INTRAOCULAR IMPLANT METHODS

RELATED APPLICATION:

This application is a division of prior application Ser. No. 07/744,472, filed Aug. 12, 1991, now U. S. Pat. No. 5,326,347.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to intraocular correction of human vision disorders and more particularly to novel intraocular implants and methods for this purpose.

2. Prior Art

The human eye is commonly regarded as comprising an outer anterior transparent cornea, an iris behind the cornea which contains the pupil and forms with the cornea an intervening anterior chamber, a lens behind the iris which forms with the iris an intervening posterior chamber, and a retina at the rear of the eye on which entering light rays are focussed by the lens and which forms with the lens an intervening vitreous chamber containing vitreous. The natural lens of the eye comprises a transparent envelope, called a capsular bag, which contains a crystalline structure and is suspended by zonules from the surrounding ciliary body. The front and rear walls of the capsular bag are known as anterior and posterior capsules, respectively.

One of the eye abnormalities or disorders that seriously affects vision is a cataract which is a condition of the natural lens of the human eye characterized by progressive opacification of the lens. A cataractous eye condition is corrected or cured by surgical removal of the cataractous lens material through an incision in the cornea. In the early days, cataract surgery involved removal of the entire cataractous lens, i.e. both the inner lens structure and the outer capsulary bag. The artificial lenses used to replace the removed human lens were thick external "cataract lenses" worn as glasses.

Shortly after World War II, a British ophthalmic surgeon by the name of Harold Ridley implanted, for the first time, an artificial lens, referred to as an intraocular lens or lens implant, directly within a patient's eye to replace the surgically removed natural lens. Since that time, cataract surgical techniques and intraocular lens implants have progressed enormously. The great advantage of intraocular lens implants, of course, resides in the fact that they eliminate the need to wear thick cataract glasses which distort vision and are uncomfortable to wear because of their weight.

Many different cataract removal and intraocular lens implanting techniques and intraocular lens implant designs have been developed over the years since the first lens implant by Ridley. Two older cataract removal techniques may be categorized generally as intracapsular cataract extraction and extracapsular cataract extraction. In the intracapsular extraction technique, the entire natural lens, including the inner lens structure and outer capsulary bag, are removed. In the extracapsular technique, the inner lens structure is removed through an anterior opening in the capsular bag, created by either incising or removing the anterior capsule of the bag, and the posterior capsule of the bag is left intact.

A great variety of intraocular lens implants have been developed. Examples of the existing intraocular implants are disclosed in the following U.S. Pat. Nos.: 4,298,996; 4,435,856; 4,573,998; 4,673,406; 4,730,286; 4,753,655; 4,813,955; 4,994,082; 4,424,587; 4,738,680; 4,842,601; EP-162-573-A (European). The implants disclosed in U.S. Pat. Nos. 4,435,856; 4,573,998; 4,813,955; 4,994,082; EP-162-573-A are adjustable by gravity, magnets, inflation, ciliary muscle action, or otherwise for near and distant vision accommodation. The implants disclosed in U.S. Pat. Nos. 4,435,856; 4,573,998; 4,753,655; EP-162-573-A have multiple lens systems. The lenses in U.S. Pat. No. 4,573,998 are foldable to minimize the size of the corneal incision through which the lenses are inserted into the eye. U.S. Pat. Nos. 4,424,597, 4,738,680, and 4,842,601 disclose intraocular lenses which are implanted in a patient's eye following extracapsular extraction of the natural lens matrix and bear against the remaining natural posterior capsule in the eye. The lenses in some patents are bifocal lenses or are optically conditioned to focus less than 50% of the light from near objects and less than 50% of the light from far objects onto the retina simultaneously. Some light is lost. The brain has then to select which image it wishes to recognize, the near image or the far image.

Cataract surgery techniques and intraocular lens implants such as those described in the above patents give rise to certain complications. The major complications in this regard are opacification of the posterior capsule when extracapsular cataract extraction is utilized, intraocular lens decentration, cystoid macular edema, retinal detachment, and astigmatism. In the late 1980's an improved surgical technique referred to as continuous tear circular capsulotomy, more technically as capsulorhexis, was developed for use in cataract surgery applications. This improved technique reduces the complications associated with such surgery, particulary lens decentration.

Simply stated, capsulorhexis involves tearing a generally circular opening (capsulotomy) through the anterior capsule of the capsular bag. This opening or capsulotomy is bounded circumferentially by an annular remnant of the anterior capsule. This annular remnant of the anterior capsule provides a continuous annular rim about the capsulotomy which forms with the posterior capsule a capsular bag. During a cataract operation, the cataractous nucleus and cortex of the natural lens is removed from the capsular bag and an artificial lens implant is inserted into the bag through this capsulotomy. U.S. Pat. Nos. 4,409,691 and 4,842,601 disclose intraocular lenses implanted within a capsular bag. The capsular bag in U.S. Pat. No. 4,409,691 appears to have an anterior circular capsulotomy.

Up to the present time, capsulorhexis has been used with conventional lens implants having haptics or the like. A unique advantage of capsulorhexis resides in the fact that fibrosis during healing-tends to effectively "shrink wrap" the capsular bag about the lens implant in such a way as to firmly retain the implant in position postoperatively.

While capsulorhexis is effective to reduce or eliminate some of the cataract surgery complications referred to above, such as lens decentration, the existing intraocular lens implants used with this and other cataract surgery techniques have certain deficiencies which this invention alleviates or eliminates. Among the foremost of these deficiencies to which some or all of the prior implants are subject are the following. Prior intraocular lenses which are either designed for or are capable of implantation in a capsular bag with an anterior capsulorhexis do not preserve the natural shape and volume of the bag and hence do not preserve the natural vitreous volume of the eye. Wile some of these lens implants may reduce some postoperative opacification of the posterior capsule of the bag, they still permit at least some opacification which is undesirable and which, ideally, should be further reduced or eliminated.