Commentary: Precision pulse capsulotomy: New technology for capsulorhexis

In cataract surgery, importance of well centered, round capsulorhexis is known to all surgeons. It aids in easy surgery, perfect central implantation of intraocular lenses (IOLs), decreases incidence of posterior capsular opacification and is of utmost significance in subluxated cataracts.[1] With the advent of premium IOLs like toric and multifocal IOLs, perfect capsulorhexis have become even more important.[2]

Gimbel and Neuhann revolutionized the phacoemulsification surgery with the introduction of manual capsulorhexis.[3] It is currently the most commonly employed technique, but has a learning curve and may not give consistent results in inexperienced hands. In today's times, we are aiming at perfection, increasing safety and reproducibility. Femtosecond laser assisted cataract surgery enabled surgeons to achieve these goals but involves high costs and increased operative time.

Precision pulse technology uses very fast electrical impulses (which is converted to mechanical energy) to cut anterior capsule engaged under a suction ring. A foldable ninitol ring with a plunger ensures easy insertion through incisions as small as 2.2 mm.[4] Anterior lens capsulotomy edge tear strength created by manual continuous curvilinear capsulorhexis (CCC), femtosecond laser capsulotomy (LenSx, Alcon, Fort Worth, TX, USA), and precision pulse capsulotomy device (PPC; Zepto, Mynosys Inc., Fremont, CA, USA) were compared in paired human cadaver eyes. PPC edge was found to be significantly stronger than that produced by femtosecond laser or manual CCC, probably because PPC causes microscopic eversion of capsulotomy edge presenting underside of the capsule as a round functional edge[5] or due to coagulation of collagen fibrils at the edge.[6] Clinically edge strength was demonstrated in a case with 180 degrees of zonular dialysis with grade 4+ cataract in which iris hooks held the capsulotomy edge for over 45 minutes.[4] A preclinical safety and performance study done in human cadaver and live rabbits eyes showed PPC to have no greater zonular stress compared with CCC in human cadaver eyes. Negligible anterior chamber (AC) temperature changes, no greater inflammatory response, and a smooth capsulotomy edge on scanning electron microscopy makes this new technology safe to work in human eyes.[6] PPC yielded 100% successful results in 38 eyes, with no PPC-related complications.[4] Pulse precision

capsulotomy occurs instantaneously all round, allowing safe release of subcapsular pressure in intumescent cataracts.[4] In a case series reported from Tasmania, PPC device created round, reproducible capsulotomies in 72% of eyes.[7] They associated the high incidence of incomplete capsulotomy and radial tear rate with the use of dispersive ophthalmic viscosurgical devices.[7] Incidence of anterior capsular tear and incomplete rhexis are variable in different studies but the technology offers promising, affordable, and safe alternative to achieve perfect round rhexis especially in difficult cataract surgeries (like small pupil, subluxated lens, corneal scar, and significant pterygium) without much shearing on zonules.

This prospective study presents use of PPC (Zepto) in Indian scenario including 123 eyes of 99 patients. Phacoemulsification was done using 2.8 mm clear corneal incision and circular capsulotomy averaging 5.5 mm diameter was achieved in 117 out of 123 eyes. Complications like capsulorhexis tear occurred in six cases, mainly in the initial cases indicating its short learning curve. Five cases had sub-incisional extension of rhexis, while one case with mature cataract had inferior capsular tag. In one case, sub-incisional iris was caught inadvertently in the suction ring, which was corrected by re-insertion of the probe. Probe malfunction occurred in six cases, which stresses the need to have a spare probe at disposal. Although subluxated, traumatic, complicated/uveitic cataracts were excluded from the study, 12 eyes with NS IV cataracts, 14 eyes with mature cataracts and 16 eyes with pupillary dilatation of 4–5 mm were included in the study. Authors found maximum rhexis run off rates in PPC group (4.9%), followed by manual CCC (1.6%), followed by femtosecond (0%) group. The technique has a learning curve and sub-incisional areas can have skip areas leading to complications.[8]

As with all the new technologies, evolution toward improving the system will increase safety and efficacy of the device. Elimination of third party operator, a more accurate suction mechanism and indicator, automation of the manual release system, enhanced ninitol ring flexibility, an altered setup process, and potential incorporation into the phacoemulsification systems are some of the possible areas of improvement to be worked on.[7]

Manual capsulorhexis is an art that should be mastered by all cataract surgeons. Newer advances like PPC can help increase safety and efficacy, but these technological advances do not undermine the significance of manual CCC. Future of the PPC technology is promising and improvements in the system might help making capsulorhexis, a complication-free step of cataract surgery.

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