Out of all the five senses, vision has long been considered the initial “sense” among humankind. It is estimated that the majority of our sensory input comes from visual input and anything that impedes this can affect our daily routine.

What are cataracts?

A cataract is the clouding of the natural lens inside the eye (Figure 1). It is a gradual thickening of the lens that causes the lens to lose its transparency so that light is either distorted or cannot reach the retina for transmission to the brain for visual processing. When left untreated, cataracts will cause blindness. In fact, cataracts are the leading cause of treatable blindness in all areas of the world. According to WHO estimates, age-related cataracts account for 48% of the world’s blindness. This figure can range from 5% in developed countries like the United States and United Kingdom, to 60% in less developed areas like some parts of Africa [1].

![Figure 1. A dense cataract on the left eye.](image)

Symptoms of cataracts

It is easy to imagine that a dense cataract can lead to a complete loss of vision. Patients may only have light perception when they suffer from severe cataracts. Severe cataracts, if left untreated, may lead to complicated sequelae like lens-induced glaucoma and lens-induced uveitis that can be highly symptomatic and difficult to treat. Apart from direct visual effects, dense cataracts are also linked to a reduced quality of life, increased rate of falls, and even depression [2-4]. However, in a modern city like Hong Kong, patients often seek medical help before they have mature cataracts, as their visual symptoms may impede an active life in their retirement years. They may experience early symptoms of cataracts, including mild blurring of vision, glare, decreased colour saturation or decreased contrast differentiation. Some patients may have increased myopia caused by cataract-induced lens power changes with paradoxical near vision improvement.

Formation of cataracts and prevention

The pathogenesis of age-related cataracts is not totally clear. Studies have shown that cataract formation can result from oxidative stresses like smoking, UV-B exposure and diabetes. These oxidative stresses cause a reduction in glutathione and loss of protein thiolation in the lens material. Since lens proteins are not recycled, damage to lens proteins is permanent and cataract formation is not reversible [5,6]. To date, there are no medicines or eyedrops proven to be effective in treating or stopping cataract formation. Although many studies have shown that anti-oxidants such as vitamin C, lutein, zeaxanthin, and multi-vitamins are associated with a lower rate of incidence and progression of cataracts in subjects exposed to high oxidative stresses, there is no conclusive evidence that anti-oxidants have a significant effect in the prevention of cataracts in normal subjects [7]. However, there is no harm in maintaining a healthy lifestyle and a balanced diet in order to prevent cataract development.

Classification of cataracts

Cataracts are classified in terms of aetiology, morphology and maturity.

Cataracts can be congenital or acquired. The majority of cataracts in our practice are senile cataracts. Trauma and drug-related causes are not common. Moreover, cataracts may be secondary to ocular diseases like uveitis or myopia, or systemic diseases like diabetes.

In terms of morphology, cataracts can be defined as a nuclear sclerosis that may cause progressive central thickening and brown colouring of the lens. Cortical cataracts cause opacities that are arranged radially in the cortical zone of the lens (Figure 2). Subcapsular cataracts lie just next to the lens capsule.

In terms of maturity, immature cataracts are described as an incomplete opacification of the lens, causing visual symptoms of varying degrees. Mature cataracts are described
as densely opacified lenses (either white or brown) that obstruct the red reflex of the fundus and are usually visually debilitating. In hypermature cataracts, water leaks out from within, causing wrinkling of the lens capsule. Further progression may result in cortex liquefaction and nucleus sinking called a morgagnian cataract.

Cataract surgery and its indication

Cataracts have long been seen as a major visually threatening condition. Fortunately, it is generally a reversible cause of visual impairment. As early as a thousand years ago, a couching technique was described to treat a cataract. The cataractous lens was pushed back by a needle, allowing it to sink into the vitreous cavity and permitting light transmission through the pupil. In modern medicine, since there is no proven topical or systemic medical treatment, surgical removal of cataracts remains the most successful treatment of choice. In fact, cataract operations have been shown to be one of the most cost-effective healthcare interventions [8].

Cataracts can be left and observed if they are mild and do not cause any visual disturbance while performing daily activities. However, this option depends on the patient’s lifestyle and their visual demands. In the past, doctors have suggested that surgery be delayed until the cataract becomes ‘ripe’. This was generally true because of the higher risk of surgical complications and the unavailability of good postoperative lens correction methods. Surgery then involved a larger wound incision and a higher risk of surgical complications like intraocular haemorrhage and retinal detachment. Post-operatively, patients were required to wear a pair of thick lenses (which were essentially magnifying glasses) for correcting the high refractive error induced by the surgery. Therefore, the risk:benefit ratio for patients with a mild cataract were significant, the worse scenario being blindness. Nowadays, thanks to the advancement in technology, cataract surgery can be performed with much lower risks. With the development of high-quality artificial intraocular lenses (IOLs), early surgical treatment can now be considered. This not only allows patients to improve their vision early but also to improve their quality of life.

There are other indications for cataract extraction apart from visual consideration. Patients with retinal disease, like diabetic retinopathy, whose cataracts have obscured the fundi are indicated for surgery to allow proper management of their retinal problem. Cataract-induced ocular problems (e.g. phacomorphic glaucoma) and cosmetic improvement for a blind eye are rare indications for surgery.

Modern cataract surgery (phacoemulsification)

Phacoemulsification (phaco) has become a popular surgical technique since the 1990’s. After certain technological modifications and refinements, it is currently the most commonly performed cataract surgery procedure in developed countries and in Hong Kong. The surgery can be done under topical anaesthesia without an anaesthetic needle injection, depending on patient cooperation. It is generally an outpatient-based procedure.

A small wound (as small as 2 mm) is created on the cornea which allows the machine probe to be inserted into the eye (Figure 3). Ultrasound energy is applied to the cataract and it causes the breakdown of lens materials which are subsequently aspirated from the eye. An IOL is then inserted to replace the lens of the eye (Figure 4). No suture is necessary for wound closure. The whole procedure typically takes around 20 minutes and patients may experience little to no pain. They can usually return to their normal activities in a few days.

IOL implantation is an essential step in modern cataract surgery. After cataract extraction, it is necessary to put in an IOL in order to reset the converging power of the eye so that the focus of an object can be placed on the retina. Accurate measurement of different eye parameters (e.g. length of the eyeball, corneal curvature and lens position) are necessary before surgery. The IOL’s power is then calculated using a specific formula and the appropriate lens is chosen to correct the patient’s refractive error, be it myopia or hyperopia. The majority of patients do not need to wear spectacles after surgery, although those with high visual demands may still have to wear glasses for very fine vision.

Nowadays, newer types of IOLs have been developed to allow patients to enjoy spectacle-free vision (Figure 5). Toric IOLs help to correct astigmatism. Multifocal IOLs and accommodating IOLs help to correct presbyopia (age-related difficulties with near vision) and allow patients to have both
distant and near focus from the same IOL implant. That means it is now possible to remove a cataract and correct distance or near vision at the same time. However, not all patients are indicated for these types of presbyopic IOLs and a thorough discussion and careful patient selection are necessary before surgery [9]. Femtosecond laser, which is currently used in laser refractive correction, has recently been shown to be effective in certain parts of cataract surgery [10-12]. However, whether this has any significant advantage over phacoemulsification still requires evidence from more studies.

Complications of surgery

A vast majority of patients see better after cataract extraction and IOL insertion. Although complications rarely occur, when present, they may result in a deterioration of vision. The most fearful risk of modern cataract extraction is post-operative infection (endophthalmitis) which can lead to a complete loss of vision. Different measures have been suggested to minimize its occurrence, such as airflow currents in the operating theatre or prophylactic antibiotics (e.g. injection of cefuroxime in the anterior chamber of the eye), but this may still occur in 0.05–0.1% of cases worldwide [13].

Other complications include intra-operative intraocular haemorrhage (seen mainly in older styles of cataract surgery), which is now fortunately very rare with modern methods. One common post-operative complication is posterior capsule opacity that usually occurs a few months after surgery (Figure 6). The patient may complain of blurring of vision (often described as regrowth of the cataract). This thickening of the capsule can be easily treated by laser with excellent visual results.

Conclusion

As the ageing population increases, cataracts will continue to be a major health issue in every part of the world, including Hong Kong. Improvements in cataract surgery have been seen in the recent years in terms of safety and technology. It is now generally a day-case office procedure which can be done under topical anaesthesia with eyedrops. Refractive errors like myopia, hyperopia, astigmatism and even presbyopia may now be corrected in the same procedure. The old adage “wait until ripe” is definitely not advised anymore.

References