"STUDY OF THE VISUAL OUTCOME AND COMPLICATIONS OF SCLERAL FIXATED POSTERIOR CHAMBER INTRAOCULAR LENS IMPLANTATION"

By

DR. SANGEETHA. T

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MASTER OF SURGERY

IN

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Under the guidance of

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LIST OF ABBREVATIONS

SL NO	ABBREVATIONS	FULL FORM
1	AC IOL	Anterior chamber intraocular lens
2	AC	Anterior chamber
3	BCVA	Best corrected visual acuity
4	CF	Counting finger
5	CME	Cystoid macular edema
6	ECCE	Extra capsular cataract extraction
7	IOL	Intraocular lens
8	ICCE	Intracapsular cataract extraction
9	PAS	Peripheral anterior synechiae
10	PC	Posterior capsule
11	PMMA	Poly methyl methaacrylate
12	PC IOL	Posterior chamber intraocular lens
13	SF IOL	Scleral fixated intraocular lens

ABSTRACT

BACKGROUND

Transscleral sulcus fixation of posterior chamber intraocular lens is the preferred surgery in aphakic eyes as the anterior chamber intraocular lens and iris fixated lens are associated with various complications. It offers a superior optical rehabilitation to aphakic patients when compared to contact lenses or aphakic glasses.

METHODS

It is a hospital based prospective study of 50 patients with aphakia and cataract attending R.L. Jalappa Hospital and Research centre, Tamaka, Kolar.

OBJECTIVES

To study the visual outcome, intraoperative and postoperative complications of scleral fixated posterior chamber intraocular lens implantation in aphakic eyes.

RESULTS

Twenty eight eyes (56%) had good vision in the range of 6/6 – 6/12, eighteen eyes (36%) had better vision in the range of 6/18 –6/24 and four eyes (8%) had vision in the range of 6/36 – CF. Among the 4 patients, 1 had less vision (CF 3m) due to persistent corneal edema, 1 patient had persistent secondary glaucoma and 2 had CME.

The most common early postoperative complications noticed were Iritis in 9(18%) eyes, followed by Secondary glaucoma in 8 (16%) eyes, Striae keratopathy in 5 (10%) eyes & Hyphaema in 5 (10%) eyes, all of which resolved with postoperative medications over a period of 2 weeks. Hyphaema resolved within 3-7 days in all the cases.

And the late complications were Cystoid macular edema in 5(10%) eyes, Suture erosion in 3 (6%) eyes, Mild lens tilt/mild decentered IOL in 2 (4%) eyes, subluxated IOL in 1(2%) patient and persistent corneal edema in 1 (2%) eye. IOL tilt which occurred in 2 cases (4%) developed significant astigmatism in one case only.

CONCLUSION

Hence we studied the safety, efficacy and stability of scleral fixated PC-IOL with the Ab – Externo four point technique. More than 50% of the cases in our series achieved a postoperative visual acuity of 6/6-6/12. Only two of the cases developed IOL tilt which was attributed to lose sutures and slippage. But significant astigmatism was noted only in one case. And one patient had persistent corneal edema even at the end of sixth month follow up probably due secondary glaucoma.

Thus we conclude that the Ab –Externo scleral fixated PC IOL was found to have stable implantation and a true posterior chamber location in eyes having no capsular or zonular support with a low intra and post-operative risk profile. This technique showed favourable postoperative visual outcome in aphakic eyes.

KEYWORDS: Aphakia, absence of capsule support, intraocular lens, ACIOL, PC IOL, Iris fixation, sclera fixation, secondary intraocular lens implantation.

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INTRODUCTION

INTRODUCTION

Cataract surgery has become the most commonly performed intraocular procedure worldwide, with constantly improving outcomes. Earlier the intracapsular technique was popular until the 1980s, which had no provision for support of an intraocular lens (IOL) by the lens capsule. Planned extracapsular cataract extraction (ECCE) with posterior chamber intraocular lens (PC-IOL) implantation became more widespread[1] and is the "Gold Standard" procedure for managing cataracts.

Refinements in surgical techniques have given way to newer techniques like manual small incision cataract surgery and phacoemulsification with, in-the-bag PC–IOL implantation which have become the procedure of choice in the management of cataracts. The essential pre-requisite for PC-IOL implantation is the presence of adequate capsulozonular support and ideally the IOL is placed in the capsular bag, which affords stable fixation at a position closest to the nodal point of the eye.

However, in the absence of this support it becomes a great challenge for a surgeon, who is faced with many decisions including when to implant the intraocular lens and which type of intraocular lens should be implanted leaving the patient aphakic (absence of crystalline lens in the pupillary area).

The lens capsule is the basement membrane of the lens epithelial cells. It is supported by the zonules which arise as multiple fine fibrils from the pars plana and also have attachment to the ciliary processes.[2] With limited zonular dehiscence, IOL placement in the capsular bag with a stabilizing capsular tension ring (CTR) may be possible. It would also be possible for placement of an IOL in the bag if there has only been a small posterior capsular tear, a longstanding post-traumatic tear with fibrosed edges[3], or a continuous posterior capsulorrhexis.

Alternatively, PC-IOL can be placed in the ciliary sulcus[4,5] without any additional support in the presence of less than 3-mm lens subluxation if the anterior capsular rim is intact.[6] If there is less capsular support present than described, an alternative method of IOL implantation needs to be considered.

Visual rehabilitation in an aphakic patient includes different modalities like spectacles, contact lens, IOL implantation and refractive corneal surgery. Although the postoperative correction of surgical aphakia with spectacles or contact lenses remains the standard of care, secondary IOL implantation provides favourable visual outcome offering superior visual rehabilitation in comparison to aphakic spectacles or contact lens, as these lenses have many advantages over both of these techniques.

They permit a better elimination of perceptual problems and reduce image size disparity. Hence implantation of intraocular lenses has become the standard procedure in the aphakic eyes.

CAUSES OF LOSS OF CAPSULAR AND ZONULAR SUPPORT

1. Excessive pressure during manual nucleus expression through an overly small incision.
2. An anterior capsule tear present after can-opener capsulotomy may extend posteriorly if a capsular tag is caught during irrigation-aspiration and pulled.
3. The posterior capsule may also be directly caught in the irrigation aspiration probe.
4. Direct trauma may occur during IOL insertion.
5. In large-incision ECCE, manual nucleus expression is performed by pressing the globe and increasing intravitreal pressure. The whole lens is pushed forward with the zonules.[2]

If a capsular opening is too small or the nucleus too big, this force may exceed the tension tolerated by the zonules leading to zonular dehiscence.

6. During hydrodissection, excessive build up of intracapsular fluid without adequate decompression may result in capsular rupture.
7. The posterior capsule may also be directly torn by accidental aspiration into the phacoemulsification probe or during aspiration of soft lens matter.
8. Zonular damage during phacoemulsification may occur during various nuclear maneuvers. Excessive separation of nuclear fragments during cracking causes traction on the zonules perpendicular to the direction of the cracking forces.
9. Inadequate hydrodissection and excessive force in attempting to rotate the nucleus are known to cause zonular ruptures.
10. Insufficient power during sculpting results in excessive lens rocking and zonular dehiscence.

OPTICS OF APHAKIA

The lens is important in refraction and hence its removal results in considerable changes mentioned below:

1. Decrease in the refractory power of the eye from +60D to +44D
2. The eye becomes highly hypermetropic.
3. The anterior focal point becomes 23.2mm in front of the cornea.
4. The posterior focal point lies 7mm behind the eyeball.
5. The power of accomodation lost.
6. Aniseikonia of 30% is detrimental to binocular vision due to anisometropia resulting in suppression amblyopia and subsequent squint.

Clinical features

Symptoms

1. Defective vision for both distant and near – due to high hypermetropia and loss of accommodation.
2. Erythropsia and cyanopsia – due to entry of infrared and ultraviolet rays in the absence of the crystalline lens.

Signs (anterior to posterior)

1. Limbal scar in case of surgical aphakia.
2. Deep anterior chamber.
3. Iridodonesis – tremulousness of the iris due to loss of support of lens.
4. Jet black pupil.
5. Loss of 3rd and 4th Purkinje's images.
6. Fundus examination reveals a small hypermetropic disc.
7. Retinoscopy reveals high hypermetropia.

Treatment: different modalities for correcting aphakia include:

1. Spectacles
2. Contact lens
3. Intraocular lens
4. Refractive surgery

1. SPECTACLES

Spectacles should be prescribed with about +10D lens for correction of aphakia along with correction for surgical astigmatism and +3 D for near vision in previously emmetropic eye.

Advantages

- Cheap
- Easy & safe method to use
- No complications

Disadvantages

- The images are magnified – about 30% – hence not useful in unilateral aphakia as it causes diplopia
- Restricted field of vision (50^0 all around)
- Spherical and chromatic aberration of high power lenses
- Prismatic aberration produces Roving ring scotoma (Jack in the box phenomenon)
- Colored hue in the vision due to the absence of natural filter of crystalline lens.
- High power glasses are cosmetically not acceptable and cumbersome to use as they are thick and heavy.

2. CONTACT LENSES

Advantages (over spectacles):

- Produces less magnification of image
- Wider and better field of vision
- Less chromatic and spherical aberration
- No aberrations & prismatic effect of thick glasses.
- Cosmetically more acceptable

Disadvantages:

- Costly & cumbersome to wear especially in children & old age.
- Corneal complications related to use of contact lenses

3. SECONDARY INTRAOCULAR LENS IMPLANTATION

This is the best preferred method of correcting aphakia nowadays as it eliminates most of the disadvantages associated with the use of spectacles or contact lenses. The lens can be implanted in the anterior chamber, iris supported or in the posterior chamber.

Advantages:

- Elimination of perceptual problems & reduces image size disparity.
- Preserves the anatomical position of the lens when implanted behind the iris.
- Eliminates all difficulties of applying and removing contact lens.
- Advantageous for those working in unusual environments.

Disadvantage: The complications associated with surgery.

4. REFRACTIVE SURGERY – This is a newly emerging treatment for aphakia which is under trial.

a. Keratophakia : a lenticule prepared from the donor cornea is placed within the lamellae of the patient's cornea.
b. Epikeratophakia : a lenticule prepared form the donor cornea is stitched to the patients cornea after removing the epithelium.
c. Hyperopic Lasik

Considering the drawbacks of aphakic correction with different modalities, IOL implantation at the time of accidental posterior capsule tear during cataract surgery or in an aphakic eye has attracted a lot of attention in recent years and is universally preferred over aphakic spectacles or contact lenses as a method for visual rehabilitation in aphakic eyes.[7]

Advantages of primary over secondary IOL implantation include the avoidance of a secondary operation, a shorter hospital stay, and faster visual rehabilitation.

The surgical options for secondary intraocular lens implantation in aphakic eyes include:

1. Angle fixated anterior chamber intraocular lenses (AC –IOLs)
2. Iris fixated intraocular lenses (IF- IOLs).
3. Scleral fixated intraocular lenses (SF -IOLs)

ANTERIOR CHAMBER INTRAOCULAR LENS

- Since the first implantation of an AC IOL in 1952 by Baron, many modifications have been made in its design. Most commonly used design is the flexible open loop AC IOLs, which have a lower rate of complications compared to closed loop or open 'C' loop lenses.
- Placing an anterior chamber intraocular lens in aphakic eyes have been discouraged due to the following factors:

Advantages

1. Single plane allows closed chamber insertion.
2. Small incision allows insertion in AC with positive pressure.
3. Positive centration of the haptic with no late dislocation.
4. No dislocation into the vitreous unless there is severe trauma.
5. No sutures related problems like erosion, infection etc.
6. The entire lens is visible for examination to monitor its tolerance by the eye.

Complications

1. Corneal edema due to endothelial damage- corneal edema is still one of the most common causes of a poor result in modern secondary ACIOL implantation. Apple postulates that subclinical uveitis caused by lens tissue contact liberates products of inflammation, which can be directly toxic to the endothelium.[8]

2. Glaucoma: The placement of ACIOL haptics in the AC angle poses the possibility of trabecular meshwork damage, angle fibrosis and even PAS formation. With diminished aqueous outflow, IOP would increase together with the incidence of secondary glaucoma.
3. Uveitis Hyphaema Glaucoma syndrome: disruption of the anterior hyaloid face and vitreous spilling into the AC results in pupillary occlusion and obstruction of a peripheral iridectomy, pupil block glaucoma. A large amount of anterior chamber vitreous may also obstruct the trabecular meshwork. Persistent vitreous traction or chafing against uveal tissues causes chronic uveitis, which may lead to secondary glaucoma.
4. Iris tuck: Iris tuck is defined as posterior bowing of the iris caused by pressure from an AC-IOL haptic. This would cause secondary ovalization of the pupil. This occurs due to oversized lenses or incorrect IOL insertion at surgery.

   During the IOL insertion, there is the possibility that a small part of the underlying iris may be caught and pulled peripherally which results in excessive uveal-IOL contact, causing possible pain and uveitis.
5. Lens dislocation: Erosion of the haptic into the ciliary body or angle recession may occur if the AC-IOL is oversized.
6. Cystoids macular edema: Causes of CME following cataract surgery include mechanical (vitreous strands or iris in the wound), iatrogenic (instillation of adrenaline or derivatives), inflammatory, or physical (ultraviolet photic damage) factors.[9]
7. Pseudophakic bullous keratopathy

AC IOL is contraindicated in extensive damage to the iris and anterior chamber angle, Pre-existing glaucoma, Peripheral anterior synechia (PAS), Low endothelial cell count and Shallow anterior chamber.[10]

IRIS FIXATED INTRAOCULAR LENS

A. IRIS CLAW LENS

Sutureless iris fixation may be accomplished in the setting of specially designed IOLs by Binkhorst and Epstein In the late 1950s, in which haptics are replaced by an "iris claw." During enclavation, a small knuckle of iris tissue is captured by the fixation hole or "claw" located on either side of the lens.

Key parts of the procedure include the use of:

(1) Miotic to maximally constrict the pupil leading to better exposure of iris tissue,

(2) Viscoelastic to create space and minimize corneal endothelial trauma,

(3) A second instrument to stabilize the body of the lens while the enclavation needle is used to fixate the IOL.

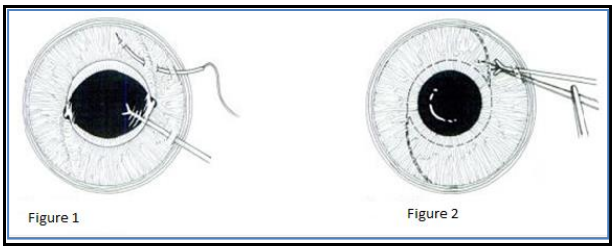
(4) Peripheral iridotomy.

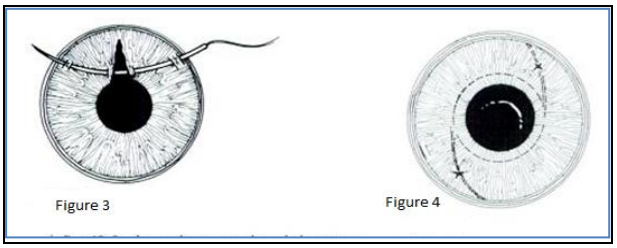
Procedure:

1. 3 and 9 o'clock paracenteses are made.
2. A superior sclerocorneal incision is made, and anterior vitrectomy performed, if necessary.
3. Acetylcholine is injected followed by viscoelastic.
4. The lens is inserted and positioned.
5. The mid peripheral iris is grasped with forceps and pulled through the claws at the 3 and 9 O'clock positions.
6. A peripheral iridectomy is performed, viscoelastic is removed and the wound is sutured.

B. <u>HAPTIC SUTURE FIXATION TO IRIS</u>

McCannel in 1976 described his method of iris suturing which has been used for securing a PCIOL to the iris.[11]





The initial steps (1-4) are same as above.

5. A single armed 10-0 polypropylene suture on a CIF or CTC needle (Ethicon) is passed through peripheral cornea, iris, under the haptic and back through iris and peripheral cornea.
6. After cutting off the needle, both suture ends are retrieved through a paracentesis with a Sinskey or Lester hook. The suture ends are tied and cut at the paracentesis and the iris pushed back into place.
7. After this, it is repeated at the other haptic, the optic is repositioned behind the iris.
8. The main incision is closed after viscoelastic removal.

<u>Advantages of iris sutured IOL</u>:

Easy implantation and a true posterior chamber location

Disadvantages:

Corneal edema, endothelial decompensation, iris chafing, pupillary constriction, uveitis, posterior synechiae formation, secondary glaucoma, excessive iris damage, sphincter damage, disenclavation and CME.

To avoid these complications and still achieve a posteriorly placed lens position, scleral fixation of posterior chamber intraocular lens to the ciliary sulcus are commonly used which have good visual outcome and less complications.

SCLERAL FIXATED PC IOL

The scleral fixated posterior intraocular lens, by virtue of its anatomical location in the eye, offers numerous advantages over the AC-IOL in certain patients but is technically more difficult and time consuming. They may be used in patients with diabetes, glaucoma, CMO, peripheral anterior synechiae, Fuch`s endothelial dystrophy and a low endothelial cell count.[12,13,14] They may also be more appropriate in the younger patient with a relatively long expected life expectancy.[15]

Advantages:

1. Preserves the corneal endothelial cells
2. Reduces the risk of injury to the iris and ciliary body
3. Produces stable long term fixation of PC-IOL.
4. It is implanted in the same plane as the crystalline lens.
5. Does not interfere with the pupillary function or AC anatomy hence optically physiological.
6. Avoids all the complications noticed with AC IOL and Iris sutured or iris claw lens implantation mentioned earlier.

Disadvantages:

Technically demanding surgery and requires elaborate skills and meticulous intraocular manipulation like anterior vitrectomy, which may be difficult to perform in a stressful situation in the primary setting as a complication has already taken place.

COMPLICATIONS

Intraoperative:

1. A too large limbus based conjunctival flap is a hindrance to the surgery
2. Hyphaema: from conjunctival or episcleral vessels
3. Descemet membrane detachment
4. Expulsive haemorrhage
5. Vitreous loss

Early post operative:

1. Corneal edema
2. Striae keratopathy
3. Secondary glaucoma
4. Cystoid macular edema
5. Endophthalmitis

Late complications:

1. Corneal endothelial decompensation due to loss of endothelial cells during surgery.
2. Pseudophakic Bullous keratopathy
3. Adhesions between lens and iris
4. Suture erosion
5. Tilted or decentred IOL due to suture erosion and loose sutures causing glare.

6. Fibrin reaction to suture material
7. Iris atrophy due to manipulation during surgery
8. Retinal detachment

In this research work, we tried to study the post-operative visual outcome and complication rate in cases where scleral fixated PCIOL implantation was done.

AIMS AND OBJECTIVES

AIMS AND OBJECTIVES

1. To assess the visual outcome in Scleral fixated posterior chamber intraocular lens implantation in aphakic eyes.
2. To study the intraoperative and postoperative complications of scleral fixated posterior chamber intraocular lens implantation in aphakic eyes.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The development of the intraocular lens (IOL) has been one of the most important achievements in ophthalmology. Perhaps the most dramatic example of the benefit of an IOL is the case of an aphakic patient (secondary IOL implantation), particularly the monocular aphakic patient.

Secondary IOL implantation refers to IOL insertion at a time remote from the initial cataract extraction. Most often, secondary IOL implantation is performed on a patient who had a previous unilateral cataract extraction and is now contact lens intolerant. Monocular aphakic spectacle correction is generally not acceptable because it induces anisometropia, creating an image size disparity as great as 25-30%.

Although there are a variety of surgical methods for correcting aphakia, secondary IOL implantation is often the best solution. There are four different types of IOLs in use today: anterior chamber IOLs, iris-fixated IOLs, posterior chamber IOLs (PC IOLs), and sulcus-fixated IOLs.

As a result of the myriad complications experienced with the older designs of anterior chamber lenses, many ophthalmologists are still hesitant to use these types of lenses. Recent studies of anterior chamber IOLs show that although closed-loop designs are associated with multiple complications, the newer, open-loop models have a much lower rate of complications. Thus, anterior chamber lenses could play a useful role in secondary lens implantation. Iris-sutured lenses have been associated with a variety of complications, including corneal edema, CME, posterior synechiae formation, excessive iris damage, sphincter damage, endothelial decompensation.

Secondary PC –IOLs are often placed in the ciliary sulcus because the capsular bag is usually collapsed and fibrotic at the time of secondary IOL implantation. There are a few caveats to consider when thinking about the option of a PC IOL.

First, synechiae between the posterior iris and the capsule are often present and may lead to decentration or even impede insertion of the loops of the PC IOL. Sometimes, the surgeon can dissect some of the adhesions with a blunt spatula or fine microscissors. When the synechiae are extensive, however, it may be easier to alter the approach, attempting instead an anterior chamber IOL insertion.

Potential complications of the ciliary sulcus placement of lenses are decentration, pupil capture, pseudophakic posterior iris chafing syndrome and alteration of the blood aqueous barrier.

The posterior chamber is the normal anatomic position of the human lens. Thus, placement of the IOL in the posterior, rather than the anterior, chamber reduces the afore mentioned complications. In addition, positioning the lens closer to the rotational center of the eye, just anterior to the vitreous face, may reduce the centrifugal forces on the lens and stabilize the ocular contents, thereby decreasing the probability of complications such as iritis, CME, and retinal detachment. Another advantage of positioning the lens closer to the nodal point and center of rotation of the eye is the superior optical properties accrued by the lens in this position.[16] In the eye without an intact posterior capsule, however, a PC IOL can be inserted only if it is sutured to the sclera.

Hu and Cowden[17], **Agapitos and Lindstorm**[18] have described various techniques for suture fixation of PC IOL implants to the sclera in the absence of adequate capsulozonular support. Trans-sclerally sutured lenses are stabilised by the fixation sutures and the presumed placement of haptics in the ciliary sulcus. Increased clinical experience with these IOLs has shown that they are well tolerated in the eye although a variety of associated complications have been described.

HISTORY OF SECONDARY INTRAOCULAR LENS IMPLANTATION

For years secondary intraocular lens implantation especially after ICCE was considered to be a dangerous procedure, much more so than the primary procedure. Hardenbergh implanted a considerable number of Binkhorst four loop lenses as secondary implants in the year 1977 and developed a technique that proved to be safe and effective. Choyce (1982) had performed secondary AC IOL after a successful ICCE three months prior to it.

Malbran et al first reported transcleral sulcus fixation of PC IOLs in aphakes post ICCE in 1986.[19] PC IOLs can also be sutured at the pars plana.[20,21] Even though most PC IOLs can be sutured via their haptics to the sclera with square knots or slip knots, there are several specialized haptic designs, which facilitate this manoeuvre. These include haptics with an enlarge end to avoid suture slippage. If this is not present, the enlargement can be created by heating the haptic end gently with a cautery device.

However, this voids the warranty and creates a rough surface. Various holes or eyelets that allow passage of a suture through the haptic have also been developed to reduce potential suture movement or instability. In addition, eyelets allow particular types of suture fixation as described below. Commonly used PC IOLs include the ALCON CZ70BD (Alcon, Fort Worth, Texas), Bausch and Lomb 6190B (Bausch and Lomb, San Dimas, California) and Pharmacia U152S (AMO, Santa Ana, California), which have one eyelet on each haptic. The Opsia (Chauvin Opsia, Labege Cedex, France) Grenat IOL has two eyelets on each haptic and has been used in a variation of **Lewis' flap free technique[22] by Cordoves et al.[23]**

Teichmann designed an IOL with haptics which had two holes drilled 2mm apart. This allows a continuous loop, four-point fixation technique without inducing torque.

For pars plana fixation, a PC IOL must have an increased diameter of about 17mm with an optic diameter of about 7mm. backward angulations of the haptics allows the optic position to be closer to the original lens position. The 'A' constant would then be similar for in-the-bag placement.[24]

Several needles are available for suturing PC IOLs. The Ethicon TG-160-2, Ethicon CIF-4, and Ethicon STC-6 (Ethicon, Somerville, New Jersey) can be used for Ab interno methods. The STC-6 straight needle is also otften used in Ab externo methods. Pannu designed a long curved needle with a hole at the sharp end.[25] In general 10-0 polypropylene has been the suture material of choice. Owing to recent concerns about the durability of this suture, there has been increasing use of 9-0 polypropylene and other suture material such as Gore-Tex for the transscleral fixation of PC IOLs.

TECHNIQUES OF SCLERAL FIXATION OF IOL

The aim in the most commonly used techniques is to place these lenses into ciliary sulcus, although the final position is not entirely predictable because it is often undertaken as a blind procedure. With respect to technique, there are several stages in the procedure where significant variations have been described.

1. The method of introducing suturing needles –Ab externo or Ab interno
2. The method of securing the haptic with the fixating suture
3. The number of points of PC IOL fixation
4. The method of avoiding suture /knot erosion

Originally, suturing techniques involved passing the needle from inside to outside the eye. Although this method may be quicker and is easier when penetrating keratoplasty is performed concomitantly, it is a blind procedure.[26]

More recently the lenses have been sutured via an Ab externo technique as described by Lewis.[27] This is also undertaken blindly in that the intraocular exit point of the needle is unseen, but by knowing the entry point, sulcus positioning of the suture may be more predictable.[28,29]

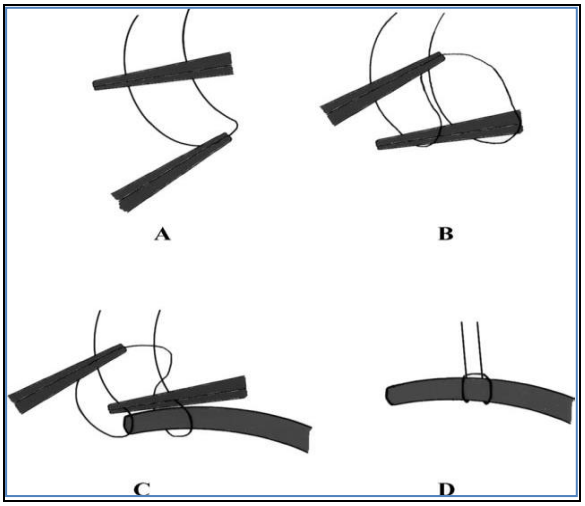
With the Ab externo technique, the AC should remain closed during needle passes. This avoids collapse of the ciliary sulcus in the hypotonus eye, thus facilitating accurate suture placement.[30] It also avoids the risk of catching vitreous with the needle and incarcerating it at the fixation points.[31]

In eyes with an increased tendency toward globe collapse (e.g.,low scleral rigidity, small palpebral fissures, Oriental eyes) performing anterior vitrectomy via the pars plana and utilizing a scleral tunnel instead of corneal incision are other measures that help preserve globe integrity during suture placement.[32]

PC IOL haptics can be secured by looping a suture over the haptic and tying several square knots[33], by using a slipknot[34], or by using a girth hitch.[35,36] If a haptic eyelet is present, it could also be secured by a suture loop with the knot initially tied outside the eye, then rotated and buried in a second maneuver.[22] Asymmetrical suture placement in this method may produce a net torque on the haptics and tilting of the IOL optic.

Teichmann and Teichmann demonstrated four perfect ways of threading a suture through the hapitic eyelet for tying in this manner. To avoid suture-induced tilt, the surgeon needs to thread corresponding sutures 180^0 apart in a symmetrical fashion through the two eyelets, either from above down or from below up.[37]

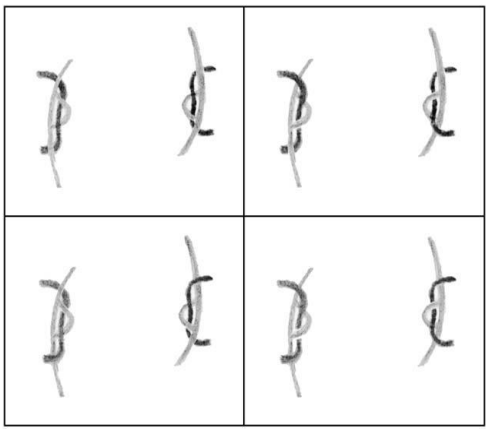
TYING THE GIRTH HITCH



A and B: A suture loop is bent over closed forceps.

C: While holding the tip of the loop with one pair of forceps, the other forceps pulls the two proximal suture strands through the loop. This creates two other laterally disposed loops through which the PC IOL haptic is placed.

D: A girth hitches securing an IOL haptic.



Four perfect ways of threading a suture through the haptic eyelet for suture fixating a PC IOL according to Lews' flapless technique.

Alternatively the suture could be passed through two seperate holes in the haptic before fixation as described by Teichmann.[21] In general, this method or the use of a girth hitch may provide better stability against rotation via two-point fixation of each haptic.

Malbran et al's original technique employed two point scleral fixations. Subsequently 1,3 & 4 point fixation techniques have been described.[22,38 – 42] Although more points of fixation allow greater stability with less risk of decenteration and tilt, this must be balanced against the vitreous cavity. Wherever possible, capsule remnants should be used for IOL support and this may even be sufficient to allow one-point scleral fixation.

Knowing the patient's history, especially of the mechanism of trauma or type of surgery previously undertaken is helpful in anticipating the amount and location of remnants. On the other hand, if the zonules are known to be weak from pre existing ocular disease, it should be prudent to rely more on sutures rather than capsular remnants. Prior to IOL implantation, an attempt should be made to determine the amount of usable capsule.

Viscoelastic can be injected both above and below the iris, the latter helping to free up iris –capsular adhesions. A Kuglen hook is used to push the iris more peripherally to expose the capsular remnants. In the presence of tenacious adhesions, blunt and sharp dissection can be used in addition to viscoelastic to seperate capsular remnants from the iris and create a space for the IOL haptic. In general, anterior capsular remnant at 3 O' clock hour provides adequate support for one haptic.

To avoid erosion of the knots through conjunctiva, scleral flaps can be used to cover knots [23,43,44,45] or they can be rotated into sclera tissue without flaps.[22] Besides this, the suture loops are sometimes left long and Tenon's and conjunctiva sutured over them. [33,46] Mittelviefhaus and Wiek described posteriorising the knot after closure of the corneoscleral wound. At the exit point of the needle, a partial thickness radial slit is cut and the needle then inserted at its peripheral end.

The needle is brought intrasclerally to a point 4-5mm posterior to the limbus where another scleral bite is taken and the suture tied to itself .[47] The knots were thus covered with thicker posterior Tenon's capsule and conjunctiva.

Prior to introducing and suturing the PC IOL, a **generous anterior vitrectomy** should be performed to avoid vitreous traction.[12] This should clear vitreous especially around the areas of suture insertion, also termed the anterior vitrectomy skirt. The vitrectomy can be performed either via the corneoscleral wound (for IOL introduction) or pars plana. In general, the use of a non peristaltic pump is preferred.

Traditionally, vitrectomy in such situations was performed via the incision for the phacoemulsification probe. A vitreous cutter with coaxial infusion was employed. However, the infusion jet exited very near the cutting end of the probe, tending to hydrate and disturb vitreous in the anterior chamber and potentially causing more vitreous to prolapse. Seperating the infusion and cutting fuctions using a two –port (anterior approach) or three –port (pars plana approach) technique minimizes this.

The identification of residual vitreous strands can be the use of a fibreoptic light pipe, the introduction of an air bubble and sweeping inward around the pupil looking for any simultaneous movement of the pupil margin. Recently, the use of a triamcinolone suspension to visualize prolapsed vitreous was described.[48]

INDICATIONS:

1. Primary or secondary cataract surgery with inadequate capsular support.
2. Aphakia in one eye and pseudophakia in the other eye.
3. Cases of intraocular lens exchange for a dislocated or subluxated IOL
4. Cases with peripheral anterior synechiae or insufficient iris tissue to support AC IOL
5. Inability to adjust to aphakic glasses.
6. Intolerance to contact lenses.
7. Secondary implantation in case of keratoplasty in an aphakic patient.

CONTRAINDICATIONS:

Absolute: 1. Uncontrolled glaucoma

2. Acute uveitis

Relative: 1. Shallow AC

2. Posterior synechiae

TECHNIQUES

Numerous techniques are available to suture an IOL in a stable position. The following techniques with variations are described below:

A. AB INTERNO TECHNIQUE

1. Classical AB Interno (one –point fixation)
2. Classical AB Interno (two –point fixation)
3. Classical AB Interno (four –point fixation)

B. AB EXTERNO TECHNIQUE

1. Classic AB Externo (two –point fixation)
2. Small incision AB Externo
3. Modified AB Externo four point technique for sutured IOLs

General considerations:

1. The two key issues with any technique are:
    a. Proper positioning and the stability of the lens to avoid lens rotation and therefore induced refractive error.
    b. Suture placement and durability to avoid long term suture breakage, which can lead to a dislocated IOL and to avoid postoperative pain from too tight knot.
2. Technique for suturing PC IOL
    a. Lens used is a Bausch & Lomb Model 6190B one piece PMMA with optic size 6.50mm, biconvex, 12.75mm in length displaying haptics with two midloop eyelets.
    b. Either 50% thickness limbal based triangular scleral flaps or circumferential 60% thickness scleral incisions are created, centred at the 3 and 9 o'clock positions.
    c. For small pupil: Flexible iris retractors are placed at 2, 4, 8 and 10 O'clock via limbal incisions created with a sharp blade, and the pupil is dilated widely.
    d. If the eye has not previously undergone vitrectomy, a conventional three port vitrectomy is done. Peripheral vitreous is dissected meticulously.
3. IOL power calculation: numerous formulas have been derived on theoretical optics and empirical data. The SRK formula is the one of the most widely used.

Power of IOL= A-2.5(AL)-0.9(K)

A= constant is determined by the manufacturer of a specific lens.

K= average keratometry measurement in dioptres.

AL= axial length of the eye in millimetres measured with A-scan ultrasonography.

Note: the US unit is set for aphakic not cataractous eye.

For sulcus implantation the following general rule is used:

a) If the planned in-the-bag IOL power is +28.5 D to +30.0D subtract + 1.50D
b) If the planned in-the-bag IOL power is +17D through +28.0D subtract +1.0D
c) If the planned in-the-bag IOL power is +9.5 through +17.0D subtract 0.5D
d) If the planned in-the-bag IOL power is +5.0D through +9.0D no change in IOL power is needed.

In general, +0.5D – +1.0D is added to the calculated emmetropic IOL power to compensate for slightly posterior placement of sclerally fixated IOL.

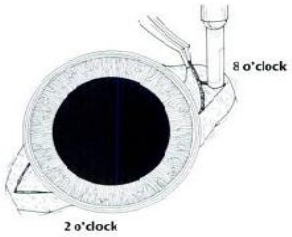
Comparison of the SRK, Hoffer Q, and Holladay Formulas with Respect to Type of IOL and the Respective Constants

	A Constant (SRK Formulas)	**ACD (Hoffer-Q)**	**S Factor (Holladay Formula)**
AC IOL	115.0-115.3	2.8-3.1mm	-0.75 to -0.40
PC IOL in sulcus	115.9-117.2	3.7-4.1mm	0.10-.0.70
PC IOL in bag	117.5-118.8	4.3-5.1mm	0.90-1.60

(Adapted from Shammas [49])

OPERATIVE PROCEDURE

1. Peribulbar anesthesia
2. Prep and drape
3. Fornix based conjunctival peritomies at 2 and 8 o' clock (Figure A)
4. Hemostasis achieved with cautery.



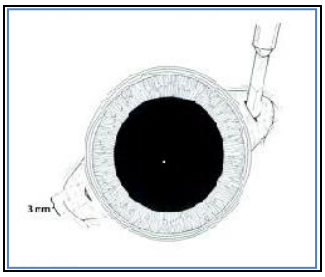


Figure: A Figure: B

5. Scleral flap creation: Perform partial thickness scleral (triangular or rectangular) flaps at the 8 o'clock position (avoid the ciliary vessels at 3 & 9 o'clock positions) and it should be 2mm by 2mm in size if rectangular or 2mm base at limbus if triangular.

   Alternative: create scleral grooves instead of flaps –make a single vertical groove 3mm wide and 1mm posterior to the limbus of 50% thickness at the 8 o'clock and 2 o'clock positions. (Figure B)
6. Perform a partial –thickness groove incision about 7-7.5mm at the 12 o'clock limbus, enter AC and extend wound.
7. Anterior vitrectomy is performed and viscoelatic instilled in AC.
8. Implantation of IOL with any one of the following techniques.

CLASSIC AB –INTERNO ONE POINT FIXATION TECHNIQUE

1. A 6-inch double armed 10-0 polypropylene suture is cut into two equal segments
2. Each free end is tied to the eyelet of each haptic using several square knots.
3. The needle tied inferior haptic is passed through the surgical incision, under the iris to be fixed at inferior ciliary sulcus at 8 o'clock position, providing counter pressure on the sclera and exit 0.75mm posterior to the limbus.(figure C)

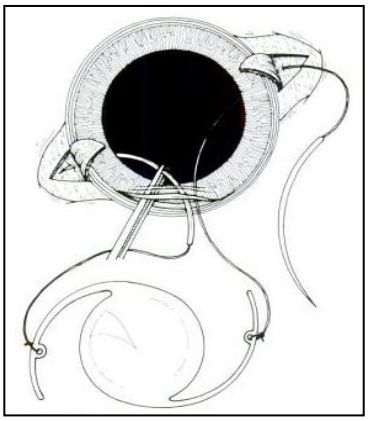


Figure: C

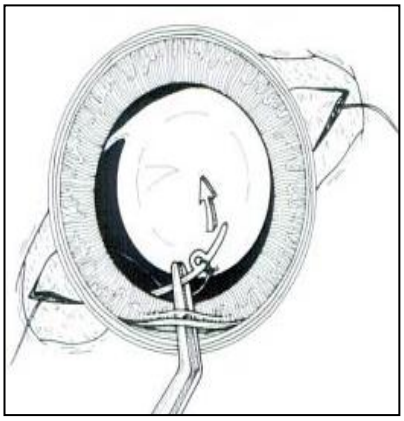
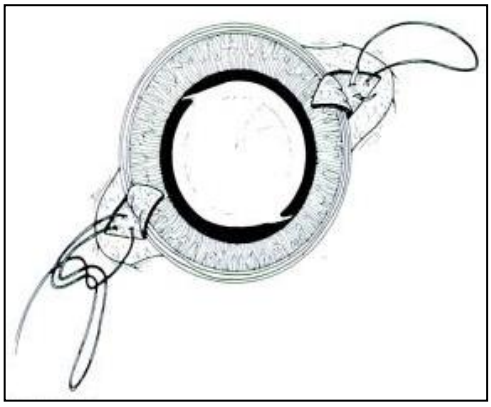


Figure: D

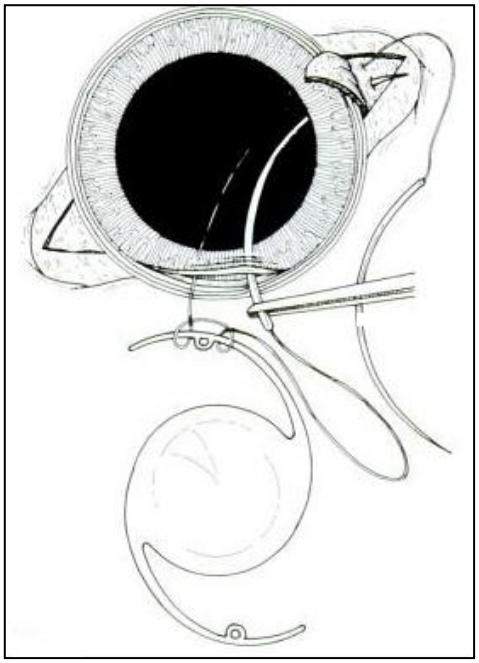
4. The second needle for the superior haptic under the superior iris at 2 o'clock position using counter pressure and exit 0.75mm posterior to the limbus.
5. The IOL is introduced into the AC and the inferior haptic is positioned in the inferior sulcus while the assistant adjusts the tension of the sutures externally.
6. Similarly the superior haptic is introduced behind the iris and positioned at the superior sulcus at 2 o'clock periphery. (Figure: D)
7. The suture is tied to itself by passing the needle in the scleral bed to create a loop (figure E)

Figure E 

8. Optional: a second 10-0 polypropylene suture with a half –circle needle is used to take short bite in the 8 o'clock scleral bed anterior to the exit of the first suture.
9. The short end of the second suture is tied to the first suture to form the hybrid suture. The long end of the second suture is tied to the hybrid suture in a 2-1-1 square knot.
10. Visco removed with I/A cannula and AC is irrigated with intracameral pilocarpine to constrict the pupil.
11. Superior wound and the scleral flaps are closed with interrupted 10-0 nylon sutures.
12. Conjunctiva repositioned at all sites and antibiotic steroid injected followed by patching the eye.

CLASSIC AB INTERNO TWO POINT FIXATION TECHNIQUE [33]

This relatively straightforward method provides good visual results but as originally described it involved suturing at the 3 and 9 o'clock meridians with the attendant risk of hemorrhage from the ciliary vessels.



1. A double-armed polypropylene suture is bisected and the ends tied to the haptics of a 7mm optic lens with square knots.
2. Following an 8-mm peritomy and haemostasis using cautery, a superior 7.5-mm two-plane incision is made at the limbus.
3. After anterior vitrectomy, the incision is completed.
4. One needle is passed through the incision, behind the iris and through the sclera 1 mm behind the limbus at 3 o'clock.
5. This procedure is repeated at 9 o'clock.
6. The IOL is inserted with forceps while an assistant adjusts suture tension externally.
7. Each needle is passed through partial-thickness sclera 1mm posterior to the exit from the sclera, and then tied to itself. The suture ends are left long (2 mm) and are laid flat under conjunctiva, which is sutured with 8-0 chromic catgut.
8. The limbal incision is closed.

AB INTERNO FOUR –POINT FIXATION TECHNIQUE

This method provides a quick way of creating an intraocular loop with four –point fixation and introduces the use of iris hooks to facilitate visualization of the ciliary sulcus region.

1. 50% thickness limbal based triangular scleral flaps are raised or 60% depth scleral incisions made at the 3 & 9 o'clock positions.
2. Flexible iris retractors are placed at the 2, 4, 8 & 10 o'clock positions.
3. After vitrectomy,a long 27G bent needle is inserted Ab externo at the 3o'clock position 1mm posterior to the limbus.

   It is pushed forward until it exits the 9.15o'clock position via the ciliary sulcus [Ab interno fashion] (position seen or estimated with widely dilated, retracted iris)
4. A straight 16mm long needle with 10-0polypropylene suture is swaged blunt end first into the barrel of the 27G needle and maximally advanced.
5. This assembly is withdrawn into the vitreous cavity then turned slightly to direct it toward the 8.45o'clock position. It is passed out of the eye at that location.
6. The straight needle (with suture) is pulled out of the 27 G hollow needle, which is then withdrawn from the eye.
7. A bevelled limbal incision is made at 12 o'clock and the anterior chamber entered with a blade.
8. The intraocular loop of suture is withdrawn from the eye with a hook.
9. Each loop is passed through the haptic eyelet; this is then looped over the haptic end (similar to the method described by Eryildirim[35]).

AB EXTERNO TWO –POINT FIXATION TECHNIQUE

1. A long straight solid needle on 10-0 prolene suture is passed through sclera from one side and a 27 G hallow needle is passed from the other side.
2. The solid needle is docked into the hollow needle and the two needles are withdrawn to the left so that the suture then traverses the AC.
3. A Sinsky hook draws the suture out of the superior corneoscleral wound (2)

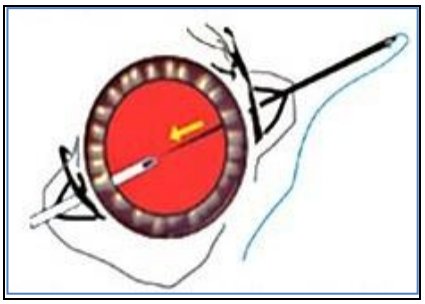


Figure: 1

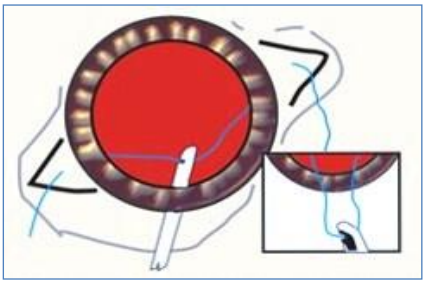


Figure: 2

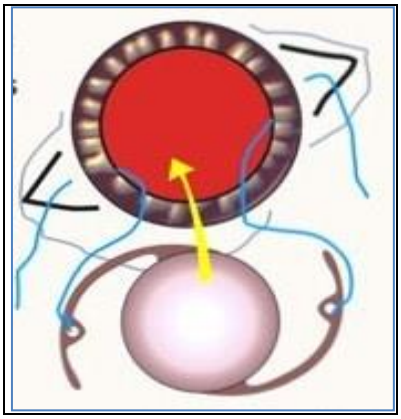


Figure: 3

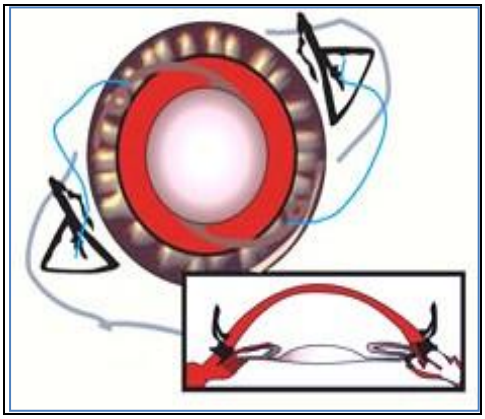


Figure: 4

4. This loop is cut and the two ends are tied to the superior and inferior haptic.
5. The IOL is inserted into the ciliary sulcus & the sutures gently pulled to secured the position of the lens.(4)
6. Each end of the suture is secured to the sclera by making a midscleral pass then tying the suture to itself followed by closure of scleral flaps & conjunctival peritomy.

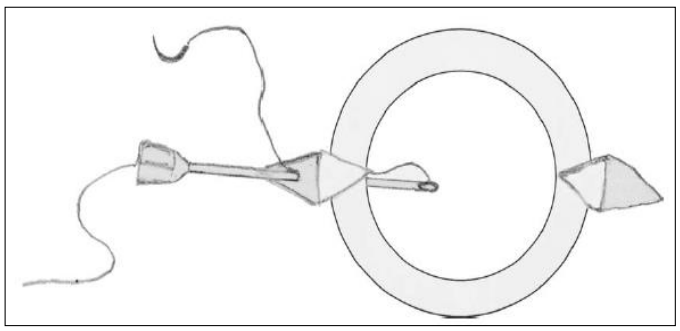
VARIATION:

DIRECT AB- EXTERNO INSERTION OF SUTURE

This method is similar to the above except that separate sutures on two straight needles are passed into the eye, one each through the sclera beds at 4 and 10 o'clock 0.5-0.75 mm posterior to the limbus.[50]

The needles are passed directly out of the eye through the superior corneoscleral wound. This avoids the need to pass a hollow needle to retrieve the suture that had been passed through the opposite scleral bed, as well as the next step of retrieving the suture with a Sinskey hook. However, passage of the needles from the wound may damage intraocular structures and distort the globe.[51]

Basti et al modified the direct introduction of sutures by utilizing 26-gauge hollow needles through which the free end of polypropylene sutures on curved needles were passed.[51] The hollow needle and loop of suture were passed ab externo through the sclera and ciliary sulcus, 0.50 - 0.75 mm from the posterior surgical limbus. The suture was withdrawn from the main incision with McPherson forceps. One advantage of this method is that it only requires routinely available materials. There is also relatively little manipulation of the globe.



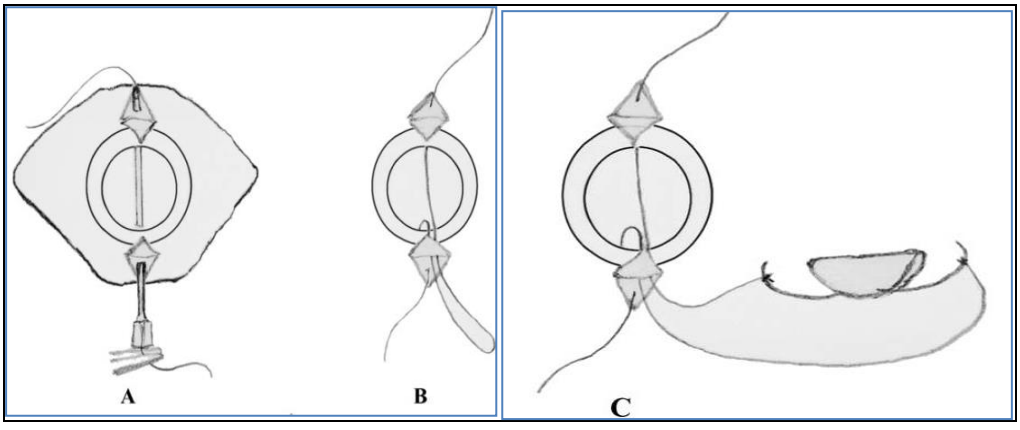
The direct introduction of a suture by a 26-gauge hollow needle through which the free end of a polypropylene suture on a curved needle was passed.

SMALL-INCISION TECHNIQUE

This method is very similar to one originally described by **Hu et al in 1988**[52], except for the use of a small incision and foldable PCIOLs.[53]

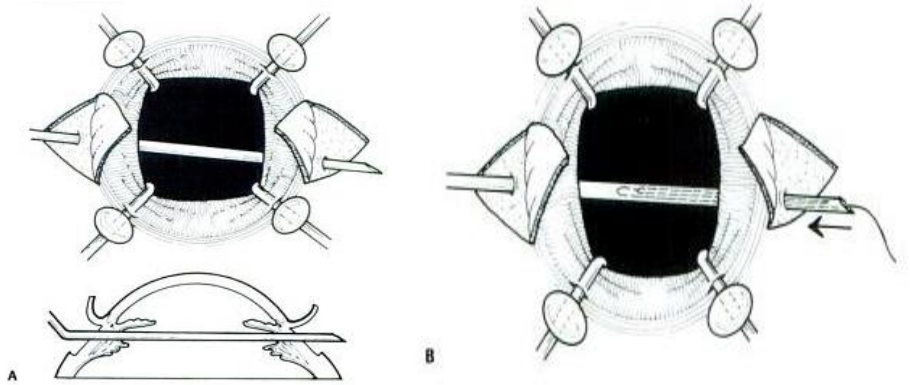
The steps are as follow:

1. Two 5-mm peritomies and two 3 x 3 mm triangular half-thickness scleral flaps are made 180^0 apart.
2. A 25-G hypodermic needle is passed in an ab externo fashion through one scleral bed and out through the opposite bed in an Ab Interno fashion. (distance from limbus not specified, although **Duffey et al**[29] measurements may be used as a guide)
3. The cut end of a 10-0 polypropylene suture is threaded through the full length of the needle, which is then withdrawn.
4. The anterior chamber is entered through the superior scleral bed with a keratome, making a 3.5-mm self-sealing incision.
5. The prolene suture is retrieved with a Kuglen hook and pulled out through the superior incision and cut into two half.
6. One end is tied to the superior haptic, and the other end tied to the inferior haptic of the IOL which is folded and then inserted through the superior incision.

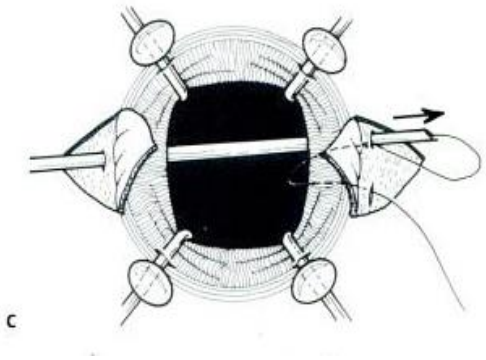


AB -EXTERNO FOUR POINT FIXATION TECHNIQUE

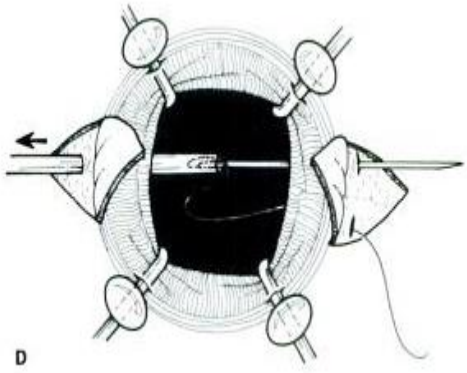
1. A long 27 gauge needle is inserted Ab externo 1mm posterior to the limbus at 3o'clock & exited at 9 o'clock in a ciliary sulcus location. (figure A)



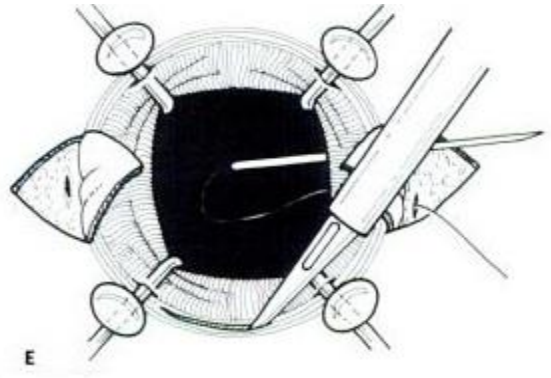
2. A straight, 16mm long needle carrying Ethicon 10-0 Prolene suture in advanced into the barrel of the 27g needle.(figure B) and the entire assembly is directed out of the eye through the ciliary sulcus at 8.45 O'clock position.(figure c)



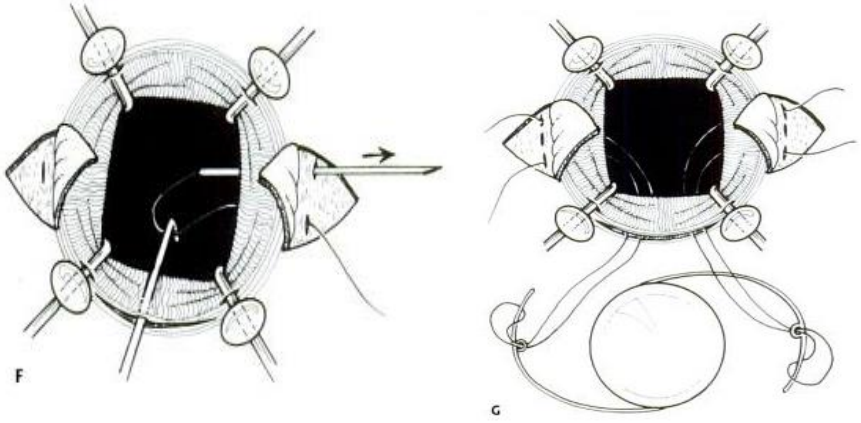
3. The 27g neeedle is withdrawn from the eye. This maneuver creates a intraocular loop of 10-0 Proline suture centered at the 9 O' clock position with two externalised sutures under the scleral flap (figure D)



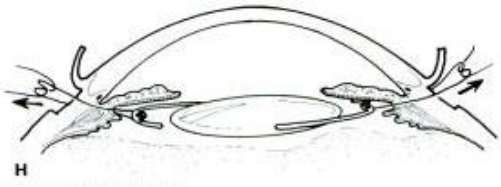
4. A scleral tunnel or partial thickness beveled limbal incision for PC IOL implantation is fashioned at 12 o'clock. If a limbal incision is made, the AC is entered with a sharpblade at 12 o'clock only. (figure E)

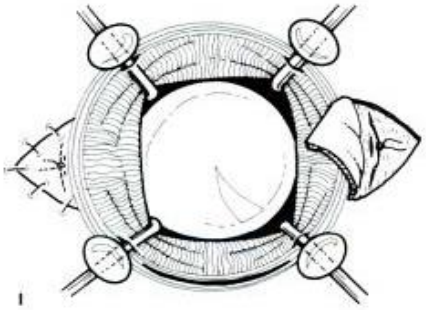


5. The loop of 10-0 Prolene is externalized through the scleral tunnel using a hook.(figure F)



6. A long 27g needle is inserted Ab externo 1mm posterior to the limbus at 9 o'clock (between the prolene sutures) and exited at 3.15 o'clock in a ciliary sulcus loction. The same steps are followed in the 3 o'clock scleral bed to create the second externalized loop of 10-0 Prolene.
7. The loop is twisted and passed through the eyelet attached to the haptic. The prolene suture is looped around the haptic without a knot.(figure G)
8. The scleral tunnel is widened as needed or the limbal nicision is opened fully to accommodate the IOL.



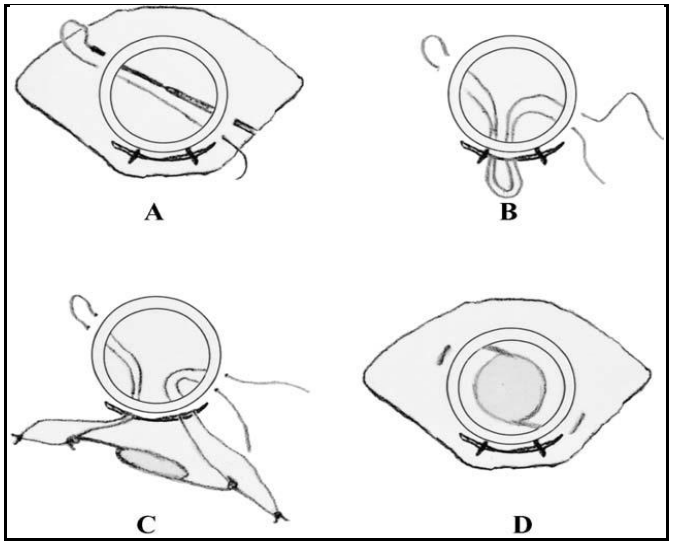


9. The PC IOL is introduced into the eye: the haptics are seated in the ciliary sulcus, and the lens is centered in the sulcus by pulling up on the externalized sutures.(figure H)
10. The externalized sutures are tied and trimmed slightly long so that they lie flat against the sclera. The knots are buried under the flaps, which are sewn shut with 10-0 nylon suture.(figure I)
11. The scleral tunnel is closed with 10-0 nylon, sclerotomies with 7-0 vicryl & conjunctival incisions with 6-0 plain gut.

AB –EXTERNO CONTINUOUS-LOOP FIXATION

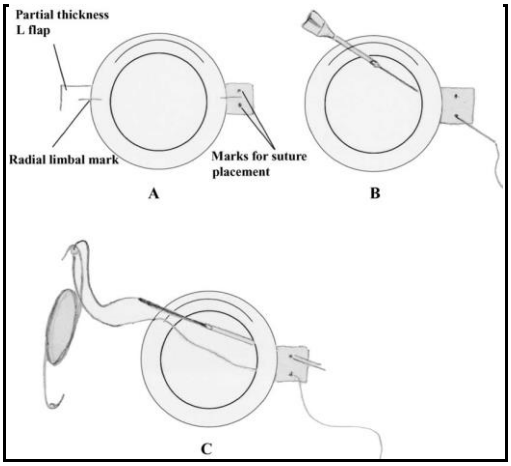
This technique allows burying the knot and does not require a scleral flap, but it may cause torque and tilt.[27]

A. After passing a needle ab externo and retrieving it via another hollow needle, it is turned around and the process repeated.
B. The double suture loop is externalized.
C. The loop is cut and the ends threaded through each haptic eyelet and tied. The knots are rotated out of the eye, and the PCIOL inserted.
D. After tying the externalized suture, the knot is rotated into the eye.



AB EXTERNO CONTINUOUS-LOOP FIXATION WITH SCLERAL FLAPS[42]

1. Conjunctival flaps are created at 3 and 9 o'clock limbus & a Superior 7-mm clear corneal incision is made. (figure A)
2. L shaped scleral incisions are made at 3 and 9 o'clock positions, and the limbus based flaps are created.
3. A needle with a 10-0 prolene suture is passed through one scleral bed 1 mm below the horizontal meridian, 1 mm posterior to the surgical limbus. It is guided out of the superior corneal incision with a 27-G needle (figure B).
4. This suture is threaded through an eyelet from below upwards, and it is passed back into the eye through the corneal incision and guided out of the eye by another 27-G needle inserted through the same scleral bed in an ab externo fashion 1 mm above the horizontal meridian, 1mm posterior to the surgical limbus (figure C). Steps 4 and 5 are repeated for the other haptic.
5. The corneal wound is fully opened and the IOL is inserted into the posterior chamber.
6. The sutures are gently pulled, tightened and tied. The knot is rotated into the eye. The scleral and conjunctival flaps are closed.



AB- INTERNO FOUR-POINT FIXATION WITH HAPTIC LOOPING [54]

A. A hollow needle is inserted ab externo then exits ab interno through the opposite scleral bed.

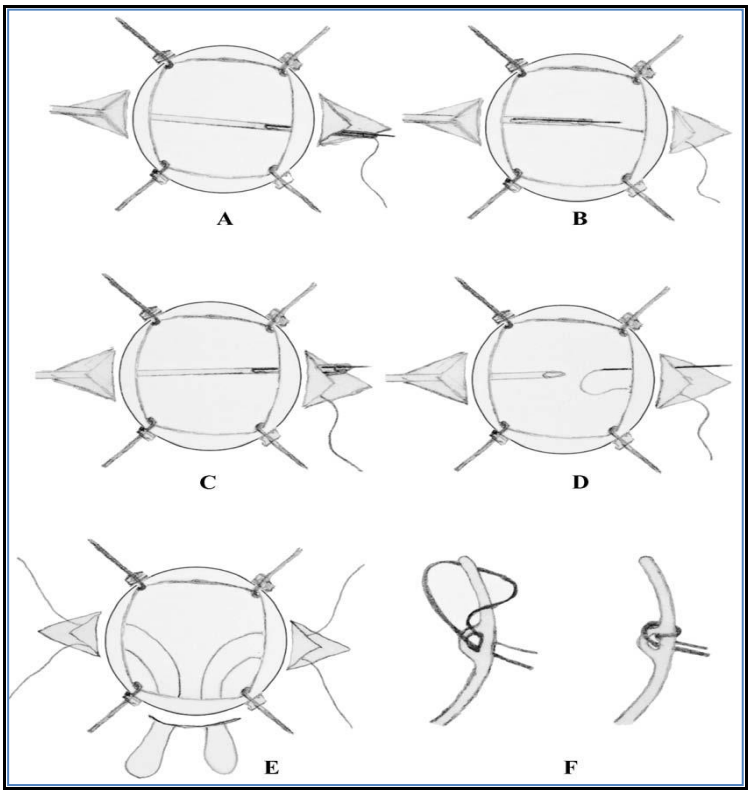
B. A straight needle is inserted into the hollow needle, which is withdrawn into the vitreous cavity.

C. The entire complex is passed out of the eye at a point adjacent to the original exit point.

D. The hollow needle is withdrawn.

E. This is repeated for the opposite side, and two suture loops are hooked out of the eye.

F. Securing the haptics.



HAPTIC LOOPING METHOD[35]

This method is similar to another originally described by Hu et al in 1988[36], and the steps are listed below:

1. Peritomies and scleral flaps are made as above in the 2 and 8 o'clock positions. A superior corneoscleral wound is fashioned.
2. A straight needle is inserted into the globe to make a port 1 mm posterior to the limbus. It is then withdrawn, and inserted again in the reverse position together with the attached 10-0 prolene suture.
3. A lens dialer is used to pull the suture out through the corneoscleral wound.
4. This is repeated at the opposite scleral bed
5. Each suture loop is inserted through the haptic eyelet of a rigid PMMA lens. At one end, the loop is passed over the IOL. At the other end, the loop is passed over the haptic to lock the suture over the eyelet
6. The IOL is implanted in the posterior chamber
7. A needle holder is used to curve the straight needles and another bite is taken through the respective scleral bed. The suture is then tied on to itself, and cut long to avoid eroding the scleral flaps and conjunctiva.

LIMBAL-GROOVE INCISION AND DOUBLE-SUTURE FIXATION TO HAPTIC[40]

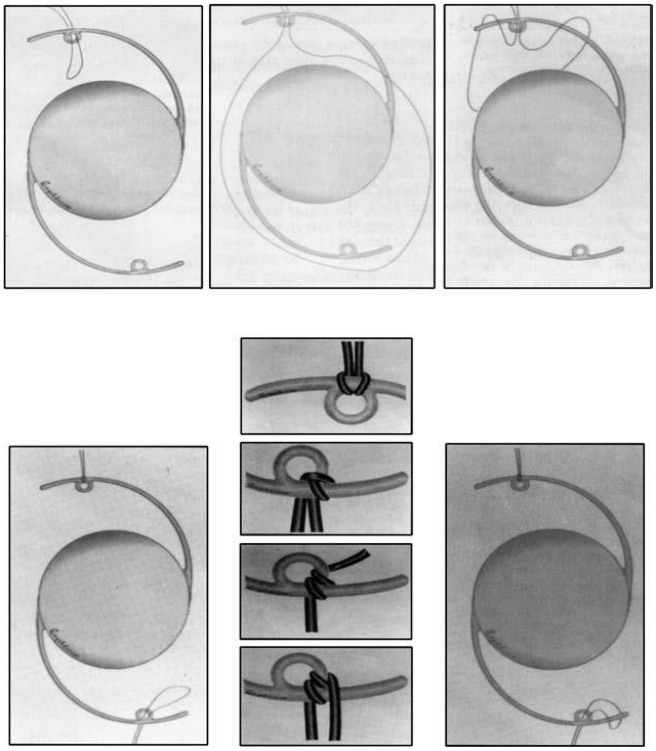
A. Two straight needles are inserted Ab externo and out through clear cornea.

B. After cutting the needles, the suture is retrieved via the superior incision and tied.

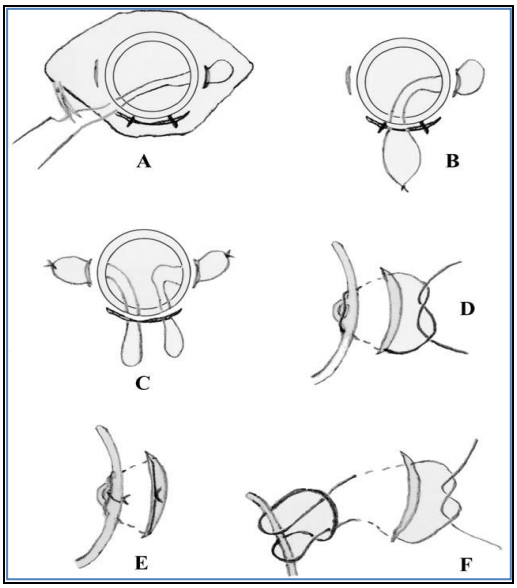
C. The knots are rotated out of the eye.

D and E: A loop over the eyelet with an additional suture secures the haptic.

F: The presence of loops allows fixation with a girth hitch. The procedure is repeated at the opposite scleral groove.



Two ways of securing PCIOL haptics without Knots.



Limbal-groove incision and double-suture fixation to haptics

PARS PLANA FIXATION

Originally described by **Girard**[55], this method of fixation has never been popular. Girard's original method used a lens with closed loops that was inserted via the pars plana and fixated within the scleral wall. Teichmann's method is significantly different and utilizes a lens with posteriorly angulated haptics.[21] Three-point fixation is used, with one haptic carrying one eyelet and the other having two eyelets.

Compared with sulcus-fixated lenses, the overall diameter of the lens is increased to 17 mm and the diameter of the optic to 7 mm. Because of the different location of the IOL, the position of suture placement would have to be altered. Keeping the needle parallel to the iris plane, the points of scleral entrance would therefore be 3.0 -3.5mm posterior to the surgical limbus instead of 1.5mm.There would be two points of scleral entrance on each side that have to be diametrically opposite each other with respect to the corneal centre to avoid lens tilt.

Teichmann suggests one fixation site inferotemporally, with the scleral entrance points 2 mm apart and parallel to the limbus. The two strands of this suture would be carried symmetrically through each eyelet (on the haptic with two eyelets), either both from above or both from below. The other haptic with one eyelet would be attached by means of a meridional (radial) suture, the scleral entrance points on this side being 3.0 and 3.5 mm from the limbus.

CILIARY SULCUS FIXATION

The ciliary sulcus is the area on the internal surface of the eye between the posterior iris and the pars plicata. It is a commonly used location if capsular complications develop in the presence of an intact anterior capsular rim.

A lens fixated in this area will be in a slightly more anterior position compared with one located in the bag.

The ciliary sulcus is a relatively avascular area and placement of the IOL here results in relatively stable fixation because of the surrounding structures. Duffey et al found in an anatomic study on cadaver eyes that the average location of the ciliary sulcus from the posterior surgical limbus was 0.94 mm in the vertical meridian and 0.5 mm in the horizontal meridian.[29]

Ab externo methods where the sutures were inserted at such locations from the posterior surgical limbus were thought more likely to enter the ciliary sulcus, if the sutures were inserted perpendicularly through the sclera.

Operative factors found to be important in attaining sulcus fixation include entering the eye while it is closed and using an appropriately sized IOL.[30] When the eye has been opened and is hypotensive, the ciliary sulcus is collapsed with the ciliary processes lying in contact with the posterior surface of the iris. Even if the needle entered the sclera at the prescribed location behind the limbus, it would easily pass through the ciliary processes or even the pars plana.[30] Althaus and Sundmacher also found that an IOL with a diameter of 12 mm was more likely to be fixated in the ciliary sulcus compared with one of 13.5 mm diameter. A large rigid lens cannot be pulled back into the sulcus once it has been displaced posteriorly initially.

MATERIALS AND METHODS

MATERIALS AND METHODS

TITLE OF THE STUDY:

Prospective two year Study of visual outcome and intra operative and postoperative complications of Scleral fixated posterior chamber intraocular lens implantation in aphakic eyes using the Modified four point Ab Externo scleral fixation technique.

SOURCE OF DATA:

Patients admitted with aphakia and cataract at R.L.J. HOSPITAL AND RESEARCH CENTRE, TAMAKA, KOLAR attached to SRI DEVARAJ URS MEDICAL COLLEGE between November 2011 and May 2013 were prospectively analysed. Total number of 50 cases fulfilling the selection criteria was included in the study after informed consent.

SAMPLE SIZE: A total number of 50 patients of primary and secondary aphakia were selected for the study.

INCLUSION CRITERIA:

1. Secondary scleral fixation of intraocular lens implantation in aphakic eyes.
2. Primary scleral fixation of intraocular lens implantation in aphakic eyes.

   (Patients with hyper mature cataracts, with pseudo exfoliation, subluxated lens)

EXCLUSION CRITERIA:

1. Any pathology of Cornea (degenerations & dystrophies)
2. Pathology of Retina, Macula and Optic nerve.
3. Chronic Uveitis
4. Traumatic cataracts
5. Bleeding disorders

PREOPERATIVE EVALUATION

1. Best corrected visual acuity with aphakic correction.
2. External ocular examination
3. Slit lamp biomicroscopic examination for evidence of the following findings:
    - Corneal clarity (endothelial status)
    - Presence of synechiae
    - AC (depth, cells, flare, vitreous)
    - Iris –iridodonesis, iridectomies, posterior synechiae
    - Type of cataract
    - Phacodonesis or frank subluxation / dislocation of lens
    - Pupillary reactions
    - Pseudoexfoliation in pupillary margins
    - Evidence of epithelialisation
    - Posterior capsule (adequacy of support and clarity)
4. Dilated evaluation of fundus periphery and biomicroscopic evaluation of macula with a + 90 D lens.
5. Gonioscopy with Goldmann three mirror.(PAS, recession, neovascularisation)
6. Applanation tonometry
7. Keratometery
8. A-scan and IOL power calculation by SRK –2 formula.
9. Lacrimal patency test
10. Routine blood investigations, fasting sugar, postprandial blood sugar and urine tests.

All patients were given systemic antibiotics (Tab Ciprofloxacin 500mg). On the day of surgery pupils were dilated adequately with 0.8% tropicamide & 5% or 10% phenylephrine eye drops every 10 minutes, one hour before surgery. To sustain the dilatation anti –prostaglandin eye drops Flurbiprofen was instilled half hourly for two hours before surgery.

SURGICAL TECHNIQUE

An Ab - externo four point scleral fixation technique described below was performed on all 50 patients under local anesthesia.

1. The eye to be operated is painted, draped and prepared for surgery under aseptic precautions.
2. Peribulbar anaesthesia with 2% xylocaine, 0.5% bupivacaine & 15000U hylase.
3. Universal wire speculum is applied.
4. Superior rectus (bridle) suture is passed to fix the eye in downgaze
5. Anterior vitrectomy was done in all patients.
6. After adequate peritomy two partial thickness scleral flaps 1.5 to 2 mm posterior to the limbus was fashioned at the 3 0'clock and 9 0' clock meridians, 180^0 apart.
7. A doubled arm 10-0 prolene suture with straight needle was used.
8. The needles were rail-roaded out of the eye through the bed of the opposite scleral flap using a bent 25g needle introduced through the scleral bed.
9. A limbal section was fashioned and the sutures were drawn out of the eye, and cut into two halves.
10. Each half of the sutures were passed through the fixation eyelet on the superior and inferior haptic of the IOL at the point of maximum haptic spread.

11. A single piece, all PMMA, large optic IOL (Aurolab equiconvex 6.5mm optic, 13mm overall length) was used for scleral fixation.
12. The IOL was introduced into the posterior chamber, and the sutures were tightened and tied & the suture knots were buried in the scleral bed and the scleral flap sutured.
13. The viscoelastic was cleared from the AC
14. The sclerocorneal and conjunctival peritomies were closed with 10-0 nylon sutures.
15. Subconjunctival gentamycin and dexamethasone 0.5cc was given at the end of the procedure.
16. Pad and bandage applied.

Important Points to remember

- Both scleral incisions should be at equal distance from limbus and should be exactly diagonally opposite.
- Distance between two sutures should be equal throughout.
- Both these sutures should be away from centre of the cornea equally on either side.
- Make sure that all sutures and haptics were away from infusion canula tip. Otherwise, on removal of infusion canula, the centration can be disturbed.
- Make sure about centration and good horizontal position of IOL before tying the knots.

Postoperatively all patients recieved a course of topical antibiotic and steroid eye drops hourly followed by a tapering dose for 6 weeks along with Flurbiprofen eye drops 0.03% TID for 4 weeks. Injection Diclofenac stat was given

to patients who complained of pain. Systemic antibiotics Tab Ciprofloxacin 500mg was given for 5 days postoperatively.

All the surgeries were performed by all operating surgeons and no major intraoperative complications were encountered. Postoperatively the patient was evaluated on 1^{st} day, 1^{st} week, 1^{st}, 3^{rd} and 6^{th} month.

The total duration of follow up was 6 months. At each postoperative visit, the patients were subjected to the following examinations:

1. Best corrected visual acuity for distant and near.
2. Slit lamp evaluation.
3. Indirect ophthalmoscopic evaluation and biomicroscopic assessment of macula was performed.

A careful note of IOL stability and centration, suture related complications, postoperative reaction and cystoid macular oedema were made and the compiled pre and postoperative data analysed. The results were compared with previously published studies.

RESULTS

OBSERVATION AND RESULTS

TABLE 2: AGE AND GENDER DISTRIBUTION OF PATIENTS STUDIED

AGE IN YEARS	MALE		FEMALE	
	NO	%	NO	%
< 50	0	0	2	7.7
51 – 60	7	29.2	10	38.5
61 – 70	13	54.2	14	53.8
71 – 80	4	16.6	0	0
Total	24	100.0	26	100.0
Mean average	65.70		61.58	
SD	7.12		7.11	

Our study included 2 (4%) patients in age group <50 years, 17 (34%)patients in the age group 51-60 years, 27 (54%) patients in the age group 61-70 years, and 4 (8%) patients in the age group 71-80 years. The average age of patients was 63.56 years and about 31 (62%) patients were above 60 years of age.

CHART 1: SHOWING AGE DISTRIBUTION

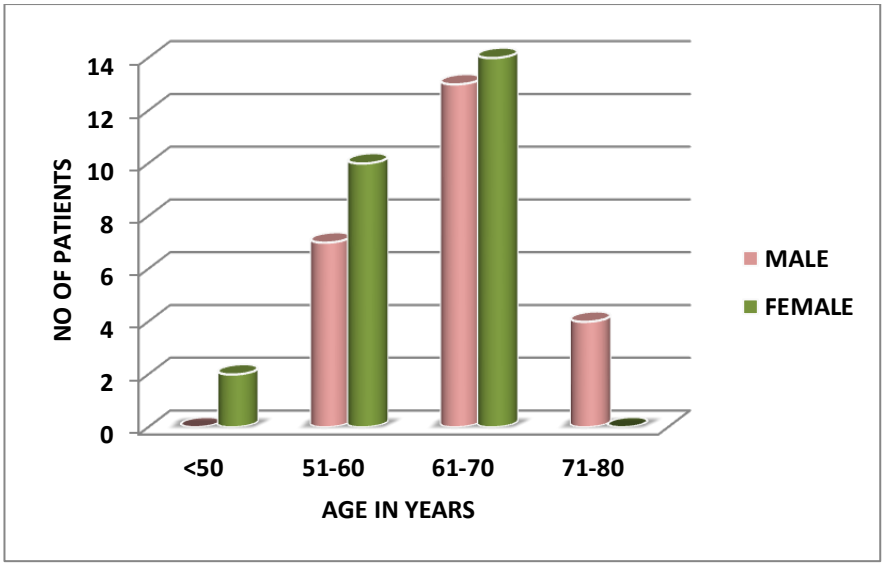


TABLE 3: GENDER DISTRIBUTION OF PATIENTS STUDIED

SEX	NO	%
MALE	24	48
FEMALE	26	52
TOTAL	50	100

Our study included 24(48%) males and 26(52%) females. Age and sex distribution is presented in table 2.

CHART 2: SHOWING SEX DISTRIBUTION

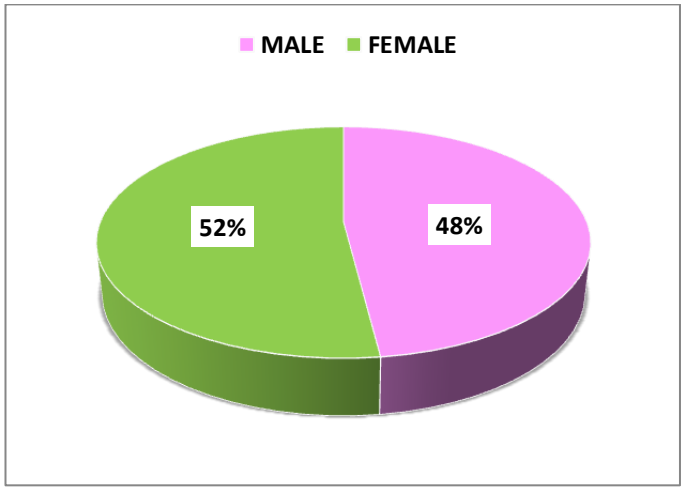


TABLE 4: INDICATIONS FOR SCLERAL FIXATION

PROCEDURE	MALE		FEMALE		TOTAL
	NO	%	NO	%	
Primary SF–IOL (PC rent, subluxated or dislocated lens)	7	14.58	8	15.38	15 (30%)
Secondary SF–IOL (Postoperative aphakia)	17	35.42	18	34.62	35 (70%)
Total	24	50	26	50	50

In this study 15(30%) patients underwent primary scleral fixated posterior chamber intraocular lens implantation due to reasons like PC rent, subluxated /dislocated lens, zonular dehiscence etc., and 35 (70%) patients underwent secondary scleral fixation due to postoperative aphakia.

CHART 3: SHOWING THE INDICATION OF SF – IOL

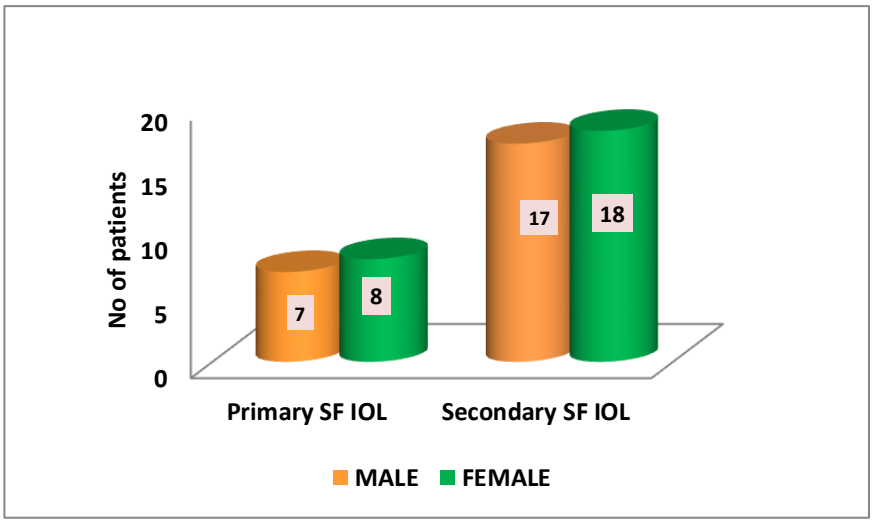
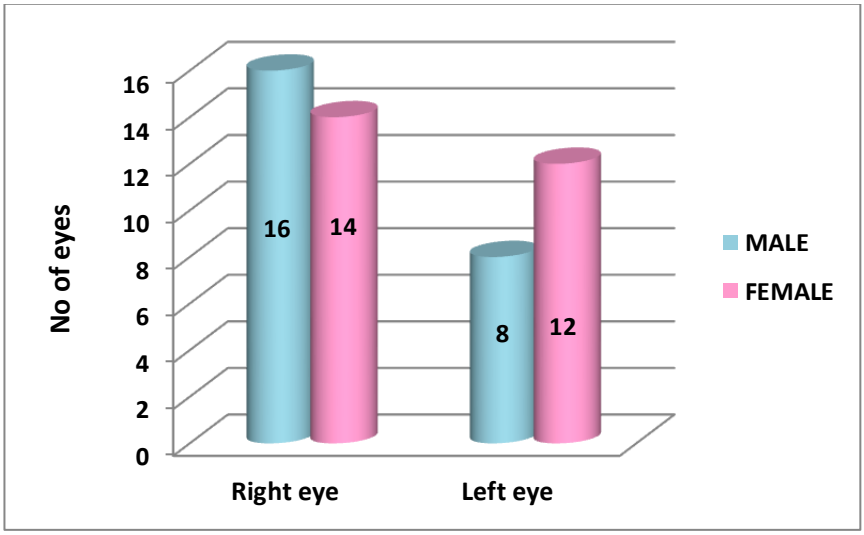


TABLE 5: LATERALITY IN EYES

EYE OPERATED	MALE		FEMALE	
	No	%	No	%
Right eye	16	66.67	14	53.85
Left eye	8	33.33	12	46.15
Total	24	100	26	100

Among the 50 patients 30 (16 male and 14 female) patients were operated for right eye and 20 (8 male and 12 female) patients were operated for left eye.

CHART 4: SHOWING LATERALITY IN EYES



VISUAL ACUITY

TABLE 6: PREOPERATIVE AND POSTOPERATIVE DISTANT VISION

BEST CORRECTED DISTANT VISION	PRE OPERATIVE		POSTOPERATIVE	
	NO	%	NO	%
6/6 – 6/12	16	32	28	56
6/18 – 6/24	14	28	18	36
6/36 – CF	20	40	4	8
TOTAL	50	100	50	100

[χ^2 = 14.44,Df = 2, P value = 0.0007]

Twenty eight eyes (56%) had good vision in the range of 6/6 – 6/12, eighteen eyes (36%) had better vision in the range of 6/18 –6/24 and four (8%) eyes had vision in the range of 6/36 – CF.

CHART 5: SHOWING PREOPERATIVE AND POSTOPERATIVE DISTANT VISION

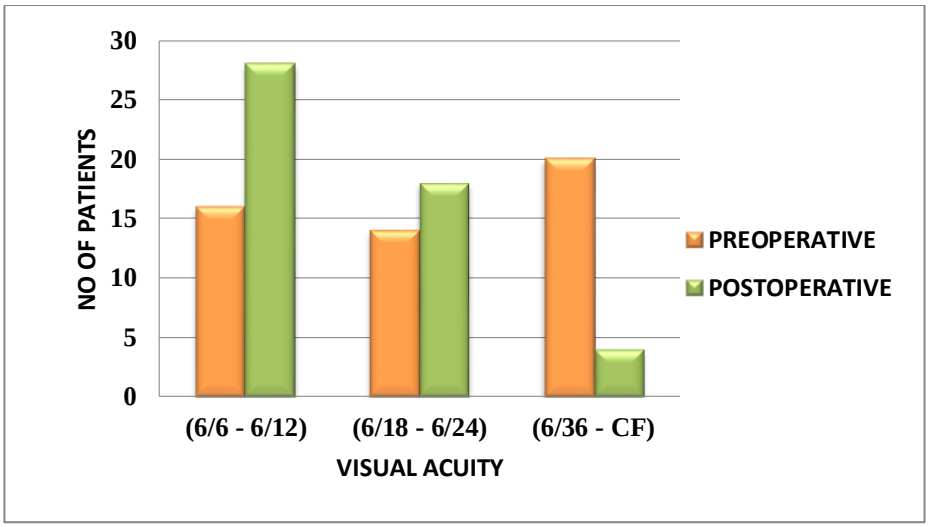


TABLE 7: PREOPERATIVE AND POSTOPERATIVE NEAR VISION

BCNV	PREOPERATIVE NV		POSTOPERATIVE NV	
	NO	%	NO	%
N_6- N_{12}	3	6	20	40
N_{18}- N_{24}	27	54	28	56
N_{36}–N_0	20	40	2	4
TOTAL	50	100	50	100

[χ^2 = 27.31, Df = 2, P = 0.000001]

The best corrected near visual acuity was noted in 20 (40%) patients in the N_6-N_{12} group, 28(56%) patients in the N_{18} –N_{24} group and 2(4%) patients in the N_{36} – N_0 group.

CHART 6: SHOWING PREOPERATIVE AND POSTOPERATIVE NEAR VISION

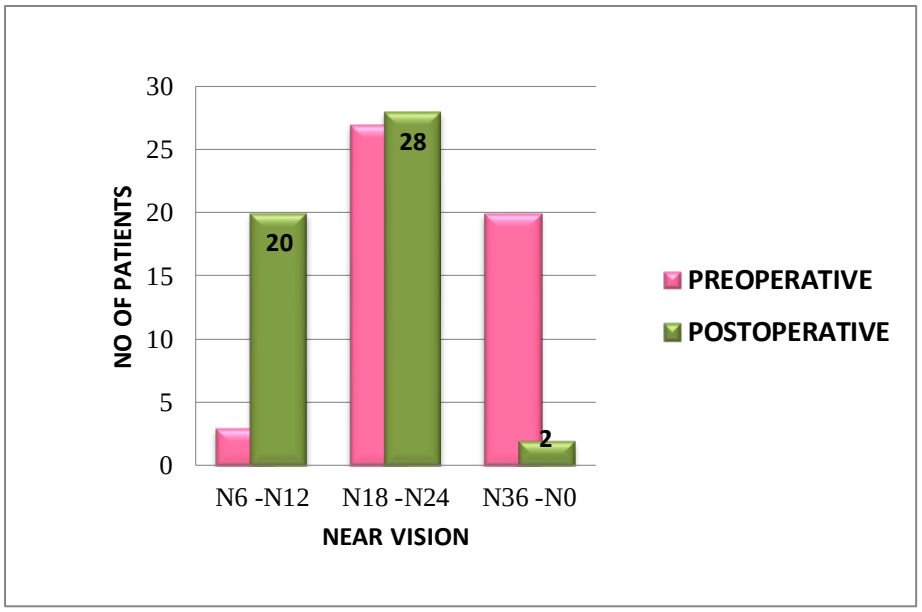


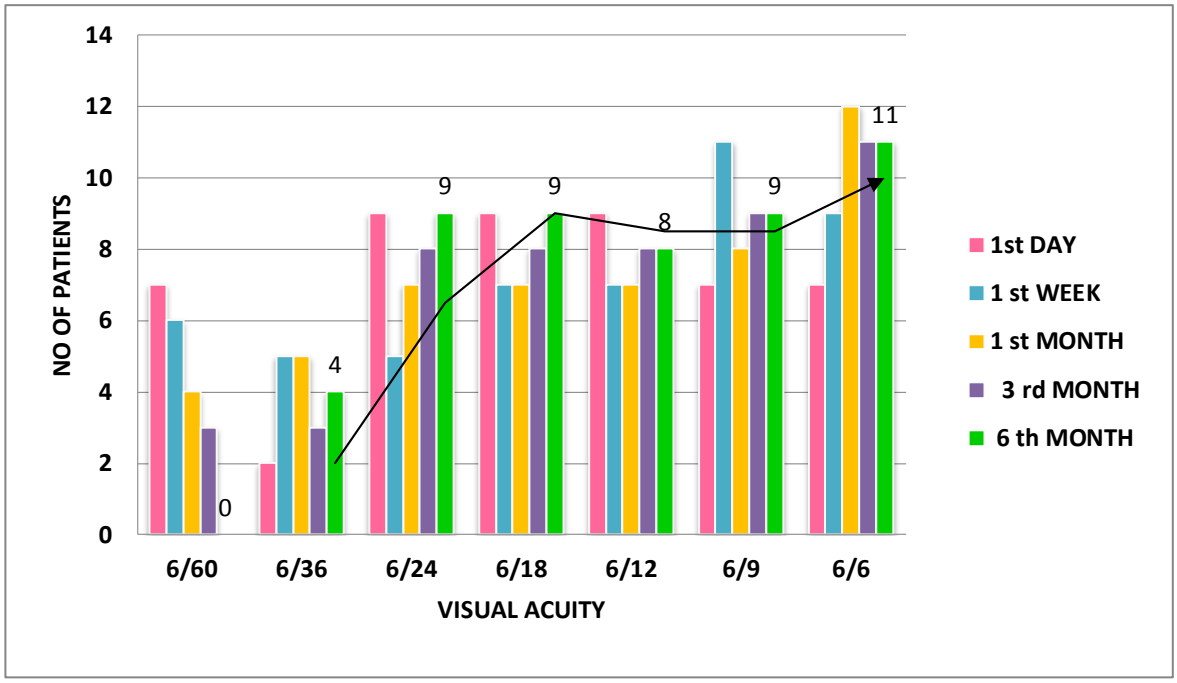
TABLE 8: PROGRESSION IN THE DISTANT VISUAL ACUITY

BCVA	First day	1st week	1st month	3rd month	6th month
6/6	7	9	12	11	11
6/9	7	11	8	9	9
6/12	9	7	7	8	8
6/18	9	7	7	8	9
6/24	9	5	7	8	9
6/36	2	5	5	3	4
6/60	7	6	4	3	0
TOTAL	50	50	50	50	50

BCVA of 6/6 was noticed in 7 patients only on the first postoperative day. Because the others developed early postoperative complications like striae keratopathy, iritis (mild and moderate), hyphaema and secondary glaucoma which exacerbated the corneal edema.

All these complications were transient which subsided by 2 weeks with steroid antibiotic eye drops, anti glaucoma & short course of cycloplegics. Following this there was gradual improvement in the vision. At the end of six months follows up 28 patients (62%) had BCVA in the range 6/6-6/12. Late cause for less vision was due to CME and persistent corneal edema.

CHART 7: SHOWING THE PROGRESSION IN VISUAL ACUITY



COMPLICATIONS

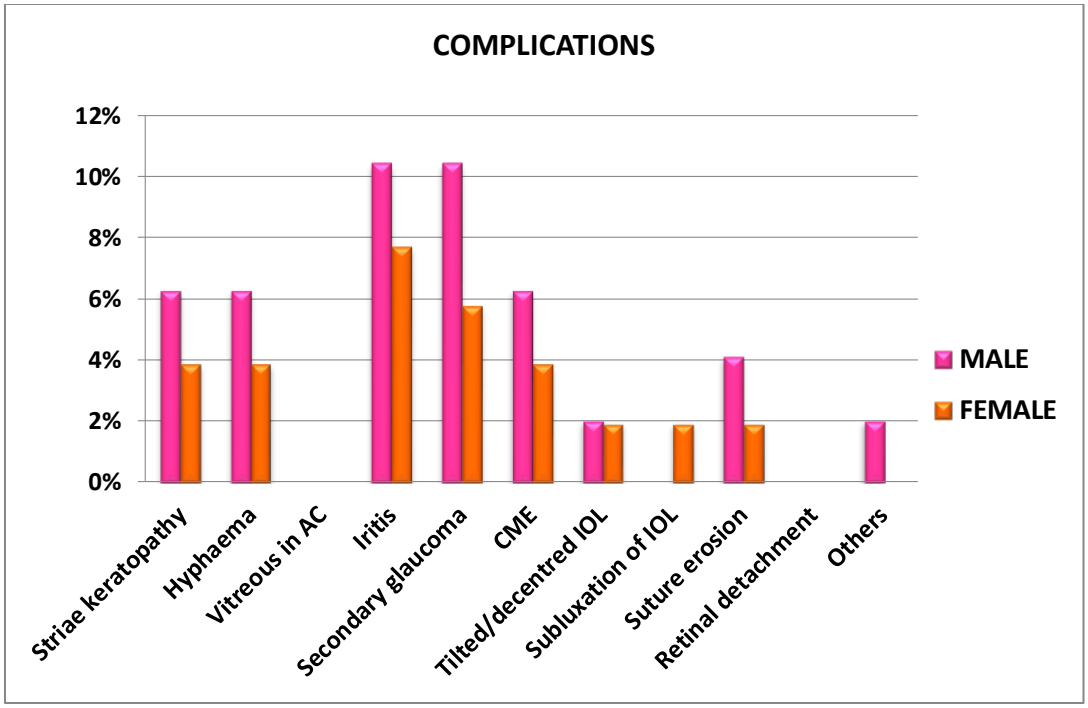
TABLE 9: POSTOPERATIVE COMPLICATIONS

COMPLICATIONS	MALE (n=24)		FEMALE (n=26)		TOTAL
	No	%	No	%	
Striae keratopathy (mild to moderate)	3	6.25	2	3.85	5 (10%)
Hyphaema	3	6.25	2	3.85	5 (10%)
Vitreous in AC	0	0	0	0	0
Iritis	5	10.41	4	7.69	9 (18%)
Secondary glaucoma	5	10.41	3	5.77	8 (16%)
CME	3	6.25	2	3.85	5 (10%)
Tilted/decentred IOL	1	2	1	1.92	2 (4%)
Subluxation of IOL	0	0	1	1.92	1 (2%)
Suture erosion	2	4.1	1	1.92	3(6%)
Retinal detachment	0	0	0	0	0
Others (Persistent corneal edema)	1	2	0	0	1 (2%)

The most common early postoperative complications noticed were Iritis in 9 (18%) eyes followed by Secondary glaucoma in 8 (16%), Striae keratopathy in 5 (10%) eyes and Hyphaema in 5 (10%) eyes.

And the late complications were Cystoid macular edema in 5(10.1%) patients, Suture erosion in 3 (6%) eyes, Mild lens tilt/mild decentered IOL in 2 (4%) eyes, subluxated IOL in 1(2%) patient and persistent corneal edema in 1 (2%) eye. IOL tilt which occurred in 2 cases (4%) developed significant astigmatism in one case only.

CHART 8: SHOWING THE COMPLICATIONS OF SF –IOL



All the early complications resolved with postoperative medications over a period of 2 weeks. Hyphaema resolved within 3-7 days in all the cases.

IOL tilt which occurred in 2 cases (4%) developed significant astigmatism (-1.5 D) in one case only.

DISCUSSION

DISCUSSION

This study consisting of 50 patients who underwent primary and secondary four point scleral fixated posterior chamber intraocular lens implantation from December 2011 and May 2013 at R.L. JALAPPA HOSPITAL AND RESEARCH CENTER, TAMAKA, KOLAR attached to Sri Devaraj Urs Medical College, were evaluated for visual outcome and complications.

As shown in **Table 2**, there were 2 (4%) patients of age group <50 years, 17 (34%) patients of age group 51-60 years, 27 (54%) patients of age group 61-70 years, and 4 (8%) patients of age group 71-80 years. The average age of patients was 63.56years and about 31 (62%) patients were above 60 years of age. The follow up ranged from 1st postoperative day to 6th month.

As shown in **table 3**, there were 24(48%) males and 26(52%) females included in this study. Age and sex distribution is presented in table 2. Studies have found equal prevalence of aphakia in both sexes.

As shown in **table 4**, 15(30%) patients underwent primary scleral fixated posterior chamber intraocular lens implantation due to various reasons like PC rent, zonular dialysis, subluxated lens, pseudo exfoliation etc., and 35 (70%)patients underwent secondary scleral fixation.

Among the 50 patients 30 (16 male and a female) patients were operated for right eye and 20 (8 male and 12 female) were operated for left eye as shown in **table 5**.

Table 6 shows the postoperative best corrected distant visual acuity which was dependant on the eye's preoperative visual potential. Twenty eight eyes (56%) had good vision in the range of 6/6 – 6/12, eighteen eyes (36%) had better vision in the range of 6/18 –6/24 and four (8%) eyes had vision in the range of 6/36 – CF.

Among the 4 patients 1 had less vision (CF 3m) due to persistent corneal edema, 1 patient had persistent secondary glaucoma and 2 had CME.

Postoperative visual acuity improved significantly (P-value of **0.0007**) as compared to preoperative.

Azizur Rahman et al (2011)[56] conducted a similar study in 30 patients which showed a BCVA in 29 (96.7%) eyes in the 6/6 – 6/18 range which was comparable to our result.

Our study gave good results when compared to another study conducted by **Zia ul Mazhry et al (2010)**[57] in 50 patients. Their study showed BCVA of 6/6-6/9 in 25 (50%) eyes, 6/12-6/18 in 16 (32%) eyes, 6/24-6/36 in 6(12%) eyes and 6/60 in 3(6%) eyes.

Our results were better than the study conducted by **K.S. Chandrakanth et al** [58] in the year 2007 in terms of visual outcome. Majority of patients achieved a BCVA of 6/9 on the 5th postoperative day (20 eyes) and this number decreased to 17 by the 1st month after surgery. By the end of 12 months 18 eyes had a BCVA of 6/9 & 6 eyes had a vision of 6/12.

As shown in **table 7**, the best corrected near visual acuity was noted in 20 (40%) patients in the N_6-N_{12} group, 28(56%) patients in the N_{18} –N_{24} group and 2(4%) patients in the N_{36} – N_0 group.

Table 8 shows the progression in visual outcome over a period of six months. BCVA of 6/6 was noticed in 7 patients only on the first postoperative day. Because the others developed early postoperative complications like striae keratopathy, mild iritis, hyphaema and secondary glaucoma which exacerbated the corneal edema.

All these complications were transient which subsided by 1month with steroid antibiotic eye drops, anti glaucoma& short course of cycloplegics.

Following this there was gradual improvement in the vision. Late cause in less vision was due to CME and persistent corneal edema.

Table 9 shows postoperative complications associated with transscleral fixation of IOL. No intraoperative complications were noted in our study and the most common early postoperative complications noticed were Iritis in 9 (18%) eyes followed by Secondary glaucoma in 8 (16%), Striae keratopathy in 5 (10%) eyes and Hyphaema in 5 (10%) eyes, all which resolved with postoperative medications over a period of 2 weeks. Hyphaema resolved within 3-7 days in all the cases.

And the late complications were Cystoid macular edema in 5(10%) patients, Suture erosion in 3 (6%) eyes, Mild lens tilt/mild decentered IOL in 2 (4%) eyes, subluxated IOL in 1(2%) patient and persistent corneal edema in 1 (2%) eye. IOL tilt which occurred in 2 cases (4%) developed significant astigmatism (-1.5 D) in one case only. There was no incidence of endophthalmitis, giant papillary conjunctivitis nor retinal detachment at the end of 6months follow up.

Cystoid macular edema seen in 5 patients was due to vitreous manipulation during surgery.

Azizur Rahman et al (2011) study which included 30 patients showed the following complications which were comparable with our study. Uveitis in 5(16.7%) patients, cystoid macular edema in 3 (10%) patients, hyphaema in 2 (6.7%) patients, suture erosion in 2 (6.7%) and IOL decentration was seen in 1 (3.3%) patient.

The most common complication observed in the study conducted by **Zia ul Mazhry et al (2010)** was glaucoma in 8 eyes (16%) followed by vitreous hemorrhage in 4 eyes (8 %) and hyphaema in 2 eyes (4%). Vitreous hemorrhage which was not observed in our study appeared more frequently in their study though it cleared inconsequentially in all the patients.

The probable reason was trans-scleral fixation in almost half of the patients. Clinically significant IOL tilt occurred one case (2%) and the IOL had to be repositioned.

Due to iris manipulation while scleral fixation of IOL we noticed mild iritis in 11(22%) patients which was comparable with the results of **Kwong et al and Kanigowska K.**[59]

The immediate post operative complications included iritis in 2 eyes, striae keratopathy in 1 eye, IOL tilt in 1 eye and vitreous in AC in 1 eye. Delayed complications included IOL tilt (1), CME (1).

TABLE 10: COMPARISON OF VISUAL OUTCOME IN DIFFERENT STUDIES

BCVA	Our study (2013)		Azizur R et al (2011)		Zia ulMazhry et al (2010)		K.S. chandrakanth et al (2007)	
	NO	%	NO	%	NO	%	NO	%
6/6-6/9	27	54	18	60	25	50	15	60
6/12-6/18	15	30	11	36.7	16	32	10	40
6/24-6/36	8	16	1	3.3	6	12	0	0
6/60	0	0	0	0	3	6	0	0
Total	50		30		50		25	

The above table shows the comparison between our study and other studies regarding the visual outcome. Considering the number of patients, it seems to be quite comparable and better as reported in various other studies.

TABLE 11: COMPARISON OF COMPLICATIONS BETWEEN DIFFERENT STUDIES

COMPLICATIONS	Our study (N=50)	Mona R D et al (N=30)	Azizur R et al (N= 30)	Zia ul Mazhry et al (N=50)
Striae keratopathy	5 (10%)	-	-	-
Hyphaema	5 (10%)	-	2 (6.7%)	2(4%)
Vitreous in AC	-	-	-	-
Iritis	9 (18%)	3 (10%)	5(16.7%)	11(22%)
Secondary glaucoma	8 (16%)	3 (10%)	-	8(16%)
CME	5 (10%)	6 (20%)	3 (10%)	-
Tilted/decentred IOL	2 (4%)	1 (3%)	1 (3.3%)	1(2%)
Subluxation of IOL	1 (2%)	-	-	-
Suture erosion	3 (6%)	1 (3%)	2 (6.7%)	-
Retinal detachment	-	-	-	-
Others	1 (2%)	1 (3%)	-	4(8%)

Table 11 shows the comparison between our study and others in terms of complications. Iritis (18%) and secondary glaucoma (16%) were the most frequent complication in our study which is slightly on higher side if compared to other studies but lesser than Zia U.M et al study. None of the patient needed trabeculectomy later on while these symptoms were transient in nature.

Hidemann and Dunn[60] reported 11% and **Qazi**[61] reported 8.3% incidence of vitreous haemorrhage in their study but not noted in ours. CME, Secondary glaucoma and Iritis were the the most frequent complications noted in Mona RD et al study conducted in 2011.

The techniques for transscleral fixation of secondary IOLs have under gone many modifications and improvements over the past 2 decades.[62] Areas for continued improvement include simplifying the technique while minimizing the incidence of IOL tilt, late IOL dislocation, and suture erosion through the conjunctiva.

Intraocular lens tilt can be improved using a technique that creates 4-point fixation rather than the 2-point variety that results from a single pass through the sclera.[37] Late IOL dislocation, resulting from a mechanism of 10-0 Prolene suture degradation, may be reduced by ensuring more accurate placement of the haptics within the ciliary sulcus and, perhaps, by using a thicker gauge suture such as 9-0 Prolene or 8-0 Gore-Tex.[45,63] Attempts to prevent suture erosion through the conjunctiva with subsequent endophthalmitis have included suture knot rotation into the eye ; suturing within a scleral groove [64,65] ; and covering the knot with a patch graft[66], fascia lata[67], or scleral flap. [27,36,42,51,53,54]

Current opinions regarding the nature of late IOL dislocation point to a mechanism of suture degradation rather than internal cheese-wiring through partial-thickness sclera.[61] Thus, from the standpoint of decreasing the incidence of late IOL dislocation, there is no added benefit to a full-thickness scleral suture pass that results from rotating a knot into the eye. It is with these points in mind that a scleral covering, which avoids the need for knot rotation, is our preferred method for scleral fixation despite the possibility that knot erosion may occasionally develop through a scleral flap or the roof of a scleral tunnel.

There were certain limitations of this study. This study does not have an epidemiological value as incidence and prevalence of aphakia with inadequate capsular support cannot be ascertained.

The positive findings of this study are that the results are comparable to other studies done in different regions, proving the efficiency of procedure. The negative findings can be improved by taking care of certain measures like; to insert the IOL without tilting and preventing its decentration, the haptics should be placed precisely into the ciliary sulcus.

CONCLUSION

CONCLUSION

We studied the safety, efficacy and stability of scleral fixated PC-IOL with the Ab – Externo four point technique. More than 60% of the cases in our series achieved a postoperative visual acuity of 6/6-6/12. Only 2 of the cases developed IOL tilt which was attributed to lose sutures and slippage. But significant astigmatism was noted only in one case. And one patient had persistent corneal edema even at the end of sixth month follow up probably due secondary glaucoma.

Thus we conclude that the Ab – Externo scleral fixated PC IOL was found to have stable implantation and a true posterior chamber location in eyes having no capsular or zonular support with a low intra and post-operative risk profile. This technique showed favourable postoperative visual outcome in aphakic eyes.

SUMMARY

SUMMARY

In the present study, 50 patients with aphakia attending R.L. JALAPPA hospital and research centre, attached to Sri Devraj Urs medical college, Tamaka, Kolar were included. The average age group of these patients was 63.56 years with slightly female preponderance.

In the present study, 15 patients underwent primary scleral fixation of PC-IOL and 35 patients underwent secondary scleral fixation of PC-IOL after anterior vitrectomy with the four point fixation technique.

Twenty eight eyes (56%) had good vision in the range of 6/6 – 6/12, eighteen eyes (36%) had better vision in the range of 6/18 –6/24 and four (8%) eyes had vision in the range of 6/36 – CF. Among the 4 patients, 1 had less vision (CF 3m) due to persistent corneal edema, 1 patient had persistent secondary glaucoma and 2 had CME.

The most common early postoperative complications noticed were Iritis in 9 (18%) eyes followed by Secondary glaucoma in 8 (16%), Striae keratopathy in 5 (10%) eyes and Hyphaema in 5 (10%) eyes, all which resolved with postoperative medications over a period of 2 weeks. Hyphaema resolved within 3-7 days in all the cases.

And the late complications were Cystoid macular edema in 5(10.1%) patients, Suture erosion in 3 (6%) eyes, Mild lens tilt/mild decentered IOL in 2 (4%) eyes, subluxated IOL in 1(2%) patient and persistent corneal edema in 1 (2%) eye. IOL tilt which occurred in 2 cases (4%) developed significant astigmatism in one case only.

In conclusion the lack of serious complication and favourable visual outcome noted in our study suggest that Ab –Externo four point scleral fixation of posterior chamber intraocular lens implantation was found to be safe and effective alternate to other methods for aphakic rehabilitation.

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PROFORMA

ANNEXURE

PROFORMA FOR THE STUDY OF VISUAL OUTCOME AND COMPLICATIONS OF SCLERAL FIXATED POSTERIOR CHAMBER INTRAOCULAR LENS IMPLANTATION

NAME: IP NO:

AGE/SEX: DOA:

ADDRESS DOS:

DOD:

CHIEF COMPLAINTS:

H/O PRESENTING ILLNESS:

PAST HISTORY:

FAMILY HISTORY:

PERSONAL HISTORY:

GENERAL PHYSICAL EXAMINATION:

VITALS

BP: PULSE: RR: TEMP:

SYSTEMIC EXAMINATION

CARDIOVASCULAR SYSTEM:

RESPIRATORY SYSTEM:

PER ABDOMEN

CENTRAL NERVOUS SYSTEM

OCULAR EXAMINATION

HEAD POSTURE:

OCULAR POSTURE:

	RE	**LE**
VISUAL ACUITY:		
DISTANT		
PIN HOLE		
NEAR		

	RE	**LE**
EYE LIDS:		

LACRIMAL APPARATUS:

CONJUNCTIVA:

CORNEA:

SCLERA:

ANTERIOR CHAMBER:

IRIS:

PUPIL: Size –

Shape –

Reaction –

LENS:

OPHTHALMOSCOPY:

1. DIRECT:
2. INDIRECT:

SLIT LAMP BIOMICROSCOPY:

GONIOSCOPY:

INTRAOCULAR PRESSURE:

RE **LE**

LACRIMAL SYRINGING:

DIAGNOSIS:

KERATOMETRY:

Horizontal:

Vertical:

Axial length:

IOL POWER:

LAB INVESTIGATIONS:

BLOOD SUGAR:

URINE SUGAR:

INTRAOPERATIVE NOTES

TYPE OF LENS: POWER:

TECHNIQUE: SUTURE MATERIAL USED:

SURGEON:

POSTOPERATIVE MEDICATIONS

POST OPERATIVE FOLLOW UP

VISUAL ACUITY:

	1st day		1st week		1st month		3rd month		6th month	
	UCVA	BCVA	UCVA	BCVA	UCVA	BCVA	UCVA	BCVA	UCVA	BCVA
DISTANT										
NEAR										
Refraction										

COMPLICATIONS:

	1st day	1st week	1st month	3rd month	6th month
Corneal edema					
Striaekeratopathy					
Hyphaema					
Vitreous in AC					
Iritis					
Secondary glaucoma					
CME					
Tilted/decentred IOL					
Subluxation of IOL					
Suture erosion					
Retinal detachment					
Others					

CONSENT TO PARTICIPATE

I, the undersigned, agree to participate in this study and authorize the collection and disclosure of my personal information as outlined in this consent form.

I have read or had read to me and understand the purpose of this study, the procedures that will be used, the risks and benefits associated with my involvement in the study and the confidential nature of the information that will be collected and disclosed during the study.

I have had the opportunity to ask questions regarding the various aspects of this study and my questions have been answered to my satisfaction.

I understand that I remain free to withdraw from this study at any time and this will not change my future care.

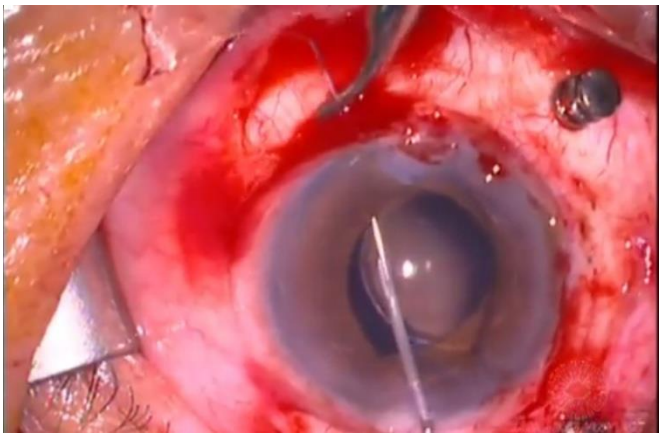
Subject's name and signature /thumb impression Date:

Name and signature of parent /guardian Date:

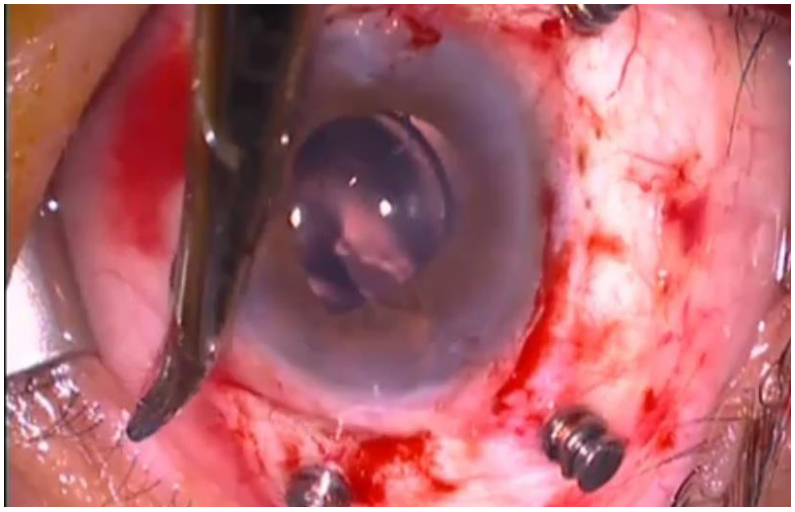
Name and signature of person obtaining consent Date:

PHOTOGRAPHS

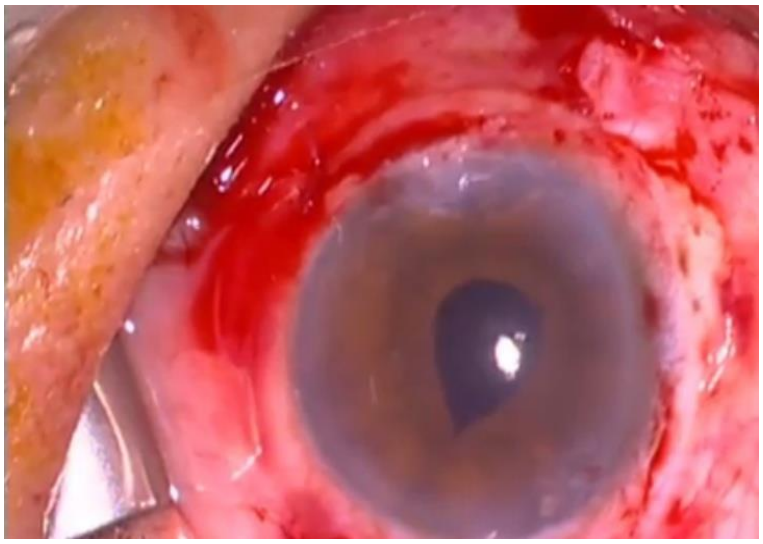
PHOTOGRAPH 1: APHAKIC EYE WITH PERIPHERAL IRIDECTOMY



PHOTOGRAPH 2: A DOUBLED ARM 10-0 PROLENE SUTURE IS PASSED INTO STRAIGHT NEEDLE.



PHOTOGRAPH 3: TIGHTENING OF SUTURES



PHOTOGRAPH 4: IOL CENTERED

PHOTOGRAPH 5: STRIAE KERATOPATHY

PHOTOGRAPH 6: CYSTOID MACULAR EDEMA

KEY TO MASTER CHART

1. SI No: Serial number
2. IP No: In patient number
3. RE: Right eye
4. LE: Left eye
5. SIMC: Senile immature cataract
6. SMC: Senile mature cataract
7. PPC: Posterior polar cataract
8. SHMC: Senile hypermature cataract
9. PSP: Pseudophakia
10. DV: Distant vision
11. NV: Near vision
12. BCVA: Best corrected visual acuity
13. CE: Corneal edema
14. SK: Striaekeratopathy
15. H: Hyphaema
16. SG: Secondary glaucoma
17. CME: Cystoid macular edema
18. RD: Retinal detachment
19. SE: Suture erosion
20. S-IOL: Subluxated intraocular lens
21. T-IOL: Tilted intraocular lens
22. UCVA: Uncorrected visual acuity
23. V in AC: Vitreous in anterior chamber

MASTER CHART

POSTOPERATIVE COMPLICATIONS

					POST OP DAY 1 RESULTS												1 WEEK POST OP RESULTS												1 MONTH POST OP RESULTS												3 MONTH POST OP RESULTS												6 MONTH POST OP RESULTS											
SL NO	Names	Age	Sex	I.P.no	SK	H	V in AC	Iritis	SG	CME	T- IOL	S-IOL	SE	RD	Others	SK	H	V in AC	Iritis	SG	CME	T- IOL	S-IOL	SE	RD	Others	SK	H	V in AC	Iritis	SG	CME	T- IOL	S-IOL	SE	RD	Others	SK	H	V in AC	Iritis	SG	CME	T- IOL	S-IOL	SE	RD	Others	SK	H	V in AC	Iritis	SG	CME	T- IOL	S-IOL	SE	RD	Others
1	ABDUL RASHID	55	M	721625	+	+	–	+	–	–	–	–	–	–	–	+	+	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2	NAGARATNAMMA	50	F	759560	–	–	–	–	–	–	+	–	+	–	–	–	–	–	–	–	–	+	–	+	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3	JAYAMMA	60	F	769184	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4	CHINNAPPA	70	M	778346	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
5	KRISHNAPPA	70	M	801805	+	+	–	–	–	–	–	–	–	–	–	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
6	SHANTHA BAI	65	F	822171	–	–	–	–	+	+	–	–	–	–	–	–	–	–	–	+	+	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
7	APPANNA	68	M	772305	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
8	SIDDAGANGAMMA	70	F	779024	+	–	–	+	–	+	–	–	–	–	–	+	–	–	+	–	+	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
9	MOHAN	66	M	771010	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
10	GURAPPA	70	M	778340	–	–	–	+	–	–	+	–	+	–	–	–	–	–	+	–	–	+	–	+	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
11	VENKATASWAMY	65	M	778340	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12	LAKSHMAMMA	65	F	797109	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
13	SHARADAMMA	65	F	782146	+	–	–	+	–	–	–	–	–	–	–	+	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
14	CHINNAPAPAMMA	37	F	819286	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
15	DODDAMUNIYAPPA	70	M	819299	–	+	–	–	–	+	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
16	RAMAKKA	60	F	821112	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
17	SHANTHA BAI	65	F	822171	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
18	KRISHNAMMA	65	F	821116	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
19	NARAYANAMMA	60	F	828415	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
20	LAKSHMAMMA	60	F	760846	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
21	SEETHAMMA	60	F	832797	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
22	MUNIYAPPA	68	M	839908	–	–	–	–	+	+	–	–	–	–	–	–	–	–	–	+	+	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
23	SUBRAMANI	55	M	843698	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
24	MUNISWAMY	70	M	769163	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
25	NARAYANAMMA	65	F	771023	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
26	MUNIVENKATAMMA	60	F	782118	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
27	RAMAKKA	70	F	824153	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
28	MUTHAMMA	65	F	832805	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
29	GOPALAPPA	65	M	829911	–	–	–	+	+	–	–	–	–	–	–	–	–	–	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
30	VENKATESHAPPA	63	M	836720	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
31	PUJARI MALLAPPA	55	M	834391	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
32	MALLESHAIAH	72	M	839944	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
33	RAJAMMA	52	F	846758	–	+	–	–	+	–	–	–	–	–	–	–	+	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
34	GUNDAPPA	58	M	851405	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
35	KADIRAPPA	77	M	860494	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
36	SHARFUNISSA	60	F	868366	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
37	GANGAPPA	60	M	872871	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
38	VENKATARAMAPPA	70	M	879278	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
39	NAGAMMA	70	F	880310	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
40	NANJUNDAPPA	78	M	855041	+	+	–	–	–	–	–	–	–	–	+	+	+	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	+
41	SAKAMMA	58	F	882051	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
42	THIMMAKKA	56	F	884098	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
43	PILLAMMA	65	F	886368	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	+	+	–	–	–	–	–	–
44	NAGAPPA	58	M	887466	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
45	BYANNA	54	M	774285	–	–	–	–	+	–	–	+	–	–	–	–	–	–	–	+	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
46	SHARADAMMA	65	F	782146	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
47	VENKOB RAO	75	M	930770	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
48	AKKAYAMMA	68	F	922194	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
49	ACHAMMA	65	F	934043	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
50	RAMANNA	65	M	928232	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–