

INTRAOCULAR LENS HAVING ANNULAR GROOVE FORMED IN ITS PERIPHERAL PORTION

This is a division of application Ser. No. 07/647,364 filed Jan. 29, 1991, now U.S. Pat. No. 5,171,320.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates in general to an artificial intraocular lens intended for implanting within the human eye, which lens is mounted on a capsular bag normally containing the natural crystalline lens of the eye, after removal of the crystalline lens from the capsular bag. More particularly, this invention is concerned with an intraocular lens that is secured in an opening in the anterior wall of the capsular bag that facilitated removal of the nucleus of the crystalline lens from the bag.

2. Discussion of the Prior Art

According to one of known methods for cataract surgery, an opening is provided in a capsule or capsular bag in which the crystalline lens of the normal eye is contained by surgically removing a portion of the anterior wall of the capsular bag so that the nucleus of the crystalline lens can be extracted through the opening from within the capsular bag. Subsequently, an artificial intraocular lens serving as a substitute for the crystalline lens is inserted through the opening into the capsular bag.

The above-described method is advantageous in that the intraocular lens within the capsular bag is prevented by the remaining portion of the anterior wall of the bag from moving forward, that is, moving toward the cornea. Where the partial removal of the capsular bag is effected according to a so-called CCC (continuous circular capsulorhexis) method, the opening provided in the bag has a circular shape having a high degree of peripheral continuity. In this case, an annular flap portion of the capsular bag which surrounds or defines the opening is unlikely to tear even with stress concentration taking place thereon, whereby the slipping-off or displacement of the intraocular lens due to the tearing of the annular flap portion of the bag is effectively avoided.

As a long period of time elapses after a portion of the capsular bag is surgically removed, however, the growth of ocular tissue or proliferation of epithelial cells develops at the annular flap portion of the bag surrounding the opening, whereby the opening is gradually closed by collagenous fibers produced during the proliferation, or due to adhesion of the annular flap portion of the bag to the intraocular lens. Consequently, the front surface of the intraocular lens inserted within the capsular bag is progressively covered by the collagenous fibers and/or the anterior wall of the bag which has been made opaque, causing problems such as distortion of an image focused by the lens and poor transparency of the intraocular lens eye. Further, since the intraocular lens is not secured in position within the capsular bag, the lens suffers from displacement or dislocation due to shrinking of the capsular bag.

In view of the above, there is proposed an intraocular lens system as disclosed in U.S. Pat. No. 4,342,123, which has a lens body, and at least one inter-acting pair of clips which are secured to the lens body so that a flap portion of the anterior wall of the capsular bag which

surrounds the opening is gripped by and between each pair of clips. Thus, the lens body of the intraocular lens system is fixedly held in position within the opening in the capsular bag. That is, the lens system can be secured in position in the opening such that the anterior portion of the lens is located outside the capsular bag, to thereby prevent the front surface of lens from being covered by the anterior wall of the capsular bag.

In the disclosed intraocular lens system, however, the annular flap portion of the anterior wall of the capsular bag surrounding the opening remains uncovered, permitting the proliferation of the cells at the flap portion of the bag. Due to this proliferation, the annular flap portion of the capsular bag expands or grows along the surface of the lens, and eventually covers an optical lens portion of the lens body. Consequently, the anterior or posterior surface of the lens becomes opaque, and the opening provided in the capsular bag is inevitably closed by the thus expanded flap portion of the bag, even though the anterior portion of the lens is located outside the bag as described above.

In the lens system disclosed in the U.S. patent identified above, there is a possibility that the iris of the eye as well as the flap portion of the capsular bag is gripped by and between the pair of clips, since the clips are made relatively large enough to provide a sufficient gripping force so as to hold the lens system in position. Further, since the intraocular lens system is held in position with the pair of clips engaging the flap portion, there has been the risk of dislocation or dropout of the intraocular lens when the gripping force of the clips is reduced with a lapse of time, or when a relatively large shock is applied to the lens, for example.

SUMMARY OF THE INVENTION

The present invention was developed in the light of the problems encountered in the prior art. It is accordingly an object of the invention to provide an intraocular lens system which can be securely held in position at the center of the eye, without subsequently closing an opening provided in the anterior wall of the capsular bag, and without causing subsequent displacement of the lens within the eye.

The above object may be attained according to the principle of the present invention, which provides an intraocular lens system adapted to be implanted within a generally circular opening in an anterior wall of the capsular bag which normally contains the crystalline lens of an eye, comprising a lens body having an annular groove which is formed in a peripheral portion thereof in a plane substantially perpendicular to an optical axis of the lens body, the lens body including an optical portion located radially inside the annular groove, and an anterior lens portion and a posterior lens portion located on respective anterior and posterior sides of the annular groove, the intraocular lens system being secured in position within the circular opening such that an annular flap portion of the capsular bag which surrounds or defines the circular opening is accommodated within the annular groove in the lens body.

In the intraocular lens system constructed as described above according to the present invention, the annular flap portion of the capsular bag defining or surrounding the circular opening is circumferentially entirely accommodated in the annular groove formed in the peripheral portion of the lens body. Accordingly, the periphery of the flap portion otherwise adjacent to the periphery of the intraocular lens body is placed