Reasons for intrastromal corneal ring segment explantation

In their recent article, Ferrer et al. report that 57 of 250 implanted intrastromal corneal ring segments (ICRS) had to be explanted—a rate of 22.8%. The main cause of this very high explantation rate was extrusion (48.3%).

There are 2 major causes of ICRS extrusion: (1) superficial implantation of a segment and (2) a segment that is placed too close to the incision. As a general rule, the thickness of the implanted ICRS should not be more than 50% of the corneal thickness in the ring track. Moreover, the incision depth should preferentially be set at 80% of the corneal thickness. Deeply located ICRS produce better results and also leave a greater amount of corneal stroma between the ICRS and the corneal epithelium, which could theoretically protect from extrusion related to progressive stromal thinning. Only rarely does an extrusion begin in the middle of the segment or far from the incision. An ICRS that is placed close to the incision, especially if implanted superficially, predisposes to adjacent corneal thinning and melting and subsequent extrusion.

As our knowledge about the corneal response to ICRS implantation has evolved, we now implant thinner segments to achieve the same or better results than in the past. One of the most feared complications of ICRS implantation, ring extrusion, is now less common because we respect the pachymetry rule.

We do not believe that the inflammatory cells and cell debris found in cases of extrusion are the cause but rather the consequence of the extrusion. The progressive epithelial and stromal thinning can lead to segment exposure, which in turn can lead to a local inflammatory reaction, triggering corneal melting around the segment, with consequent extrusion.

It would be important to know the device used to measure the corneal pachymetry in Ferrer et al.’s study as there are differences among the most commonly used devices. The explanted ring thickness and ring track pachymetry should also be described to clarify the relationship between ring extrusion and corneal thickness.

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REFERENCES

REPLY: Although the incidence of ICRS explantation is an interesting question, these data are beyond the scope of our work. The goal of our study was not to know the explantation rate but rather to know the main cause of explantation in the first 9 years of segment implantation and correlate it with pathological findings. Because of the comments of Torquetti and Ferrara, we would like to emphasize that an explantation rate of 22.8% in 9 years is not very high if you consider that this period included all ICRS implantation cases performed in our clinic since the first one. This involved the clinicians’ learning curve, obsolete implantation techniques, the first ring models, the first measurement methods, and the lack of a standard nomogram for the implantations. In addition, we are a referral center and difficult cases from other centers are sent to us; this affected the explantation rate. Nine years is a long period of time and as time passes, the probability of explantation increases. How many segments implanted in 2000 remain in the patient?

Regarding the extrusion cases, slightly less than half the explanted segments were due to extrusion (48.3%); therefore, approximately 10% of the segments implanted over 9 years were explanted because of extrusion. This group includes the segments that were too close to the incision or positioned superficially and those that extruded because of corneal thinning (advanced keratoconus). Table 3 of our article shows that the time from implantation to explantation ranged from 0.1 to 82.0 months. It is normal to assume that a longer implantation-to-explantation time (years) was caused by stromal thinning over time and a shorter time was due to incorrect positioning. In all cases, the pachymetry rules were respected.

Although we have reread our article twice, we cannot find any place in which we said the inflammatory cells were the cause of extrusion. However, there is a paragraph in the discussion section (page 975) in which we commented on how the inflammatory response is triggered in the extrusion process.