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**PLACEMENT OF SECOND ARTIFICIAL
LENS IN EYE, TO CORRECT FOR OPTICAL
DEFECTS OF FIRST ARTIFICIAL LENS IN
EYE**

BACKGROUND OF THE INVENTION

This invention relates generally to improving vision in an eye containing an artificial lens, and more particularly concerns providing a second artificial lens in the eye having optical characteristics cooperating with those of the first lens to produce good vision.

When an artificial lens is implanted in the capsule of the eye, it sometimes happens that vision is not improved to the degree as was expected, due to characteristics of the implant. Such lens implant usually follows a cataract extraction procedure. For example, the lens implant may be aphakic. There can be a strong demand for sufficient correction of these refractive errors, so strong that patients want the erroneous lens implants to be extracted, which can be very dangerous.

There is need for a simple procedure which will correct this undesired condition, and will result in good vision, without involving extraction of the errant first lens implant.

SUMMARY OF THE INVENTION

It is a major object of the invention to provide a procedure or method, as well as a means, for meeting the above need.

Basically, the method of the invention involves the steps:

- a) providing a second artificial lens to have opposed surfaces,
- b) and inserting the second lens into the eye posterior chamber between the iris and the lens capsule so that one of the opposed surfaces faces toward the first lens,
- c) the second lens characterized as correcting for optical defects associated with the first lens.

As will be seen, one surface of the second inserted lens is typically positioned to be concave toward the first lens, and the second lens is inserted into the eye to extend proximate the first lens and intermediate the cornea and the first lens.

Another object is to employ a secondary lens implant whose posterior surface conforms to the anterior surface of an initially inserted aphakic lens implant. The secondary lens implant also has a corrective dioptric power necessary to achieve a desired refractive value for refractive errors of myopia, hyperopia, and astigmatism and even for anisometropia, and mechanical ability to correct for excess mydriasis.

A secondary benefit, so desirable for elderly seniors and aphakicly lens implanted patients, is that of achieving significant improvement in accommodation that does not exist in up to 99% of these patients.

A further object is to provide strand-like haptics attached to the second lens and characterized by one of the following:

- i) the haptics project substantially parallel to the iris,
- ii) the haptics have root ends projecting from edges of said second lens, in the posterior chamber,
- iii) the haptics extend substantially perpendicular to haptics attached to the first lens.

Yet another object of the method is to first insert the secondary lens into the anterior chamber of the eye, and maneuvering the second lens through the eye pupil area into the posterior chamber, wherein it may also be rotated. As will be seen, the second lens may for example consist of a soft, compliant lens.

A further object is to provide a method wherein one the two lenses has haptics variably constrained by eye muscle

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induced movement, to variably displace the one lens, axially, and relative to the other of the two lenses.

These and other objects and advantages of the invention, as well as the details of an illustrative embodiment, will be more fully understood from the following specification and drawings, in which:

DRAWING DESCRIPTION

FIG. 1 is a view taken in section through the eye;

FIG. 2 is a view taken along the optical axis to show the relative positions of the two lenses and their haptics;

FIG. 3 is a plan view of an alternative lens;

FIG. 4 is a plan view of yet another modified lens; and

FIG. 5 is a plan view of a further modification.

DETAILED DESCRIPTION

Referring first to FIG. 1, the natural lens capsule, from which the natural lens material has been removed, is indicated generally at 10. It is attached at 11a to ciliary muscles 11. A frontal opening 12a is cut or formed in the front wall 12 of the capsule to allow insertion or implanting of a first artificial lens 13. Haptics 14 and 15 of lens 13 extend to the inner surface of the capsule peripheral wall 16, as shown, to centrally position the lens. See also FIG. 2 showing legs 14a and 15a of such haptics.

Also shown in FIG. 1 is a second artificial lens 20 having opposed surfaces 20e and 20f. Surface 20e is preferably concave toward the first artificial lens 13, and is inserted in the eye so that surface 20e extends proximate the convex surface 13a of the first lens, at the capsular opening 12a. The second lens is characterized, or formed, so as to correct for optical defects associated with the implanted first lens, whereby the combined optical properties of the first and second lenses disposed in "piggy-back" relation result in good or desired vision. Note the compliant concave surface of lens 20 adjacent and conforming to the forward convex surface of lens 13.

In this regard, the corrective second lens 20 corrects for the in-place optical deficiencies or errors of the first lens, however those errors may have arisen. One example would be that the first lens may have become slightly distorted after extended use in the eye. Distortion might arise due to changes in physical properties of the synthetic material of the lens, or physical changes in the surrounding tissue.

The second lens has positioning haptics 20a and 20b that extend in posterior chamber 28 from the periphery of lens 20 to the sulcus inner surfaces 24 and 25, as shown, thereby centering the lens 20, and assisting its positioning between the iris 26 and the first lens 13. Haptics legs 20a' and 20b' are also seen in FIG. 2, and desirably are positioned to extend in substantially perpendicular superimposed relation to the respective legs 14a and 14b, for optimum relative positioning of the two lenses. The leg 20a' extends within an angular section zone angularly closer to leg 14a than to leg 14b; and leg 20b' extends within an angular section zone angularly closer to leg 14b than to leg 14a. Lenses 13 and 20 are substantially coaxial and may be relatively rotated into correct position. Curved outer stabilizing portions of the haptics are seen at 14c and 14d, and 20c and 20d, to engage the walls 16 and 24.

Accordingly, the method of the invention basically includes the steps

- a) providing a second artificial lens to have opposed surfaces,
- b) and inserting the second lens into the eye posterior chamber between the iris and the capsule so that one of the opposed surfaces of the second lens faces toward the first lens.