MAGNETIC RETENTION SYSTEM FOR INTRAOCULAR LENS

The present invention relates to intraocular lenses (IOL) for the human eye and more particularly relates to magnetic retention means for securing an IOL in position in the human eye.

The replacement of the crystalline lens portion of the human eye with an artificial intraocular lens implant (IOL) has become an established procedure in the ophthalmolic field. The procedure usually involves a corneo-scleral incision through which the natural crystalline lens is removed and an artificial lens inserted. The inserted lens can be secured in position in either the anterior chamber or the posterior chamber of the eye in accordance with various techniques developed. Intraocular lenses are of various designs and materials and are generally constructed from inert materials such as an optically clear plastic polymeric materials, such as polymethylmethacralate (PMMA), cellulose acetate buterate (CAB) or glass. The lenses have various powers and may be bi-convex, plano-convex or concavo-convex.

Various iris clips and irido-capsular lenses have been developed for securement of these lenses. For example, the lens known as the Binkhorst iris clip lens comprises a plastic lens having four loops which are sutured to the iris. Such suturing is sometimes undesirable in that the sutures may require special surgical techniques and, in some cases, may be torn loose. Lenses of this type may also become dislocated if the eye of the patient is dialated.

Other types of lenses have been developed utilizing only two loops, but such lenses require extracapsular extraction techniques requiring locking of the intraocular lens within the capsule of the crystalline lens.

Other lens mounting arrangements can be found in the prior art. For example, U.S. Pat. No. 4,127,903 to Schachar discloses an IOL with a loop and pin arrangement. Utilizing the loops and pins, the lens may be implanted in a human eye with the pins disposed generally horizontally through apertures in the mid-region of the iris.

U.S. Pat. No. 4,174,543 issued to Kelman shows an intraocular with multiple point position fixation having positioning elements that provide lens stability with respect to the pupil.

Another solution to the problem is found in U.S. Pat. No. 4,124,905, which describes an artificial intraocular lens having posterior and anterior tabs adapted to receive and hold a pin substantially perpendicular thereinbetween. One of the pins is anchored into the lens so that during the surgical implantation the pin cannot be lost.

While the foregoing developments provide certain advantages, a need exists in the art for a system of securing an IOL in position which is effective, stable and which minimizes trauma.

It is an object of the present invention to provide an intraocular lens having a support structure which minimizes the surgical procedure involved in the implantation.

Further, it is an object of the present invention to provide an intraocular lens system which avoids the necessity of a surgical incision through the iris and securing the intraocular lens to the iris with sutures, clips, or pins and which allows the surgeon flexibility in positioning the lens during the procedure.

Further, it is an object of the invention to provide a retention system which adequately secures the lens in place without dislocation particularly during the important initial period immediately after surgery as well as later.

Briefly, the above objects are achieved by the lens of the present invention which includes a medial light focusing lens body with one or more support elements attached to the lens body and extending outward from the lens to an area corresponding to the iris. A first magnetic fixation member is carried on the support member so the fixation member is carried on the support member so the fixation member is positionable at either the anterior or posterior side of the iris. A second magnetic fixation member is positionable opposite the first fixation member on the opposite side of the iris. At least one of the fixation members has magnetic characteristics so a trans-iris magnetic attraction exists therebetween to secure the lens in place.

Other objects and features of the present invention will become more apparent from the following description, claims and drawings in which:

FIG. **1** is a vertical cross-section of an eyeball illustrating a lens according to the present invention implanted therein;

FIG. **2** is a perspective view illustrating an embodiment of the present invention;

FIG. **3** is a perspective view illustrating another embodiment of the present invention;

FIG. **4** is a perspective view illustrating still another embodiment of the present invention;

FIG. **5** is a sectional view taken along lines **5—5** of FIG. **3**;

FIG. **6** is a sectional view taken along lines **6—6** of FIG. **4**;

FIG. **7** is a perspective view illustrating still another embodiment of the present invention;

FIG. **8** is a perspective view illustrating another embodiment of the present invention;

FIG. **9** is a sectional view taken along lines **9—9** of FIG. **8**;

FIG. **10** is a perspective view of another embodiment of the present invention utilizing electromagnetic means;

FIG. **11** is a sectional view taken along lines **11—11** of FIG. **10**;

FIG. **12** is a perspective view illustrating yet another embodiment of the present invention; and

FIG. **13** is a partial perspective view showing still another aspect of the present invention.

Referring now to the drawings and the various figures therein, particularly FIGS. **1** and **2**, reference numeral **10** generally designates an eyeball, portions of which are described herein to facilitate an understanding of the present invention.

Eyeball **10** has a cornea **12** which is part of the external portion of the eyeball. A membrane, not shown, contains cavity **14** and a retina. The natural lens generally occupies a location between the membrane and the iris **16** and is not shown since in implant procedures, this portion of the eye structure is surgically removed prior to implantation of an artificial lens. The artificial lens is generally designated by the numeral **20** and is shown secured to the iris **16**, as will be more fully described hereafter. An aqueous zone, between the cornea and the membrane, is divided by the iris into an anterior cham-