

## Editorial: Current status of intraocular lenses

The past 5 years have seen a reawakening of interest in intraocular lenses after the early disasters of the mainly angle-fixated lenses. The subject has been kept alive owing to the work of Choyce in England and Binkhorst in Holland, and it can now be conservatively estimated that there have been 50 000 American and 10 000 European intraocular implant operations. Implant societies are being formed in many parts of the world. Recently the United Kingdom Intraocular Implant Society was formed, with Mr Neil Dallas as its first president (see p. 000).

The well-known advantages of intraocular lens implantation are: Freedom from patient handling, minimum aniseikonia, rapid return of binocularity, and normal peripheral vision. However, the operation is undoubtedly technically difficult, and such complications as corneal dystrophy, implant dislocation, pupil block glaucoma, and cystoid maculopathy have led to a conservative approach by many surgeons.

All intraocular lenses should be made of monomer-free polymethylmethacrylate (PMMA), as was used by Ridley for his first posterior chamber implant in 1949. PMMA has been shown in 30 years of clinical use to be remarkably free from degradation *in vivo*. At present there are 4 European manufacturers of lathe-turned lenses, while the 8 American firms generally produce moulded lenses. Lenses are biconvex or plano/convex, 4 to 6 mm in diameter. Most firms supply lens powers from 10 to 25 dioptres in aqueous. The standard-power lens of 19.50 dioptres in aqueous is approximately equivalent to an 11.0-dioptre sphere spectacle lens; this usually produces iseikonia. Individual lens power can be assessed in an aphakic eye for secondary implantation by refraction. However, lens-power measurements for primary implantation necessitate axial length measurement with ultrasonography, keratometry, and the use of standard calculation tables as produced by Binkhorst and others. Generally speaking, the standard 19.50-dioptre lens is used except in children, who require a more powerful 22.50-dioptre lens. Supporting lens loops are either made from polyamide (nylon), which, while being light and easily manufactured, may be a potential source of weakness, as it is hygroscopic (though nylon has been shown not to be attacked by pure water), or polypropylene (Prolene), which is probably more stable, being less hygroscopic and already available. Metal loops of platinum/iridium, titanium, and gold alloy are said to be

inert, though few *in vivo* data are available. They are heavier than plastic, with a greater tendency to iris sphincter erosion; moreover, anterior dislocation produces greater corneal endothelial damage.

Iris suture materials in use are 22 to 24  $\mu$ m polyamide (Perlon or Ethilon), which, being hygroscopic, may disintegrate in time. More stable polypropylene, platinum/iridium, or stainless steel wire is available swaged to 5 to 6 mm iris needles.

### Sterilisation of implants

Dry or moist heat sterilisation gives plastic degradation to harmful monomers, while excessive irradiation makes PMMA brown and brittle and should be avoided. Considerable satisfactory clinical experience of the caustic soda method of F. Ridley has made it the sterilisation method of choice since 1957. Objections have been made to chemical sterilisation by some authorities recently, and its effectivity against fungi has been challenged.

### Types of cataract surgery suitable for intraocular lenses

Implant surgery should be performed with the aid of the operating microscope to ensure watertight closure of the wound. Postoperative flat anterior chamber with plastic-endothelial contact can give rise to corneal endothelial decompensation. Cases to avoid include uncontrolled glaucoma, overt corneal dystrophy, younger diabetics, retinal detachment (history of either eye), and unocular patients.

Primary implantation after intracapsular extraction provides a rapid return of visual function, but may have a higher late incidence of cystoid macular oedema.

Binkhorst has revived interest in planned extracapsular surgery, claiming that capsular fixation of his 2-loop lens gives a deeper anterior chamber, normal pupillary function, less prosthesis movement (pseudophakodonesis), and a lower incidence of endothelial corneal dystrophy, cystoid maculopathy, and retinal detachment. The disadvantages are: sometimes a slower return of visual function owing to cortical remnants and the necessity of up to 30% subsequent capsulotomies.

Secondary insertion of an intraocular lens after contact lens failure is particularly rewarding. Nevertheless, an eye with vitreous knuckle or free

vitreous in the anterior chamber should be approached with great caution.

### Intraocular lenses in current use

#### ANTERIOR CHAMBER FIXATED LENSES

Choyce Mark VIII (Fig. 1a) fabricated of PMMA only with a 6-mm optic (4-mm optic if coloured haptic); available in various lens powers. Weight is 25 mg in air. The haptic feet lie on the iris root behind the scleral spur. Implant size is calculated by measuring either the horizontal or vertical corneal diameter and adding 1.00 to 1.50 mm. It can be used either as a primary or secondary implant, being reasonably simple to insert and giving normal pupillary function without fear of dislocation. It is especially useful in the presence of large iris colobomata. However, several peripheral iridectomies are required to avoid pupil block glaucoma.

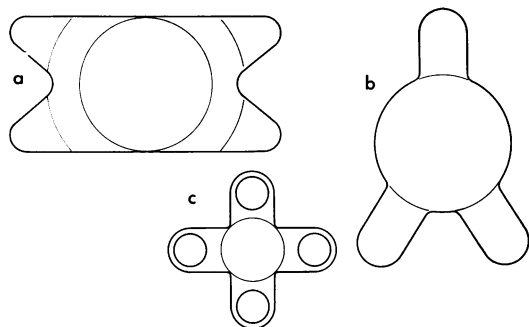


Fig. 1 a Choyce lens (Mark VIII). b Ridley's tripod lens. c Epstein-Copeland Maltese lens

This lens, therefore, should not be used in eyes with prior angle PAS or shallow anterior chambers.

The Ridley tripod anterior chamber lens (Fig. 1b) is similarly placed as the Choyce Mark VIII in the anterior chamber, but this lens has few followers.

#### IRIS PLANE LENS

Epstein-Copeland Maltese cross plane lens (Fig. 1c) 4-mm optic of PMMA; weight 7.5 mg in air. Two limbs lying anterior and 2 posterior to the iris sphincter. This lens has little following outside the United States. It is simple to insert, but miotics are generally necessary. It is especially prone to pupil block glaucoma, chronic iritis, and formation of pupillary membrane. It is also said to be associated with a higher incidence of cystoid maculopathy.

#### BINKHORST (FIG. 2d) AND FEDEROV (FIG. 2e) 4-LOOP IRIS SUPPORTED LENSES

In use since 1958. 5-mm optic, weight 14 mg in air, with 2 anterior and 2 posterior loops of polyamide,

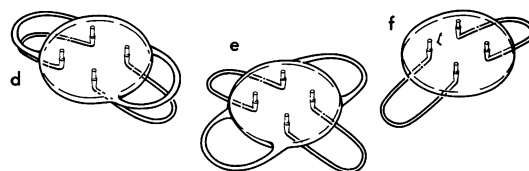


Fig. 2 d Binkhorst 4-loop, iris-clip lens. e Federov iris-supported lens. f Binkhorst 2-loop lens

angled backwards. Available in various lens powers. The Federov lens has the posterior loops at right-angles to the anterior loops (said to have a lower incidence of implant dislocation).

These lenses can be used after intra- or extracapsular surgery and are simple to insert. The loops can be sutured together through a peripheral iridectomy or directly sutured to the iris. Without suture fixation of the implant the patient may have to be kept on miotics, and iris sphincter atrophy may occur.

Adequate peripheral iridectomies are essential to avoid pupil block glaucoma. Vertical meridian implantation of the Binkhorst lens should be performed to avoid any possibility of endothelial contact from the anterior loops in horizontal eye movements.

The Binkhorst 3-loop lens is without 1 anterior loop and is used in association with iris suture fixation of the remaining anterior superior loop.

#### BINKHORST 2-LOOP IRIDOCAPSULAR LENS (FIG. 2f)

In use since 1965. 5-mm lens available in various powers; 2 posterior loops of either polyamide or metal; weight with nylon loops is 12 mg in air. The posterior loops are theoretically placed in the capsular bag to give capsular fixation without implant movement, thereby allowing normal pupillary function. Other advantages claimed by Binkhorst of extracapsular surgery associated with an iridocapsular lens have been enumerated in a previous paragraph.

#### WORST MEDALLION LENS (FIG. 3g)

In use since 1969. A 5-mm optic PMMA available in various lens powers from 10.00 to 21.75 dioptres

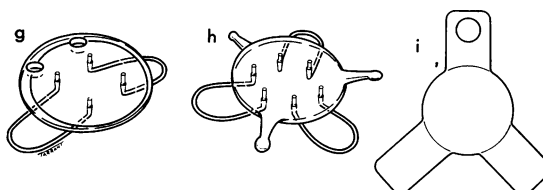


Fig. 3 g Worst Medallion lens. h Federov Sputnik lens. i Little-Arnott posterior chamber lens (Mark I)

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in aqueous. Each lens has a 1-mm fenestrated haptic of PMMA, the posterior loops being of nylon or titanium. Some of these lenses allow for a very small pupil (as small as 1.2 mm). Iris fixation is either by direct suture through a fenestration in the haptic or by Worst's transiridectomy safety-pin fixation; the posterior wire loop is pinned over an anterior safety clip through a peripheral iridectomy. Various models are available, suitable for intra- or extracapsular extraction.

**FEDEROV SPUTNIC LENS (FIG. 3h)**

This is similar in principle to the Binkhorst 4-loop lens, having 3 posterior loops and 3 anterior prongs of polyamide attached to the optic (or moulded to the optic) lying in front of the iris.

**KRASNOV EXTRAPUPILLARY LENS**

The first model has a 5-mm optic with 2 prongs of gold alloy which are placed through the irido/puncture; the second design has 1 prong looped for placing a direct iris suture. It is claimed that this lens design allows normal pupillary function (see p. 000).

**Posterior chamber lenses****PEARCE TRIPOD AND BIPOD POSTERIOR CHAMBER LENS**

A 4-mm optic with 3 or 2 limbs at varying radii, fabricated of PMMA. The tripod lens weighs 9 mg and the bipod 8 mg in air. This lens is used after extracapsular extraction with or without direct iris suture fixation through a limb fenestration. Standard power lens is 21.0 D in aqueous; other powers will be available. It is claimed that this lens allows

normal pupillary function, no possibility of endothelial contact with little danger of pupillary-block glaucoma (peripheral iridectomies can be omitted) (see p. 000). Aniseikonia is reduced to the minimum, the lens being in the corrected anatomical position in the eye. However, lens centration outside the visual axis and subsequent capsulotomies are postoperative complications.

**LITTLE-ARNOTT POSTERIOR CHAMBER LENS (FIG. 3i)**

A 5-mm optic with a tripod configuration.

Lens dislocation is the only complication peculiar to implant cataract surgery. Discussion of other aphakic complications, such as endothelial corneal dystrophy, cystoid maculopathy, sepsis, and retinal detachment, is concerned with their incidence with and without lens implantation.

Implant surgery has stimulated considerable research into safe intraocular plastics, iris suturing materials, aphakic cystoid maculopathy, and retinal detachments. Recently it has revived, in conjunction with phako-emulsification techniques, a fresh assessment of the value of extracapsular cataract surgery.

A conservative approach to intraocular implantation would be to select suitable cases over the age of 65, implanting in 1 eye only, and avoiding monocular patients. At present a safe plastic in PMMA is in use, which has passed 20 years of extensive clinical testing. Patients with successful intraocular lenses are generally satisfied. However, development of a safe permanent-wear soft contact lens, not requiring constant supervision by the patient and giving the same optical qualities as an intraocular lens, may make implantation an unnecessary risk.