SOFT INTRAOCULAR LENS

FIELD OF THE INVENTION

The present invention relates to an intraocular lens and more particularly to an intraocular lens made of a soft material and having fenestrated haptics.

BACKGROUND OF THE INVENTION

It is now commonly accepted that the vision impairing disease known as cataracts can be alleviated by surgically replacing the natural lens of the eye with an artificial intraocular lens.

The anatomy of the eye is shown schematically in FIG. 7. The cornea **2** forms the front surface of the eye and connects with the ciliary muscle **3** from which iris **4** extends. Iris **4** divides the front portion of the eye into the anterior chamber **5** in front of iris **4** and the posterior chamber **6**, behind iris **4**. The pupil **7** is the aperture at the center of iris **4** through which light passes to posterior chamber **6** and onto the back of the eye (not shown).

The condition of cataracts is characterized by the clouding or opacification of the natural lens (not shown) of the eye which reduces the image forming capability or contrast sensitivity of the eye. The natural lens of the eye is encased in a capsular bag **8**, as shown in FIG. 7, which is supported by suspensory ligaments, or zonules, **9** from ciliary muscle **3** near the base of iris **4**, also called the ciliary sulcus.

During intraocular lens surgery, the natural lens of the eye is removed by a variety of methods well known to those skilled in the art. The front surface of the capsular bag is removed. The eye shown schematically in FIG. 7 has the natural lens and the front surface of capsular bag **8** removed so that the eye is ready for the insertion of the intraocular lens.

Still referring to FIG. 7, there is shown an incision **12** at the edge of the eye through which the lens will be inserted. The patient is usually lying on his back with the doctors standing facing the top of the patient's head. The incision would be made at a position called the superior part of the eye, and the intraocular lens is inserted from the superior portion of the eye toward the inferior portion of the eye. This terminology of inferior position and superior position is generally used in the field, and inferior positions are those spaced further away from the entrance incision, and superior positions are those spaced closed to the entrance incision.

An intraocular lens has two parts: a medial light focusing body called an optic and one or more haptics which extend from the optic to the surrounding anatomy of the eye. The haptic is meant to support the optic in the eye. The optic has an anterior surface facing forward toward the cornea and a posterior surface facing toward the retina. The optic has an optical axis which extends generally perpendicular to the plane of the optic.

Certain intraocular lenses of the kind shown in U.S. Pat. No. 4,573,998 to Thomas R. Mazzocco entitled "Method for Implantation of Deformable Intraocular Lenses" made of very soft flexible silicone type material. Although such lenses apparently make satisfactory intraocular lenses, there has been some concern expressed in the literature about the stability of fixation of such lenses to adjacent tissue. Questions have been asked whether a fibrous reaction that would enhance fixation occurs adjacent to silicone haptics, "Pathologic Findings of an Extended Silicone Intraocular Lens", Donald A. Newman et al., *Journal of the Cataract Refract. Surg.*, Vol. 12, May 1986. That paper also suggests that certain complications can be prevented by avoiding in-the-bag placement of the implant. The article continues, however, that the lens reported in the present study was not implanted in the capsular bag yet complications did occur. Other clinical investigators recommend not placing silicone implants in the bag. In "Early Experience with STARR TM Silicone Elastic Lens Implants" by Gerald D. Faulkner, M.D., *Journal of Cataract Refract. Surg.*, Vol. 12, January 1986, pp. 36–39, Dr. Faulkner comments that fibrous adhesions of the anterior capsular flap to the posterior capsule made the capsular bag space shorter than the implant, causing it to bend at the haptic-optic junction. The resulting tilt and decentration of the optic caused an increase in myopic astigmatism. Dr. Faulkner reports that Dr. Mazzocco and other doctors as well, reported the same complication in eyes in which the implant was placed in the capsular bag. Dr. Faulkner recommends that placing a silicone lens in the capsular bag should be avoided as it tends to result in decentration and tilting of the optic, which in most cases requires surgical intervention. Dr. Faulkner says that the flexibility of this elastic implant can be an advantage and disadvantage. It permits easier, less traumatic insertion through a smaller incision, but makes the implant vulnerable to forces caused by post-operative fibrosis that occur in some eyes. I believe it would be useful to have a soft intraocular lens which would be capable of placement in the bag or the ciliary sulcus and which would permit the fibrosis that occurs in some eyes to help hold the implant in place rather than to cause complications with the implant.

SUMMARY OF THE INVENTION

The present invention provides a soft one-piece intraocular lens with an optic and two fenestrated haptics extending from opposite peripheral edges of the optic. The lens may be used for anterior chamber placement or posterior chamber placement with the entire lens placed in the bag or with the lens haptics extending into contact with the ciliary sulcus. Previous lenses of this type like the lenses discussed in the Faulkner article are made of silicone and are so flexible that they require the extra rigidity provided by a solid flange-like haptics in order to permit them to keep their shape when implanted in the eye. The present fenestrated haptic has a specially constructed member extending about the periphery of the haptic and defining the fenestration. This member has three basic parts including a tissue contact portion remote from the optic, first and second beam portions extending from opposite ends of the tissue contact portion in a direction towards the optic and tapering so as to widen in a direciton measured in the plane of the fenestration when proceedings from the tissue contact portions toward the optic and also to widen in a direction measured generally parallel to the optic axis when proceeding from the tissue contact portion toward the optic. Each beam portion is connected to the optic by a support portion which widens in the plane of the fenestration as one proceeds from the beam portion toward the optic but narrows in the direction of the optical axis when one proceeds from the beam portion toward the optic. The tissue contact portion provides a very soft flexible area for contact with