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ARTIFICIAL CORNEAL IMPLANTS HAVING A REMOVABLE LENS MEMBER

William Stone, Jr., 478 Commonwealth Ave., Boston Mass. 02115

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The present invention relates to artificial corneal implants, each having a removable lens member.

In my Letters Patent No. 2,714,721, dated Aug. 9, 1955, there are disclosed artificial corneal implants of stock that is inert with respect to corneal stroma and sufficiently clear for optical uses. Each such implant is to be inserted between surgically established anterior and posterior corneal layers, which are then sutured, and the implants have passages through which corneal stroma grows to anchor them permanently in place. After an implant has become thus anchored by the ingrowth of the corneal stroma, the anterior layer and, often, the posterior layer as well are trephined.

Continuing animal experimentation with such implants confirms that such corneal implants can be used safely in surgically correcting corneal opacification in humans. While such experimentation has also established essential surgical techniques, certain problems must be solved before human surgery is attempted not only for the correction of corneal opacification but also in case of certain complications such as those sometimes attendant cataracts, synechia, and reformed membranes.

It must be assumed that a permanently anchored implant will, for one reason or the other, become no longer sufficiently clear for satisfactory use or that it will prove necessary or desirable to have the implant function as a corrective lens that, from time to time, would need to be changed.

Another problem is that of simplifying certain phases of surgery. As stated above, trephining of the posterior layer is often necessary or desirable. This cannot readily be done with an implant in accordance with said patent until it has become anchored by the ingrowth of stroma and it is somewhat difficult for the surgeon to enter the anterior chamber marginally of the implant and trephine the posterior layer.

The principal objective of the present invention is to eliminate the two problems to which reference has been made, an objective attained by providing an implant including a holding member of concavo-convex form having a central opening and marginal passages for the anchoring ingrowth of corneal stroma, and a lens member removably held in the opening. At least the portion of the holding member having the anchoring passages must be of a material that will be tolerated by corneal stroma and the lens member must be of a material that is sufficiently clear for optical purposes. While the holding member and the lens member may be formed from the same material, one of the attributes of the present invention is that they may be formed from different materials. With such an implant, the lens member may be removed and replaced safely and easily and, in addition, by removing the lens member, after the implant has become securely anchored by the ingrowth of stroma, the posterior layer may be trephined through the central opening.

The lens member may be connected to the holding member in various ways provided leakage between them is prevented and an important objective of the parent invention is to provide implants where the mutually engaged surfaces of the members are of such extent that leakage problems are avoided. This objective is attained by providing the holding member with a central portion having a lens receiving opening effecting communication between its anterior and posterior faces, the central portion projecting with respect to either or both of those faces. This construction ensures adequate joint length without the height of the anterior projection being such as to cause discomfort. This feature of the invention is also of importance because trephined corneal layers tend to grow until healing is complete and any encroachment on the lens member must be prevented. Such projecting portions function to prevent such overgrowth whenever it otherwise might occur.

These and other of the objectives, novel features, and advantages of the invention will be apparent from the accompanying drawings which show illustrative embodiments of the invention.

In the drawings:

FIGURE 1 is a perspective, fragmentary view of an eyeball illustrating the division of its cornea into anterior and posterior layers,

FIGURE 2 is a fragmentary section, on a substantially increased scale, of the corneal portion of a human eyeball with a corneal implant in accordance with the invention held by the anterior corneal layer, the posterior corneal layer having been trephined,

FIGURE 3 is a like section of the corneal portion of a human eyeball with the holding member of the corneal implant anchored by ingrown stroma, the anterior corneal layer having now been trephined and the holding member now removably supporting a temporary member whose primary function is to block the growth of the anterior layer,

FIGURE 4 is a like view with the temporary lens member replaced by the permanent lens member,

FIGURE 5 is a plan view of the implant,

FIGURE 6 is a section taken approximately along the indicated lines 6—6 of FIGURE 5,

FIGURE 7 is a plan view of an implant in accordance with another embodiment of the invention,

FIGURE 8 is a section taken approximately along the indicated lines 8—8 of FIGURE 7, but with the temporary lens replaced by a permanent lens,

FIGURE 9 is a fragmentary section of the corneal portion of a human eyeball with the implant of FIGURE 7 inserted between anterior and posterior corneal layers, the anterior layer having been trephined, and

FIGURE 10 is a like view with the posterior corneal layer trephined and the temporary lens member replaced by the permanent lens member.

Reference is first made to FIGURE 1 wherein the cornea of a human eyeball is generally indicated at **15**. The cornea **15** protrudes slightly relative to the general contour of the remainder of the eyeball thus establishing the limbus **16**. As illustrated by FIGURES 2, 3, 4, 9 and 10, the space between the cornea **15** and the lens **17** and iris **18** is the anterior chamber C containing aqueous humor. In the correction of corneal opacification by means of an artificial corneal implant, the technique is to form a pocket by dividing the cornea **15** into an anterior layer **19** and a posterior layer **20** with the incision being started in the zone of the limbus **16**. The pocket is dimensioned to enable the implant to be inserted therein following which insertion the incision is sutured.

In the embodiment of the invention illustrated by FIGURES 2–6, an implant is shown as including a holding member **21** of concavo-convex form and having a multiplicity of marginal holes **22** extending from face-to-face thereof to permit the anchoring ingrowth of stroma. The holding member **21** has a central, inwardly extending portion **23** having an opening **24** extending therethrough, the opening being shown as threaded and as having an annular recess **25** at its anterior end. The portion **23** extends inwardly into the anterior chamber C beyond the tre-