

Introducing a new dye for vitreoretinal surgery

Lack of toxicity & good staining make it a viable alternative to ICG

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The majority of vitreoretinal surgeons use dyes to stain the internal limiting membrane (ILM) and/or epiretinal membranes.¹ Dyes are mostly used to assist surgeons during macular hole and pucker surgery, with the gold standard for such procedures being indocyanine green (ICG).

ICG selectively stains the ILM and the large majority of vitreoretinal surgeons are quite comfortable with this dye, because it improves the safety and ease of ILM peeling, whilst also saving time during surgery. Functional improvement with ICG compared with ILM peeling without ICG is discussed controversially,² with some reports even urging caution when using ICG, because of the risk of adverse effects on the retina.³ The use of alternative dyes, such as trypan blue, is also questionable, primarily because this dye is thought to be less well tolerated by the retina than ICG.⁴

Recently, a Japanese group tested a new dye, Brilliant Blue G (BBG), which shows a better biocompatibility than ICG.⁵

BBG is a blue dye with the formula $C_{47}H_{48}N_3O_7S_2Na$ (molecular weight, 854.0 g/mol) that is also known as acid blue 90, and Coomassie BBG (**Figure 1**). It has been used for protein staining in biologic fields for some time, because it binds non-specifically to virtually all proteins.

Why is it better than ICG?

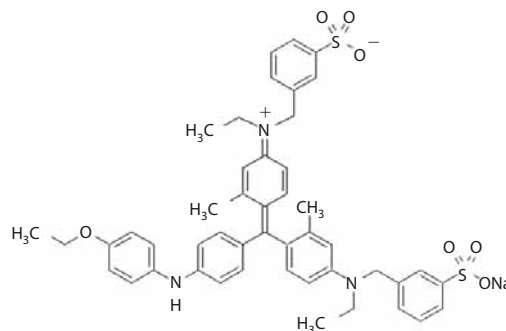
From their studies with the dye, Hiroshi Enaida, MD and colleagues found that BBG is non-toxic to the retina in concentrations from 1 to 10 mg/ml. Since it is a non-fluorescent dye, the presence of light toxicity, such as that found in ICG, is highly unlikely. The staining of the ILM is comparable to ICG, however, the BBG concentration required for ILM staining in primates (0.5 mg/ml) is one tenth of that required for ICG (5 mg/ml). Moreover, Dr Enaida has more recently published a clinical study showing that a concentration of 0.25 mg/ml of BBG is sufficient to stain ILM.⁶ BBG is also now being used as a stain for the lens capsule.⁷

The use of BBG for chromovitrectomy is patented⁸ and is also EC-approved.

I was given the opportunity to conduct a surveillance study on BBG (0.25 mg/ml), which is marketed in Europe by German firm Fluoron under the brand name Brilliant Peel. I used the dye on ten macular hole patients between January and February 2007 and I found that it stained the ILM in a comparable manner to ICG in terms of selectivity and intensity (**Figure 2a, b & c**). The dye appears more violet in colour, when compared with ICG and it was simple to completely remove the redundant dye from the eye. The functional results were also comparable to ICG staining with a closure rate of 95% and functional improvement in 40% of eyes.

In my opinion, the handling of BBG is better than ICG (**Table 1**) because it is in liquid form and is ready to inject. So far, the feedback from my vitreoretinal colleagues, who have also had the chance to test BBG, (Stanislao Rizzo, Pisa, Italy; Andreas Mohr, Bremen, Germany; Arthur Mueller, Augsburg, Germany) has been uniformly positive.

With BBG, I am now confident that we have finally found a dye, which will be accepted throughout the vitreoretinal community, because of its undisputed tolerance, its good staining ability and its cost effectiveness.



Properties

Chemical group: triphenylmethane dye

Colour: blue

Absorption maximum: 584 nm

Dosage for significant cytotoxic effect: >0.3 mg/ml

pH value: 7.52

water-soluble

No side reactions such as photo-induced cross-linking of collagen fibres

Table 1: Comparison of physical properties of ICG and BBG.

	ICG	BBG
Composition	Powder, does not dissolve in BSS	Phosphate buffered liquid, 0.5 ml (0.25 mg/ml)
Quantity	Minimum quantity 25 mg	Standard quantity 0.125 mg
Use	To be dissolved in distilled water	Ready to use

Figure 1: Chemical formula of BBG. Blue, water-soluble and non-fluorescent triphenylmethane dye with an absorption maximum at 584 nm and a cytotoxic limit of 0.3 mg/ml.

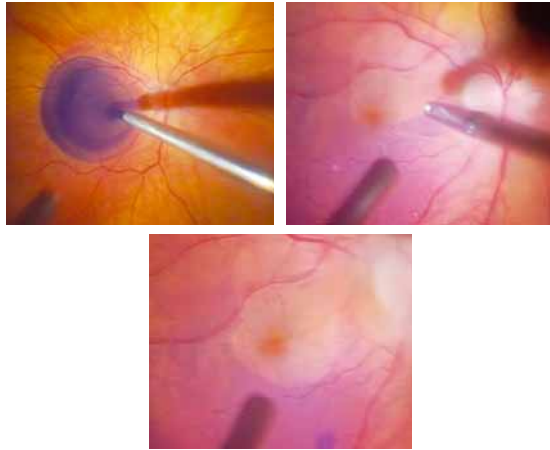


Figure 2: a) Injection of BBG in the fluid-filled eye b) partially removed stained ILM c) macula delaminated of ILM, stained ILM outside the macula.

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In short...

Bernd Kirchof, MD, discusses the merits of a new dye for vitreoretinal surgery. Brilliant Blue G (BBG) is a novel dye that selectively stains the internal limiting membrane (ILM). According to Dr Kirchof, it appears to be the first viable alternative to indocyanine green (ICG) because of its lack of toxicity and good staining ability. Furthermore, he feels that BBG is easier to handle compared with ICG, and would therefore recommend it for use in all vitreoretinal surgery procedures.



AUTHOR

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