

# Enhanced Tissue Staining Solutions for Vitreoretinal Surgery



Monoblue Dual increases transparency and improves visibility during routine and challenging cases.

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The complexity of the vitreoretinal structures and the delicacy of its tissues pose unique challenges during retinal detachment repair, macular hole closure, epiretinal membrane (ERM) removal, and other retinal procedures. Adequate and reproducible tissue staining is a vital tool to enhance visualization through improved tissue contrast, facilitate precise surgical maneuvers, and ultimately improve postoperative outcomes.

## COMMONLY USED DYES AND CONSIDERATIONS

Commonly, brilliant blue G (BBG) and indocyanine green (ICG) are used to stain the internal limiting membrane (ILM), allowing it to be precisely located and peeled from the underlying retina. Trypan blue (TB) dye and triamcinolone acetonide are used to stain the ERM, facilitating its identification and complete removal, minimizing the risk of residual membrane formation. In some instances, dyes such as BBG and TB are combined to stain the ILM and ERM simultaneously.

Selecting a tissue-staining dye requires careful consideration of factors such as dye toxicity, transparency, staining duration, and potential adverse effects on ocular tissues. The benefits of improved visualization must be balanced with the safety profile of the staining agent as well as ease of use to minimize the risk of intra- and postoperative complications.

Although TB-based staining agents are commonly used because they are inexpensive and provide more intensive staining than other dyes, the obstacle with most formulations currently available is that the eye fundus is hard to see. Transparency is therefore vital in facilitating vitreoretinal surgical precision.



Figure 1. Monoblue DUAL View from BVI Medical.

Both of us have experience with a novel single-dose, reduced viscosity TB-based dye that is transparent enough to view the eye fundus while still efficiently staining epiretinal structures. Monoblue DUAL View (BVI Medical, Figure 1) is clinically proven to provide comparable intraoperative and postoperative safety to other TB dyes<sup>1</sup> but at a 40% lower concentration of TB. It is a fixed combination of two staining agents—TB 0.09% and DDG 0.025%—plus diglycerol 2.6%, a novel “sinking agent” that increases the density of the staining solution.

The sinking agent allows quick and cohesive delivery of the dye to the eye fundus, and the combination of TB and DDG stains the target tissue without diffusion throughout the whole globe. DDG is a noncytotoxic and nonphototoxic dye<sup>2</sup> that replaces the ethoxy substituent of BBG with a methoxy group to enhance staining and affinity to membrane proteins.

Before Monoblue DUAL View was available, we used MembraneBlue Dual (DORC) with good results. For vitreoretinal surgery, however, we now have entirely

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shifted to Monoblue DUAL View. We have found that Monoblue DUAL View is more transparent and allows a better view of the eye fundus anatomy once injected over the macula compared to other dyes such as MembraneBlue Dual, which provide only minimal visibility of blood vessels. With a macular hole, for instance, Monoblue DUAL View makes it easier to peel only the tissue that we want to remove.

## ENHANCED SURGEON CONTROL AND COMFORT

Monoblue DUAL View optimizes each step of membrane staining. It provides a quick and heightened dye intensity on the retinal surface while remaining transparent. The lighter hue of Monoblue DUAL View facilitates improved visibility during all steps of surgery, which is especially useful in complex and challenging cases. Additionally, Monoblue DUAL View makes it easier to peel the ILM and retinal membrane in the same maneuver. Further, it is possible to go as close to the macula as possible because of the enhanced view of the dye.

In addition to staining efficiency, another important consideration with dyes is the controllability of injection. Monoblue DUAL View can be injected using a packaged tuberculin syringe or complementary squeezer (Figure 2).

With both injection methods, you can control the amount of dye that is injected into the eye. The squeezer is a clever and easy-to-use device. For us, the squeezer is the preferred method of injection because dye administration can be precisely regulated, thereby minimizing damage to the retina and increasing safety. Three drops from the squeezer provide the adequate amount of staining in the area that it is needed while

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eliminating the formation of bubbles in the syringe, which is extremely important in combined vitreoretinal procedures.

The advantages of the squeezer are increased safety, the elimination of any effort required to inject the dye, and quicker washout times. The low volume of dye and translucent appearance facilitates safe and quick aspiration with a lower risk of touching the retinal surface.

It should be noted that minimizing retinal exposure to staining agents can mitigate potential toxicity risks. With Monoblue DUAL View, about 30 to 60 seconds of application under saline irrigation is required to get an appropriate stain once the retina has been cleared of vitreous and posterior hyaloid residue. The lower viscosity of Monoblue DUAL View simplifies aspiration of excessive dye solution, translating to quicker removal from the eye. Air fluid exchange is not required.

Surgical experience and preference must also be considered when selecting a tissue-staining solution. Monoblue DUAL View works with all vitreoretinal procedures, which means that tissue visualization is optimal, staining intensity is exact, and procedural efficiency is increased.

With some digital 3D visualization systems like the Ngenuity (Alcon), special filters

can be applied to increase visualization with specific dyes. As a result, the power of staining is enhanced.

Lastly, one of us (Dr. Guigou) uses special ILM microforceps that are designed for use with Monoblue Dual View. A small plate at the end of the tip and a wide opening helps grab the ILM precisely and safely. The forceps is rigid, and there is less of a shadow underneath the device, which is especially important in long eyes or when peeling a thick ILM.

## CONCLUSION

The proper use of tissue-staining dyes in vitreoretinal surgery minimizes the risk of intra- and postoperative complications by enhancing visualization of specific tissues and structures and facilitating precise surgical maneuvers. Monoblue DUAL View helps surgeons navigate the complexities of the vitreoretinal structures with greater accuracy and confidence, prioritizing patient safety, procedural efficacy, and surgical precision. ■

1. Blanckaert G, Mijnsbrugge JV, Delbecq AL, Jansen J, Stalmans P. Efficacy and safety evaluation of Monoblue Dual View and Monoblue ILM View vital stains during vitrectomy surgery. Submitted for publication.

2. Mohr A, Cendoya P, Gabel D, et al. New dual dye for vitreoretinal surgery with increased transparency. *BMJ Open Ophthalmol.* 2022;7(1):e001116.

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Figure 2. Monoblue-Dual View tuberculin syringe.