

# Crystalens HD Accommodating IOL Available in New Zealand

Dr David Kent of Fendalton Eye Clinic, Christchurch implanted the first series of Bausch & Lomb Crystalens HD accommodating intraocular lenses in New Zealand in March 2009. The Crystalens HD is currently the only accommodating IOL approved by the US FDA and mimics the natural focusing action of the eye. Here Dr Kent explains the development of the lens, how it works, what patients are most suitable for this lens and an overview of multifocal and accommodating IOLs in New Zealand

BY DR DAVID KENT

The FDA study looked at the results of 125 primary eyes implanted with the Crystalens HD in patients who had a visually significant cataract, less than 1 dioptre of corneal astigmatism, and the potential for best corrected visual acuity (BCVA) of 6/7.5 or better in both eyes. Of these patients, 80% reported unaided vision of J2 (N6) or better at four months.

"If I were a patient having cataract surgery, I would want an IOL that projects a single point of focus and also provides a broad range of distance, intermediate and near vision. The Crystalens HD is the best available lens to achieve that goal," said Dr John Hovanesian, a Principal Investigator in the FDA study.

## History and development of the Crystalens HD

The Crystalens HD is a fourth generation of the original Crystalens design. The Crystalens HD IOL was approved by the USA FDA in June, 2008. The Crystalens HD is now available to patients in Australia and New Zealand. It is the evolution of some 15 years of ongoing research and development which dates back to the Chiron/Staar plate haptic silicone IOL. With this lens, a number of patients saw clearly at distance and were able to read, even though their refraction measured plano and they had no accommodative capacity<sup>1</sup>. Studies later emerged indicating that the ciliary body continues to function throughout a person's life. In fact one's ciliary function may indeed actually demonstrate greater contractile ability following cataract extraction<sup>2,3</sup>. Altering anterior chamber depth, and cause a forward movement of the vitreous<sup>4,7</sup>. Further studies correlated a 1.0mm forward movement of the vitreous with roughly 1.3D of accommodation for a patient with an average axial length of 24mm<sup>8</sup>.

## Mechanism of action of the Crystalens HD

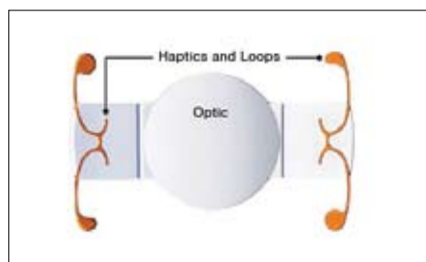
In addition to the forward movement of the vitreous and its movement in turn of the Crystalens, there is another key albeit secondary mechanism of accommodation - "Accommodative Arching" of the optic, as established in the work of Kevin Waltz, O.D., M.D. Dr. Waltz has demonstrated that when the Crystalens HD optic moves in the eye and arches, it mimics the natural crystalline lens as it accommodates<sup>9</sup>.

With the Crystalens HD lens, the central anterior 1.5mm of the optic is slightly thicker. This provides increased arching effect, and a greater depth of field. The plate haptic portions adjacent to the 5mm optic of the lens are hinged to facilitate flexing in the eye. The large polyimide haptics allow placement deep within the capsular bag to encourage more movement.

In the FDA trial of the Crystalens HD, all patients achieved at least 2.00D of accommodation (overall accommodation averaged 4.00D<sup>10</sup>).

At the close of surgery a mild cycloplegic drop is used to relax the ciliary body & allow the Crystalens to assume its most posterior position in the eye. This may affect near vision for the first week after surgery.

Weak reading glasses are often required in the first week but once



Hinged haptic allows the Crystalens HD to flex in-situ, mimicking natural accommodation

the cycloplegia wears off the eye can begin to "accommodate" using the Crystalens HD. The accommodative effect of the Crystalens does not wear off and in many cases there is improvement with time.

## Advantages of the Crystalens HD over current multifocal IOL designs

The updated HD design did not negatively affect distance or intermediate visual results, including contrast sensitivity<sup>10</sup>.

Most importantly, unlike its multifocal counterparts, the monofocal optic of the Crystalens does not lose light, split light or compromise contrast sensitivity in any way - inherent challenges to multifocal IOLs. Any multifocal IOL will compromise contrast sensitivity in exchange for multifocality.

Importantly, there is no need for Crystalens patients to "neuro-adapt" to retinal images, as Crystalens places a single image on the retina, hence the patient satisfaction levels rival those of lenses which are multifocal in nature. Of all the presbyopia lenses, Crystalens is least dependent on lighting conditions or pupil size. But like any other refractive procedure, patient selection and patient expectations management is key. Some patients may still require spectacles for night driving or reading fine print.

## The history of multifocal IOLs

In New Zealand the history dates back to the early 1990s when Dr Harold Coop presented his results with the 3M diffractive multifocal IOL. This lens was the forerunner of the Alcon ReSTOR diffractive multifocal IOL. Then in the late 1990s the AMO Array refractive multifocal IOL was introduced and used in many hundreds of eyes by a number of ophthalmologists throughout New Zealand. The Array was replaced about 4-5 years ago by the AMO ReZoom refractive multifocal IOL. The most widely used multifocal IOL used in New Zealand has been the Alcon ReSTOR diffractive multifocal IOL. Well over 1000 ReSTOR IOLs have been implanted by New Zealand eye surgeons since 2004. The ReSTOR IOL has the property of apodization making it a distance weighted lens in dim light and a near weighted lens when the pupil is small in bright light. The visual performance of the ReSTOR IOL was improved by both the adaption of the Alcon AcrySof aspheric optic design as well as the more recent introduction of the lower power reading add ReSTOR that has a more normal reading distance and fewer intermediate distance problems.

The Crystalens HD is not the first accommodating IOL to be used



These images demonstrate the action of the Crystalens compared with multifocal & monofocal IOLs

in New Zealand as the Human Optics accommodating IOL was briefly used here but did not prove to be successful.

## The current limitations of refractive and diffractive multifocal IOLs

Both the AMO ReZoom and Alcon ReSTOR may cause night driving problems including glare and halos around lights. The ReZoom has good intermediate range function but is not as good at near. The ReSTOR functions like a bifocal with very good near vision performance but more intermediate range blur. The ReSTOR IOL can also mildly reduce the sharpness and crispness of distance vision in some patients. All multifocal IOLs can cause a mild reduction in contrast sensitivity.

## Which patients might be good candidates for the Crystalens HD?

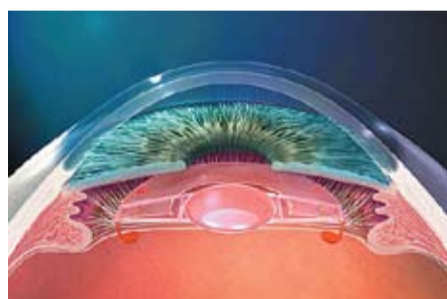
- Anyone with a visually significant cataract who would like to be as independent as possible from spectacles after cataract surgery and has visual potential of 6/7.5 or better with one dioptre or less of corneal astigmatism. It may be possible to correct the patient's pre-existing corneal astigmatism with either limbal relaxing incisions done at the time of cataract surgery or excimer laser surgery done at least 6 weeks after cataract surgery.
- The patient has to be prepared to pay the extra cost of the Crystalens HD over and above the normal cost of private cataract surgery. It is more expensive than a standard monofocal IOL. The additional cost to the patient may then vary from surgeon to surgeon.
- Presbyopic hyperopes with poor unaided distance vision and less than one dioptre of corneal astigmatism who would like to be as independent from spectacles as possible. It may be possible to correct up to 1.5 dioptres of corneal astigmatism with limbal relaxing incisions or in some cases plan to correct it with excimer laser surgery at a later date.
- Patients who develop cataracts after excimer laser surgery and would like maximal spectacle independence.

## References

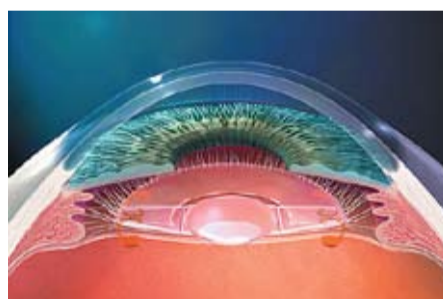
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Distance – the ciliary muscle is totally relaxed, the lens is back allowing images in the distance to be in focus



Near – the ciliary muscle contracts, causing the lens to gently move forward allowing images at near to be in focus



Intermediate – the ciliary muscle is slightly relaxed, allowing the lens to gently reshape