INTRAOCULAR SILICONE LENS

This is a continuation-in-part of Ser. No. 08/308,606 filed Sep. 19, 1994, with the United States Patent and Trademark Office, now abandoned.

FIELD OF THE INVENTION

The present invention relates generally to intraocular lenses, and more particularly, to an intraocular lens made from silicone that may be inserted into the iris of the eye or into an opening formed in the capsular bag.

BACKGROUND OF THE INVENTION

An intraocular lens is an artificial lens that is implanted into the eye of a patient to correct various problems associated with the patient's vision. For example, an intraocular lens may be implanted into the eye to correct high myopia, or nearsightedness, thereby alleviating the need for glasses or contact lenses. In another application, an intraocular lens may be inserted into the eye following removal of a cataract, which typically destroys the entire natural lens of the patient. Although existing intraocular lenses may be used in these applications, they suffer from many drawbacks.

Specifically, current intraocular lenses made from polymers cannot be fixated to the iris of eye, which cannot tolerate the stresses and strains caused by the weight of the lens. Further, current intraocular lenses fixated in the anterior chamber, which are used to correct myopia, touch the angle between the cornea and the iris, and may damage the cornea during use. Additionally, prior attempts to fixate an intraocular lens in the capsular bag have used a cross-like structure that depends upon the iris holding the lens in position. This type of lens also creates the possibility of damage to the iris during use of the lens.

Additionally, most existing intraocular lenses to be used after the removal of a cataract rely upon placement of the intraocular lens inside of the capsular bag. Typically they are fixated by outwardly extending spring-like members that embed into the walls of the capsular bag. However, during removal of a cataract, the capsular bag may be destroyed, thereby rendering unusable intraocular lenses that are designed for placement in the capsular bag.

Accordingly, there is a substantial need for an intraocular lens that may be used either in conjunction with the iris or the capsular bag, and which does not cause damage to the structures of the eye.

SUMMARY OF THE INVENTION

The present invention provides an intraocular lens adapted to receive either the periphery of the iris or an opening formed in the capsular bag which overcomes the drawbacks associated with existing intraocular lenses. More specifically, and in accordance with the present invention, an intraocular lens is provided that includes an integral annular ring having an outer upper flange, an outer lower flange, and an inner wall interconnecting the flanges wherein the flanges are spaced to receive therebetween the periphery of the iris or an opening in the capsular bag independent of additional support means, and a substantially circular lens whose perimeter is integrally formed with the inner wall of the annular ring such that the annular ring and circular lens are a single, unitary structure. The annular ring and lens are preferably flexible and may be manufactured from silicone. The intraocular lens may include fixation members where the lens is to receive the periphery of the iris. The lens may

be a thin membrane having a plurality of concentric circular grooves therein, for using a plurality of concentrive annular prisms. Still further, a separate reinforcement ring may be attached to the annular ring to reduce the collapsibility of the intraocular lens. This reinforcement ring may be located along the lower flange of the annular ring, and preferably is manufactured from teflon, polymethymethacrylate, or a metal. Further, where the lens is a thin membrane, the reinforcement ring serves to maintain the lens in a planar orientation in use.

The radial dimension of the upper and lower flanges may be sized to accommodate the expansion and contraction of the iris of the eye. Further, the annular ring may have an outer diameter from about 3 millimeters to about 10 millimeters, and preferably having an outer diameter from about 5 millimeters to about 6 millimeters. Still further, the lens may have a diameter from about 2 millimeters to about 7 millimeters, and, more preferably, a diameter from about 3 millimeters to about 5 millimeters. If the lens is a thin membrane, Fresnel lens, the lens may have a diameter of from about 14 millimeters to about 15 millimeters.

To permit the free passage of intraocular fluid through the annular ring, a plurality of channels may be formed therein and extending therethrough.

The perimeter of the lens may be integrally formed with the inner wall of the annular ring by a plurality of circumferentially spaced apart tabs between the perimeter of the lens and the inner wall, wherein the tabs also form a plurality of openings therebetween that permit the free passage of intraocular fluid through the intraocular lens. Alternatively, the perimeter of the lens may be integrally formed along its entire length with the inner wall of the annular ring.

Depending upon the application, the flanges of the annular ring may have differing radial dimensions. Specifically, the lower flange may have a larger radial dimension than the upper flange, or the

upper flange may have a larger radial dimension than the lower flange.

Alternatively, and in accordance with a further aspect of the present invention, an intraocular lens is provided that includes a substantially circular lens having a U-shaped annular channel extending inwardly along the perimeter thereof, wherein the channel is adapted to receive the periphery of the iris of an eye or an opening in the capsular bag independent of additional support means. Preferably, the lens is manufactured from a flexible polymer, such as silicone. The lens may also be a thin-membrane having a plurality of circular grooves therein, each forming a prismatic lens. Additionally, the lens may further include a separate reinforcing ring attached to the lens to reduce the collapsibility thereof. The intraocular lens may include fixation members where the lens is to receive the periphery of the iris.

The intraocular lens of the present invention may be used in several procedures. First, the intraocular lens may be used in repairing the vision of an eye that is blocked by a cataract. In use, an opening is made in the capsular bag of an eye. The cataract is extracted, and the intraocular lens adapted to engage the periphery of an opening in the capsular bag for support thereof is inserted into the capsular bag. Finally, the periphery of the opening in the capsular bag is engaged by the intraocular lens. The opening in the capsular bag to which the intraocular lens is fixated may be made in either the anterior capsule or the posterior capsule. Further, the cataract may be extracted by extracapsular cataract phacoemulsification of the lens followed by aspiration of the lens fragments.