

Commentary: Intracameral illumination for cataract surgery

Cataract surgery has evolved into one of the safest ophthalmic surgeries with low complication rates. Still efforts are on to further reduce the complications or to minimize iatrogenic harm to the patients. Apart from instruments used for surgery, advancements in the illumination system are another aspect to be worked on.

Intravitreal illumination during vitrectomy has been seen to cause almost fourfold increase in contrast and a twofold increase in resolution when compared with external microscope illumination.^[1] Illuminated infusion chandelier has been used to enhance red reflex, helping in continuous curvilinear capsulorhexis and safe capsular polishing especially in patients with poor red reflex.^[2] Similar improved visualization has been noted in cases with corneal opacities or severe bullous keratopathy.^[3]

23G illumination probe has been tried through intracameral route for cataract surgery. The system provides oblique illumination through a paracentesis creating an enhanced three-dimensional effect, contrast, resolution, brilliance, and improved depth perception of lens, greatly improving safety of the procedure.^[4]

Lens fibers adhering to anterior and posterior lens capsules which seemed optically insignificant under direct microscope light especially in eyes with poor red glow (vitreous opacities or hemorrhages) appeared evident with oblique intracameral illumination. Near-total removal of residual lens epithelial cells (LECs) is necessary to prevent anterior capsular phimosis and formation of posterior capsular opacification. Although

removal of equatorial germinative LECs could not be accomplished with this system, improved contrast and depth perception help in advanced polishing of the capsules than the surgical microscope illumination.^[5]

Another advantage is 360° visualization of the lens capsule structures, which is of great help in eyes with poor red reflex. Endo-illuminator provides dynamic, focused, and stereoscopic illumination which has been successfully tried in a case of corneal scar, providing better view, in contrast to the problems of corneal scattering, reflection, and attenuation noted with the microscope light. In another case of angle closure glaucoma with small pupil, compromised retroilluminated retinal reflex and limited field of microscope illumination, oblique intracameral illumination provided additional surgical field under the inferior iris.^[6]

The intracameral illuminator is passed through the paracentesis wound, which is normally made during cataract surgery, hence no additional instrument or time is needed. The illuminator can be used as a nucleus manipulator, although less efficient than a chopper. The technique was performed by a single surgeon in approximately 300 cases of cataract of various densities. It involved trenching until the posterior plate till a reflex between an endonucleus and an epinucleus is identified (enhanced depth trench). Then nucleus is cracked using minimal separation force and its completion is confirmed by posterior capsule reflex. Individual heminuclei are then efficiently cut into small fragments by a chisel-shaped illuminator. The authors mention shorter effective phacoemulsification time than that with conventional method, with no intraoperative complications. The system works well with capsular staining or with iris dilating devices and simplifies challenging cataract surgery.^[7]

Every new technology or procedure has its own risks. Insertion and removal of the illuminator can increase the risk of a tear in the Descemet membrane or zonular dehiscence, hence such manipulations need extra care. Use of thinner endo-illuminator (25G) can further decrease this risk. Another potential risk is increased retinal phototoxicity, but intracameral insertion increases the distance between the light source and the posterior pole to greater than 3.0–7.0 mm, generally used during conventional vitrectomy, and also adds another capsular barrier between the illuminator and the macula.^[5]

To further substantiate lesser iatrogenic phototoxicity in this method, comparison of direct microscope illumination and intracameral illumination in 30 patients has been done. Optical illuminance and irradiance from the microscope illumination (60%, 40%, 20% intensity) and the intracameral illumination (60% intensity) were measured at the point of the ocular of an operating microscope using a light meter and a spectrometer. Average illuminance (lux) and average total spectral irradiance ($\mu\text{W}/\text{cm}^2$) were noted to be higher in the microscope illumination than in the intracameral illumination. With superiority in visualization in certain conditions, intracameral illumination offers an advantage of lower light exposure reaching patient's and surgeon's retina.^[8]

To summarize, intracameral mode of illumination can be a stepping stone for future improvements in cataract surgery providing high-quality intraoperative lens images and less macular toxicity with no additional surgical steps. The efficacy and safety of this technology needs to be confirmed through a prospective study in future.

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Access this article online	
Quick Response Code:	Website: www.ijo.in
	DOI: 10.4103/ijo.IJO_1143_19

Cite this article as: Dudeja L. Commentary: Intracameral illumination for cataract surgery. *Indian J Ophthalmol* 2019;67:1627-8.