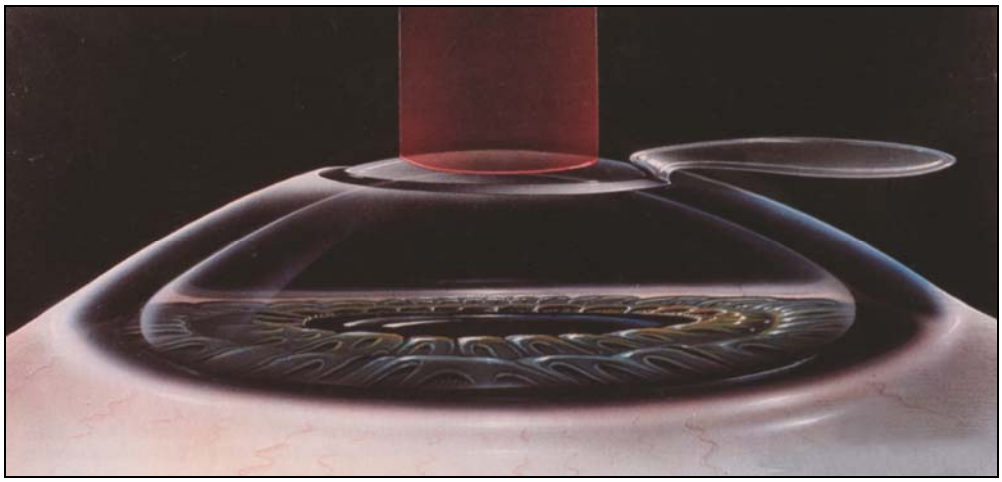
OUTCOME OF LASIK IN MILD, MODERATE AND HIGH MYOPIA



Dissertation submitted to the Tamil Nadu M.G.R. Medical University Chennai, India.

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CONTENTS

INTRODUCTION

Lasik - Laser in situ keratomileusis is by far the predominant refractive procedure in use today. We are beginning to learn both its full potential and its limitations. This includes refining our knowledge about how much refractive error can be corrected with LASIK while maintaining a high quality of vision.

Laser in situ keratomileusis has become the most popular refractive procedure performed today because of its safety, efficacy, quick visual recovery and minimal patient discomfort.

In LASIK, an automated microkeratome is used to create a corneal flap. The stromal bed is ablated with excimer laser, depending on the type and amount of refractive error in accordance with the predetermined data that has been entered in the excimer laser system. Under this precise control the laser reshapes the curvature of the cornea to correct myopia, hypermetropia or astigmatism. The flap adheres to the underlying stroma within 24 hrs. as a result of the endothelial pump. LASIK is performed on an out patient basis.

The efficacy and success of LASIK depends largely on the type of laser platform in use. Current fifth generation systems use a very rapidly repetitive and extremely small spot laser delivery with automated tracking of the eye movements to ensure precise treatment.

Refractive errors which include myopia, hypermetropia, astigmatism are optical defects of the eye that prevent light from being brought to a point focus by cornea, lens onto the retina. These refractive errors are the third leading cause of visual impairment and fifth leading cause of blindness. Uncorrected myopia is responsible for most refractive blindness and visual disability.

Myopia / short sightedness is a refractive error in which the parallel rays of light from infinity come to focus in front of the retina when eye is at rest, thus grossly reducing the vision. Myopia could be axial due to elongation of antero posterior diameter of the eye ball or curvature myopia due to increase in radius of curvature of the cornea; and index myopia due to change in refractive index of lens, cornea, aqueous, vitreous thus increasing dioptric power of the eye. Lasik ablates the central cornea, flattening it and hence the image is brought into focus.

AIM OF THE STUDY

To study the outcome of LASIK performed in patients with mild, moderate and high myopia using the Mel 80 excimer laser system

REVIEW OF LITERATURE

ERRORS OF REFRACTION

In normal individuals parallel rays of light are focused on the retina. Such a state of refraction is termed emmetropia. If in a state of rest the parallel rays of light from infinity are focused either in front or behind the sensitive layer of retina in one or both meridian it is termed ametropia.

Ametropia include

i) Hypermetropia

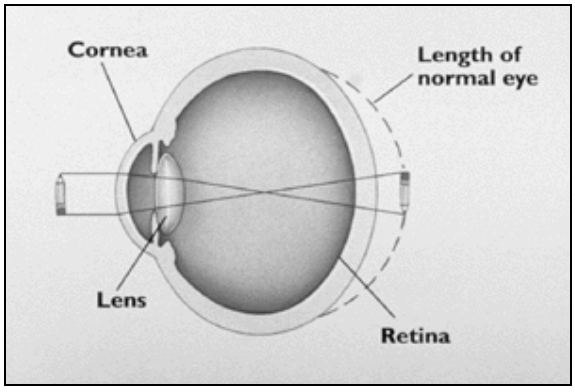
ii) Myopia

iii) Astigmatism

HYPERMETROPIA: [in excess, measure, the eye]

Long sightedness

It is a term of refractive error in which parallel rays of light are brought to a focus some distance behind the retinal layer when eye is at rest. The image formed is a circle of diffusion and is blurred.



Axial hypermetropia

An abnormal shortness of anteroposterior length of the eye. Each mm of shortening represents 3 D of refractive change. Pathological cause of anteroposterior shortening includes - orbital tumor, inflammatory mass, intraocular tumors, oedema, retinal detachment.

Curvature Hypermetropia:

Curvature of any of the refracting surface is unduly small.

Cornea is usual site of anamoly

Certain conditions

- cornea plana, following trauma,
- An increase in 1 mm of radius of curvature produces hypermetropia of 6 D

Index Hypermetropia

- Manifests itself as decrease in the effectivity of lens. It occurs physiologically in old age, pathologically in diabetes, posterior dislocation of lens, absence of lens - Aphakia.

Clinical features

- Blurring of vision for close work, headache, Eye strain, spasm of ciliary muscle, accomodative convergent squint.

Signs

- Eye is usually small, small cornea, shallow anterior chamber, retina has Shot-silk sheen, optic disc may be dark greyish red colour; Accentuated vascular reflex and tortousity

TREATMENT

Non-surgical Treatment

Spectacle correction after cycloplegic refraction with convex lens

Contact lens

Surgical Treatment

- LASIK / PRK / conductive keratoplasty / Phakic IOLs / Refractive Lens exchange (RLE)
- Holmium laser thermoplasty for lower degree of hyperopia
- Hyperopic PRK
- Hyperopic Lasik

Complication of Hypermetropia

- Recurrent styes, blepharitis, chalazion
- accomodative convergent squint
- Ambylopia

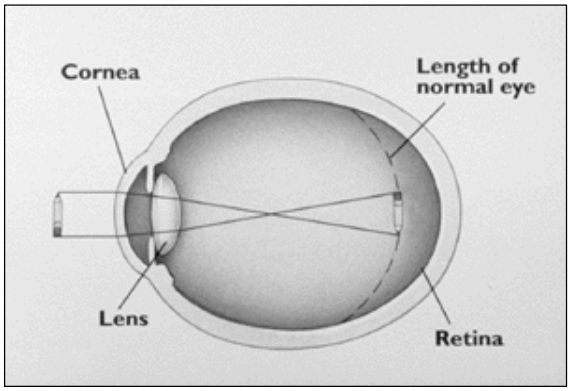
  predispose to primary narrow angle glaucoma

MYOPIA: [I Close the eye]

Short sightedness

Definition

It is that form of refractive error wherein parallel rays of light from infinity come to focus in front of the sensory layer of retina when eye is at rest.



The term myopia comes from the habit which short sighted people frequently half close the lids when looking at distant object so that they may gain advantage of stenopaeic opening.

Optics of Myopia

In myopes a near object may be focussed without any effort of accomodation if it is situated at the punctum remotum. The image of an object at infinity is made up of circles of diffusion formed by diverging beam. The nodal point in myopes is further away from the retina and image formed is larger in size. Accomodation is of little value to myopes for higher errors. The amplitude of accomodation is small.

Classification

i) Simple myopia

ii) Pathological myopia

i) Simple myopia

Simple or developmental myopia is the commonest type and considered as a physiological error and not associated with any disease of the eye. It results from normal biological variations in development of eye which may or may not be genetically determined.

- Axial myopia - results from increase in the anteroposterior length of eye ball. It is the commonest form.
- Curvature myopia - results from increase in the radius of curvature of cornea, lens or both. A variation of 1 mm of radius of curvature results in a refractive change of 6 D.
- Index myopia - Here changes in dioptric system may be due to change in refractive index of lens, cornea, aqueous, vitreous. The dioptric power of the eye is too strong for the axial length of the eye.

Clinical picture

The eye of simple myopia is large and prominent, chamber is deep, pupil reaction is sluggish, macula appear slightly nearer to the disk. There may be an associated divergent squint.The main symptom include: decreased visual acuity, occasional photophobia. Myopic patient concentrate more or indoor activity.

- ocular asthenopia due to dissociation between convergence and accomodation. Over accomodation results in spasm increasing myopia
- Fusion becomes weak and binocular vision is affected

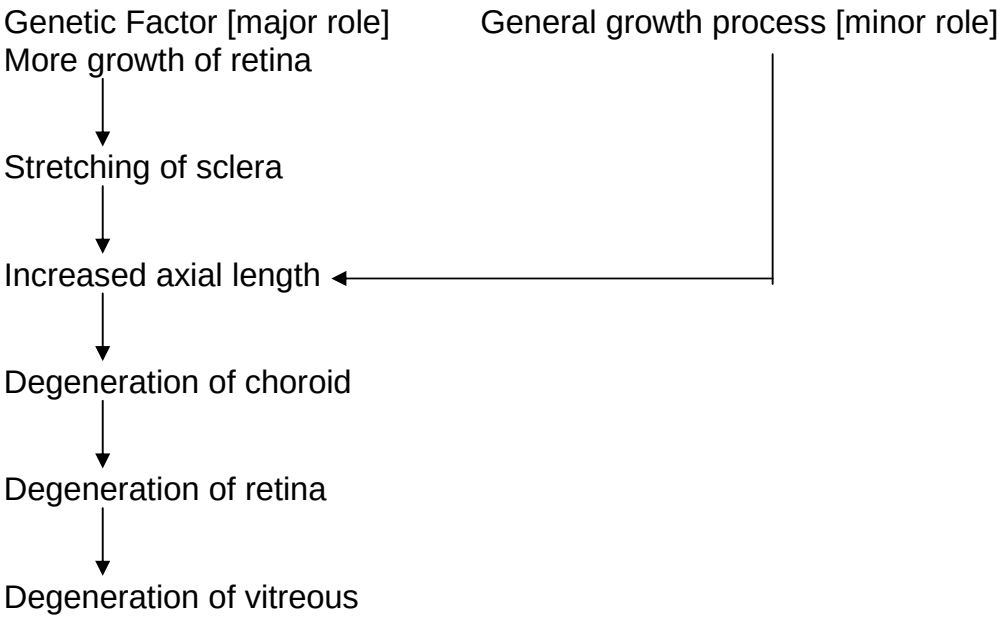
- Patient starts suppressing one eye and suppressed eye deviates outwards.

PATHOLOGICAL MYOPIA / DEGENERATIVE / PROGRESSIVE

- It is a rapidly progressive error resulting in high myopia during early adult life. Usually associated with degenerative change in the eye.
- It results from rapid axial growth of eye ball outside the normal biological variation of development.
- It is definitely linked with i) hereditary ii) general growth process

i) Hereditary factor : - progressive myopia is famalial, more common in races like Chinese, Japanese. Arabs and Jews

ii) Role of general growth process: - Factors like nutrition deficiency, debilitating diseases endocrinal disturbance and indifferent general health also influence progress of myopia.



CLINICAL PICTURE

- Defective vision which may be uncorrectable.
- Muscae volitantes
- Night blindness

Signs

- Eyes are more prominent
- cornea appears large
- deep anterior chamber
- pupils slightly large and sluggish

Fundus picture

- optic disc appears large and pale
- myopic cresent
- atropic patches at macula
- Foster Fuch's spot
- Cystoid degeneration
- Posterior staphyloma
- Posterior vitreous detachment
- Contraction of visual fields

ERG - subnormal

Complications

- retinal detachment
- complicated cataract
- vitreous haemorrhage
- choroidal haemorrhage

Treatment:

Non-surgical

- spectacle correction with concave lens
- contact lens

Surgical Treatment

- radial keratotomy (historic importance)
- photo refractive keratectomy
- LASIK
- Intracorneal ring implantation for low myopia
- Phakic IOLs, RLE (refractive lens exchange)

ASTIGMATISM

Astigmatism is a type of refractive error wherein refraction varies in different meridia. Consequently the rays of light entering the eye cannot converge to a point focus but form focal lines.

Two types of :

i) Regular Astigmatism

ii) Irregular Astigmatism

Regular Astigmatism

- The refractive power changes uniformly from one meridian to another.
- May be corneal due to abnormality of curvature of cornea.
- Lenticular astigmatism may be due to lenticonus, subluxation.

Types: i) depending on axis

With the rule - the two principle meridian are placed at right angle to one another but vertical meridian is more curved than the horizontal. Correction includes concave cylinder at $180^{o} \pm 20^{o}$ or convex cylinder at $90^{o} \pm 20^{o}$.

Against the rule - horizontal meridian is more curved than the vertical meridian . Correction requires convex cylinder at $180^{o} \pm 20^{o}$ and concave cylinder at $90^{o} \pm 20^{o}$.

Oblique astigmatism: Here the two meridian are not horizontal or vertical meridian though they are at right angle to each other.

Types of regular astigmatism

Simple astigmatism

- The rays are focused on the retina in one meridian either in front or behind the retina in other meridian. Simple myopic / hypermetropic.
- Compound astigmatism The rays of light in both meridia are focused either in front or behind retina - compound myopic or compound hypermetropic

Mixed Astigmatism : The light rays in one meridia are focussed in front and in other meridia behind the retina thus one meridia is myopic and the other hypermetropic

Symptoms

- Defective vision
- Blurring of objects
- Asthenopia

Treatment

Non-Surgical - spectacle correction, contact lens

Surgical - Astigmatic keratotomy

- photo astigmatic refractive keratotomy
- Lasik

Irregular Astigmatism

Irregular change of refractive power in different meridia

Types

- curvature irregular astigmatism found in corneal scars or keratoconus
- Index irregular astigmatism in immature cataracts

Symptom: Defective vision, polyopia, distortion.

Treatment

- Contact lens
- Penetrating keratoplasty
- Lamellar keratoplasty

UNDERSTANDING REFRACTIVE CORNEAL SURGERY

Refractive corneal surgery has been used to correct myopia and hypermetropia for more than 40 years. Conceptually refractive corneal surgery attempts to remove, add, modify the corneal stroma so that radius of curvature of anterior corneal interface is altered as desired.

History

The root of lamellar refractive corneal surgery lay in Bogota, Colombia and in the persistent work of Professor Jose Ignacio Barraquer.[2-6] Based on the fundamental principle that cornea contributes two thirds of refracting power of the eye, Barraquer attempted to alter the tear film / anterior cornea interface radius of curvature by adding or removing corneal tissue.

Keratomileusis in situ: - derived from Greek world keras (Horn-like = cornea) smileusis - (carving). Keratomileusis in situ for myopia was the first to develop in late 1940. The procedure involved raising a corneal flap and removing tissue from residual stromal bed. Barraquer[3-6] performed a free hand lamellar dissection of anterior half of cornea with a keratome. Subsequently, refractive cut was attempted with second pass of the knife to remove stromal bed and cap was replaced with flattening of the corneal curvature thus reducing myopia. This procedure was abandoned due to many technical difficulties.

This gave way to keratophakia in 1961 which involved steepening of central corneal curvature by placing a disc of tissue under the lamellar cap derived from alloplastic stromal disc harvested from a donor cornea.

This was seen as possible solution in aphakia but with advent of IOL interest in keratophakic subsided.

Freeze myopic keratomileusis[4]

In an effort to overcome technical difficulties of manual cut Barraquer used contact lens lathe to sculpture the frozen lamellar corneal cap. Barraquer recognised that the cutting speed and relation between IOP and diameter of resection were factors directly affecting quality and depth of the cut.

His efforts for more predictable and accurate cuts led to the development of applanator lenses, suction rings of various diameters and various heights of microkeratome tracks. This work constituted the basis for future microkeratome evolution.

The freeze myopic keratomileusis has two disadvantages

- Cryolathe was too expensive and complex to maintain.
- Learning curve was too steep with high complication rate.

Epikeratophakia / Epikeratoplasty

Kaufmann and Werblin introduced epikeratophakia in 1979 in a effort to avoid use of cryolathe. The innovators attempted to use preprocessed refractive lenticules.

A stromal disc was removed from donor eye with microkeratome and was frozen and lathed into a concave or convex lens and then lyophilized and stored for later use. It was intended for use in myopia,

hypermetropia, keratoconus. Unfortunately, the results were neither predictable nor safe. Major complications were epithelization of donor lenticule, persistent epithelial defect, epithelial in growth, melting, scarring and hence epikeratophakia was withdrawn.

Barraquer - Krumeich Swinger (BKS) techniques[2]

It was introduced in 1985. An improved microkeratome, a set of dyes, and suction stand microkeratome was used to perform a total lamellar cap. The cap was placed epithelial side down on suction dyes for microkeratome to perform second cut on stromal aspect of the cap. The sculpture lamellar disc was finally sutured back to the bed. The non freezing technique has more advantage over freeze techniques with rapid and comfortable recovery, preservation of fibroblasts and epithelium. However, significant astigmatism could not be avoided.

Automated lamellar keratoplasty

Development of automated geared microkeratome by Ruiz in late 1980 introduce automated lamellar keratoplasty. Speed of cut could be controlled resulting in more even and consistent cuts. The second cut was made on the bed. The depth of second cut was adjusted by altering the height of suction ring and corneal cap was sutured back.

Advantages

- Ease of use
- Efficacy in correcting high myopia
- Rapid recovery

Disadvantages

- High degree of irregular astigmatism

Photorefractive keratectomy

Trokel *et al.*[21] suggested PRK in 1983. Use of 193 nm excimer laser in refractive surgery was introduced. It was found that for myopias greater than 6 D, PRK resulted in corneal haze, regression of refractive effect and poor predictability.

In this procedure the centre of entrance pupil is marked and the epithelium is mechanically removed followed by ablation of corneal stroma with excimer laser. Reepithelisation occurs in 3 – 4 days. However PRK was limited to myopia from -1 to -5 D. In the present day, higher degree of myopia upto -12.00 D can be corrected with PRK. Improvements in the laser profile, small spot size, Gaussian curve have made this possible.

Indications

- Cornea thinner than 500 μm.
- Crowded orbits with narrow palpebral fissure.
- Recurrent corneal erosion. Anterior basement membrane disorders with refractive errors.
- Glaucoma suspects.

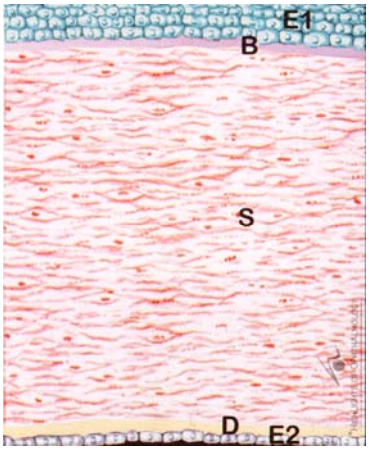
Laster in situ keratomileusis

Laser in situ keratomileusis was introduced designed and developed at University of Crete and Verdin Oyannion Eye Institute of

Crete in 1988. The procedure was introduced to describe a combination of lamellar refractive corneal surgery and excimer laser photo ablation of cornea under a hinged flap and removing central tissue from bed by Pureskin in 1966. The hypothesis was that a flap would assure better fitting of tissue after removing intrastromal tissue with excimer laser photo ablation and would not affect the anatomical relation of corneal layer in two ways :

- preservation of Bowman's layer
- integrity of nervous net
- reduction of maneuvers and time required for the procedure.

CORNEAL ANATOMY



E1 – Epithelium (30 – 50 μ)

B – Bowmans Membrane (10 – 14 μ)

S – Stroma (500 – 900 μ)

D – Descemets membrane (3 – 12 μ)

E2 – Endothelium (4 – 6 μ)

Contribution of corneal layers and shape of the optics of the eye.

The air - tear film interface procedure the major optical power of the eye.

The optical power of the eye derives primarily from the anterior corneal curvature which produces approximates 2/3 of eyes refraction power accounting for + 48 D.

By altering corneal shape, keratorefractive surgical procedure changes refractive status of the eye for example the changing refractive status of the eye by 2 D may require a shape change of less than 30 μm.

The central cornea is not spherical and hence reduces spherical aberration minimising refractive error fluctuation as pupil size changes. If the central cornea is steeper than its periphery the corneal shape is prolate and when the central cornea is flatter than the periphery then the corneal shape is oblate. Prolate cornea reduces spherical aberration while the oblate increase it .

Computerised corneal topography

Corneal topography can be determined using keratoscopic images or using corneal elevation data. Keratoscopic image can be digitally captured and analysed. Placido disc based computerised topographers are most commonly used. These units assure that the angle of incidence is nearly perpendicular to the corneal surface and the radius of curvature is the distance from the surface to the intersection with the line of sight or visual axis.

Instantaneous power and curvature

A method of describing corneal curvature on placido disc based topography is to use instantaneous radius of curvature / (tangential power). The radius is determined by taking a perpendicular path through the point in question from a place that intersects the point and the visual axis but allowing the radius to be the length necessary to correspond to a sphere with some curvature at that point. The instantaneous radius of curvature with curvature given in diopters is estimated by the differences between the corneal index of refraction and 1.000 divided by this tangential determined radius.

Mean Curvature

The algorithm determines a minimum size and maximum size best fit sphere and from their radius determines an average curvature known as mean curvature for that point. These power are then mapped using standard colours to represent diopter changes allowing even more sensitivity to peripheral changes of curvature.

Corneal shape - Corneal shape can be indirectly described from placido disc based topography.

In addition to power and elevation maps computerised topography systems may display, other data - pupil size, location, indices estimating regular and irregular astigmatism, estimates of probability of having keratoconus, simulated keratometry, corneal asphericity.

Indication of corneal topography in refractive surgery

- Preoperative evaluation of potential refractive surgical candidates
- Detection of irregular astigmatism, keratoconus, other thinning disorders of cornea. Corneal surgery, trauma, ectasia contact lens warpage.
- To demonstrate effects of keratorefractive procedures.
- Pre and post-operative maps may be compared to determine the achieved refractive effect.

Pachymetry

Pre-operative pachymetric measurement of corneal thickness is mandatory because an adequate stromal bed must remain to minimize the possibility of post-operative corneal ectasia. The following formula is used to calculate the corneal thickness.

Central corneal thickness - thickens of flap - depth of ablation = residual bed thickness. The procedure is usually performed with ultrasound pachymetry.

Most practitioners use as a guide line a minimum residual corneal bed thickness of 250 μm.

Many surgeons use intraoperative pachymetry especially for high myopic correction, enhancements or thin corneas to determine actual flap thickness.

In calculating the likely residual thickness, the surgeon must use the ablation depth based on the intended total correction and not the value of nomogram - adjusted refractive error that is programmed into the laser.

Wavefront Analysis

The wave theory of light has a major application in wave front analyses. Wave front analysis measures the relative location of the light waves based on an arbitrary reference sphere. As light waves converge to the focal point in an ideal optical system, they cross the reference sphere simultaneously.

If the image is astigmatic the light waves will cross the reference sphere at slightly different times. In optically perfect system the references sphere and wave front coincide. So wave front aberration is zero.

Measurement of wave front aberration and graphic representation.

There are several techniques for measuring wave front aberration like. Hartmannshack, Tscherning, thinbeam single ray tracing and optical path difference.

Hartmannshack. Sensor is the most popular techniques. Here a low power laser beam is focused on the retina. A point on the retina then acts as a point source. An array of lenses samples parts of the wave front and focuses light on a detector. The wave front shape can be determined from the position of the focus on each detector. The wave front aberration is represented as three dimensional shapes.

Lower order aberrations include myopia, hypermetropia, regular astigmatism. Myopia produces: Positive defocus , Hypermetropia produces: Negative defocus.

Regular astigmatism have orthogonal and oblique components.

Higher order aberrations

- spherical aberration
- coma and trefoil
- secondary astigmatism
- Quadra foil
- Pentafoil

3rd and 4th order aberrations (i.e. HOA in the central part of the Zernike Pyramid) are more likely to affect the functional visual acuity post

lasik and if significant can cause post lasik, glare, haloes, monocular diplopia, starburst, difficulty in night vision. Wasca aberrometry used in this study measures the 3rd and 4th HOAs. If significant HOA are detected in patients undergoing lasik, a customised correction is performed.

Laser Biophysics

Three laser- tissue interactions are exploited for keratorefractive surgery.

- Photothermal uses holmium Yag laser with wavelength 2-13 μm.
- Photo disruption uses picosecond Nd:Yag to performed intrastromal ablations.
- Photoablation is the most important laser tissue interaction in refractive surgery. It breaks chemical bonds using excimer (excited -Dimer). Laser energy of more than 4 eV. Per photon is sufficient to break.

Carbon -nitrogen or carbon tissue bonds. Argon fluorids (ARF) lasers are excimer lasers that use electrical energy to stimulate organ to form dimers with the caustic fluerine gas. They generate a wave length of 193 nm with 6.4 ev. Per photon. They have high energy per photon, light at this end of electromagnetic spectrum are also very, low tissue penetration. It is not only capable of great precision with little thermal spread but also lacks penetrance or lethal to cells thus making it non mutagent enhancing its safety.

Types of photoablation lasers

i) Broad beam lasers - rely on internal optics to create a smooth and homogeneous multimedia laser beam of up to 7 mm in diameter. They have very high energy per pulse and require small number of pulse

ii) Scanning slit laser - use excimer technology to generate narrower slit beam that is scanned over the surface of the tissue to alter photoablation profile improving the smoothness of ablated cornea.

iii) Flying spot lasers - use smaller diameter beams - 0.7 - 2.0 mm that are scanned at a higher rate but require a tracking mechanism for precise placement to create desired pattern of ablation.

Wave front - guided laser ablation

Information obtained from wave front sensing aberrometer is transferred electronically to the treatment laser in order to programme the laser ablation. The wave front guided laser uses an active tracking system which stabilizes the eye during treatment and allows the delivery of customised ablation profile. The wave front guided laser attempts to treat both lower order (myopia, hyperopia or astigmatism) and higher order aberrations.

PATIENT EVALUATION AND PROCEDURE

Preoperative evaluation

A thorough pre-operative evaluation is of critical importance in achieving a successful outcome following refractive surgery. During this evaluation the ophthalmologist decides if the patient is or is not a good candidate for refractive surgery.

i) Patient expectation - surgeon should explore expectation relating to both refractive result and emotional result (improved self esteem). Patient should understand that they should not expect the procedure to improve their best corrected visual acuity and the procedure will not prevent possible future ocular problems like cataract, glaucoma, retinal detachment. Patients should be told that lasik is being done to decrease dependence on glasses and not to get rid of glasses.

ii) Medical History - it should include history of any systemic conditions like diabetes, prior surgeries, connective tissue disorders, any immunocompromised state like HIV / AIDS, drug history – isotretinold, somatripten, amiadarone, hormone replacement therapy.

iii) Pertinent ocular history - dry eyes, blepharitis, recurrent errosion, retinal tears, detachment, uses of glasses, stability of current refraction, contact lens history - types of contact lens, duration of contact lens use (contact lens may change shape of cornea). Patient should discontinue soft contact lens for at least three days to two weeks and rigid lens for at least 2-3 weeks prior to surgery. After 40 years, patient who have undergone refractive surgery will

need presbyopic correction with glasses and this should be explained to the patient. Monovision - one eye corrected for distance fully and the nondominant eye is under corrected to approximately -1.5 to -1.75 D, so that it allows good uncorrected distance and near vision without use of glasses.

iv) Examination - uncorrected visual acuity for distance and near should be measured to determine amount of correction to be performed. A full cycloplegic refraction is mandatory. A final subjective refraction using the autorefractometer, Wasca oberrometer values should be done by ophthalmologist and refined using duochrome test.

Anterior segment examination

Pupillary examination involving evaluating pupil size in bright room light and dim illumination, any afferent pupillary defect, various techniques to measure size of pupil - light amplification pupillometer, infrared pupillometer, Wasca abarrometer. It is important to standardise pupil size measurement. Large size pupil may be one of risk factors for post-operative glare and halo after refractive surgery. As a rule pupil size greater than effective optical zone (6-8 mm) increase risk of glare. Optical zone should be larger than the pupil diameter to prevent glare, halos.

Ocular motility, confrontation fields

Asymptomatic tropia and phoria patients may develop symptoms after surgery if change of refraction causes the motility status to break down. Orthoptic evaluation should be done pre-operatively. Confrontation

fields should be done in all patients. General anatomy of orbit should be assessed. Patients with small palpebral fissure, large brow may have inadequate exposure and difficulty in achieving suction with microkeratome.

Intraocular pressure

- In patients with glaucoma, refractive surgery elevates the intraocular pressure during procedure aggravating optic nerve damage.
- Topical corticosteroid use after the procedure may cause elevation of intraocular pressure in corticosteroid responders. NCT / Applanation Tension in all prelasik patients is mandatory. After lasik - Applanation Tension - shows a false low reading.
- ***Slit lamp examination***: Complete slit lamp examination of eye lids, cornea, anterior segment should be performed.
- To check for Blepharitis, meibomites, stye, tear film stability, conjunctival scarring, pterygium, corneal surface abnormalities, epithelial erosions, look for any dystrophies, keratoconus, ABMD corneal size, vascularisation, any opacities.
- *Anterior chamber examination* - depth, iris, crystalline lens - for cataract
- *Dilated fundus examination* - It is important to be certain that posterior segment is normal. Special attention given to optic nerve (glaucoma, optic nerve drusen), peripheral retina - (retinal tear, detachment, retinal holes, peripheral degenerations) (high myopia are at increased risk for retinal detachment).

CORNEAL TOPOGRAPHY

Pachymetry

Wave front analysis

Informed consent

After evaluation the surgeon analysis all the information and discusses the findings with the patient. Risk and benefits of various medical and surgical alternatives are discussed.

Discussion about

- Expected uncorrected visual acuity
- Need of distance or reading glasses
- Risk of decreased best corrected visual acuity, severe visual loss, glare halos, dry eyes
- Need to revise a corneal flap for flap displacement, striae, epithelial in growth
- Patient should be given informed consent documents and should sign the form well before the surgery.

PROCEDURE

Preoperative preparation of the patient

- Topical anaesthetic drops are instilled.
- Skin is usually prepped with povidone iodine
- Pre-operative topical antibiotic is used
- The skin or eyelashes are drapped with plastic drape or steri-strips.
- Universal eyelid speculum is placed to accommodate the suction device and the path of microkeratome.
- The cornea may be marked with asymmetric corneal marker, a variety of which are available. We use gentian violet pen to mark the cornea.

Programming the Lasik

Actual treatment value programmed into the laser is typically an adjustment of the final refractive goal derived from each surgeons individual nomogram as developed by monitoring outcome. The size of ablation zone will be determined by the patient refractive error, the calculated residual stromal bed and the pupillary diameter.

Creations of flap by microkeratome

The diameter of the flap is determined by the surgeon based on type of refractive error, the corneal curvature and microkeratome suction ring dimension, corneal anatomy. The suction ring is centered over the entrance pupil, suction is activated. The intraocular pressure is assessed at this point (low intraocular pressure can result in poor quality, thin or incomplete flap) with a Barraquer applanator, pneumotonometer, or digitally. The IOP should be greater than 65 mm Hg. prior to making the lamellar cut the surface of cornea is moistened with BSS (Balanced Salat Solution).

The suction ring provides 3 functions: globe fixation, elevation of intraocular pressure to make possible a keratectomy of even thickness and a dove tail track to guide the advancement of microkeratome head. Once adequate high IOP is obtained the corneal surface is irrigated with BSS to minimize epithelial roughening as the microkeratome is passed. The microkeratome is loaded into the dove tailed groove on the suction ring. The instrument is advanced by activation of surgeon controlled foot pedal. It is advanced to stopper mechanism. Upon completion the cut the instrument is reversed and removed. The vacuum is discontinued and the suction ring is removed. The flap is reflected with a single motion using a flap elevator.

Ablation

The excimer laser system is then focused and centered over the pupil and the patient is asked to look at a fixation light. The flap is reflected and the patient is asked to continue to fixate. The stromal bed is dried with a microsurgical debris free sponge. The laser is focused on the stromal bed and centered on the pupil. The tracking system is activated when the patient confirm that the fixation light of the laser is still visible ablation is started. In larger diameter ablations, a hinge protector may be needed to shield the underside of the flap near the hinge from the laser pulse.

Replacing the flap

After ablation is completed the flap is replaced onto the stromal bed, the interface is irrigated until any interface debris is eliminated. The surface of the flap is stroked with smooth instrument like the irrigation canula or moistened microsurgical spear sponge from hinge to the

periphery to ensure wrinkles are eliminated and that flap settles back into its original position indicated by the radial marks. The physiologic dehydration of the stroma by the endothelial pump will begin to secure the flap in position in few minutes. Once flap is adherent the speculum is carefully removed. A drop of antibiotic and corticosteroid is placed at the end of the procedure. The flap is rechecked at the slit lamp before the patient leaves to make sure it is in position. Protective Goggles are worn to prevent accidental trauma.

Post-operative management

Topical antibiotics and corticosteroids are prescribed for 5-7 days. Artificial tear substitute are prescribed to keep the ocular surface lubricated for 3 months

Follow up

1 day - to make sure that flap remains in proper alignment, no evidence of infection, inflammation and at 1 week, 1 month, 3 months, 6 months and 12 months.

Complications

Flap related complication

1. Corneal perforation - due to faulty assembly of microkeratome. It may be associate with immediate expulsion of intraocular structures and vitreous due to high intraocular pressure produced by suction ring. very common.
2. **Incomplete flap** due to electrical failure, incorrect use of automated microkeratome foot pedal control, Obstruction by, eyelashes, eyelids

speculum, drape, loose epithelium. - Abort procedure, put flap back and repeat procedure at a later date.

Button hole flap, large flap tears and irregular flaps. - due to inadequate suction with insufficient high IOP, epithelial sloughing, excessive steep or flat corneal curvature.

Free flaps or caps

- Due to faulty microkeratome assembly, flat corneal curvature, inadequate suction.
- Perform ablation and replace the flap with or without sutures.

Poor flap adhesion

May be a sequel to excessive irrigation during flap replacement or too much manipulation of flap. The flap is gently stroked into place and given longer than 4 minutes drying time.

Trapped Debris

May originate from tear film, unclear irrigation solution, surgical instruments, sponges, atmosphere pollution - good irrigation under the flap at the end of procedure is done.

Post-operative flap complication:

Wrinkling - produces, glare, multiple images, distortion - The flap should be reflected repositioned and left to dry. Repositioning of flap can be done one or more years after surgery.

Dislocation and flap slippage

- Flap must be repositioned after the bed and flap stromal surfaces are cleared carefully.
- Prevention is by maintaining moist, smooth epithelial surface by frequent application of artificial tears.

Epithelial in growth

- Occurs from fistulous tract at edge of the flap.
- It is prevented by pressing down the edge of the flap at the end of the surgery with micro sponge.

Central Island

Results from uneven stromal hydration or obstruction to laser energy from ejected corneal vapour. It may produces glare, or ghosting.They often resolve spontaneously.

Complication due to ablation

1. Decentered ablation - due to inadequate fixation. It is prevented by a good eye tracking system. It may cause double vision, glare, shadow
2. Cresent shaped second image results from performing laser ablation smaller the pupil diameter. When pupil dialates in dark ghost images appear. It can be prevent by using pupillometer and making sure ablation diameters are greater than 5.5 mm.

PATIENTS AND METHODS

Patients with low myopia (- 1.00 D to - 6.00 D) Moderate myopia (- 6.00 D to - 12 D) and High myopia (> - 12 D) undergoing LASIK using the Mel 80 excimer system at the cornea clinic of Institute of Ophthalmology, Joseph Eye Hospital, Trichy between August 2005 to December 2005 were included in the study.

Exclusion Criteria

Patients with

- Corneal thickness < 500 μm
- Keratoconus
- Previous corneal surgery
- Cataract
- Immunocompromised patients (poor healing, increase risk of infection)
- Pregnant women (due to possible change in refraction)
- Corneal opacities
- Basement membrane dystrophies
- Strabismus
- Narrow palpebral fissure
- Glaucoma, retinal detachment

A standard protocol was used to collect and document all the details regarding the cases included in the study.

A detailed information about history, complaints, occupation of the patient were taken. This included type of visual problem, duration of symptoms, duration of wearing glasses / contact lens, frequency of change of glasses, any prior corneal surgery, trauma, any prolong use of topical medications, any history of systemic disease.

A complete ocular examination was done for each patient which included uncorrected visual acuity, best corrected visual acuity following cycloplegic refraction, slit lamp examination, corneal topography, ultrasound pachymetry, pupillary size, non-contact tonometry, slit lamp biomicroscopy with +90 D and indirect ophthalmoscopy, Wasca abberometer.

Informed consent was taken for all the patients after informing all the risk factors of the procedure.

- Antibiotic drops (Ofloxacin / Gatifloxacin) 4 times a day prescribed 1 day before surgery
- Patient was advised not to use deodrants, perfumes, flowers on the day of surgery to avoid attenuation of laser energy.
- Patient was asked to wash face with soap and water
- Ofloxacin eye drops and NSAID eye drops applied 3 times at 15 min. intervals.
- One drop proparicaine applied 20 min. before scheduled surgery.
- Patient was positioned on the laser bed and one more drop of proparicaine applied.
- Eyelid margins was prepared with betadine (0.5%)
- Head was draped with towel and speculum applied

- Asymmetrical corneal marking was made with gention violet pen.
- Eye washed with BSS (basal salt solution)
- Suction ring / microkeratome complex placed on the eye after proper centration and vacuum was activated.
- Cut was made when IOP reached to minimum of 60 - 65 mm Hg. which was determined by dilated pupil, vacuum of 29.1 mm Hg. on the microkeratome console or Barraquers applanation tonometer.
- On completing the cut the instrument was reversed and removed, vacuum discontinued and suction ring removed.
- Corneal flap was lifted using flap elevator.
- The stromal bed was dried with merocel sponge.
- The CCA plus unit swings in before laser ablation can be activated.
- Continuous monitoring of the pupil with infrared cameras and plume evaluation in CCA plus unit ensures precise ablation.
- Depth of ablation determined by various parameters - amount of refractive error, pupil size in dark, thickness of the cornea.
- Based on computer calculations programmed for final desired correction laser ablation was performed
- Stromal bed and under surface of flap washed before repositioning of the flap.
- Corneal markings aid in precise repositioning of the flap.
- Flap was allowed to dry for 3-4 min.
- 1 drop moisol PFS applied and speculum removed.
- 1 drop antibiotic drop (Ofloxacin) and NSAID was applied
- patient was asked to wear dark glasses and keep eyes closed for 1 hour.
- The patient was reviewed in slit lamp before leaving the hospital

Post-operative management

Topical antibiotic drops (Ofloxacin), FML eye drops 4 times a days and lubricating drops was prescribed 4 times a day.

Follow-up

Follow up was done on 1st post-operative day and subsequently on 1st week, 1st month, 3rd month and 6th month.

Thorough slit lamp examination was done during each visit and visual acuity was recorded.

Final refraction was done at 6th month.

RESULTS

In this prospective, randomised study 37 eyes of 19 patients belonging to the mild myopia group (-1 D to -6 D). 41 eyes of 23 patients belonging to the moderate myopia group (-6 D to -12 D) and 18 eyes of 13 patients belonging to high myopia group (> - 12 D) who underwent lasik between the period August 2005 to June 2006 at Institute of Ophthalmology, Joseph Eye Hospital, Trichy, were included in the study.

Gender

- In mild myopia group there were 5 males and 14 females
- In moderate myopia group there were 11 males and 12 females
- In high myopia group there were 8 males and 5 females.

Age

The mean age was 24.5.

The maximum number of patients were in the age group 18-35 years

In mild myopia group 12 patients were in 18 to 25 years age group.

5 patients were in 25 to 35 years age group.

2 patients were in above 35 years age group

In moderate myopia group 14 patients were in 18 to 25 years age group.

6 patients were in 25 to 35 years age group.

3 patients were in above 35 years age group

In high myopia group 8 patients were in 18 to 25 years age group.

3 patients were in 25 to 35 years age group.

2 patients were in above 35 years age group

Laterality

In 48 patients both eyes underwent the procedure.

In one patient only right eye underwent the procedure.

Indications: The most common complaints of the patients during presentation was defective vision, cosmetic.

Pre-operative Visual acuity

In mild myopia group 27 eyes of 19 patients had UCVA between 6/9 - 6/60 and 8 eyes of 4 patients had UCVA of $\leq 5 / 60$, mean of 0.1

In moderate myopia group 8 eyes had UCVA between 6/9 - 6/60 and33 eyes had UCVA of $\leq 5 / 60$, mean of 0.081

In high myopia group 1 eye had UCVA between 6/9 - 6/60 and 20 eyes had UCVA of $\leq 5 / 60$, mean of 0.05.

Post-operative Visual acuity

In mild myopia group 36 eyes of 19 patients had UCVA of 6/6 mean of 1 which is clinically significant.

In moderate myopia group 36 eyes had UCVA of 6/6 after 6 months. 5 patients had UCVA between 6/36 and 6/9 which improved to 6/6 with refraction. Mean of 1.

In high myopia group 5 eyes had UCVA of 6/6 after 6 months and 14 eyes had UCVA between 6/9 - 5/60 mean of 0.5

One patient in the high myopia group whose pre-operative vision was 5/60 did not show any improvement after the procedure or with final refraction was found to be ambylopic

The mean corneal thickness

In low myopia	544
In moderate myopia	539
In high myopia	542

The mean pre-operative BCVA

In low myopia	1
In moderate myopia	1
In high myopia	0.30

The mean post-operative BCVA

In low myopia	1
In moderate myopia	1
In high myopia	0.50

The mean pre-operative spherical equivalent

In low myopia	-3
In moderate myopia	-8
In high myopia	-14.75

The mean post-operative spherical equivalent

In low myopia	-0.056
In moderate myopia	-0.12
In high myopia	-1.36

This was found to be statistically very significant for all the three groups ($p = 0.0069$).

None of the eyes had any intraoperative complication during the procedure and there was no immediate post-operative complication.

However, left eye of one patient in mild myopia group whose immediate post-operative vision was 6/6 developed corneal ulcer 13 days post-operatively who was treated with topical antibiotics. The ulcer healed leaving a leucomatous corneal opacity with vision of hand movements. The organism was found to be atypical mycobacterium.

One eye in high myopia group whose pre-operative BCVA was 5/60 did not improve following the procedure and the vision remained the same with correction and was found to be ambylopic.

There was no deterioration of vision or any late post-operative complications in all the three groups except for one eye of one patient who developed corneal ulcer 13 days post-lasik.

There was no ectasia of cornea seen post-operatively during 6 months follow up.

DISCUSSION

Overall, many reports have shown excellent medical outcome in terms of predictability, efficacy and safety after lasik. Lasik surgery is still a controversial issue despite almost 10 years of experience and over 8 million patient treated worldwide.

In our study when comparing the 6 months post surgical uncorrected vision with the best corrected pre-surgical visual performance in the 3 groups, patient described themselves as satisfied with the mean presurgical BCVA being 1 and postoperative mean UCVA of 1 in low myopia group. Mean BCVA of 1 and post-operative mean UCVA of 1 in the moderate myopia groupand a mean BCVA of 0.3 and post-operative UCVA of 0.5 in high myopia.

The overall predictability was 100% in the mild and moderate myopia group and > 80% in high myopia group which is comparable to the study conducted by Nayyirih G[18] and associates.

The uncorrected vision score was directly correlated with the mean post-operative spherically equivalent.

In our study lasik was performed using Mel 80 excimer laser system. Compared to our results other studies conducted on Mel 80 platform showed similar results (Frank Goes, MD). Also, predictability was good as in all 3 groups, 90% of the patient were within mean spherical equivalent of -0.056 D range in low myopia group and mean of -0.12 D range in moderate myopia group and mean of -1.368 D range in high myopia group after 6 months follow up.

Also, the Mel 80 excimer system was compared to other wave front guided Zyoptic laser system. In a study conducted by Naryyirih G and workers using wave front guided Lasik, the mean post-operative UCVA at 6 months was - 0.072 ± 0.008 and mean spherical equivalent of - 0.11 ± 0.24 D which was comparable to our study on the Mel 80 system with a mean overall post-operative UCVA of 0.9 and mean post-operative spherical equivalent of -0.29.

In a study done on Mel 80 laser system by Frank Goes and workers similar results to our study were obtained. The mean post-operative spherical equivalent was 0.07 ± 0.35 D at 6 months with a standard deviation of below 0.5 D which was comparable to our study which showed an overall post-operative means spherical equivalent of -0.297 and a standard deviation of 0.83 .

In another study done by Sujal Shah and workers 1357 eyes with myopia between -1 D to -15.5 D. At 12 months follow up

863 eyes were within -0.5 D

981 eyes were within -1 D of intended correction.

926 eyes had unaided vision of 6/6.

978 eyes had 6/12 or better which was similar to our study.

In a study done by Manns T and Workers mean pre-operative UCVA was -4.41 ± 1.98. Mean post operative UCVA at 1 year was -0.14 ± 0.31 D. Standard deviation below 0.5 D, which is comparable to our study.

Stability

The stability of vision was maintained throughout the 6 months follow up in all the three groups.

In high myopia group the pre-operative mean UCVA was 0.05 which was comparable to the 6 months post-operative UCVA of 0.5 which remained stable which is statistically significant.

All the patients in the high myopia group maintained their pre-operative BCVA or did better except for one patient whose vision remained the same pre and post operative due to ambylopia.

In our study one eye of one patient in low myopia group developed corneal ulcer 13 days post-operatively whose vision was 6/6 on the first post operative day and deteriorated to hand movements at 6 months. The organism was found to be atypical mycobacterium.

There was no intraoperative complications in our study. There was no retreatment done on any of the patients. No patients developed corneal ectasia and only 6% of patient reported dry eyes requiring tear substitute at 6 months.

Importantly the safety profile of LASIK in this study is excellent. No eye lost more than one line of BCVA.

SUMMARY

In this prospective study 96 eyes of 57 patients underwent LASIK with Mel 80 Laser system of which 37 eyes were of low myopia, 41 eyes were of moderate myopia and 18 eyes were of high myopia.

- Pre-operative UCVA, BCVA, spherical equivalent, topography, corneal thickness, keratometry, pupil diameter were recorded for all the patients.
- Lasik was done for all the patients in an attempt to achieve the preoperative BCVA.
- Post-operative UCVA was recorded for all the patients on Day I, first week, first month, third month and six months.
- Pre-operative and post-operative BCVA was compared which was found to be statistically significant.
- There was no postoperative decrease in vision during the 6 months follow up.
- There was no incidence of corneal ectasia during the 6 months.
- There was no retreatment in this study
- Importantly the safety profile of LASIK in the study was found to be excellent.

CONCLUSION

The findings in this study, are significant showing good unaided post-operative visual acuity with excellent safety profile. Overall patient satisfaction with the procedure is high with the Mel 80 laser system which is comparable to other fifth generation excimer laser system. The emergence of better laser nomograms, safer microkeratomes, larger optical zones, and improved understanding of aberrations and their significance will lead to improvements in patient outcome in future.

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INSTITUTE OF OPHTHALMOLOGY
JOSEPH EYE HOSPITAL
TIRUCHIAPPALLI.

Outcome of Lasik in Mild, Moderate and High Myopia

Proforma

Name Age Sex

Occupation IP No.

Address

DOA

DOO

DOD

History

Complaints

History of
(i) Eye Disease
(ii) Allergy
(iii) Previous Refractive Surgery
(iv) Wearing Spectacles – Duration, last change of glasses
(v) Wearing contact lens – Duration – soft / rigid
(vi) Pregnancy / Lactation
(vii) Previous Squint Surgery. RD surgery. Laser for retinal holes

General Physical Examination

Ocular Examination

1. Head Posture
2. Facial Symmetry
3. Lids & Adnexia – Chalazion, Blepheritis stye
4. Palperbral fissure – Deep socket, Prominent Eyes
5. EOM
6. Squint Nystagmus
7. Conjunctiva – Scarring, Pterygium, Papillae
8. Corena – Clarity, Vascularisation, Size of Cornea
9. Anterior Chamber

10. Pupil – Size, shape, reaction
11. Lens – Opacities, Subluxation

Vision		**RE**	**LE**
Distant Vision	-	Unaided	
	-	With pinhole	
Refraction			
	-	With correction	
AR			
BCVA			
Near Vision	-	Unaided	
	-	With correction	

Investigation

- Slit lamp examination
- Appalanation tonometry
- Ultrasound pachymetry
- Corneal topography – irregular astigmatism, R/O Ectatic disease
- Indirect Ophthalmoscopy
- Tear film stability – schirmers test
- WASCA aberrometry – 3rd, 4th aberration, pupil size in dark

Procedure

Post Operative Evaluation

1 hr after LASIK	-	Flap, visual acuity, refraction, slit lamp examination
1 day	-	Flap, visual acuity, refraction, slit lamp examination
1 week	-	Flap, visual acuity, refraction, slit lamp examination
1 month	-	Flap, visual acuity, refraction, slit lamp examination
3 month	-	Flap, visual acuity, refraction, slit lamp examination
6th month	-	Flap, visual acuity, refraction, slit lamp examination

Patient satisfaction

Slit Lamp examination

LASIKCENTRE
INSTITUTE OF OPHTHALMOLOGY
JOSEPH EYE HOSPITAL

INFORMED CONSENT FOR EXCIMER LASER SURGERY (LASIK / PRK / PTK)

Patient Name M.R. No:

The information detailed in this "CONSENT FORM" is provided so that a person interested in Excimer laser surgery can make an informed decision. Please read the form carefully and clarify all doubts that you may have before undergoing the procedure.

What is LASIK

Lasik (or laser assisted in situ keratomilueusis) reshapes the cornea, the clear front surface of the eye. Using the precision of computer controlled excimer laser, Lasik alters the shape of the cornea and improves the focus of image by the eye. This technique is very safe and has excellent results. The aim of Lasik surgery is to bring down dependency over spectacles or contact lenses. Lasik is an elective procedure.

Lasik Procedure

This is performed under topical anaesthesia. A thin flap of corneal tistue is made using a specialised microkeratome. Laser spots are applied on the corneal surface under the flap and the flap is placed back after the procedure. Patient co-operation is very important for the success of this surgery and patient will, be required to fix his / her gaze at a blinking light to ensure proper centration. Patient may feel some pressure, but no pain on his / her eye just before the microkeratome flap is raised. A clicking sound is heard during the procedure.

PATIENT CONSENT

In giving permission for using the microkeratome and excimer laser, you have received no guarantee as to the success of your particularcase. You should be aware that few risks, though uncommon are associated with the procedure.

1. Malfunctioning of the microkeratome or excimer laser unit may require the procedure to be stopped before completion.
2. If the flap raised is not to the required precision levels, surgery may have to be postponed and rescheduled after 2-3 months.
3. If patient co-operation is inadequate, surgery may have to be postponed.
4. Rare possibility of sight threatening infection as with all other surgical procedures is present.
5. Glares, haloes and fluckuation in sharpness of vision may be experienced for upto 2-3 months by some.
6. Calculations used in this surgery are based on previous experience on large numbers of patients. Thus depending on individual variations in response to the procedure there might be some under correction or over correction.
7. I understand that as I get older (40 years or older), I may require reading glasses which is a normal eye related change.
8. Very rare complications of this procedure include severe corneal edema, loss of corneal flap which may require appropriate management such as corneal transplant or in exceedingly rare cases lead to partial or complete loss of vision in the eye.
9. As this technique has been in practice for less than 2 decades, long term effects of this procedure are not known.

I understand that although an attempt has been made to give a complete list, this list does not include every possible side effect, risk and complication of Lasik / Excimer PRK / PTK.

I hereby consent to release / publish medical data of the procedure are the subsequent treatment for purpose of research and advancement of medical knowledge.

In signing this consent for Lasik / Excimer PRK, / PTK, I state to have read the form and understood the nature purpose and possible side effects, risks and complications of Lasik / Excimer PRK / PTK. Also I have had all my queries answered to my satisfaction.

I give permission to Dr. _____ to perform Lasik Excimer

PRK PTK. procedure on my _____ eye(s.)

Date Patients Signature

Name: Witness Signature

Date Witness Signature

Name

Date of Surgery Signature of surgeon.

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JOSEPH EYE HOSPITAL
PATIENT INSTRUCTIONS FOR LASIK

DATE: TIME:

Patient's Name:

Prior to surgery:

- Discontinue contact lens wear in the eye to be treated for at least 10 days for soft lenses and 21 days for gas permeable rigid contact lenses or hard lenses.
- Do not use Mascara or eye liner for 3 days prior to surgery
- Confirm the date and time of surgery and arrange payment for your surgical fee before the procedure.
- The surgical fees for Lasik inclusive of investigations will be: Rs. 15,000/- for both eyes or Rs. 8000/- for one eye.
- Arrange for transport on the day of surgery if residing in Trichy or come prepared for one day in patient stay.

The Day of your treatment

- Please arrive on time
- Wear comfortable clothing. Please do not wear perfume, cologne, flowers and after shave as these may interfere with the laser. Please do not wear eye make-up on the day of treatment.
- Eat a light meal before your appointment.
- Please bring the following items: A copy of these instructions

After surgery

- You can go home and relax on the day of treatment.
- You should come for follow up the next day to LASIK CENTRE at 2.00 p.m.
- Avoid going to dusty place for a period of one week

- You can read, work on computers or watch television after 2 or 3 days
- You can take head bath after a week
- DO NOT RUB YOUR EYE FOR ONE MONTH AFTER SURGERY
- The following medicines must be used as directed:
  FML drops for 4 times for 5 days
  Ocucin drops for 4 times for 5 days
  Refresh tears for 3 times for one month

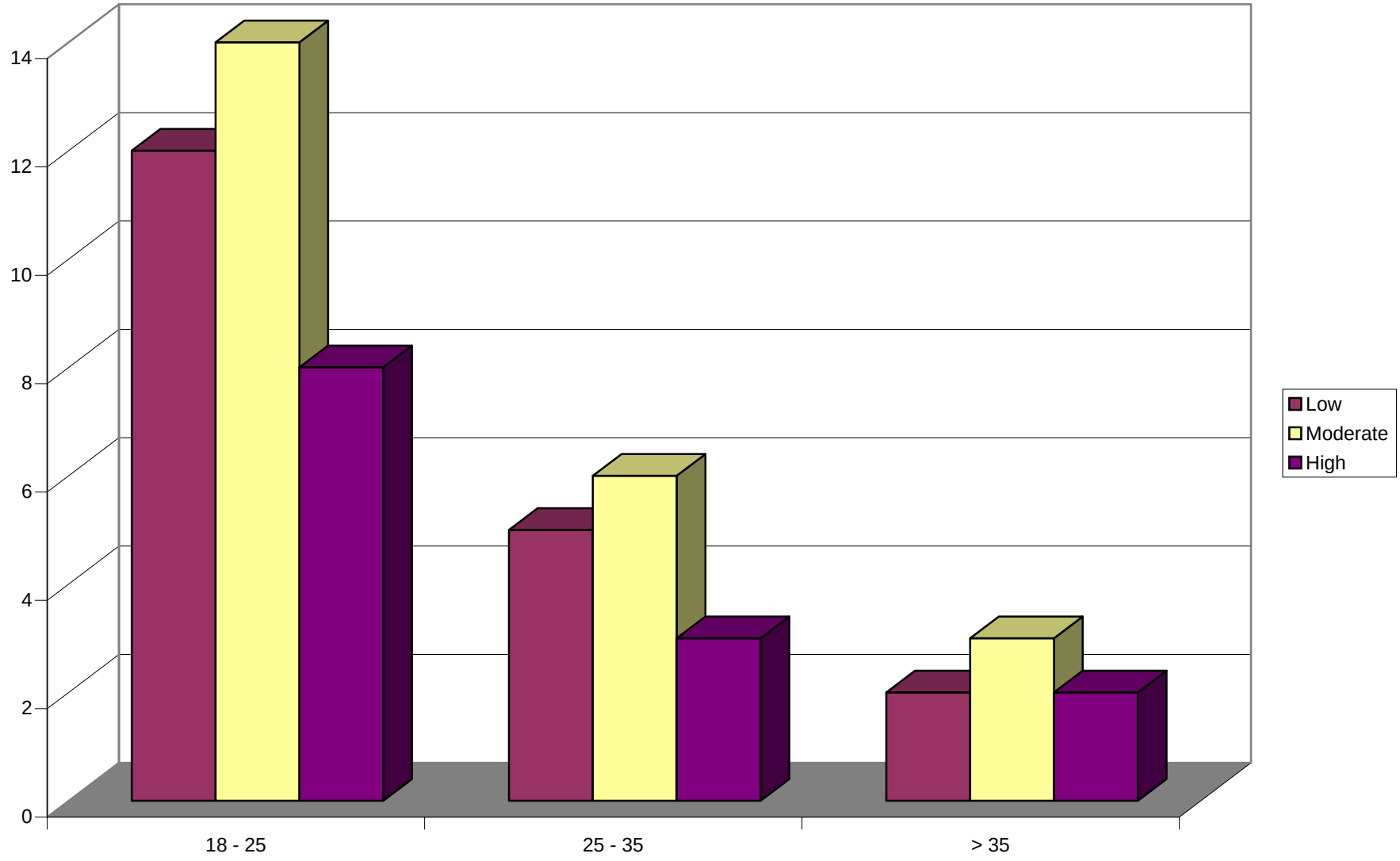
- It is advisable to wear eye protective sun glasses for a month when you go out
- Do not use Mascara or eye-liner for one week after surgery.
- It is normal to experience any of the following redness, light sensitivity, irritation or fluctuating pain for several days after treatment.
- Vision begins to improve within 24 hours after surgery, but may fluctuate for several weeks. Glare and haloes may be present at night, but these usually diminish over weeks to months.
- If there is any unbearable pain, redness or defective vision, kindly contact.

  LASIK CENTRE
  JOSEPH EYE HOSPITAL
  TIRUCHIRAPPALLI 620 001 Ph: 2460622,2462862

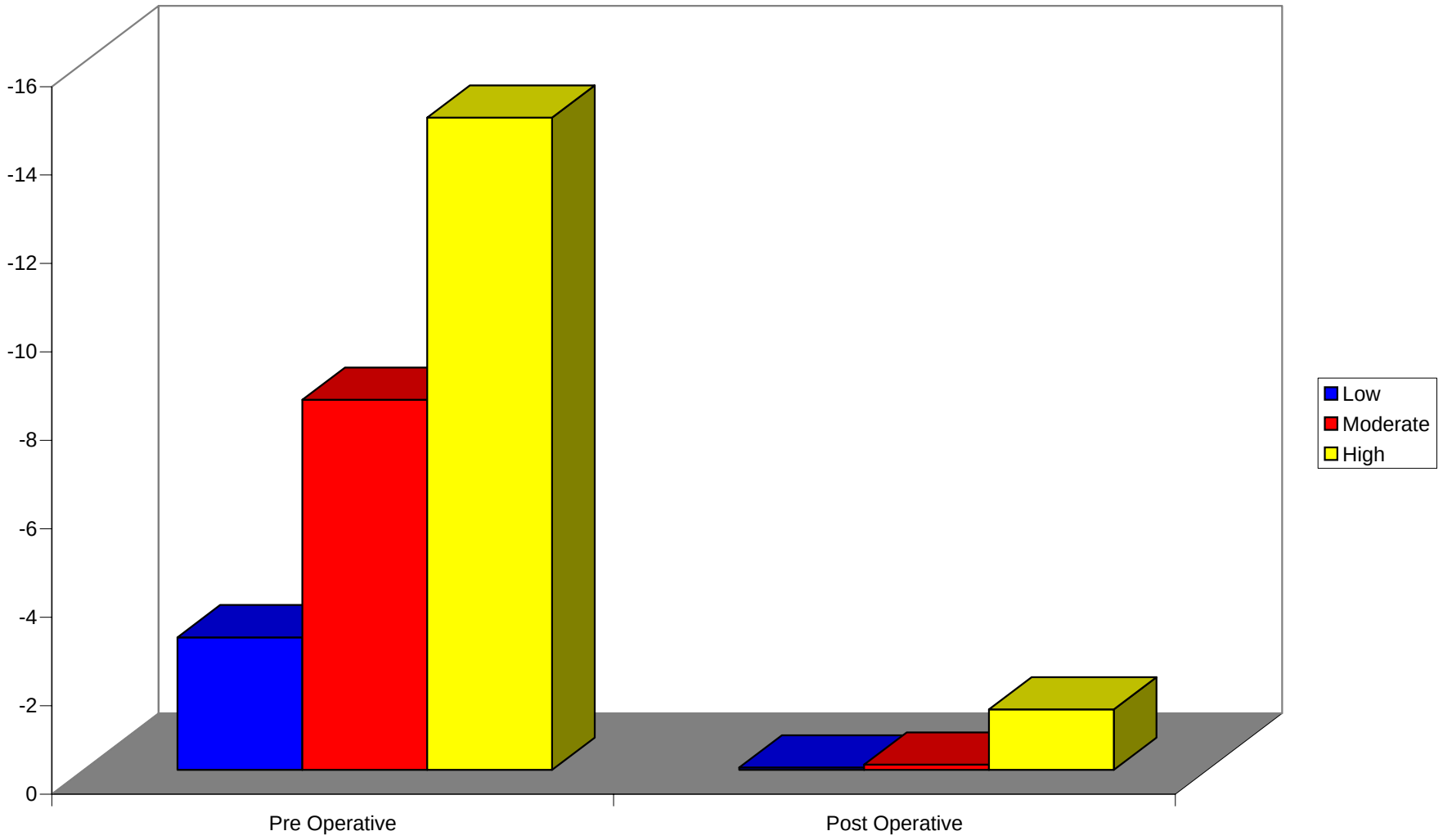
- The exact refractive status will be assessed one month after surgery
- Patient has to come for Is' month post-op. preferably on Friday or Saturday after 2.00 p.m.

S. No.	Name	MR No.	Age	Sex	Pre Operative Vision		Best Corrected Visual Acuity						Topography				CIM		Pre Op Pachymetry		Pupil Size		Intra Op Complications	Immediate Post Op Vision		Post Op Complications	Follow Up Vision										Post Operative BCVA			
							Retinoscopy value		Spherical Equivalent		Vision		RE		LE												Day I		1 Week		1 Month		3 months		6 months					
					RE	LE	RE	LE	RE	LE	RE	LE	K1	K2	K1	K2	RE	LE	RE	LE	RE	LE		RE	LE		RE	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE
Mild Myopia (-1.00 DSM + 0 - 6.00 DSPh																																						
1	Jesintha	439094	31	F	6/60	6/60	-3.00	-3.00/-0.50 - 90	-3.00	-3.25	6/6	6/6	44.20	43.62	44.32	44.25	0.18	0.80	543	554	7.02	6.54	Nil	6/6	6/6	Nil	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
2	Maria Thama Prakasa	440162	33	M	5/60	5/60	-5.00	-4.50	-5.00	-4.50	6/6	6/6	46.60	45.50	46.00	45.12	0.49	0.41	522	518	6.48	6.00	Nil	6/6	6/6	Nil	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
3	Nirmala Ahilam	442687	36	F	6/60	6/60	-4.00/-0.5 - 180	-3.25	-4.25	-3.25	6/6	6/6	44.00	43.50	45.37	44.62	0.52	0.51	504	507	5.72	5.52	Nil	6/9	6/9	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
4	Mouptappa Devadi	445690	18	F	5/60	5/60	-4.50/-1 - 180	-4.50/-1 - 180	5.00	-5.00	6/6	6/6	42.25	40.25	42.75	41.75	0.72	1.55	558	534	6.21	6.22	Nil	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	-0.25	6/6	-0.25	6/6
5	Aarty Anbalgan	449571	19	F	6/60	6/60	-4.0/-0.75 - 10	-4.50	-4.25	-4.50	6/6	6/6	45.37	44.50	45.12	45.00	0.99	0.61	541	545	6.36	5.57	Nil	6/6	6/6	LE corneal ulcer 13 days post lasik	6/6	6/6	6/6	6/6	6/6	6/36	6/6	HM	6/6	HM	0.00	6/6	Nil improvement	
6	Vinoth Kumar	450125	22	M	6/24	6/36	-1.25	-1.50/-0.50 - 90	-1.25	-1.75	6/6	6/6	46.56	45.87	47.25	46.00	0.75	1.08	546	556	7.36	4.44	Nil	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	-0.12	6/6	0.00	6/6
7	Rahamathunisa	449705	43	F	6/60	6/60	-5.50/-0.75 - 100	-6.0/-0.75 - 100	-5.75	-6.50	6/6	6/6	44.37	44.12	44.50	43.62	0.54	0.46	544	561	5.25	5.10	Nil	6/9	6/9	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
8	Bhuvaneswari	452012	24	F	6/60	6/60	-2.00	-2.50	-2.00	-2.50	6/6	6/6	46.12	45.87	46.75	45.87	0.61	0.49	592	589	6.55	6.46	Nil	6/9	6/9	-	6/6p	6/6	6/9	6/6	6/6p	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
9	Sangeetha	455920	22	F	5/60	5/60	-3.00	-3.00	-3.00	-3.00	6/6	6/6	47.75	46.62	48.12	46.75	0.67	0.57	604	618	6.27	6.32	Nil	6/9	6/9	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
10	Sujatha	454445	25	F	6/60	6/60	-4.00	-4.00	-4.00	-4.00	6/6	6/6	45.15	44.00	45.37	44.25	1.36	1.17	467	471	6.25	6.18	Nil	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	-0.25	6/6	-0.12	6/6
11	Anuradha	460078	23	F	6/60	6/60	-2.50	-2.00	-2.50	-2.00	6/6	6/6	43.50	42.75	43.75	42.50	0.18	0.98	470	481	7.01	6.36	Nil	6/6	6/6	-	6/9	6/6	6/6p	6/6	6/6	6/6	6/6	6/6	6/6	6/6	-0.25	6/6	0.00	6/6
12	Mahendra Varman	459499	25	M	6/24	6/24	-0.75/-1.50 - 80	-1.25/-1.50 - 80	-1.50	-2.00	6/6	6/6	44.12	43.62	44.25	44.25	0.68	0.58	531	521	7.83	7.55	Nil	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
13	Kumar	463149	27	M	5/60	5/60	-3.0 / -0.5 - 90	-4.0 / -0.5 - 90	-3.25	-4.25	6/6	6/6	46.37	45.87	46.62	46.12	0.56	0.71	571	564	6.43	6.71	Nil	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
14	Manjula	473681	31	M	6/36	6/36	-1.25	-1.75	-1.25	-1.75	6/6	6/6	41.25	41.25	41.37	41.12	0.63	0.79	584	586	6.15	5.45	Nil	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	-0.12	6/6	-0.12	6/6
15	Kokila perumal	472751	23	F	6/60	6/60	-2.50	-2.50	-2.50	-2.50	6/6	6/6	46.62	45.75	46.00	45.25	0.62	0.48	536	548	5.33	5.68	Nil	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/9	6/6	6/6	6/6	6/6	-0.25	6/6	-0.12	6/6
16	Jayashree	471188	22	F	6/36	6/36	-1.75	-1.75	-1.75	-1.75	6/6	6/6	45.87	45.12	45.87	44.54	0.58	1.06	560	570	5.66	5.28	Nil	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
17	Shanthi	470118	33	F	6/60	6/60	-3.50/-0.75 - 10	-3.50/-0.50 - 10	-3.75	-3.75	6/6	6/6	45.00	44.62	45.37	45.12	0.73	0.71	507	499	5.92	6.01	Nil	6/6	6/6	-	6/6p	6/6p	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
18	Haritha Kamana	463779	21	F	6/60	6/60	-3.50	-2.75			6/6	6/6							516	510	6.41	5.88	Nil	6/6	6/6		6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
Moderate Myopia > -6.00 D to -12.00																																						
1	Jency	444148	24	F	5/60	5/60	-7.50	-7.50	-7.50	-7.50	6/6	6/6	44.12	44.50	43.00	43.37	0.75	0.92	551	550	7.48	7.46	Nil	6/9	6/9	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
2	Viji	442697	23	F	5/60	5/60	-9/-0.75 - 140	-10/-0.75 - 180	-9.50	-10.50	6/6	6/6	46.87	45.87	46.81	42.81	0.91	0.75	570	577	6.72	6.78	Nil	6/9	6/9	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	-0.25	6/6	-0.12	6/6
3	Thavasimuthu	440504	38	M	6/60	6/60	-9.50	-9.00	-9.50	-9.00	6/6	6/6	47.56	45.60	47.37	45.50	0.94	0.98	511	500	4.56	4.26	Nil	6/9	6/9	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.25	6/6	0.25	6/6
4	Annapoorani	442004	28	F	2/60	3/60	-8/-1 - 180	-6/-1 - 30	-8.50	-6.50	6/6	6/6	44.87	43.62	44.87	43.75	0.79	0.66	539	536	3.00	2.66	Nil	6/9	6/9	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
5	Farzana	442686	24	F	5/60	5/60	-10.00	-11.00	-10.00	-11.00	6/6	6/6	43.12	42.25	43.25	42.37	0.91	0.89	568	580	6.17	6.58	Nil	6/9	6/9	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
6	Md. Ali Jinnah	450539	23	M	5/60	5/60	-6/-1 - 180	-8/-1 - 180	-6.50	-8.50	6/6	6/6	48.37	47.12	47.87	46.50	2.63	0.91	504	509	6.69	6.98	Nil	6/6p	6/6p	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.12	6/6	0.12	6/6
7	Benjamin Franklin	448210	24	M	4/60	4/60	-7.00	-6/-1 - 180	-7.00	-6.50	6/6	6/6	42.62	44.31	44.12	44.12	0.79	0.82	557	556	6.70	5.98	Nil	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
8	Alamelukaliamurthy	437596	31	F	4/60	4/60	-10.50	-6.50	-10.50	-6.50	6/6	6/6	45.75	44.12	45.50	44.25	1.00	0.86	541	558	5.63	5.95	Nil	6/12	6/12	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
9	Anandh	456748	21	M	6/60	6/60	-6.00	-7.00	-6.00	-7.00	6/6	6/6	41.50	46.00	48.50	46.12	0.68	0.85	524	544	7.46	7.31	Nil	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	-0.12	6/6	0.00	6/6
10	Sivakumar	451676	24	M	4/60	4/60	-8/-3 - 180	-7/-2 - 20	-9.50	-8.00	6/18	6/18	45.37	42.37	45.50	44.75	1.00	1.55	525	525	4.82	5.37	-	6/18	6/18	-	6/9	6/9	6/6p	6/6p	6/6p	6/6p	6/6p	6/6p	6/6p	6/6	-0.25	6/6	-0.25	6/6
11	Sathya Sudhakar	455976	23	F	3/60	3/60	-8.50	-8.50	-8.50	-8.50	6/6	6/6	45.87	45.12	45.67	45.12	0.81	0.48	524	538	6.20	6.08	-	6/6p	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
12	Venkatesan	455527	19	M	3/60	3/60	-7.00	-7.50	-7.00	-7.50	6/6	6/6	48.00	46.75	47.62	47.00	0.93	0.74	538	542	6.72	6.94	-	6/9	6/9	-	6/9	6/9	6/9	6/9	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
13	Sangeetha, S.	554195	20	F	3/60	3/60	-9/-1 - 30	-9.00	-9.50	-9.00	6/6	6/6p	44.87	44.12	44.25	43.50	0.86	0.97	542	542	4.57	4.87	-	6/12	6/12	-	6/6p	6/6p	6/6p	6/6p	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
14	Pushpalatha	457379	27	F	6/60	6/60	-6.50	-6.00	-6.50	-0.60	6/6	6/9	44.12	43.75	43.75	43.37	1.02	0.69	540	547	5.18	5.50	-	6/12	6/12	-	6/12	6/12	6/9	6/6	6/9	6/6	6/18	6/6	6/18	6/6	-0.25	6/6	-0.25	6/6
15	Savithri	456883	33	F	3/60	3/60	-8 / -0.50 - 90	-8 / -1 - 90	-8.25	-8.50	6/6	6/6	45.37	44.70	45.12	44.02	1.04	0.76	524	519	6.23	5.49	-	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
16	Stanley	463168	27	M	3/60	3/60	-8.50	-8.00	-8.50	-8.00	6/6	6/6	43.31	41.62	45.12	41.87	0.62	0.59	502	506	5.96	5.99	-	6/9	6/12	-	6/6p	6/6p	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
17	Dhanasekaran	464160	24	M	5/60	5/60	-6.50/-1.50 - 180	-7/-1.50 - 170	-7.25	-7.75	6/6	6/9	43.37	41.62	43.12	41.87	0.93	0.76	515	515	5.88	5.02	-	6/9	6/9	-	6/6p	6/6p	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
18	Vellai Sami	471147	35	M	5/60	5/60	-11.00	-11.50	-11.00	-11.50	6/36	6/36	46.25	42.62	46.62	45.37	0.83	0.63	547	533	5.08	4.50	-	6/36	6/36	-	6/24	6/24	6/36	6/24	6/36	6/6	6/36	6/24	6/36	6/24	-1.25	6/6	-1.00	6/6
High Myopia > 12.00 D																																						
1	Edward	452513	23	M	3/60	3/60	-13.00	-13.00	-13.00	-13.00	6/6	6/9	43.62	42.12	44.12	43.00	0.90	0.82	564	543	9.74	8.80	-	6/12	6/12	-	6/6p	6/6p	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	-0.50	6/6	-0.25	6/6
2	Arumuga Raja	439714	24	M	½/60	1/60	-14.00	-7.00	14.00	-7.00	6/9	6/6	43.87	43.62	44.25	44.00	0.69	1.66	515	514	5.98	4.90	-	6/6P	6/6P	-	6/18	6/6	6/9p	6/6	6/12	6/6	6/18	6/6	6/18	6/6	-1.25	6/9	-0.25	6/6
3	Vanitha	436706	25	F	2/60	3/60	-12.50/-0.75 - 90	-14.50/-0.50 - 90	-12.75	-14.75	6/18	6/18	43.38	46.25	47.00	46.37	1.04	1.13	524	540	6.35	6.70	-	6/12P	6/12P	-	6/12p	6/18	6/12	6/12	6/12	6/18	6/18	6/18	6/24	6/18	-1.50	6/18	-1.50	6/18
4	Ambika	434728	22	M	5/60	6/9	-20/-2 - 180	-5/-0.50 - 20	-21.00	-5.25	6/12	6/6	45.37	43.50	45.12	44.25	0.62	0.79	540	536	4.96	5.87	-	6/9	6/9	-	6/36	6/6	6/60	6/6	6/60	6/6	6/36	6/6	6/12	66	-4.00	6/12	-0.25	6/6
5	Chitra	451974	25	F	6/60	6/60	-12.50	-7.00	-12.50	-7.00	6/12	6/9	46.37	-44.12	46.00	43.37	0.98	0.97	579	579	5.74	2.79	-	6/6P	6/6P	-	6/6	6/9	6/6	6/9	6/6	6/6	6/6	6/6	6/6	6/6	0.00	6/6	0.00	6/6
6	Sai Ram	461917	40	M	6/60	5/60	-7.50 / -0.5 - 70	-12.50	-7.25	-12.50	6/9	6/12	43.29	43.12	45.87	43.12	0.64	0.61	564	560	4.42	4.85	-	6/9	6/9	-	6/9	6/12	6/9	6/12	6/6	6/12	6/6	6/12	6/6	6/12	0.00	6/6	-2.00	6/9p
7	Dharmaraj	459571	26	M	1½/60	1½/60	-18/-0.75 - 60	-16/-2 - 180	-18.50	-17.00	6/18	6/18	46.37	45.62	46.72	45.62	0.74	0.78	542	528	7.04	6.99	-	6/24	6/24	-	6/24	6/24	6/18	6/24	6/9	6/18	6/9	6/12	6/9	6/12	-1.50	6/6p	-1.00	6/12
8	ana Joyce	462014	18	F	½/60	6/6	-18	00	-18.00	0.00	2/60	6/6	41.87	40.00	42.00	41.68	0.92	0.87	538	-	4.86	-	-	4/60		-	5/60		5/60		5/60		5/60		5/60	6/6	-5.00	5/60	0.00	6/6
9	Guru Murthy	460656	33	M	5/60	5/60	-14	-14.50	-14.00	-14.50	6/18	6/18	43.50	42.00	43.50	42.37	1.11	1.31	542	540	4.00	9.00	-	6/18	6/18	-	6/12p	6/12p	6/18	6/18	6/18	6/18	6/12	6/12	6/12	6/12	-0.25	6/12	-0.50	6/12
10	Ananthi	459120	20	F	5/60	4/40	-9/-2.50 - 90	-15/-3 - 90	-10.25	-16.50	6/9	6/24	44.50	44.37	44.40	43.37	0.75	1.14	544	556	7.00	6.25	-	6/12	6/2	-	6/9	6/24	6/12	6/36	6/24	6/24	6/12	6/24	6/12	6/24	0.00	6/12	-3.00	6/24
11	Baskaran	459170	37	M	3/60	3/60	-12.50	-13.00	-12.50	-13.00	6/18	6/24	43.25	40.75	43.75	41.37	0.87	0.74	622	646	4.12	3.53	-	6/24	6/24	-	6/18	6/24	6/12	6/18	6/12	6/18	6/12	6/18	6/12	6/18	-1.00	6/12	-1.25	6/18
12	Sasikala	472756	22	F	2/60	3/60	-16	-6	-16.00	-6.00	6/60	6/9	45.62	44.25	45.50	45.00	0.53	0.54	527	527	6.30	7.00	-	6/60	6/12	-	6/60	6/6	6/60	6/9	6/60	6/9	6/60	6/9	6/60	6/9	-4.00	6/60	0.25	6/9
13	Jayaseelan	464531	28	M	3/60	3/60	-17/-0.75 - 45	-17/-0.75 - 135	-17.25	-17.25	6/6	6/6	42.37	43.00	43.98	41.87	0.79	0.93	591	571	5.97	4.35	-	6/6	6/6	-	6/6	6/6	6/6	6/6	6/6	6/6p	6/6	6/6p	6/6	6/6p	0.00	6/6	-0.25	6/6

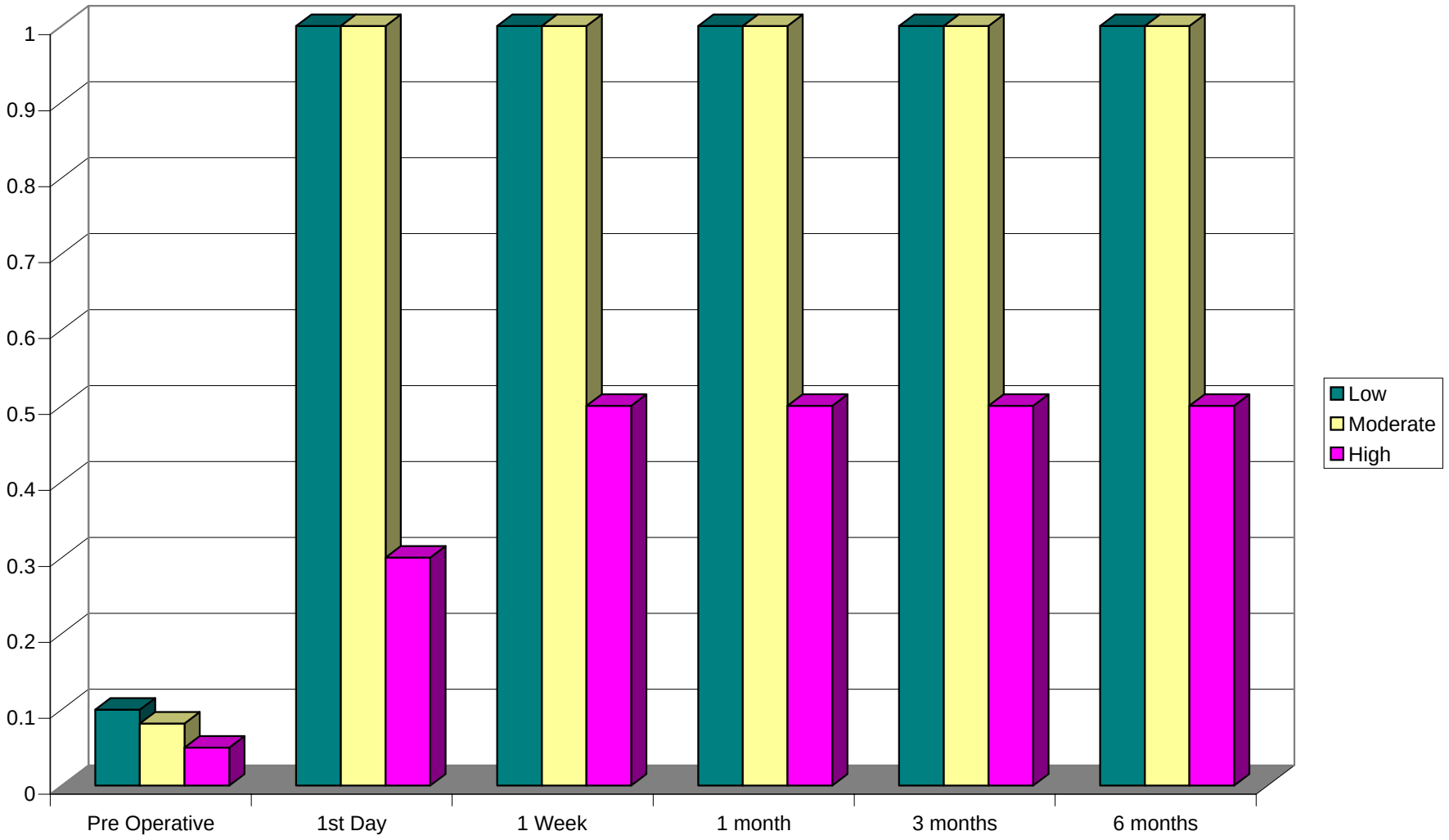
Age Distribution



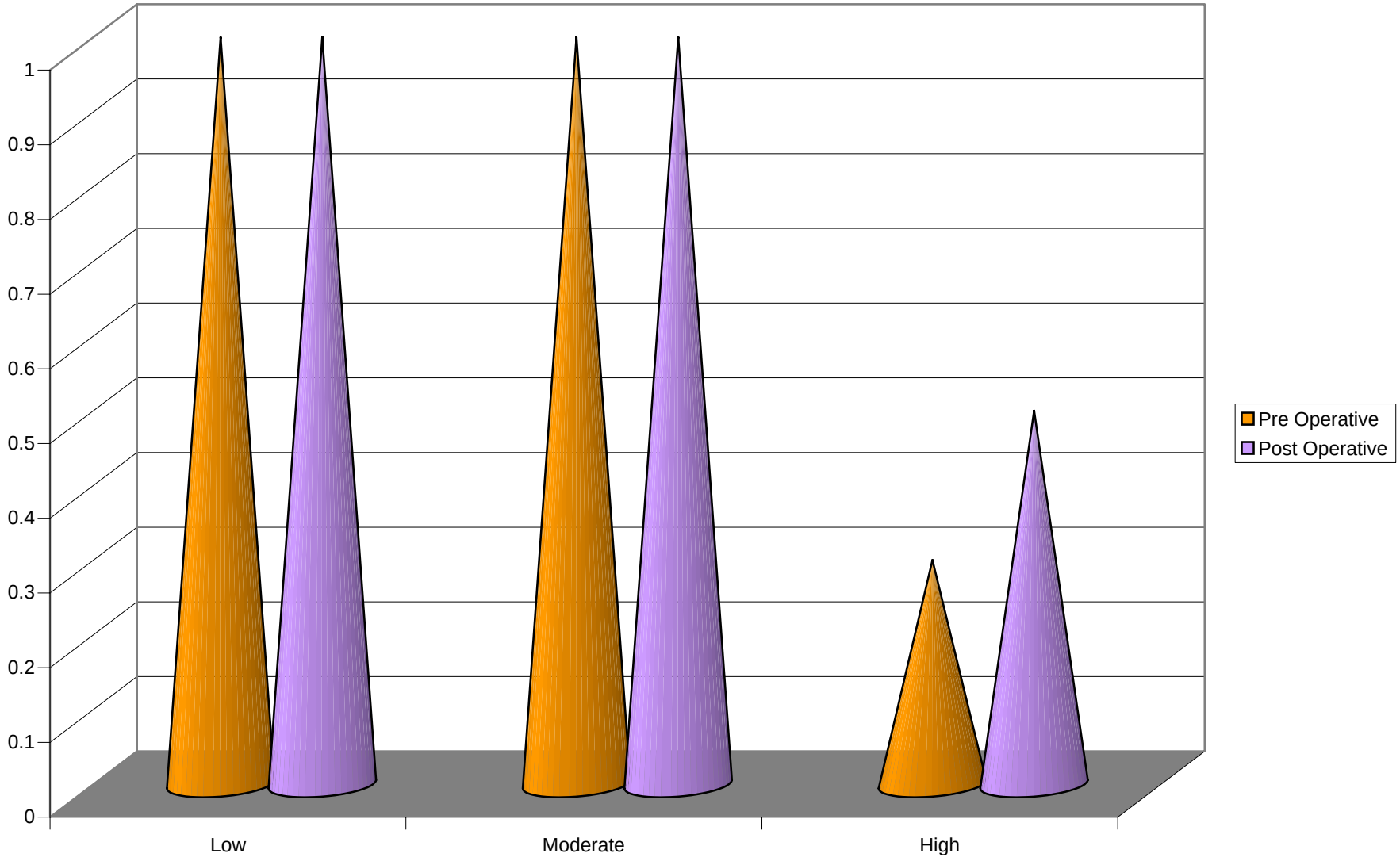
Pre & Post Operative Spherical Equivalent



Pre Operative and Post Operative Uncorrected Visual Acuity



Pre and Post Operative Best Corrected Visual Acuity



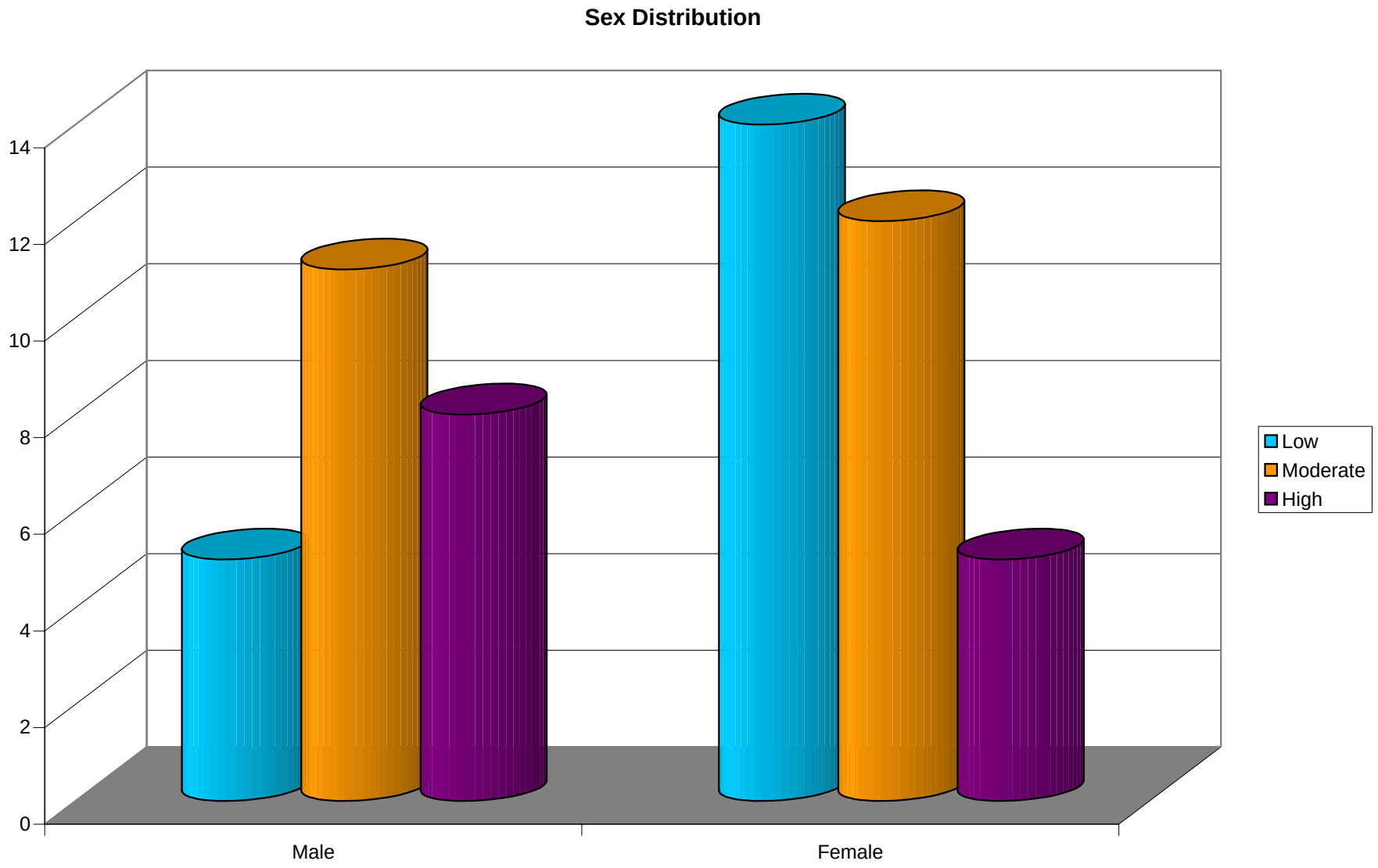
	Low	Moderate	High
18 - 25	12	14	8
25 - 35	5	6	3
> 35	2	3	2

	Low	Moderate	High
Male	5	11	8
Female	14	12	5

	Pre Operat	1st Day	1 Week	1 month	3 months	6 months
Low	0.1	1	1	1	1	1
Moderate	0.0815	1	1	1	1	1
High	0.05	0.3	0.5	0.5	0.5	0.5

	Pre Operat	Post Operative
Low	-3	-0.056
Moderate	-8.37	-0.12
High	-14.75	-1.368

	Pre Operat	Post Operative
Low	1	1
Moderate	1	1
High	0.3	0.5


Sex Distribution
14
12
10
8
6
4
2
0
Male
Female
Low
Moderate
High

Corneal Topography

Pachymetry

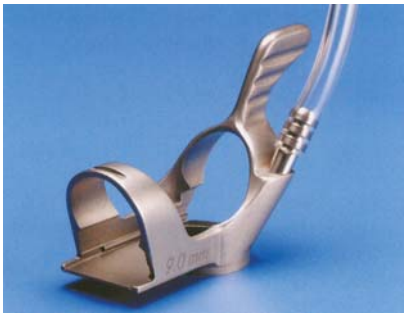
Wasca Aberrometer

Mel 80 Excimer Laser Platform

BD K-3000 Microkeratome

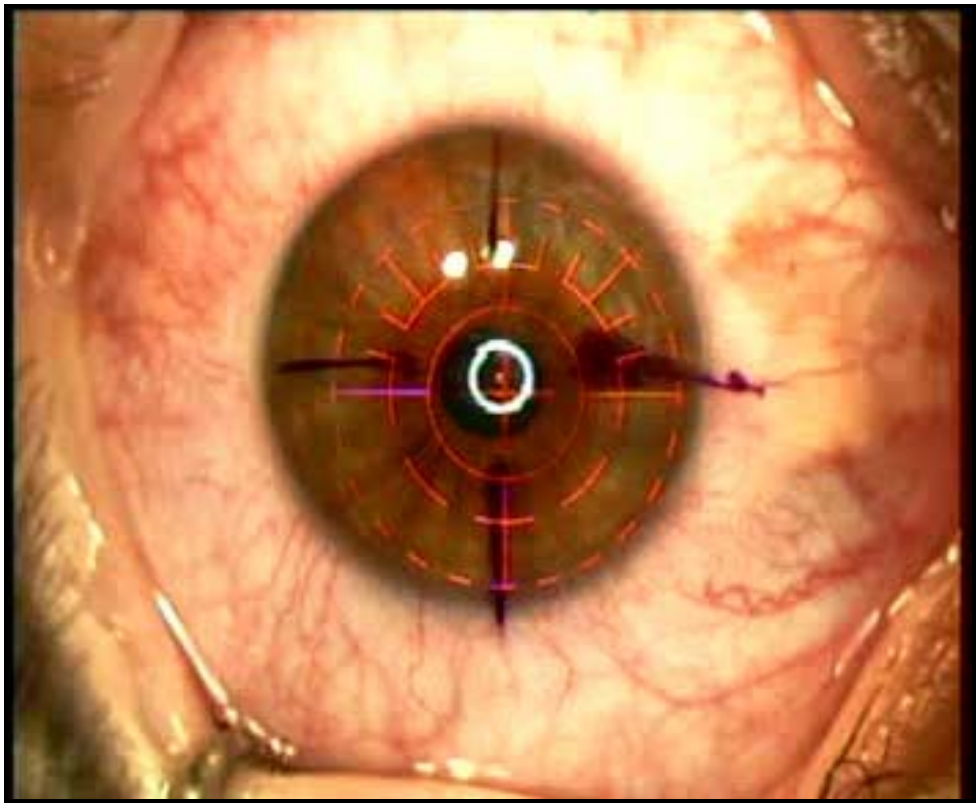
Handpiece

Keratome Heads

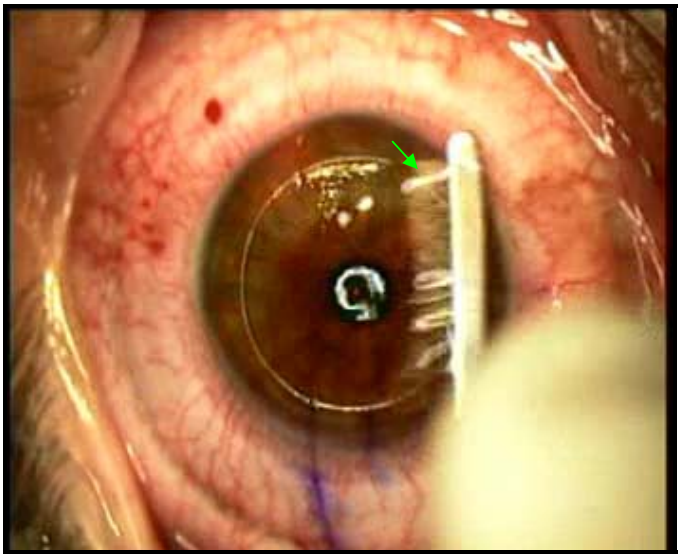


Suction Rings with tubing

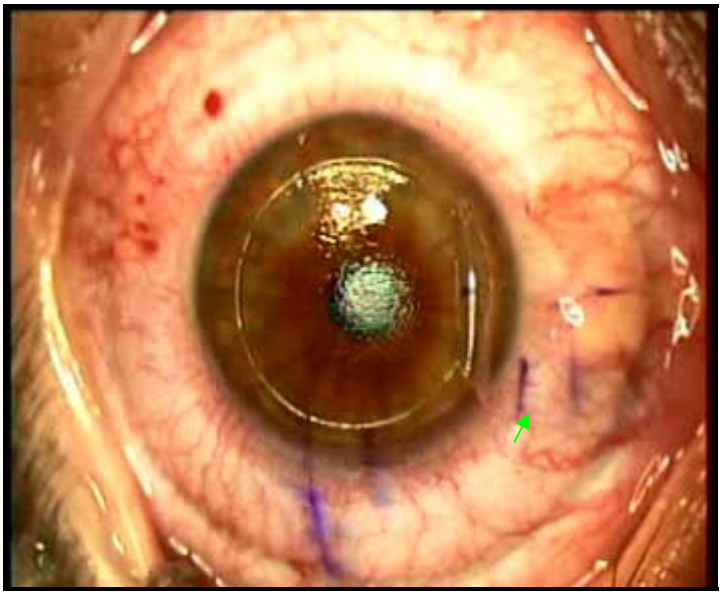
Applanator



Corneal Marking with Tracking System



Elevation of Corneal Flap



Elevated Corneal Flap