

Retrospective on Staining With Trypan Blue

The development of a rapid, one-step method for using this capsular dye during cataract surgery.

BY MINAS CORONEO, MD, MS, MSc, FRACS, FRANZCO

By the end of my ophthalmic training, I had become responsible for providing an ophthalmic service in the outback town of Bourke, New South Wales, Australia. Its remoteness meant that many patients (some indigenous Australians) either could not afford or refused to travel to Sydney and thus created a backlog of patients who were blind due to cataract. My colleagues and I organized the town's first list of individuals to undergo surgery—a horrendous experience for me as the surgeon. Many of the cataracts were mature, some of the corneas had trachomatous or traumatic scarring, and many of the eyes were heavily pigmented, contributing to a poor red reflex. Nevertheless, there were few mishaps. By early on the first postoperative morning, reports of success had filtered through the local bakery where many townspeople gathered for breakfast; patients had ripped off their dressings before attending the clinic.

On my 10-hour drive back to Sydney, I recollected my work with trypan blue while a trainee. In particular, I recalled an entry in *Toxicology of the Eye*¹ that noted the dye's safety and the related work by Norn.²⁻⁴ A literature search revealed that the dye was commercially available. The pilot study that my colleagues and I conducted progressed slowly because of the relative shortage of mature cataracts

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in metropolitan Sydney. An initial clinical report appeared in the literature,⁵ but the patenting process^{6,7} for the dye impeded early publication. Interestingly, many of the early problems we encountered and obvious advantages of the dye were subsequently reported in the literature.

The written rejection from one of the first pharmaceutical companies we approached was both shortsighted and prophetic: "It is unlikely that we would pursue such a new product idea because the bulk of the cataracts operated are not nearly as mature as those requiring this type of assisted visualization. Also even though this could be a simple product, the regulatory requirements would likely be too extensive to justify an investment in a product like this."

The US awarded me the first patents for my method of capsular staining despite these discouragements.^{6,7} This article shares both our original and our current staining techniques.

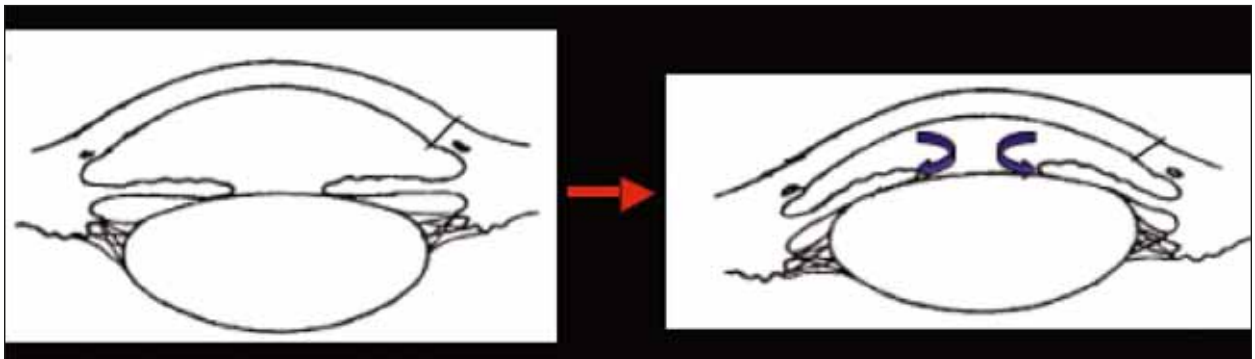


Figure 1. A shallow anterior chamber induces pupillary block and confines trypan blue to the pupillary area.

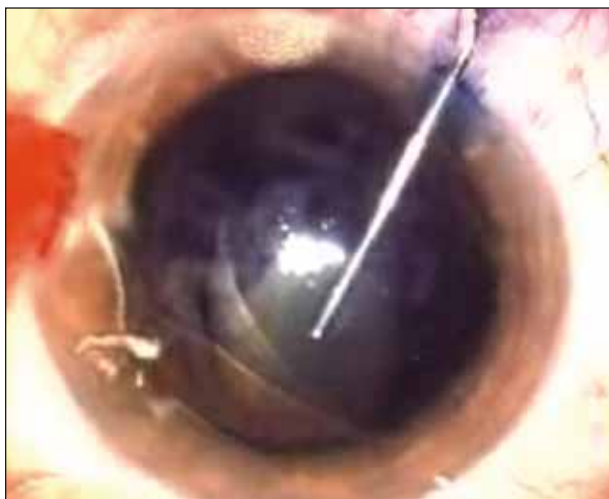


Figure 2. The surgeon depresses the posterior lip of the paracentesis wound with the injection cannula to facilitate the egress of dyed aqueous humor from the anterior chamber.

INITIAL TECHNIQUE

The first patient on whom the dye was used in Sydney was morbidly obese and had bilateral white cataracts. Our hospital's pharmacy dissolved trypan blue in BSS as a 0.1% solution (filtered through a 0.22- μ m filter). The pH testing of the preservative-free preparation revealed neutrality, and the solution was found to be isosmolar.

My fellow Evan Soicher and I instilled the dye under a layer of Healon (Advanced Medical Optics, Inc., Santa Ana, CA), because I disliked using air in the eye. Because this technique unevenly distributed the dye on the anterior capsule and stained the viscoelastic, we had to wash out the anterior chamber and reinflate the eye with viscoelastic. At first, it appeared that little had happened. Upon the initial capsulotomy, however, the stark contrast between the pale blue capsule and white cortex was evident.

During our second case, I unknowingly overfilled the anterior segment with trypan blue. Although the capsulorhexis was uneventful, the red reflex failed to materialize during phacoemulsification. We thought that a vitreous hemorrhage had occurred during the peribulbar anesthetic. Indirect ophthalmoscopy showed little, but slit-lamp examination confirmed a blue tinge to the posterior capsule. On the next day, the patient's visual acuity was 20/20 with no evidence of retinal perforation.

We then developed a method to try to confine the dye to the anterior capsule. A reverse soft shell technique evolved in which we initially instilled Healon GV (Advanced Medical Optics, Inc.) in the anterior chamber and then placed a dollop of Healon centrally onto the anterior capsule. We allowed trypan blue to trickle

under the Healon, and the dye was largely confined to the anterior capsule most of the time. After 30 seconds, a time chosen more or less arbitrarily, we washed out the anterior chamber with BSS, reinflated it with Healon, and performed the capsulorhexis, which was usually easy; we had no cases of the so-called *Argentinean flag sign* in our first 50 cases.⁸ We were impressed that we could see the edge of the capsulorhexis during the case and that, by the end of the case, most of the dye had disappeared. There were no obvious signs of toxicity.

The technique was time consuming, requiring a wash-out step, and entailed the expense of two viscoelastics.

CURRENT TECHNIQUE

My senior resident, Joseph San Laureano, and I developed and recently reported⁹ our current technique with trypan blue. First, we drain aqueous via the paracentesis port prior to injecting the dye. Trypan blue is largely confined to the pupillary area as the anterior chamber shallows due to relative pupillary block (Figure 1). After a dye-contact time of 30 seconds, we inject viscoelastic by inserting the cannula fully into the anterior chamber while placing pressure on the posterior lip of the paracentesis port. Dyed aqueous humor exits the anterior chamber through the port site (Figure 2).

We inject a small amount of viscoelastic just inside the paracentesis to minimize the risk of damage to the anterior capsule by the cannula's tip, because the dye may block visualization at this stage. We complete the corneal or scleral incision and add viscoelastic via the incision to dilute further the anterior chamber dye. Thus, the additional step of removing dye and/or viscoelastic from the anterior chamber becomes unnecessary.



Figure 3. The surgeon begins the capsulorhexis with a clear view through the partially stained viscoelastic.

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The capsulorhexis proceeds (Figure 3). Occasionally, the fresh secretion of aqueous can dilute the dye at the pupillary margin, and the re-injection of dye into the anterior chamber may be required for adequate capsular staining.

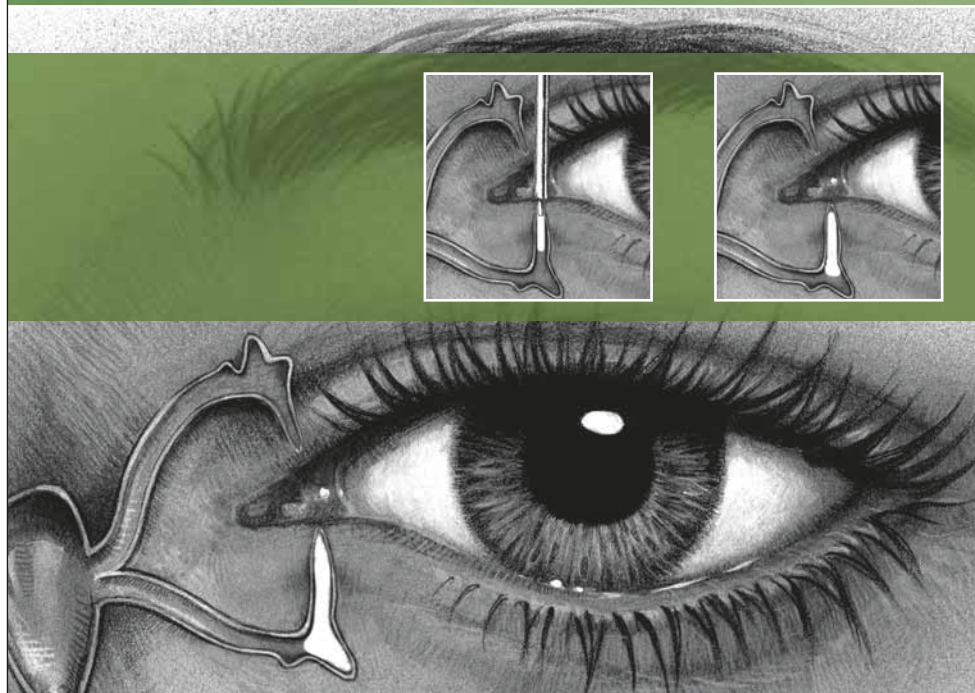
INDICATIONS

Trypan blue is useful for any type of opacity that hinders capsular visualization, including brunescant cataracts and cortical spokes in addition to mature cataracts. Other indications include corneal opacity or haze from any cause and vitreous opacity such as hemorrhage and asteroid hyalosis in particular. Darkly pigmented fundi, which diminish the red reflex, are another indication. My colleagues and I also use the dye in all cases of pseudoexfoliation and zonular compromise. ■

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1. Grant WM. *Toxicology of the Eye*. 3rd ed. Springfield, IL: Charles C. Thomas; 1985.
2. Norn MS. Vital staining of corneal endothelium in cataract extraction. *Acta Ophthalmol (Copenh)*. 1971;49:725-733.
3. Norn MS. Pachometric study on the influence of corneal endothelial vital staining. Corneal thickness after cataract extraction studied by vital staining with trypan blue. *Acta Ophthalmol (Copenh)*. 1973;51:679-686.
4. Norn MS. Per operative trypan blue vital staining of corneal endothelium. Eight years' follow up. *Acta Ophthalmol (Copenh)*. 1980;58:550-555.
5. Melles GR, de Waard PW, Pameyer JH, et al. Trypan blue capsule staining to visualize the capsulorhexis in cataract surgery. *J Cataract Refract Surg*. 1999;25:7-9.
6. Coroneo MT, inventor. Methods for visualizing the anterior lens capsule of the human eye. US Patent 6 367 480. April 9, 2002.
7. Coroneo MT, inventor. Ophthalmic methods and uses. US Patent 6 372 449. April 16, 2002.
8. Günenc U. Argentine flag sign. *Video Journal of Cataract and Refractive Surgery*. 2001;17(1).
9. Laureano JS, Coroneo MT. Crystalline lens capsule staining with trypan blue. *J Cataract Refract Surg*. 2004;30:2046-2049.



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