

INTRAOCCULAR LENS WITH HAPTIC ANCHOR PLATE

BACKGROUND OF THE INVENTION

Surgical removal of the opaque lens from the eyes of cataract patients is one of the most common surgical procedures. In the past, contact lenses or spectacles were usually prescribed for the patient to provide at least limited vision following the operation. However, there were many drawbacks to the use of contact lenses and spectacles for such purposes. The present-day practice involves the implantation of an artificial intraocular lens to replace the removed opaque human lens as a preferred procedure to restore the patient's sight. The first intraocular lens was inserted in 1949 by Harold Ridley in England.

The eye is divided by the iris into an anterior chamber in front of the iris and a posterior chamber behind the iris and in front of the human lens. The intraocular lens can be placed either in the anterior chamber or the posterior chamber. Placement in the posterior chamber is preferred because the lens can simply be positioned by the use of centering haptic loops or the like extending from the lens body. Such an intraocular lens is described, for example, in U.S. Pat. No. 4,634,441 Clayman et al.

Until recent years intraocular lenses have been constructed of hard material, such as glass or plastic. Typically the lens body of the prior art intraocular lens is formed of polymethylmethacrylate (PMMA) and the haptics have been formed of polypropylene (PROLENE). However, PMMA is a hard material and the lenses made from this material usually have a diameter of between 6 and 7 mm. This requires an incision of 7-8 mm in order to insert the lens into the eye. Accordingly, proposals have been made in the past to form the intraocular lens of a soft flexible material such as silicone or hydrophilic polymer which can be folded.

Moreover, those skilled in the art of cataract extraction have long recognized the need to develop a foldable or compressible lens that will pass through a small incision of 4 mm or less. The advantages of a small incision include reduced complications, more rapid visual and physical rehabilitation, and reduced costs. A method for implanting a deformable intraocular lens into the eye is described, for example, in U.S. Pat. No. 4,573,998. Deformable intraocular lenses made primarily of HEMA (hydroxyethylmethacrylate) and silicone have been developed that will pass through incisions of 4 mm or less.

However, difficulties have been encountered in the design of soft deformable intraocular lenses, and such problems have consisted mainly in staking the haptic onto the soft, optical zone of the intraocular lens. The PROLENE haptic, when anchored onto the optical zone necessitates thickening the edge of the optical zone in order to accommodate the staked end of haptic. This reduces the useful optical zone of the lens down to 4.5 mm when it should be 6 mm. In addition, it is proven difficult to attach the haptic to the optical zone of the soft deformable intraocular lens, since it is essential that the haptic has a constant angular relationship with the optical zone. For that reason, the rejection rate in manufacturing of present-day soft intraocular lenses is high and, therefore, the cost of acceptable soft deformable intraocular lenses is also high.

It is well known that some of the prior art intraocular lenses are misplaced during insertion so that one or both of the haptic loops are inadvertently inserted into the sulcus. The sulcus is longer than the capsular bag into which the lens was intended to be placed, and thus the prior art intraocular lens must have haptic loops long enough to fix the intraocular lens into the sulcus should it be misplaced. Otherwise, the misplaced lens could be decented within the eye.

It is known to attach the haptic loops to the optical region of an intraocular lens. Such a construction is disclosed, for example, in U.S. Pat. Nos. 4,834,751 and 4,790,846. However, the present invention provides a soft deformable intraocular lens having a rigid haptic anchor plate attached to the opposite ends of the optical region of the lens.

The haptic anchor plate is designed so that there is no loss of the optical zone. The anchor plate provides a base into which relatively short looped haptics formed, for example, or PROLENE or polyamide, can be staked, allowing for a large staking area of adequate thickness, without affecting the dimensions of the optical zone itself. Moreover, the haptic anchor plate makes decentration of the intraocular lens impossible when the lens is placed in the capsular bag, because the anchor plates are rigid enough to resist deformation when capsule fibrosis occurs and because the length of the lens is at least as long as the diameter of the capsular bag.

In the construction of the intraocular lens of the invention, with a flexible material the provision of the semi-rigid haptic anchor plate and the relatively short haptic arcuate resilient members or loops attached to the anchor plate provide a construction which enables the intraocular lens to be compressed for insertion through a small incision without damage to the haptic loops. This is an important feature, because it has been found that attempts to compress soft intraocular lenses having relatively long haptic loops attached to the optical region is difficult and frequently causes damage to the lens. In addition, the possibility of decentration after insertion of the lens is reduced because the semi-rigid haptic anchor plate resists folding or compression by the fibrosis of the human capsular bag, unlike the long PROLENE haptics of conventional intraocular lenses.

In the embodiment of the invention to be described, grooves are formed at the end edges of the rigid haptic anchor plate which receive the haptic loops when the intraocular lens is correctly placed in the capsular bag. During such placement, the ends of the haptic anchor plate containing the haptic loops engage the margins of the capsular bag holding the intraocular lens correctly centered and in place. However, if the intraocular lens is misplaced into the sulcus, the haptic loops will spring outwardly and extend beyond the ends of the anchor plate and press against the sulcus and stabilize the intraocular lens within the eye of the recipient. Accordingly, complications are prevented should the intraocular lens be misplaced within the eye, which studies have revealed to happen approximately 50% of the time.

The intraocular lens of the invention can be folded and compressed through a 3-4 mm phacoemulsification incision, or it can be used in the routine planned extracapsular cataract extraction with a large 15 mm incision. Decentration of the intraocular lens of the invention is virtually eliminated when the lens is placed in the capsular bag, as mentioned above, due to the haptic anchor plate, this plate being used not only to provide a base for affixing the haptic loops to the lens, but also for