

element 112a in a position to bring its image to the top of the retina.

FIG. 11 illustrates a hydrogel lens 120 including six lens elements 122a-122f in which lens element 122a has a power D1, elements 122b and 122f have powers D2, and elements 122c, 122d, and 122e have powers D3.

FIG. 12 illustrates a hydrogel lens 130 including eight lens elements 132a-132h, wherein elements 132a, 132c, 132e, and 132g have the same power D1, elements 132b and 132h have the same power D2, and the remaining lens elements 132d and 132f have the same power D3.

FIG. 13 illustrates a hydrogel lens 140 including 12 lens elements 142a-142l which alternate between powers D1 and D2.

FIG. 14 illustrates a hydrogel lens 150 including lens elements 152a-152d which differ from those earlier described in that the lens elements are not symmetrical to the adjacent lens element. It can be seen that the elements 152a and 152c, which have like powers D1 make up a larger portion of the lens 150 than do the other two elements 152b and 152d which have like powers D2. This configuration may be used where the use of one power predominates, to facilitate adaptation of the user to the lens.

FIG. 15 illustrates a hydrogel lens 160 including lens elements 162a-162d, which also have nonsymmetrical adjacent lens elements, and in which the predominant elements 162b and 162d are arranged along the horizontal axis, instead of the vertical axis. This is also for the purpose of assisting the user in the adaptation process.

FIG. 16 illustrates two hydrogel lenses 170 and 172 which represent the lenses to be used in the right and left eyes, respectively, of a user. In this embodiment, the lens elements 174a-174f for the left eye have powers respectively corresponding to the powers of lens elements 176a-176f for the right eye. This too, is to facilitate the adaptation process.

MODE OF OPERATION

Reduction of the cost of the lenses would have the effect of increasing the availability of this procedure to those who currently lack the economic means to afford such an operation. This is particularly the case in third world countries where costs are often the overriding consideration in medical care.

There is no question that the technique of using less than the entire retina is usually not as desirable as a system which duplicates the normal lens use of the entire retina. There is a loss of acuity which shows up in reduced resolution and contrast, particularly in low light conditions. In addition, the accommodation of the brain to such a system takes a period of time, and the degree of success in such accommodation varies with individuals.

In the case where a defective natural lens is to be replaced, it is customary to make extensive measurements on the eye prior to the removal of the defective natural lens and its replacement with a fixed focus implantable lens. Such measurements allow the selection of a lens having appropriate power for the individual, and the nominal distance to the object which is desired to be brought into focus on the retina. This approach to the problem has the disadvantage that a wide range of powers must be available to the surgeon. Since each lens is individually fabricated, the economic burden of fabricating a wide variety of powers adds substantially to the cost of lenses. It would be much cheaper to manufacture only a few lenses and use them in all patients.

The cost of manufacture would be reduced and inventory requirements would be much less burdensome.

The flexible hydrogel material allows the lens to be folded or rolled up and inserted into the eye through an incision or puncture which is much smaller than required for a conventional, rigid lens. Since the insertion procedure is simplified, the cost of implantation is reduced and the chance for success is enhanced.

Various modifications can be made to the present invention without departing from the apparent scope thereof.

I claim:

1. A zone of focus hydrogel lens for use with an eye comprising:
 - a. a plurality of pie-shaped optical hydrogel elements joined at the sides to form a unitary lens structure having a front surface, a rear surface and a circular periphery;
 - b. each of said pie-shaped hydrogel elements serving to create an image on a distinct portion of the retina; and
 - c. at least two of said hydrogel elements having different powers whereby objects at different distances from the eye are simultaneously brought to a focus on distinct portions of the retina; and
 - (d) at least two of said pie-shaped elements are of different colors.
2. A lens according to claim 1 wherein at least two of said pie-shaped elements are of hydrogel materials having different indices of refraction.
3. A lens according to claim 1 wherein at least two of said pie-shaped elements have different surface curvature.
4. A lens according to claim 3 further including a layer of transparent material overlying said front and rear surfaces to provide a smooth exterior.
5. A lens according to claim wherein the boundaries between said pie-shaped elements include an anti-reflective material.
6. A lens according to claim 1 wherein the surface areas of the boundaries between said elements are masked with an opaque material to block passage of rays which would otherwise cause reflections.
7. A lens according to claim 1 wherein said pie-shaped elements are joined with a transparent adhesive material.
8. A lens according to claim 1 wherein said pie-shaped elements are joined during an extrusion process.
9. A lens according to claim 1 wherein adjacent of said pie-shaped elements have different indices of refraction.
10. A lens according to claim 9 comprised of first and second elements having first and second indices of refraction.
11. A lens according to claim 1 comprised of elements each having different indices of refraction.
12. A lens according to claim 11 consisting of three elements.
13. A lens according to claim 11 having at least three elements.
14. A lens according to claim 1 wherein pie-shaped elements of like index of refraction are positioned diametrically opposite in said lens.
15. A lens according to claim 1 wherein said pie-shaped elements providing sharp focus images of near objects are positioned horizontally across said lens.