TWO-PIECE INTRAOCULAR LENS

BACKGROUND OF THE INVENTION

The present invention relates to an intraocular lens, and particularly to a self-centering lens which can be implanted through a very small incision.

When the natural lens is removed from the eye of a patient, for example as a result of the formation of cataracts, it is current practice to replace the natural lens with a synthetic lens. The synthetic lens is generally introduced in a folded state through an incision made in the cornea. It is then placed in the anterior chamber of the eye (forward of the iris) and mounted to it, or in the posterior chamber (behind the iris) and mounted to either the sulcus or fornix. In either case, for a variety of medical reasons, it is desired that the incision be as small as possible.

Since the muscles within the eye cannot change the focus, or curvature, of a synthetic lens in the manner achieved with the natural lens, there has been interest in the provision of a lens having several different refractive powers in order to permit the formation of in-focus images of objects at different ranges. However, in view of the configuration which such a lens must have, it heretofore appeared that such a lens could not be compressed to a size which would permit safe implantation.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an intraocular lens which can be implanted safely and easily.

Another object of the invention is to make possible safe implantation of an intraocular lens having a variety of optical shapes and refractive elements.

A further object of the invention is to facilitate the fabrication of multifocal intraocular lenses.

The above and other objects are achieved, according to the invention, by an implantable intraocular lens assembly comprising:

a first member having an annular form, an outer periphery and an inner periphery delimiting an opening; and

a second member of transparent material having at least one curved surface and an outer periphery;

wherein: the second member is separated from the first member before implantation and is inserted into the opening of the first member after implantation of the first member.

Objects according to the invention are further achieved by a method of implanting the lens assembly defined above as follows:

after a small (3 mm) incision is made in the cornea, a circular tear capsulotomy (capsulorhexis) is performed to remove the anterior capsule;

the cataract is removed through the same 3 mm incision or slit;

cortex material is removed as necessary via asperatean;

via the same incision formed in the cornea, the first member is placed into the eye chamber so that it is held in position in that chamber via its outer periphery. This is achieved either by folding or rolling the first member so it will pass through the small incision; and

after implantation of the first member, the second member is implanted via the same incision, into the opening delimited by the inner periphery of the first member so that the outer periphery of the second member engages the inner periphery of the first member.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a cross-sectional view of the ocular portion of a human eye having a lens assembly according to the invention implanted in the posterior chamber.

FIG. **2** is a cross-sectional view of one component of the lens assembly of FIG. **1**.

FIG. **3** is a cross-sectional view of a second component of the lens assembly of FIG. **1**.

FIG. **4** is a front view of the lens assembly of FIG. **1**.

FIG. **5** is a cross-sectional view of a second embodiment of a lens assembly according to the present invention.

FIGS. **6** and **7** are front views of different lenses according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** is a side cross-sectional view of the ocular area of the human eye after extracapsular cataract extraction and implantation of a lens according to a preferred embodiment of the present invention. The eye parts illustrated in FIG. **1** include the cornea **2** and the iris **4** which delimits the pupil **6**. Posterior to, or behind, iris **4** there is disposed the hyloid membrane **8**.

When extracapsular cataract surgery is performed, there further remains within the ocular area the posterior capsule **10** and portions **12** of the anterior capsule. Posterior capsule **10** and the remaining portions **12** of the anterior capsule form what is commonly known as the capsular bag. The posterior capsule is attached to ciliary body **14** by means of zonular fibers **16**. The region between cornea **2** and iris **4** is identified as the anterior chamber **20**, while the region between posterior capsule **10** and iris **4** is the posterior chamber **24**. At the location where anterior capsule portions **12** join to posterior capsule **10**, there is created an annular pocket, or fornix.

Preferred embodiments of the present invention are constructed to be implanted in the capsular bag and to be supported in the fornix in a manner to assure accurate and reliable centering of the optical components of the lens.

FIG. **1** further illustrates one embodiment of a lens assembly according to the invention composed of an annular member **30** surrounding and supporting a central lens member **32** having a circular outline.

Annular member **30** is formed of a single piece of material, such as silicone, and has, over the major portion of the region between its inner and outer peripheries, a thin-walled structure enabling member **30** to be folded or rolled into a compact configuration for implantation into posterior chamber **24** via an incision in cornea **2** and then via pupil **6**. However, annular member **30** has sufficient shape retention to subsequently expand, after withdrawal of the implantation tool to assume the configuration shown in FIG. **1**.

Lens member **32** which, in the illustrated embodiment, is a biconvex lens made of silicone, PMMA, hydrogel or the like. It is implanted subsequent to implantation of annular member **30** and is preferably made to have at least a limited degree of compressibility to allow insertion through the same incision. Typically, such a lens would have a diameter of about 3.0 mm to about 8.0 mm. After being positioned in the opening formed by annular member **30**, and removal of the implantation