

ANTERIOR CHAMBER INTRAOCULAR LENS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of Ser. No. 560,132, filed Dec. 12, 1983, now abandoned.

FIELD OF THE INVENTION

This application relates to an intraocular lens for permanent implantation into the anterior chamber of an aphakic human eye.

BACKGROUND OF THE INVENTION

This invention relates to an intraocular lens for implantation into the anterior chamber of a human eye.

A large number of intraocular lenses have been described for implantation in the eye after cataract surgery, but none of them have been adequately successful in use. There are three common techniques for cataract surgery: intracapsular, where the entire lens is removed including the capsule; extracapsular, where the nucleus and cortex of the lens are removed, leaving the posterior portion of the capsule in place; and phakoemulsification, which often leaves the posterior capsule in place, and which is done through a very small incision. Lens implantation requires different surgical techniques for the different forms of cataract surgery. Microsurgical techniques are employed.

Problems have frequently arisen with prior art lenses. One problem is the requirement of a larger incision than is desirable, since this causes attendant pain and possible tissue damage. If an incision is too large, the anterior chamber of the eye may collapse and cause damage to the cornea. Also, since human eyes vary in size and shape, prior art lenses must be made in a variety of sizes and shapes to accommodate these differences. Errors in selecting the proper size of lens for each eye are quite common. Additionally, the cost of maintaining a large inventory of different sizes of lens is quite expensive.

Among the prior art lenses are those which claim the ability to be used in both the anterior and posterior chambers of the eye; this prevents optimal design for either chamber. Implantation needs vary between the two chambers and one lens cannot satisfactorily bridge these variances, due to differences in tissue structure and fixation properties.

An anterior chamber lens may be used after any type of cataract removal surgery, and is the only type of lens that can be used in many complicated cases.

The newer anterior chamber lenses are modeled after a lens introduced by Strampelli in 1953. These lenses cause complications due to difficult insertion, sizing and fixation, resulting in cornea damage, dislocation, hemorrhage and glaucoma. Rainin (U.S. Pat. No. 4,242,760), presented a new lens in 1979, which could be placed in either the anterior or posterior chamber of the eye. The haptics were always secured in the ciliary sulcus of the posterior chamber, since placement of the haptics of this lens into the anterior chamber would have projected the optic against the cornea. By definition, an anterior chamber lens is fixated in the anterior chamber by means of stabilization in front of the iris muscle tissue, and a posterior chamber lens is fixated in the posterior chamber by placement of the haptics behind the iris muscle tissue. The fixation of Rainin's lens (which is in the posterior chamber even if the lens itself is placed in the anterior chamber), is largely dependent

upon support from the pupil and iris, and this can result in extensive inflammation, uveitis and glaucoma. The Rainin lens is not a true anterior chamber fixed lens.

Shepard and Copeland devised anterior chamber lenses with some degree of flexibility. Their usage has been limited by unnecessary tissue damage occurring since these lenses are both designed to be inserted through a large limbal incision which cuts through a large portion of the trabecular meshwork. The haptics, which are adjustable approximately 2 mm in length, traverse the remaining trabecular meshwork in the anterior chamber angle thereby damaging by traction that part of the trabecular meshwork which is not damaged by incision. The haptics collapse against the iris tissue, causing tearing and contributing to astigmatism post-operatively. Also, the haptics may pull, tear and break preplaced sutures at the incision, requiring additional surgical maneuvers.

Cilco has designed a variety of lenses for the anterior and posterior chamber. None of these lenses are suitable for insertion through a small incision, in which the incision need be no larger than the size of the optic.

The semi-flexible lens of Hahs, U.S. Pat. No. 4,437,194, is designed for implantation into the anterior or posterior chamber. This closed loop, double reinforced haptic design is very rigid and has limited compressibility for the anterior chamber, causing undue tissue tenderness due to the rigid design.

The intraocular lens of Drake, U.S. Pat. No. 4,543,673, also has a rigid design, using either three or four haptics.

SUMMARY OF THE INVENTION

An intraocular lens structure has been designed for permanent implantation into the anterior chamber of any size aphakic human eye. The lens optic is centrally placed and maintained in position in the anterior chamber by completely flexible haptics. The lens is inserted through a very small incision, no larger than the diameter of the lens and the flexible haptic arrangement allows for perfect fit of the lens into any size of eye, with maximal lens stability. The lens may also be implanted into the posterior chamber of an aphakic eye.

In one embodiment of this invention, a pair of closely spaced parallel haptics extends outwardly from one end of the optic and a similar pair extends in diametrically opposed position from the other end of the optic. In each pair one haptic has its open curved end portion curving outwardly in one direction and the other haptic has its end portion curving oppositely.

In another embodiment of this invention, two similar haptics extend at spaced apart positions from the median portion of the optic so that their end portions curve toward one another, with the positioning hole of the optic being in between. A third similar haptic extends from a position near the point of attachment of one of the other two haptics but in the opposite direction, its open curved end portion being curved in the same direction as the remaining haptic. In both this and the preceding embodiment all the haptics are flexible and have their curved end portions offset from their connecting portions. This offset or "crimp" in design allows bending of the haptic at that site, and thus gives added flexibility for proper fit, ease of insertion and lens stability. Also, this flexibility in the lens design minimizes eye tenderness.