

# Why Did We Abandon the Can-Opener Capsulotomy?

An explanation regarding why surgeons transitioned from this technique to the continuous curvilinear capsulorhexis.

BY DAVID J. APPLE, MD

In 1754, Jacques Daviel, MD, originated the extracapsular cataract extraction procedure and provided, for the first time, a cataract removal technique that spared surgeons and patients from the perils and complications of the ancient couching technique.<sup>1</sup> The latter technique was, of course, laden with complications such as hemorrhage, inflammation, and infection. Dr. Daviel's procedure permitted for the first time an extraction of the crystalline lens as opposed to pushing the lens into the interior of the eye.

## A BRIEF HISTORY

### Residual Peripheral Tears

From Daviel's time until the mid-20th century, the anterior capsular opening (anterior capsulotomy) maneuvers, including the can-opener procedure, consisted of procedures where one or more jagged residual peripheral tears were left. Whenever such a tear exists there is a high likelihood that the tear(s) would extend to the periphery toward and even around the equator. Therefore, the diameter and shape of the capsular opening are not well controlled.

### Lack of Equatorial Support

In the 1940s, when Sir Harold Ridley invented the IOL he used an extracapsular cataract extraction procedure

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pioneered by the Austrian ophthalmologist, Anton Elschmig, MD.<sup>1</sup> This technique was not unlike the can-opener procedure, but the diameter of the capsulotomy orifice was much greater. Elschmig's procedure was characterized by a very large opening, and it also left numerous tears extending into the equator, so that not only was the entire anterior capsule removed, but some of the equatorial capsule was torn away. Ridley intended his lenses to be inserted into the capsular bag. In many instances, however, this was not possible because little or no equatorial support was left that could tightly sequester the lens periphery into the bag. His implants were actually most commonly on-the-bag, rather than in-the-bag as we know it. It is well known that the most common complication Ridley had to handle was an inferior decentration (sunset syndrome). Most au-

thorities have attributed this dilemma to the excess weight of the implant, which was only partially true. The lack of capsular support at the equator was equally or even more important than the IOL's weight in the pathogenesis of this problem.

## Attempts to Securely Fixate the IOL

By the 1970s and 1980s, surgeons were still searching for a better way to achieve high-quality symmetrical fixation of the IOLs' haptics, initially attempting ciliary sulcus fixation. Many soon realized the disadvantages of this type of fixation as compared with fully sequestering the pseudophacos in the capsular bag.<sup>2-4</sup> They therefore began to change to a goal of achieving in-the-bag fixation. Although the trend towards in-the-bag fixation was a step in the right direction, most surgeons still continued with the can-opener capsulotomy technique.

“The invention of the continuous curvilinear capsulorhexis provided for the first time a means of avoiding capsular tears.”

It soon became clear that most in-the-bag lenses did not end up in the capsule as planned. Rather most were situated with one haptic in and one haptic out of the bag, almost invariably causing an unwanted IOL decentration.<sup>4</sup> This was noted clinically by many surgeons at that time and we confirmed this in our pathological studies. By the mid-1980s, only 30% of IOLs were actually situated in the bag, 10% were in the ciliary sulcus, and 60% were situated asymmetrically although most surgeons attempted a more accurate surgical result. Usually, the lens would be centered upward (sunrise syndrome) because the superior haptic would generally end up in the soft tissues of the ciliary sulcus, whereas the inferior (ie, trailing) haptic would end up in the inferior capsular fornix.

At first, many surgeons feared that the quality of their surgery was poor, leading to the high incidence of such unwanted asymmetric fixations. I recall that many were genuinely distressed, believing that they could not successfully localize the haptics of the lens where they intended. Their distress was compounded by their need to deal with subsequent decentrations that followed. Young residents in training today cannot imagine what a problem this was, especially during

the nascent years of flexible PC-IOLs between 1977 to 1985.

Scientific analysis gradually made it clear that the problem was not surgeons' "miss-aiming" of the haptics, but rather the so-called "pea-podding" effect in which, in many cases, a lens haptic initially implanted correctly within the bag would spring out via a capsular rent at the peripheral jagged edge characteristic of the can-opener.

## THE INVENTION OF THE CAPSULORHEXIS

The invention of the continuous curvilinear capsulorhexis (CCC) by Thomas Neuhann, MD, of Munich, Germany, and Howard Gimbel, MD, of Alberta, Canada, (there were early possible mentions of this technique by two surgeons, Drs. Stein and Fercho) provided for the first time a means of avoiding capsular tears, which is the main reason that the CCC became the procedure of choice. As the CCC was adopted throughout the 1980s and 1990s, this in turn, decreased the incidence of many cases of tear-induced decentration that presented as a result of pea-podding that was so common in the era of the can-opener.

I was involved in running wet labs for surgeons in the early years when CCC was being introduced around 1984. One not only had to teach the technique but also justify it. In these labs and lectures, I discerned that it was sometimes difficult for surgeons to perceive its advantages by simply providing a didactic presentation without an accompanying demonstration. I found one means of demonstrating its safety and efficacy using what I have termed the "story of the peanut bag."

All of us have sometimes noted the difficulty in opening an airline-provided sealed peanut bag in the absence of a pre-cut tear in the bag's periphery. In sharp contrast, when such preformed tears are present, it is easy to extend the tear and open the bag. This extension of the tear in the peanut bag is analogous to the extension of a radial tear.

During this period a major American airline went out of business. I remember vividly that their peanut bags had no preformed tears. Thus, it was easy to joke that their lack of an appropriate preformed tear with subsequent difficulty in opening peanut bags might have been one reason for the company's demise. Of course, there was no relationship to the airline's financial misfortunes and the peanut bags, but this fable helped me demonstrate to surgeons during the early years of the CCC the pathophysiology and potential

negative implications of having or not having a preformed tear. Some of the best scientific studies on the pathophysiology of the CCC were performed by Assia et al.<sup>5</sup> In clinical surgery, of course, any radial tear is analogous to the preformed tear of the peanut bag, whereas the smooth edge of the CCC is analogous to the peanut bag that is difficult to open in the absence of the preformed tear.

Why mention this nonsensical story of the peanut bag? This tale is by no means just a historical vignette. We still use it today to help explain this technique to patients or lay individuals—especially to preoperative patients who are interested but have difficulty in understanding the intricacies of this stage of the procedure.

How can we be sure that the CCC technique works so well? One has to simply ask our young residents-in-training today if they have ever seen or heard of the pea-podding phenomenon. The CCC has almost made this complication an issue of the past!

## CONCLUSION

In summary, the reason that surgeons transitioned away from the can-opener capsulotomy was to solve a problem, difficult to comprehend and solve in those early years, but very simple as viewed now in retrospect with 20/20 hindsight. The almost total eradication of the complication of pea-podding by the introduction of the CCC represented one more critical step in our move to today's modern cataract/IOL operation. The capsulorhexis is one of several techniques and devices such as hydrodissection and phacoemulsification that have made modern small-incision cataract/IOL surgery the wonderful procedure that benefits our patients today. ■

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