INTRAOCULAR LENS WITH CONVERGING AND DIVERGING OPTICAL PORTIONS

FIELD OF THE INVENTION

This invention relates to intraocular lenses to be implanted in the eye upon removal of the natural lens for treatment of macular degeneration of the eye. The intraocular lens includes a converging lens that provides the patient with substantially the same vision he or she had prior to implantation of the intraocular lens, i.e., the decreased visual acuity normally associated with macular degeneration but with unmagnified vision and unrestricted field of vision. The intraocular lens also includes a diverging lens, which when combined with an external converging lens located outside and adjacent the eye, increases, i.e., magnifies, the retinal image size of a given object and improves visual acuity but provides a restricted field of vision. Thus, the invention provides the patient with the choice of unmagnified but peripherally unrestricted vision or magnified but peripherally restricted vision.

BACKGROUND OF THE INVENTION

A disease of the eye known as macular degeneration has become one of the leading causes of blindness in adults. This disease affects the central retinal area known as the macula which affords acute vision and receives light focused by the cornea and lens. This disease can lead to a gradual or sudden loss of vision to the level of 20/200 or less. Commonly, loss of vision only affects the central retinal area of about 0.25 to 4 square millimeters and does not usually progress beyond this area, thereby leaving 95–99% of the retina unaffected. Thus, reading and driving vision can be lost but peripheral vision remains intact.

Most cases of macular degeneration are untreatable, although laser photocoagulation has been some benefit in certain instances. Telescopic systems that attach to eye glasses also have been used for many years to improve vision in patients with macular degeneration. These systems, which work by increasing the retinal image size of a given object, however, have not been very successful because they restrict the visual field to about 11° so that normal activity is not possible. They are also large and bulky. Attempts have been made to increase the visual field by putting part of the telescope within the eye. A Galliean telescope is useful for this purpose and consists of a high converging objective lens and a high diverging ocular lens, which together produce a telescopic effect.

Recent publications by Charles Koester disclose that a high diverging lens can be implanted inside the eye and then high converging glasses are worn to provide a telescope having a significantly improved visual field of about 37°. A similar system was earlier described by Peter Choyce, who implanted a high diverging anterior chamber lens and used high converging spectacle glasses to create telescope in patients.

While the system described by both Koester and Choyce is an improvement over the prior spectacle-attached telescopes, it nevertheless has one inherent and severe drawback. The high minus intraocular lens implanted in the patient's eye is incapable of providing a focused retinal image by itself. It can only provide a focused retinal image when combined with an external converging spectacle lens, and then, the only image possible is a magnified image of reduced visual field. The adjustment to such permanent magnification and reduced visual field is very difficult for patients since objects seem larger and thus appear closer and peripheral vision is severly restricted. Magnification may be fine for reading and other close work which use direct vision, but it is very burdensome for activities such as walking, shopping, etc., which can be comfortably carried out even with macular degeneration. Likewise, permanent reduction in peripheral vision restricts a person's activities.

Thus, there is a need for an ocular device which allows a patient to choose between magnified vision with decreased visual field, or the less acute vision normally associated with macular degeneration with unrestricted peripheral vision.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide an ocular device that will allow a patient to control his or her vision by choosing either magnified vision with decreased visual field or the vision normally associated with macular degeneration with unrestricted peripheral vision.

Another object of the invention is to provide an ocular device that allows a person with macular degeneration to switch from magnified more acute vision to unmagnified and unrestricted peripheral vision by merely removing spectacles.

The foregoing objects are basically accomplished by an intraocular lens adapted to be implanted in the eye, and used with an external converging spectacle lens to provide a magnified retinal image of a given object comprising an optical element having a first portion and a second portion, the first portion including a diverging lens, and the second portion including a converging lens; and means, coupled to the optical element, for supporting the optical element in the eye, wherein use of the intraocular lens in combination with the converging spectacle lens will provide a magnified retinal image of a given object while use of said intraocular lens without the converging spectacle lens will provide unmagnified and unrestricted peripheral vision.

Other objects, advantages and salient features of the present invention will become apparent from the following detailed description, which, taken in conjunction with the annexed drawings discloses a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings which form a part of this original disclosure:

FIG. **1** is a side elevational view in longitudinal section of a schematic representation of a human eye including a natural lens;

FIG. **2** is a side elevational view in longitudinal section similar to that shown in FIG. **1** except that the natural lens has been removed and an intraocular lens in accordance with the present invention has been implanted;

FIG. **3** is a side elevational view in longitudinal section similar to that shown in FIG. **2** except that converging lens means have been positioned outside the eye in accordance with the present invention;

FIG. **4** is a front elevational view of the intraocular lens shown in FIGS. **2** and **3**;

FIG. **5** is a right side elevational view in longitudinal section of the intraocular lens shown in FIGS. **2–4**;