INTRAOCULAR LENS IMPLANT HAVING EYE ACCOMMODATING CAPABILITIES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to accommodating intraocular lenses which can be surgically implanted as a replacement for the natural crystalline lens in the eyes of cataract patients.

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 accommodation 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.

Others returned to the practice of inserting the lens in the area of the eye posterior to 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 are disclosed 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 have focusing capability.

Lenses capable of focusing offered 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.

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. The '691 lens is deficient because it requires the ciliary muscle to exert force through the zonules on the capsule in order to compress the haptics inward and drive 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 accommodation for near vision is the normal status of the capsule, the Levy lens' haptics are loaded, reducing the fatigue life of the springlike haptics.

U.S. Pat. No. 5,674,282 to Cumming is directed towards an accommodating intraocular lens for implanting within the capsule of an eye. The Cumming lens comprises a central optic and two plate haptics which extend radially outward from diametrically opposite sides of the optic and are movable anteriorly and posteriorly relative to the optic. However, the Cumming lens suffers from the same shortcomings as the Levy lens in that the haptics are biased anteriorly by pressure from the ciliary bodies. This will eventually lead to pressure necrosis of the ciliary body.

Finally, U.S. Pat. No. 4,842,601 to Smith discloses an accommodating intraocular lens having anterior and posterior members which urge against the anterior and posterior walls of the natural lens capsule. The muscular action exerted on the natural capsule will thus cause the lens to flatten, thereby changing the focus thereof. The Smith lens is formed of first and second plastic lens members connected to one another adjacent their peripheral edges so as to provide a cavity therebetween. The connection between the lens members is accomplished by way of a U-shaped flange on the first member which forms an inwardly facing groove for receiving an outwardly extended flange on the second member. The Smith lens is lacking in that the first and second members must be separately inserted into the capsule and assembled within the capsule which is extremely difficult for even highly skilled surgeons to accomplish.

There is a need for an intraocular lens implant capable of focusing in a manner similar to the natural lens. This lens implant should be readily insertable into the capsule and should last for a substantial number of years without damaging any of the eye components.

OBJECTS AND SUMMARY OF THE INVENTION

The present invention fills this need by providing an intraocular lens with focusing capabilities which is safe for long-term use in an eye.

In more detail, the lens of the invention comprises an optic presenting a convex anterior surface and a resilient optic positioning element or body coupled to the optic to cooperatively present a discoid shaped lens that generally conforms to the shape of the natural eye capsule. The optic positioning element presents a posterior face that engages the posterior wall of the natural capsule, and an anterior face that engages the anterior wall of the natural capsule. The anterior and posterior faces of the optic positioning element are joined together by a bight.

As a result of the size and shape of the inventive lens, the focusing action of the natural lens is simulated. That is, the ciliary body of the eye (which remain connected to the capsule) continues to exert a muscular force radially outward from the center of the capsule through the zonular fibers so as to flatten the capsule. Because the posterior and anterior walls of the capsule are engaging the anterior and posterior faces of the optic positioning element, the inventive lens flattens in a manner similar to the natural capsule. This flattening alters the distance between the optic of the inventive lens and the fovea of the eye, thus allowing distant objects to be viewed.

The optic and optic positioning element can be formed of any biologically inert material conventionally used in intraocular lens construction, (e.g., yieldable synthetic resin