tonometry
- Cataract and Manual Small Incision Cataract Surgery
- Ophthalmic Viscoelastic Devices
- Intraocular pressure changes post cataract surgery

Relevant Anatomy of the Eye

The Orbits

The orbits, comprising two bony chambers, house the eyeballs along with their associated supporting structures, including muscles, blood vessels, fat, nerves, and the lacrimal system. Each orbit is anatomically structured with an apex, base, roof, floor and both medial and lateral walls, forming a pyramidal shape that optimally provides protection, support, and a broad field of vision for the eyes.

There are seven orbital bones. It includes: "*a) frontal bone, b) sphenoid bone, c) zygomatic bone, d) ethmoid bone, e) lacrimal bone, f) maxilla bone, and g) palatine bone"* (Figure 1) (7).

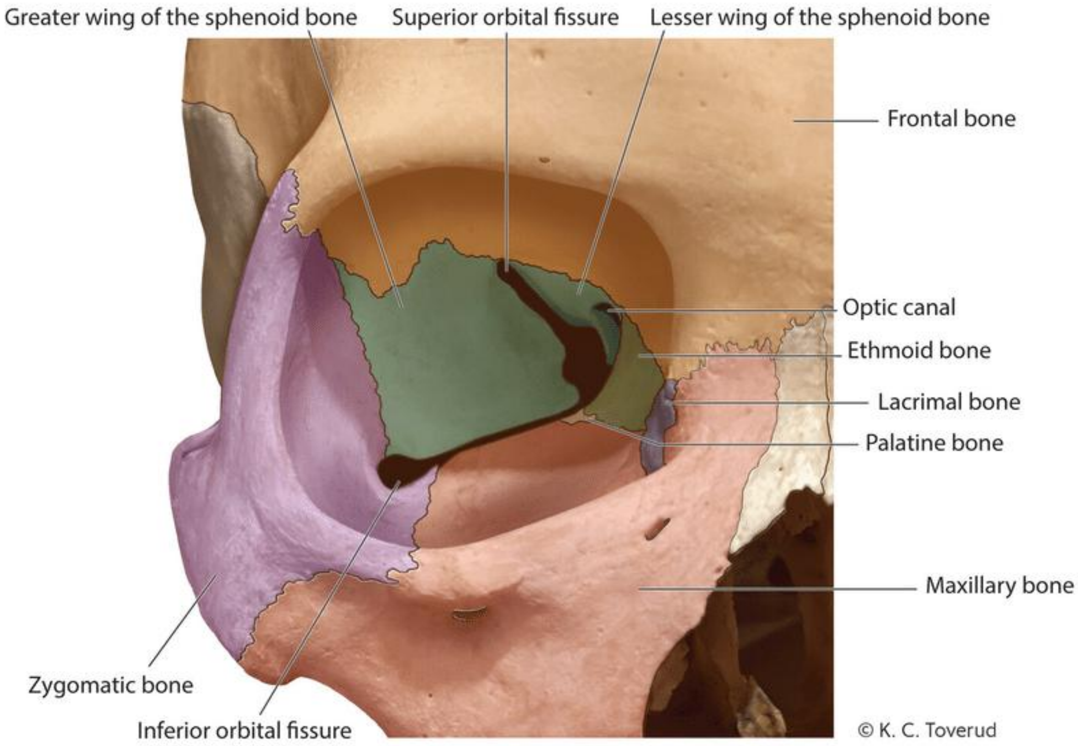


Figure 1: Bones of the orbit (Source: Doving M et al., 2022 (8))

Walls of Orbit

"Roof of the orbit is made of orbital plate of frontal lobe and lesser wing of sphenoid. The medial wall of the orbit is formed by maxillary, lacrimal, ethmoid and sphenoid bones. The lateral wall of the orbit is formed by the greater wing of sphenoid and zygomatic. The floor is formed by zygomatic, maxillary and palatine bones" (Khurana AK et al) (Figure 2) (7).

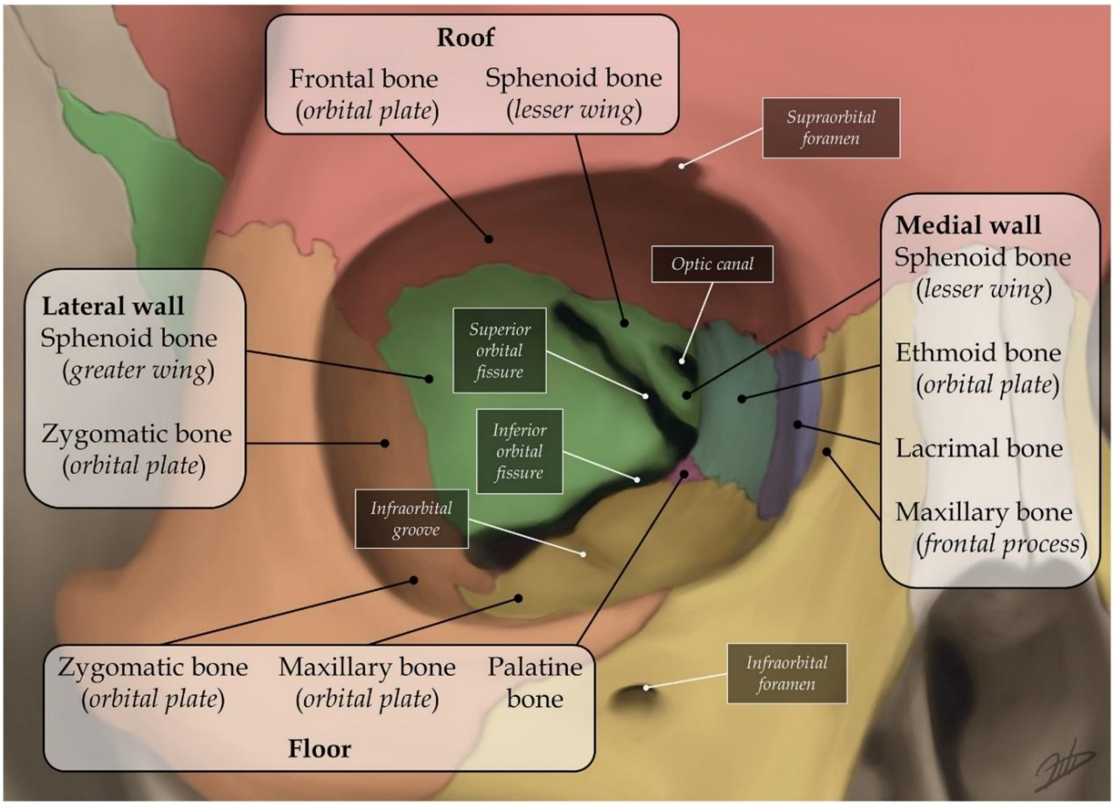


Figure 2: Walls of orbit (Pandya RP et al 2023) (9)

<u>Globe</u>

The three layers of globe are (Figure 3):

1. Outer fibrous layer:
    a. Cornea (Anterior 1/6th)
    b. Sclera (Posterior 5/6th)
2. Middle vascular layer (Uveal tract):
    a. Iris
    b. Pars plicata and pars plana of ciliary body
    c. Choroid
3. Inner nervous layer:
    a. Retinal pigment epithelium
    b. Neurosensory Retina

Two Segments

1. Anterior segment:

   The globe contains the lens, which suspends from ciliary body, along with several structures situated anteriorly including the iris, cornea and two chambers filling with aqueous humour: the anterior chamber and the posterior chamber.

   "Anterior chamber: This space is formed at the front by the back of the cornea and at the back by the iris and part of the ciliary body. In normal adults, the anterior chamber is approximately 3mm deep at the centre, with variations ranging between 2.5 to 4.4 mm. This chamber holds up to 0.25 ml of aqueous humour and connects to the posterior chamber via the pupil." (Khurana AK et al)

   "The Posterior Chamber: This triangular space contains about 0.06 ml of aqueous humour. It is bounded at the front by the posterior surface of the iris and part of the ciliary body, at the back by the crystalline lens and its zonules, and laterally by the ciliary body". (Khurana AK et al)

2. Posterior Segment:

   This section encompasses the structures located posterior to the lens, including the vitreous body, retina, choroid and optic disc.

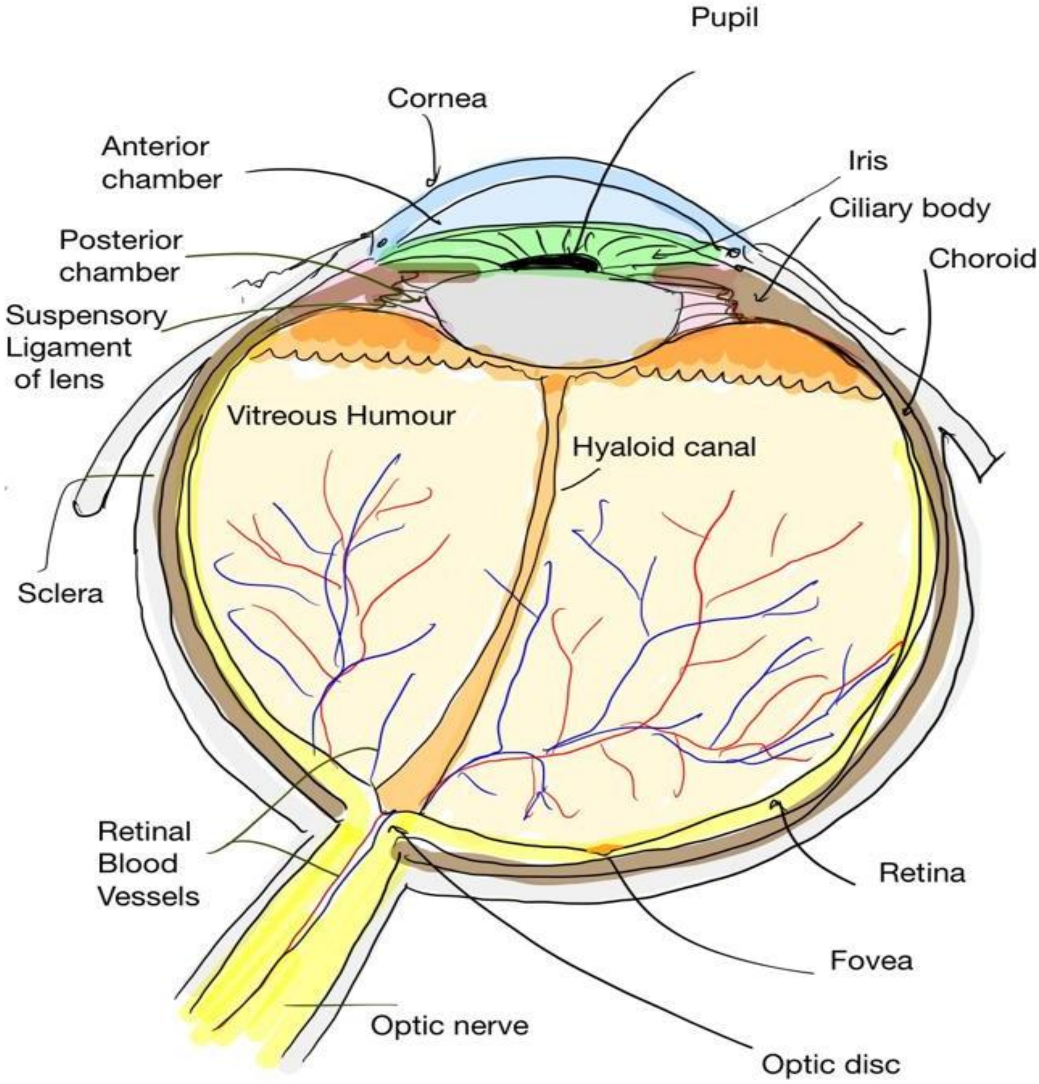


Figure 3: Human Eye section (adapted from Richards E et al., 2024) (10)

<u>Sclera:</u>

The Sclera, forming the posterior 5/6th of the coat of eyeball, is a robust, opaque layer of dense fibrous tissue that ensures the structural stability and shape of the globe. The sclera is externally enveloped by Tenon's capsule, which covers its smooth white surface. While the located anteriorly, is visible as white portion of eye, covered by the conjunctiva.

Cornea:

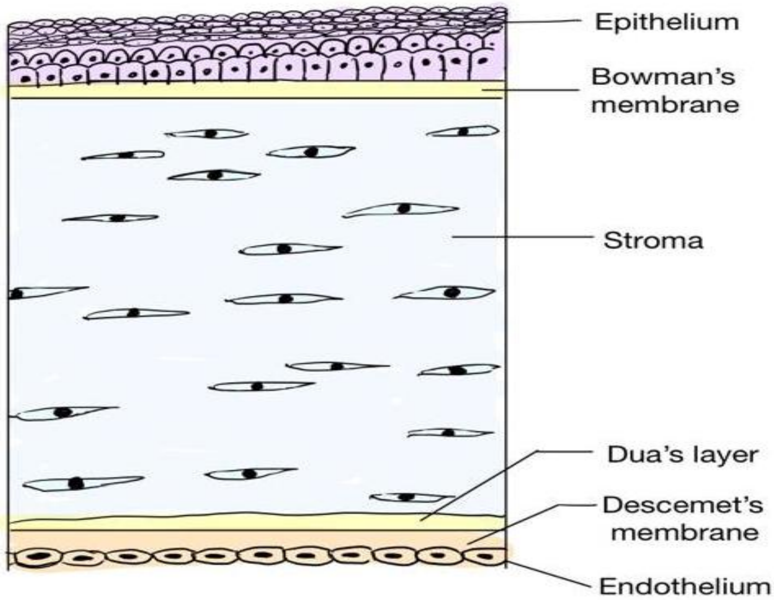


Figure 4: Cornea (adapted from Khurana A et al., 2015) (11)

"The cornea is a clear, avascular component forming the anterior one-sixth of the eye's outer fibrous layer. Its anterior surface is elliptical, with an average horizontal diameter of 11.75 mm and a vertical diameter of 11mm, while the posterior surface is nearly circular, measuring around 11.5mm in diameter. The corneal thickness is not uniform, measuring approximately 0.52mm at the centre and increasing to about 0.67mm at the periphery" (Khurana AK et al) (Figure 4).

Six layers of cornea includes (12):

1. Epithelium
2. Bowman's membrane
3. Corneal stroma
4. Dua's layer or pre-Descemet's membrane
5. Descemet's membrane and
6. Endothelium

Choroid:

"Choroid is a vascular pigmented tissue situated between the retina and the sclera. It terminates at the ora serrata anteriorly, where it integrates with the ciliary body "(Khurana AK et al) (7).

Ciliary body:

"The choroid continues anteriorly as the ciliary body at the ora serrata, appearing triangular in cross-sectional view. The ciliary body produces the aqueous humour and helps in regulation of eye's accommodation "(Doving M et al) (8).

Retina:

This is the eyeball's inner layer. Rods, cones, bipolar cells, and ganglion cells make up the retina's inner sensory layer, while the outer pigment epithelium shields these more delicate inner layers from damage. The ora serrata, also called the scalloped border, is the junction of the retina and pars plana. It is joined to optic nerve posteriorly. Optic disc is a circular region located inferomedial to the posterior pole. It has a diameter of 1.5 mm (Figure 5).

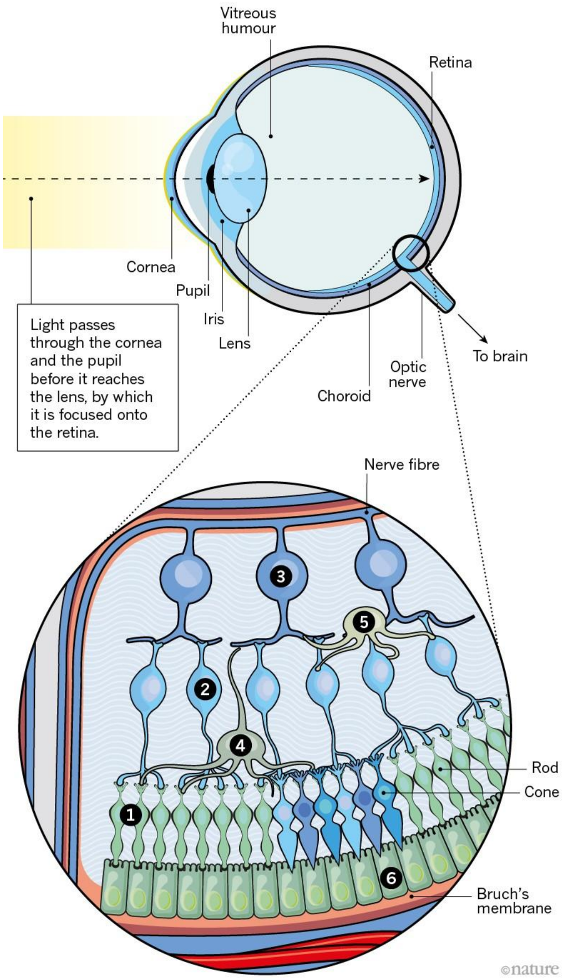


Figure 5: Retina (Holmes D 2018) (13)

There are 10 layers of retina (Figure 6).

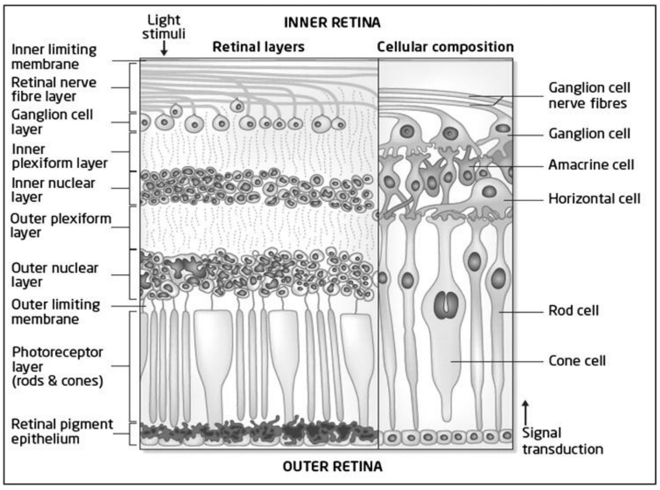


Figure 6: 10 layers of retina (Yang S et al 2021) (14)

Aqueous humour (AH):

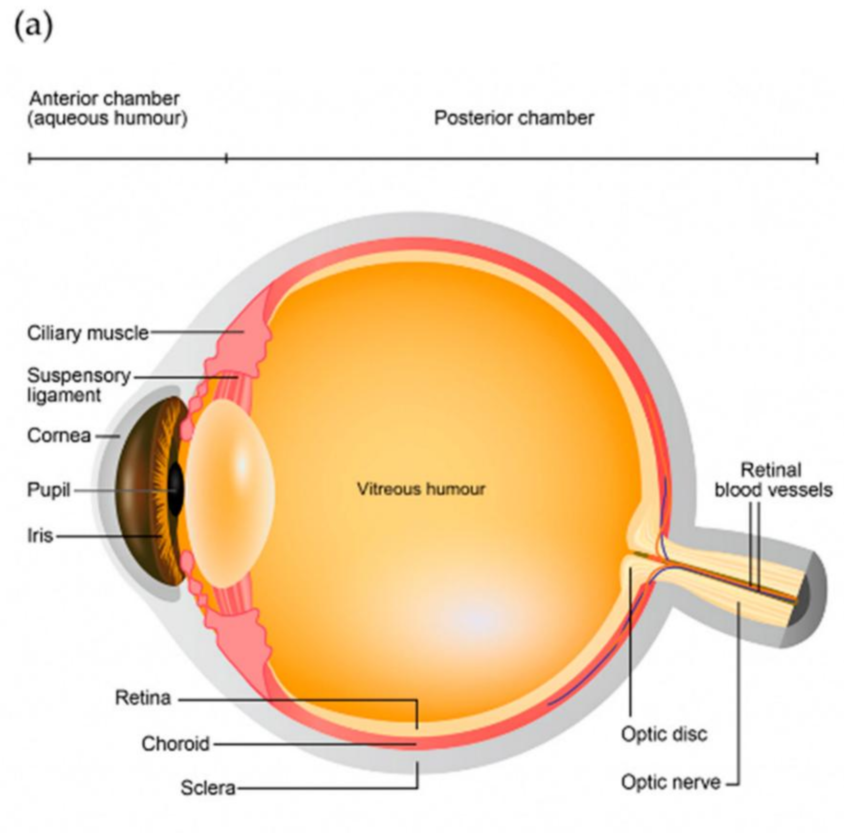


Figure 7: Aqueous and vitreous humour (Thacker M et al 2020) (15)

"This transparent fluid occupies the space between the lens and cornea in the anterior segment of the eye. Aqueous humour is secreted by the capillaries in the ciliary processes into the posterior chamber, subsequently passing through the pupil into the anterior chamber. And, it drains into the canal of Schelmm (Conventional outflow) or via ciliary body to suprachoroidal space (Uveoscleral outflow) " (Khurana AK et al).

Interference with AH outflow can lead to an increase in IOP. This elevated pressure can cause pressure-induced axonal atrophy and cupping of the optic disc, ultimately leading to blindness (Figure 7) (7).

Lens:

"The transparent, biconvex lens is situated between the anterior segment and posterior segment of the eye, exhibiting a diameter of approximately 9-10 mm and thickness of 4-5 mm. One of the key functions of the lens is its ability to adjust dioptric power, contributing approximately 15 - 16 dioptres to the eye's overall dioptric strength of 58 - 60 dioptres "(Khurana AK et al) (7).

Vitreous body:

"The vitreous is a translucent, colourless gel-like substance that occupies the posterior segment, comprising approximately four-fifths of the eyeball. Encased within a thin, homogenous hyaloid membrane, the vitreous is free suspended and intimately contacts the retina, while being anchored to the optic disc margin posteriorly and anteriorly to the ora serrata "(Khurana AK et al) (7).

Anterior chamber angle (ACA)

"The angle of the anterior chamber forms at the periphery of the anterior chamber, where the corneoscleral and uveal tissue meet. Anatomically, on the inner surface of the limbus is an indentation called the scleral sulcus, which has a posterior margin, the scleral spur. A sieve- like structure, the trabecular meshwork, bridges the scleral sulcus and converts it into a canal called the Schlemm canal. The meshwork inserts into the peripheral cornea, creating a ridge, known as the Schwalbe line. the aqueous humour exits the anterior chamber through the ACA. A narrow ACA can increase the risk of developing acute angle-closure glaucoma, which can lead to permanent vision loss "(Alward WLM et al) (16).

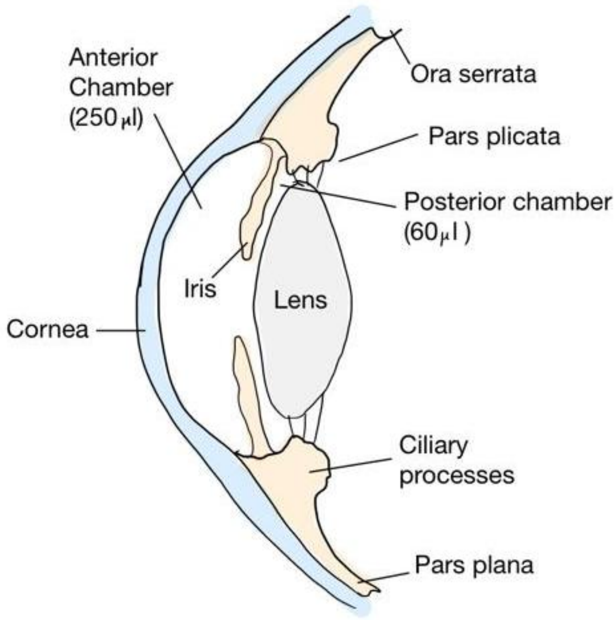


Figure 8: Anterior chamber anatomy (adapted from Srinivas SP et al, 2021) (17)

Aqueous humour formation and drainage [18-25]

The anterior chamber is perpetually filled with transparent aqueous humour, which is continuously produced, secreted, and reabsorbed. The mechanisms governing the production, circulation, and reabsorption of aqueous humour are critical for maintaining ocular homeostasis. Modifications in secretion and drainage of AH may result in elevated IOP, which can lead to optic nerve damage associated with ocular hypertension or glaucoma (Figure 8).

Production and Circulation of AH

The ciliary body epithelium secretes approximately 2-3 microliters of aqueous humour per minute, consisting of water, carbon dioxide, amino acids, carbohydrates, glutathione, and various organic and inorganic ions. The chief function of AH is to provide the optical clarity and to provide nutrition to the cornea and lens, which doesn’t have the blood supply.

Aqueous humour is secreted by the ciliary body. Aqueous humour homeostasis is maintained by trabecular meshwork and uveoscleral pathway. The synthesis of aqueous humour is linked to the blood flow in the systemic circulation. The blood goes to the ciliary process. Here the gradient of pressure helps the ultrafiltration process of plasma in to the ciliary interstitial space. Subsequently, the plasma gets transported from the epithelium of ciliary process constituting from the basal surface to apical surface. By this process, it generates AH and goes to the posterior chamber (Figure 9).

The initial synthesis of aqueous humour predominantly depends on passive diffusion and ultrafiltration; however, the final synthesis necessitates production on an active basis across the blood-aqueous barrier though mechanisms involving sodium-potassium-ATPase, carbonic anhydrase and aquaporin enzymes. Pharmacological interventions often target these active transport enzymes, which are crucial for the ultimate synthesis of aqueous humour, particularly when aiming to reduce its production (Figure 10).

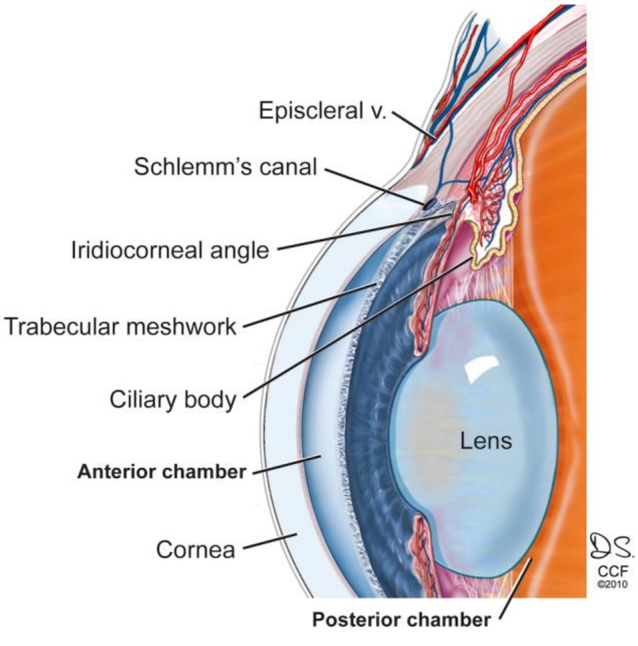


Figure 9: Trabecular meshwork (Bollinger KE et al 2001) (26)

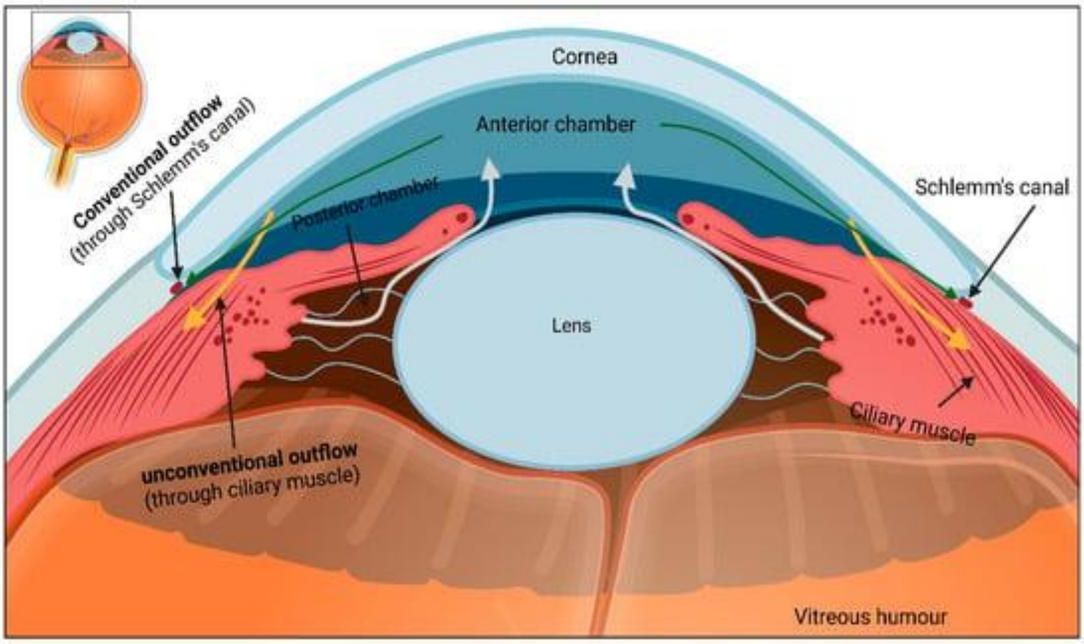


Figure 10: Flow of aqueous humour (Uddin N et al 2022) (27)

<u>Drainage</u>

"There are two principal drainage pathways: the episcleral venous system, Schlemm's canal, collector channels, and trabecular meshwork, along with an unconventional pathway comprising the uveoscleral, uveovortex and uveolymphatic routes."

The conventional drainage route primarily involves passive drainage through trabecular meshwork. Trabecular meshwork (TM) depicts a porous triangular shape. It consists of endothelium and the connective tissue. It obtains the sympathetic activation from the superior cervical ganglion. It obtains parasympathetic activation from Edinger-Westphal nucleus. Schlemm's canal itself features a fenestrated, thin endothelial lining bordered by connective tissue, similar to the structure of venous vasculature. The drainage of AH is through the TM to Schlemm's canal. It then goes to the episcleral venous system and get to the central venous system through the collector channels.

Although the precise mechanisms remain elusive, increased outflow resistance through Schlemm's canal and TM has been extensively documented and is critical for regulating intraocular pressure and pathophysiology of glaucoma. The iris and ciliary muscles influence outflow rates through contraction and relaxation mediated by cholinergic innervation. During ciliary muscle contraction, both Schlemm's canal and the TM dilate, reducing resistance and enhancing outflow.

Almost 25% to 40% of the aqueous outflow takes the unconventional drainage pathway. The pathway follows the orbital vasculature and goes to vortex veins and lymphatics of ciliary body. The uveoscleral route facilitates diffusion into the sclera and episclera. Absorption of osmotic fluid via choroid to the vortex veins is the uveovortex pathway. This pathway helps in drainage into the vessels of the lymphatics in the ciliary body (Figure 11).

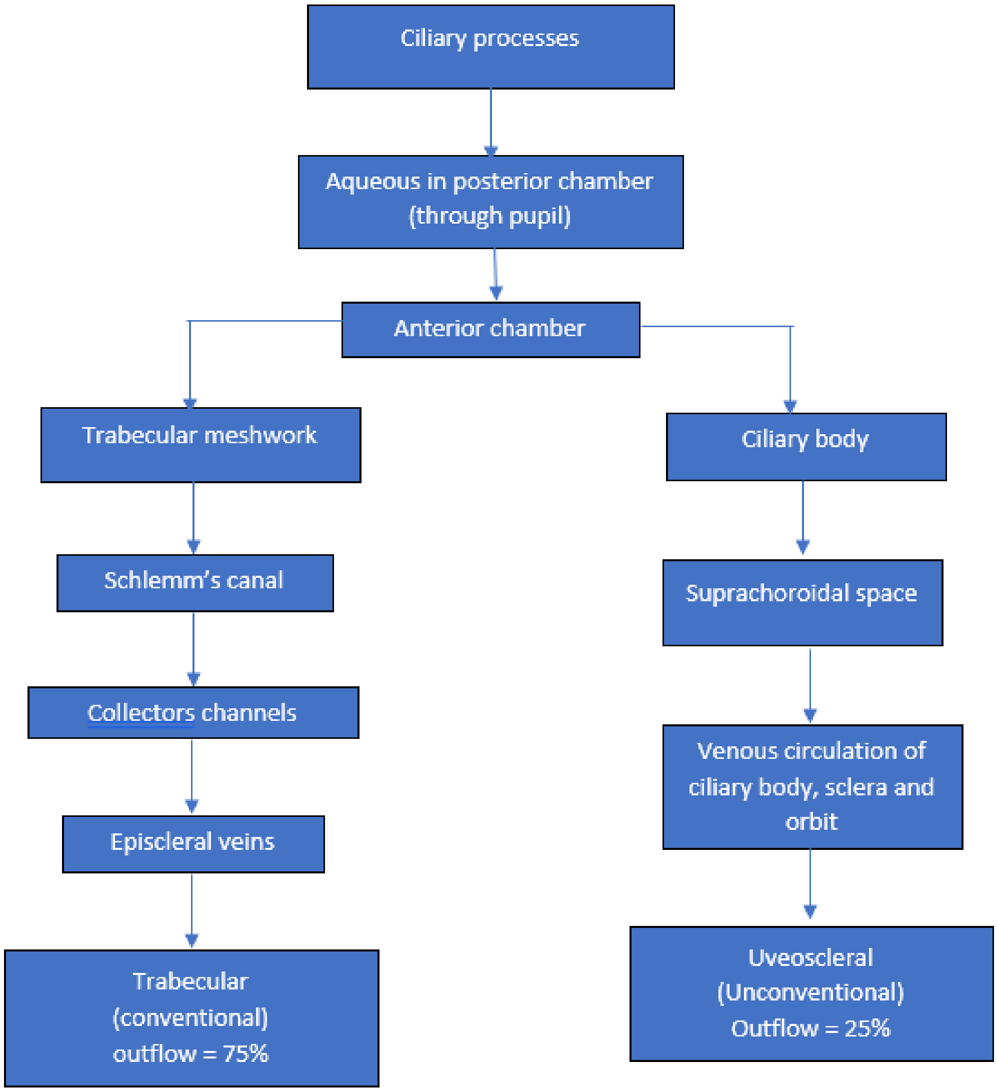


Figure 11: Dynamic model for normal intraocular pressure

Intraocular pressure (IOP) and Tonometry [28, 29]

Definition of IOP

*"The pressure created by the continuous production and drainage of fluids within the eye, which is essential for maintaining the shape, growth and optical properties of the eye. This pressure is sustained through the continuous production and outflow of fluid. "(*Machiele R et al).

Physiology of IOP

"Intraocular pressure quantifies the force exerted by aqueous humour on the anterior surface of the eye, analogous to how pressure measures force per unit area. It results from a finely tuned balance between the production and drainage of AH." (Machiele R et al).

The maintenance of IOP is achieved through a sophisticated homeostatic mechanism. In the short term, the sympathetic neurons exert a direct influence on aqueous production; beta-2 adrenergic receptors promote aqueous production, while alpha-2 receptors inhibit it. However, the primary method of regulating IOP homeostasis involves controlling aqueous outflow through the trabecular meshwork. This is accomplished by modulating the resistance found in the juxtacanalicular region of TM. The mechanical stress imposed by IOP on this cellular layer initiates a signalling cascade that enhances the activity of matrix metalloproteinases, particularly MMP14 and MMP2, which increases cellular turnover within the TM and facilitates enhanced outflow of aqueous humour.

Device used for Measurement of IOP

IOP is measured using tonometry. Principle behind the tonometry is, the eye ball as a whole, has a pressure which is consistent and distributed between the anterior chamber and vitreous body. The IOP value is considered in the normative range if it is between 10 to 21 mm of Hg.

Applanation tonometry

Goldman Applanation tonometry (GAT)

Hans Goldmann in 1948 invented GAT. It is used to estimate IOP. GAT operates on principal of applanation, which quantifies energy required to flatten a particular area of cornea. This technique grounded in Imbert-Fick law. It measures the pressure inside eye by using force required to flatten area divided by surface are of the flattened area. Higher IOP correlates with an increased force needed for corneal compression.

Clinicians utilize GAT as a routine part of slit-lamp examinations. The procedure begins with the application of topical anaesthetic and fluorescein dye in eye. Cobalt blue light which is filtered and which has a diameter of 3.06 mm is used to illuminate fluorescein and the tip of the tonometer applies the pressure. A prism within the tonometer tip divides this circular fluorescein film into two green semicircles. The clinician adjusts the tonometer’s force by rotating a dial on the device until the inner margins of the two semicircles just overlap. This slight overlap signifies an accurate measurement of IOP in mm of Hg, as indicated on the dial of the tonometer.

Several factors influence the accuracy and of IOP measurements, such as central corneal thickness (CCT), high astigmatism, corneal hysteresis, tear film stability, oedematous cornea, the amount of fluorescein used, and a history of refractive surgery. Although Goldmann applanation tonometry (GAT) is widely considered the gold standard for measuring intraocular pressure, its limitations have led to the development of alternative tonometry devices. Challenges associated with the Goldmann technique include the need for skilled operation, difficulty in measuring IOP in supine or uncooperative patients, dependence on topical anaesthetics and fluorescein, and reduced accuracy when assessing irregular or scarred corneas (Figure 12).

Figure 12: Goldman applanation tonometry (GAT) (30)

Perkins and Dreager Applanation Tonometer

The Perkins and Dreager handheld tonometers are portable tonometers that use the same applanation principle as the Goldmann tonometer. This makes them particularly valuable in settings where slit lamp examinations are impractical, such as emergency rooms and operating theatres, and they can be used in both upright and supine positions. However, their reliance on the applanation technique means they share similar limitations with the Goldmann method. Additionally, their handheld nature introduces challenges such as the need for operator expertise and potential instability during measurements.

Non-Contact Tonometers (NCT)

Commonly called “air-puff” tonometers, non-contact tonometers measure IOP by directing a brief puff of air at central cornea. The force of the air rebounding from the corneal surface is detected by a membrane equipped with sensors, detectors, and light beams, which then process the data through an internal algorithm to determine IOP. NCT is generally considered less accurate, precise, and sensitive than the Goldmann tonometer. It is also significantly affected by central corneal thickness (CCT), making it less suitable for managing glaucoma patients or individuals at risk for ocular hypertension.

Ocular-Response Analyzer (ORA)

Ocular response analyser is an advanced form of non-contact tonometry that utilizes a column of air to applanate the cornea. The airflow initially deforms the cornea and then gradually decreases until the cornea regains its original shape. By assessing the force exerted by the air and the cornea’s recovery rate, optical sensors analyse corneal elasticity, providing measurements for corneal hysteresis (CH), Goldmann- correlated intraocular pressure (IOPg), and corneal-compensated intraocular pressure (IOPcc). Corneal hysteresis represents the cornea’s ability to absorb and dissipate mechanical energy. Studies suggest that lower corneal hysteresis values are associated with a greater risk of glaucoma progression.

Indentation Tonometer

Schiotz Tonometer

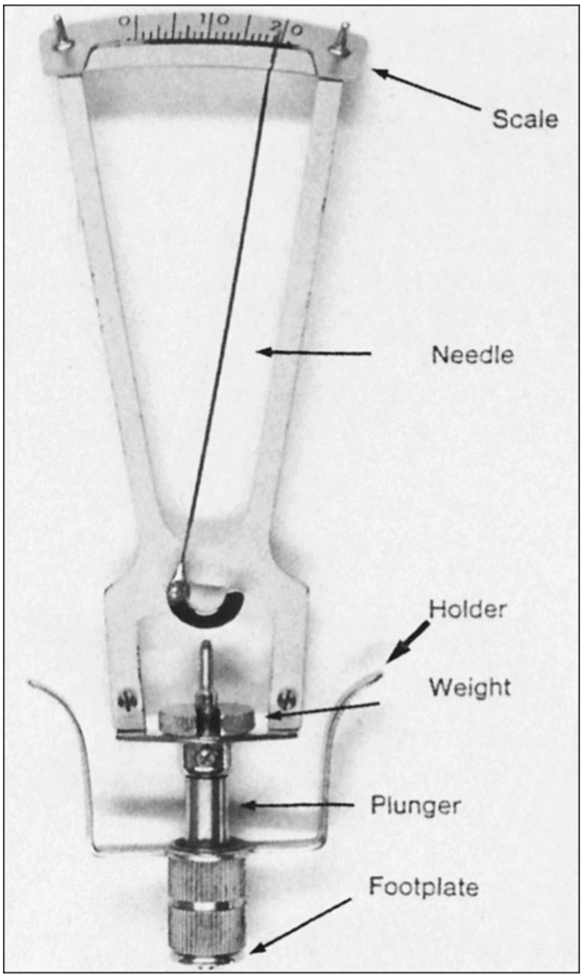


Figure 13: Schiotz Tonometer (Zhou D et al, 2020 (31))

The Schiotz tonometer operates on the principle of indentation tonometry, where IOP is measured based on depth of indentation made by weighted plunger on cornea. It consists of a weighted plunger connected to a footplate, which is placed on the cornea. By applying different weights to the probe, the cornea is depressed, and the corresponding indentation is used to determine intraocular pressure (IOP) based on a calibration chart. However, it is not widely favoured in clinical practice due to potential inaccuracies caused by calibration issues, device malfunction, variability in measurements, improper placement, and factors like ocular rigidity (Figure 13).

Tono-Pen Indentation Tonometer

The Tono-Pen is a handheld device that measures intraocular pressure (IOP) by assessing the force needed to deform the cornea by a small probe, using electronic transducer for precise readings. It incorporates indentation principle, making it highly useful for mobile screenings, emergency cases, bedridden patients, and intraoperative assessments. A key advantage of the Tono-Pen is its ability to obtain IOP readings through a soft contact lens, on irregular corneal surfaces, and at the corneal periphery in cases involving scarring or ulcers. However, its measurements tend to show considerable variability, often influenced by central corneal thickness (CCT).

Pneumatonometer

The pneumatonometer utilizes a controlled air stream to applanate the cornea through a 5mm silicone-tipped piston. It works on principle of dynamic applanation tonometry, where IOP is determined based on the resistance of cornea to the air stream. The device measures force applied to cornea and converts it into IOP using an integrated transducer, which records the force exerted during corneal flattening in mmHg.

Rebound tonometry

Rebound tonometry operates on the principle of an induction-based coil that records the motion dynamics of the probe. It is a lightweight, battery-operated handheld device designed for user-friendly operation. The device features a disposable probe with a plastic tip attached to a thin steel wire, which briefly contacts the cornea and then rebounds. The deceleration of the probe upon impact is measured and converted into intraocular pressure (IOP) readings. The speed of deceleration is directly related to IOP—faster deceleration indicates higher pressure, while slower deceleration suggests lower pressure.

A key advantage of the rebound tonometer is its ease of use and the lack of need for topical anaesthesia, making it particularly beneficial for children, uncooperative patients, individuals allergic to fluorescein or anaesthetics, and those unable to tolerate traditional contact methods or slit-lamp examinations. Due to its efficiency, portability, and minimal impact on the cornea, it is widely used for screening, routine IOP assessments in both adults and children, and postoperative monitoring.

Figure 14: Rebound tonometry

Figure 15: Usage of Rebound tonometry (iCare website (32))

The rebound tonometer delivers accurate, consistent, and reproducible intraocular pressure (IOP) measurements, aligning closely with those obtained through Goldmann Applanation Tonometry (GAT), particularly at low to moderate IOP levels. Its user-friendly design, cost-effectiveness, and strong correlation with GAT make it a practical tool for routine clinical use (Figure 14 and Figure 15).

Dynamic contour tonometry (DCT)

DCT was introduced in 2003, determines IOP using the contour- matching principle, which uses a concave, pressure sensing probe that naturally conforms to the corneal curvature, minimizing the influence of corneal biomechanical properties like thickness and rigidity. This method employs a contour-adapted piezoelectric sensor to detect small dynamic pulsations in IOP at the corneal surface.

A key advantage of DCT is that it measures IOP without altering corneal shape, making its readings less dependent on corneal thickness compared to other tonometry techniques. Research indicates that DCT offers high precision, reproducibility, and strong agreement with Goldmann Applanation Tonometry (GAT) and other devices. However, obtaining an accurate measurement requires approximately ten seconds of corneal contact, which may limit its practicality for certain patients.

Continuous IOP monitoring

Continuous IOP monitoring is a technique used to track intraocular pressure over time, providing insights into diurnal variations, nocturnal fluctuations, and glaucoma progression. Traditional tonometry (e.g., Goldmann Applanation Tonometry) provides only single-time-point measurements, missing critical fluctuations. Ideally, continuous 24-hour IOP measurements would provide insight into true IOP fluctuations and spikes occurring throughout waking and sleeping hours, significantly aiding in understanding target pressures, progression rates, and tailoring treatment strategies for individual patients. Methods for continuous IOP monitoring are implantable sensors, contact lens sensors, non-invasive scleral sensors.

Cataract and Manual Small Incision Cataract Surgery (MSICS)

Definition of Cataract

“A cataract is a clouding or opacification of the eye's normally clear lens or its capsule, prevents light from passing through it to the retina.” (Nizami 2009).

Its severity can differ, and it may affect both eyes. Initially, the condition progresses slowly, leading to difficulties in daily tasks. Over time, particularly by the age of forties or fifties, cataract fully develops, becoming completely opaque and significantly impacting vision and daily functioning.

Globally, cataracts are a leading cause of blindness. In the early stages, corrective glasses may help improve vision. However, as the cataract advances and starts interfering with daily life, surgical intervention may be necessary (33).

Epidemiology of Cataract

According to the National Blindness and Visual Impairment Survey of India (2015–2019), cataracts account for 14.85% of cases of blindness and visual impairment among individuals aged 60–69 years (34). The prevalence of visual impairment due to cataracts among individuals aged 70-79 years was found to be 35.7% (35), while the overall occurrence of cataracts was recorded at 66.2% (36).

Aetiology of cataract [(30)]

Cataracts can arise from various aetiologies, with aging being the most common prevalent cause. Additional factors include congenital origins, subcapsular cataracts, traumatic injuries, systemic conditions, endocrine disorders.

Congenital:

Congenital cataracts can be unilateral or bilateral. They have been strongly linked to factors such as oxygen deprivation due to placental haemorrhage, maternal nutritional deficiencies, and infections like rubella and rubeola.

Subcapsular cataract:

Anterior sub capsular cataract is linked to fibrous metaplasia of the lens epithelium. Posterior subcapsular cataract appears as granules or as a plaque in front of posterior capsule. Under retro-illumination, posterior subcapsular cataracts look dark and vacuolated. Posterior subcapsular opacity has a significant impact on vision since it is situated near the nodal point of the eye. Patients typically report glare and halos.

Nuclear sclerotic cataract:

Age is a common factor in nuclear sclerosis, and ageing brings about alterations. In some elderly individuals with nuclear sclerosis, a secondary elevation of refractive index, linked to the myopia, allows them to regain the ability to read without glasses, a phenomenon often known as the "second sight of aging."

Cortical cataract:

The equatorial, posterior, or anterior cortex may be affected by cortical cataracts. The lenticular fibre clefts and vacuoles that result in cortical hydration are indicative of cortical opacities. The characteristic wedge-shaped (cuneiform) or radial spoke-like opacity, typically first appearing in the inferonasal quadrant, develops as the lens becomes opaque. This type of opacity often leads to increased glare and visual disturbances.

Traumatic injury:

Frequent unilateral rosette type of cataract affecting the younger age groups after ocular trauma.

Endocrine diseases:

Endocrine diseases like diabetes mellitus, and hypoparathyroidism causes cataract.

Secondary cataract:

Cataract can develop secondary to chronic anterior uveitis, acute angle closure glaucoma, high myopia, trauma, drugs, poor nutrition, and alcohol or smoking habits.

LOCS III Classification (37)

The Lens Opacities Classification System III (LOCS III) is a standard system used to grade and compare the types and severity of cataracts. It has three sets of standardized photographs and four features including:

a. Nuclear opalescence (NO): Graded on a decimal scale of 0.1-6.9 using six slit lamp images
b. Nuclear colour (NC): Graded on a decimal scale of 0.1-6.9 using six slit lamp images
c. Cortical cataract (CC): Graded on a decimal scale of 0.1-5.9 using five retro illumination images
d. Posterior subcapsular cataract (PSC): Graded on a decimal scale of 0.1-5.9 using five retro illumination images.

It was developed from LOCS II by narrowing scaling intervals and reducing 95% tolerance limits for reproducibility (Figure 16).

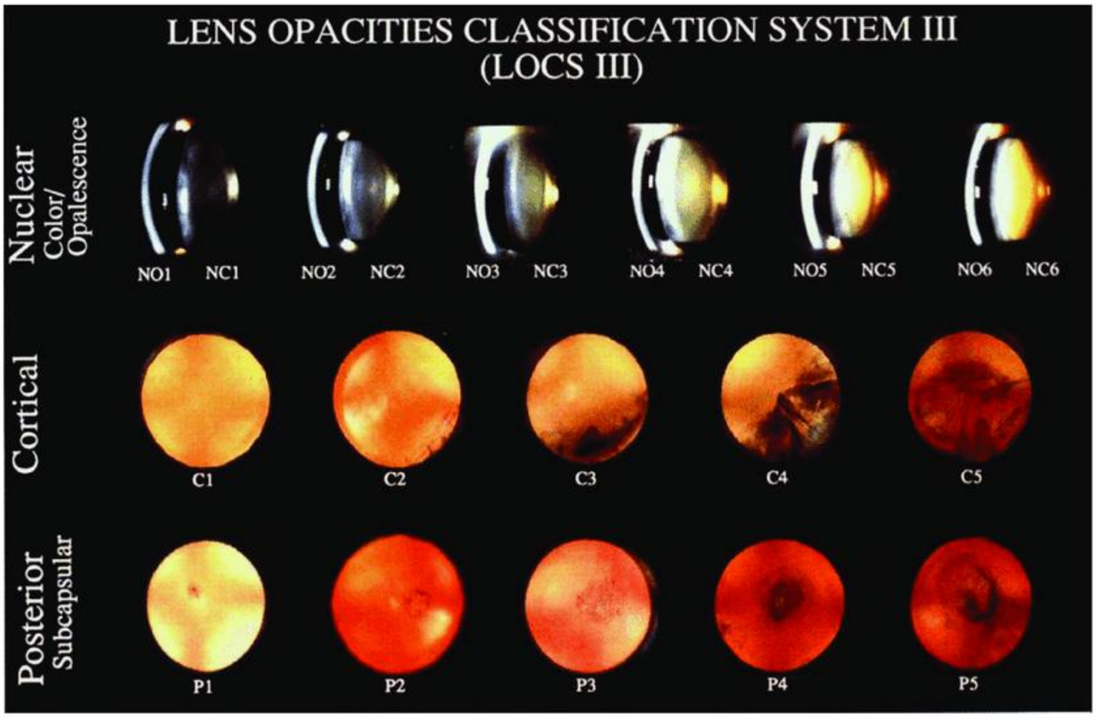


Figure 16: LOCS III Standardized chart (Bencic G et al 2005) (37)

Pathophysiology of cataract [33]

The lens is composed of fibres, which are modified epithelial cells, engulfed within membrane-like lens capsule. There are two parts: the cortex, which contains younger fibres on the surface, and the nucleus, which houses older fibres in the deeper layers.

Various degenerative processes lead to the denaturation and coagulation of lens proteins through different pathways, ultimately resulting in a loss of translucency and the formation of cataract. The mechanisms involved include disruptions in lens development (leading to congenital cataracts), fibrous metaplasia of the lens epithelium (causing subcapsular cataracts), cortical cataracts due to hydration between lens fibres, and the deposition of pigments such as urochrome resulting in nuclear cataracts.

Symptoms of cataract (33)

The symptoms of cataract include glare, photophobia (in posterior subcapsular cataract type), difficulty in reading small letters, reduced distant vision, difficulty in night driving.

Ophthalmic assessment

Visual acuity, pupillary response, ocular adnexa examination, slit lamp evaluation, fundus evaluation, keratometry, and A-scan ultrasound are used for assessment.

Treatment of cataract

Phacoemulsification (38)

Phacoemulsification uses a combination of ultrasonic energy to emulsify the nucleus, suction to collect nuclear material and irrigation and aspiration to remove the cortex and viscoelastic material from the anterior chamber. A handpiece, irrigation and aspiration system, foot pedal are the usual components of a phaco machine." (Wang KM et al).

It involves creating a small corneal incision through which a probe is inserted. This probe uses ultrasound energy to chop the eye's cataractous lens into tiny fragments. These fragments are then suctioned out while a continuous irrigation system maintains the anterior chamber's shape and stability. After the lens is removed, an artificial intraocular lens (IOL) is implanted in the capsular bag. The small incision allows for rapid healing and minimizes complications compared to traditional cataract surgery methods (Figure 17).

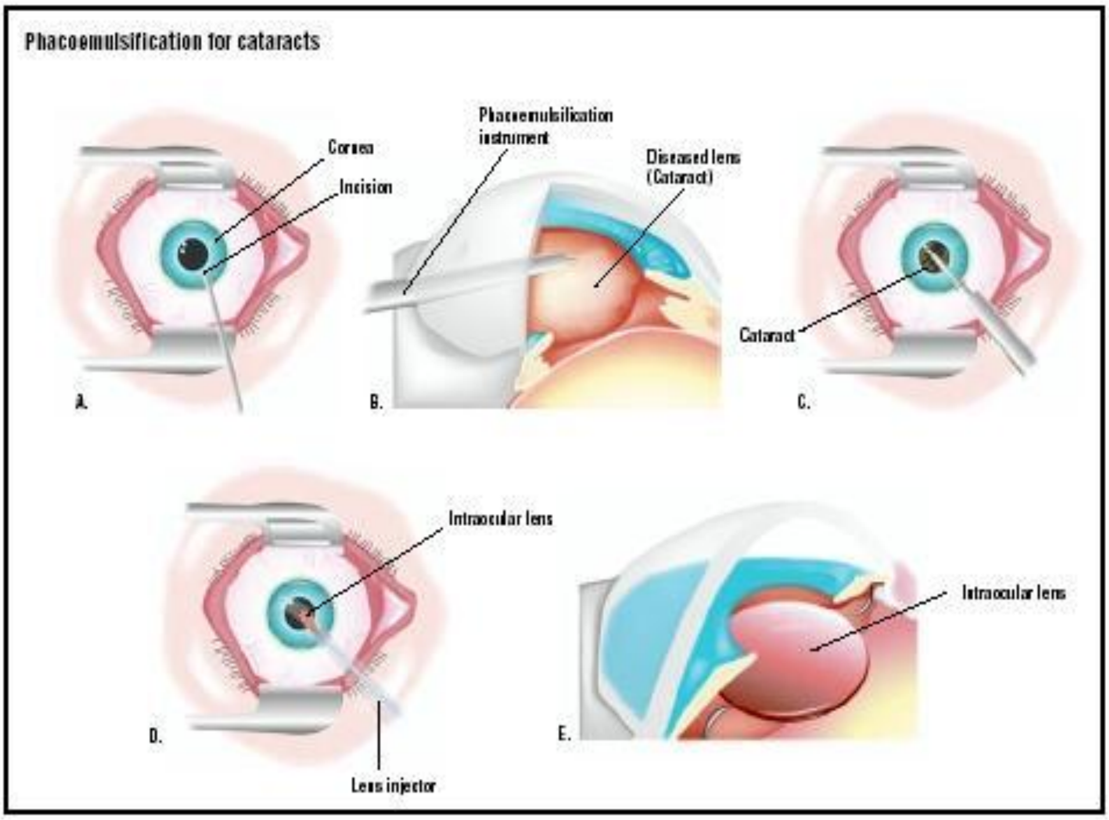


Figure 17: Phacoemulsification in removal of cataract (GGC Inc.,)

<u>Femtosecond Laser-assisted cataract surgery (FLACS) (39)</u>

FLACS uses a laser to perform precise incisions and lens fragmentation during the cataract surgery.

Femtosecond-Laser-Assisted Cataract Surgery (FLACS) is a technique that uses a femtosecond laser to automate corneal incisions, capsulorrhexis (opening the lens capsule), and lens fragmentation. The laser improves precision and safety, reducing manual variability and enhancing outcomes. This method is considered more consistent and safer than traditional manual procedures.

Intracapsular cataract extraction (ICCE) [40]

ICCE surgical procedure involving single incision to remove entire lens and capsule; ICCE is rarely done due to decreasing complication rates with improved surgical procedures.

Manual Extracapsular cataract extraction [41]

This method involves making an incision to remove the lens, after which the intraocular lens (IOL) is placed. But because it is less expensive, this method is still used all throughout the world. These days, the results of manual small incision cataract surgery, an adaption of ECCE, are comparable to those of phacoemulsification (Figure 18).

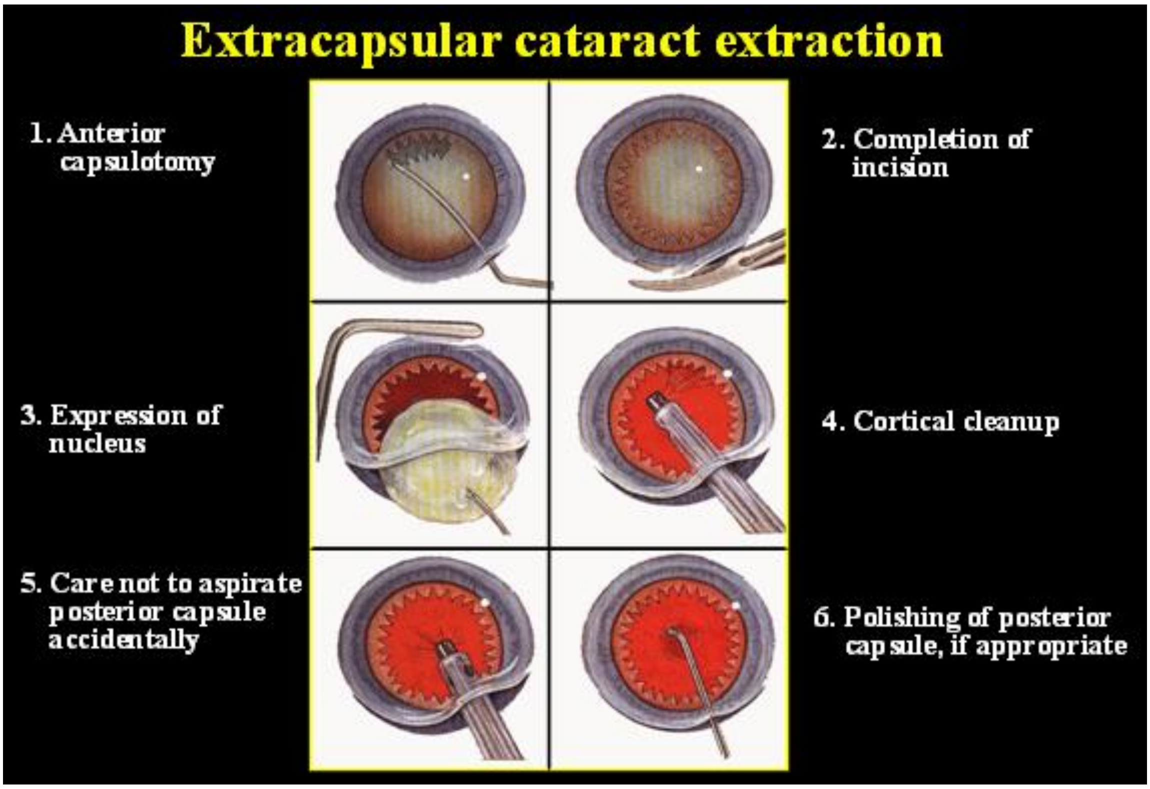


Figure 18: Extracapsular cataract extraction (Swaraashi Netralaya) (42)

Manual Small incision cataract surgery (MSICS) [41]

A type of cataract surgery which removes the cataractous lens through a small, self-sealing tunnel.

Benefits of MSICS include superior quality of care, patient comfort, less surgically induced astigmatism compared to conventional ECCE, absence of suture-related issues, and early rehabilitation. MSICS is easy, inexpensive, and has a low learning curve. It can be used for almost all forms of cataracts and has multiple indications.

Manual Small Incision Cataract Surgery (MSICS) is a technique for cataract removal that involves the following steps (43):

1. **Incision**: A small incision, typically around 6-7 mm in length, is made on the scleral. A triplanar sclerocorneal tunnel is constructed. This smaller incision and self-sealing tunnel reduces the risk of complications and promotes faster healing compared to larger incisions.

2. **Capsulorrhexis**: The anterior capsule of the cataract lens is carefully opened to remove the lens. This step is crucial for ensuring proper removal of the cataract material.

3. **Lens Extraction**: The cataractous lens is manually extracted through the small incision. The procedure often involves using specialized instruments to facilitate the removal of the lens, which may be performed in one piece or in fragments.

4. **Intraocular Lens (IOL) Implantation**: A new artificial lens (IOL) is inserted into eye to replace removed cataractous lens.

5. **Closure**: The sclero-corneal tunnel is often self-sealing or may require a few stitches. The small size of the incision usually promotes natural healing without the need for sutures.

Viscoelastic substances in cataract surgery [44, 45]

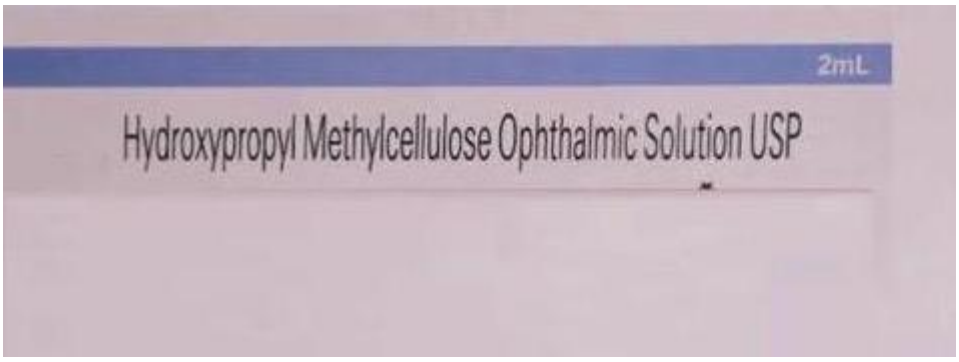
A viscoelastic material exhibits the rigidity of an elastic solid while simultaneously flowing and dissipating energy through frictional losses, similar to a viscous fluid.

Viscoelastic substances are commonly used in cataract surgery to facilitate procedures such as capsulotomy and nucleus manipulation. Additionally, they play a role in corneal, glaucoma, open globe, retinal and pediatric, surgeries. These materials are divided by their origin and rheological properties.

However, use of viscoelastics is associated with certain complications, including secondary glaucoma, capsular block syndrome, capsular bag distension syndrome, pseudo anterior uveitis and intraocular lens crystallization (Figure 19).

Classification of viscoelastic substances:

a. Cohesives (higher viscosity): Example –Sodium Hyaluronate.
b. Dispersives (lower viscosity): Example -hydroxypropylmethylcellulose
c. Viscoadaptives: Example- Healon5 (Table 1).

a) 

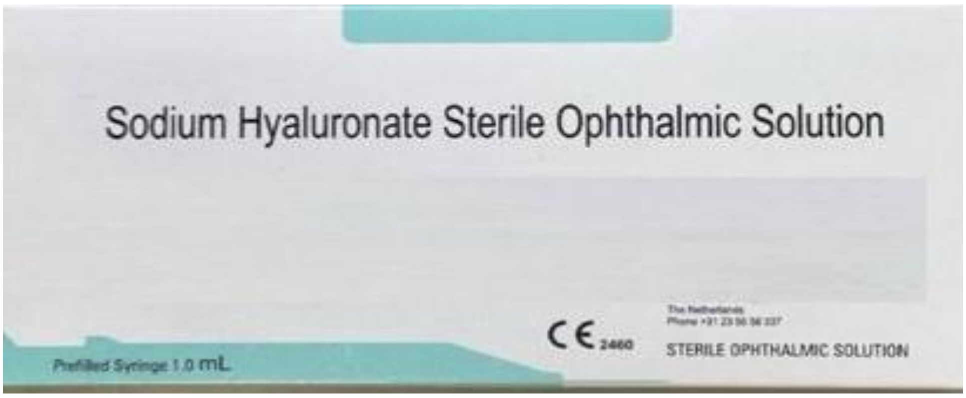
b) 

Figure 19: Viscoelastic substance a) Hydroxypropyl methylcellulose (HPMC) b) Sodium hyaluronate

Table 1: Arshinoff's classification

Type	Properties	Advantages	Disadvantages
1. Cohesives	High molecular weight, High viscosity, High pseudoplasticity, High surface tension & Less coatability	Helps to create space, & Induce and sustain pressure	Greater tendency to escape, Less corneal endothelial protection, If left in the anterior chamber, can cause secondary glaucoma.
2. Dispersives	Prolonged retention time and creates partition spaces	Lesser tendency to escape from the anterior chamber, better protection of intraocular structures,	It is aspired in small fragments creating an irregular viscoelastic aqueous interface that partially obscures the view. Difficult to remove
3. Viscoadaptives	Act as cohesives under low shear stress Also called as pseudo-dispersive	Ultra-viscous cohesive (solids)	Under high fluid flow, they easily fracture, freeing pieces to float. Retained in anterior segment similar to dispersive OVDs.

<u>Viscoelastic substances and changes in IOP</u>

Failure to completely remove viscoelastic from the anterior chamber and capsular bag during surgery may end in postoperative rise in intraocular pressure (IOP), usually within 6 to 24 hours. This increase in IOP occurs because of hindrance of TM, where large viscoelastic particles create mechanical resistance, hindering normal aqueous outflow. While the issue usually resolves on its own within 72 hours, persistent IOP elevation should be treated with antiglaucoma medications.

Drainage of viscoelastic in cataract-Techniques of removal of viscoelastic substances

i. Rock and Roll Technique: Intraocular lens (IOL) optic is tilted to one side, allowing viscoelastic removal from beneath the IOL. The same process is repeated on the opposite side to ensure complete clearance.

ii. Compartment Technique (Bimanual Irrigation and Aspiration): Using a bimanual approach, the irrigation and aspiration tip is moved back and forth, removing viscoelastic from different sections of the anterior chamber and capsular bag.

iii. Tapping Technique: In this approach, the I/A tip is used to gently tap the surface of the intraocular lens, facilitating the extraction and removal of any residual viscoelastic material.

iv. Spinning technique: After implanting IOL, it can be rotated to 360 degrees to clear any residual viscoelastic substances remaining around the equator.

Post-op Complications of MSICS (46)

a) Weak Tunnels: Occasionally, minor surgical errors such as weak tunnels, slight premature entry, or buttonholes may go unnoticed during the procedure.

b) Shallow Anterior Chamber: If a premature entry or buttonhole is not adequately sutured, it can result in a shallow or flat anterior chamber immediately after surgery.

c) Cortex in the Anterior Chamber: In cases involving hard mature or intumescent cataracts, residual cortical material in the fornices may be overlooked during irrigation and aspiration. This remaining cortex can subsequently enter the anterior chamber in small fragments with the flow of aqueous humour, typically observed on the first postoperative day.

d) Corneal Oedema: Microcystic corneal oedema may develop on the first postoperative day due to retained viscoelastic material from surgery.

e) Striate Keratopathy: Corneal oedema and Descemet membrane folds may occur postoperatively due to prolonged surgical time, excessive irrigation pressure on the endothelium, or direct contact of the nucleus with the endothelium in the absence of sufficient viscoelastic protection. Treatment typically involves topical sodium chloride eye drops and steroids.

f) Descemet Membrane Detachment (DMD): Shallow DMD may go unnoticed during surgery and become apparent on POD 1 or within a week. Causes include oversized nucleus pressure against the Descemet membrane due to inadequate viscoelastic coverage, improper entry plane during side port creation, or instrument-related trauma.

g) Fibrinous Membrane Formation: Inadequate instrument sterilization, excessive iris manipulation during nucleus prolapse can result in fibrinous membrane formation. Management includes frequent topical steroid and cycloplegic administration.

h) Retained Cortical Matter: A small pupil or sticky cortex can lead to residual cortical material remaining in the capsular bag, causing elevated intraocular pressure (IOP) and postoperative inflammation.

i) Intraocular Lens (IOL) Drop: When a significant posterior capsular rupture occurs and the IOL is placed in the sulcus due to inadequate capsular support, the lens may dislocate into the vitreous cavity due to positional changes.

j) Anterior or Posterior Subluxation of IOL: The IOL or its haptic may shift into the anterior chamber or vitreous cavity due to excessive positive pressure or insufficient capsular support.

k) Vitreous Wick Syndrome: In cases where incomplete vitrectomy is performed, vitreous strands may migrate into the anterior chamber, leading to vitreous wick syndrome.

l) Vitreous Touch Syndrome: Prolapse of the vitreous into the anterior chamber, may lead to endothelial contact, resulting in vitreous touch syndrome. Automated anterior vitrectomy is recommended to prevent long-term corneal damage.

m) Toxic Anterior Segment Syndrome (TASS): TASS typically manifests within 12-48 hours after intraocular surgery. Management involves aggressive topical steroid treatment.

n) Acute Early Endophthalmitis: Though uncommon, early-onset endophthalmitis can occur on POD 1 following cataract surgery. Treatment follows standard endophthalmitis vitrectomy study protocols.

Intraocular pressure post Cataract surgery

Following MSICS and traditional ECCE, there was a documented brief increase in intraocular pressure (IOP) in non-glaucomatous eyes during the early post-operative period. This increase was related to type of viscoelastic material utilised and procedure of cataract surgery employed.

a. *Immediate post-operative changes*: Studies have documented transient increases in IOP immediately following cataract surgery. This is often due to the use of OVDs during the surgery and the manipulation of the anterior chamber. For example, a study by Todorovic M (2019) showed that IOP can rise shortly after surgery due to retained viscoelastic materials and inflammation-induced changes (47).

b. *Chronic post-operative intraocular pressure changes*: Research indicates that while transient IOP spikes are common, the long-term IOP generally reduces following cataract surgery. Luo et al. (2012) found that cataract surgery might lead to a reduction in IOP in patients with elevated preoperative IOP, possibly due to improved aqueous outflow (48).

c. *Influence of surgical technique in alteration of IOP*: The type of cataract surgery can also influence IOP. For instance, Kessel et al. (2016) compared phacoemulsification with manual small incision cataract surgery (MSICS) and found differences in IOP outcomes between the two methods. Phacoemulsification generally leads to less IOP fluctuation compared to MSICS (49).

d. *Post-operative management in alteration of IOP*: Postoperative inflammation and the use of anti-inflammatory medications can also affect IOP. Pleyer et al (2013) discuss how steroid use postoperatively can lead to elevated IOP in some patients, necessitating careful monitoring and management (50).

Need for study

Manual Small Incision Cataract Surgery (MSICS) is a widely adopted, cost-effective procedure in resource-limited settings, yet its effects on intraocular pressure (IOP) remain inadequately explored. This study aims to evaluate the impact of MSICS on IOP by comparing preoperative values with those obtained at postoperative intervals.

Additionally, the research investigates the influence of two ophthalmic viscoelastic devices (OVDs), hydroxypropyl methylcellulose (HPMC) 2% and sodium hyaluronate 1.4%, on postoperative IOP changes.

Ultimately, the findings are expected to improve surgical practices, optimize OVD selection, and enhance patient safety by mitigating postoperative IOP spikes, thereby contributing to improved overall surgical outcomes.

MATERIALS AND METHODS

Source of Data

Setting: This study was carried out in patients presenting to outpatient department/In patient Department of Ophthalmology in KLE's Dr. Prabhakar Kore Hospital and medical research center, a tertiary care hospital.

Study design: A hospital-based comparative longitudinal study

Study Period: One year (Between April 2023 to March 2024)

Sample size calculation

The formula used for sample size calculation was,

$$n = \frac{2\left(Z_{1-\beta} + Z_{1-\alpha/2}\right)^2 (1 + (m-1)\rho)\sigma^2}{md^2}$$

where σ is the pooled standard deviation, d is clinically meaningful difference in outcome, m is the number of time points, ρ is the correlation between outcome variables at different time points, for 95% confidence level, $Z_{1-\alpha/2}$value is 1.96 and for 80% power, $Z_{1-\beta}$is 0.8416. Considering the study by Jacob JM et al (51), the mean pre-operative intraocular pressures was 13.5 ± 3.1 mmHg, mean post-operative intraocular pressure at day 1 was 15.3 ± 5.1 mmHg, at 1 week was 12.8 ± 4.8 mmHg, at 3rd week was 14.0 ± 3.9 mmHg and at 3rd month 13.0 ± 2.1 mmHg. Considering similar result at 95% confidence level, 80% power and with 0.3 correlation, the sample size was obtained as 109 subjects.

Considering 10% follow-up loss, the minimum sample size required was **120 subjects.**

Sampling technique: Convenient sampling

All the subjects meeting the inclusion criteria, presenting to the OPD of KLE's DR. PRABHAKAR KORE HOSPITAL was selected till the sample size was achieved.

Inclusion criteria

- All patients of cataract willing to undergo manual small incision cataract surgery was included in the study.
- Patients >40 years of age
- Clear cornea

Exclusion criteria

- Patients with peripheral anterior synechiae
- Patients with corneal opacity
- Patients with congenital, juvenile cataract
- Patients with h/o ocular surgery in the past
- Patients with h/o trauma in the eye
- Patients on medications like steroids, I0P lowering drugs
- Structural damage of optic disc
- Angle pathology
- All known cases of glaucoma

Method of data collection

This comparative longitudinal study was conducted in the Department of Ophthalmology at KLE's Dr. Prabhakar Kore Hospital and Medical Research Centre, a tertiary care institution. The study enrolled 120 eyes from 120 patients who underwent manual small incision cataract surgery performed by a single surgeon. All patients were over 40 years of age with clear corneas and provided informed consent prior to participation. After obtaining consent, detailed clinical histories were recorded to ensure compliance with the inclusion and exclusion criteria. The study received approval from the Institutional Ethics Committee and adhered to the tenets of the Declaration of Helsinki.

Each participant underwent a comprehensive ocular examination, which included measuring uncorrected distance visual acuity (UCVA) and best corrected visual acuity (BCVA) using a Snellen's chart, assessing the anterior segment with a slit-lamp, measuring intraocular pressure (IOP) by rebound tonometry, and determining anterior chamber depth (ACD) and axial length (AL) via A-scan. IOP measurements were consistently taken between 9:00 AM and 10:00 AM to minimize diurnal variations. Patient confidentiality was strictly maintained throughout the study, and all assessments were conducted by the principal investigator, who ensured that patient comfort was prioritized at all times.

Data were recorded on a predesigned and pretested semi-structured proforma and later entered into MS Excel, where they were stored on a password-protected digital system. Sociodemographic details, including age and gender, were collected using a semi-structured questionnaire. Data collection occurred preoperatively and at postoperative intervals on day 1, week 1, week 6, and at 3 months.

Statistical analysis

Data was analyzed using statistical software IBM SPSS version 27 and Microsoft Excel. One-way repeated measures of ANOVA were used to compare mean/ distribution of intra ocular pressure over time points. P-value less than or equal to 0.05 indicates statistical significance.

RESULTS

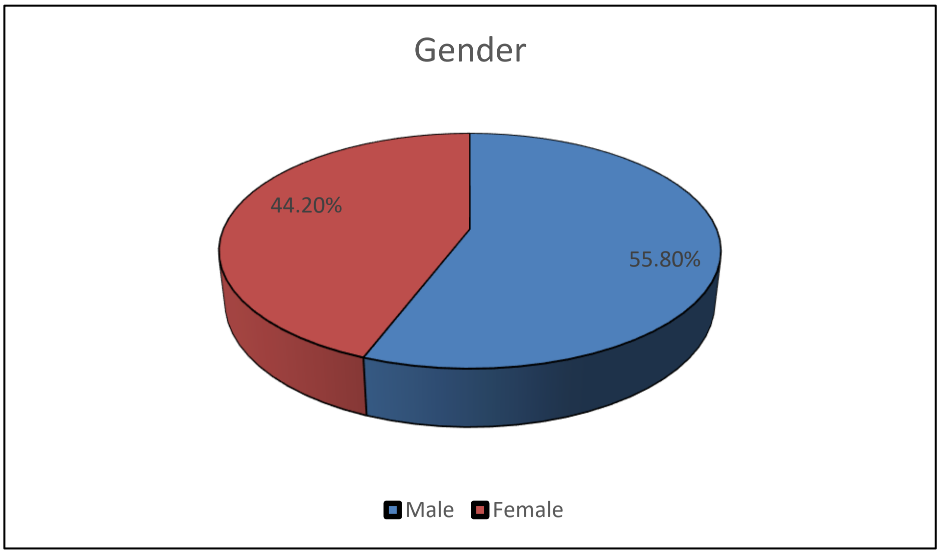
Age and Gender

A total of 120 study participants were included in the study. The mean age of study participants was 64.39 ± 9.48 years. The mean age of study participants among male and female were 66.19 ± 8.89 years and 62.05 ± 9.80 years respectively (Table 2).

Table 2: Age of study participants

Group	Mean age
Overall	64.39 ± 9.48
Male	66.19 ± 8.89
Female	62.05 ± 9.80

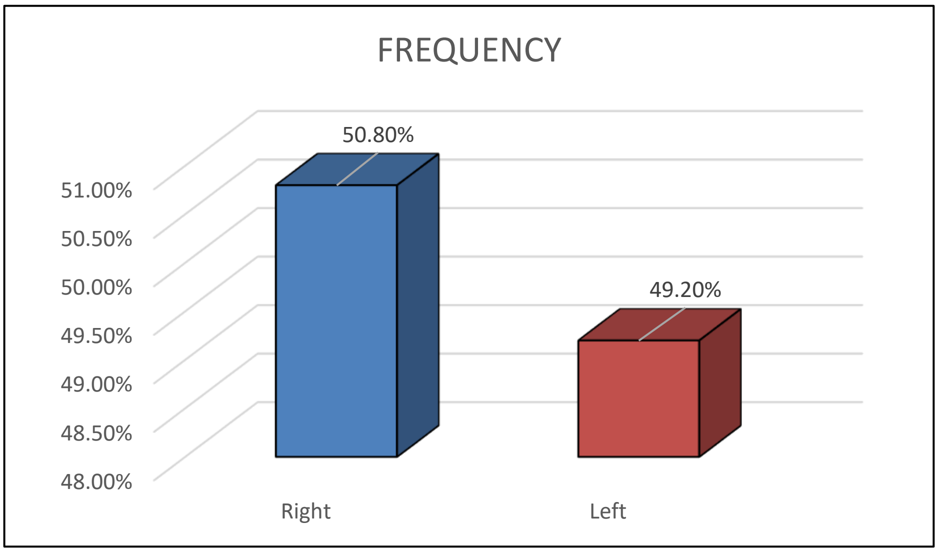
Among study participants, 55.8% (n=67) were male and 44.2% (n=53) were female (Figure 20).



Graph 1: Gender distribution among study participants

Frequency of eye operated

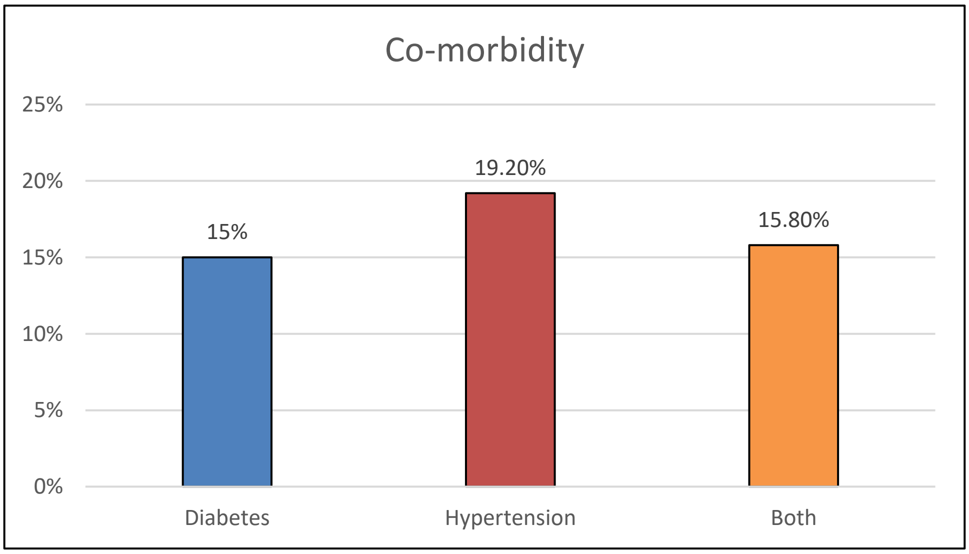
The frequency of right eye and left eye operated among the study participants were 50.8% (n=61) and 49.2% (n=59) respectively (Figure 21).



Graph 2: Frequency of the eye operated

Presence of co-morbidities

Prevalence of diabetes in study participants was 15% (n=18). Prevalence of hypertension in the study participants was 19.2% (n=23). Prevalence of both diabetes and hypertension in the study participants was 15.8% (n=19) (Figure 22).



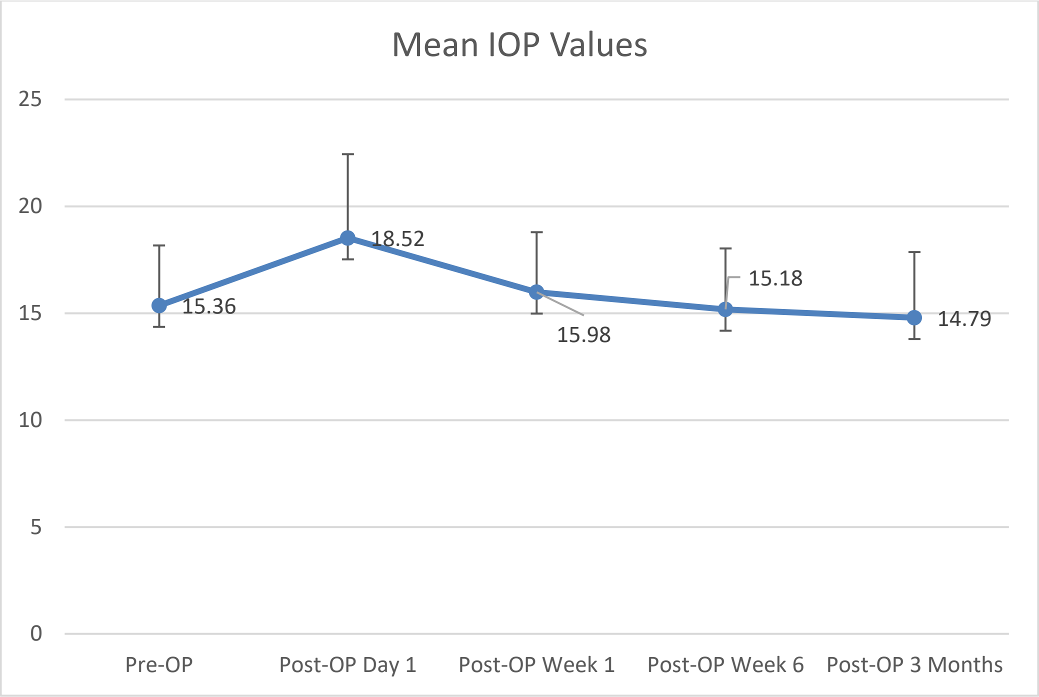
Graph 3: Prevalence of comorbidities among study participants

Intraocular pressure value

The mean IOP value of study participants before the surgery were 15.36 ± 2.81. The follow-up values of IOP at Post-op Day 1, Post-op week 1, post-op week 6 and post-op 3 months were 18.52 ± 3.92, 15.98 ± 2.81, 15.18 ± 2.85 and 14.79 ± 3.07 respectively. The mean IOP when compared to the pre-op had increased in the post-op Day 1 and reduced subsequently in the next follow-ups. However, the post-op week 1 values were slightly higher than the pre-op values. The post-op week 6 and 3-months values were lower than the pre-op value. All the follow-up values were statistically significant when compared with pre-op IOP (p=0.000 each). All the follow-up IOP values reported statistical significance compared to the pre-op value, depicting the impact of surgery (Table 3 and Figure 23).

Table 3: Mean IOP values at pre-op and follow-ups

Duration	Duration	IOP value (Mean ± SD)	P value
Pre-Op 15.36 ± 2.81	Post-op Day 1	18.52 ± 3.92	**0.000**
	Post-op 1 week	15.98 ± 2.81	**0.000**
	Post-op 6 weeks	15.18 ± 2.85	**0.000**
	Post-op 3 months	14.79 ± 3.07	**0.000**



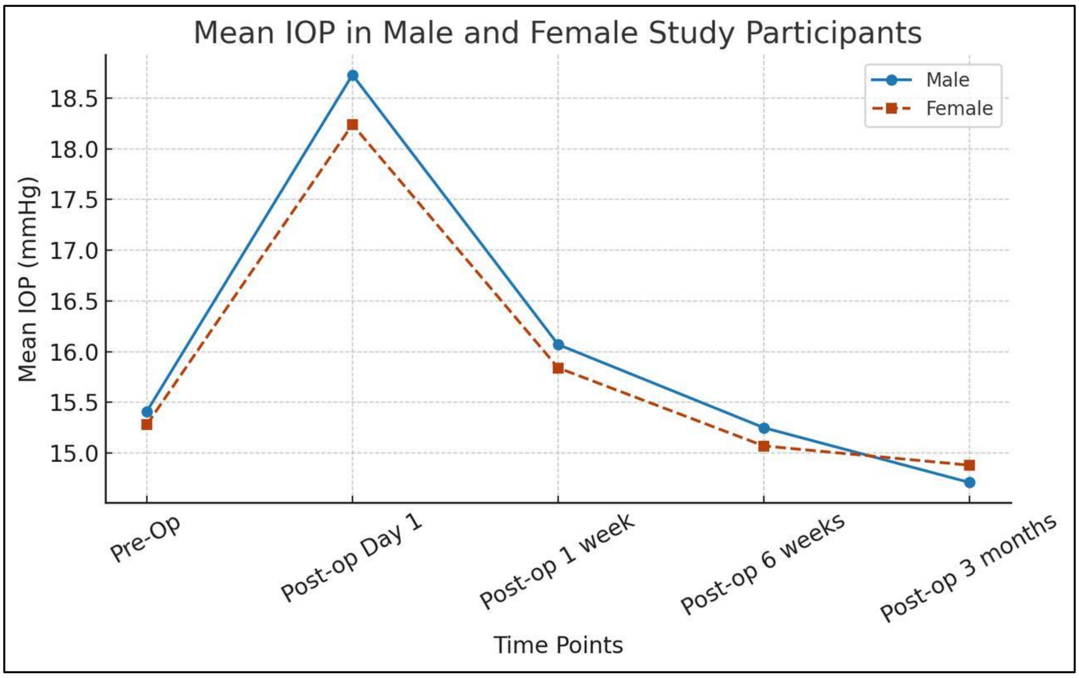
Graph 4: Mean IOP values

Gender distribution Vs IOP

The pre-op value of IOP among male and female study participants were 15.41 ± 2.58 and 15.28 ± 3.10 respectively. The post-op IOP follow-up values at Day 1, week 1, week 6 and 3 months among male were 18.73 ± 4.30, 16.07 ± 2.53, 15.25 ± 2.57 and 14.71 ± 2.97 respectively. The post-op IOP follow-up values at Day 1, week 1, week 6 and 3 months among female were 18.24 ± 3.41, 15.84 ± 3.15, 15.07 ± 3.19 and 14.88 ± 3.20 respectively. The mean IOP values in the male and female were similar at the pre-op level. Both the gender showed increase in the IOP values after the surgery in post-op day 1 and week 1 values. The post-op 6 weeks and 3 months values were lower and reduced when compared to the pre-op values. There was no statistical significance in the IOP values among male and female gender. This suggest that IOP rise and fall post-operatively does not vary with gender (Table 4 and Figure 24).

Table 4: Mean IOP among male and female study participants

IOP VALUE (Mean ± SD)	Male (n=67)	Female (n=53)	P value
Pre-Op	15.41 ± 2.58	15.28 ± 3.10	0.833
Post-op Day 1	18.73 ± 4.30	18.24 ± 3.41	0.321
Post-op 1 week	16.07 ± 2.53	15.84 ± 3.15	0.388
Post-op 6 weeks	15.25 ± 2.57	15.07 ± 3.19	0.558
Post-op 3 months	14.71 ± 2.97	14.88 ± 3.20	0.113



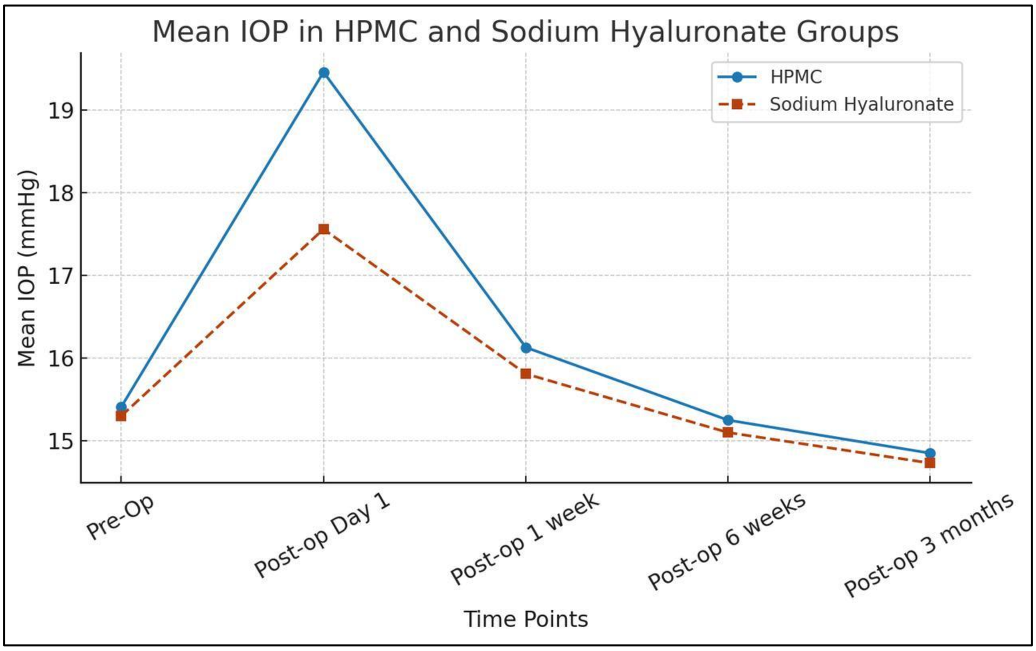
Graph 5: Mean IOP in male and female study participants

Viscoelastic substance and IOP

Among the study participants, HPMC and sodium hyaluronate were the viscoelastic substances used. The pre-op IOP value of study participants in HPMC and sodium hyaluronate groups were 15.41 ± 3.11 and 15.3 ± 2.49 respectively (p=0.776). There was no statistically significant difference in pre-operative IOP among the two groups. The post-op IOP value at Day 1, week 1, week 6 and 3 months in HPMC group were 19.46 ± 4.42, 16.13 ± 3.24, 15.25 ± 3.30 and 14.85 ± 3.56 respectively. The post-op IOP value at Day 1, week 1, week 6 and 3 months in sodium hyaluronate group were 17.56 ± 3.10, 15.81 ± 2.31, 15.10 ± 2.34 and 14.73 ± 2.50 respectively. The mean IOP value in the both the groups had higher values in the post-op day 1 and post-op 1 week when compared to the pre-op mean IOP values. The reduction in IOP values when compared to the pre-op values were reported in the post-op 6 weeks and 3 months. The difference in post-op Day 1 increase in IOP in HPMC and sodium hyaluronate groups was statistically significant (p=0.049). The difference in post op IOP during subsequent visits in HPMC group and sodium hyaluronate group was statistically insignificant. (Table 5 and Figure 25).

Table 5: IOP in different viscoelastic substance groups

IOP VALUE (Mean ± SD)	HPMC	Sodium Hyaluronate	P value
Pre-Op	15.41 ± 3.11	15.3 ± 2.49	0.776
Post-op Day 1	19.46 ± 4.42	17.56 ± 3.10	**0.049**
Post-op 1 week	16.13 ± 3.24	15.81 ± 2.31	0.199
Post-op 6 weeks	15.25 ± 3.30	15.10 ± 2.34	0.285
Post-op 3 months	14.85 ± 3.56	14.73 ± 2.50	0.108



Graph 6: Mean IOP in HPMC and NAH groups

The post-op day 1 value was increased in both the groups when compared to the Pre-OP IOP values. The post-op week 1 values were reduced than the post-op day 1 in both the groups. Post-op week 6 and 3-months' values in both groups were reduced than pre-op values (Table 6).

Table 6: Changes in the IOP based on viscoelastic substances

IOP VALUE (Mean ± SD)	HPMC	Sodium Hyaluronate
Post-op Day 1	Increased than Pre-OP	Increased than Pre-OP
Post-op 1 week	Increased than Pre-OP Decreased than Post-op Day 1	Increased than Pre-OP Decreased than Post-op Day 1
Post-op 6 weeks	Decreased than Pre-OP	Decreased than Pre-OP
Post-op 3 months	Decreased than Pre-OP	Decreased than Pre-OP

Change in IOP from pre-operative value to post-operative value during the follow-up's day 1, week 1, week 6 and 3 months, showed statistical significance respectively (p=0.040, 0.000, 0.000, and 0.000 respectively) in HPMC as well as Sodium hyaluronate group. (Table 7).

Table 7: Comparison of IOP within HPMC and NAH groups

Visco group	Follow-up	IOP Value (Mean ± SD)	P value
HPMC Pre-OP value 15.41 ± 3.11	Post-op Day 1	19.46 ± 4.42	**0.040**
	Post-op 1 week	16.13 ± 3.24	**0.000**
	Post-op 6 weeks	15.25 ± 3.30	**0.000**
	Post-op 3 months	14.85 ± 3.56	**0.000**
NAH 15.3 ± 2.49	Post-op Day 1	17.56 ± 3.10	**0.000**
	Post-op 1 week	15.81 ± 2.31	**0.000**
	Post-op 6 weeks	15.10 ± 2.34	**0.000**
	Post-op 3 months	14.73 ± 2.50	**0.000**

Xylocaine and IOP

The pre-op IOP values in xylocaine 6, 7, 8 and 9 ml were 14.52 ± 2.85, 15.83 ± 2.65, 15.17 ± 2.81 and 15.65 ± 2.96 respectively (p=0.258). The post-op day 1 IOP values of xylocaine 6, 7, 8 and 9 ml were 18.29 ± 4.13, 18.93 ± 3.68, 18.15 ± 3.78 and 18.80 ± 4.43 respectively (p=0.595). The post-op week 1 IOP values of xylocaine 6, 7, 8 and 9 ml were 15.76 ± 2.58, 16.58 ± 2.65, 15.73 ± 2.69 and 15.80 ± 3.34 respectively (p=0.430). The post-op week 6 IOP values of xylocaine 6, 7, 8 and 9 ml were 14.58 ± 3.02, 15.64 ± 2.42, 15.02 ± 2.86 and 15.26 ± 3.24 respectively (p=0.354). The post-op 3 months IOP values of xylocaine 6, 7, 8 and 9 ml were 14.11 ± 3.12, 15.38 ± 2.49, 14.73 ± 2.83 and 14.61 ± 3.99 respectively (p=0.785). The difference in IOP in all 4 groups was statistically insignificant pre operatively as well as on each post-operative follow up visit. (Table 8). This shows that amount of Xylocaine does not affect the IOP in the long term and only has immediate perioperative effect on IOP.

Table 8: Mean IOP based on the xylocaine used

IOP	Xylocaine used				P value
	6	7	8	9	
Pre-OP	14.52 ± 2.85	15.83 ± 2.65	15.17 ± 2.81	15.65 ± 2.96	0.258
Post OP Day 1	18.29 ± 4.13	18.93 ± 3.68	18.15 ± 3.78	18.80 ± 4.43	0.595
Post OP Week 1	15.76 ± 2.58	16.58 ± 2.65	15.73 ± 2.69	15.80 ± 3.34	0.430
Post OP week 6	14.58 ± 3.02	15.64 ± 2.42	15.02 ± 2.86	15.26 ± 3.24	0.354
Post OP 3 month	14.11 ± 3.12	15.38 ± 2.49	14.73 ± 2.83	14.61 ± 3.99	0.785

Irrigation time and IOP

Irrigation time was divided into 3 groups- <1min, 1-2 min and >2 minutes. The pre-op IOP value in less than 1 minute, 1-2 minute and more than 2 minutes group of irrigation time were 15.20 ± 2.56, 15.42 ± 2.77, 14.25 ± 4.92 respectively. The IOP values in less than 1 minute group at post-op day 1, week 1, week 6 and 3 months were 18.26 ± 2.73, 16.20 ± 1.89, 15.20 ± 2.65 and 14.80 ± 2.62 respectively. The IOP values in 1–2-minute group at post-op day 1, week 1, week 6 and 3 months were 18.61 ± 4.03, 16.02 ± 2.79, 15.23 ± 2.84 and 14.81 ± 3.07 respectively. The IOP values in more than 2 minutes group at post-op day 1, week 1, week 6 and 3 months were 17.00 ± 5.35, 13.75 ± 5.50, 13.50 ± 4.12 and 14.25 ± 5.05 respectively. The difference in IOP in all 3 groups was statistically insignificant pre operatively as well as on each post-operative follow up visit. Sodium hyaluronate is easier to remove post-surgery than HPMC due to its cohesive nature but as the surgeon always tries to do complete OVD wash irrespective of the viscoelastic used and the time taken, therefore, the difference in irrigation time does not have an effect on IOP. (Table 9).

Table 9: Mean IOP based on the irrigation time

IOP	Irrigation time			P value
	Less than 1 min	1-2 min	More than 2 min	
Pre-OP	15.20 ± 2.56	15.42 ± 2.77	14.25 ± 4.92	0.150
Post OP Day 1	18.26 ± 2.73	18.61 ± 4.03	17.00 ± 5.35	0.275
Post OP Week 1	16.20 ± 1.89	16.02 ± 2.79	13.75 ± 5.50	0.125
Post OP week 6	15.20 ± 2.65	15.23 ± 2.84	13.50 ± 4.12	0.063
Post OP 3 month	14.80 ± 2.62	14.81 ± 3.07	14.25 ± 5.05	0.572

Intergroup comparison of IOP

Intergroup comparison of IOP between baseline and follow-ups were performed using repeated measures ANOVA. The baseline and follow-ups were statistically significant (Table 10). The baseline IOP when compared to the post-op day 1, week 1, week 6 and post-op 3 months, it was statistically significant with p values 0.000 each. When the post-op day 1 value was compared with baseline, post-op week 1, week 6 and post-op 3 months were found statistically significant with p value of 0.000 each. Post-op week 1 when compared to baseline, post-op day 1, week 6 and post-op 3 months were statistically significant with p value of 0.000 each. Post-op week 6 when compared to baseline, post-op day 1, week 1 and post-op 3 months were statistically significant with p value 0.000 each. Post-op 3 months when compared to baseline, post-op day 1, week 1 and post-op week 6 were statistically significant with p value 0.000 each (Table 10).

Table 10: Comparison of IOP at different time points

IOP		Mean IOP	P VALUE
Baseline 15.36 ± 2.81	Post OP Day 1	18.52 ± 3.92	**0.000**
	Post OP Week 1	15.98 ± 2.81	**0.000**
	Post OP Week 6	15.18 ± 2.85	**0.000**
	Post OP Mon 3	14.79 ± 3.07	**0.000**
Post OP Day 1 18.52 ± 3.92	Baseline	15.36 ± 2.81	**0.000**
	Post OP Week 1	15.98 ± 2.81	**0.000**
	Post OP Week 6	15.18 ± 2.85	**0.000**
	Post OP Mon 3	14.79 ± 3.07	**0.000**
Post OP Week 1	Baseline	15.36 ± 2.81	**0.000**

15.98 ± 2.81	Post OP Day 1	18.52 ± 3.92	**0.000**
	Post OP Week 6	15.18 ± 2.85	**0.000**
	Post OP Mon 3	14.79 ± 3.07	**0.000**
Post OP Week 6 15.18 ± 2.85	Baseline	15.36 ± 2.81	**0.000**
	Post OP Day 1	18.52 ± 3.92	**0.000**
	Post OP Week 1	15.98 ± 2.81	**0.000**
	Post OP Mon 3	14.79 ± 3.07	**0.000**
Post OP mon 3	Baseline	15.36 ± 2.81	**0.000**
	Post OP Day 1	18.52 ± 3.92	**0.000**
	Post OP Week 1	15.98 ± 2.81	**0.000**
	Post OP Week 6	15.18 ± 2.85	**0.000**

DISCUSSION

Age and Gender

A total of 120 study participants were included in the study. The mean age of study participants was 64.39 ± 9.48 years. A similar mean age of 64.5 ± 8.2 years was reported in the study conducted by Morya AK et al (52). Lower mean age was reported in several studies. The mean age of study participants in Pal V et al study among their two groups, that is extracapsular cataract extraction (ECCE) with posterior chamber intraocular lens (PCIOL) implantation and phacoemulsification with PCIOL implantation were 57.33 ± 10.83 and 61.06 ± 7.05 years respectively (53). In a prospective observational study conducted by Kesireddy A et al, the mean age of study participants in small incision cataract surgery group (SICS) and phacoemulsification group were 62.02 ± 8.53 and 57.74 ± 8.49 years respectively (54). The mean age of study participants in the randomized clinical trial conducted by Sengupta S et al was 58.1 ± 5.3 years (55). The age group is comparable in all the studies. The age of the study participants was higher than 40 in all the studies reported.

In our study, majority of the study participants were males (55.8%). Similar results with majority of males were reported in multiple studies (54, 52). In the study conducted by Pal V et al, majority of the study participants were females (53). Similarly, female study participants were higher in Sengupta S et al (58), and Sharma PD (56). This suggests that post-operative changes in IOP are independent of gender of the patient.

Frequency of eye operated

In our study, the frequency of right eye and left eye operated among the study participants were 50.8% (n=61) and 49.2% (n=59) respectively. A total of 117 eyes were operated in the study conducted by Pal V et al (53). In the study conducted by Kesireddy et al., the frequency of eyes operated on the right and left eyes were 102 and 98 respectively (54). In Sengupta S et al study, 500 eyes of the study participants were operated (55). A total of 160 eyes were operated in the study conducted by Sharma PD et al (56).

Presence of co-morbidities

The prevalence of diabetes, hypertension and both diabetes & hypertension in the present study were 15%, 19.2% and 15.8% respectively. Prevalence of diabetes and hypertension in Morya AK et al study was 18.1% and 15.2% respectively (52).

Intraocular pressure value after MSICS

Most studies show immediate IOP spike after all types of cataract surgeries i.e. MSICS, Phacoemulsification and Conventional ECCE. The IOP eventually lowers down and reduces below the baseline pre-operative value.

In our study, the total mean IOP value of the study participants during pre-op was 15.36 ± 2.81. The follow-up values of IOP at Post-op Day 1, Post-op week 1, post-op week 6 and post-op 3 months were 18.52 ± 3.92, 15.98 ± 2.81, 15.18 ± 2.85 and 14.79 ± 3.07 respectively. The mean IOP when compared to the pre-op had increased in the post-op Day 1 and reduced subsequently in the next follow-ups. However, the post-op week 1 values were slightly higher than the pre-op values. The post-op week 6 and 3-months values were lower than the pre-op value. All the follow-up values were statistically significant when compared with pre-op IOP (p=0.000 each). All the follow-up IOP values reported statistical significance compared to the pre-op value, depicting the impact of surgery.

These results were similar to other studies done to establish change in IOP post different types of cataract surgeries.

In the study conducted by Pal V et al., the mean IOP during the pre-operative time was 13.58 ± 2.31. The follow-up values of IOP at post-op 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, 8^{th}, 10^{th} and 12^{th} months were 13.22 ± 2.44, 12.11 ± 2.15, 11.40 ± 2.17, 10.86 ± 2.01, 11.10 ± 2.06 and 11.03 ± 2.03 respectively. There was significant reduction in IOP at the end of second month in this study (53).

The mean IOP at baseline in the study conducted by Sengupta S et al was 14.4 ± 2.8. The mean IOP at follow ups at 1 month, 3 months and 6 months were 12.3 ± 3.0, 11.3 ± 2.7 and 11.8 ± 2.8 respectively. The IOP values had reduced comparably in both manual small incision cataract surgery (MSICS) and phacoemulsification (55).

The mean IOP at baseline was 15.2 ± 4.1 and 14.9 ± 3.4 respectively in ophthalmic viscosurgical devices group (OVD) and basal salt solution (BSS) group. The percentage of changes in the IOP from baseline compared to post-op day 1 and day 30 was 0.7% and 8.7% respectively in the OVD group and 2.7% and 7.5% respectively in the BSS group. Significant reduction in IOP was noted which was higher in the BSS group compared to OVD group (52).

Multiple factors can contribute to the increase in the IOP immediately after the surgery. Obstruction of trabecular meshwork by residual cortical lens material, retained viscoelastic substances, pigment particles from iris, inflammatory and RBCs.

As the postoperative inflammation reduces and remaining viscoelastic and pigment debris get gradually cleared, the IOP value decreases gradually (56).

Viscoelastic substance and IOP

OVDs used in this study can be classified as Dispersive and Cohesive viscoelastic devices. Dispersive OVDs coat the endothelium better but are difficult to remove from the anterior chamber while Cohesive OVDs are better for creating space in the anterior chamber for capsulotomy and IOL implantation but they leave the anterior chamber quickly in an en mass fashion (57).

The post-operative rise in IOP post cataract surgery has been well documented with remnant viscoelastic in the anterior chamber being one of the causes. It causes mechanical obstruction of the trabecular meshwork therefore causing a transient rise in IOP (57).

Among the study participants in our study, HPMC and sodium hyaluronate were the viscoelastic substances used. The pre-op IOP value of study participants in HPMC and sodium hyaluronate groups were 15.41 ± 3.11 and 15.3 ± 2.49 respectively (p=0.776). The post-op IOP value at Day 1, week 1, week 6 and 3 months in HPMC group were 19.46 ± 4.42, 16.13 ± 3.24, 15.25 ± 3.30 and 14.85 ± 3.56 respectively. The post-op IOP value at Day 1, week 1, week 6 and 3 months in sodium hyaluronate group were 17.56 ± 3.10, 15.81 ± 2.31, 15.10 ± 2.34 and 14.73 ± 2.50 respectively. The mean IOP value in the both the groups had higher values in the post-op day 1 and post-op 1 week when compared to the pre-op mean IOP values. The reduction in IOP values when compared to the pre-op values were reported in the post-op 6 weeks and 3 months. The Post-Op Day 1 values of HPMC and sodium hyaluronate groups were statistically significant (p=0.049).

The post-op day 1 value was increased in both the groups when compared to the pre-op IOP values. The Post-Op Week 1 values were reduced than the Post-Op Day 1 in both the groups. Post-Op Week 6 and 3-months' values in both groups were reduced than Pre-Op values.

These results were corroborated with study done by Chaudhari et al. The mean IOP value in HPMC and sodium hyaluronate group in the study conducted by Chaudhuri et al were 15.9 ± 3.5 and 15.7 ± 2.8 respectively. In this study, the follow-up values of HPMC group at 1-4 hours, day 1 and week 1 were 24.0 ± 11.4, 21.3 ± 8.3 and 13.9 ± 3.5 respectively. In the sodium hyaluronate group, the follow-up IOP values at 1-4 hours, day 1 and week 1 were 23.6 ± 9.5, 17.6 ± 4.7 and 13.4 ± 3.5 respectively. Both groups showed immediate increase in the IOP after surgery and gradual significant reduction. However, sodium hyaluronate group showed lesser IOP spike on day 1 compared to the HPMC group (57).

The difference in Post Op Day 1 IOP spike in HPMC and sodium hyaluronate groups can be attributed to easier and faster removal of sodium hyaluronate at the end of surgery leading to complete removal of OVD and lesser obstruction of the outflow pathway while HPMC is difficult to remove. Once the remnant OVD is cleared from anterior chamber after a few days, it leads to reduction and stabilization of IOP. (57)

The strength of the present study was, it evaluated the IOP values at various time points after the surgery (Day 1, Week 1, Week 6 and 3 Months) which provided a detailed understanding of IOP fluctuations after MSICS. The study demonstrated the comparison of IOP values between the viscoelastic substance used and the techniques used for the surgery to demonstrate the difference and the better performance. However, there are few limitations in this study. The study was conducted in a single tertiary care center and hence the results may not be generalizable. Long-term follow-up was not done in this study. A possibility of potential measurement bias while measuring the IOP or inter-observer variability in the results.

CONCLUSION

The Pre-Op IOP value of study participants in HPMC and sodium hyaluronate groups were 15.41 ± 3.11 and 15.3 ± 2.49 respectively (p=0.776). The Post-Op IOP value at Day 1, Week 1, Week 6 and 3 Months in HPMC group were 19.46 ± 4.42, 16.13 ± 3.24, 15.25 ± 3.30 and 14.85 ± 3.56 respectively. The Post-Op IOP value at Day 1, Week 1, Week 6 and 3 Months in sodium hyaluronate group were 17.56 ± 3.10, 15.81 ± 2.31, 15.10 ± 2.34 and 14.73 ± 2.50 respectively. The difference in post-op day 1 IOP values of HPMC and sodium hyaluronate groups were statistically significant (p=0.049). The mean IOP value in the both the groups had higher values on Post-Op Day 1 and Post-Op Week 1 when compared to the Pre-Op mean IOP values. The reduction in IOP values when compared to the Pre-Op values were reported in the Post-Op Week 6 and 3 months. The hydroxypropyl methyl cellulose and sodium hyaluronate group both showed significant reduction in the IOP in the follow-ups. Reduction of IOP when compared to the baseline was recorded following the 6 weeks' follow-up.

The mean intraocular pressure value of study participants before the surgery were 15.36 ± 2.81. The follow-up values of mean IOP at Post-op Day 1, Post-op week 1, Post-op week 6 and Post-op 3 months were 18.52 ± 3.92, 15.98 ± 2.81, 15.18 ± 2.85 and 14.79 ± 3.07 respectively. The mean IOP when compared to the Pre-op had increased in the Post-op Day 1 and reduced subsequently in the next follow-ups. However, the Post-op week 1 values were slightly higher than the Pre-op values. The Post-op week 6 and 3-months values were lower than the Pre-op value. All the follow-up values were statistically significant when compared with Pre-op IOP (p=0.000 each). The mean IOP values showed significant reductions in IOP following 6 weeks after the cataract surgery.

This study aimed to assess the impact of manual small incision cataract surgery on intraocular pressure by comparing preoperative values with postoperative values measurements at different time intervals. The findings provide valuable insights into the changes in IOP at the post-operative day 1, week 1, week 6 and 3 months. Understanding these variations can aid in optimizing postoperative care, minimizing complications, and improving surgical outcomes for patients undergoing cataract surgery.

SUMMARY

This hospital-based comparative longitudinal study was conducted in patients of Department of Ophthalmology in KLE's Dr. Prabhakar Kore Hospital and medical research center, a tertiary care hospital. The study was conducted for a period of one year, between April 2023 to March 2024.

After eligibility and satisfaction of inclusion and exclusion criteria, informed consent was obtained from the patients who were willing to participate in the study.

The study included a total of 120 study participants were included in the study. The mean age of study participants was 64.39 ± 9.48 years. The mean age of study participants among male and female were 66.19 ± 8.89 years and 62.05 ± 9.80 years respectively.

Among study participants, 55.8% (n=67) were male and 44.2% (n=53) were female.

The frequency of right eye and left eye operated among the study participants were 50.8% (n=61) and 49.2% (n=59) respectively.

Prevalence of diabetes and hypertension among the study participants was 15% and 19.2% respectively. Prevalence of both diabetes and hypertension among the study participants was 15.8% (n=19).

The mean IOP value of study participants before the surgery were 15.36 ± 2.81. The follow-up values of IOP at Post-op Day 1, Post-op week 1, post-op week 6 and post-op 3 months were 18.52 ± 3.92, 15.98 ± 2.81, 15.18 ± 2.85 and 14.79 ± 3.07 respectively. The mean IOP when compared to the pre-op had increased in the post-op

Day 1 and reduced subsequently in the next follow-ups. However, the post-op week 1 values were slightly higher than the pre-op values. The post-op week 6 and 3-months values were lower than the pre-op value. All the follow-up values were statistically significant when compared with pre-op IOP (p=0.000 each).

The mean IOP values in the male and female were similar at the pre-op level. Both the gender showed increase in the IOP values after the surgery in post-op day 1 and week 1 values. The post-op 6 weeks and 3 months values were lower and reduced when compared to the pre-op values. There was no statistical significant difference in the IOP values among male and female gender. This suggest that IOP rise and fall post-operatively does not vary with gender.

The mean IOP value in the both the OVD groups had higher values in the post-op day 1 and post-op 1 week when compared to the pre-op mean IOP values. The reduction in IOP values when compared to the pre-op values were reported in the post-op 6 weeks and 3 months. The difference in rise of IOP on post-op Day 1 in HPMC and sodium hyaluronate groups were statistically significant (p=0.049).

BIBLIOGRAPHY

1. Liu YC, Wilkins M, Kim T, Malyugin B, Mehta JS. Cataracts. The Lancet. 2017 Aug;390(10094):600–12.
2. Mishra D, Gurnani B, Kaur K, Heda A, Sahu A. Evolution of manual small-incision cataract surgery from 8 mm to 2 mm - A comprehensive review. Indian Journal of Ophthalmology. 2022;70(11):3773.
3. Borkenstein AF, Borkenstein EM, Malyugin B. Ophthalmic Viscosurgical Devices (OVDs) in Challenging Cases: a Review. Ophthalmology and Therapy. 2021 Oct 6;10(4):831–43.
4. Malvankar-Mehta MS, Fu A, Subramanian Y, Hutnik C. Impact of Ophthalmic Viscosurgical Devices in Cataract Surgery. Lansingh VC, editor. Journal of Ophthalmology. 2020 Oct 20;2020:1–17.
5. Thomas M, Vajaranant TS, Aref AA. Hypotony Maculopathy: Clinical Presentation and Therapeutic Methods. Ophthalmology and Therapy. 2015 Aug 8;4(2):79–88.
6. Jayaram H. Intraocular pressure reduction in glaucoma: Does every mmHg count? Taiwan Journal of Ophthalmology. 2020;0(0):0.
7. Khurana AK, Khurana I. Anatomy and Physiology of Eye [Internet]. CBS Publishers & Distributors; 2017. Available from: https://www.google.co.in/books/edition/_/MBBrAQAACAAJ?hl=en&sa=X&ved=2ahUKEwi729Gn4d2KAxX1SWwGHcOiBmgQ7_IDegQIDBAC
8. Døving M, Lindal FP, Mjøen E, Galteland P. Orbital fractures. Tidsskrift for Den norske legeforening [Internet]. 2022 Apr 4 [cited 2023 Mar 16]; Available from: https://tidsskriftet.no/en/2022/04/clinical-review/orbital-fractures

9. Pandya RP, Deng W, Hodgson NM. Current Guidelines and Opinions in the Management of Orbital Floor Fractures [Internet]. Otolaryngologic Clinics of North America, Volume 56, Issue 6, 1101 - 1112. 2023. Available from: https://www.oto.theclinics.com/article/S0030-6665(23)00080-4/abstract

10. Richards E, Munakomi S, Mathew D. [Figure, Diagram of the human eye...] [Internet]. www.ncbi.nlm.nih.gov. 2022. Available from: https://www.ncbi.nlm.nih.gov/books/NBK554479/figure/article-79614.image.f3/

11. Khurana A, Khurana B, Khurana AK. JaypeeDigital | Diseases of Cornea [Internet]. Jaypeedigital.com. 2015 [cited 2025 Mar 4]. Available from: https://www.jaypeedigital.com/book/9789351526575/chapter/ch6

12. Qazi Y, Wong G, Monson B, Stringham J, Ambati BK. Corneal transparency: Genesis, maintenance and dysfunction. Brain Research Bulletin. 2010 Feb;81(2-3):198–210.

13. Holmes D. Reconstructing the retina. Nature. 2018 Sep;561(7721):S2–3.

14. Yang S, Zhou J, Li D. Functions and Diseases of the Retinal Pigment Epithelium. Frontiers in Pharmacology. 2021 Jul 28;12.

15. Thacker M, Tseng CL, Lin FH. Substitutes and Colloidal System for Vitreous Replacement and Drug Delivery: Recent Progress and Future Prospective. Polymers. 2020 Dec 30;13(1):121.

16. Alward WLM, Longmuir RA. Anatomy of the Angle [Internet]. American Academy of Ophthalmology. 2017. Available from: https://www.aao.org/education/disease-review/anatomy-of-angle

17. Srinivas SP, Guidoboni G, Anirudh Burli, Bhavya Harjai, Kompella UB. Anatomy and Physiology of the Anterior Chamber: Impact on Product

Development. AAPS advances in the pharmaceutical sciences series. 2021 Jan 1;39–64.

18. Davidson HJ, Kuonen VJ. The tear film and ocular mucins. Veterinary Ophthalmology [Internet]. 2004 Mar 1;7(2):71–7. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7169288/#b8
19. Meek KM, Knupp C. Corneal structure and transparency. Progress in Retinal and Eye Research [Internet]. 2015 Nov;49:1–16. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4655862/
20. Goel M. Aqueous Humor Dynamics: A Review. The Open Ophthalmology Journal [Internet]. 2010 Sep 3;4(1):52–9. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3032230/
21. Ponsioen TL, Hooymans JMM, Los LI. Remodelling of the human vitreous and vitreoretinal interface--a dynamic process. Progress in Retinal and Eye Research [Internet]. 2010 Nov 1;29(6):580–95. Available from: https://pubmed.ncbi.nlm.nih.gov/20621195/
22. Engman JH, Harrison AR, Krachmer JH. CHAPTER 8 - Lens Abnormalities [Internet]. Palay DA, Krachmer JH, editors. ScienceDirect. Philadelphia: Mosby; 2005. p. 127–37. Available from: https://www.sciencedirect.com/science/article/abs/pii/B9780323033169500140
23. Motlagh M, Geetha R. Physiology, Accommodation [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2022. Available from: https://www.ncbi.nlm.nih.gov/books/NBK542189/
24. Gupta MP, Herzlich AA, Sauer T, Chan CC. Retinal Anatomy and Pathology. Developments in Ophthalmology. 2016;7–17.

25. Gupta SK, Lyubomyr Lytvynchuk, Ardan T, Studenovská H, Faura G, Eide L, et al. Retinal Pigment Epithelium Cell Development: Extrapolating Basic Biology to Stem Cell Research. Biomedicines [Internet]. 2023 Jan 23 [cited 2023 Oct 12];11(2):310–0. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9952929/

26. Bollinger KE, Crabb JS, Yuan X, Tasneem Putliwala, Crabb JW. Proteomic similarities in steroid responsiveness in normal and glaucomatous trabecular meshwork cells. Molecular Vision [Internet]. 2012 Jul 20;18(211-14):2001–11. Available from: https://www.researchgate.net/publication/230639083_Proteomic_similarities_in_steroid_responsiveness_in_normal_and_glaucomatous_trabecular_meshwork_cells

27. Uddin N, Rutar M. Ocular Lymphatic and Glymphatic Systems: Implications for Retinal Health and Disease. International Journal of Molecular Sciences. 2022 Sep 4;23(17):10139.

28. Machiele R, Motlagh M, Patel BC. Intraocular Pressure [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2020. Available from: https://www.ncbi.nlm.nih.gov/books/NBK532237/

29. Bader J, Havens SJ. Tonometry [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2020. Available from: https://www.ncbi.nlm.nih.gov/books/NBK493225/

30. Zeppieri M, Gurnani B. Applanation Tonometry [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2022. Available from: https://www.ncbi.nlm.nih.gov/books/NBK582132/

31. Brusini P, Salvetat ML, Zeppieri M. How to Measure Intraocular Pressure: An Updated Review of Various Tonometers. Journal of Clinical Medicine. 2021 Aug 27;10(17):3860.

32. iCare. iCare IC100 Tonometer for all eye care professionals [Internet]. iCare. Available from: https://www.icare-world.com/product/icare-ic100-tonometer/

33. Nizami AA, Gulani AC. Cataract [Internet]. Nih.gov. StatPearls Publishing; 2019. Available from: https://www.ncbi.nlm.nih.gov/books/NBK539699/

34. Directorate of Health Services, Ministry of Health & Family Welfare, Government of India. National Blindness and Visual Impairment Survey 2015-2019 Report. 2019.

35. Sarkar D, Sharma R, Singh P, Verma V, Samendra Karkhur, Verma S, et al. Age-related cataract - Prevalence, epidemiological pattern and emerging risk factors in a cross-sectional study from Central India. Indian Journal of Ophthalmology [Internet]. 2023 May 1;71(5):1905–12. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10391463/#:~:text=Results%3A

36. Das S, Sinha A, Srikanta Kanungo, Pati S. Decline in unmet needs for cataract surgery among the ageing population in India: findings from LASI, wave-1. Frontiers in health services. 2024 Mar 19;4.

37. Bencić G, Zorić-Geber M, Sarić D, Corak M, Zdravko Mandić. Clinical importance of the Lens Opacities Classification System III (LOCS III) in phacoemulsification. Collegium Antropologicum [Internet]. 2005 Feb 1;29 Suppl 1:91–4. Available from: https://www.researchgate.net/publication/7570704_Clinical_importance_of_the_Lens_Opacities_Classification_System_III_LOCS_III_in_phacoemulsification

38. Wang KM, Jun AS, Ladas JG, Uday Devgan. Phacoemulsification: Principles and Techniques. Springer eBooks. 2020 Jan 1;1–24.

39. Sun H, Fritz A, Dröge G, Neuhann T, Bille JF. Femtosecond-Laser-Assisted Cataract Surgery (FLACS) [Internet]. Bille JF, editor. PubMed. Cham (CH): Springer; 2019. Available from: https://pubmed.ncbi.nlm.nih.gov/32091840/

40. Ang M, Evans JR, Mehta JS. Manual small incision cataract surgery (MSICS) with posterior chamber intraocular lens versus extracapsular cataract extraction (ECCE) with posterior chamber intraocular lens for age-related cataract. Cochrane Database of Systematic Reviews. 2014 Nov 18;

41. Singh K, Misbah A, Saluja P, Singh AK. Review of manual small-incision cataract surgery. Indian Journal of Ophthalmology [Internet]. 2017 Dec 1 [cited 2020 Sep 27];65(12):1281–8. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5742955/

42. Swaraashi Netralaya. Swaraashi Netralaya : Cateract Extraction [Internet]. Swaraashinetralaya.in. 2025 [cited 2025 Jan 6]. Available from: https://swaraashinetralaya.in/edu_cat_extra.html

43. Berges AJ, Zhu A, Sikder S, Yiu S, Ravindran RD, Parikh KS. Addressing the MSICS learning curve: identification of instrument-holding techniques used by experienced surgeons. International Journal of Ophthalmology. 2021 May 18;14(5):693–9.

44. Haddad YM. Viscoelasticity/Anelasticity. Elsevier; 2003. p. 9530–6. Available from: https://www.sciencedirect.com/science/article/abs/pii/B0080431526017241

45. Kaur K, Gurnani B. Viscoelastics [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2022. Available from: https://www.ncbi.nlm.nih.gov/books/NBK578189/

46. Goel R, Shah S, Malik KS, Sontakke R, Golhait P, Gaonker T. Complications of manual small-incision cataract surgery. Indian Journal of Ophthalmology. 2022;70(11):3803.

47. Todorović M. Intraocular Pressure Changes after Uneventful Phacoemulsification in Early Postoperative Period in Healthy Eyes. Acta Clinica Croatica. 2019;

48. Luo C, Chen M, Xu H. Complement gene expression and regulation in mouse retina and retinal pigment epithelium/choroid. Molecular Vision [Internet]. 2011 Jun 14 [cited 2025 Jan 6];17:1588. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3123163/

49. Kessel L, Erngaard D, Flesner P, Andresen J, Tendal B, Hjortdal J. Cataract surgery and age-related macular degeneration. An evidence-based update. Acta Ophthalmologica [Internet]. 2015 Nov 1;93(7):593–600. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6680180/

50. Pleyer U, Ursell PG, Rama P. Intraocular Pressure Effects of Common Topical Steroids for Post-Cataract Inflammation: Are They All the Same? Ophthalmology and Therapy [Internet]. 2013 Sep 17 [cited 2019 Apr 29];2(2):55–72. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4108144/

51. Jacob JM, Jacob AD, Goudinho S. The effect of manual small incision cataract surgery on the intraocular pressure – A prospective study in south Kerala. Indian Journal of Clinical and Experimental Ophthalmology [Internet]. 2020 Dec 15;4(3):409–12. Available from: https://www.ijceo.org/journal-article-file/7365

52. Morya AK, Gurnani B, Mishra D, Kaur K, Porwal A, Sisodia P, et al. Comparison of corneal endothelial cell loss during manual small-incision

cataract surgery using viscoelastic-assisted nucleus removal versus continuous balanced salt solution plus technique - Randomized controlled trial. Indian Journal of Ophthalmology [Internet]. 2022 Nov;70(11):3960–6. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC9907241/

53. Pal V, Ajai A, Suman S, Pratap V. Long-term change in intraocular pressure after extracapsular cataract extraction with posterior chamber intraocular lens implantation versus phacoemulsification with posterior chamber intraocular lens implantation in Indians. Middle East African Journal of Ophthalmology. 2013;20(4):332.

54. Kesireddy A, Vivekanand U, Lobo S. A prospective observational study of changes in intraocular pressure before and after cataract surgery using noncontact tonometer in small incision cataract surgery and phacoemulsification. Odisha Journal of Ophthalmology. 2022 Jul;29(2):64–8.

55. Sengupta S, Venkatesh R, Krishnamurthy P, Nath M, Mashruwala A, Ramulu PY, et al. Intraocular Pressure Reduction after Phacoemulsification versus Manual Small-Incision Cataract Surgery. Ophthalmology. 2016 Aug;123(8):1695–703.

56. Sharma PD, Madhavi MR. A comparative study of postoperative intraocular pressure changes in small incision vs conventional extracapsular cataract surgery. Eye. 2009 Jul 24;24(4):608–12.

57. Ray-Chaudhuri N, Voros GM, Sutherland S, Figueiredo FC. Comparison of the Effect of Sodium Hyaluronate (Ophthalin®) and Hydroxypropylmethylcellulose (HPMC-Ophtal®) on Corneal Endothelium, Central Corneal Thickness, and Intraocular Pressure after Phacoemulsification. European Journal of Ophthalmology. 2006 Mar;16(2):239–46.

ANNEXURES

ANNEXURE – I

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH STUDY

KAHERs JNMC BELAGAVI

INFORMED CONSENT FORM

"A COMPARATIVE LONGITUDINAL STUDY TO EVALUATE THE CHANGES IN INTRA OCULAR PRESSURE, AFTER MANUAL SMALL INCISION CATARACT SURGERY BETWEEN PRE - OPERATIVE AND POST - OPERATIVE PERIOD''

Name of Student/Principal Investigator: BK0122004

Name of Guide/Co Investigators: ,

Introduction:

Lens is a very important part of the eye which helps us to see. As we age the lens gets opacified which is known as cataract. Cataract is the commonest cause of blindness and small incision cataract surgery is the most widely done procedure. Our eyes is like a ball of fluid and the Intraocular pressure is the fluid pressure of the eye. This study is being done to see the changes in the Intraocular pressure before and after manual small incision cataract surgery with the help of a Intraocular pressure measuring device called rebound tonometer. Explanation of procedure: After routine examination, Intraocular pressure values will be recorded pre-operatively, post operatively at 1st day, 1st week, 6th week, and 3rd month with the help of a rebound tonometer.

At every visit the intraocular pressure will be measured between 9.00 am to 10.00 am by a rebound tonometer. Rebound tonometer is a device to measure the Intraocular pressure which is very safe, and comfortable to the patient.

Withdrawal from participation in the study:

Participation in this study in voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator. Possible benefits from participating in the study: You will not get any benefits by participating in this study. The data gathered will help population at large. Possible risks from participating in the study: There are no risks involved in participating in this study. Privacy and confidentiality: The information collected from you will be coded, to prevent any person to identify you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication. Financial incentives: You will not receive any payment for participating in this study. Cost of investigations done during the course of study will be paid by the principal investigator / Participant. (Authorization for publication of aggregated data:

Results obtained after processing of the aggregated data will be published for scientific purpose and or presented to scientific groups. However, your identity will never be revealed.

Questions: In case of any questions with regard to this study, you are free to contact:

’ If you have any question or complaints with regard to your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052. Legal rights: By signing this consent form, we are not waving any of your legal rights.

CONSENT STATEMENT

I am making a voluntary decision to participate in the study **"A COMPARATIVE LONGITUDINAL STUDY TO EVALUATE THE CHANGES IN INTRA OCULAR PRESSURE, AFTER MANUAL SMALL INCISION CATARACT SURGERY BETWEEN PRE – OPERATIVE AND POST - OPERATIVE PERIOD''.** My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

काहेर'स जे एन एम सी

बेलागावी

माहितीपूर्ण संमती पत्र

"इंट्रा ऑक्युलरमधील बदलांचे मूल्यांकन करण्यासाठी तुलनात्मक अनुदैर्ध्य अभ्यास प्रेशर, प्री-ऑपरेटिव्ह आणि दरम्यान मॅन्युअल लहान चीरा मोतीबिंदू शस्त्रक्रियेनंतर पोस्ट - ऑपरेटिव्ह कालावधी".

विद्यार्थ्यांचे/मुख्याध्यापक अन्वेषकाचे नाव: BK0122004

मार्गदर्शक/सहनिवेषकांचे नाव :

परिचय:

लेन्स हा डोळ्याचा एक महत्वाचा भाग आहे जो आपल्याला पाहण्यास मदत करतो. जसजसे वय वाढत जाते तसतसे लेन्स अपारदर्शक होते ज्याला मोतीबिंदू म्हणतात. मोतीबिंदू हे अंधत्व आणि लहान चीराचे सर्वात सामान्य कारण आहे मोतीबिंदू शस्त्रक्रिया ही सर्वात व्यापकपणे केली जाणारी प्रक्रिया आहे. आपले डोळे द्रवपदार्थांच्या बॉलसारखे आहेत आणि इंट्राओक्युलर प्रेशर म्हणजे डोळ्यातील द्रवपदार्थांचा दाब. मधील बदल पाहण्यासाठी हा अभ्यास केला जात आहे च्या मदतीने मॅन्युअल लहान चीरा मोतीबिंदू शस्त्रक्रियेपूर्वी आणि नंतर इंट्राओक्युलर दाब इंट्राओक्युलर प्रेशर मापन यंत्र ज्याला रिबाउंड टोनोमीटर म्हणतात.

प्रक्रियेचे स्पष्टीकरण :

नियमित तपासणीनंतर, अंतःस्रावी दाब मूल्ये शस्त्रक्रियेपूर्वी, पोस्टनंतर रेकॉर्ड केली जातील रीबाउंड टोनोमीटरच्या मदतीने पहिल्या दिवशी, पहिला आठवडा, सहावा आठवडा आणि तिसरा महिना ऑपरेटिव्हपणे. प्रत्येक भेटीमध्ये इंट्राओक्युलर प्रेशर सकाळी ९.00 ते 10.00 दरम्यान रिबाउंडद्वारे मोजले जाईल. टोनोमीटर रिबाउंड टोनोमीटर हे इंट्राओक्युलर प्रेशर मोजण्यासाठी एक उपकरण आहे जे अतिशय सुरक्षित आहे, आणि रुग्णाला सोयीस्कर.

अभ्यासातील सहभागातून माघार घेणे :

या अभ्यासात स्वैच्छिक सहभाग. या अभ्यासात भाग घ्यायचा की नावनोंदणी झाल्यावर सहभाग सुरू ठेवायचा हे ठरवण्यासाठी तुम्ही मोकळे असाल. तुम्ही तुमचा सहभाग मागे घेण्याचा निर्णय घेतल्यास, तुम्ही तसे करण्यास मोकळे आहात. तथापि, कृपया मुख्य अन्वेषकांना निर्णय कळवा.

अभ्यासात सहभागी होण्याचे संभाव्य फायदे :

तुम्हाला सहभागी करून कोणतेही फायदे मिळणार नाहीत
या अभ्यासात. गोळा केलेला डेटा मोठ्या प्रमाणावर लोकसंख्येला मदत करेल.

अभ्यासात सहभागी होण्याचे संभाव्य धोके :

या अभ्यासात सहभागी होण्यात कोणतेही धोके नाहीत .

गोपनीयता

कोणत्याही व्यक्तीला तुमची ओळख पटवण्यापासून रोखण्यासाठी तुमच्याकडून गोळा केलेली माहिती कोड केली जाईल. तुमची ओळख कधीच उघड होणार नाही. तुमच्याकडून गोळा केलेला डेटा गोपनीय ठेवला जाईल आणि केवळ प्रक्रिया केलेला किंवा एकत्रित केलेला डेटा प्रकाशनासाठी वापरला जाईल .

आर्थिक प्रोत्साहन :

या अभ्यासात सहभागी होण्यासाठी तुम्हाला कोणतेही पेमेंट मिळणार नाही.

अभ्यासादरम्यान केलेल्या तपासणीचा खर्च मुख्य अन्वेषक /सहभागी .

एकत्रित डेटाच्या प्रकाशनासाठी अधिकृतता :

एकत्रित डेटाच्या प्रक्रियेनंतर प्राप्त झालेले परिणाम वैज्ञानिक हेतूसाठी प्रकाशित केले जातील आणि किंवा वैज्ञानिक गटांना सादर केले जातील. मात्र, तुमची ओळख कधीही उघड होणार नाही .

प्रशनावळी:

या अभ्यासाबाबत काही प्रश्न असल्यास, तुम्ही संपर्क करण्यास मोकळे आहात: तुम्हाला अभ्यास सहभागी म्हणून तुमच्या अधिकाराबाबत काही प्रश्न किंवा तक्रारी असल्यास तुम्ही डॉ. हर्षा हेगडे, अध्यक्षा, जे एन एम सी च्या नैतिक समिती, 0831-2473777 विस्तार 4052 यांच्याशी संपर्क साधू शकता .

कायदेशीर अधिकार :

या संमती फॉर्मवर स्वाक्षरी करून, आम्ही तुमचे कोणतेही कायदेशीर अधिकार गमावत नाही

संमती विधान

मी अभ्यासात सहभागी होण्याचा ऐच्छिक निर्णय घेत आहे च्या प्रादुर्भावाचा अंदाज लावण्यासाठी "इंट्रा ओक्युलरमधील बदलांचे मूल्यांकन करण्यासाठी तुलनात्मक अनुदैर्ध्य अभ्यास प्रेशर, प्री-ऑपरेटिव्ह आणि दरम्यान मॅन्युअल लहान चीरा मोतीबिंदू शस्त्रक्रियेनंतर पोस्ट - ऑपरेटिव्ह कालावधी". खाली दिलेली माझी स्वाक्षरी सूचित करते की मी सहभागी होण्याचा निर्णय घेतला आहे आणि मी वर दिलेली माहिती वाचली आहे किंवा वर दिलेली माहिती मला चांगल्या प्रकारे समजत असलेल्या भाषेत वाचण्यात आली आहे. मला प्रश्न विचारण्याची संधी देण्यात आली आणि त्यांना माझ्या समाधानासाठी उत्तरे देण्यात आली .

सहभागीचे नाव:

सहभागीची सही किंवा डाव्या अंगठ्याचा ठसा:

साक्षीदाराचे नाव:

साक्षीदाराची सही किंवा डाव्या अंगठ्याचा ठसा:

तपासकर्त्याचे नाव:

अन्वेषकाची स्वाक्षरी:

ಕಾಹೇರ್ಸ್ ಜೆ ಎನ್ ಎಂ ಸಿ

ಬೆಳಗಾವಿ

ತಿಳುವಳಿಕೆಯುಳ್ಳ ಒಪ್ಪಿಗೆ ಪತ್ರ

"ಕಾರ್ಯಾಚರಣೆಯ ಪೂರ್ವ ಮತ್ತು ನಂತರದ ಅವಧಿಯ ನಡುವಿನ ಹಸ್ತಚಾಲಿತ ಸಣ್ಣ ಛೇದನದ ಕಣ್ಣಿನ ಪೊರೆ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರ ಇಂಟ್ರಾ ಆಕ್ಯುಲರ್ ಒತ್ತಡದಲ್ಲಿನ ಬದಲಾವಣೆಗಳನ್ನು ಮೌಲ್ಯಮಾಪನ ಮಾಡಲು ತುಲನಾತ್ಮಕ ರೇಖಾಂಶದ ಅಧ್ಯಯನ".

ವಿದ್ಯಾರ್ಥಿ/ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿಯ ಹೆಸರು : : BK0122004

ಗೈಡ್/ಸಹ ತನಿಖಾಧಿಕಾರಿಗಳಯ ಹೆಸರು: ಡಾ.

ಪರಿಚಯ:

ಮಸೂರವು ಕಣ್ಣಿನ ಒಂದು ಪ್ರಮುಖ ಭಾಗವಾಗಿದ್ದು ಅದು ನಮಗೆ ನೋಡಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ. ವಯಸ್ಸಾದಂತೆ ಮಸೂರವು ಅಪಾರದರ್ಶಕವಾಗುತ್ತದೆ ಇದನ್ನು ಕಣ್ಣಿನ ಪೊರೆ ಎಂದು ಕರೆಯಲಾಗುತ್ತದೆ. ಕಣ್ಣಿನ ಪೊರೆ ಕುರುಡುತನ ಮತ್ತು ಸಣ್ಣ ಛೇದನಕ್ಕೆ ಸಾಮಾನ್ಯ ಕಾರಣವಾಗಿದೆ ಕಣ್ಣಿನ ಪೊರೆ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆ ಅತ್ಯಂತ ವ್ಯಾಪಕವಾಗಿ ಮಾಡುವ ವಿಧಾನವಾಗಿದೆ. ನಮ್ಮ ಕಣ್ಣುಗಳು ದ್ರವದ ಚೆಂಡಿನಂತೆ ಮತ್ತು ಇಂಟ್ರಾಕ್ಯುಲರ್ ಒತ್ತಡವು ಕಣ್ಣಿನ ದ್ರವದ ಒತ್ತಡವಾಗಿದೆ. ಬದಲಾವಣೆಗಳನ್ನು ನೋಡಲು ಈ ಅಧ್ಯಯನವನ್ನು ಮಾಡಲಾಗುತ್ತಿದೆ ಒಂದು ಸಹಾಯದಿಂದ ಹಸ್ತಚಾಲಿತ ಸಣ್ಣ ಛೇದನದ ಕಣ್ಣಿನ ಪೊರೆ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗೆ ಮುನ್ನ ಮತ್ತು ನಂತರ ಇಂಟ್ರಾಕ್ಯುಲರ್ ಒತ್ತಡ ರೀಬೌಂಡ್ ಟೋನೋಮೀಟರ್ ಎಂದು ಕರೆಯಲ್ಪಡುವ ಇಂಟ್ರಾಕ್ಯುಲರ್ ಒತ್ತಡವನ್ನು ಅಳೆಯುವ ಸಾಧನ.

ಕಾರ್ಯವಿಧಾನದ ವಿವರಣೆ :

ದಿನನಿತ್ಯದ ಪರೀಕ್ಷೆಯ ನಂತರ, ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರ, ಇಂಟ್ರಾಕ್ಯುಲರ್ ಒತ್ತಡದ ಮೌಲ್ಯಗಳನ್ನು ದಾಖಲಿಸಲಾಗುತ್ತದೆ 1 ನೇ ದಿನ, 1 ನೇ ವಾರ, 6 ನೇ ವಾರ ಮತ್ತು 3 ನೇ ತಿಂಗಳುಗಳಲ್ಲಿ ರೀಬೌಂಡ್ ಟೋನೋಮೀಟರ್ ಸಹಾಯದಿಂದ ಆಪರೇಟಿವ್ ಆಗಿ. ಪ್ರತಿ ಭೇಟಿಯಲ್ಲಿ ಇಂಟ್ರಾಕ್ಯುಲರ್ ಒತ್ತಡವನ್ನು 9.00 ರಿಂದ 10.00 ರವರೆಗೆ ಮರುಕಳಿಸುವ ಮೂಲಕ ಅಳೆಯಲಾಗುತ್ತದೆ. ಟೋನೋಮೀಟರ್. ರೀಬೌಂಡ್ ಟೋನೋಮೀಟರ್ ಇಂಟ್ರಾಕ್ಯುಲರ್ ಒತ್ತಡವನ್ನು ಅಳೆಯುವ ಸಾಧನವಾಗಿದ್ದು ಅದು ತುಂಬಾ ಸುರಕ್ಷಿತವಾಗಿದೆ, ಮತ್ತು ರೋಗಿಗೆ ಆರಾಮದಾಯಕ.

ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆಯಿಂದ ಹಿಂತೆಗೆದುಕೊಳ್ಳುವಿಕೆ :

ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿ ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆ. ಒಮ್ಮೆ ದಾಖಲಾದ ನಂತರ ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಬೇಕೆ ಅಥವಾ ಭಾಗವಹಿಸುವಿಕೆಯನ್ನು ಮುಂದುವರಿಸಬೇಕೆ ಎಂದು ನಿರ್ಧರಿಸಲು ನೀವು ಸ್ವತಂತ್ರರಾಗಿರುತ್ತೀರಿ. ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆಯನ್ನು ಹಿಂತೆಗೆದುಕೊಳ್ಳಲು ನೀವು ನಿರ್ಧರಿಸಿದರೆ, ಹಾಗೆ ಮಾಡಲು ನೀವು ಸ್ವತಂತ್ರರು. ಆದಾಗ್ಯೂ, ದಯವಿಟ್ಟು ನಿರ್ಧಾರವನ್ನು ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿಗೆ ತಿಳಿಸಿ.

ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದರಿಂದ ಸಂಭವನೀಯ ಪ್ರಯೋಜನಗಳು :

ಭಾಗವಹಿಸುವುದರಿಂದ ನೀವು ಯಾವುದೇ ಪ್ರಯೋಜನಗಳನ್ನು ಪಡೆಯುವುದಿಲ್ಲ
ಈ ಅಧ್ಯಯನದಲ್ಲಿ. ಸಂಗ್ರಹಿಸಿದ ಮಾಹಿತಿಯು ಜನಸಂಖ್ಯೆಗೆ ಸಹಾಯ ಮಾಡುತ್ತದೆ.

ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದರಿಂದ ಸಂಭವನೀಯ ಅಪಾಯಗಳು :

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದರಿಂದ ಯಾವುದೇ ಅಪಾಯಗಳಿಲ್ಲ.

ಗೌಪ್ಯತೆ

ಯಾವುದೇ ವ್ಯಕ್ತಿ ನಿಮ್ಮನ್ನು ಗುರುತಿಸದಂತೆ ತಡೆಯಲು ನಿಮ್ಮಿಂದ ಸಂಗ್ರಹಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಕೋಡ್ ಮಾಡಲಾಗುತ್ತದೆ. ನಿಮ್ಮ ಗುರುತನ್ನು ಎಂದಿಗೂ ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ. ನಿಮ್ಮಿಂದ ಸಂಗ್ರಹಿಸಿದ ಡೇಟಾವನ್ನು ಗೌಪ್ಯವಾಗಿ ಇರಿಸಲಾಗುತ್ತದೆ ಮತ್ತು ಪ್ರಕ್ರಿಯೆಗೊಳಿಸಿದ ಅಥವಾ ಒಟ್ಟುಗೂಡಿದ ಡೇಟಾವನ್ನು ಮಾತ್ರ ಪ್ರಕಟಣೆಗಾಗಿ ಬಳಸಲಾಗುತ್ತದೆ.

ಆರ್ಥಿಕ ಪ್ರೋತ್ಸಾಹಗಳು :

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಿದ್ದಕ್ಕಾಗಿ ನೀವು ಯಾವುದೇ ಪಾವತಿಯನ್ನು ಸ್ವೀಕರಿಸುವುದಿಲ್ಲ.
ಅಧ್ಯಯನದ ಅವಧಿಯಲ್ಲಿ ಮಾಡಿದ ತನಿಖೆಗಳ ವೆಚ್ಚವನ್ನು ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿಯಿಂದ ಪಾವತಿಸಲಾಗುತ್ತದೆ / ಭಾಗವಹಿಸುವವರು.

ಒಟ್ಟು ಡೇಟಾದ ಪ್ರಕಟಣೆಗೆ ಅಧಿಕಾರ :

ಒಟ್ಟು ದತ್ತಾಂಶವನ್ನು ಸಂಸ್ಕರಿಸಿದ ನಂತರ ಪಡೆದ ಫಲಿತಾಂಶಗಳನ್ನು ವೈಜ್ಞಾನಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಪ್ರಕಟಿಸಲಾಗುತ್ತದೆ ಅಥವಾ ವೈಜ್ಞಾನಿಕ ಗುಂಪುಗಳಿಗೆ ಪ್ರಸ್ತುತಪಡಿಸಲಾಗುತ್ತದೆ. ಆದಾಗ್ಯೂ, ನಿಮ್ಮ ಗುರುತನ್ನು ಎಂದಿಗೂ ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ.

ಪ್ರಶ್ನೆಗಳು:

ಈ ಅಧ್ಯಯನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಯಾವುದೇ ಪ್ರಶ್ನೆಗಳಿದ್ದಲ್ಲಿ, ನೀವು ಸಂಪರ್ಕಿಸಲು ಮುಕ್ತರಾಗಿದ್ದೀರಿ: [redacted] ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವ ನಿಮ್ಮ ಹಕ್ಕಿನ ಕುರಿತು ನೀವು ಯಾವುದೇ ಪ್ರಶ್ನೆಗಳನ್ನು ಅಥವಾ ದೂರುಗಳನ್ನು ಹೊಂದಿದ್ದರೆ, ನೀವು ಜೆ ಎನ್ ಎಂಸಿ ನ ನೈತಿಕ ಸಮಿತಿಯ ಅಧ್ಯಕ್ಷರಾದ ಡಾ. ಹರ್ಷ ಹೆಗ್ಡೆ, 0831-2473777 ವಿಸ್ತರಣೆ 4052 ಅನ್ನು ಸಂಪರ್ಕಿಸಬಹುದು.

ಕಾನೂನು ಹಕ್ಕುಗಳು :

ಈ ಸಮ್ಮತಿಯ ನಮೂನೆಗೆ ಸಹಿ ಮಾಡುವ ಮೂಲಕ, ನಿಮ್ಮ ಯಾವುದೇ ಕಾನೂನು ಹಕ್ಕುಗಳನ್ನು ನಾವು ಕೈಬಿಡುತ್ತಿಲ್ಲ.

ಸಮ್ಮತಿ ಹೇಳಿಕೆ

ನಾನು ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಸ್ವಯಂಪ್ರೇರಿತ ನಿರ್ಧಾರವನ್ನು ಮಾಡುತ್ತಿದ್ದೇನೆ "ಕಾರ್ಯಾಚರಣೆಯ ಪೂರ್ವ ಮತ್ತು ನಂತರದ ಅವಧಿಯ ನಡುವಿನ ಹಸ್ತಚಾಲಿತ ಸಣ್ಣ ಛೇದನದ ಕಣ್ಣಿನ ಪೊರೆ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರ ಇಂಟ್ರಾ ಆಕ್ಯುಲರ್ ಒತ್ತಡದಲ್ಲಿನ ಬದಲಾವಣೆಗಳನ್ನು ಮೌಲ್ಯಮಾಪನ ಮಾಡಲು ತುಲನಾತ್ಮಕ ರೇಖಾಂಶದ ಅಧ್ಯಯನ". ಕೆಳಗಿನ ನನ್ನ ಸಹಿ ನಾನು ಭಾಗವಹಿಸಲು ನಿರ್ಧರಿಸಿದ್ದೇನೆ ಮತ್ತು ನಾನು ಮೇಲೆ ಒದಗಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಓದಿದ್ದೇನೆ ಅಥವಾ ಮೇಲೆ ಒದಗಿಸಿದ ಮಾಹಿತಿಯನ್ನು ನನಗೆ ಚೆನ್ನಾಗಿ ಅರ್ಥವಾಗುವ ಭಾಷೆಯಲ್ಲಿ ಓದಲಾಗಿದೆ ಎಂದು ಸೂಚಿಸುತ್ತದೆ. ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲು ನನಗೆ ಅವಕಾಶವನ್ನು ನೀಡಲಾಯಿತು ಮತ್ತು ಅವುಗಳಿಗೆ ನನ್ನ ತೃಪ್ತಿಗೆ ಉತ್ತರಿಸಲಾಗಿದೆ.

ಭಾಗವಹಿಸುವವರ ಹೆಸರು:

ಭಾಗವಹಿಸುವವರ ಸಹಿ ಅಥವಾ ಎಡ ಹೆಬ್ಬೆರಳಿನ ಗುರುತು:

ಸಾಕ್ಷಿಯ ಹೆಸರು:

ಸಾಕ್ಷಿಯ ಸಹಿ ಅಥವಾ ಎಡ ಹೆಬ್ಬೆರಳಿನ ಗುರುತು:

ತನಿಖಾಧಿಕಾರಿಯ ಹೆಸರು:

ತನಿಖಾಧಿಕಾರಿಯ ಸಹಿ:

काहेर'स जे एन एम सी

बेलागावी

सूचित सहमति पत्र

"इंट्रा ओकुलर में परिवर्तनों का मूल्यांकन करने के लिए एक तुलनात्मक अनुदैर्ध्य अध्ययन दबाव, मैनुअल छोटे चीरे के बाद प्री-ऑपरेटिव और के बीच मोतियाबिंद सर्जरी पोस्ट - ऑपरेटिव अवधि ".

छात्र/प्रधान अन्वेषक का नाम: BK0122004

गाइड का नाम / सह अन्वेषक:

परिचय:

लेंस आंख का एक बहुत ही महत्वपूर्ण हिस्सा है जो हमें देखने में मदद करता है। जैसे-जैसे हमारी उम्र बढ़ती है, लेंस अपारदर्शी हो जाता है जिसे मोतियाबिंद के नाम से जाना जाता है। मोतियाबिंद अंधेपन और छोटे चीरे का सबसे आम कारण है मोतियाबिंद सर्जरी सबसे व्यापक रूप से की जाने वाली प्रक्रिया है। हमारी आंखें तरल पदार्थ की गेंद की तरह हैं और इंट्राओकुलर दबाव आंख का द्रव दबाव है। मैं बदलाव देखने के लिए यह अध्ययन किया जा रहा है एक की मदद से मैन्युअल छोटे चीरा मोतियाबिंद सर्जरी से पहले और बाद में इंट्राओकुलर दबाव इंट्राओकुलर प्रेशर मापने वाला उपकरण जिसे रिबाउंड टोनोमीटर कहा जाता है।

प्रक्रिया की व्याख्या:

नियमित जांच के बाद, ऑपरेशन से पहले, इंट्राओक्यूलर प्रेशर वैल्यू को रिकॉर्ड किया जाएगा रिबाउंड टोनोमीटर की मदद से पहले दिन, पहले हफ्ते, छठे हफ्ते और तीसरे महीने में ऑपरेटिव रूप से।
प्रत्येक मुलाकात पर आंतराक्षि दाब सुबह 9.00 बजे से 10.00 बजे के बीच रिबाउंड द्वारा मापा जाएगा टोनोमीटर। रिबाउंड टोनोमीटर इंट्राओकुलर दबाव को मापने के लिए एक उपकरण है जो बहुत ही सुरक्षित है, और रोगी के लिए आरामदायक।

अध्ययन में भाग लेने से पीछे हटना:

स्वैच्छिक रूप से इस अध्ययन में भागीदारी। आप इस अध्ययन में भाग लेने या एक बार नामांकित होने के बाद भागीदारी जारी रखने का निर्णय लेने के लिए स्वतंत्र होंगे। यदि आप अपनी भागीदारी वापस लेने का निर्णय लेते हैं, तो आप ऐसा करने के लिए स्वतंत्र हैं। हालांकि, कृपया मुख्य अन्वेषक को निर्णय बताएं।

अध्ययन में भाग लेने से संभावित लाभ:

भाग लेने से आपको कोई लाभ नहीं होगा
इस अध्ययन में। एकत्र किए गए डेटा से बड़े पैमाने पर आबादी को मदद मिलेगी।

अध्ययन में भाग लेने से संभावित जोखिम :

इस अध्ययन में भाग लेने में कोई जोखिम शामिल नहीं है।

गोपनीयता :

आपसे एकत्र की गई जानकारी को कोडित किया जाएगा, ताकि कोई भी व्यक्ति आपको पहचानने से रोक सके। आपकी पहचान कभी उजागर नहीं होगी। आपसे एकत्र किए गए डेटा को गोपनीय रखा जाएगा और प्रकाशन के लिए केवल संसाधित या एकत्रित डेटा का उपयोग किया जाएगा।

वितीय प्रोत्साहन :

इस अध्ययन में भाग लेने के लिए आपको कोई भुगतान नहीं मिलेगा।

अध्ययन के दौरान किए गए अन्वेषणों की लागत का भुगतान प्रधान अन्वेषक/ द्वारा किया जाएगा। प्रतिभागी।

समेकित डेटा के प्रकाशन के लिए प्राधिकरण :

एकत्र किए गए डेटा के प्रसंस्करण के बाद प्राप्त परिणाम वैज्ञानिक उद्देश्यों के लिए प्रकाशित किए जाएंगे और या वैज्ञानिक समूहों को प्रस्तुत किए जाएंगे। हालांकि, आपकी पहचान कभी उजागर नहीं की जाएगी।

प्रशन :

इस अध्ययन के संबंध में किसी भी प्रश्न के मामले में, आप संपर्क करने के लिए स्वतंत्र हैं: [redacted] [redacted] यदि आपके पास अध्ययन प्रतिभागी के रूप में अपने अधिकार के बारे में कोई प्रश्न या शिकायत है, तो आप डा. हर्षा हेगडे, अध्यक्ष, जेएनएमसी नैतिक समिति, 0831-2473777 एक्सटेंशन 4052 से संपर्क कर सकते हैं।

कानूनी अधिकार :

इस सहमति फॉर्म पर हस्ताक्षर करके, हम आपके किसी भी कानूनी अधिकार को खत्म नहीं कर रहे हैं

सहमति वक्तव्य

मैं अध्ययन में भाग लेने का स्वैच्छिक निर्णय ले रहा/रही हूं "इंट्रा ओकुलर में परिवर्तनों का मूल्यांकन करने के लिए एक तुलनात्मक अनुदैर्ध्य अध्ययन दबाव, मैनुअल छोटे चीरे के बाद प्री-ऑपरेटिव और के बीच मोतियाबिंद सर्जरी पोस्ट - ऑपरेटिव अवधि ". नीचे दिए गए मेरे हस्ताक्षर इंगित करते हैं कि मैंने भाग लेने का निर्णय लिया है और मैंने ऊपर दी गई जानकारी को पढ़ लिया है या ऊपर दी गई जानकारी मुझे उस भाषा में पढ़ ली गई है जिसे मैं सबसे अच्छी तरह समझता हूं। मुझे प्रश्न पूछने का अवसर दिया गया था और उनका उत्तर मेरी संतुष्टि के अनुरूप दिया गया है।

प्रतिभागी का नाम:

प्रतिभागी के हस्ताक्षर या बाएं अंगूठे का निशान:

गवाह का नाम:

गवाह के हस्ताक्षर या बाएं अंगूठे का निशान:

अन्वेषक का नाम:

अन्वेषक के हस्ताक्षर:

ANNEXURE II: PROFORMA

Serial no. PROFORMA Date:

Title Of Research Study:
"A COMPARATIVE LONGITUDINAL STUDY TO EVALUATE THE CHANGES IN INTRA OCULAR PRESSURE, AFTER MANUAL SMALL INCISION CATARACT SURGERY BETWEEN PRE - OPERATIVE AND POST - OPERATIVE PERIOD "

NAME:

AGE Years SEX: (1-Male; 2-Female)
ADDRESS:

CONTACT NUMBER: OP NUMBER/ IP NUMBER:

DATE OF ADMISSION: DATE OF DISCHARGE:

IS THE PATIENT ELIGIBLE FOR STUDY? (I-YES; 2-NO)
HAS INFORMED CONSENT BEEN GIVEN? (1-YES; 2-NO)
SURGEON'S NAME:

CHIEF COMPLAINTS:
DIMINUTION OF VISION (RE / LE)
Duration: days/ months/years

HISTORY OF PRESENT ILLNESS:
DIMINUTION OF VISION (RE / LE)
1- Gradual 2- Sudden
1-Painless 2- Painful

PAST HISTORY:
TRAUMA TO THE EYE (RE / LE)
1- Present 2- Absent

OCULAR SURGERY (RE / LE)
1-Present 2- Absent

If present what type of surgery:
Duration: months/ years ago

DIABETES:
1- Present 2- Absent
If present ; Duration: months / years

HYPERTENSION:
1- Present 2- Absent
If present ; Duration: months/ years

ANY OTHER MEDICAL DISORDERS:

SMOKING/TOBACCO ADDICTION: 1- Present 2- Absent

Any known allergies: 1-Yes 2-No
If allergies present, please specify

VITALS
PULSE beats/min
BLOOD PRESSURE mmHg
RESPIRATORY RATE /min
TEMPERATURE

PRE- OPERATIVE PERIOD

OCULAR EXAMINATION

VISUAL ACUITY	RIGHT EYE	LEFT EYE
DISTANT (UNCORRECTED)		
PINHOLE		
NEAR		
BEST CORRECTED (WITH SPECTACLES)		

ANTERIOR SEGMENT	RIGHT EYE	LEFT EYE
ADNEXA		
SCLERA		
CONJUNCTIVA		
CORNEA		
ANTERIOR CHAMBER		
IRIS		
PUPIL		
LENS		

POSTERIOR SEGMENT	RIGHT EYE.	LEFT EYE
GLOW		
MEDIA		
DISC		
C:D		
BLOOD VESSELS		
BACKGROUND		
MACULA		

DIAGNOSIS

INVESTIGATIONS

RANDOM BLOOD SUGAR:

INTRAOCULAR PRESSURE: NCT: RT: (time:)

performed by:

NASOLACRIMAL DUCT PATENCY : RIGHT LEFT

A-SCAN

RIGHT EYE/ LEFT EYE

KI (IN DIOPTRE)
K2 (IN DIOPTRE)
AXIAL LENGTH (in mm)
ANTERIOR CHAMBER DEPTH (in mm)
PCIOL POWER (IN DIOPTRE)

B-SCAN REQUIRED (1-YES, 2-NO)

B-SCAN FINDINGS (IF B SCAN IS REQUIRED)

PRE-OPERATIVE NOTES

AMOUNT OF XYLOCAINE GIVEN :

INTRAOPERATIVE NOTES

1. TRYPHAN BLUE USED (YES/NO)
2. VISCOELASTIC SUBSTANCE USED (Na HYALURONATE / HPMC)
3. SIDE PORT DONE (YES/NO)
4. TYPE OF CAPSULOTOMY (CAPSULORRHEXIS/ CANN-OPENER)
5. NUCLEUS MANAGEMENT – (BIMANUAL ROTATION OF THE NUCLEUS / BISECTION OF NUCLEUS/ VISCOSANDWICH- EXPRESSION OF NUCLEUS)
6. TIME TAKEN FOR INTRAOCULAR IRRIGATION -
7. AC CLOSED WITH SALINE / AC CLOSED WITH AIR BUBBLE
8. ENDOTHELIAL TOUCH BY INSTRUMENTS (YES/NO)
9. SUTURING DONE (YES/NO)

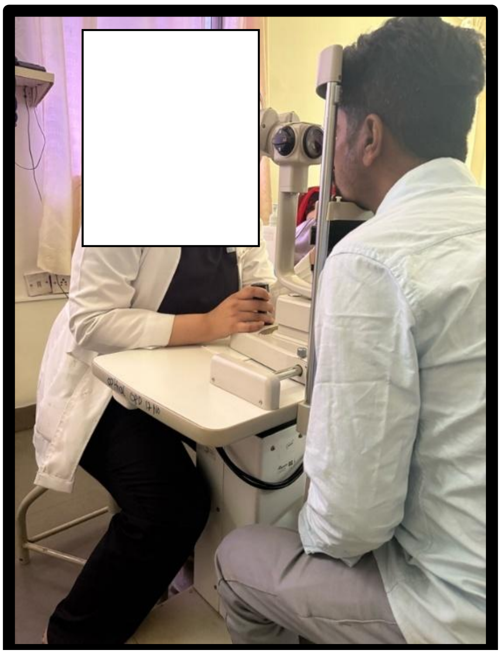
NAME **DIAGNOSIS** (EYE OPERATED - RIGHT EYE /LEFT EYE)

GROUP: -**A**-hydroxypropyl methyl cellulose 2% / **B**- sodium hyaluronate 1.4%

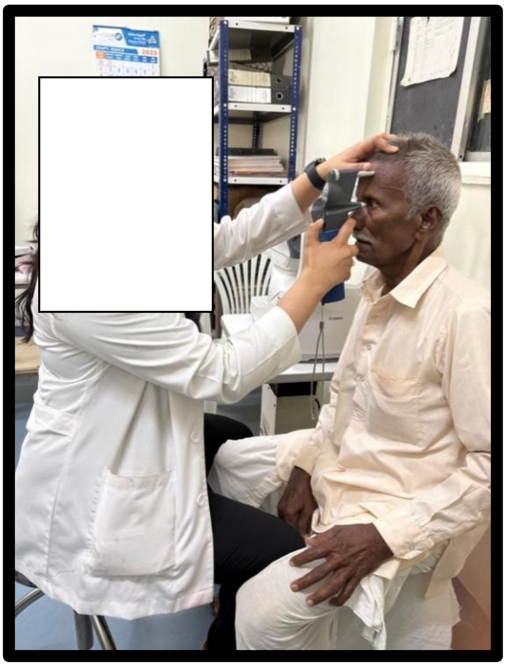
OCULAR EXAMINATION.	PRE -OPERATIVE		POST OPERATIVE DAY 1		POST OPERATIVE 1^{ST} WEEK		POST OPERATIVE 6^{TH} WEEK		POST OPERATIVE 3^{RD} MONTH	
	RIGHT EYE	LEFT EYE	RIGHT EYE	LEFT EYE	RIGHT EYE	LEFT EYE	RIGHT EYE	LEFT EYE	RIGHT EYE	LEFT EYE
UCVA										
PIN HOLE										
NEAR VISION										
BCVA										
ANT. SEGMENT										
ADNEXA										
SCLERA										
CONJUCTIVA										
CORNEA										
ANTERIOR CHAMBER										
IRIS										
PUPIL										
LENS										
POSTERIOR SEGMENT										
GLOW										
MEDIA										
DISC										
C:D										
B/V										
B/G										
MACULA										
IOP										
NCT										
RT										

SIGNATURE OF GUIDE

ANNEXURE III-PHOTOGRAPHS



Assessment of anterior segment on slit lamp



Measurement of intra-ocular pressure (IOP) by rebound tonometer

ANNEXURE IV: MASTER CHART

Sl No	Sex	Eyeside	Pre-op Vision	Type	DM/HTN	Xylo given	Visco Used	Capsulotomy Used	Nucleus Management	Irrigation time	Intra-op AC Closed With	Endothelium Touch	Intra-op Suturing Done	Pre-op	Postop Day1	Postop Week1	Postop week6	Postop 3 mon	Post-op BCVA at 6 weeks
1	Female	Left	CF 2Mts	LE SMC	HTN	9ml	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	3min	Saline	NO	NO	10	13	9	10	10	6/6 (p)
2	Female	Left	PL+ive PR acc	LE SMC	HTN	7ml	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min	Saline	NO	NO	17	32	20	19	18	6/6 (p)
3	Female	Right	Jun-18	RE PSC	DM	9ml	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1.5min	Saline	NO	NO	20	19	20	19	19	6/6 (p)
4	Female	Left	06-Dec	LE SIMC	DM/HTN	9ml	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1.5min	Saline	NO	NO	17	23	17	14	17	6/6 (p)
5	Female	Left	Jun-60	LE SIMC	NO	7ml	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	3min	Saline	NO	NO	18	23	18	16	17	6/6 (p)
6	Female	Left	CF 2Mts	LE SMC	NO	7	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min	AC Closed with air bubble	NO	NO	8	14	9	8	8	6/6 (p)
7	Male	Left	CF 3Mts	LE SIMC	NO	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1.5min	Saline	NO	NO	15	17	15	14	14	6/6 (p)
8	Female	Right	Jun-24	RE PSC	NO	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1.5min	Saline	NO	NO	14	19	14	14	14	6/6 (p)
9	Female	Right	HMCF	RE SMC	HTN	8ml	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min	Saline	NO	NO	15	16	15	14	15	6/6 (p)
10	Male	Right	Jun-18	RE PSC	DM/HTN	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1.5min	Saline	NO	NO	11	14	14	14	13	6/6 (p)
11	Female	Right	Jun-36	LE SMC	DM/HTN	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	2 min	Saline	NO	NO	18	20	18	18	17	6/6 (p)
12	Male	Right	CF 1mt	RE SIM	HTN	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1.5min	Saline	NO	NO	12	11	12	11	11	6/6 (p)
13	Male	Right	Jun-60	RE SIMC	DM	7	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min	AC Closed with air bubble	NO	NO	15	18	18	16	15	6/6 (p)
14	Male	Right	HMCF	RE SMC	HTN	6	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min	Saline	NO	NO	14	17	15	13	14	6/6 (p)
15	Female	Right	Jun-24	RE PSC	NO	7	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1.5 min	Saline	YES	YES	15	20	15	15	15	6/6 (p)
16	Male	Right	Jun-24	RE PSC	DM	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	2 min	Saline	NO	NO	18	21	18	18	18	6/6 (p)
17	Female	Right	Jun-24	RE PSC	DM	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	2min	Saline	NO	NO	17	18	18	18	18	6/6 (p)
18	Male	Left	CF CF	LE SMC	HTN	6	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min 40 sec	Saline	NO	NO	15	32	19	19	16	6/6 (p)
19	Female	Left	CF 1/2 mt	LE SMC	HTN	7	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	3 min	Saline	NO	NO	10	12	9	10	10	6/6 (p)
20	Male	Left	CF CF	LE SMC	HTN	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min	AC Closed with air bubble	YES	NO	18	19	19	18	18	6/6 (p)
21	Female	Right	Jun-18	PSCC	DM	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	2min	Saline	NO	NO	20	18	20	19	19	6/6 (p)
22	Male	Left	Jun-60	LE SIMC	DM/HTN	8	HPMC	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1.5min	Saline	NO	NO	16	28	16	17	16	6/6 (p)
23	Female	Left	Jun-60	LE SIMC	NO	6	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	3min	Saline	NO	NO	19	20	19	18	20	6/6 (p)
24	Female	Right	Jun-36	LE SMC	DM/HTN	7	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min	Saline	NO	NO	17	20	19	17	17	6/6 (p)
25	Male	Right	Jun-18	RE PSC	NO	7	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	2min	Saline	NO	NO	18	20	19	18	18	6/6 (p)
26	Female	Left	CF 2Mts	LE SIMC	NO	8	HPMC	CAPSULORRHEXIS	VISCOEXPRESSION	1min	Saline	NO	NO	10	20	11	10	10	6/6 (p)

									OF NUCLEUS										
27	Female	Left	CF 3Mts	LE SIMC	NO	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min	Saline	NO	NO	15	17	16	15	15	6/6 (p)
28	Male	Left	Jun-60	LE SIMC	NO	8	HPMC	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1 min	Saline	NO	NO	19	28	17	17	17	6/6 (p)
29	Male	Right	Jun-60	RESIMC	NO	9	HPMC	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	60 sec	Saline	NO	NO	14	23	16	13	3	6/6(p)
30	Male	Right	Jun-24	RE SIMC	DM/HTN	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min	Saline	NO	NO	13	17	12	12	12	6/6 (p)
31	Male	Left	CF CF	LE SMC	NO	8	HPMC	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	90sec	Saline	NO	NO	15	19	16	15	15	6/6 (p)
32	Male	Left	Jun-36	LE PSC	DM/HTN	7	HPMC	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1min	Saline	NO	NO	14	22	17	14	13	6/6 (p)
33	Female	Right	CF 2Mts	RE SIMC	NO	6	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1.5min	Saline	NO	NO	16	20	18	16	15	6/6 (p)
34	Male	Right	HMCF	RE SMC	NO	8ml	HPMC	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1min	Saline	NO	NO	15	23	16	15	15	6/6 (p)
35	Female	Left	6/24 (p)	LE SIMC	NO	6	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1min	Saline	NO	NO	9	13	10	9	9	6/6 (p)
36	Female	Left	CF 1mt	LE SIMC	NO	6	HPMC	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1min	Saline	NO	NO	14	19	17	14	12	6/6 (p)
37	Male	Right	CF 1mt	RE SIMC	DM	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1.5min	Saline	NO	NO	9	14	10	9	9	6/6 (p)
38	Female	Left	HMCF	LESIMC	HTN	6	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	50 sec	Saline	NO	NO	9	15	11	8	8	6/6 (p)
39	Male	Right	CF 1/2 mt	REPPC	NO	9	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	20	28	20	20	19	6/6 (p)
40	Female	Left	CF1mt	RESIMC	NO	9ml	HPMC	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1.5 min	Saline	NO	NO	18	24	21	21	20	6/6 (p)
41	Male	Right	6/24(p)	REPSC	NO	9	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	15	21	15	14	14	6/6 (p)
42	Male	Right	6/24(p)	REPSC	NO	8	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	17	22	17	16	16	6/6 (p)
43	Male	Right	Jun-24	REPSC	DM	8	HPMC	CANN-OPENER	PHACOSANDWICH	50 sec	Saline	NO	NO	19	21	18	18	18	6/6 (p)
44	Female	Left	CFCF	LESMC	NO	8	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	17	18	17	17	16	6/6(P)
45	Female	Left	CF 1/2 mt	LESMC	HTN	9	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	11	13	10	9	9	6/6 (p)
46	Male	Right	Jun-36	REPSC	DM	8	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	19	21	20	19	18	6/6 (p)
47	Male	Left	Jun-60	LESIMC	No	9	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	18	20	17	17	17	6/6 (p)
48	Male	Left	CFCF	LESMC	DM/HTN	8	HPMC	CANN-OPENER	PHACOSANDWICH	1.5 min	Saline	NO	NO	17	18	17	17	16	6/6(P)
49	Female	Right	Jun-36	REPSC	NO	7	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	18	20	18	17	17	6/6 (p)
50	Male	Right	CF 2Mts	RESIMC	NO	8	HPMC	CANN-OPENER	PHACOSANDWICH	40 sec	Saline	NO	NO	17	21	19	17	16	6/6 (p)
51	Female	Right	Jun-36	REPSC	DM	8	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	12	15	11	11	11	6/6 (p)
52	Female	Left	Jun-60	LESIMC	NO	7	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	16	20	18	16	16	6/6 (p)
53	Male	Right	Jun-60	RESIMC	DM	9	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	17	21	18	18	18	6/6 (p)
54	Female	Right	CFCF	RESIMC	HTN	9	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	15	16	15	15	14	6/6 (p)
55	Male	Right	CF1mt	RESIMC	NO	7	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	16	19	18	15	15	6/6 (p)
56	Male	Right	CF 1mt	RESIMC	NO	7	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	19	24	19	18	18	6/6
57	Male	Left	CF 1/2 mt	LE SIMC	NO	8	HPMC	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	13	13	13	11	10	6/6
58	Male	Left	Jun-60	LE SIMC	NO	9	HPMC	CANN-OPENER	PHACOSANDWICH	40 sec	Saline	NO	NO	16	17	17	17	16	6/6
59	Female	Right	CF 1mt	RESIMC	NO	7	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	19	23	19	19	19	6/6
60	Male	Left	CFCF	LE SMC	HTN/DM	8	HPMC	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	17	19	19	19	18	6/6
61	Female	Left	CF 2Mts	LESIMC	no	8	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1.5 min	Saline	NO	NO	11	15	12	11	11	6/6
62	Female	Left	CF 1mt	LESMC	no	6	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	12	19	15	12	11	6/6(P)
63	Female	Right	6/24(P)	RESIMC	NO	7	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	17	18	17	17	17	6/6
64	Male	Left	Jun-36	LESIMC	HTN/DM	8	NAH	CAPSULORRHEXIS	PHACOSANDWICH	50 sec	Saline	NO	NO	12	25	16	12	12	6/6(P)
65	Male	Right	CFCF	RESIMC	NO	9	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	10	24	10	10	9	6/6
66	Female	Right	CF 2.5 mt	RESIMC	NO	9	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	12	12	11	11	11	6/6(P)

67	Male	Left	CF 1 mt	LESMC	NO	9	NAH	CANN-OPENER	PHACOSANDWICH	1.5 min	Saline	NO	NO	10	9	10	10	9	6/6(P)
68	Female	Left	Jun-60	LESIMC	HTN/DM	8	NAH	CANN-OPENER	PHACOSANDWICH	1.5 min	Saline	NO	NO	15	17	16	15	15	6/6
69	Female	Right	Jun-36	REPSC	NO	7	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	14	15	14	14	14	6/6
70	Female	Right	6/36(p)	REPSC	DM	6	NAH	CAPSULORRHEXIS	PHACOSANDWICH	50 sec	Saline	YES	NO	18	20	18	18	18	6/6
71	Male	Left	Jun-60	LESIMC	NO	8	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	12	13	13	12	12	6/6
72	Male	Left	Jun-60	LESIMC	DM/HTN	9	NAH	CANN-OPENER	PHACOSANDWICH	50 sec	Saline	NO	NO	15	17	16	15	15	6/6
73	Male	Left	Jun-60	LESIMC	NO	6	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	YES	NO	16	19	16	16	16	6/6(P)
74	Male	Right	Jun-24	REPSC	NO	7	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	15	16	15	15	15	6/6
75	Female	Left	Jun-60	LESIMC	NO	8	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	16	18	18	17	16	6/6
76	Male	Right	Jun-36	REPSC	DM	9	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	17	18	18	17	17	6/6
77	Male	Left	CF 1mt	LESMC	HTN	6	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	15	16	15	15	14	6/6
78	Male	Right	CFCF	LE SIMC	HTN	7	NAH	CANN-OPENER	PHACOSANDWICH	50 sec	Saline	NO	NO	14	15	15	14	13	6/6
79	Female	Left	CF 1 mt	LESMC	HTN	8	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	17	19	17	17	17	6/6
80	Male	Left	CF 1/2 mt	LESMC	HTN	9	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Air Bubble	NO	Yes	17	18	18	17	17	6/6
81	Male	Left	CF 1/2 mt	LESMC	HTN	6	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	16	18	16	15	15	6/6
82	Male	Left	CF 3Mts	LESIMC	NO	7	NAH	CAPSULORRHEXIS	PHACOSANDWICH	50 sec	Saline	NO	NO	17	18	17	17	16	6/6
83	Male	Right	Jun-36	REPSC	DM	8	NAH	CANN-OPENER	PHACOSANDWICH	1.5 min	Saline	NO	NO	17	18	17	17	17	6/6
84	Male	Right	Jun-36	REPSC	DM	9	NAH	CANN-OPENER	PHACOSANDWICH	40 sec	Saline	NO	NO	18	19	18	18	18	6/6
85	Female	Left	CF 3Mts	LESIMC	DM/HTN	9	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	18	21	18	18	17	6/6
86	Male	Right	Jun-60	RESIMC	HTN/DM	8	NAH	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	50 sec	Saline	NO	NO	13	15	15	14	13	6/6
87	Female	Left	Jun-60	LESIMC	HTN/DM	7	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1.5 min	Saline	NO	NO	17	16	16	16	16	6/6
88	Male	Right	6/24 (p)	REPSC	NO	6	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	15	16	16	15	15	6/6
89	Female	Right	Jun-60	RESIMC	NO	7	NAH	CANN-OPENER	PHACOSANDWICH	30 sec	Saline	NO	NO	15	16	15	15	14	6/6
90	Male	Left	Jun-36	LESIMC	HTN	8	NAH	CAPSULORRHEXIS	PHACOSANDWICH	30 sec	Saline	NO	NO	15	18	16	15	15	6/6
91	Male	Right	Jun-60	RESIMC	DM	9	NAH	CANN-OPENER	PHACOSANDWICH	1.5 min	Air Bubble	YES	Yes	17	26	18	16	16	6/6 (p)
92	Female	Left	Jun-36	LESIMC	HTN	8	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	17	19	18	17	17	6/6(P)
93	Female	Right	Jun-36	RESIMC	DM	8	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	20	22	19	19	19	6/6
94	Male	Left	Jun-60	LESIMC	DM/HTN	8	NAH	CANN-OPENER	PHACOSANDWICH	1.5 min	Saline	NO	NO	17	21	18	17	17	6/6 (p)
95	Male	Right	Jun-36	RESIMC	DM/HTN	7	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	15	20	17	15	16	6/6
96	Male	Right	CF 3Mts	RESMC	NO	7	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	19	20	19	17	17	6/6
97	Female	Right	6/24(p)	REPSC	NO	7	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	18	19	18	18	17	6/6
98	Male	Left	Jun-60	LESIMC	NO	7	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	14	19	15	15	14	6/6
99	Male	Right	Jun-60	RESIMC	NO	6	NAH	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1 min	Saline	NO	NO	13	18	16	15	13	6/6 (p)
100	Male	Right	Jun-36	RESIMC	NO	6	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	12	16	14	14	13	6/6
101	Female	Right	6/24(p)	RESIMC	NO	7	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	12	17	14	12	11	6/6
102	Male	Left	CF 3Mts	LESMC	NO	8	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1min	Saline	NO	NO	9	10	9	9	8	6/6
103	Male	Left	Jun-36	LESIMC	HTN/DM	9	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min	Saline	NO	NO	16	18	17	17	15	6/6
104	Female	Right	6/36 (P)	REPSC	NO	7	NAH	CAPSULORRHEXIS	PHACOSANDWICH	50 sec	Saline	NO	NO	15	18	16	15	15	6/6 (p)
105	Female	Left	CF 3Mts	LESIMC	NO	8	NAH	CANN-OPENER	PHACOSANDWICH	30 sec	Saline	NO	NO	15	19	16	15	15	6/6 (p)
106	Male	Right	Jun-36	RESIMC	NO	6	NAH	CANN-OPENER	PHACOSANDWICH	2 min	Saline	NO	NO	18	19	19	18	18	6/6
107	Female	Left	Jun-60	LESIMC	NO	7	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min 30 sec	Saline	Yes	Yes	15	17	17	16	15	6/6 (p)
108	Male	Left	CF 1 mt	LESMC	HTN	6	NAH	CANN-OPENER	PHACOSANDWICH	1min	Saline	NO	NO	16	14	14	13	13	6/6
109	Female	Right	Jun-60	RESIMC	NO	8	NAH	CANN-OPENER	PHACOSANDWICH	1 min	Saline	NO	NO	13	15	15	14	13	6/6
110	Male	Left	Jun-60	LESIMC	HTN/DM	9	NAH	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1 min 30 sec	Saline	NO	NO	16	14	14	14	13	6/6
111	Male	Left	Jun-24	LEPSC	NO	9	NAH	CANN-OPENER	PHACOSANDWICH	2 min	Saline	NO	NO	19	18	18	17	17	6/6

112	Male	Right	Jun-60	RESIMC	NO	8	NAH	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1min	Saline	NO	NO	15	14	14	13	13	6/6
113	Male	Left	6/36(P)	LESIMC	HTN	8	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min 40 sec	Saline	NO	NO	13	13	13	11	11	6/6
114	Female	Left	CF 1 mt	LESMC	DM	8	NAH	CAPSULORRHEXIS	PHACOSANDWICH	2 min	Saline	NO	NO	17	19	17	17	17	6/6
115	Male	Right	CF 1 mt	RESMC	HTN	9	NAH	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1 min	Air Bubble	NO	NO	14	19	14	14	14	6/6
116	Female	Right	Jun-36	RESIMC	HTN	9	NAH	CANN-OPENER	PHACOSANDWICH	1 min 20 sec	Saline	NO	NO	17	18	16	16	16	6/6
117	Female	Right	Jun-60	RESIMC	NO	8	NAH	CANN-OPENER	PHACOSANDWICH	2 min	Saline	NO	NO	16	18	17	16	15	6/6
118	Male	Left	6/24(P)	LESIMC	NO	7	NAH	CAPSULORRHEXIS	VISCOEXPRESSION OF NUCLEUS	1 min	Saline	NO	NO	15	15	15	15	15	6/6(p)
119	Female	Right	Jun-60	RESIMC	HTN	7	NAH	CANN-OPENER	PHACOSANDWICH	1 min 20 sec	Saline	NO	NO	19	20	18	17	17	6/6
120	Male	Left	Jun-60	LESIMC	DM	7	NAH	CAPSULORRHEXIS	PHACOSANDWICH	1 min 30 sec		NO	NO	20	21	20	19	19	6/6