Architecture of Clear Corneal Incisions Demonstrated by Optical Coherence Tomography (OCT)

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The role of unsutured clear corneal incisions for cataract surgery in the apparent increased incidence of post-operative endophthalmitis is under intense scrutiny and the literature is not conclusive.[2-9]

Clear corneal incisions, which involve an incision in the plane of the cornea with a length equal to 2.0mm, were first described in 1992[10] and we continue to construct them in essentially the same manner in our practice. In 1992, the incisions were as wide as 4.0mm, but more recently the maximum width is 3.5 – 3.8mm, if not sutured. **Figure 1** shows an artist's view of what the profile of clear corneal incisions were thought to look like. Part A shows the single plane incision and its apparent inherent lack of stability as one surface can easily slide over another. Charles Williamson, MD, from Baton Rouge, innovated an alteration of that incision which involves a shallow, perpendicular groove prior to incising the cornea into the anterior chamber (Part B). David Langerman, MD, deepened the perpendicular groove with the belief that it lead to greater stability (Part C). These grooved incisions have been abandoned by the authors in favor of a paracentesis-style incision due to gaping of the groove and the difficulties associated with persistent foreign body sensation and the pooling of mucus and debris in the gaping groove. More importantly, the grooved incisions represent a disruption in the fluid barrier that intact epithelium creates, which allows for a vacuum seal as a result of endothelial pumping.

That artist's view of these incisions has perpetuated until today, as we see in **Figure 2**[11], which has a similar architecture to the drawing in Figure 1, with the explanation of how these incisions open as a result of hypotony. In actual fact, since pressure within a fluid acts perpendicular to all surfaces, there would be a greater amount of pressure lifting the roof of the incision off the floor of the incision under conditions of eye pressure than the smaller area against which intraocular pressure would be pushing to help close the incision. However, as we will see, this view of the incision architecture is erroneous, with respect to our clear corneal incisions.

The initial incision construction technique began with a blade applanated to the surface of the globe, with the point at the edge of the clear cornea; the blade advanced for 2.0mm into the cornea before incising Descemet's membrane (**Figure 3**). These early incisions were made with knives with straight sides; however, these were subsequently replaced by trapezoidal-shaped knives in order to be able to enlarge the incision without violating the

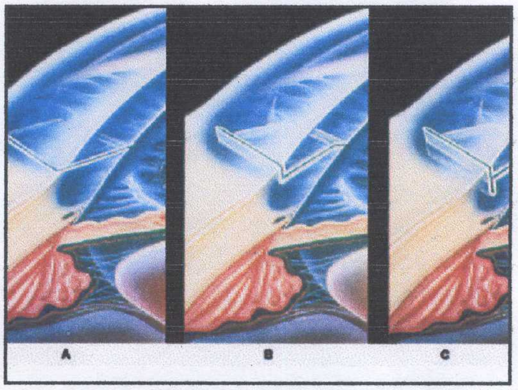

Figure1: Artist's interpretation of cross section view of clear corneal incisions circa 1992.

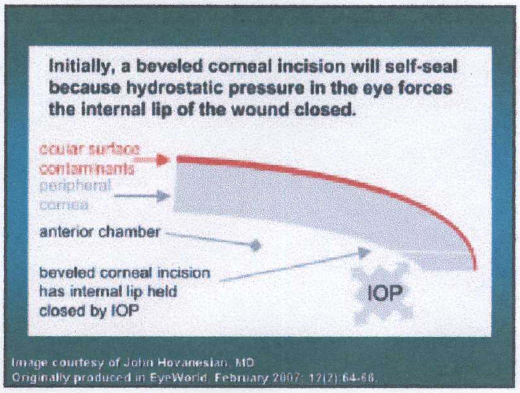

Figure 2: Another artistic interpretation of cross section view of clear corneal incisions.

architecture by cutting sideways. From the onset of the use of clear corneal incisions, stromal hydration of the incisions, which thickens the cornea, forcing the roof of the incision onto the floor of the incision and facilitating endothelial pumping to the upper reaches of the cornea, was strongly advocated. Testing the seal of the incision with a Seidel test using fluorescein was also strongly advocated. These practices have not changed since 1992, except for eliminating the depression of the posterior lip of the incision.

We examined the profile of clear corneal incisions using the Zeiss Visante Optical Coherence Tomography (OCT) anterior segment imaging system. This technology has allowed the first view of the clear corneal incision in the living eye in the early postoperative period. All previous views were in autopsy eyes sectioned through the incision, which introduces artifacts. **Figure 4** shows an example of the corneal periphery in a control eye which includes the anterior chamber angle. The regularity of the corneal