INTRAOCULAR LENS WITH ROTATABLE APPENDAGE

BACKGROUND OF THE INVENTION

The present invention relates to an intraocular lens which may be implanted in the anterior or posterior chamber of the eye after removal of the natural lens of an eye as a result of a cataract condition.

Intraocular lenses have been successfully used to correct impaired vision after cataract surgery. A persistent problem has been the proper fitting of intraocular lenses, thus obviating the necessity of reentry into the eye and replacement of the lens. Also, dislocation of the intraocular lens after placement has caused problems in destruction of endothelial cells, infliction of pain, resulting in reentry into the eye to relocate the errant lens.

Though there is general agreement that posterior chamber placement of intraocular lenses produces an optically superior result, anterior chamber lens is a fairly common procedure. It is believed that placement of an intraocular lens in the anterior chamber of the eye may be accomplished by a less demanding surgical effort. Also, the optical results from an intraocular lens placed in the anterior chamber has been found to be satisfactory. However, there is a distinct danger of destruction of the endothelium layer of the cornea as a result of touching of the same. This touching may occur during the surgical insertion of the intraocular lens or if the intraocular lens in the anterior chamber dislocates or moves forward with changes in the shape of the eye. It has recently been found that it is best for an intraocular lens to not touch the iris portion of the eye in the vicinity of the pupil. For example, U.S. Pat. No. 3,994,027 to Jensen, et al, described a vaulted intraocular lens. Vaulting and adjustability of the fixation mechanism of an intraocular lens has also been found to be useful in the posterior chamber of the eye to avoid touching the iris and to insure that dislocation of the intraocular lens does not occur when the lens is being supported by the ciliary sulcus.

Various designs for flexible or adjustable intraocular lens fixation mechanisms have been proposed. Reference is made to U.S. Pat. No. 4,134,161 to Bayers which shows an intraocular lens mechanism which includes an adjustable leg. The leg may be adjusted before hand or continually adjusted with an elastic spring mechanism. Although this design recognizes the problem associated with the changing dimension of an eye during and after surgery, its use is impractical. The intraocular lens described in U.S. Pat. No. 4,159,546 to Shearing reveals an intraocular lens having springy open looped legs. Although adjustable to a certain extent, the intraocular lens shown therein would dislocate or thrust forward in the anterior chamber causing the problems heretofore described. The same would be true of the lens design shown in U.S. Pat. No. 4,257,130 to Bayers which describes a ribbon loop design. Finally, U.S. Pat. No. 4,296,501 to Kellman describes a hinged leg which determines the overall length of the lens prior to insertion within the eye. Although solving the problem of maintaining a large inventory of lenses, the Kellman lens fails to continually adjust its overall length without movement along the optical axis toward the endothelium layer or the iris in the anterior chamber or toward the iris or vitreous humor in the posterior chamber of the eye (intra capsular surgical procedure).

An intraocular lens which may be placed either in the anterior or posterior chamber of the eye that is adjustable in its overall dimension without thrusting generally at right angles to the deformation force applied would be a very useful advance in the art of manufacture of intraocular lenses and treatment of eye diseases.

SUMMARY OF THE INVENTION

In accordance with the present invention a novel and useful intraocular lens with a rotatable appendage which solves many of the heretofore described problems in the prior art is provided.

The intraocular lens of the present invention utilizes an optical portion with or without a haptic with the proper optical correction determined by prior art methods. At least one appendage is associated with the optical portion by a rotatable connection. The appendage includes at least a first portion and a connected second portion. Means is also provided for permitting rotation in one direction of the first portion of the appendage in relation to the optical portion upon the application of an actuating force on the second portion of the appendage. Rotation in the opposite direction of the first portion of the appendage occurs upon removal of the actuating force.

The appendage may be constructed of flexible material which is nonreactive to biological tissue. The intraocular lens of the present invention may also embrace the addition of a third portion of the appendage which is connected to the second portion and means for permitting rotation of the third portion in relation to the optical portion of the lens. Rotation of the third portion would occur again with application of an actuating force upon the second portion of the appendage which extends away from the optical portion to a distance further than the first or third portions of the appendage. Thus, a closed loop would be formed in this aspect of the invention such that the second portion of the appendage includes a proximal part connected to the first and third portions of the appendage, and a distal part extending from the optical portion to receive the actuating force. The actuating force may be applied by the periphery of the eye during initial placement or upon contraction postoperatively. The distal part of the second portion may be offset from the connection of the first and third portions to the optical portion of the lens to cause rotation of the first and third portions in the same direction relative to the optical portion upon the application of the actuating force. Likewise, the distal part of the second portion may be placed such that the actuating force causes rotation of the first and third portions in the opposite direction relative to the optical portion when the actuating force is applied. It should be noted that the relative rotation may actually cause rotation of the optical portion about its axis without a thrust along the optical axis.

The means for permitting rotation of the first or third portions of the appendage may include an enclosure connected to the optical portion or a hole or opening in the optical portion. The first portion of the appendage may freely rotate within the enclosure or opening. In addition, means is also provided for confining a part of the first portion to the enclosure without preventing rotation of the same within the enclosure. A confining means may include an enlarged portion of the opening as well as an enlargement on the first portion of the appendage. In addition, the second portion of the appendage may be angularly disposed in relation to the