

The Stromal Hydration of Clear Corneal Incisions

Is the benefit real or imaginary?

BY ABHAY R. VASAVADA, MS, FRCS; MAMIDIPUDI R. PRAVEEN, DOMS;
DEVARSHI U. GAJJAR, PHD; AND DEEPAK PANDITA, MS

Dr. Vasavada regularly performs stromal hydration, at both the clear corneal temporal incision and paracentesis, as part of his strategy for sealing the wound after cataract surgery. Further, he has found stromal hydration to be a useful adjunct in clear corneal cataract surgery, because it allows the adequate approximation of the anterior and posterior aspects of the corneal tunnel.

Today, surgeons perform stromal hydration to enhance the sealing of the wound and thus preclude the need for sutures. The stromal hydration of the incisions was advocated and popularized by Fine.¹ In a recent study, he and his colleagues used anterior segment optical coherence tomography to evaluate the profiles of the clear corneal incision's construction and architecture. They found persistent stromal swelling from stromal hydration, even on the first postoperative day.² Furthermore, Wong found that stromal hydration assists in securing clear corneal incisions, thereby helping to prevent endophthalmitis.³

Some critics of clear corneal incisions maintain that stromal hydration is detrimental to structural integrity. This assertion presumes that the endothelial pump has no effect on stromal hydration.

We decided to investigate whether hydrating the corneal stromal incision has

any impact on the ingress of fluid from the ocular surface into the anterior chamber. This article summarizes our findings.

METHODOLOGY

We prospectively randomized 80 consecutive patients undergoing phacoemulsification to an evaluation of the self-sealing property of the corneal incision in response to stromal hydration. For this trial, we used 0.0125% trypan blue

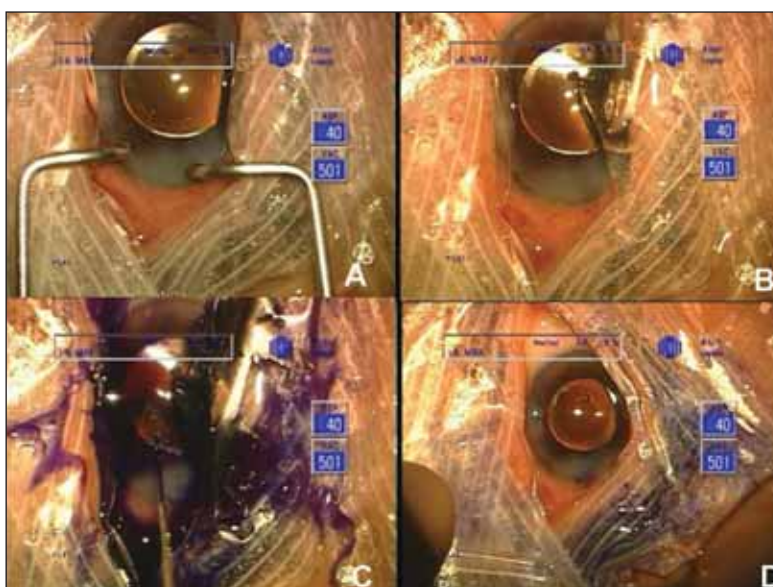


Figure 1. The surgeon removes the speculum from the eye (A) and instills trypan blue (B, C). Two minutes later, he performs gentle irrigation with BSS Plus (D).

solution as a tracer for quantifying the ingress of fluid from the ocular surface into the anterior chamber, and we measured the optical density of the dye in the fluid aspirated from the anterior chamber. We performed micro-coaxial phacoemulsification by creating two clear corneal paracentesis incisions of 1 mm and a single-plane temporal clear corneal tunnel of 2.2 mm with an internal entry of at least 1.5 mm. We measured the internal entry with specially designed calipers. If it were less than 1.5 mm, we excluded the eye from the study. We used standardized surgical techniques with the Infiniti Vision System (Alcon Laboratories, Forth Worth, TX). Immediately after completing the cataract procedure, we randomly assigned the eyes to group 1 or 2. For group 1, we gently irrigated the main incision, including the stroma of the sidewalls, with BSS Plus (Alcon Laboratories, Inc.) to facilitate the apposition of the roof and floor of the incision. We continued injecting BSS

Plus at the internal ends of the lateral walls to seal the internal entry completely. In both the groups, we removed the speculum from the eye to facilitate the application of trypan blue (0.0125%, pH = 7.39, osmotic pressure = 1.22; Shah & Shah, Calcutta, India) over the conjunctival surface with a micropipette. Patients were advised to blink voluntarily.

After 2 minutes, we gently irrigated the eyes with BSS Plus to wash the excess trypan blue from the ocular surface. Subsequently, we collected 0.1 mL of anterior chamber aspirate by means of a 27-gauge needle mounted on a tuberculin syringe and calculated the amount of dye present (Figure 1). At the end of the trial, in both groups, we sealed the paracentesis incisions along with the main incision by hydrating the stroma with BSS Plus (Figure 2).

We estimated the amount of trypan blue in the aspirate from the anterior chamber by measuring the optical densi-

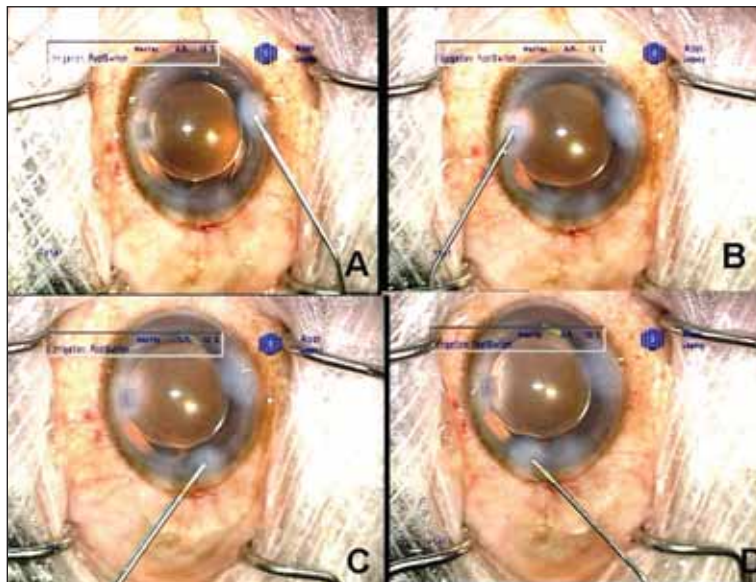


Figure 2. The surgeon performs stromal hydration with BSS Plus of the side walls of the main incision to help appose the roof and floor of the incision (A, B). He seals the two paracentesis incisions by hydrating the stroma (C, D).

ty with a UV-Visible spectrophotometer (Lambda 25; PerkinElmer, Inc., Waltham, MA). We created a standard curve at 595 nm where the maximum absorbance was found when undiluted trypan blue solution was scanned from 190 to 1,100 nm. Simultaneously, using normal saline, we created another standard curve from serial dilutions of undiluted trypan blue (0.012%) down to diluted trypan blue (1:100,000), and we measured absorbance levels at 595 nm. The samples of aspirated aqueous containing trypan blue were measured for optical density by adding 0.9 mL of normal saline to the cuvette. The optical-density values were converted into dilution factors using the standard graph mentioned earlier. The quantitative difference in the ingress between the two groups was determined by comparing the dilution factors. The dilution factor of trypan blue was converted into log values, because the values

TABLE 1. A COMPARISON OF LOGS OF DILUTION AND DILUTION FACTORS OF TRYPAN BLUE'S INGRESS INTO THE ANTERIOR CHAMBER BETWEEN THE TWO GROUPS

Group	Log of Dilution			Dilution Factor	
	N	Mean	Median	Mean	Median
Stromal hydration	40	3.125 ±0.47	3.2	1:11337±30341.45	1:1585
No stromal hydration	40	2.145 ±0.60	2.2	1:220 ±154.15	1:170
	<i>P</i> <.001			<i>P</i> <.001	

Note: Mann-Whitney U test.

were increasing and to simplify our calculations. The results were expressed as mean and median values.

OBSERVATIONS

We studied the ingress of trypan blue into the anterior chamber in both groups (Table 1). We found that it was several times lower in the eyes of group 1 (stromal hydration) versus group 2 (not hydrated). The mean log value was significantly higher for group 1, a finding indicating less penetration of trypan blue into the anterior chamber compared with that for group 2 (3.12 ± 0.48 vs 2.14 ± 0.60 , $P < .001$). Similarly, there was a statistically significant difference in the mean dilution of trypan blue in the aqueous aspirate. The higher the dilution, the lower the penetration of trypan blue into the anterior chamber ($1:11,337 \pm 30,341.46$ [group 1] vs $1:220 \pm 154.15$ [group 2], $P < .001$).

CONCLUSION

Our clinical trial is the first of its kind to demonstrate the impact of hydrating corneal incisions on the ingress of extraocular fluid into the anterior chamber during micro-coaxial phacoemulsification.⁴ We believe that hydrating these incisions may help to prevent aqueous leakage and also, to some extent, the inflow of fluid from the ocular

surface into the anterior chamber, because it restricts the ingress of small particles. In our experience, a corneal incision coupled with stromal hydration is consistently self-sealing and resistant to collapse. In some situations, when Dr. Vasavada notices any distortion or stretching of the incision or even a short internal entry (which raises questions about the integrity of the incision), he does not hesitate to place a single 10–0 Vicryl suture (Ethicon Inc., Somerville, NJ). The situations in which he has found stromal hydration most helpful are cases involving large incisions during standard coaxial phacoemulsification.

Our clinical findings provide evidence in favor of the hydration of corneal incisions after phacoemulsification. The benefits of stromal hydration are far from imaginary. ■

Devarshi U. Gajjar, PhD, is a postdoctoral fellow at Iladevi Cataract & IOL Research Centre, Raghudeep Eye Clinic, Memnagar, Ahmedabad, India. She acknowledged no financial interest in the products or companies mentioned herein.

Deepak Pandita, MS, is a research fellow at Iladevi Cataract & IOL Research Centre, Raghudeep Eye Clinic, Memnagar, Ahmedabad, India. He acknowledged no financial interest in the products or companies mentioned herein.

Mamidipudi R. Praveen, DOMS, is a junior consultant at Iladevi Cataract & IOL Research Centre, Raghudeep Eye Clinic, Memnagar, Ahmedabad, India. He acknowledged no financial interest in the products or companies mentioned herein.

Abhay R. Vasavada, MS, FRCS, is Director of the Iladevi Cataract & IOL Research Centre, Raghudeep Eye Clinic, Memnagar, Ahmedabad, India. He acknowledged no financial interest in the products or companies mentioned herein. Dr. Vasavada may be reached at + 91 79 27492303 or +91 79 27490909; icirc@abhayvasavada.com.



Freedom. See it in their eyes.SM
www.AcrvofReSTOR.com

CAUTION: ReSTOR lens materials this device to use by or on the order of a physician. **INDICATIONS:** The AcrySof ReSTOR Apollon Diffraction Optic Posterior Chamber Intraocular Lens (IOL) is intended for primary implantation for the visual correction of aphakia secondary to removal of a cataractous lens in adult patients with and without presbyopia, who desire near, intermediate and distance vision with increased spectacle independence. The lens is intended to be placed in the capsular bag. **WARNINGS:** Careful preoperative evaluation and careful clinical judgment should be used by the surgeon to decide the risk/benefit ratio before implanting a lens in a patient with any of the conditions described in the Directions for Use labeling. Some adverse reactions that have been associated with the implantation of intraocular lenses are hypopyon, intraocular infection, acute corneal decompensation, macular edema, pupillary block, retinal detachment, and secondary glaucoma (including but not limited to lens repositioning, blebby eye, vitreal detachment or patient disorientation). As a result of the multifocality, some visual effects (halos or small lines around point sources of light at night) may also be expected due to the superposition of focused and unfocused multiple images. A reduction in contrast sensitivity may also be experienced by some patients, especially in low lighting conditions such as driving at night. In order to achieve optimal visual performance with this lens, an adequate rest between eyes is advised. Patients with significant preoperative or postoperative astigmatism (4.00 diopters) will have optimal visual outcomes. Care should be taken to address IOL rotation, as lens decentration may result in a patient experiencing visual disturbances under certain lighting conditions. **PRECAUTIONS:** Do not rub eyes. Do not store over 10°C. Use only sterile handling solutions such as BSS PLUS or BSS PLUS with Intraocular Infusing Solution. Clinical studies with the AcrySof ReSTOR IOL indicate that posterior capsule opacification (PCO), when present, developed earlier in clinically significant PCO. Studies have shown that color vision discrimination is not adversely affected in individuals with the AcrySof ReSTOR IOL and normal color vision. The effect on vision of the AcrySof ReSTOR IOL in eyes with color vision defects and/or peripheral vision defects secondary to corneal disease (eg, glaucoma, keratic ringopathy, chronic keratitis) and other retinal or optic nerve disease has not been studied. The long-term effects of filtering the light and the clinical efficacy of that filtering on the retina have not been conclusively established. **ATTENTION:** Refer to the Physician Labeling, Directions for Use for complete labeling of indications, contraindications, and precautions.



1. Fine IH. Corneal tunnel incision with a temporal approach. In: Fine IH, Fichman RA, Grabow HB, eds. *Clear Corneal Cataract Surgery and Topical Anesthesia*. Thorofore, NJ: Slack, Inc.; 1993:25.
2. Fine IH, Hoffman RS, Packer M. Profile of clear corneal cataract incisions demonstrated by ocular coherence tomography. *J Cataract Refract Surg*. 2007;33:94-97.
3. Wong MY. Securing clear corneal incisions. *Cataract & Refractive Surgery Today*. 2003 March. Available at: http://www.crstodayarchive.com/03_archive/0303/051.html. Accessed April 20, 2007.
4. Vasavada AR, Praveen MR, Pandita D, et al. Effect of stromal hydration of clear corneal incisions: quantifying ingress of trypan blue into the anterior chamber after phacoemulsification. *J Cataract Refract Surg*. 2007;33:623-627.

SIGN UP FOR OUR E-NEWSLETTER

Cataract & Refractive Surgery Today's e-News provides cutting-edge information on the field, including updates on research, relevant legislative efforts, and new and developing technologies and pharmaceuticals. To join the mailing list, send an e-mail to enews@bmcstoday.com with a subject line of "subscribe+eNewsletter."