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Service (sector)  
Retina and Vitreous

Nº CEP  
1038/06

### **Vital dyes for chromovitrectomy: comparative assessment of osmolarity, pH, and spectrophotometry analysis with regard to vitrectomy light sources**

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Purpose: Investigate in-vitro the pH, osmolarity, spectrophotometry, and photostability proprieties of nine vital dyes for vitreoretinal surgery.

Design: Experimental study

Methods: Detailed evaluation of the pH and osmolarity of nine vital dyes was performed: indocyanine green (ICG), trypan blue (TB), brilliant blue (BriB), bromophenol blue (BroB), congo red (CR), light green (LG), fast green (FG), indigo carmine (IC), evans blue (EB) for chromovitrectomy diluted in four solvents (BSS, glucose 5%, water, and viscoelastic). Spectrophotometry was utilized to examine the absorbance of those nine novel dyes in three different solutions (BSS, glucose 5% and water). The absorbance was matched with irradiance emission of seven endoillumination fiberoptics: Alcon Xenon 20G, Alcon Accurus H3 20g, Grieshaber GLS 20g, B&L Millenium 20G, DORC Metal Halide 20G, Synergetics Photon, and Synergetics Photon 2. Photostability measurements were obtained; thereafter pH, osmolarity, and spectrophotometry measurements were reassessed.

Results: Osmolarity of the dyes in tree solvents (BSS, glucose and viscoelastic) and the pH in four solvents ranged within the following values: FG from 290-344 mOsmo and pH 3.82-7.12; CR from 291-385 mOsmo and pH 6.74 to 9.85; LG from 288-325 mOsmo and pH 3.4-6.92; EB 291 to 345 mOsmo and pH 4.7-9.32; ICG 288-338 mOsmo and pH 3.88-7.48; TB 287-332 mOsmo pH 4.12-8.37; IC 291-333 mOsmo pH 3.3-7.17; BroB 257-329 mOsmo pH 2.6-6.71; BriB 267-350 pH 5.15-7.12. Osmolarity of all nine dyes decreased to very low when diluted in water ranging from 0 to 54 mOsmo while BSS and glucose promoted small but clinically relevant changes in osmolarity and pH. ICG, LG, TB, BroB, CR, and IC demonstrated different absorbance according to the solvent, while BriB or FG showed similar absorbance curves when diluted in glucose, BSS, or water. Spectrophotometry revealed that most vital dyes except for ICG have remarkable overlap with currently available vitrectomy light sources.

Conclusion: Vital dyes used in chromovitrectomy possess much variable properties in regard to osmolarity and pH depending on the solvents. Intra-operative light exposure should be minimized since endoillumination fiberoptics overlap with vital dyes.

