INTRAOCULAR LENS IMPLANT HAVING EYE FOCUSING CAPABILITIES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an improved focusing intraocular lens which can be surgically implanted as a replacement for the natural crystalline lens in the eyes of cataract patients. More particularly, it is concerned with a strategically configured lens including an optic and one or more haptics constructed to position the lens within the capsule of the eye, the haptics continuously urging the optic against the anterior face of the capsule and thereby moving the lens during normal ciliary muscle movement incident to focusing.

2. Description of the Prior Art

Cataracts occur when the crystalline lens of the eye becomes opaque. The cataracts may be in both eyes and, being a progressive condition, may cause fading vision and eventual blindness. Cataracts were once surgically removed along with the anterior wall of the capsule of the eye. The patient then wore eyeglasses or contact lenses which restored vision but did not permit focusing and gave only limited depth perception.

The first implant of a replacement lens within the eye occurred in 1949 and attempted to locate the replacement lens in the posterior chamber of the eye behind the iris. Problems such as dislocation after implantation forced abandonment of this approach, and for some period thereafter intraocular lenses were implanted in the anterior chamber of the eye. Lenses implanted in the anterior chamber include those shown in U.S. Pat. Nos. 3,673,616, 3,906,551, 3,922,728, 3,925,825, 3,971,073, 3,975,779, 3,979,780, 3,986,214, 3,996,627, 4,010,496, 4,056,555, 4,073,015, 4,077,071, 4,079,470, 4,087,866, 4,254,509, and 4,370,760.

Others returned to the practice of inserting the lens in the area of the eye posterior of the iris, known as the posterior chamber. This is the area where the patient's natural crystalline lens is located. When the intraocular lens is located in this natural location, substantially normal vision may be restored to the patient and the problems of forward displacement of vitreous humor and retina detachment encountered in anterior chamber intraocular lenses are less likely to occur. Lenses implanted in the posterior chamber include those shown in U.S. Pat. Nos. 3,718,870, 3,866,249, 3,913,148, 3,925,825, 4,014,049, 4,041,552, 4,053,953, and 4,285,072. None of these lenses had focusing capability.

Lenses capable of focusing offer the wearer the closest possible substitute to the crystalline lens. U.S. Pat. No. 4,254,509 to Tennant discloses a lens which moves in an anterior direction upon contraction of the ciliary body and which is located anterior to the iris. Though providing focusing capabilities, it presents the same disadvantages as other anterior chamber lenses. U.S. Pat. No. 4,253,199 to Banko approaches the problem of providing a focusable lens differently, by providing a replacement lens of deformable material sutured to the ciliary body. This lens functions much as the original crystalline lens but risks bleeding from the sutures and requires, as do the prior references, removal of the anterior wall of the capsule.

U.S. Pat. No. 4,409,691 to Levy is asserted to provide a focusable intraocular lens positioned within the capsule. This lens is located in the posterior area of the capsule and is biased toward the fovea or rear of the eye.

It is believed the Levy lens is deficient because it requires the ciliary muscle to exert force through the zonules on the capsule to compress the haptics inward driving the optic forward for near vision. However, the ciliary muscles do not exert any force during contraction because the zonules, being flexible filaments, exert only tension, not compression on the capsule. The natural elasticity of the lens causes the capsule to become more spherical upon contraction of the ciliary muscle. Thus there is no inward force exerted on the capsule to compress the haptics of the Levy lens, and therefore accommodate for near vision. Even if such force were somehow available, the Levy lens' haptics are loaded inward when accommodating for near vision. Since accomodation for near vision is the normal status of the capsule, the Levy lens' haptics are normally loaded, reducing the fatigue life of the springlike haptics.

SUMMARY OF THE INVENTION

The present invention provides a superior focusable intraocular lens which is designed for positioning within the capsule and includes specialized structure for biasing of the optic portion of the intraocular lens against the anterior wall of the capsule. Such continuous contact against the anterior wall of capsule not only provides additional support for the lens but serves, in co-operation with the natural movement of the anterior capsule wall incident to ciliary muscle movement, for focusing the lens.

In preferred forms, the intraocular lens in accordance with the present invention includes an optic presenting a convex anterior face and a posterior face with a haptic or series of haptics extending from posterior surface or side marginal edge of the optic. The optic and each haptic is constructed of biologically inert material to prevent absorption by the body of the patient. The haptics are advantageously of thin, flexible, arcuate configuration and are connected to the posterior surface or side marginal edge of the optic and extend therefrom both radially and rearwardly to contact the portion of the capsule adjacent the zonular fibers. The haptic or haptics thus center the optic in the eye behind the pupil and hold the optic against tha anterior wall of the capsule. This haptic structure enables the optic to move forward as the ciliary muscles contract to focus on objects which are relatively near the eye, and, conversely, to move rearwardly as the ciliary muscles retract to focus on objects at a greater distance.

Alternate embodiments of the lens provide different configurations and placement of the haptics. The number of haptics may increase to two or three to provide additional support within the capsule. A U- or S-shaped bend may be formed in the haptics to enhance their biasing capability. Finally, the haptics may extend from the side of the optic rather than depend from the posterior face.

Alternatively, a continuous skirt may replace the haptics as a positioning and biasing means. The skirt may surround the lens and extend to a capsule-engaging biasing flange to contact the capsule opposite the zonular fibers. The skirt margin engages the capsule wall adjacent the zonular fibers. The flange extends posteriorly from the skirt margin and engages the posterior capsule wall adjacent the zonular region.