INTRAOCULAR LENSES

BACKGROUND OF THE INVENTION

This invention relates to improved intraocular lenses. In another aspect, the invention relates to an improved method for restoring or improving vision in humans by the implantation of intraocular lenses.

When the natural lens of an eye is removed, a condition known as an aphakic condition results. Such a condition is caused by the intracapsular or extracapsular lens extraction of the natural lens of the eye. As a result, the eye does not have the ability to focus on rays of light. Therefore, the eye receives a blurred image and vision is severely impaired.

Throughout the past several years, many different methods and apparatus have been suggested to correct aphakic conditions. For example, contact lenses, spectacles or a combination thereof have been utilized. Such methods and apparatus have only met with limited success because such solutions to the problem pose many problems. For example, spectacles that are used to correct aphakic conditions have been found to remarkably increase the size of familiar articles. Therefore, it may take many weeks for a patient to adjust to the condition of wearing spectacles. Additionally, the wearer of such spectacles experiences problems of straight lines of the outside world being transformed into curves. Additionally, when the wearer moves his or her eyes, the curves seem to squirm which requires the wearer to hold the eye still and look only through the optical center of such spectacles.

While contact lenses may be superior to the aforementioned spectacles, there are still many problems connected with the wearing of contact lenses to correct aphakic conditions. For example, such contact lenses are very small and fragile and it is difficult to insert and remove them daily. It is also well known that such contact lenses cannot be worn for prolonged periods of time.

In view of the foregoing shortcomings connected with spectacles and contact lenses to correct aphakic conditions, there has been an increasing amount of interest in the use of intraocular lenses that are suitable for use as artificial lens implants to correct aphakic conditions. While the first suggestion of implanting artificial lenses within the eye to obviate the condition of aphakia was probably made by Tardini in 1764, the first actual lens implant was not carried out until 1949 when Dr. Harold Ridley implanted a rather crude intraocular lens. Ridley's first work was centered around the implantation of an intraocular lens in the posterior chamber of the eye behind the iris. This early work of implantation of an intraocular lens in the posterior chamber was abandoned by Ridley because of instances of dislocation after implantation and because of failures associated with glaucoma.

Soon after Ridley's work of limited success with posterior chamber artificial lenses, several others, such as D. P. Choyce, began work with the implantation of intraocular lenses in the anterior chamber of the eye, between the iris and the cornea. The early work in anterior chamber intraocular lenses also met with limited success, mostly because of problems connected with irritation of the eye by the supporting feet or the supporting structure of the intraocular lenses.

Soon after the early work by Ridley and Choyce, surgical techniques for lens implantation were improved by such workers as Drs. C. D. Binkhorst and J. G. F. Worst. The work performed by Binkhorst and Worst developed intraocular lenses that utilized an iris-clip lens and an iridocapsular lens. Both of these types of lens comprise a lens of a larger diameter than the pupil and are placed so that the periphery of the lens engages the front of the iris. The iris-clip lens is held in place by loops which flank the iris and support the lens in front of the pupil. In some instances, the iris is sutured to the clip to secure the positioning of the lens. The iridocapsular lens had two or three loops which protrude from the back of the lens and extend posteriorly behind the iris and engage the capsula of the crystal lens that is left inside the eye after the extracapsular cataract extraction. Both of these early types of intraocular lens met with only limited success because they interferred with the constriction of the pupil and fixed the size of the pupil.

Various other types of intraocular lenses have been suggested and used with varying degrees of success. Such other types of lenses are described in and 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; 4,056,855, 4,073,015; 4,077,071; 4,079,470; 4,087,866; 4,092,743; 4,174,543; 4,285,072; 4,014,049; 4,053,953; 3,866,249; 4,041,552; 3,913,148 and various technical articles appearing in technical journals and the like.

As a result of the evolution of intraocular lenses, medical science now has progressed to a point where intraocular lenses are used in increasing numbers to correct aphakia. Some of the more widely used and more successful intraocular lenses utilize a design and construction that generally include a light focusing lens body known as an optic that is provided with a support structure known as a haptic. The optic functions to refract light waves in the desired amount to correct the vision of the user. The haptic functions as the fixational element to support and position the intraocular lens apparatus within the eye. In some instances the haptic may be fixed to the natural regions of the eye to align and stabilize the intraocular lens within the eye. All such prior art intraocular lenses are based on the premise that the geometric center axis of the cornea is the desired position for the optical axis of the intraocular lens implant. Therefore, elaborate schemes and structural designs have been devised whereby the intraocular lens can be precisely positioned whereby the optical axis of the lens is positioned precisely at the geometric center of the cornea.

It has now been discovered that the geometric center of the cornea is not the desired or preferred optical axis of the eye. With that discovery, an improved method for correcting vision in humans by the implantation of intraocular lens and improved lens structure has been invented whereby the optical axis of the intraocular lens can be accurately and consistently positioned in the optimum location to restore vision in the human eye when the natural lens of the eye has been removed.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide an improved method for the implantation of intraocular lenses to improve and restore normal vision to the human eye when the natural lens of the eye has been removed. It is also an object of this invention to provide an improved intraocular lens that is suitable for implan-