A Brief History of Ocular Implantology

November 29, 1949, is date that many of us consider to be paradigmatic as regards a profound change in ophthalmology: on that date, Sir Harold Ridley implanted the first intraocular lens to replace a cataractous crystalline lens. Since then, more than 120 million lenses have been implanted worldwide. In little over 65 years only, intraocular lenses have changed and revolutionized the most frequently performed surgery, not only in ophthalmology, but in any field of medicine. The extraction of the human crystalline lens and its replacement by an implant designed and manufactured by man, viewed from the perspective of years, is undoubtedly one of those milestones that have really overturned a paradigm established centuries earlier.

The first intraocular lens implanted all those years ago was a biconvex lens made of a biocompatible material, with a diameter of 8.35 mm and a central thickness of 2.44 mm[1]. Ridley suspected that polymethyl-methacrylate (PMMA) might be well tolerated, after he observed its "inoffensive" nature in fragments of cockpit canopies that had been lodged in the eyes of some war pilots for years. This posterior chamber lens was not used for very long however, and soon after, in the 1950s, it was ousted by angle supported anterior chamber lenses[2]. These were not well tolerated because of the endothelial damage that they generated, and were eventually succeeded by iris-supported lenses (Worst lenses). Meanwhile, in the 1960s, Charles Kelman was already working with the idea of destroying the cataractous crystalline lens by emitting ultrasounds within the eye[3], in order to minimize the size of the large incision required for extraction of the crystalline lens, thereby reducing the risk of developing high astigmatism. Thus we come to the 1980s, where, with the return to the belief that the best position to implant a lens is in the capsular bag, it was assumed that this should be the natural, definitive site to place the material that would substitute an opaque crystalline lens. From then on, work commenced to improve the materials used in posterior chamber monofocal lenses: PMMA, hydrophilic coating, hydrophobic coating, mixtures of both, PMMA haptics, monoblock lenses, rigid and then foldable lenses, "anti-capsule opacity", surfaces to compensate asphericity and to obtain an ocular diopter with zero asphericity, toricity… and almost astounding stability and biocompatibility (albeit with exceptions, as in any field in technological development). In parallel, investigators continued to "think" (despite no verifiable practical results) about a solution for the loss of accommodation that occurred on exchanging the natural lens for a device that was unable to accommodate[4].

The final stage in this march towards achieving a state similar to the "natural" one upon replacing the crystalline lens (achieving emmetropia in distance vision and spectacle independence for near vision) commenced years ago with the emergence of refractive and accommodative multifocal lenses and, as almost the last step, diffractive lenses. The latter did not enter into widespread use until the late 2000s[5], and although widely accepted for years, there was a "catch": they were pupil dependent and limited to use in patients with spherical refractive defects.

Then, just when we thought that little could be improved, diffractive, toric lenses appeared "unsurpassable" but there were still patients who complained of not seeing well at certain distances.

In this unstoppable technological progress, the intermediate distance had been forgotten (since nowadays, the world functions in many of its aspects with devices that make us work at that "imprecise" distance that is "neither far, nor near"). To overcome this penultimate (?)

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obstacle, what many believe to be the greatest breakthrough in intraocular multifocality to date was developed[7], true multifocality that spans all the distances: trifocal lens. Today these are considered the final technological step, although recent studies report imperfections, such as reduced distance visual quality and increased halos[8].

The relentless quest to reproduce the naturalness of the crystalline lens and the precise accommodation of the ciliary muscle has made us discard any lens with limitations, which then inspire the design of subsequent devices. Although we have introduced new lenses in this exciting yet frustrating road, we have not dared to completely discard some of the ideas that were used in its infancy: in-the-bag positioning and monofocality for patients with other eye defects continue to be valid of course.

All these technological advances and developments have led us to increasingly consider lens surgery as a complete refractive solution for patients over 45-50 years of age with refractive defects in their distance vision.

We do not know whether the future will give a nod to the lenses already in use, or on the contrary it will disconcert us with the introduction of new materials or ideas that will shift the current paradigm from a definitive solution to refractive defects and the problems of presbyopia, but there is no doubt that non-conformity and the quest for perfection will continue to be the common thread that guides our steps, as it has been for more than six decades. And as usual, our "successors" in this world of ophthalmology will be amazed at how daring we were a few decades earlier.

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