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OVERVIEW OF PREMIUM IOL IN CATARACT SURGERY

Ophthalomology

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ABSTRACT

Nowadays cataract surgery is not anymore synonyms with lens extraction; it evolved in a more refined procedure due to advance in IOL technology. New Indian generation patients who are well educated and using digital smart phone, computer, online cash payment by using UPI system for business, job, shopping, banking, bill payment, gaming , teaching, etc. These new class of patients expect spectacle free excellent visual results at both distance, intermediate and near. The new modality of premium presbyopia -correcting IOLs are designed to achieve the best possible refractive outcome with restoration of vision at near and distance without glasses. The aim of this overviewing premium IOL enables young ophthalmic surgeons to learn techniques and implement them in cataract surgery for successful outcomes. Multifocal IOL(MFIOL), Accommodating IOL, Extended defpht of focus (EDOF IOL), Toric IOL, Aspheric MFIOL TORIC IOL are Premium IOLs which allow the presbyopic patients to regain the ability to accommodate and achieve their visual goal for both at distance and near.

KEYWORDS

Premium IOL, Multifocal IOL, EDOF IOL, TORIC IOL, Accomodating IOL, Aspheric MFIOL

INTRODUCTION

Cataract presents the leading cause of preventable blindness in the world. Artificial intraocular lens iol replace the eye's natural lens in cataract surgery. These traditional iol are monofocal offering vision at one distance only and most patients needing spectacle for reading. The goal of premium iol is to allow the presbyopic patients to regain the ability to accommodate. Premium iol may be one way to achieve spectacle free postoperative visual outcome in selected patients. History of IOL evaluation from PMMA IOL in 1949 – Hydrophilic acrylic iol -Hydrophobic acrylic iol - silicon iol – Frist Bifocal iol in 1986 - Frist Toric iol in 1992 - Frist FDA approved Accomodativ iol in 2003 - Frist EDOF iol in 2016. Hoffer in 1982 was the first to bring idea of a multifocal iol. Dr. John Pierce in 1986 who implanted the bull's eye style of the multifocal iol.

MULTIFOCAL IOL

Classification regarding optical design multifocal iol is of three type Refractive, Diffractive and combination of both called Hybrid iol. According to focus point three type Bifocal iol, Trifocal iol and Extended depth of focus EDOF iol.

REFRACTIVE MFIOLs has concentric rings of different power. It has two type (1) TWO ZONE LENS in which central ring of 2mm size is for near vision and surrounding outer ring segment for distance vision. When pupil dilate during distant viewing peripheral segment exposed. (2) ANNULAS / BULL'S EYE TYPE LENS it has three zone central most for distance surrounded by near vision segment which is surrounded by distance vision ring. All three segments exposed when pupil is dilated. These iols are pupil dependent.

DIFFRACTIVE MFIOLs utilizes the principal of diffraction where two images are formed at different axial location. The basic refractive power is provided by the anterior surface and the diffractive power comes from the multiple grooves on its posterior surface. 41% of light is focused for distance vision another 41% is focused for near vision and remaining portion of light is distributed to higher order of diffraction. Since this lens has a different optical effect present at all points of the lens even if the lens is decentred or the pupil is eccentric or deformed lens will always supply power for distance and near vision. These iols are pupil independent.

Frist FDA approved foldable MFIOL was Silicon AMO Array. It has five zone with varying optical power 50% for distance, 37% for near 15% for intermediate vision. It is pupil dependent.

Foldable Acrylic Aspheric MFIOL AMO ReZOOM has 5 zone in which zone 1,3,5 for distance vision and zone 2,4 for near vision.

Foldable Silicon Acri-Tec Bifocal Diffractive iol is based on the idea of " Bilateral summation effect " It has two models 733D for near dominant and 737D for distance dominant.

TECNIS MFIOL Diffractive AMO is frist wavefront designed modified prolate lens.

The most recently introduced is the Acysoft ReSTOR Apodized Diffractive MFIOL from Alcon which has 12 Diffractive zone over central 3.6mm optic. The inner most ring has a step height of 1.3 micron with subsequent ring gradually decreasing in height until the outer ring with a height of 0.2micron. The inner rings are further apart and the distance between rings gradually decrease towards the periphery. The add power is 4.0 D at the iol plane and 3.2 D at the spectacle plane.

Acysoft IQ ReSTOR Multifocal TORIC IOL is Aspheric, single piece with UV blue light filter with 0.5-3.0D Astigmatism range.

Trifocal Diffractive FINE VISION where FINE stands for an acronym Far, Intermediate and Near.

Extended Depth of Focus EDOF IOL or Extended Range of Vision EROV is a new presbyopia correcting iol having single contagious elongated focal point that enhances depth of focus. Edof IOLs aim to reduce photic phenomenon glare and haloes. There are three types of EDOF iols

1. Small aperture True EDOF IOL
2. EDOF-Effect iol
3. Enhanced Monofocal or Beam-shaping EDOF – NOT TRUE EDOF by FDA standerd

Accommodating IOL

It provides unaided near vision without the optical abberation and image degradation. They are three types 1. Single optic, 2. Dual Optic and 3. Deformable Optic iol.

EYEONICS CRYSTALENS hinged plate silicon lens 10.5mm with 4.5mm optic is the FDA approved iol. Dual-optic SYNCHRONY IOL is under FDA clinical trials. The Medennium Smart Iol, Flex optic , Fluid vision, Nu lens, etc are Deformable iols.

Table 1. Most Commonly Used Multifocal IOL (MFIOLs)

Multifocal IOL	Material	Design	Iol/ optic diameter (mm)	Focal point	Symmetry	Intermediate/ near add (D)
ReSTOR Acysoft Alcon	Hydrophobic	Single piece loop haptics	13.0/6.0	Bifocal Refractive Diffractive	Rotationaly symmetric, Apodized	0/4
PanOptix Acysoft Alcon	Hydrophobic	Single piece loop haptics	13.0/6.0	Trifocal, Refractive	Rotationaly symmetric, constant	2.17/3.25

TECNIS J & j	Hydrophobic	Single piece C loop haptics	13.0/6.0	Diffractive	Rotationaly symmetric, Constant	+2.75 + 3.25 +4.0
At Lisa (Carl Zeiss Meditec)	Hydrophilic acrylic with hydro-phobic surface	Single piece plate haptics	11.0/6.0	Bifocal//Trifocal Diffractive	Rotationaly symmetric Constant/Zonal	1.67/3.75
Symphony TECNIS AMO	Hydrophobic	Single piece loop haptics	13.0/6.0	EDOF Diff minractive	Rotationaly symmetric Achro-matic	1.78/0
ReZOOM Abbot	Hydrophilic	Three-piece modified C loop haptics	13.0/6.0	Ref-ractive	Zonal progressive	0/3.5
Fine Vision	Hydrophilic	Double loop haptics	10.75/6.15	Trifocal Diffractive	Rotationaly symmetric Constant	1.75/3.5

Table 2. Most Commonly Used Multifocal Toric IOL

Toric IOL	Material	Design	IOL diameter (mm)	Multifocal technology	Near add (D)	Spherical power (D)	Cylinder power (D)	Incision size
Acysoft IQ ReSTOR Toric Alcon	Hydrophobic	Loop	13.0	Diffractive + Refractive	+3.0	+6.0 to + 34.0	1.0 to 3.0 (0.5 - 0.75 steps)	2.2
Acri Lisa Toric Carl Zeiss Meditec	Hydrophilic acrylic with hydrophobic surface	Plate	11.0	Diffractive	+3.75	+10.0 to +32.0	1.0 to 2.0 (0.5 steps)	<2.0
M-flex T Rayner	Hydrophilic acrylic with hydrophobic surface	Loop	12.0/12.5	Refractive	+3.0 to +4.0	+14 to 32.0	1.5 to 6.0 (0.5 steps)	<2.0
Lentis Mplus Toric Oculentis	Hydrophilic acrylic with hydrophobic surface	Plate	11.0	Refractive	+3.0	0.0 to +36.0	+0.25 to +12 (0.75 steps)	2.6
TECNIS ZMT Abbot	Hydrophobic	Loop	13.0	Diffractive	+4.0	+5.0 to +34.0	+1.5 to +4.0 (0.50 steps)	2.2

Table 3. Most Commonly Used Accommodating IOLs

IOL	Material	Design	Iol /optic diameter (mm)	Mechanism of action	Location	Measured accommodation (D)	Incision size (mm)
Crystalens (Bausch & Lomb)	Silicone	Biconvex hinged plate haptics	11.5-12.0/5.0	Single optic forward motion	Capsular bag	>0.4	2.8
1CU Lens (Human optics)	Hydrophilic	4 flexible haptics	9.8/5.5	Single optic forward motion	Capsular bag	1.36-2.25	3.0
Tetraflex (Lenstec Inc)	Hema	Closed loop haptics	11.5/5.75	Single optic forward motion	Capsular bag	2	2.8
Synchrony (Abbot)	Silicone	2 optics with 4 spring haptics	9.8/5.5-6.0	Dual optic IOL	Capsular bag	1	3.8
Lumina (AkkoLens Int)	Acrylic	Elastic loop with spring function	Customized	Alvarez principal	Ciliary sulcus	2	2.8
NuLens	PMMA – Silicone	4 PMMA haptics with posterior position	2.0 central position 10.0 overall	Axial motion	Ciliary sulcus	50-70	3.8
FluidVision	Hydrophobic acrylic fluid	2 fluid filled haptics	10.0/6.0	Fluid movement within the IOL	Capsular bag	3	3

Pre-operative consideration :

1. Patient selection by their desire to be spectacle free and proper counselling about pros and cons of premium iols
2. Age limit 35-65 is better
3. Functional and occupational requirment
4. Accurate Biomerty using optical biometer and Power calculation with axial length, keratometry, pachymetry, anterior chamber depth ACD, pulil size , angle kappa and alpha, lens thickness to provide best estimate of the effective lens position ELP by advance formula.

Contraindications of MFIOLs :

1. Ocular surface disorder Dry eye , degeneration , opacity
2. Pre-existing ocular pathology like glaucoma , uveitis , retinitis pigmentosa, stargardts disease, ARMD, iris coloboma, traumatic bag dialysis or zonular weakness, PEX
3. Occupational night drives
4. Over demanding with Higher expectations patients should be discouraged for premium iol
5. Past history of refractive surgery
6. Intra-ope surgical complications like PCR, ZD , capsulorhexis tear, trauma to pupil

Complications

Most patients after MFIOLs implantation are happy. However, in some patients may experience glare, halos, low contrast, reduce quality of vision, residual refractive error, PCO formation, decentred or off-centerd iol, cystoid macular edema.

Treatment for Unhappy patients :

- Assurance and counseling long chair time
- Bilateral implantation may provide an adequate neuro adaptation period.
- For astigmatism less than 1 D of cylinder perform limbal relaxing incision LRIs.
- For extremely unhappy patients may need enhancment or iol explantation surgery.

CONCLUSION

There is a wide range of expensive Indian and international presbyopia correcting premium IOLs in the market; a careful and complete examination of patient and iol selection which is based on his visual need and lifestyle would be recommended. Premium IOL technology like biomaterial , aspheric design, refractive , diffractive, hybrid properties, UV blocking blue light filter with advance new generation IOL calculating formulas using optical biometer and Topical phaco-emulsification surgical technique have significantly improved desired post-operative visual outcome.

REFERENCES

1. Current and future IOL choices where we stand with MFIOLs,by Stefanie petrou binder, MD
2. Xu C. Successful premium iol surgery : London Intech open 2021
3. Ichhpujani P,Bhartiya S, Sharma A. Premium IOL in glaucoma. J curr Glaucoma Pract,2013;7:54-7
4. Alio JL ,Maldonado M. Multifocal IOL: An overview.surv Ophthalmol.2017;62:611-34
5. Source: https://www.eyeworld.org/
6. ATLAS ophthalmology pdf web portal