Choices in intra-ocular lens

When the natural eye lens is removed because of cataract or as part of a refractive lens exchange, the quality of vision after surgery is determined by the health and anatomy of the eye, and by the choice of artificial intraocular lens (IOL) inserted. More than six million IOLs are implanted worldwide every year and there are a wide range of lens designs, styles and materials to choose from. This overview will help in understanding how the best lens is chosen.

Dr Ian Anderson,
Ophthalmologist

Features common to all lenses

- A central optic - part that focuses light. Small size optics may cause unwanted aberrations (e.g. halos) while larger optics may require larger incisions. The focusing power of the cornea and the distance to the retina are measured to calculate the right IOL power.
- The haptic - a supporting structure that holds and centres the lens behind the pupil (many different designs and materials).
- Inbuilt ultraviolet light blocking – tinting to protect the retina from light damage.

The ideal lens would give perfect vision at all distances without any need for glasses, would be inserted through a small incision and have no complications with long term safety. The quality of IOLs available in Australia is extremely high but unfortunately this perfect lens does not yet exist.

Consider the focus zone chart (below) to understand what can be achieved with different IOLs.

Focus Zone Chart

Zone 1	Zone 2	Zone3	Zone 4	Zone 5
Fine Newsprint	Computer	TV	Day Driving	Night Driving
Phone Book	Headlines	Indoors	Sport	Movies
Sewing	Cards/Bridge	Cooking & Meals	Road signs	Theatre
Maps	Menus	Clocks	Sightseeing	Candlelight

Monofocal implants

In use since 1950, these IOLs focus at a single distance so they give good vision in three adjoining zones in the focus chart, but glasses are still required to see well in the other zones. By implanting a different power lens in each eye the range can be extended with one eye focused for near and the other for distance vision (called monovision, decreasing the need for glasses).

Advantages: proven track record with rare problems; potentially very high quality vision with no loss of contrast sensitivity (good vision in dim light); and low incidence of unwanted visual aberrations.

Disadvantages: Need for glasses or, if monovision is used, some imbalance and compromise is induced.

Multifocal implants

These IOLS focus both for distance and near vision by having concentric rings of different power. The design involves some compromise between trying to minimise problems and maximize visual function and freedom from glasses. The design can make the lens dominant for distance or for near vision.

Advantages: about 90% of patients will be glasses free (although many will need some help in poor lighting).

Disadvantages: altered vision requires a period of learning as the brain adapts; concentric rings cause halos and glare in some lighting (problems with night driving); vision may vary with pupil size and lighting; and some light is not correctly focused, which leads to reduced vision in poor light (loss of contrast sensitivity). Overall, about 30% of patients experience initial problems most of which become insignificant over months.

Types:

1) refractive optics - concentric rings of different power that blend into each other, similar to multifocal glasses, creating good vision in zones 2-5 but less detail in zone 1; halos are a common side effect.

2) diffractive optics - sharp junctions between zones act more like a bifocal, giving very good distance and near vision (zones 1, 4 & 5) but less detail at intermediate distance (zones 2 & 3); fewer problems with halos.

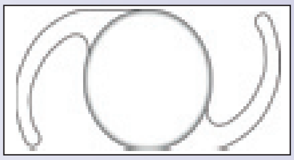
Accommodating lenses

The muscles that focus the natural lens could flex a soft pliable lens, effectively changing its focus from distance to near.

Advantages: potential for perfect vision without loss of contrast sensitivity and no rings to cause halos and glare problems.

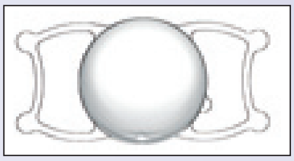
Disadvantages: new technology with limited follow up and no long term results; most current designs do not give a full range but an increased range of focus (usually 4 of the focus zones); and a small group of patients achieve good distance vision but no assistance with their near vision perhaps because their muscles are unable to move the new lens. ■

Exanples of lens types



■ *Softec® IOL*

Softec®. The one piece monofocal lens is aspheric to reduce aberrations and improve vision in dim lighting. It is produced in very small precise power steps, designed to give perfect vision at one distance.

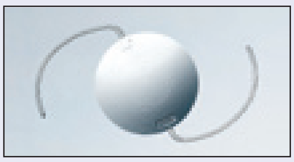


■ *Tetraflex® IOL*

Tetraflex®. Designed to flex so will provide some near vision in addition to excellent distance vision without the problems of halos, loss of contrast sensitivity and poor night vision. Imperfect near vision can be boosted by making one eye slightly near dominant (mild monovision) or by wearing weak reading glasses.

ReSTOR®. Diffractive multifocal lens has two very precise focus points so gives extremely good distance vision with excellent near vision and tends to be independent of pupil size. Some night halos and some compromise at intermediate distance (e.g. computer screen).

ReZoom®. A three-piece refractive multifocal that gives a smooth blend from distance to near vision. It gives excellent distance and intermediate vision but some assistance may be needed for very fine near vision and it tends to be more dependent on pupil size. Halos are common.



■ *TECNIS® Multifocal IOL*

TECNIS®. Highly spherical aberration corrected lens designed to give optimum vision in dim light so may be suggested for people who do a lot of night driving. It is available as a monofocal or as a diffractive multifocal.

This clinical update is supported by the Eye Surgery Foundation.