

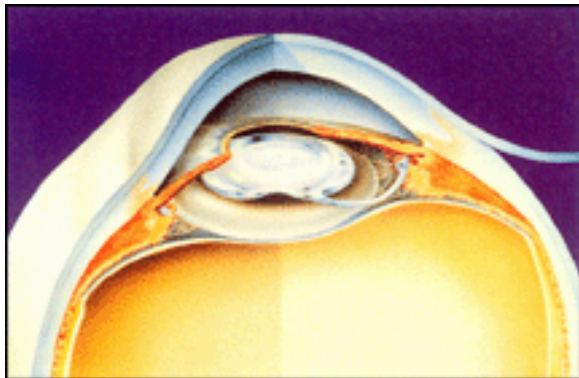
## Correction of High Myopia with Precrystalline Posterior Chamber IOL, Respecting the Transparent Lens and Accommodation

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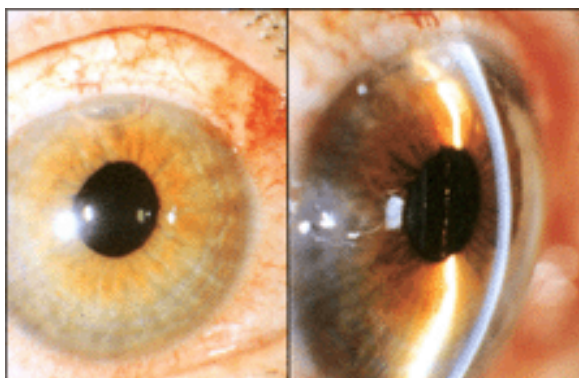
We are going to discuss the implantation of a **precrystalline IOL**, in front of the transparent lens, behind the iris, for correction of high myopia. The focus of the myopic eye is excessively short, which means that the images are seen out of focus. An adequate negative lens placed in the posterior chamber (Fig.1), projects the image correctly on the macula. This idea occurred to us after having seen some cases with a Fjedorov lens, which does not produce anatomic lesions of the crystalline lens but the optic results are poor, the same as with the lens described by Fechner. Both are posterior chamber lenses.

With Messrs. Corneal W.K. we designed a precrystalline lens, supported in the sulcus. It is made of polymethylmethacrylate, the anterior surface is slightly convex and the curvature of the posterior surface contains the refractive correction of the myopia. Contact with the crystalline lens is limited to two peripheral areas in the 6 mm. diameter. The haptics are supported in the sulcus. Fig.1 shows the lens in place, supported in the sulcus and the two areas of contact with the crystalline lens in the superior and the inferior third of the lens. There is adequate circulation of aqueous humor between the anterior face of the crystalline lens and the IOL through two communication channels.

We are going to see a video of a young patient, 32 years old, with bad tolerance of contact lenses. Intolerance of the contact lens had produced pannus and whitish infiltrations between the epithelium and Bowman's membrane. Astigmatism was 1.12 D, but with -26 D. With a correction of -26 D the patient could see 20/100, Jaeger n° 1. The video shows the implantation of a precrystalline lens with adequate optic correction.



*Fig. 1 Precrystalline lens located in the posterior chamber; behind the iris, in front of the crystalline lens and centered with the pupil. The flexible haptics are supported in the sulcus. Contact with the anterior lens capsule is limited to the superior third and to the inferior third of the 6 mm central circumference.*



*Fig. 2 RE of a myopic patient (-26 D, poor tolerance of contact lenses) two days after the implantation of a precrystalline IOL. TG = 10 mmHg. Tyndallometry 76.6, flare. VA without additional correction 20/100. Astigmatism with the rule -4.42 D.*

**(Commented video projection)** The fornix-based conjunctival flap has already been prepared and sutured to the surgical drape to prevent contact of the instruments and/or the IOL with the eyelashes. The nodules, which were due to prolonged contact lens wear, are removed with a disposable Desmarres scarifier avoiding damage to Bowman's membrane.

A non-penetrating groove, 0-4 to 0.5 mm in depth, is prepared at the limbus. At this level the total thickness is about 1 mm. Fortunately in this case the incision is completed without perforation.

A beveled corneal paracentesis is performed, avoiding the pannus. In this case there is no bleeding from the pannus but in some cases this happened. The pupil has been dilated with cycloplegics, phenylephrine, tropicamide and Voltaren. Mannitol has been applied to induce maximum ocular hypotony. Healon has been injected into the anterior chamber and a horizontal incision is performed with a disposable keratome to obtain a two-plane incision. The incision is continued with Jose I Barraquer's scissors, originally designed for intracapsular cataract surgery but which has proved to have multiple applications in ocular microsurgery.

Some Healon escapes but there is still enough viscoelastic left to maintain the anterior chamber depth and applanation does not occur. A -25 D lens is applied, the negative power is clearly appreciated in the video. The corneal lip of the incision is carefully mobilized with the traction suture and the lens is introduced as parallel as possible to the iris plane to avoid damage to the crystalline lens. There is some Healon between the crystalline lens and the IOL and between the IOL and the cornea. Introducing the

superior haptic, damage to the crystalline lens must be carefully avoided. With a blunt-pointed forceps the superior haptic is finally pushed behind the iris and centered with a Sinsky hook.

Two weeks previously two peripheral iridotomies had been performed with the Nd:YAG laser, to prevent pupillary block. A suture is placed, irrigation with 1% acetylcholine solution is performed and more Healon is introduced into the anterior chamber. The pupil constricts in front of the lens and the IOL is left centered with the pupil. Soon the pupil has constricted and once the wound closure has been completed, the anterior chamber is of normal depth, the pupil is round and central and the result is very satisfactory (end of video projection).

Fig. 2 shows the result of the case shown in the video, on the second postoperative day. The IOL is very clear, the cornea transparent and the wound hermetically closed. The sutures induced astigmatism with the rule of 4.42 D because of the traction exerted, but this is necessary in the early postoperative course to guarantee good coaptation. Nine days postoperatively the eye continued in perfect conditions from the biomicroscopic point of view. The posterior surface remained perfectly well separated from the anterior lens capsule. The astigmatism had already decreased to 3.53 D nine days postoperatively.

Fig. 3 shows the result 40 days after the operation. Everything is in perfect conditions and the astigmatism has decreased to 0.66 with the rule (Fig. 4). This confirms that the high astigmatism in the early postoperative course is due to the suture and will decrease when the suture loosens in the late postoperative course. If not, three months postoperatively some nylon sutures may be cut to decrease or eliminate the astigmatism.

The result in this case, as in the majority of these cases, shows that if preoperatively the patient had a visual acuity of 20/100 with a correction of -26, one year after the operation the visual acuity is 20/40 without correction. With correction of 0.75 D of astigmatism the vision is 20/30, Jaeger n° 1. This confirms that although this is a relatively new method and our experience is limited, it represents an alternative to be taken into account in the management of high myopia from -10 to -30 D.

In the first series there were some complications inherent to the first generation of lenses (for this reason we developed a second and a third generation). Fig. 5 shows the eye of a Russian singer, living in Moscow, who had -13.50 D of myopia. In December 1995 I implanted a precrystalline IOL. Fig. 5a shows the result a few days after the operation. The patient was very satisfied. VA was 15/25 without additional correction and 20/25 with correction of astigmatism. The patient was happy with her uncorrected visual acuity of 15/25 and did not want to use glasses.

The patient returned to Moscow and after two months she informed us that her far vision was decreasing. When she returned to Barcelona we found the following problem: Fig. 5b shows the lens in place but there is no intermediate space between the IOL and the crystalline lens. The anterior lens capsule was in contact with the posterior face of the IOL (first generation) producing myopia. Thus, three months after

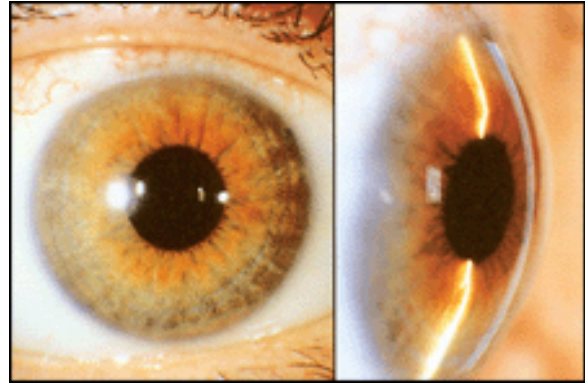


Fig. 3 The same eye 40 days after the operation. TG = 13 mmHg. Tyndallometry 14.7, VA without additional correction 20/40, +5 Jaeger n° 1.

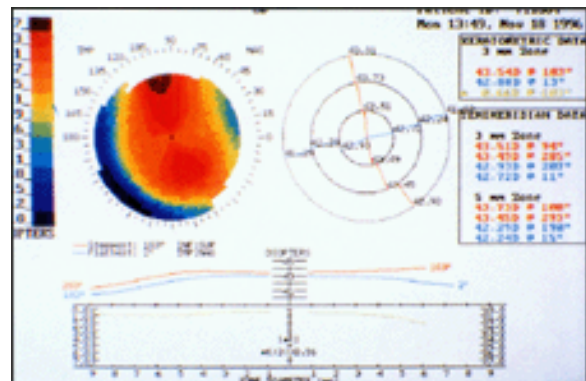


Fig. 4 Astigmatism with the rule -0.66 D.

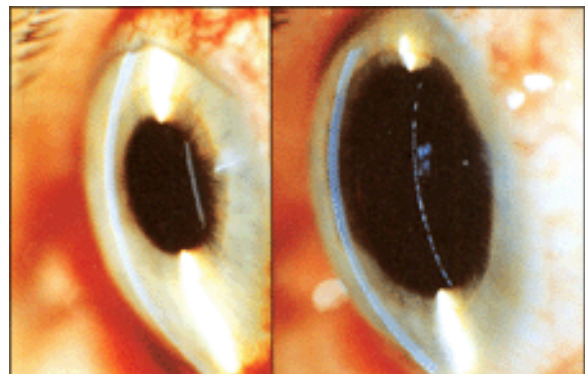


Fig. 5 (a) Good early result of precrystalline lens implantation (first generation) in a myopic eye (-13.50 D). (b) Contact of the anterior lens capsule with the IOL, two and a half months after implantation: vacuum effect. Myopisation of -4.00 D.

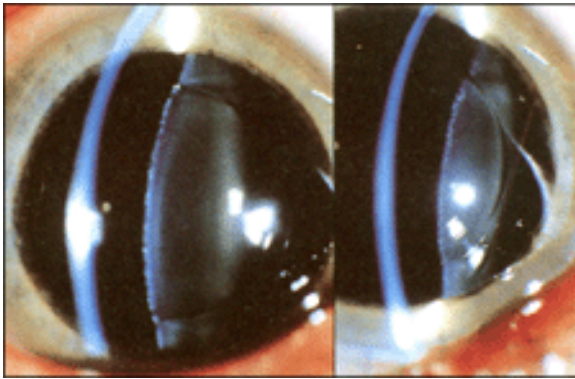


Fig. 6 Pseudo-exfoliation appearance of the contact area.

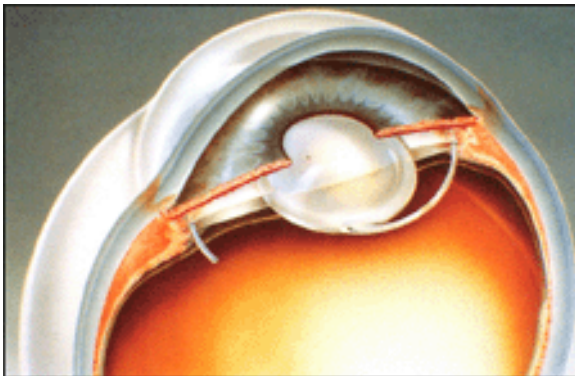


Fig.7 Extracapsular lens extraction and implantation of a classic posterior chamber IOL (Perlens 2, +10).

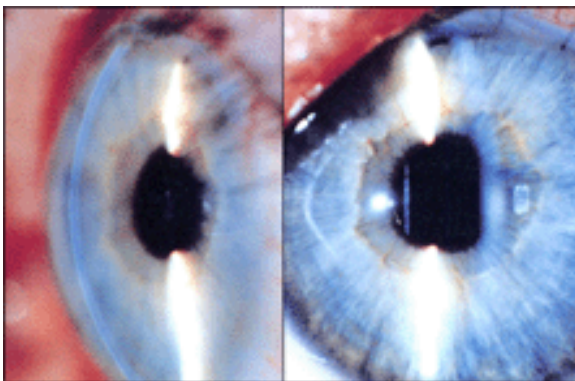


Fig. 8 Final result. VA without additional correction 20/70, with  $10^\circ - 2.75 - 2 = 20/20$ , +s Jaeger n° 1.

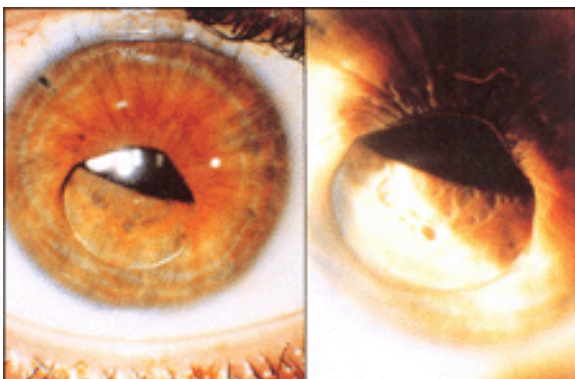


Fig. 9 (a) and (b) Capture of the precrystalline lens by the pupil, due to spontaneous mydriasis. The iridotomy performed with the Nd-YAG laser, two weeks before the inclusion of the precrystalline lens, is clearly seen.

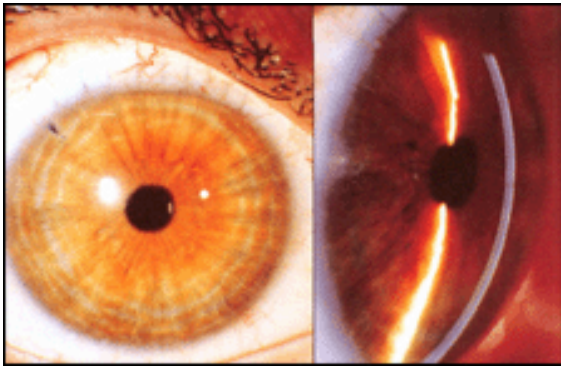
the operation, the refraction of the eye had changed again from emmetropia to four diopters of myopia. The visual acuity was good, but a correction of -4.00 D was necessary.

Fig. 6 shows the vacuum effect and signs of capsular pseudo-exfoliation are observed in the area of contact of the anterior lens capsule and the posterior surface of the IOL.

What could be done to resolve this case? We decided to remove the IOL and the crystalline lens. Extracapsular extraction was performed as in any routine cataract case with implantation of a conventional IOL (+10 D) (Fig. 7). Fig. 8 shows the final result. The visual acuity is 20/20 with a correction of -2.75 of astigmatism and -2.00 of myopia. Without correction her vision is 20/70, but she is happy because what she wanted was sufficient distant vision without glasses. Being a singer her residual myopia permits her to read perfectly her partituras. She is also able to read at normal distance without correction for near vision. Therefore, fortunately, the complication caused by the "vacuum effect" may be considered a minor complication which can be managed satisfactorily.

To prevent the complications produced by the "vacuum effect" a second generation of lenses was designed with improved communication of the intermediate space between the posterior face of the IOL and the anterior lens capsule. Two lateral grooves ensure adequate circulation of aqueous between the IOL and the anterior surface of the crystalline lens into the posterior chamber.

Fig. 9 illustrates a complication observed principally with the second generation of lenses. This was a case of high myopia (-14.50 D), the anterior chamber was deep. Two peripheral iridotomies had been performed previously with the Nd:YAG laser. The eye was perfect four days after the implantation of a -17 D precrystalline lens. The anterior surface of the IOL was in contact with the iris, as in all these cases. The posterior surface of the IOL was seen to be well separated from the anterior lens capsule. Consequently, there was no risk of a "vacuum effect". However, in this case, spontaneous, excessive, dilatation of the pupil, occurred rather frequently, especially at night. Thus, one day the patient presented at the Clinic with the eye in the condition shown in Fig. 9. Excessive pupillary dilatation had occurred during the night and the border of the lens was captured in the pupil when it constricted again. No other lesions of importance were observed. Treatment consisted of application of phenylephrine and tropicamide to dilate the pupil. Mannitol was applied and the patient was maintained in the supine position for several hours. After the pupil had been dilated, it was constricted with a penlight. The iris constricted in front of the rigid part of the haptics (plates) (the flexible haptics are located in the sulcus and do not change). Fig. 10 shows the result 24 hours later, with the pupil constricted. The functional result was very good ( $100^\circ -2.00 = 20/25$ , n°



*Fig. 10 Result 24 hours later, after intensive treatment with local mydriatics and osmotherapy. The lens is behind the iris. The pupil constricts with light.*

1, 20/30 without correction) one month after the intervention.

To avoid recurrence of the problem, the patient was instructed to apply one drop of pilocarpine 0.5% at 6 p.m. and another drop just before going to sleep.

Nevertheless, in some cases of capture of the precrystalline lens re-intervention has been necessary. To avoid this problem, a third generation of lenses has been designed. These have a total diameter of 14 mm (a 6 mm optic, two 1.5 mm rigid haptic plates and two flexible haptics supported in the sulcus) which prevents lens capture by the iris, even if the pupil dilates widely.

At present we have implanted 236 precrystalline lenses between July 3, 1995 and June 15, 2000 [18 of the first generation, 45 of the second generation and 173 of the third generation (superior and inferior haptic plates 0.5 mm larger than the second generation to avoid capture due to mydriasis)]. Considering our results this procedure is thought to be a valuable alternative for surgical correction of high myopia (-10 to -30 D), preserving the transparent lens and accommodation and improving the quality of vision and life of the myopic patient.