VARIABLE POWER INTRAOCULAR LENS AND METHOD OF IMPLANTING INTO THE POSTERIOR CHAMBER

TECHNICAL FIELD

This invention relates to intraocular lenses. More particularly, this invention relates to posterior chamber intraocular lenses having variable power.

BACKGROUND ART

Intraocular lenses have been heretofore successfully implanted in human eyes. For example, anterior chamber lenses have been implanted directly behind the cornea, but such a lens is sometimes considered undesirable in that it is positioned very close to the cornea and in some cases may result in traumatization of the endothelium. In order to minimize the problems of anterior chamber lenses, various iris-clip and iridocapsular lenses have been developed.

There have been many other designs of intraocular lenses and the latest and most popular intraocular lens involves the use of posterior chamber lenses. The reason for the popularity of the posterior chamber lens is predominantly because many that are skilled in the art believe that breaking or incising the posterior capsule of the lens results in a higher incidence of retinal detachment and cystoid macula edema. These complications appear to be decreased in any type of extracapsular cataract extraction whether it is done in the standard manner or by the procedures of lensectomy or phacoemulsification.

However, one of the present problems with intraocular lenses is that it is necessary to decide on the power of the lens preoperatively. This can be accomplished, for example, by performing an ultrasound scan and/or evaluating the patient's refraction preoperatively and then making a clinical estimate of the proper power of the lens in order to determine proper refraction of the eye.

Accordingly, there is a need for a posterior chamber lens having a variable power of refraction.

DISCLOSURE OF THE INVENTION

In accordance with the present invention, a posterior chamber intraocular lens for a human eye is provided that includes a fluid-expandable sac that is constructed of a flexible transparent material for containing fluid. The sac is dimensioned for occupying the posterior chamber of an eye in place of the natural lens and contains a fluid when implanted in the posterior chamber of an eye for providing the desired correction, the fluid forming the interior portion of the posterior chamber intraocular lens of the present invention. The sac which forms the exterior portion of the intraocular lens further includes a neck portion that serves as a valve and extends through the sclera of an eye when inserted therein. The valve allows fluid contained in the sac to be withdrawn or replaced to change the index of refraction of the lens, and/or, change the thickness of the lens and thereby change the power of the lens.

In accordance with the surgical procedure provided, the posterior chamber intraocular lens of the present invention is implanted into the eye by inserting a needle through the sclera of the eye and into the posterior chamber. Thereafter, the fluid-expandable sac, constructed of a flexible transparent material is inserted through the needle in a collapsed condition and into the posterior chamber. A fluid is then instilled into the sac thereby expanding it and isolating the vitreous face from the natural lens. Thus, the insertion and expansion of the sac dissects the attachment of the vitreous face from the posterior natural lens capsule. A pressure relief aperture is formed in the cornea of the eye so that pressure produced on the interior portion of the eye as fluid is instilled into the sac is relieved. The natural lens is then extracted from the eye, and may be removed through the pressure relief aperture, by any suitable manner known to those skilled in the art, such as by cryoextraction, extracapsular extraction or phacoemulsification.

In accordance with another embodiment of the posterior chamber intraocular lens of the present invention, the fluid-expandable sac is filled with a liquid crystal material. The accommodation of the eye is monitored and to provide an input signal to a microprocessor that is capable of producing an output voltage proportional to the desired accommodation. The output voltage is transmitted to and applied across the liquid crystal material contained in the sac for providing an index of refraction that is required to achieve the power necessary for the desired accommodation.

DESCRIPTION OF THE DRAWINGS

The present invention can be more completely understood by reference to the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. **1** is a horizontal section through a human eyeball partially broken away;

FIG. **2** is a horizontal section through a human eyeball partially broken away illustrating the insertion of a needle through the sclera and into the posterior chamber of the eye;

FIG. **3** is a horizontal sectional view of a human eyeball partially broken away showing the posterior chamber intraocular lens implanted in the eye;

FIG. **4** is a sectional view of a needle, partially broken away, utilized in implanting the intraocular lens of the present invention illustrating a collapsed intraocular lens in accordance with the invention being transported through the needle; and

FIG. **5** is a horizontal sectional view of a human eyeball partially broken away showing an alternate embodiment of the posterior chamber intraocular lens of the present invention.

DETAILED DESCRIPTION

In accordance with the present invention, a posterior chamber intraocular lens together with a surgical method for the implantation thereof in a human eye is provided. Unlike previous intraocular lenses, the posterior chamber intraocular lens of the present invention is a nonrigid lens that permits the corrective power of the lens to be changed after implantation thereof into an eye.

Referring to the figures generally, and particularly to FIG. **1**, there is depicted a horizontal cross section of a human eye, partially broken away and generally referred to by reference numeral **10**. Eye **10** includes a cornea **12**, limbus **14**, a sclera **16**, conjunctiva **18**, an iris **20**, an anterior chamber **22**, a posterior chamber **24**, a natural lens **26**, ciliary body **28**, suspensory ligaments **30** and a vitreous chamber **32**. The function and interrelationship of these components of the eye are well known