USE OF THE PUPILLARY LENS (IRIS CLIP LENS) IN APHAKIA*

OUR EXPERIENCE BASED ON THE FIRST FIFTY IMPLANTATIONS

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WHATEVER type of lens implant is used, its essential feature is the method whereby it is held in place within the eye, as this determines the contact with and the possible damage to the ocular tissues. Three basic methods of fixing lens implants have been advocated:

- (1) By the suspension system of the crystalline lens, *i.e.* the zonular fibres and lens capsule (Ridley).
- (2) In the anterior chamber angle, by rigid angle supports (Strampelli, Scharf, Schreck, Bietti, Apollonio, Ridley, Choyce, Cogan, Boberg-Ans, etc.), by elastic angle supports (Dannheim, Barraquer, Lieb, etc.), or by "trans-scleral" angle fixation (Strampelli, Apollonio, etc.).
- (3) By the iris diaphragm (*e.g.* Binkhorst, Epstein, Schillinger).

Our experience with various types of implants (Binkhorst, 1959a, b, c, d, 1960a, b) has permitted us to evaluate the results obtained with different methods by the same surgeon.

Any lens implant of inert material is well tolerated in the aphakic eye if the following requirements are fulfilled:

- (a) The implant must stay in place;
- (b) The implant must avoid contact with the corneo-scleral wall, as its deformations may result in pressure atrophy or even open lesions; contact with the corneal endothelium has particularly to be avoided.
- (c) The unavoidable contact with the intra-ocular tissues must be minimal and harmless.

Ridley's method fulfils some of these conditions, but his type of fixation is rather delicate. Anterior chamber lenses, on the other hand, can be well fixed into the chamber angle, but there is always a chance of damage to the angle or to the corneal endothelium, leading to corneal dystrophy, whether the lens fits tightly or not, and even if the supports are well fitted and well polished. Fine elastic wire angle supports can be less dangerous in this respect than rigid angle supports, but, if elastic angle supports are used, the vitreous may interfere with the position of the lens in the anterior chamber and so increase the risk of contact with the corneal endothelium.

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Late corneal dystrophy has been encountered with every type of angle-supported lens implants, whether rigid or elastic. I have warned surgeons against this complication at the XVIII International Congress of Ophthalmology in Brussels in 1958 (Binkhorst, 1959a), at the Oxford Ophthalmological Congress in 1959 (Binkhorst, 1959b), and in various published articles.

The pupillary lens fulfils the necessary conditions and has so far given the best long-term results. No case of late corneal dystrophy has been seen in a series of more than ninety patients observed for periods up to 4 years.

Pupillary Lens

The optical part consists of a biconvex acrylic lens which can be made to individual specifications. It has a diameter of 5 mm. and is about 0.6 mm. thick at the centre. It is located immediately in front of the pupil and is kept in position by two wire loops attached to the posterior surface close to the equator and bent at right angles (Figs 1 and 2). These wire loops are inserted through the pupil and come to lie against the posterior surface of the iris without reaching the ciliary body. The distance between the ends of these loops is about 8 mm.

FIG. 2.—Characteristics and principle of fixation of pupillary lens.
(a) Section; arrows point to attachments of posterior loops where lens is mainly supported.
(b) Front view.

The attachments of these posterior loops are 0.5 mm. from the equator and thus form a square, the diagonals of which are about 4 mm. long. These posterior loops prevent the forward displacement and decentration of the lens. When the pupil is constricted around the attachments of these loops its form is more or less square. In order to prevent luxation of the lens backwards even with an abnormally wide pupil, two flat wire loops are mounted on the equator of the lens, increasing the greatest diameter of the part in front of the pupil to about 8 mm. These anterior loops are adjacent to the anterior surface of the iris, keeping a safe distance from the anterior chamber angle. The clearance between the anterior and posterior loops is 0.5 to 0.75 mm., just enough to enable the iris to slide in between. The loops consist of elastic Supramid wire, 0.1 mm. thick, a synthetic resin which is as well tolerated by the eye as acrylic material. We chose these wire loops for fixing the lens because it is essential to keep the total weight as low as possible (about 10 mg. in the air) and to limit contact with the iris to a minimum. The lens is shown *in situ* in a cadaver eye in Fig. 3.

FIG. 3.—Pupillary lens in cadaver eye.

This pupillary lens has the same advantages as those which have made the anterior chamber lens popular and the Ridley lens obsolete: the dioptric power can be adapted to individual specifications, a second-stage implantation technique can be used, and the lens itself is stable. Moreover, the pupillary lens has the following distinct advantages of its own:

(1) It is independent of the diameter of the anterior chamber; this avoids the difficulty of having to determine the so-called ideal length of the usual anterior chamber lens and the consequent complications. If desired, the pupillary lens can be implanted into an eye which is not yet fully grown.

(2) It is also independent of the configuration of the anterior chamber angle. Peripheral anterior synechiae, which add to the difficulty of determining the ideal

length of the usual anterior chamber lens, or may even make implantation impossible, do not usually contraindicate the insertion of a pupillary lens. It can be used in eyes with wide and narrow chamber angles alike, whereas in the latter case angle supports are contraindicated (Du Pont Guerry).

(3) As the lens is centred in front of the pupil by the sphincter muscle itself, an ideal position is always attained, even in cases with a slightly eccentric pupil, as the iris will support all four insertions of the posterior loops to an equal extent. Such exact centring cannot be obtained with the Ridley lens or with the usual anterior chamber lens, a slight deviation from the ideal length of the latter being sufficient to interfere with the desired centring.

(4) As the lens is at a greater distance from the cornea, the size of the retinal image is more physiological and less aniseikonia is to be expected.

(5) Late corneal dystrophy due to corneal endothelial damage is not likely to occur because:

(a) The pupillary lens has no contact with the anterior chamber angle and cannot cause decubitus in this region.

(b) The pupillary lens has no contact with the cornea through deformation of the anterior segment as it is contiguous to the iris diaphragm and is situated further from the corneal endothelium than the usual anterior chamber lens (Fig. 4).

FIG. 4.—Consequences of deformation of anterior segment.

Left: Angle-supported lens, the corneal endothelium pouches the lens supports.

Right: Pupillary lens; contact between corneal endothelium and lens is impossible.

Selection of Cases

The pupillary lens is suitable in selected cases of unilateral cataract if there is no other way of re-establishing the function of the eye, whatever the aetiology of the cataract. Many presenile or senile cataracts manifest themselves unilaterally for a long period, if not for the rest of life; many such patients can be made very happy with a pupillary lens, and the fellow eye can also be provided with a pupillary lens when required later. It may soon be suitable to perform bilateral implantations in patients who suffer severely from the functional and psychological restrictions inherent in the use of cataract spectacles. Patients with senile cataract, who have undergone a

complete integral extraction of the lens, offer a better prognosis than those with cataract due to other causes. Our first fifty implantations of pupillary lenses may be classified as follows:

Aetiology of Cataract	No. of Cases
Senile	35
Traumatic	6
Radiational	2
Cyclitic	2
Not Known	5
Total	50

The ideal eye for the implantation of a pupillary lens is one that has undergone an uncomplicated lens extraction at least 3 months before, and has a round and centrally situated pupil of normal width, no anterior or posterior iris synechiae, an unruptured hyaloid membrane, a normal depth of the anterior chamber, a clear cornea with vital endothelium, a normal tension, and good visual acuity. The presence of at least one or more peripheral iris gaps, made at the time of the cataract extraction, giving free communication between the anterior and posterior chamber, is an imperative condition for the implantation of any artificial lens. The neglect of this rule may result in post-operative pupillary block and secondary glaucoma with iris bombé. In the absence of free communication a peripheral iridectomy should be done as a preliminary operation. As advanced cataract surgery aims at leaving the eye in as *integral* a state as possible, the conditions necessary for the implantation of a pupillary lens will often be more readily fulfilled after intracapsular than after extracapsular lens extraction.

However, the condition of the anterior segment may not always be so ideal. Total iris coloboma or an abnormally wide pupil (the pupil width should be tested in the dark as well as in the light) will not allow the implantation of a pupillary lens.

Sometimes the anterior chamber of the aphakic eye is so flat that the lens implant could not fail to touch the corneal endothelium.

More often peripheral anterior synechiae, resulting from a delayed re-formation of the anterior chamber, make the chamber partially flat; in some of these cases there is no interference with the pupillary implant and sometimes, when the anterior synechia flattens the anterior chamber and decentrates the pupil too much, an anterior synechiolysis can be done as a preliminary operation. In one of our cases, in which peripheral anterior synechiae of the upper segment of the iris caused a slight decentration of the pupil, we

removed the anterior loops of the pupillary lens in order to reduce the size of the implant and lessen the risk of contact with the corneal endothelium (there was no fear of backward luxation as the pupil in this case was rather small). Thus, in many cases with peripheral anterior synechiae, in which the implantation of an angle-supported lens would be contraindicated, a pupillary lens can be used. More centrally-situated anterior iris synechiae, such as may occur in traumatic cases, have always to be dealt with in a preliminary operation. In one case, in which there was no risk of haemorrhage, we cut a vitreous strand to a previous corneal wound at the time of the insertion of the lens.

The presence of posterior iris synechiae should always be checked with the aid of a mydriatic. In many cases they can be avoided by the posterior loops of the lens, and in some they can be loosened without bleeding before the lens is introduced. Only strong and extensive posterior synechiae render the implantation of a pupillary lens impossible.

The most ideal condition of the vitreous for the implantation of a pupillary lens is an unruptured hyaloid membrane with no mushroom-like vitreous prolapse into the anterior chamber. Experience has shown, however, that neither the large mushroom-like vitreous prolapse with unbroken hyaloid membrane, nor the ruptured hyaloid membrane with or without vitreous prolapse into the anterior chamber, necessarily disallows the implantation of a pupillary lens. In all cases the final decision, whether to implant a pupillary lens or not, ought to be taken during the operation, and it depends on the condition and behaviour of the vitreous after the anterior chamber has been opened.

In general terms, the implantation of any kind of lens is contraindicated by the following:

- (1) Poor visual acuity;
- (2) Untoward behaviour of the vitreous in previous cataract surgery;
- (3) Guttate cornea;
- (4) Extensive and intractable anterior iris or vitreous synechiae;
- (5) Extremely flat anterior chamber;
- (6) Extremely eccentric pupil;
- (7) Uveitis;
- (8) Glaucoma;
- (9) Absence of peripheral iridectomy or iridotomy.

The implantation of a pupillary lens is contraindicated by the following:

- (1) Extremely wide pupil;
- (2) Total iris coloboma;
- (3) Extensive and intractable posterior iris synechiae.

Technique

Preparation of the Lens

The dioptric power of the lens is adapted to the individual patient. For this purpose the back vertex power of the spherical correction at 12 mm. corneal distance has to be determined, either to render the combined dioptric system emmetropic or to give it the same refraction as that presented by the other eye.

The standard attachments of the posterior loops that may influence the size and form of the pupil fit very well, but it would be possible to adapt them in individual cases to reduce pupillary distortion.*

There are various methods of sterilization, but our experience has been limited to the use of ultra-violet rays, with which we have always been well satisfied (Binkhorst and Flu, 1956), and which appears to reduce post-operative reaction (Strampelli, Schreck).

The pupillary lenses are packed in sealed glass ampoules filled with sterile distilled water, after being sterilized by ultra-violet rays. Before use they are rinsed in Ringer's solution or balanced salt solution.

Preparation of the Patient

The details of anaesthesia, akinesia of the eye and eyelids, hypotonia of the eyeball, sterilization of the conjunctival sac, and the systemic administration of a broad-spectrum antibiotic, etc., may be taken for granted.

Our present technique is based on a dilated pupil. The iris is brought between the loops of the pupillary lens by injecting acetylcholine solution into the anterior chamber. The pre-operative dilatation of the pupil is achieved by the retrobulbar injection of Novocain and epinephrine, the influence of which may be promptly reversed by acetylcholine. Superficial anaesthesia should not influence the size of the pupil. For further details the reader is referred to the section on the surgical technique.

To guard against post-operative reaction one should study the reaction of the eye to the presence of the artificial lens material. There is usually a sharp and extensive cellular reaction of the anterior uvea, with deposits of cell-clumps in the anterior chamber, on the lens surfaces, and sometimes in the anterior part of the vitreous, and frequently accompanied by a hypopyon of varying height (Fig. 5a, overleaf).

These exudative changes usually reach their peak within 2 or 3 days; the hypopyon disappears within 24 or 48 hours, but the cellular deposits elsewhere may interfere with visual acuity for a much longer period. The cellular exudate may also cause long-range toxicity leading to oedematous changes in the macular area and irreversible functional loss. Macular oedema after artificial lens implantation has been observed by several surgeons, and we believe it may be prevented if the anterior uveal reaction is prevented. This uveal reaction, whatever its origin, can be checked by the local and systemic use of corticosteroids combined with a strong

* The pupillary lenses used were all manufactured by Mr. K. Morcher, Daimlerstrasse 11, Stuttgart-Cannstadt, Germany.

local vasoconstrictor. This treatment aims not at cure but at prevention, and must be started pre-operatively. The regimen found most helpful is as follows:

(a) 4-hrly instillations, day and night, of a 0.1 per cent. solution of dexamethasone 21-phosphate, from 24 hrs pre-operatively until the 8th post-operative day, and afterwards gradually diminishing.

(b) Oral doses of dexamethasone and intramuscular injections of corticotrophin, beginning 24 hrs pre-operatively and continued until the 8th post-operative day (Table).

TABLE
DEXAMETHASONE AND CORTICOTROPHIN TREATMENT IN INTRA-OCULAR
ARTIFICIAL LENS SURGERY, BEGINNING 24 HOURS PRE-OPERATIVELY

Day	Dexamethasone (mg.)	Corticotrophin (I.U.)
1st	4	30
2nd	3	20
3rd	2	20
4th	2	15
5th-8th	1	10

(c) 4-hrly instillations, day and night, of a 0.5 per cent. solution of 2-naphthyl-methyl-imidazoline (Naphazoline), from immediately after the implantation until the 8th post-operative day, and afterwards gradually diminishing.

If this scheme is followed the eye remains almost white, clear, and comfortable, and usually develops good visual acuity very soon after the implantation (Fig. 5b).

FIG. 5.—Anterior segment with pupillary lens on 3rd post-operative day.

(a) Without corticosteroid and vasoconstrictor treatment. Note cloudiness of anterior chamber and small hypopyon.

(b) With corticosteroid and vasoconstrictor treatment. Note clear anterior chamber. The incision has been sutured.

Surgery

It is a little more difficult to implant a pupillary lens than an angle-supported lens. Our experience has enabled us to improve our technique, and a special "irrigating forceps"* has been evolved for introducing the lens; this not only grasps the lens but also allows the irrigation of the anterior chamber. The "irrigating forceps" consists of two very fine metal tubules which are split apart at the tip and suitably bent into forceps points which can be used to grasp the lens. These tubules can be connected with syringes by fine polyvinylchloride tubes. The tips of the tubules can be moved with the hand just like the ordinary forceps and the lens is fixed by a spring action in the handle (Fig. 6).

FIG. 6.—"Irrigating forceps" for inserting the pupillary lens; it comprises two metal tubules, which are split apart at the end and suitably bent to form the forceps to grasp the lens.

- (a) Instrument with polyvinylchloride tubes for connecting to syringes with pupillokinetic solutions.
(b) Tip of instrument with pupillary lens.

The steps in the implantation of a pupillary lens are briefly summarized below:

- (1) Dilatation of pupil with retrobulbar injection of Novocain and epinephrine (best pupil diameter 6 to 7 mm.);
- (2) Incision;
- (3) Loosening of posterior iris synechiae (if necessary);
- (4) Introduction of lens into pupillary area and positioning of lens loops (Fig. 7a);
- (5) Constriction of pupil by irrigation of anterior chamber with 1:2000 solution of acetylcholine (Fig. 7b);

FIG. 7.—Insertion of pupillary lens.

- (a) Pupillary lens held level in a dilated pupil.
(b) After the injection of acetylcholine solution into the anterior chamber; the iris has moved between the lens loops.

* The "irrigating forceps" can be ordered from Mr. K. Morcher, Daimlerstrasse 11, Stuttgart-Cannstadt, Germany.

- (6) Suturing of incision (three sutures of virgin silk);
- (7) Restoration of anterior chamber with Ringer's solution or air bubble;
- (8) Dressing with pilocarpine ointment.

The surgeon should use spectacles magnifying at least 2 to 3 times. Good illumination from every side will avoid disturbing reflections and render the lens and its loops clearly visible. The size of the pupil should be carefully checked and corrected. The corneal incision is 7 to 8 mm., preferably on the temporal side, which gives more room for manoeuvre, and usually has a favourable influence on corneal astigmatism. The incision can if necessary be made at any point of the corneal circumference, to avoid any peripheral vascularization of the cornea, or anterior or posterior iris synechiae. Haemorrhage into the anterior chamber should be avoided by all means, as this may lead to untoward reactions in the anterior segment. The incision is usually made with a large keratome. It is very useful to wait a few minutes after the incision has been made to allow the vitreous to retract itself. If unavoidable posterior iris synechiae are present, a straight spatula is used for loosening distal synechiae and a bent spatula for loosening proximal synechiae (Figs 8 and 9). In this way even iris synechiae with the hyaloid membrane can be dealt with without disturbing the continuity of the latter.

FIG. 8.—Technique of posterior synechiolysis.
(a) Under distal iris sector.
(b) Under proximal iris sector.

FIG. 9.—Iris spatulae for posterior synechiolysis.
(a) Under distal iris sector.
(b) Under proximal iris sector.

The lens is then grasped in the “irrigating forceps” and introduced into the anterior chamber. When the ends of the loops have reached the distal pupillary border one must watch carefully that the iris slides in between the anterior and posterior loops. This manoeuvre can be achieved by bringing the lens into the desired position, supported by transcorneal pressure on the lens loop or on the iris with an iris probe. At this stage the lens and its loops should be made clearly visible by illumination from the side. The posterior loops are easily recognizable because they are a little thicker than the anterior loops and slightly pointed, so that they are not covered by the anterior loops. When the distal posterior loop passes

beneath the iris, the lens is advanced until the tip of the proximal posterior loop enters the pupillary area. Then the lens is moved backwards to bring the proximal posterior loop under the iris. Where both posterior loops are in position under the iris, a freshly-prepared 1:2000 solution of acetylcholine is introduced into the anterior chamber through the "irrigating forceps". This results in an immediate constriction of the pupil, and the forceps is then removed. The pupillary lens is firmly caught by the sphincter muscle constricted around the posterior loop attachments, and it is thus automatically centred, the pupil now being more or less square. Because of the post-operative corticosteroid treatment (described above) it is absolutely necessary to suture the incision with three sutures of virgin silk. Ringer's solution or an air-bubble is introduced in the anterior chamber in order to separate the lens and iris from the cornea. Finally pilocarpine ointment is administered.

Complications during the Operation and Methods of Counteracting Them

(a) The aqueous evacuates after the incision has been made and the iris bulges forward. The lens can be introduced as described above, but in order to avoid the loop tips catching in the iris, it is necessary to proceed carefully with slight zig-zag movements. The distal iris sector may adhere to the cornea, and this makes it difficult to introduce the distal anterior loop between the iris and the cornea. An air bubble can be injected into the anterior chamber and massaged between the distal iris sector and the cornea.

(b) The pupil appears too narrow for the introduction of both posterior loops behind the iris. A solution of epinephrine can be injected into the anterior chamber through the "irrigating forceps".

(c) Visibility in the anterior chamber is poor through the presence of air bubbles. The anterior chamber can be irrigated with Ringer's solution through the "irrigating forceps".

(d) Vitreous enters the anterior chamber after the incision has been made, but without presenting itself into the wound. The lens can be introduced as described above, and the vitreous may afterwards appear to have been pushed back by the lens or to surround the lens partially, but this is of no practical importance. The presence of vitreous in the anterior chamber does not *per se* interfere with the final position of a pupillary lens.

(e) Vitreous presents itself into the wound after the incision has been made. If the vitreous does not retract spontaneously, it can sometimes be pushed back with the lens. If, however, there is evidence that vitreous remains in contact with the wound, the implantation should be abandoned, as vitreous strands may interfere with the final position of iris and lens.

Post-operative Course and Treatment

The pupil usually remains constricted without administration of pilocarpine, but pilocarpine ointment is administered every day during the first post-operative week. The appearance of the anterior segment after the pre-treatment described above is as follows:

Depending on the amount of manipulation a slight degree of striate keratitis may be present during the first post-operative days. The eye usually remains perfectly white and quiet. A few cells can be seen with the slit lamp in the aqueous as well as on the surfaces of the lens, and these gradually disappear during the first week or two.

Examination of the fundus as well as retinoscopy are usually practicable soon after the implantation. Visual acuity is usually good and the eye feels quite comfortable from

the very beginning. Slight adhesions usually form between the pupillary border and the attachments of the posterior loops.

General corticosteroid and corticotrophin treatment is discontinued on the 8th post-operative day. Local corticosteroid and vasoconstrictor treatment is given 4-hrly, day and night, until the 8th post-operative day, and is afterwards diminished, but should be continued four times daily for at least 2 months post-operatively. The patient is discharged on the 10th post-operative day, but the sutures should not be removed until the end of the 4th post-operative week. Binocular function is restored spontaneously in most cases.

After the cellular deposits mentioned above have disappeared and the lens surfaces have regained their full transparency, greyish-white, round, oval, comet-like, or ring-like "spots" usually appear on the lens surfaces in the 3rd or 4th post-operative week. These spots, if numerous, reduce visual acuity, but tend to disappear gradually in a few months. They have nothing to do with the cellular exudate of the first post-operative days, and are most probably of a physico-chemical nature, although so far undefined.

Post-operative Complications

Macular Oedema.—Intense post-operative uveal reaction was sometimes seen in cases not treated or insufficiently treated with corticosteroids and vasoconstrictors. Early post-operative macular oedema with alteration of the macular area and some loss of visual acuity was most probably caused by this reaction pattern of the anterior uvea in two cases.

Localized Corneal Oedema.—In two cases in which more manipulations than usual had been necessary, an endothelial lesion resulted in longer-standing localized corneal oedema.

Adhesion between Anterior Loop of Lens, Iris, and Cornea.—In four cases vigorously treated with corticosteroids, the incision had not been sutured. The anterior chamber remained flat during the first few days and the tip of the proximal anterior loop of the lens together with a part of the corresponding peripheral iris adhered to the internal opening of the incision. In one case anterior synechiolysis was performed with good results 4 weeks post-operatively.

Displacement of the Lens.—Early post-operative displacement of the lens occurred in six cases—one posterior and the rest anterior. The displacement was due to the posterior loops being too short, or to poor surgical technique (no suturing of the incision, etc.), or to inadequate post-operative care (no application of pilocarpine, etc.). These six cases are detailed below.

Case 3.—Post-operatively a 1 per cent. solution of atropine was administered daily. No danger of displacement seemed to exist in the beginning. On the 7th post-operative day, however, one of the posterior loops appeared in front of the iris, the rest of the lens remaining in place. Atropine drops were stopped and the iris was pulled over the posterior loop with a blunt iris hook through a small keratome incision. A 1:2000 solution of acetylcholine was injected into the anterior chamber. Next day the pupil appeared to be dilated again and the same posterior loop was displaced in front of the iris. This time, after re-insertion of the loop, the pupil was constricted with a 4 per cent. solution of pilocarpine, and the lens then remained in place without further miotics. In this case the displacement was due partly to the instillation of atropine, and partly to the fact that the posterior loop concerned was shorter than was needed.

Case 17.—Sudden tenderness and redness of the eye occurred about 2 weeks after the implantation, and the lens appeared to be floating in the anterior chamber. It was known before the operation that the pupil was rather wide, especially in darkness and along the horizontal meridian. The lens was extracted through a 12 o'clock incision and reinserted in the vertical position. Even without miotics the pupil has since remained constricted around the posterior loop attachments and there is no danger of renewed luxation.

Case 24.—Though this eye was energetically treated with corticosteroids, the incision was not sutured, and the anterior chamber remained flat during the first post-operative days. The pupil was distorted towards the incision and the distal posterior loop of the lens luxated in front of the iris. The lens was replaced with a blunt iris hook through a small keratome incision, and the incision was sutured and covered with a conjunctival flap. The lens has since remained in place.

Case 28.—After the operation, the patient was sent back to the ward, with the loops apparently well in place, but next day the lens was afloat in the vitreous. One of the anterior loops that was supposedly in front of the iris must have actually been behind the iris, and this had caused the lens to be pressed into the vitreous when the pupil constricted. Fortunately the lens could be extracted from the vitreous, and a few months later the implantation was performed again; this time the incision was insufficiently sutured and the distal posterior lens loop became dislocated. Although the lens loop was replaced, the pupil remained distorted and peripheral anterior synechiae formed between the incision and the lens and iris. This was the only really unsatisfactory result in our fifty cases.

Case 32.—It was known that the pupil in this case was rather wide, especially in darkness. An attempt was made to keep the lens in place without post-operative pilocarpine, but the lens luxated into the anterior chamber on the 4th post-operative day. It was easily re-inserted, and the pupil was kept narrow by the use of miotics for a few weeks; adhesions which formed between the pupillary border and the posterior loop attachments then made the use of miotics unnecessary.

Case 39.—In this case the lens luxated into the anterior chamber after a heavy contusion of the eyeball. The pupil was also known to be rather wide and the posterior lens loop rather short. The lens was reinserted and adhesions have now formed between the pupillary border and the posterior loop attachments.

All these displacements occurred soon after the operation and could have been prevented, if we had always followed the rules laid down above. There is no fear of late displacement of a pupillary lens made to the design described above and implanted in carefully selected eyes using the technique which has now been evolved. The prolonged use of miotics has never been necessary.

Note: In the past year pupillary lenses have been inserted at the time of extraction of the cataract. The patients concerned were elderly, with predominantly unilateral senile cataracts; the pre-cataractous refraction of the eye was known. The incision in these cases was closed with eight virgin silk sutures, the post-operative course was uncomplicated, and the results obtained were very good.

Summary

The use of the pupillary lens (iris clip lens) designed by the author for the correction of aphakia can produce good results both immediate and long-term. The selection and preparation of patients is described, with the surgical technique of implantation and directions for post-operative management. The long-term results are to be the subject of a future communication.

The pupillary lens gives a full guarantee against late displacement and is well tolerated by the eye because of its minimal contact with the iris. The method of fixing the pupillary lens is quite different from the angle-fixation of the anterior chamber lens in which the possibility of late damage to the corneal endothelium and subsequent corneal dystrophy cannot be excluded.

We are indebted to the Board of the St. Elisabeth Hospital, Sluiskil, Netherlands, to Mr. J. Worst and Mr. K. Otter for the development of the "irrigating forceps", and to Mr. B. Cardon, Mr. R. van Damme, and Mr. H. Hommers for their excellent photographs. Our thanks are also due to Dr. Richard C. Troutman for his valuable advice in the development of our present surgical technique.

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