

CATARACT - VISUAL FUNCTION

WHAT ARE CATARACTS?

Cataracts occur when the lens loses its transparency and becomes opaque. The lens is an internal structure of the eye whose function is to focus images clearly and sharply on the retina, in addition to being a natural sunlight filter.

(See Figure 1)

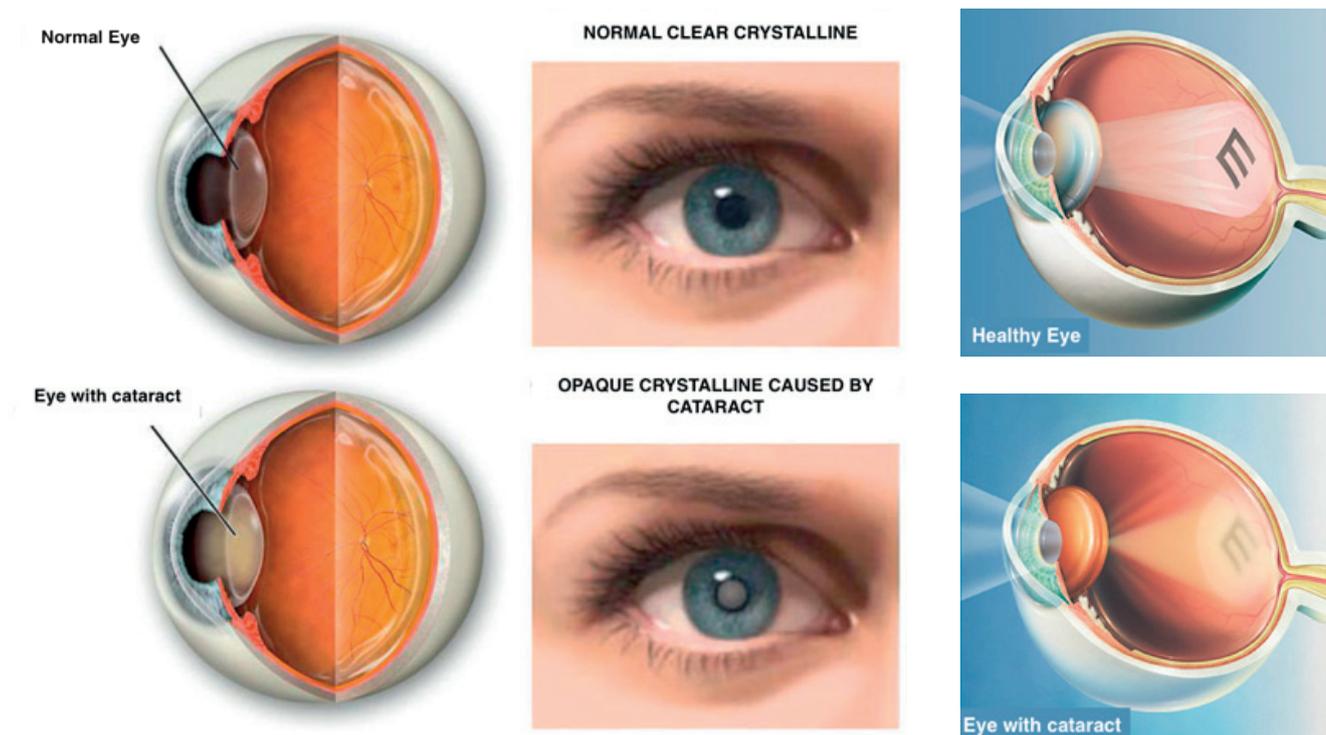


Illustration 1: The differences between normal clear crystalline (above) and opaque crystalline (below).

There are several causes for the development of cataracts:

- Congenital Cataract: diseases during pregnancy can cause the newborn to be born with cataracts.
- Cataracts due to altered metabolism (as in diabetes mellitus, amongst others).
- Cataracts due to the taking of drugs (such as with the taking of corticosteroids, amongst others).
- Cataract due to severe eye trauma or exposure to radiation.

Senile cataracts: are the most frequent. With the passage of time, the lens hardens and loses its transparency, becoming yellow, brown or even black, impacting on vision. (See Illustration 2). At first the colors are less intense, as if seen through a waterfall (hence its name); Halos can be seen around lights, especially in the dark and little by little there is a loss of clarity in distance vision that can not be completely corrected with glasses. All this, produces a significant decrease of visual quality. (See illustration 3).

At the present time, the only definitive solution is cataract surgery.



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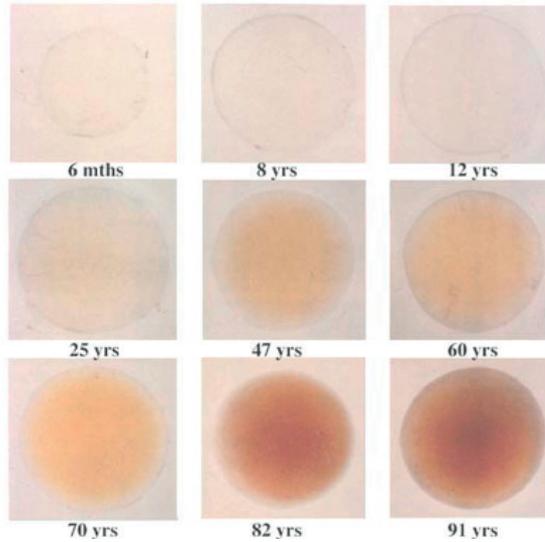


Illustration 2 – Age related changes in coloration of crystalline lens

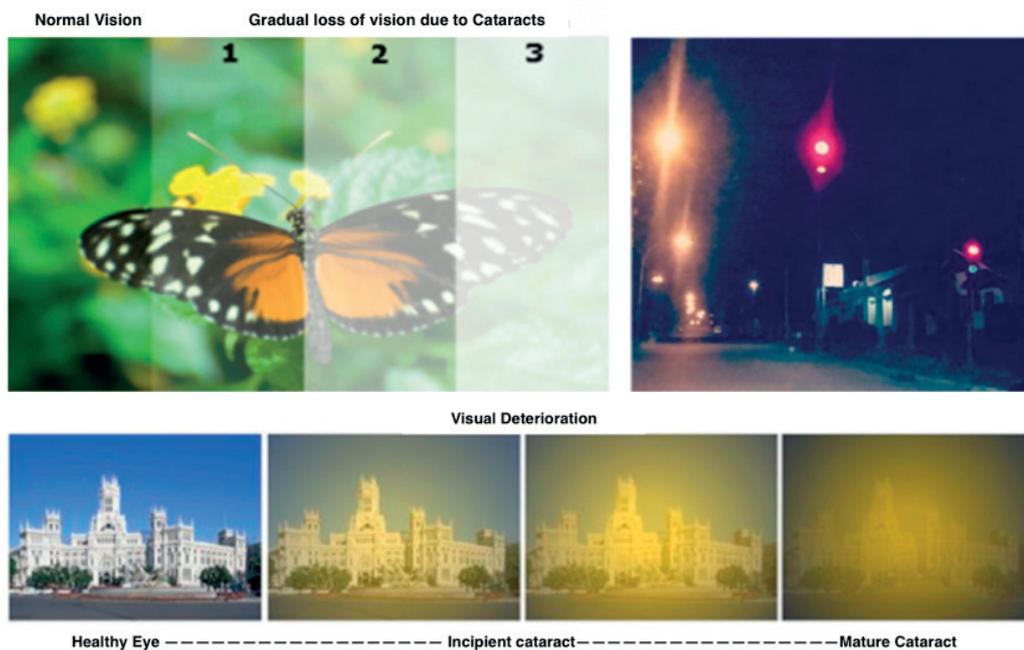


Illustration 3 : Alteration of vision with cataracts: progressively blurred vision, less intense colors (left), halos around lights (right).

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WHAT IS CATARACT SURGERY?

Cataract surgery consists of replacing the opaque lens with an artificial lens inside the eye, in the same position.

It is a protocolized surgical technique, that is, with well-defined steps. The surgeon makes small openings in the eye where a surgical probe is inserted to ultrasonically fragment the cataract into small pieces and suck them out whilst holding the outer capsule of the lens, which serves as a support to place the new intraocular lens. (See Illustration 4)

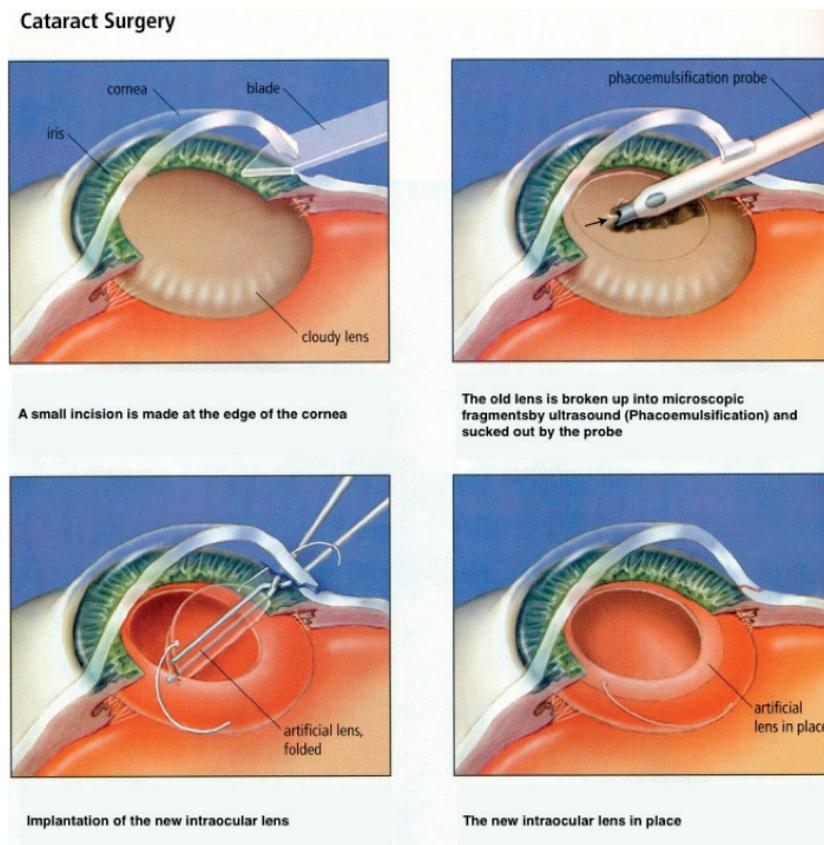


Illustration 4: Cataract surgery

The surgery is performed using topical anesthesia, i.e. Using anaesthetic eye drops so the patient does not feel any pain, although it is possible that the patient may notice that the eye is being manipulated and/or pressure changes within the eyeball. During the surgery the patient is usually awake and looking at a light source, as his/her collaboration is key to surgical success.

Each surgery is unique and individualised, but it can be said that under normal conditions it is a relatively fast procedure and has a low rate of complications, which allows the patient to be at home in just a few hours.

At present, the aim of surgery is not only to remove the cataract, but also to restore the visual quality of the patient as much as possible and so we endeavour to implant the most appropriate lens for each patient, which best corrects their vision. Most lenses that are implanted only distance vision but in recent years there has been an increase in the development and use of lenses that can correct both near and far vision. (See Figure 5 and 6).

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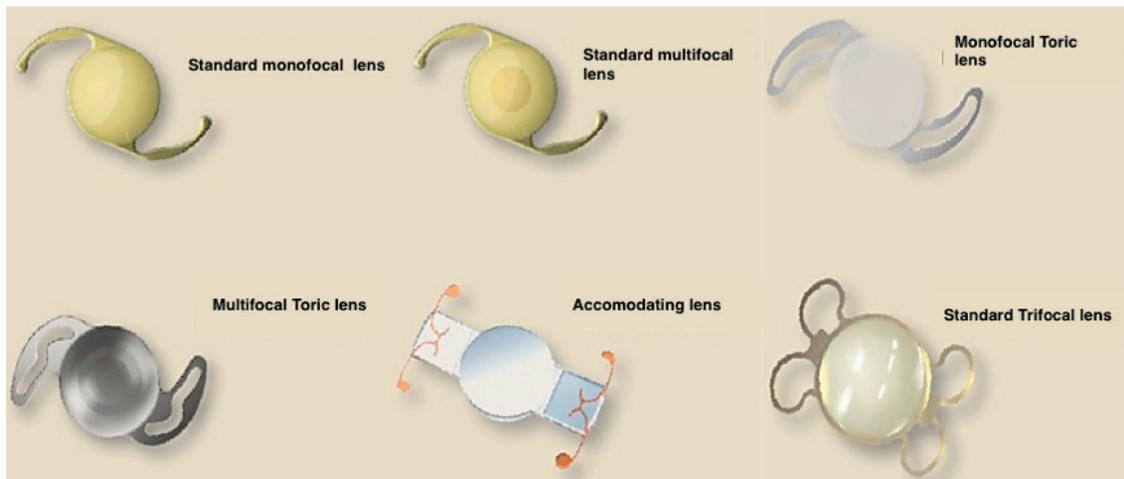


Illustration 5. Possible types of lenses implanted in cataract surgery

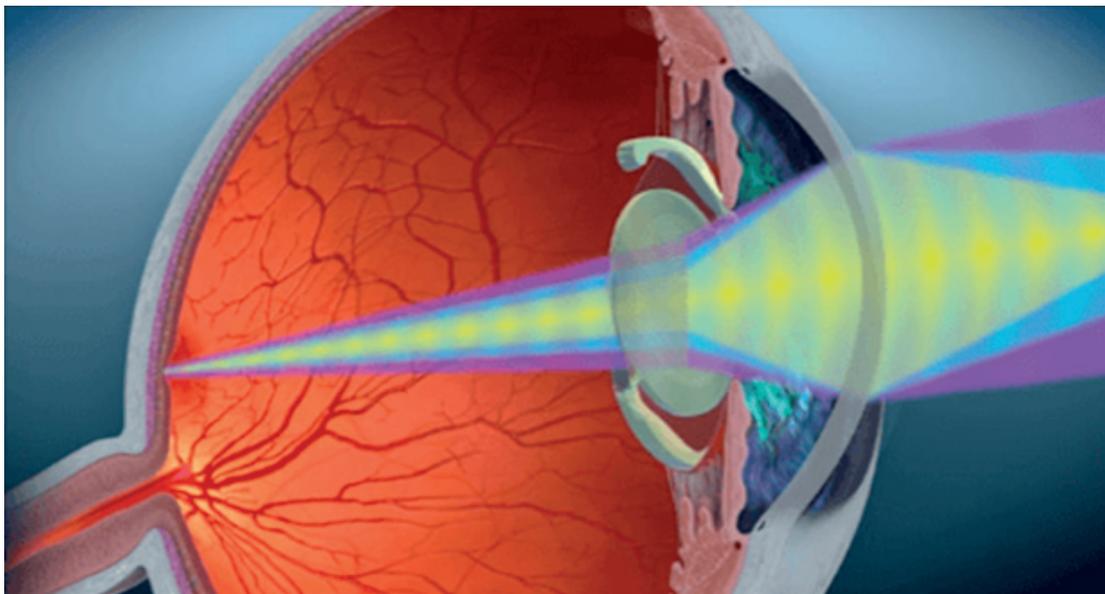


Illustration 6: The intraocular lens allows the image (distant and/or near, depending on the type of implanted lens) to focus on the retina to recover sharp vision.

<https://www.youtube.com/watch?v=rYVbLGAF6gM>

The postoperative period is painless and lasts for about a month in which vision progressively improves. The patient will have to follow specific recommendations (especially avoiding physical effort) and the treatment prescribed by his ophthalmologist, which will consist of the daily application of antibiotic and anti-inflammatory eye drops.

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WHAT IS VISUAL FUNCTION AND HOW IS IT ASSESSED?

Visual function is a term that encompasses different qualities of vision such as the ability to differentiate colors or that of seeing small objects, defining, overall, the visual quality of the patient.

During the process of cataract formation, because the transparency of the lens is lost, some of these qualities will be affected, such as the intensity with which we see colors or the ability to distinguish small and distant objects and/or the ability to see clearly in situations with little contrast or brightness such as on cloudy days or in dim forests etc).

Visual function is assessed through a series of tests in which the patient reports what he sees and the clinician analyzes and/or quantifies the results to form a global idea of how good the patient's vision is, and can compare it before and after cataract surgery.

Tests are performed on:

Visual Acuity Visual acuity is tested using different contrasts (100%, 2.5%, 1.25%): the test consists of reading letters that are smaller and smaller (black on white - contrast 100%, or grays on white - contrast 2.5% and 1.25%). This test assesses the patient's ability to see distant or small objects clearly (see Figure 7).



Illustration 7: ETDRS charts assess the visual acuity using contrasts of 100%, 2.5% and 1.25%

Contrast Sensitivity: This test consists in distinguishing separate stripes from greater to lesser thickness or smaller and smaller letters from higher to lower contrast. It evaluates the ability to distinguish objects when the object and background are very similar, as, for example, it would be to see a black cat on a dark night. (See Illustration 8).

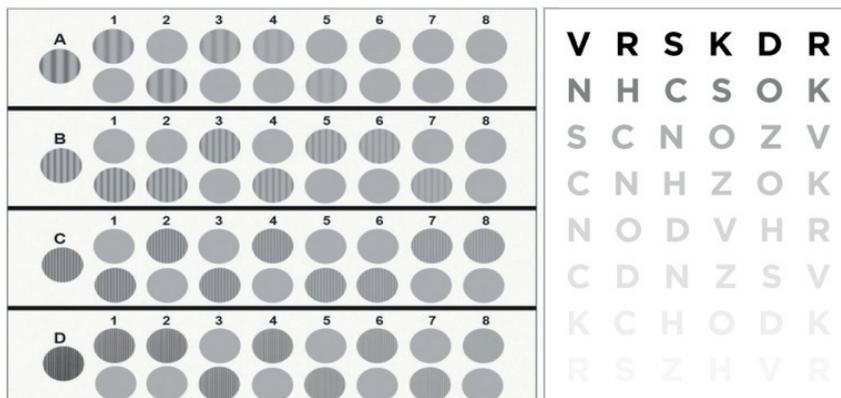


Illustration 8: Contrast sensitivity tests CSV-1000E (left), Pelli Robson (right)

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Color vision: the test consists of putting a sequence of colors in order. It evaluates if the patient is able to detect small variations in color tone. (See Figure 9)



Illustration 9: Putting colors in order

WHAT RESEARCH DOES GIMSO DO IN RELATION TO CATARACTS AND VISUAL FUNCTION?

The research group at Miguel Servet Ophthalmology Department has been active for more than 15 years in the study of eye diseases and in the prevention of blindness. Since 2013, a high-resolution cataract surgery program has been developed, based at the Nuestra Señora de Gracia Hospital in Zaragoza, where an average of 5700 cataract surgeries are performed annually.

This program provides quality care to patients with this pathology, investigating which features of the treatment which intraocular lens implanted in cataract surgery can help optimise their postoperative visual function. We also study the therapeutic profitability and the level of user satisfaction.

On this long journey, different aspects related to cataract surgery have been studied.

- How does cataract surgery affect the results of diagnostic ophthalmologic tests.
 - “Effect of cataract surgery on OCT measurements in diabetic patients”
<https://www.ncbi.nlm.nih.gov/pubmed/23860762>
 - “Influence of cataract surgery on OCT measurements in patients with Retinitis Pigmentosa”
<https://www.ncbi.nlm.nih.gov/pubmed/23677138>
 - “Effect of cataract surgery on OCT and GDx measurements in patients with glaucoma”
<https://www.ncbi.nlm.nih.gov/pubmed/20051889>
- How visual function improves after cataract surgery.
 - “Differences in quality of life and quality of vision between monofocal and multifocal intraocular lenses”
<https://www.ncbi.nlm.nih.gov/pubmed/28106237>

