Multifocal IOL implantation: 16 cases

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Abstract

We interpreted the clinical data from 16 eyes with a 3M multifocal implant and compared them with data from 16 monofocal implants with the same follow-up period. The multifocal implant has several disadvantages: a lower initial visual acuity, a higher frequency of posterior synechiae, and slightly more difficult ophthalmoscopy than with conventional lenses. The great advantage of the multifocal implant is the good near visual acuity without additional correction.

The 3M multifocal IOL was implanted in 16 eyes of 12 patients; four patients received a bilateral 3M multifocal IOL implant. The patients ranged in age from 39 to 86 years (mean 73 years). The length of follow-up ranged from three to 16 weeks (mean seven weeks).

All the patients in our study group underwent an extracapsular cataract extraction with IOL implantation according to the envelope technique, except for one patient who had a secondary IOL implantation (in the sulcus ciliaris) after a previous extracapsular lens extraction for a traumatic cataract.

The 3M multifocal IOL is an entirely polymethyl methacrylate (PMMA) lens. It creates near and far vision through the use of precision diffractive optics rather than relying on conventional refractive optics alone.¹

This bifocal vision is realised by the design of the 3M IOL, which consists of a diffractive microstructure superimposed on the posterior surface of a conventional lens. This micro-

Figure 2 'Simultaneous vision' imaging with an IOL which has two powers: (a) distant vision; (b) near vision.

structure is composed of a series of concentric sloped rings which diffract light in a specific way to create two foci (Fig 1).

The base power of the lens (distance focus) is equivalent to that of a conventional lens of the same dioptric power (Fig 2). The 'add-' power (near focus) is provided by the correct diffractive microstructure on the posterior surface.

Results

For each case we studied several parameters and compared the results with those from 16 monofocal lenses implanted on the same day by the same surgeon and thus with exactly the same postoperative follow-up. These parameters included refraction, visual acuity, glare testing, slit-lamp examination, and near vision.

Figure 1 The 3M diffractive bifocal lens.

Figure 3 Postoperative refraction in spherical equivalents of the multifocal cases.

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Figure 4 Evolution of the postoperative visual acuity.

The 'final' postoperative refraction noted in spherical equivalents was in the slightly myopic range for most of the cases. The histogram on Figure 3 represents the refraction distribution of the multifocal cases. It was exactly superposable on the monofocal distribution with the exception of one isolated case of high myopia, which was unexpected and not planned. A slight postoperative myopia is an acceptable result when using monofocal lenses; with multifocal lenses, however, the goal is emmetropia.

When comparing the evolution of the postoperative visual acuity between the two groups (Fig 4), we found that during the first weeks this visual acuity was a little lower for the multifocal cases. But after a period of seven weeks one can see the two curves joining each other. At that time the visual acuity was almost similar for both groups. This phenomenon is not of major importance on a long term basis, though it induces a lower degree of initial postoperative satisfaction.

We also studied the glare phenomenon (Fig 5), but only for the multifocal lenses. With the 'Brightness acuity tester' there was a slight decrease in visual acuity during the first postoperative weeks. But from the eighth week on we found that glare was no longer a problem. One patient, however, continued to mention glare spontaneously in the longer term.

By slit-lamp examination a surprisingly high frequency of posterior synechiae was found. This phenomenon is probably due to the configuration of this type of lens, especially to its higher anterior convexity. The anterior capsule

Figure 5 Influence of glare on the visual acuity for the multifocal cases. BAT = brightness acuity tester.

NEAR VISION

Figure 6 Efficiency of the near focus of the multifocal IOL.

is compressed between the iris and lens, which favours the formation of synechiae. The postoperative amount of flare and number of cells in the anterior chamber was comparable in both groups after four weeks of follow-up.

A longer follow-up period is certainly necessary to evaluate whether the irregular surface of this lens induces inflammatory reactions in the longer term.

The main advantage of this lens is undoubtedly the near vision (Fig 6). Most of the patients ('Snellen 1 without addition') could read the smallest text of the Snellen chart, and this by using their correction for far vision. The second group of patients ('Others') could not read the smallest text, probably owing to a slight cystoid macular oedema. To verify if these patients will ultimately succeed in reading Snellen 1 a longer follow-up period is necessary.

The third group of patients ('Snellen 1 with addition') could read the smallest text, but only with additional correction for near vision. These patients have probably not yet succeeded in finding the use of their near focus. Patients with a multifocal IOL presumably need an adaptation period, which might last a few months, before they discover the optimal use of their two foci.²

As an illustration of the use of these two foci, Figure 7 shows two automatic perimetries of the same patient with a multifocal IOL and an emmetropic postoperative refraction. The perimetry shown in Figure 7A was performed without a corrective glass. The patient used his focus for near vision. During the perimetry shown in Figure 7B a corrective glass of 2.5 dioptres was used; here the patient used his focus for far vision. The deficits can be perfectly superposed. This example indicates that this patient could switch, unconsciously and with great ease, from the use of far focus to near focus – and with a comparable visual result.

Discussion

We compared 16 eyes which underwent a multifocal IOL implantation with 16 eyes with a monofocal implant. Several parameters were studied. The average postoperative refraction was in the slightly myopic range in both groups. This was less desirable for the multifocal implants, where the aim is emmetropia. Lens calculation methods will have to be refined to obtain a higher number of emmetropic cases.³

Figure 7A

Figure 7 Automatic perimetry (A) without and (B) with the use of a near addition of the same patient with a multifocal IOL. The nasal visual field defect is due to a retinoschisis.

In the multifocal group we found a lower initial visual acuity than in the monofocal group. The occurrence of posterior synechiae was much more frequent with the multifocal lenses, probably owing to a greater anterior convexity of these lenses. If biodegradability of intraocular lenses should become a problem for some patients in the longer term, it will certainly become so for

this type of multifocal IOL because of its much larger PMMA surface.

The great advantage of the 3M multifocal IOL is the ability of the patient to use near vision without additional correction. Most patients succeeded in doing this soon after operation. This feature is probably more appreciated by younger patients, who are still working, than by

CENTRAL 30 - 2 THRESHOLD TEST

NAME M. BIRTHDATE 22-09-11 DATE 04-04-89

STIMULUS III, WHITE, BCKND 31.5 ASB BLIND SPOT CHECK SIZE III FIXATION TARGET CENTRAL ID TIME 09:58:53

STRATEGY FULL THRESHOLD RX USED DS+2.5 DCX DEG PUPIL DIAMETER VA

Figure 7B

older, inactive patients.⁴ The fact that this advantage might influence the indication for IOL implantation (implanting an IOL at the presbyopic age with almost no cataract or none at all) will probably be a matter for debate in future. A parameter we did not study is the contrast sensitivity. The study of Olsen and Corydon⁵ indicates that there is a decrease in contrast sensitivity for near vision, not for distance vision,

making the near focus somewhat less efficient than the far focus.

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