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Three decades ago a philanthropist and a great visionary, Late Dr. R. K. Seth, laid the seed of Venu Eye Institute. At a young age of 36 yrs, Dr. Seth realised the limitation of a private practice. His desire to spread his reach to the needy, overarching social and economic hurdles, created Venu.

Inspite of the tremendous growth in eye care service delivery, the services are limited not just geographically, but also affordability, to a few. The irony is the needless suffering of the vast majority of patients. It is this gap that Venu seeks to address.

Venu today has 5 Satellite Hospitals, and 12 Vision Centres in Haryana, Uttar Pradesh, Uttarakhand and Rajasthan. The Base Hospital in New Delhi is a referral and teaching institute.

Venu Eye Institute & Research Centre is today recognized as a leading Eye Hospital in India. It has made quality eye care available, affordable, accessible and sustainable for over 36 years.

Venu's statistics bear mute testimony to the direction of the thrust of the Institute's work.

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<th>Total Patients</th>
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<td>Free Patients</td>
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<td>Cataract Surgeries</td>
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<td>Free Surgeries</td>
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The real voyage of discovery consists not in seeking new landscapes but in having new eyes.
- Marcel Roust

From The Editor's Desk

Dear Readers,

Greetings from the Venu family!

We take this opportunity to proudly present before you this special issue of “Vision” to commemorate the 77th birth anniversary of our founder, Late Dr. R. K. Seth. Dr. Seth was a brilliant ophthalmologist and a great philanthropist, who dedicated his life to the cause of taking quality eye care to the doorstep of every human being.

This journal is an endeavour to keep abreast with the latest development and technology in the field of ophthalmology.

Preoperative evaluation of patients with co-existing diseases like pseudoexfoliation plays a pivotal role in the safety of cataract surgery. Evaluation of anterior chamber depth could indicate the possibility of intra-operative complication in these patients.

Macular edema post cataract surgery is an unfortunate cause for decreased vision in patients following cataract surgery. It may occur despite perfect surgery without any complications. Evaluation of macular thickness prior to surgery can help predict the chances of developing macular edema post uneventful phacoemulsification surgery.

LASIK is currently the latest innovative surgery for patients with myopia. It offers a spectacle and contact lens free life to an individual. However, changes in corneal thickness after LASIK surgery can pose a difficulty in recording accurate intra ocular pressure post surgery. Pentacam is a reliable tool which gives a correction factor to compensate for the change in corneal thickness and hence measure IOP reliably.

Glueless and sutureless pterygium surgery is a cost effective technique to serve people, especially with limited means. We did a case series on the same and found excellent results.

Stargardt's disease is the most common form of inherited juvenile macular degeneration. There is a progressive vision loss in this disease to the point of legal blindness. Gene studies and research for possible treatment techniques is currently underway.

Another genetic disease, though uncommon, is Bardet – Biedl Syndrome. Less than fifteen cases have been reported from India. We happen to report a case report of four siblings affected with this disease.

Corneal blindness continues to be one of the major public health problems in developing countries. Optical penetrating keratoplasty is the answer to many corneal diseases. However, its success depends on many factors, including follow up of patients and their compliance towards treatment.

We, the editorial team, would like to express our heartfelt gratitude to all our staff and support team. As always we solicit your feedback which helps us in making this publication a useful endeavour.

With warm regards,

Editorial team
Anterior Chamber Depth and Complications During Cataract Surgery in Eyes With Pseudoexfoliation Syndrome

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Abstract

Purpose: To look for associations of preoperative A-scan ultrasound ocular dimensions with complications during phacoemulsification in eyes with pseudoexfoliation. Methods: A total of 90 eyes with pseudoexfoliation of 90 patients undergoing planned cataract surgery were included in a cross-sectional study. Preoperatively, A-scan ultrasound examination with measurement of anterior chamber depth, lens thickness, and total axial length was performed. Small incision cataract surgery or phacoemulsification with implantation of a posterior chamber intraocular lens was performed by a total of five surgeons. Intraoperative complications (zonular dialysis and/or vitreous loss) were correlated with preoperative findings including ultrasound dimensions. Multivariate logistic regression analysis with a generalized estimating equations method was used for statistical analysis. Results: Intraoperative complications occurred in 14 (56%) of the 25 eyes with an anterior chamber depth of < 2.5mm. The anterior chamber was significantly shallower in eyes with complications like posterior capsular rent (PCR), vitreous loss (VL), zonular dialysis (ZD), difficult anterior capsulotomy (DC), corneal endothelial touch (CET) than in eyes without complications. In MSICS cases, complications (PCR, VL, ZD, DC) were 3-4 times higher in the shallow ACD group. In Phacoemulsification cases, complications (PCR, VL, CET) were 3 times higher in the shallow ACD group. Conclusions: A small anterior chamber depth may indicate zonular instability in eyes with pseudoexfoliation syndrome and should alert the cataract surgeon to the possibility of intraoperative complications.

Introduction: Pseudoexfoliation syndrome is a condition characterized by widespread intraocular and systemic production and deposition of an abnormal fibrillar extracellular material and is clinically diagnosed by slit-lamp examination. Besides being a frequent cause of secondary open-angle glaucoma, pseudoexfoliation syndrome actively involves all tissues of the anterior segment of the eye and thus may lead to a large variety of complications.1,2 In this context, zonular instability is frequently associated with pseudoexfoliation syndrome and may lead to intraoperative complications during cataract surgery, most notably zonular dialysis and vitreous loss.3-8 However, because only a minority of eyes with pseudoexfoliation syndrome develop intraoperative complications related to zonular weakness, it would be helpful for the cataract surgeon to be able to rely on predictive factors, preferably objective and quantitative ones, that indicate the propensity of eyes with pseudoexfoliation syndrome to develop intraoperative zonular dialysis and/or vitreous loss. Therefore, it was the aim of this study to look for possible associations of preoperative A-scan ultrasound ocular dimensions with complications during cataract surgery in eyes with pseudoexfoliation syndrome.

Methods: Eyes with pseudoexfoliation syndrome with significant cataract that underwent small incision cataract surgery or phacoemulsification between 1st December 2014 to 30th November 2015 at Venu Eye Institute & Research Centre were included in the study. All eyes with slit-lamp biomicroscopic picture of pseudoexfoliation syndrome planned for cataract surgery were included in the study. Exclusion criteria were previous ocular trauma with traumatic lens changes, manifest luxation or extensive subluxation of the lens visible preoperatively at slit-lamp examination, previous intraocular surgical procedures except for laser treatment. All patients had undergone complete dilated ophthalmologic examination preoperatively and had been examined by at least one resident and one experienced staff member.
The presence of glaucoma, phacodonesis visible at slit-lamp examination, antiglaucoma medication, and previous antiglaucoma laser surgery were noted. Preoperative A-scan ultrasound examination was done after medical pupillary dilation and cycloplegia with phenylephrine 5.0% and tropicamide 0.8%, one drop every 15 minutes, applied 1 hour before ultrasound examination. A-scan ultrasound examination was performed by specially trained residents using Alcon Ocuscan Rxp (immersion scan method) with the patient in supine position to minimize intra and inter observer variability. Anterior chamber depth and total axial length was measured.

Cataract surgery was performed by a total of five experienced anterior segment surgeons. Informed consent was obtained from all patients before surgery. After creation of a self-sealing sclero-corneal tunnel incision for MSICS or a clear corneal incision for phacoemulsification, the anterior chamber was filled with a viscoelastic substance. In MSICS, anterior capsulotomy by continuous curvilinear capsulorrhexis or can-opener's technique was left to surgeon's choice. In phacoemulsification, a capsulorhexis was created and phacoemulsification of the lens nucleus was performed. The lens cortex was aspirated, and a one-piece polymethylmethacrylate posterior chamber intraocular lens (5.25 mm to 6.25 mm optic) was implanted after the capsular bag was filled with a viscoelastic substance. If necessary, intraoperative synechiolysis and mechanical dilation of the pupil was done, sphincterotomy was performed or iris hooks were employed.

Immediately after surgery, the surgeon created a surgical report. In this report, intraoperative details including difficult anterior capsulotomy, corneal endothelial touch, difficult nucleus delivery and complications like posterior capsular rent, vitreous loss or zonular dialysis, were documented. Outcome measures were intraoperative complications (zonular dialysis and/or vitreous loss) documented by the surgeon immediately after surgery.

For correlation with intraoperative complications, only preoperative findings were considered. This was done to avoid a possible bias that might be caused by the fact that the surgeon himself defined intraoperative details immediately after surgery, because it cannot be excluded that the surgeon tended to interpret intraoperative details (for example, pupil width, positive vitreous pressure, density of lens nucleus, etc) differently if intraoperative complications had occurred than if they had not.

Results: In 90 patients, 90 eyes (mean age, 69.68 years; range, 52 –84 years) were included in the study. 48.9% were males and 51.1 % were females. 82.2% cases had pseudoexfoliative material at the pupillary border.

Post dilatation pupillary diameter of <6mm was considered poorly dilating pupil. Small pupil was noted in 46.7 % patients, which necessitated surgical synechiolysis and/or mechanical dilation of the pupil. 10 (14.3%) eyes required sphinterotomy in MSICS and iris hooks were applied in 3 (15%) eyes during phacoemulsification.

Anterior chamber depth (ACD) of less than 2.5 mm was considered shallow ACD. 22 (31.4%) out of the 70 MSICS cases had a shallow ACD and 3 (15 %) out of the 20 phacoemulsification cases had a shallow ACD. Overall 25 (27.8%) of the 90 eyes had a shallow ACD.

Intraoperative complications (zonular dialysis, PCR, vitreous loss) occurred in 14 eyes (56.0%) of the 25 eyes with shallow ACD. As shown in graph 1, Complications (PCR, VL, ZD, DC) were 3-4 times higher in the shallow ACD group. Anterior chamber depth was significantly less in eyes with complications (ZD, PCR, VL) than in eyes without complications (P= <0.001).

Scatterplot (graph 2) shows Correlation Coefficient (r) = - 0.407, suggesting significant negative correlation between ACD and Complications (ZD, PCR, VL).

Discussion: Recent studies have shown that
pseudoexfoliation syndrome is not only a localized phenomenon affecting the pupillary rim of the iris and the anterior lens capsule but a systemic disorder of the extracellular matrix that actively involves all structures of the anterior segment of the eye. Local production and deposition of pseudoexfoliation syndrome fibers may lead to characteristic clinical and ultrastructural changes of the corneal endothelium (pseudoexfoliation syndrome corneal endotheliopathy), trabecular meshwork (capsular glaucoma), iris (pseudoexfoliation syndrome iridopathy), ciliary body (pseudoexfoliation syndrome cyclopathy), zonules (pseudoexfoliation syndrome zonulopathy), lens (pseudoexfoliation syndrome phacopathy), and structures of blood-aqueous barrier (blood-aqueous barrier breakdown). Although all of the above-mentioned alterations may have consequences and cause complications for anterior segment surgical procedures, the most frequent and dreaded complication of pseudoexfoliation syndrome during cataract extraction is severe zonular weakness that may lead to extensive intraoperative zonular dialysis, vitreous loss, and dislocation of the lens or of a posterior chamber intraocular lens during or after surgery.

Possible consequences of reduced zonular integrity in pseudoexfoliation syndrome seen at slit-lamp examination include phacodonesis, spontaneous dislocation of the lens into the vitreous space (first described by Vogt in 1938), and anterior subluxation of the lens sometimes precipitated by the use of topical miotics and leading to ciliolenticular angle-closure glaucoma. In addition, zonular weakness is one of the mechanisms by which pseudoexfoliation syndrome predisposes to pupillary block angle closure glaucoma. The incidence of phacodonesis and/or subluxation of the lens or both in eyes with pseudoexfoliation syndrome has been reported to be between 8.4% and 10.6%. Many reports have described increased rates of intraoperative complications, that is, zonular dialysis and vitreous loss, during cataract extraction in eyes with pseudoexfoliation syndrome. In these studies, the frequency of zonulolysis in series of eyes with pseudoexfoliation syndrome was reported to be 17.9%, 17.1%, 14.8%, 13.1%, and 13.1%, and the frequency of vitreous loss was reported to be 11.1%, 7.4%, 7.1%, 6.7%, and 5.1%. Guzek and associates, in a prospective study on 1,000 eyes undergoing extracapsular cataract extraction, found that pseudoexfoliation syndrome was a highly significant risk factor for the occurrence of zonular breaks.

Electron microscopic studies have analyzed the exact location and nature of zonular changes in pseudoexfoliation syndrome. One study that looked at 11 eyes with pseudoexfoliation syndrome found zonular alterations at three levels: (1) at the origin and anchorage or the zonules in the ciliary body, (2) in the pars plicata of the ciliary body where the zonular bundles passed alongside the ciliary processes, and (3) at the zonular attachment to the anterior lens capsule. Disinsertion of the zonular attachments was caused by local production of pseudoexfoliation syndrome material by the nonpigmented epithelium of the ciliary body and by the lens epithelium. In addition, the zonular fibers were infiltrated by pseudoexfoliation syndrome material, and lysosomal enzymes were detected within the pseudoexfoliation
syndrome aggregates.  

Reports in the literature concerning the overall ocular dimensions of eyes with pseudoexfoliation syndrome are controversial. Earlier studies that looked at anterior chamber depth in eyes with pseudoexfoliation syndrome did not detect significant shallowing of the anterior chamber in comparison with normal control eyes. \(^{35-37}\) In contrast, one recent study that analyzed age-matched and gender-matched patients with and without pseudoexfoliation syndrome found significantly smaller anterior segments ("relative anterior microphthalmus") in eyes with pseudoexfoliation syndrome. \(^{38}\) In addition, the anterior chamber volume was found to be significantly smaller in eyes with pseudoexfoliation syndrome than in eyes without pseudoexfoliation syndrome. \(^{39}\) However, none of the studies looking at ocular dimensions in pseudoexfoliation syndrome so far has specifically analyzed eyes with zonular weakness or eyes with intraoperative complications.

Our hypothesis, which led to this study, is that zonular weakness in pseudoexfoliation syndrome leads to anterior movement and increased curvature of the lens, similar to findings in traumatic cyclodialysis. \(^{40}\) We were able to show a significantly reduced anterior chamber depth in eyes with pseudoexfoliation syndrome with intraoperative complications in contrast to eyes with pseudoexfoliation syndrome without intraoperative complications. We believe that preoperative weakness of the zonules in the group of eyes with pseudoexfoliation syndrome that are prone to intraoperative complications leads to anterior movement of the lens. In addition, zonular weakness may lead to increased curvature and increased thickness of the lens, as has been shown by ultrasound biomicroscopy imaging. \(^{41,42}\) However, the major limitation of our study was that it did not consider factors like different grades of cataract, severity of pseudoexfoliation, and the type of surgery (MSICS/Phacoemulsification) being performed, which affect the intraoperative complications. Our results were also affected by the varying abilities of the different operating surgeons.

Interestingly, none of the twenty eyes in which phacoemulsification was done, had zonular dialysis as an intraoperative complications. This indicates that increased awareness of potential complications and additional attention by the surgeon may have prevented complications.

In conclusion, the risk of intraoperative complications in eyes with pseudoexfoliation syndrome was quadrupled in eyes with an anterior chamber depth of less than 2.5 mm compared with eyes with pseudoexfoliation syndrome with an anterior chamber depth of more than 2.5 mm. Although cataract surgery in pseudoexfoliation syndrome is challenging, if the surgeon is aware of the condition preoperatively and pays meticulous attention to the surgical technique, the intraoperative complications can be managed and a good visual outcome can be expected.

REFERENCES

11. Schlote-Schrehardt U, Naumann GOH. Trabeicular meshwork in pseudoexfoliation syndrome with and without open-angle glaucoma.
INTRODUCTION
Pterygium is one of the most frequently encountered eye pathology in the outpatient department. Prevalence rate varies from 0.7% to 3.1% in various population around the world. Pterygium is a Greek word which means (pteryx) = wing and (gion) = fin. It is believed that pterygium is a growth disorder characterized by conjunctivalisation of the cornea due to localized ultraviolet rays stimulated damage to the limbal stem cells. Pterygium is characterized by a triangular portion of the bulbar conjunctiva encroaching onto the cornea. It occurs most commonly in the “pterygium area”, which is defined by geographical latitude of 40° north and south of the equator. The greater affinity of pterygium towards nasal side is due to lack of subconjunctival tissue in temporal region and less extent of UV exposure to temporal side due to upper lid bowing.

Etiopathogenesis of Pterygium
Various studies suggest that pterygium is cumulative effect of ultraviolet and infra radiation from sunlight. The working hypothesis is that this radiation causes mutation in p53 tumour suppressor gene, thus facilitating the abnormal proliferation of limbal epithelium.

Grades of Pterygium
Grade 1 -- Midway between limbus and pupil border (undilated).
Grade 2 -- Extends upto pupil border.
Grade 3 -- Crosses pupil.

According to Tan's classification Staging of Pterygium is:
T1--(ATROPHIC) Episceral vessels clearly seen.
T2 --(Intermediate) Partially visible episcleral vessels.
T3 --(FLESHY) Episceral vessels obscured.

Management Options for Pterygium
1. Bare sclera excision (rarely done now)
2. Excision with Conjunctival Autograft (CAG)
3. Excision with Limbal Autograft (CLAG)
4. Rotational Autografts
5. Excision with Amniotic membrane/Buccal mucous membrane graft
6. Excision followed by Barraquer polishing technique.

CONCEPT BEHIND GRAFT APPPOSITION WITH AUTOLOGOUS BLOOD SERUM
Post pterygium removal episcleral vessels are ruptured with help of Limbs forceps. Due to trauma activation of fast process (extrinsic pathway coagulation) and slow process (intrinsic pathway coagulation) occur leading to fibrin formation. This fibrin is responsible for attaching the graft to the bare sclera.

PRE-OP INVESTIGATIONS FOR AUTOLOGOUS BLOOD SERUM:--
1. Complete blood count
2. Bleeding Time
3. Clotting Time
4. Slit Lamp examination to see for scleral bed vascularity.

Disclaimer: The author does not have any financial interest in this study.
**Steps of Surgery: With Autologous Blood Serum**

- Dissect the pterygium and clean its remnants present on cornea with crescent/blade.
- Take the conjunctival autograft from superior bulbar conjunctiva and reorient in a way that limbal graft attaches to limbal area of dissected bare area. (This maneuver is done keeping the graft on cornea)
- Bleeding is induced from episcleral vessels present in dissected bare area.
- Once the dissected bare area is flooded with pool of blood, autograft is quickly moved to the planned area and pressed with iris repositor and edges are undermined below the attached bulbar conjunctiva.
- Graft is allowed to settle down for next 5 mins with minimal handling and gentle compression is given with iris repositor.
- Blood clots surrounding the graft are gently...
cut with vannas scissor instead of being cleaned with a cotton bud (as this can displace the graft)

- Graft vascularity is assessed and a fair idea can be made of graft uptake.
- Speculum is removed while observing the eye under microscope.
- Lids are properly and gently closed over the graft and a tight patch is done. (Avoid use of ointment at time of patching).

**Discussion**

UV radiation is believed to be an important risk factor and protective eye glasses are recommended. There is a lack of consensus about the medical and surgical management of pterygium. Early in the disease process, Ophthalmologist often takes a conservative approach to NSAID, lubricating drops. Surgery is indicated if it extends to the visual axis or it is inducing astigmatism, patient should be explained that there is fairly high risk of recurrence.

Bare sclera technique involves excising the pterygium leaving behind the bare sclera bed; but it had high recurrence rate, 24% to 89%. In addition to a thorough removal of the pterygium, another key to preventing recurrence is using a graft over the pterygium site to act as a barrier to regrowth. Due to low rate of recurrence, 1.6% to 33%, conjunctival auto graft has become very popular.

Conjunctival autograft were popularized by Kenyon et al. The most common method of autograft fixation is suturing, with the drawbacks of prolonged operating time, postoperative discomfort, suture abscesses, buttonholes, and granuloma formation. Commercial fibrin adhesive has been used widely in neurosurgery, plastic surgery, and ear, nose, and throat surgery. It is also reported that fibrin adhesive is useful in ophthalmology for conjunctival wound closure.

Koranyi et al in a randomized clinical trial, reported that fibrin glue TISSEEL Duo Quick (Baxter, Vienna, Austria) could be used to attach the conjunctival autograft instead of sutures. The glue is not only costly but also Human infection of parvovirus B19 (HPV B19) has been reported after use of fibrin glue products from different manufacturers.

**Our Experience with the Autologous Blood Serum** - A total of 27 eyes of 27 patients (22 females and 5 males) were operated for pterygium excision with conjunctival graft using autologous blood serum technique at Rewari Satellite Hospital. In 25 patients conjunctival autograft was put up while 2 patients were left with bare sclera. Patients were followed up for period of 8 months. There was no intra-operative complication. Post op 1” day cosmetic appearance was good in 22 cases, in 2 case graft had moved superiorly and in 1 case the graft had moved completely and was out. Out of 22 well placed graft cases 6 showed improved vision, 3 cases showed decrease in vision while the rest didn’t show any change in vision. In cases where the graft had moved superiorly excess graft was cut under topical anesthesia under slit lamp microscope on 1st day post op. 1st day post op patient complained of vague pain which was relieved with oral pain killers. Post-op patients were put on topical steroids + antibiotic, with topical NSAID and a lubricant and reassessed after one week. There were no intra- or post-operative complications requiring further treatment.

**Conclusion** - This simple technique for pterygium is proving to be cheap, easy, patient and doctor friendly with minimum post operative symptoms of pain, foreign body sensation, watering, or any hypersensitivity reactions and complete recovery between 2 to 3 weeks time.
IOP Measurement Post Lasik

Dr. Tania Jain, DNB Tutor
Venu Eye Institute & Research Centre

Introduction: Glaucoma affects about 70 million people worldwide, of whom about 10% are believed to be bilaterally blind. It is estimated that by the year 2020, this number would rise to around 79.6 million.\(^{(1)}\)

Early detection of glaucoma is the key to preserve vision in glaucomatous eyes. Intraocular pressure (IOP) is a major risk factor and also plays an important role in the diagnosis and management of glaucoma. Goldmann applation tonometry (GAT) is currently the gold-standard for measuring IOP.\(^{(5)}\) Measuring IOP by GAT has been found to be influenced by the central corneal thickness (CCT) of the individual. Studies on ocular hypertension (OHT) have stressed upon the influence of CCT on IOP measurement.\(^{(6-8)}\) This variation is not taken into account by GAT, as it assumes a standard 520 μm thickness for all corneas.\(^{(15)}\) It is now quite well recognized that abnormally thick or thin corneas give rise to fallacious IOP measurement.

High myopia is also one of the important risk factors for the development and progression of glaucomatous optic neuropathy.\(^{(17,18)}\) The prevalence of myopia is significantly higher in Asian populations than in populations of European descent.\(^{(19,20)}\) The increased risk of development of glaucomatous change may be related to the already reduced retinal nerve fiber layer (RNFL) thickness in myopic eyes or the reduced RNFL thickness in myopia may itself represent a risk factor for development of glaucoma.\(^{(18)}\)

Persons with moderate or high myopia have an almost 3 times higher risk of POAG compared with those with emmetropia.\(^{(22)}\)

Many studies have been done to evaluate IOP after photorefractive surgery. These studies found a significant decrease in IOP postoperatively.\(^{(34-36)}\) There is no study done in India to evaluate IOP changes after LASIK surgery. The reduced IOP value is said to be related to the absence of Bowman's membrane and central thinning in post LASIK and post PRK patients. In this study I have attempted to study the post LASIK IOP and correlated it with the corresponding decrease in central corneal thickness. This study might help us to fill the gap in our existing knowledge on this topic.

The study was conducted at Venu Eye Institute & Research Centre, New Delhi to assess the correlation between intraocular pressure (IOP) and central corneal thickness (CCT) after laser in situ keratomileusis (LASIK) in myopia or myopic astigmatism and to assess the decrease or increase in IOP on subsequent follow up over a 3 month period after LASIK surgery and correlated the results with corresponding CCT reading at each follow up.

Patients with myopia in both eyes who were willing to undergo LASIK were screened for inclusion criteria. Patients were informed about the aim of study to ensure best possible compliance throughout the study period. Informed consent was taken from patients after explaining the relative safety of the procedures done. It was a prospective hospital based observational study done within time frame of October 2014 and November 2015. The patients were taken from Out Patient Department and satellite hospital of Venu Eye Institute & Research Centre, New Delhi. Sixty eyes of 30 patients were enrolled in the study. With reference to the previous study by Recep FO et al\(^{(49)}\) and the precision error of estimation (d) = 0.10 or 10%, sample size came out to be 60 with a power of 80% and 5% level of significance. Sample size was calculated using the formula:-

\[
n = \frac{\sigma^2(Z_{1-\alpha/2} + Z_{1-\beta})^2}{d^2}
\]

Since the study was time bound, all consecutive patients meeting the eligibility criteria during the study period were enrolled.

The following patients were included in the study, myopic patients with stable refraction for
last 6 months, over 18 years of age, patients with spherical error between 1D - 10 D, patients with cylindrical error between 1D - 4 D and normal cornea with thickness between 500 – 600 μ. Thin cornea with thickness less than 500 μm, keratoconus/pellucid marginal degeneration, Fuch's disease, severe dry eye syndrome, corneal scarring, autoimmune diseases, glaucoma (excluded by measuring IOP, complete disc evaluation followed by visual fields in suspicious cases), uveitis, prior intraocular surgery, presence of any choroidal or retinal disease, history of trauma, unstable refraction were excluded from study.

METHODOLOGY: Patients who met the eligibility criteria were enrolled in the study. Detailed history was taken. Detailed ocular and systemic examination was done. Patient were asked about the record of their changing spectacle number. Contact lens were discontinued for about 1 week for soft, 1-2 weeks for toric, 2 weeks for extended wear and 1 month for RGP.

Pre-LASIK visual acuity was recorded with Snellen's chart, refractive status was recorded by auto-refractometer and subjective testing was also done. Central corneal thickness measurement using ultrasound pachymetry and Scheimpflug imaging (Pentacam) was done. Intraocular pressure by Goldmann's applanation tonometry (GAT) was recorded. The GAT used for study was checked monthly to ensure proper calibration. Additionally corneal compensated IOP values were also calculated using nomogram given by Ehler et al at preoperative and each follow up visit. Pre-operative and 3 month post LASIK Scheimpflug imaging (Pentacam) was done. Pentacam corrected IOP was also calculated pre-operatively and on last follow up visit at 3 months. Pre-LASIK slit lamp examination and fundus examination with indirect ophthalmoscopy was carried out. Patient were followed up with the same evaluation procedure immediately post-LASIK and at 1 week, at 1 month and 3 months. BCVA was measured by Snellen's chart for distant vision pre-operatively as well as post-operatively. Patient were instructed to read the letters on the Snellen's chart from a distance of 6 meters and the BCVA for distance vision was noted. Similarly BCVA for near vision was recorded by using Jaeger's chart. Auto-refractometer findings with TOPCON KR800 were recorded. Refractive status by subjective testing was assessed and recorded.

Ultrasound pachymetry with ALCON OCUSCAN™ RXP was done after using Proparacaine eye drops (0.5%). Post procedural antibiotic drop CIPLOX (Ciprofloxacin 0.3%) was instilled to prevent infection. CCT measurement was done pre-operatively and post-operatively at 1 week, 1 month and 3 months.

For all patients included in the study, pre-operative Pentacam was done to screen for subclinical keratoconus and early corneal ecstasias. Post-operative Pentacam was repeated at 3 month. Pentacam corrected IOP was also calculated pre-operatively and at 3 month post-operatively. This was done by feeding the IOP value in Pentacam and adding the Pentacam correction factor to the IOP recorded by GAT. IOP was measured pre-operatively and post-operatively at 1 week, 1 month and 3 months. Fundus was evaluated using indirect ophthalmoscopy and 90 D lens.

LASIK procedure was performed according to the standard parameters. A corneal flap was created. Suction pressure greater than 65 mm Hg was ensured. Stromal bed ablation was performed. Ablation was done in all eyes within a diameter of 6.5 mm. Post-operatively patients were started on topical Prednisolone acetate ophthalmic suspension USP 1% w/v (ALCON), Moxicip eye drops (moxifloxacin 0.5% w/v) (CIPLA) and Systane Ultra (polyethylene glycol 400 NF 0.4% w/v, propylene glycol USP 0.3% w/v (ALCON ) eye drops.

Patients were followed up immediately post-LASIK at 1 week, 1 month, and 3 months. At each follow up visit uncorrected and best corrected visual acuity, refractive status with auto-refractometer and subjective testing was done, IOP measurement by GAT was recorded. CCT was recorded using ultrasound pachymeter. All patients who reported with IOP greater than 30
mm Hg while on topical steroids post-operatively were labelled as steroid responders. Their post-operative steroids were stopped and anti-glaucoma medication was started. These patients were subsequently excluded from study.

Statistical analysis was conducted with the statistical package for the social science system version SPSS 17.0. Continuous variables were presented as mean ± SD and categorical variables were presented as absolute numbers and percentages. The comparison of continuous variables between the groups was performed using Student’s t test. Pearson’s correlation was used to find the correlation between CCT and IOP and the significance level. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

Discussion: For all the patients, pre-operative CCT was calculated by ultrasound pachymetry. The mean pre-operative CCT was 530.03 ± 25.24µm. One week post LASIK, the mean CCT was 457.77 ± 27.83µm. At 1 month post LASIK, it showed an increase to 460.43 ± 28.40µm and at 3 month to 461.82 ± 28.59µm. The decrease in CCT was significant at each visit from the preoperative CCT. The decrease in CCT for each patient was related with the amount of ablation done which was dependent on degree of myopia. Several processes occur during the early postoperative period, including resorption of fluid introduced by intraoperative irrigation, biomechanical hydration shift, epithelial thickness modulation in response to laser ablation and interface reflectivity changes. However, the systematic changes are small after 1 week and the posterior stroma is significantly thickened after 1 week postsurgery. Peng et al reported that just after LASIK surgery, keratocytes were activated by cytokines that induced collagen fiber synthesis. Keratocyte activation was strongest at 1 to 2 weeks, and persisted until 3 months after LASIK surgery. This could cause the increase in posterior stromal thickness and may be why the CCT values continue to increase after 1 week postsurgery. Corneal wound repair is another reason believed to be a contributing factor in the gradual increase of corneal thickness.

In this study, the pre-operative IOP was calculated by GAT for all patients. Patients with pre-operative IOP more than 30 mm Hg were excluded from the study. Post-operatively the IOP was measured at 1 week, 1 month and 3 months by GAT. The mean pre-operative IOP was 15.38 ± 2.545 mm Hg which decreased postoperatively to 13.83 ± 2.644 mm Hg at 1 week, 13.03 ± 2.636 mm Hg at 1 month and 12.63 ± 2.497 mm Hg at 3 months. This suggests that there is a clear cut decrease in IOP recorded with GAT after LASIK. The decrease in IOP was more at 3 months compared to 1 month and 1 week. One reason for this could be that there is a possible fibrosis which stiffens the cornea post surgery and as it disperses over time, a decrease in measured IOP is observed. On applying the paired t test, it was found that correlation between pre-op IOP and post-op IOP at 1 week (r = 0.264) was statistically significant (p = 0.041). The correlation between pre-op IOP & post-op IOP at 1 month was 0.319 with a p value of 0.013 which was also significant.

The Pearson correlation was applied between CCT and IOP readings to find whether there exists any correlation between CCT and IOP. It was found that there is no significant correlation between pre-op CCT and pre-op IOP (r = 0.147, p = 0.263). Postoperatively at 1 week, there was no significant correlation between post-operative CCT and IOP (r = 0.196, p=0.133). A further decrease in IOP continued till 1 month and 3 months. By applying pearson correlation between post-op CCT and IOP at 1 month, we found a significant correlation between the two (r = 0.442, p = 0.000). This shows that the decrease in post-op IOP recorded at 1 month is dependent on the decrease in post-op CCT at 1 month. There was also significant correlation between post-op CCT and IOP at 3 months (r = 0.452 , p=0.000).

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This emphasized the point that the decrease in IOP recorded by applanation shows a positive correlation with the decrease in CCT recorded at 3 months. Different studies have also proved the same. Whitacre et al confirmed the relationship between CCT and error of applanation tonometry, with a mean error of 1.5 to 2 mm Hg for every 70 µm change in CCT. Faucher et al found a mean decrease in Goldmann tonometry of 2.4 ± 3.02 mm Hg after a 73.4 ± 0.028 µm keratectomy and Mardelli et al reported a decrease of 0.5 ± 2.1 mm Hg in IOP after a 23 ± 23 µm ablation. In the study by Emara et al post-LASIK measurements showed a decrease of 1.0 mm Hg per 37.8 µm reduction in CCT. We could not find any reason for not finding a significant correlation between CCT and IOP at 1 week.

Ehler's nomogram was applied to IOP readings obtained with GAT. Ehler's nomogram was initially used to compensate for variability in CCT from the normal. The mean of corrected IOP (by applying Ehler's nomogram) before LASIK was 16.50 ± 2.873 mm Hg. The mean of corrected IOP at 1 week was 19.38 ± 2.84 mm Hg, at 1 month was 18.52 ± 2.23 mm Hg and 18.00 ± 2.01 mm Hg at 3 months. This data shows that on applying the Ehler's nomogram, it overcorrected the IOP and gave an increased reading. Many studies have shown that the true IOP shows a slight decrease after refractive surgery. Hence this nomogram is not of any use in post refractive surgery patients and shouldn't be used to correct IOP.

Post LASIK there was a negative correlation between post-op CCT and corrected IOP at 1 month (r = -0.179, p = 0.179). This shows that as the CCT decreases, there is an increase in corrected IOP. If we presume that Ehler's nomogram corrects for change in IOP, then after applying the nomogram there should ideally be no relationship between CCT and IOP.

Ehler and co-workers developed a nomogram based on manometric experiments (we shall refer to this as the Ehler's model) for correction of IOP for the errors induced due to normal CCT variation. This nomogram corrects the IOP for the errors induced due to CCT as well as corneal curvature. When IOP correction factors derived from the Ehler's nomogram are applied to IOP measured by the GAT, one would expect any association between CCT and IOP to be nullified. Thus the corrected IOP should be independent of the CCT and should not correlate with CCT. From the study done by Gunvant P et al in 2005 it was found that there is a significant negative correlation between CCT and corrected IOP calculated using the Ehler's model.

This study concluded that there is a residual association of CCT on corrected IOP. The reason could be that the Ehler's nomogram overestimates the effect of corneal parameters on IOP measurement. This results in an overcorrection of IOP, thus predicting a erroneously low corrected IOP in eyes with thicker than normal corneas, and an erroneously high corrected IOP in eyes with thinner than normal corneas. The results of many studies are consistent with the finding that the variation in CCT contributes to some error in IOP measurement on the assumption that the hydrostatic IOP is independent of the CCT. But from the above analysis and that proved previously, we come to a conclusion that Ehler's model overestimates the effect of CCT on IOP measurements and hence should be used with caution in drawing conclusions about corrected IOP for patient's diagnosis and management.

Pentacam corrected IOP was also calculated pre-operatively and 3 months post LASIK. The Pentacam corrected pre-op IOP was 16.005 ± 2.58 mm Hg and Pentacam corrected post-op IOP at 3 months was 15.313 ± 2.21 mm Hg. There
Stargardt’s Disease
Dr Rahul Sharma, Fellow
Venu Eye Institute & Research Centre

In 1909 Stargardt described a form of recessive inherited macular dystrophy characterized by the presence of an atrophic macular lesion, which was eventually surrounded by irregular, white-yellow deep retinal lesions.

1962, Franceschetti proposed the term “fundus flavimaculatus” to designate a peculiar fundus affection in which the hallmark was the presence of yellow-white deep “fishlike” retinal lesions, now known as “flecks,” varying in size, shape, opaqueness, and density, and limited to the posterior pole or extending to the equatorial region.

After the initial descriptions by Stargardt and Franceschetti, there was controversy in the literature as to whether or not Stargardt’s disease (STGD) and fundus flavimaculatus (FFM) were representing different clinical entities. It is now widely accepted by clinicians and researchers that STGD and FFM are not separate diseases but different spectrums of the same disorder.

**Case report:** A 31 year old female had presented in our OPD with complain of blurring of vision both eyes (left> right) since 1 year which was gradual painless progressive, no h/o photophobia/ redness/ blurring of vision in the evening/ trauma/use of glasses/drug intake.

Her vision in right eye was 20/40 and in left eye was 20/200. Colour vision (pseudischiara chart) w a s defective and central scotoma in Amsler’s grid (Figure 1) in both eyes. ERG w a s abnormal.

Fundus examination (Figure 2) showed pisciform flecks, vermilion colour of fundus.

Fundus fluorescein angiography (Figure 3) showed classical DARK CHOROID with hyperfluorescence in areas of flecks.

OCT (Figure 4) documented foveal atrophy, which was more temporally than nasally corresponding to finding that peripapillary retina is relatively spared in Stargardt's disease.

**Epidemiology:** There is a wide variation in

✓ Age at onset of the disease, which can occur from early childhood to Adulthood

1,2,6,7,8,9,10
Presenting complaints: Patients with STGD may be asymptomatic or complain, most frequently of
- Visual acuity loss,
- Photophobia, and,
- Less commonly, nyctalopia.

Clinical feature: Visual acuity usually ranges from 20/20 to 20/400. In very few patients visual acuity may fall to a counting finger or hand motion level. In comparison, older patients, aged 21 to 40 or 41 to 60, presenting with a visual acuity of 20/40 or better, would experience a deterioration in vision to 20/200 in a median time of 22 and 29 years respectively. However, once vision has deteriorated to below 20/40, it usually decreases rapidly to 20/200 or worse and this occurs independent of the age of the patient. Early in the course of the disease fundus examination may be normal, even when the visual acuity is already reduced (malingering?)

Fundus examination gives a vermillion appearance. Macular abnormalities are seen later on, including, pigment mottling, “Bull’s eye” appearance, frank macular atrophy and fundus flecks.

Clinical clue: It has been noted that in STGD there is a typical peripapillary sparing characterized by lack of flecks and atrophy in this region, even in those cases with diffuse RPE abnormalities and atrophy.

Genetics and molecular biology:
- Stargardt’s disease is inherited as an autosomal recessive trait and occurs as a result of mutations in a gene that was initially mapped to the short arm of chromosome 1 (1p) and subsequently identified as the ABCA4 gene (figure 5).
- Most sequence changes thought to be pathogenic in STGD patients are missense mutations
- Mutations in the ABCA4 gene are responsible for STGD.

The function of the ABCR protein (figure 6) is the transport of retinoids in photoreceptor outer segments, preferentially N-retinylidene-phosphatidylethanolamine (N-retinylidene-PE) and all-trans-retinal.

- ABCR acts to reduce the accumulation of N-retinylidene-PE and all-trans-retinal in outer segment disc membranes.
- Changes in ABCR protein would cause increased A2E(C42H58NO, molecular weight 592) named because it could be synthesized from vitamin A aldehyde (all-trans-retinal) and ethanolamine when combined in a 2:1 ratio, formation in the RPE.
- Accumulation of A2E in the RPE seems to be one of the major events leading to RPE cell damage and loss in STGD.
- Loss of RPE cells may be followed by degeneration and loss of photoreceptor cells.
and vision.

- Potentially noxious effects of LF and A2E, one of the LF components are:
  - Photochemical blue light damage,
  - Inhibition of lysosomal digestion of proteins,
  - Detergent-like disruption of membranes,
  - RPE apoptosis, and
  - DNA damage.

**Electrophysiology**: Patients with STGD may have different degrees of functional loss, as detected by

- Pattern electroretinogram (PERG),
- Full-field electroretinogram (ERG), and
- Electro-oculogram (EOG)

Patients with STGD may have one of three patterns (figure 7) of functional loss including

- Macular dysfunction alone (abnormal PERG with normal full-field ERG),
- Macular and peripheral cone dysfunction (abnormal PERG and photopic responses) or
- Macular and peripheral cone and rod dysfunction (abnormal PERG and scotopic responses).

There seems to be no reliable way of predicting which type of functional visual loss would be found in patients with STGD based on the fundus appearance alone.

Electrophysiological tests have a **prognostic value**, i.e., patients with early peripheral cone and rod dysfunction would have higher chance of developing peripheral visual loss and, thus, a more severe form of the disease.

Electrodiagnostic tests are **essential** in the evaluation of patients with this retinal disorder.

**Fundus fluorescein angiography**:

- FFA in patients with STGD will reveal a lack of early hyperfluorescence coming from the choroid, so that the retinal blood vessels, even the small capillaries, are easily seen over a very dark background where no choroidal fluorescence is apparent.
- A2E blocks the exciting blue light from reaching the dye in the choroidal circulation, resulting in a finding that is variously known as a **dark, silent, or masked choroid** (fig. 8).
- This sign is often best appreciated in the peripapillary region.
- “Choroidal silence” is not exclusively seen in patients with STGD and it has also been observed in patients with cone dystrophy.
- “**Active**” flecks appear hypofluorescent in the early and late frames of the FFA.
- “**Resorbed**” flecks may appear hypo- or hyperfluorescent.
- Numerous hyperfluorescent lesions seen angiographically in patients with flecks are the transmission defects around the flecks.

**Indocyanine green angiography (ICG)**:

- With ICG it is possible to see the choroidal details even in those patients with “dark choroid” on FFA.

- This suggests that the “choroidal silence” or “dark choroid” on FFA relates to an obscuration of the view of the choroidal circulation by the accumulation of material beneath the retina, rather than being related to a lack of perfusion through the choroid.
- Fundus flecks appear hypofluorescent on ICG, and are usually best detected on late frames of
Although FFA and ICG are safe, they are nonetheless invasive imaging techniques.
The information gathered by FFA and ICG is usually not required for diagnostic or prognostic purposes.
These tests should be reserved for selected cases of STGD.

**Autofluorescence:**
- Fundus autofluorescence (AF) (figure 9) is a relatively new imaging technique that allows the evaluation of the RPE in vivo and, indirectly, of the photoreceptors.
- AF signal is predominantly derived from lipofuscin in the RPE.

**Optical coherence tomography (OCT):**
- Optical coherence tomography (OCT), including ultrahigh-resolution OCT (UHR-OCT) has been very recently used to evaluate patients with STGD.
- The value of this imaging technique in facilitating the diagnosis or establishing the prognosis of patients with this condition, to date, remains to be elucidated.

**Colour Vision:**
- Color vision deficits are common in STGD, although in a few patients color vision can be normal.
- Elevation in the tritan axis is most frequently observed.
- However, when increased thresholds for all axes (protan, deutan and tritan) are present, there is usually a more severe elevation of protan and deutan axis.

**Visual field:**
- Visual field testing may be normal or show relative or absolute central or paracentral scotomas.
- In severe cases of widespread retinal atrophy peripheral visual field constriction can occur.

**Histopathology:**
- Histopathological evaluation of eyes from patients with STGD has shown RPE cells engorged and densely packed with a substance with ultrastructural, autofluorescent and histochemical characteristics consistent with lipofuscin.
- Subretinal desquamated RPE cells, some of which had undergone cell lysis with spillage of their contents into the subretinal space.
- Macrophages engorged with melanolipofuscin in the outer retina.
- RPE and choriocapillaris atrophy at the fovea, and
- Photoreceptor cell loss at the fovea have also been observed.
- Scanning electron micrograph (SEM) of RPE cells showed lipofuscin laden cells (figure 10).

**Current and future treatments:**
- There is currently no treatment available for patients with STGD.
- It is likely that the increasing knowledge in the structure and mechanism of action of ABCR and the development of an animal model of the disease (abcr-/- mice) may lead to the discovery of possible treatment strategies for patients with STGD.
- Inhibition of 11-cis-retinol dehydrogenase would be expected to inhibit the regeneration of rhodopsin and would potentially reduce the formation of all-transretinal and N-retinylidene-PE in the disc membranes of photoreceptor outer segments and the formation of A2E in RPE cells.

**Advice to patient:**
- Patients should wear dark glasses and a hat whenever they are exposed to prolonged bright light (to reduce the rate of formation of A2E in RPE cells).
of all-trans retinol in the photoreceptors).

- **Avoid** cigarette smoking.
- **Avoid** high-dose vitamin A supplements, including AREDS vitamins, because of their potential to increase the formation of bisretinoids in the retina.

**References:**
3) Essential in ophthalmology Medical Retina pg 167

**Contd. from pg.14**

was a significant decrease in Pentacam corrected IOP post LASIK by 0.6917 ± 2.39 mm Hg (p = 0.029). This suggests that there is an actual decrease in IOP pressure after LASIK surgery.

Scheimpflug imaging (Pentacam) is the most commonly used machine nowadays to screen pre-operatively for LASIK patients. It has many inherent formulae fed to compensate for IOP correction according to a decrease in corneal thickness post LASIK. Shireen Shousha et al studied 10 normal corneas with GAT, air puff tonometry, Ocular Response Analyzer corneal compensated IOP (ORA IOPcc) and Pentacam corrected IOP. They found that there is a significant correlation between Pentacam corrected IOP and IOP recorded by GAT.

Lian Hua Hong et al in a study measured IOP of 124 eyes from 62 patients who underwent LASIK with GAT at 6 months pre- and post-operatively. The collected data was fed into Pentacam and it was found that Pentacam was most accurate to measure IOP post LASIK.

**Conclusion**:

LASIK is currently the latest innovative surgery for patients with myopia. It offers a spectacle and contact lens free life for young individuals. Myopes have a risk of developing POAG. All myopes should be screened for glaucoma before and after LASIK surgery. After LASIK surgery, there is a decrease in IOP recorded with GAT compared to pre-operative IOP levels. This decrease in IOP is attributed to decreased CCT post LASIK. Ehler's nomogram was initially used to compensate for variation in IOP due to CCT. This nomogram actually overestimates the effect of CCT on IOP.

Hence this nomogram should not be used in post LASIK eyes. Pentacam is a recent imaging modality to screen myopic patients for various ectatic disorders prior to LASIK surgery. Pentacam has a correction factor which compensates for decreased IOP post LASIK. It is a more reliable factor to evaluate IOP in post LASIK surgery.

Hence we come to the conclusion that there is a post-op decrease in recorded IOP measured with GAT. Pentacam is a more reliable indicator to measure the IOP after LASIK. Ehler’s nomogram overcorrects the IOP and so should not be used.
Measurement of Central Macular Thickness by Optical Coherence Tomography (Oct) in Healthy Population before and after Uncomplicated Phacoemulsification

Dr. Rizwan Ahmed, DNB Tutor, Venu Eye Institute & Research Centre

Abstract

Purpose: To measure and compare central macular thickness by optical coherence tomography in a healthy population before and after uncomplicated phacoemulsification surgery in patients aged > 50 years. To calculate percentage of patients developing visually significant macular edema even after uncomplicated phacoemulsification. Methods: This hospital based prospective non-randomized study was conducted at Venu Eye Institute & Research Centre, New Delhi from November 2014 to October 2015. The first 100 consecutive eyes posted for cataract surgery during the above period were enrolled in this study. These patients underwent phacoemulsification with foldable posterior chamber IOL implantation. They were prescribed standard postoperative drug regime and were followed up on post op day 1, 7-10 days, 1-3 months and 4-6 months postoperatively. We measured BCVA (Log MAR) and CMT (microns) preoperatively and postoperatively on 1st day (1st visit), between 7th-10th day (2nd visit), 1-3 months (3rd visit) and 4-6 months (4th visit). Results: In present study the preoperative mean Log MAR BCVA was 0.73 ± 0.22. Postoperatively the mean Log MAR BCVA on 1st visit, 2nd visit, 3rd visit, and 4th visit was 0.06 ± 0.09, 0.05 ± 0.08, 0.07±0.17, 0.06±0.12 respectively. There was a statistically significant (p < 0.05) improvement in the mean BCVA at each postoperative visit compared to preop value. In 3rd post op visit 4% patients developed decline in vision with BCVA of Log MAR 0.6 or worse. Of these, 2% showed improvement with BCVA of 0.47 and rest 2% improved to BCVA of 0.6 in 4th postop visit. In present study mean preoperative CMT recorded was 234.80 ± 8.603 (Range 220 – 250 micron). Mean CMT In 2nd (CMT 2), 3rd (CMT 3) and 4th (CMT 4) post op visits was 237.92 +/- 7.473, 248.96 +/- 29.125, 243.16 +/- 18.893 respectively. In 3rd post op visit, maximum increase in mean CMT (6.03%) compared to preop values was seen. 16% patients showed increase in CMT beyond preoperative range (> 250 microns) out of which 4% patients had decline in BCVA that was 0.17 to 0.6, 0.17 to 0.77, 0.3 to 1 and 0.17 to 0.77 (visually significant macular edema) while rest 12 patients had maintained stable vision (visually insignificant macular edema) despite of increase in CMT. In 4th post op visit, in 12% patients with visually significant macular edema, CMT decreased to preoperative range (220-250 microns). In 4% patients with visually significant macular edema there was some decline in CMT (340 to 325, 360 to 320, 390 to 325, 390 to 341) but it didn't come to normal preoperative range although decline in CMT in these patients was associated with some improvement in BCVA (0.6 to 0.47, 0.77 to 0.6, 1 to 0.6, 0.77 to 0.47). Conclusion: The results of our study showed that phacoemulsification with foldable IOL implantation is a safe, minimally traumatic, surgery of choice for management of cataract and it provides better quality of vision, fewer complications if performed carefully and early postoperative visual rehabilitation. Pseudophakic CME remains a common cause of reduced vision following cataract surgery. Even after uncomplicated phacoemulsification, significant increase in macular thickness is observed which does not affect BCVA except in few cases. The peak increase is mainly seen at 1-3 months postoperatively and it normalizes over 4 to 6 months. Incidence of visually significant CME is minimal (around 4%) after uncomplicated phacoemulsification.

Introduction: Phacoemulsification with foldable intraocular lens implantation has become the surgery of choice for management of cataract in recent years, as it provides better quality of vision, minimal operative trauma, fewer complications if performed carefully and early postoperative visual rehabilitation compared to conventional intracapsular and extracapsular cataract extraction. Various factors like Ultrasonic energy and fluidics involved in phacoemulsification can influence the tissue structures of the eyeball and produce mechanical effects that can cause an inflammatory reaction, compression, and
hypoxia on the tissues by means of direct effects and instantaneous pressure fluctuation.

Macular edema (ME) is considered to be one of the most important causes of an unfavourable visual outcome after uncomplicated cataract surgery. Pseudophakic CME also known as Irvine-Gass syndrome, was first reported by A. Ray Irvine Jr., MD in 1953 and later demonstrated with fluorescein angiography by J. Donald M. Gass, MD, in 1969. Pseudophakic CME remains an important cause of reduced vision following cataract surgery. Highest incidence is seen with intracapsular cataract extraction and least with modern phacoemulsification. Risk of CME is more in complicated surgery, pre-existing diabetic macular edema, uveitis, glaucoma medications like prostaglandin analogues, retinal vein occlusion, epiretinal membrane etc. Despite advances in technique, incidence of clinical CME after uncomplicated small incision phacoemulsification is 0.1% to 2.35%.

Traditional methods for evaluating changes in macular thickness, such as slit lamp biomicroscopy, stereoscopic photography, and FFA are relatively insensitive to small changes in retinal thickness. FFA is the gold standard for the diagnosis of CME but it is an invasive procedure. OCT is good, noninvasive, quantitative, and reproducible method. It can detect changes in macular thickness even before it manifests clinically.

Most of the patients with ME found via angiography or OCT may not have visual changes. Furthermore, most patients with clinical ME will experience spontaneous improvement by 3 to 12 months.

It has been observed repeatedly in clinical practice that the presence of macular edema does not necessarily preclude good vision. It is therefore relevant to distinguish symptomatic or clinical ME from angiographic or optical coherence tomographic ME.

Various studies in the past have demonstrated that the onset of clinically significant CME is much less common after uncomplicated phacoemulsification cataract surgery, but with respect to preoperative values an asymptomatic increase in macular thickness and volume is observed in postoperative period.

Materials and Methods: In the present study conducted at Venu Eye Institute & Research Centre, New Delhi, we measured BCVA (Log MAR) and CMT (microns) in 100 eyes of 100 healthy patients undergoing elective phacoemulsification with foldable intraocular lens implantation preoperatively and postoperatively on 1st day (1st visit), between 7th-10th day (2nd visit), 1-3 months (3rd visit) and 4-6 months (4th visit).

Patients more than 50 years of age having no ocular or systemic disease except Immature Senile Cataract permitting minimum fundus view for preoperative OCT were included in study.

Patients with advanced cataract or hazy media due to causes other than cataract which obscures adequate fundus view for preop OCT, Ocular trauma, inflammation or any other preexisting ocular or systemic disease were excluded from study. All patients had undergone elective phacoemulsification with foldable intraocular lens implantation by single surgeon and were prescribed standard postoperative topical medication.

Results: There were 47 (47%) males and 53 (53%) females in present study. The mean age of patients was 62.59 ± 6.546 years (range 51 to 78 years). The study included 56 right and 44 left eyes.

In present study the preoperative mean Log MAR BCVA was 0.73 ± 0.22. Postoperatively the mean Log MAR BCVA on 1st visit, 2nd visit, 3rd visit, and 4th visit was 0.06 ± 0.09, 0.05 ± 0.08, 0.07±0.17, 0.06±0.12 respectively. There was a statistically significant (p < 0.05) improvement in the mean BCVA at each postoperative visit compared to preop value. In 1st post op visit the BCVA of Log
MAR 0.17 or better was achieved in 95% of patients. Overall, 100% of patients had Log MAR 0.3 or better BCVA. In 2nd post op visit the BCVA of Log MAR 0.17 or better was achieved in 97% of patients. Overall, 100% of patients had Log MAR 0.3 or better BCVA.

In 3rd post op visit 4% patients developed decline in vision with BCVA of Log MAR 0.6 or worse. Of these, 2% showed improvement with BCVA of 0.47 and rest 2% improved to BCVA of 0.6 in 4th postop visit.

Overall 96% of patients had Log MAR 0.3 or better BCVA on 4th post op visit.

All previous studies 89, 90, 91, 92, 93 had recorded statistically significant improvement in BCVA in postoperative period in nearly all patients undergoing uncomplicated phacoemulsification except for those developing CME. Approximately similar improvement in BCVA is seen in present study.

Central Macular Thickness (CMT): In present study mean preoperative CMT recorded was 234.80 ± 8.603 (Range 220 – 250 micron). Mean CMT In 2nd (CMT 2), 3rd (CMT 3) and 4th (CMT 4) post op visits was 237.92 +/- 7.473, 248.96 +/- 29.125, 243.16 +/- 18.893 respectively. The mean difference between preop CMT and CMT at second, third and fourth visit was found to be statistically highly significant (P < 0.001). Mean change in CMT at the second, third and fourth visit form preop CMT was -3.120 ± 3.102 (1.32%), -14.160 ± 29.305 (6.03%), -8.360 ± 18.611 (3.56%) respectively.

In 3rd post op visit, maximum increase in mean CMT (6.03%) compared to preop values was seen. 16% patients showed increase in CMT beyond preoperative range (> 250 microns) out of which 4% patients had decline in BCVA that was 0.17 to 0.6, 0.17 to 0.77, 0.3 to 1 and 0.17 to 0.77 (visually significant macular edema) while rest 12 patients had maintained stable vision (visually insignificant macular edema) despite of increase in CMT.

In 4th post op visit, in 12% patients with visually insignificant macular edema, CMT decreased to preoperative range (220-250 microns). In 4% patients with visually significant macular edema there was some decline in CMT (340 to 325, 360 to 320, 390 to 325, 390 to 341) but it didn't come to normal preoperative range although decline in CMT in these patients was associated with some improvement in BCVA (0.6 to 0.47, 0.77 to 0.6, 1 to 0.6, 0.77 to 0.47).
So in postoperative period, subclinical or visually insignificant macular edema was observed in 12% patients between 1 - 3 months which normalized over 4-6 moths and visually significant cystoid macular edema was observed in 4 patients which persisted in 4th postop visit.

Discussion: Phacoemulsification with foldable IOL implantation is a safe, minimally traumatic, surgery of choice for management of cataract. Even after uncomplicated phacoemulsification, significant increase in macular thickness is observed which does not affect BCVA except in few cases. The peak increase is mainly seen at 1-3 months postoperatively and it normalizes over 4 to 6 months.

Pseudophakic CME remains a common cause of reduced vision following cataract surgery. Even after uncomplicated phacoemulsification, significant increase in macular thickness is observed which does not affect BCVA except in few cases. The peak increase is mainly seen at 1-3 months postoperatively and it normalizes over 4 to 6 months. This asymptomatic post op increase in CMT can be attributed to effects of ultrasound energy and fluidics that can cause anterior chamber inflammation and release of inflammatory mediators which can diffuse through retinal layers causing accumulation of fluid within retinal layers causing subclinical retinal inflammation. Incidence of visually significant CME is minimal (around 4%) after uncomplicated phacoemulsification.

Spectral-domain OCT is objective, noninvasive, quantitative, and reproducible method which can detect changes in macular thickness even before it manifests clinically. It is most convenient, reliable and sensitive method to monitor and quantitate macular thickness changes during post cataract surgery follow up visits.

Conclusion: Phacoemulsification with foldable IOL implantation is a safe, minimally traumatic, surgery of choice for management of cataract. Even after uncomplicated phacoemulsification, significant increase in macular thickness is observed which does not affect BCVA except in few cases. The peak increase is mainly seen at 1-3 months postoperatively and it normalizes over 4 to 6 months.

References:

A Clinical Study on Optical Penetrating Keratoplasty and its Outcome
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Abstract:
Aim: To study indications, outcome, complications and risk factors for graft survival in optical penetrating keratoplasty patients. Study design: Retrospective hospital based. Materials and method: Data of patients who underwent optical penetrating keratoplasty between January 2014 and December 2015 at Venu Eye Institute & Research Centre was recorded. Cases with less than 6 months followup were excluded from post operative analysis. Therapeutic, lamellar, tectonic PK and paediatric cases were also excluded. Indication for surgery divided into good, fair and poor prognosis cases. Visual outcome graded depending on lines of improvement. Graft survival period of the patients studied and relationship with various risk factors analysed using Kaplan Meier Survival Analysis. Results: Out of 89 patients, 60.6% patients were male and 39.2% were female. Median age was 56 years. Mean graft survival period was 8 months. Aphakia had a strong association with graft failure. 58% patients had visual improvement of 2 lines or more. Conclusion: Graft survival is dependent upon various factors. Paucity of longterm follow up and non compliance can be contributory factor in graft failure in present setup.

Introduction
Corneal blindness continues to be one of the major public health problems in developing countries. According to WHO, corneal diseases are among the major causes of vision loss and blindness in the world today, after cataract and glaucoma. In India, there are approx. 6.8 million people who have vision less than 6/60 in one eye due to corneal diseases, of whom one million have a bilateral involvement. According to NPCB estimates, there are currently 120,000 corneal blind persons in the country. The burden of corneal blindness in our country is reflected by the fact that 90% of global causes of ocular trauma and corneal ulceration leading to corneal blindness occur in developing countries.

Materials and Methods: It was a retrospective hospital based study conducted at Venu Eye Institute & Research Center. Data was recorded from patients undergoing optical penetrating keratoplasty between Jan 2014 and Dec 2015.

Inclusion Criteria
- Optical PK between Jan 2014 and Dec 2015
- Both male and female patients.

Exclusion Criteria
- Therapeutic PK
- Lamellar PK
- Tectonic PK
- Paediatric cases

Cases with less than 6 months follow up were excluded from post operative analysis.

Indications for surgery were divided into good, fair and poor prognosis cases.

GOOD
- Corneal dystrophy
- Corneal scarring
- Pseudophakic bullous keratopathy
- Corneal ectasias

FAIR
- Adherent leucoma
- Corneal scarring with less than 2 quad vascualrization

POOR
- Corneal scarring with more than 2 quad vascualrization
- Post herpetic corneal opacity
- Aphakic bullous keratopathy
- Prexisting glaucoma
- Failed graft

Visual outcome graded depending on lines of improvement
- **GOOD**: > 2 lines improvement
- **MODERATE**: 1 line improvement
- **NO IMPROVEMENT**: Same or worsening of vision

Graft survival period of the patients were studied and relationship with various risk factors analysed using Kaplan Meier survival analysis

**Results**: 89 patients underwent optical PK during the study period.

Out of the 89 patients, 27 patients were on follow up for less than 6 months. They were thus, excluded from further analysis.

**Results**: 89 patients underwent optical PK during the study period.

1. Age distribution: The median age of study group was 56 years
2. Sex distribution
3. The various indications were as given in the table below.
4. Follow-up
5. Graft size:
6. The post operative lens status was as shown in the table below
7. Post operative visual acuity
8. Details of patients with no improvement or worsening

<table>
<thead>
<tr>
<th>INDICATION</th>
<th>No. of Pts</th>
<th>% of Pts</th>
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<tbody>
<tr>
<td>Pseudophakic bullous keratopathy</td>
<td>20</td>
<td>22.4</td>
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<tr>
<td>Corneal dystrophy</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>K scarring</td>
<td>17</td>
<td>19.1</td>
</tr>
<tr>
<td>Scarring with &lt; 2 quad vascularisation</td>
<td>9</td>
<td>10.1</td>
</tr>
<tr>
<td>Scarring with &gt; 2 quad vascularisation</td>
<td>9</td>
<td>10.1</td>
</tr>
<tr>
<td>Adherent leucoma</td>
<td>15</td>
<td>16.8</td>
</tr>
<tr>
<td>Aphakic bullous keratopathy</td>
<td>3</td>
<td>3.37</td>
</tr>
<tr>
<td>Failed graft</td>
<td>5</td>
<td>5.61</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Post herpetic</td>
<td>6</td>
<td>6.7</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Size</th>
<th>No. of Pts</th>
<th>% of Pts</th>
</tr>
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<tbody>
<tr>
<td>&lt; 8mm</td>
<td>15</td>
<td>24.2%</td>
</tr>
<tr>
<td>8. mm</td>
<td>34</td>
<td>54.8%</td>
</tr>
<tr>
<td>&gt;8mm</td>
<td>13</td>
<td>20.9%</td>
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<table>
<thead>
<tr>
<th>Post Op Lens Status</th>
<th>No of Pts</th>
<th>% of Pts</th>
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</thead>
<tbody>
<tr>
<td>Phakia</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>Aphakia</td>
<td>15</td>
<td>24.2</td>
</tr>
<tr>
<td>Pseudophakia</td>
<td>23</td>
<td>46.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Post op BCVA</th>
<th>No. of Pts</th>
<th>% of Pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;2 lines</td>
<td>25</td>
<td>41.9</td>
</tr>
<tr>
<td>2 lines</td>
<td>10</td>
<td>16.12</td>
</tr>
<tr>
<td>&lt; 2 lines</td>
<td>10</td>
<td>16.12</td>
</tr>
<tr>
<td>No improvement or worseing</td>
<td>4</td>
<td>25.8</td>
</tr>
</tbody>
</table>
All these patients had one factor or the other contributing to reduced graft survival period.

9. Complications following surgery

The purpose of the present study was to analyze the various factors which could possibly influence the survival of graft and overall visual outcome. Of the 89 patients who underwent optical penetrating keratoplasty (OPK) at our institute, 60.6% were males. Majority of patients (38.2%) were above 60 years. (median age group 56 years.) Commonest indication for surgery was corneal scarring (39.3%), of which 10% had two quadrant vascularization and 10% had four quadrant vascularization. Second most common indication was pseudophakic bullous keratopathy (22.47%), followed by adherent leucoma (16.85%), post herpetic (6.7%), failed graft (5.6%), aphakic bullous keratopathy (3.3%) and glaucoma with decompensated cornea (1.1%).

**Discussion:** Penetrating keratoplasty is the most commonly performed allograft and is said to be the most successful solid organ transplants, with short-term survival rates (1 year) as high as 90%. However, the long term survival of the graft diminishes.

The purpose of the present study was to analyze the various factors which could possibly influence the survival of graft and overall visual outcome. Of the 89 patients who underwent optical penetrating keratoplasty (OPK) at our institute, 60.6% were males. Majority of patients (38.2%) were above 60 years. (median age group 56 years.) Commonest indication for surgery was corneal scarring (39.3%), of which 10% had two quadrant vascularization and 10% had four quadrant vascularization. Second most common indication was pseudophakic bullous keratopathy (22.47%), followed by adherent leucoma (16.85%), post herpetic (6.7%), failed graft (5.6%), aphakic bullous keratopathy (3.3%) and glaucoma with decompensated cornea (1.1%).
Out of the total 89 cases, 27 were censored from post operative data analysis as the period of followup was less than 6 months. 54.8% patients had graft size of 7.5 × 8.0 mm. 24% had smaller size grafts and 20% larger size. In our study, there was no significant difference in graft survival between the 3 groups. (p = 0.9). Post operatively, 29% were phakic, 24.2% aphakic and 46.7% pseudophakic. There was a significant difference between graft survival of aphakic cases and phakic or pseudophakic cases. Mean graft survival period of aphakic patients was 3.5 to 6.5 months, whereas in the other group it was 7.4 to 11.3 months. (P = 0.003) Thompson et al (Ophthalmology, July 2003) also documented lower graft survival rates in aphakic patients. Olson and Kaufman proposed that the elevated IOP following PK in an aphakic patient might be the result of angle distortion secondary to a compressed tissue in the angle, resulting in graft failure. Zimmerman et al proposed that mechanical collapse of the trabecular meshwork in aphakic grafts is the main problem leading to glaucoma. The median survival period of good prognosis cases was 5.2 – 8.7 months, 4.1 to 7.8 months in fair prognosis and 4.4 to 7.5 months in poor prognosis cases. However, the difference in graft survival period among them was not statistically significant (P= 0.4) In our study, 41.6% patients had more than 2 line improvement, while 2 line and 1 line improvement was seen in 16.12% each. However, 25% (16 pts.) showed either no improvement or worsening. All these patients had one or more than one poor prognostic factors. Post operatively, complications were seen in 43 patient. (56.4%). Eleven cases had episode of rejection, out of which 2 was controlled with IV methylprednisolone. 1 patient was lost to follow up and rest had graft failure. Thirteen patients developed secondary glaucoma and 3 had large non healing epithelial defects leading to graft failure. One patient developed endophthalmitis for which ultimately evisceration had to be done. Six patients developed graft infiltrate, out of which three had graft failure.

**Conclusion**: Graft survival following OPK is dependent on multiple factors. The scenario in developing countries is quite different from western world due to differences in patient profile, different indications for surgery and socioeconomic factors affecting healthcare provision. Quality of donor cornea, surgical procedure and postoperative care together determine the success of corneal transplantation and consequent visual rehabilitation of the corneal blind.

**Limitation of study:**
- Analysis of donor tissue not included in the study.
- Loss to follow up of patients affecting analysis.
- Relatively short study period.

**Indications:**

- Corneal Scaring with Vascularization
- Pseudophakic bullous keratopathy
- Keratoconus

**Complications:**

- Graft Infiltrate
- Failing Graft
Title: A rare case report of four siblings with Bardet-Biedl syndrome (BBS)

Abstract: Bardet–Biedl syndrome (BBS) is characterized by retinal dystrophy, obesity, postaxial polydactyly, renal dysfunction, learning difficulties and hypogonadism. The diagnosis is based on clinical findings and can be confirmed by sequencing of known disease-causing genes in 80% of patients. Less than 15 cases have been reported from India. We report a rare case of four siblings with BBS presenting to ophthalmology outpatient department. Diagnosis was based on clinical features.

Keywords: Bardet–Biedl syndrome (BBS), siblings, polydactyly, exotropia

Introduction: Bardet–Biedl syndrome (BBS) is a rare autosomal recessive (AR) ciliopathy characterized by 6 primary features namely retinal dystrophy, obesity, postaxial polydactyly, renal dysfunction, learning difficulties, and hypogonadism and a wide range of secondary features including brachycephaly, short stature, speech disorder, brachydactyly, ataxia, poor coordination/clumsiness, diabetes mellitus, congenital heart block, left ventricular hypertrophy, hepatic fibrosis, sensory-neural deafness and neurological disorders. The frequency of the syndrome is estimated to vary between 1:160000 in northern European populations to 1:13500 in some Arab populations. Less than 15 cases have been reported from India, and to the best of our knowledge, there is no case report of more than two affected siblings till date. BBS being an AR disorder has a very rare chance of affecting multiple siblings. The authors present a case of four siblings with BBS who reported to the outpatient department (OPD) of one of the satellite centres of our hospital.

Case report: Four siblings reported to one of the satellite OPDs of our hospital with the complaints of diminished vision since birth (Figure-1). The first was a 45-years-old diabetic male with best corrected visual acuity of 20/200. On ophthalmic examination, he had bilateral, symmetrical, horizontal jerk nystagmus and left exotropia. Fundus examination revealed optic disc pallor, with normal rim to disc ratio, bilaterally attenuated retinal blood vessels and retinal pigmentary changes. There were no signs of diabetic retinopathy. The patient was obese, with basal metabolic rate (BMR) of 27. The other peculiar feature was the presence of polydactyly (hexadactyly) in all four limbs. Syndactyly was present in his right hand (Figure-2).

The second patient was 42-years-old diabetic and obese male. He was mentally challenged. His best corrected vision was 20/120. Fundus showed features of retinal pigment dystrophy. Polydactyly was seen in all four limbs. Syndactyly was present in right foot (Figure-3).

The third patient was 38-years-old male, and had the best corrected vision of 20/240, with features of retinal pigment dystrophy. He was also obese and diabetic. Brachydactyly was present in upper
The fourth patient, 35-years-old male with best corrected vision of 20/120, had retinal pigment dystrophy. He was also obese and diabetic. Like his other siblings, he also had polydactyly in all the limbs and brachydactyly in upper limbs (Figure-5).

On the basis of history and examination, these patients were diagnosed clinically as cases of BBS.

In any of these patients, there was no history related to any symptoms in genito-urinary system. No history of consanguineous marriage in the family was revealed.

**Discussion**: A family of four siblings with retinal dystrophy, obesity, spastic paraparesis and cognitive deficit was first described in 1866 by Laurence and Moon described. Later, Bardet and Biedl reported similar presentation in patients, who additionally had post-axial polydactyly, describing the condition as Laurence–Moon–Bardet–Biedl syndrome. The allelic nature of these two conventionally divided syndromes, viz. Laurence–Moon syndrome and Bardet–Biedl Syndrome (BBS), is suggested by the considerable overlap in their phenotype. Now BBS is the commonly used standard term for this condition.

The prevalence of BBS varies markedly between populations. The prevalence is reported to be 1:160000 in north European population, whereas in isolated communities in Kuwait, the prevalence is reported to be 1:13500. Higher prevalence is reported from the populations where a higher level of consanguinity prevails. In India, the exact prevalence is not known, not only due to rarity of the conditions, but also to the paucity of its reporting to hospitals. Less than 15 cases of BBS have been reported in Indian population, and to the best of our knowledge no case of more than two siblings has been reported.

Clinically the diagnosis of BBS was made, fulfilling primary and secondary criteria for diagnosis. Further, genetic testing of the patients was also planned.

The diagnosis of BBS is mainly based on careful clinical examination. The existence of a nosological entity is demonstrated by occurrence of similar cases within a family. Molecular confirmation of the diagnosis can be obtained in nearly 80% via direct sequencing of the BBS genes.

BBS is generally inherited in an AR manner. Cases of triallelic inheritance have also been reported, but these cases are difficult to identify and account for less than 10% of all cases. Therefore conventionally, the patients and their families are counselled according to the AR recurrence risk. Hence, any sibling of an affected child has a 25% risk of being affected, 50% risk of being an asymptomatic carrier and 25% of being unaffected and not a carrier.
This case of four siblings is reported for its rarity and exemplifies the need for multidisciplinary management in such cases along with genetic counselling. In general, BBS patients are social and happy persons, therefore a non-discriminatory and friendly attitude toward them should be adopted by their family and the society, so that their quality of life may be improved.

References:
5. Laurence JZ, Moon RC. Four cases of retinitis pigmentosa occurring in the same family, and accompanied by general imperfections of development. Obes. Res. 1995; 3:400–403.

Contd. from pg.7

### Teaching & Training Programmes

**Venu Eye Institute & Research Centre, New Delhi**

#### A. Medical Teaching Programmes

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Programme</th>
<th>Duration</th>
<th>No. of seats</th>
<th>Course Fee per candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>DNB(Primary)</td>
<td>3 years (July each year)</td>
<td>Three</td>
<td>₹ 70,000/year</td>
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<tr>
<td>2.</td>
<td>DNB (Tutor)</td>
<td>2 years (July each year)</td>
<td>Three</td>
<td>₹ 70,000/year</td>
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#### B. Medical Training – Long Term

<table>
<thead>
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<th>Programme</th>
<th>Duration</th>
<th>No. of seats</th>
<th>Course Fee per candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Intensive IOL Fellowship</td>
<td>1.5 years</td>
<td>Six</td>
<td></td>
</tr>
<tr>
<td>2. Oculoplasty</td>
<td>2 years</td>
<td>Two</td>
<td></td>
</tr>
<tr>
<td>3. Glaucoma</td>
<td>2 years</td>
<td>Two</td>
<td></td>
</tr>
<tr>
<td>4. Cornea</td>
<td>2 years</td>
<td>Two</td>
<td></td>
</tr>
<tr>
<td>5. Vitreo-retina Fellowship</td>
<td>2.5 years (6 months Sub Speciality)</td>
<td>Two</td>
<td></td>
</tr>
<tr>
<td>6. Comprehensive Ophthalmology Fellowship</td>
<td>2 years</td>
<td>Two</td>
<td></td>
</tr>
<tr>
<td>7. Cornea &amp; Refractive Surgery Fellowship</td>
<td>2 years</td>
<td>Two</td>
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#### Medical Training – Short Term

<table>
<thead>
<tr>
<th>Programme</th>
<th>Duration</th>
<th>No. of seats</th>
<th>Course Fee per candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ECCE with IOL Implantation</td>
<td>1 month</td>
<td>Two</td>
<td>₹ 25,000</td>
</tr>
<tr>
<td>2. SICS</td>
<td>1 month</td>
<td>One</td>
<td>₹ 30,000</td>
</tr>
<tr>
<td>3. Phacoemulsification</td>
<td>1 month</td>
<td>One</td>
<td>₹ 40,000</td>
</tr>
<tr>
<td>4. Advanced Phacoemulsification</td>
<td>15 days</td>
<td>One</td>
<td>₹ 30,000</td>
</tr>
<tr>
<td>5. Medical Glaucoma</td>
<td>2 months</td>
<td>One</td>
<td>₹ 20,000</td>
</tr>
<tr>
<td>6. Medical Retina</td>
<td>2 months</td>
<td>One</td>
<td>₹ 20,000</td>
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#### Workshop (Periodical)

<table>
<thead>
<tr>
<th>Programme</th>
<th>Duration</th>
<th>No. of seats</th>
<th>Course Fee per candidate</th>
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<tbody>
<tr>
<td>1. Contact Lens</td>
<td>3 days workshop (June / December)</td>
<td>12</td>
<td>₹ 6,000</td>
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<tr>
<td>2. Basic clinical low vision</td>
<td>3 Days (1st week of January &amp; July)</td>
<td>12</td>
<td>₹ 6,000</td>
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#### Paramedical Training – Short Term

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<thead>
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<th>Duration</th>
<th>No. of seats</th>
<th>Course Fee per candidate</th>
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</thead>
<tbody>
<tr>
<td>1. Eye Bank Technician’s Training Course (Basic)</td>
<td>Three months</td>
<td>02</td>
<td>No fee</td>
</tr>
<tr>
<td>2. Eye Donation counsellor’s Training Program</td>
<td>One month</td>
<td>02</td>
<td>No fee</td>
</tr>
<tr>
<td>3. Instrument Maintenance Course</td>
<td>Six weeks</td>
<td>2</td>
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#### Observership

<table>
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<th>No. of seats</th>
<th>Course Fee per candidate</th>
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</thead>
<tbody>
<tr>
<td>1. Eye Bank Observership for Medical Directors</td>
<td>One week (3rd week of every month)</td>
<td>One per course</td>
<td>No fee</td>
</tr>
<tr>
<td>2. Eye Bank Observership for Eye Bank Managers</td>
<td>One week (3rd week of every month)</td>
<td>One per course</td>
<td>No fee</td>
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#### Customized Courses

<table>
<thead>
<tr>
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<th>Duration</th>
<th>No. of seats</th>
<th>Course Fee per candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Refresher course for Optometrists</td>
<td>2 weeks</td>
<td>5</td>
<td>₹ 6,000</td>
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<tr>
<td>2. Foreign graduate observation programmes</td>
<td>1 month</td>
<td>2</td>
<td>US$ 250</td>
</tr>
</tbody>
</table>

For further queries, kindly contact at education@venueyeinstitute.org or write to The HoD, Teaching & Training Department, Venu Eye Institute & Research Centre, 1/31, Sheikh Sarai –II, New Delhi -110017, Ph. No. 91-11-29252417, 29251155/56, Fax No. 91-11-29252370
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- Squint
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- Oculoplasty
- Contact Lens
- Cataract
- Neuro Ophthalmology

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