

INTRAOCULAR LENS APPARATUS WITH HAPTICS OF VARYING CROSS-SECTIONAL AREAS

BACKGROUND OF THE INVENTION

In cataract surgery, the clouded natural lens is normally removed. An artificial lens known as an intraocular lens, or IOL, is implanted within either the posterior chamber or the anterior chamber of the eye. The IOL comprises an optic lens portion and a portion to retain and support the lens within the eye. The supporting and retaining portion usually employs one or more elongated strands, referred to as loops or haptics, which are resiliently deformable to facilitate insertion of the IOL into the eye, and expansion of the portion bearing against the interior surface of the eye, once implanted. The present invention relates in general to such an intraocular lens apparatus, and in particular, to a posterior chamber intraocular lens apparatus having loop-shaped haptics having areas of varying transverse cross-sectional area, so as to minimize the effective maximum width dimension or transverse profile of the IOL upon insertion through the smallest possible incision, and maximize the region of contact by the haptics with the interior surface of the eye upon implantation for greater stability.

In order to effectively utilize an intraocular lens within the eye, the clouded natural lens must first be removed prior to insertion of the IOL. Such removal can be achieved by a number of different processes. One such process is phacoemulsification, wherein a micro-needle is vibrated approximately forty thousand times per second so as to effectively liquify the nucleus of the natural lens for facilitated removal. Once this occurs, the remainder of the natural lens is removed from the eye by a finely regulated suction process.

In cataract surgery, it is extremely important to keep the incision made in the eye, which provides access to the posterior chamber, as small as possible in order to speed the healing process. While several prior art IOLs have employed haptics configured so as to provide the narrowest transverse profile and thereby enable insertion of the IOL through the smallest possible incision in the eye, few, if any such IOLs, have been designed so as to allow for a maximum region of contact with the interior surface of the eye after implantation and positioning within the eye. Likewise, such narrow profile prior art IOL's tend to have relatively rigid haptics that tend to increase the risk of puncturing or scratching the interior of the eye. Furthermore, no known prior art IOL incorporates a haptic which is configured so as to have alternating regions of varying transverse cross-sectional areas along the length of the haptic which serve to combine a narrow insertion profile with great flexibility for maximum stability upon implantation within the eye.

Historically, conventional IOLs have been of either the C-loop type or the J-loop type.

J-loop haptics have a thin insertion profile and relatively stiff legs extending outwardly in a nearly straight, tangential fashion from the lens, and have a small, sharply curved open end. Hence, J-loop haptics provide a higher potential for damaging (by scratching or puncturing) the interior of the eye, and at times are less stable, once implanted, due to their increased, almost column-like rigidity.

C-loop haptics provide improved stability upon insertion, in light of their prolonged, smoother curved regions of contact with the interior of the eye, but require larger incisions and usually more manipulation upon insertion, as a result of their wide profile. Examples of prior art J-loop haptics are U.S. Pat. Nos. 4,159,546; 4,581,031; and 4,636,210, while examples of prior art C-loop haptics are U.S. Pat. Nos. 4,535,896; 4,585,456; 4,601,722; and 4,629,461.

It is thus an object of the present invention to provide a posterior chamber intraocular lens apparatus which can be inserted through a relatively small axial incision in the eye, that is smaller than the incision required for a normal C-type haptic, much like a J-type haptic, while retaining the retention and increasing stability capabilities of a C-type haptic, once implanted.

It is another object of the present invention to provide a posterior chamber intraocular lens apparatus which employs regions of varying cross-sectional area along the length of its haptics to maximize flexibility and, in turn, the region of contact with the interior of the eye once inserted.

Another object of the present invention is to provide a posterior chamber intraocular lens apparatus which can be easily manipulated into proper position once it has been inserted into the eye, while also reducing the risk of damaging the interior of the eye during such manipulation.

It is another object of the invention to provide a new and improved posterior chamber intraocular lens that assumes the shape of the intraocular confines, such as the capsular bag or ciliary sulcus, because of the increased flexibility of the haptic design.

It is another object of the invention to provide a new and improved posterior chamber intraocular lens apparatus which avoids one or more of the above-mentioned limitations and disadvantages of prior art intraocular lenses.

These and other objects of the present invention, shall become apparent from the description of the drawings and claims that follow.

SUMMARY OF THE INVENTION

The present invention relates to an intraocular lens apparatus for implantation in the posterior chamber of an eye, in which the apparatus is to be inserted into the eye along a longitudinal or radial direction with respect to the center of the eye through a relatively small incision which is made in the eye along the outer periphery of the corneal-scleral junction. The apparatus is configured in such a way as to have strong, yet flexible support means which are used for positioning, and maintaining the position, of the apparatus once it has been inserted within the interior of the eye, and to further enable ease of manipulation, rotation and positioning of the apparatus after it has been inserted into the posterior chamber of the eye.

The intraocular lens apparatus includes a substantially circular transparent optical, light-focusing lens means which includes an anterior side, and an opposite posterior side, as well as a peripheral edge. The apparatus may or may not also include positioning means which are operably attached to the lens means, and which serve to enable facilitated manipulation of the intraocular lens apparatus once it has been inserted within the eye, thereby enabling proper positioning therewithin. Resilient support means are also a structural feature of the intraocular lens apparatus. These resilient support means are operably attached to the lens