ARTIFICIAL EYE LENS AND METHOD OF TRANSPLANTING SAME

This application is a continuation, of Ser. No. 849,325, filed on Apr. 8, 1986, now abandoned.

FIELD OF THE INVENTION

The present invention relates to artificial lenses for eyes, in general, and to soft intraocular lenses and a method for implanting them in the posterior chamber or anterior chamber, in particular.

BACKGROUND OF THE INVENTION

A number of eye diseases exist wherein it is necessary to surgically remove the natural lens of the eye. During such surgery, it is necessary to replace the lens with an artificial lens, if the patient is to regain the use of the eye. Numerous artificial lenses have been developed and disclosed in the patent literature. These include glass intraocular lenses or hard plastic lenses known as PMMA that are held in place in the eye with loops, clips, staves and sutures.

Lenses for insertion into the lens capsule are illustrated, for example, in U.S. Pat. Nos. 4,251,887, 4,254,510, 4,476,591, 4,477,931. Lenses adapted for attachment to the ciliary body of the eye are disclosed, inter alia, in U.S. Pat. Nos. 4,253,199, 4,249,272, 4,254,509. Still other artificial intraocular lenses are disclosed in U.S. Pat. Nos. 4,253,200, 4,254,511, 4,257,130, 4,480,340, 4,338,687 and 4,414,694. There is shown in U.S. Pat. No. 4,277,852 an intraocular lens with supporting mount which is automatically implantable with correct optical orientation of the correction axis.

These lenses are generally so-called hard lenses which are relatively inflexible. There are also known soft lenses made of a flexible material. Soft lenses require the selection of an appropriate material which is sufficiently flexible yet has the necessary optical qualities, which is non-toxic and which can be manipulated to the desired shape. They also require an effective design to provide a suitable optical region and effective fixation.

U.S. Pat. No. 4,424,597 to Schlegel discloses a posterior chamber implant lens comprising a homogeneous, clear, vulcanized silicone rubber optical portion and a radially outwardly extending, thin-walled support encircling the centerpoint of the lens body and having several openings distributed thereover. The lens of silicone rubber is is flexible and of a constant size since it does not absorb fluid in the eye. Thus, in order to implant this lens, the incision must be as large as the lens, or the lens must be folded for insertion and then unfolded within the eye. Furthermore, this lens is very thin so that upon fibrosis, when the capsule constricts about it, the lens often pops out.

There is shown in U.S. Pat. No. 4,449,257 to Koeniger an intraocular soft lens of HEMA plastic cut into a round lens with concentric grooves around peripheral margins which frictionally engage the rough interior walls of the posterior lens capsule. Koeniger replaces the entire natural lens with an artificial lens of substantially identical shape and size. Due to the absorptive nature of the HEMA plastic material, when implanted, the dry lens softens by absorbing aqueous humor and expands to fill the lens bag. The disadvantages of this method are twofold. First, a relatively large incision is required through which the lens is inserted, due to the width of the lens. Second, since the power of the lens depends on its curvature, the lens of this shape detracts from normal vision because the size and shape of the lens physiologically does not permit the provision of the necessary optical diopters, in the shape described.

There is shown in U.S. Pat. No. 4,253,199 a deformable implant lens including upper and lower pieces which are sealed around the edges thereof leaving a lip or flap on one or both pieces. The flap is attached to the ciliary body as by sutures. Insertion of the lens is accomplished while the implant is partially dehydrated. The point at which the lens pieces are bent to form the lip is a weak point about which the lens which can deform during dehydration, causing difficulty during insertion.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an intraocular soft lens including a central optical portion and a fixation or support portion which permits easy and accurate implantation in the desired location in the eye, preferably in a partially dehydrated state for expansion during implantation, to give relatively rapid and efficient fixation within the eye.

There is thus provided in accordance with the present invention an intraocular lens made of a hydrogel material, preferably having about 60% water content, and defining a central, preferably bi-convex, optical portion and two oppositely situated, integrally formed, elongate, tapered fixation elements.

According to a preferred embodiment, the lens defines a vertical cross-section which is gradually tapered from the optical portion along the length of the fixation elements, permitting dehydration without substantial deformation.

There is also provided in accordance with the present invention a method of operating in the eye including the steps of removing the lens of the eye and part of the anterior capsule portion, inserting a lens implant of a hydrogel material defining an optical portion and two oppositely situated, integrally formed, elongate, tapered fixation elements in a partially dehydrated state into the posterior chamber of the eye, and permitting the lens implant to expand into fixative contact in a predetermined location.

BRIEF DESCRIPTION OF THE DRAWINGS

The lens of the present invention will be further understood and appreciated from the following detailed description taken in conjunction with the drawings in which:

FIG. **1** is a schematic illustration of an eye with a lens according to the present invention inserted into the posterior lens capsule;

FIG. **2** is a plan view illustration of an intraocular lens constructed and operative in accordance with an embodiment of the present invention;

FIG. **3** is a side sectional view of the lens of FIG. **2**;

FIG. **4** is a plan view illustration of an intraocular lens constructed and operative in accordance with an alternate embodiment of the present invention;

FIG. **5** is a schematic illustration of an eye with a lens according to the present invention inserted into the posterior chamber and affixed to the ciliary sulcus; and

FIG. **6** is a schematic illustration of an eye with a lens according to the present invention inserted into the anterior chamber and affixed in the angle.