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FEOph Symposium and Roundtable Discussion
SOI Congress 2015, Rome
Topic: Femtosecond Laser-Assisted Cataract Surgery

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Summary by Dr. Ricardo Díaz Céspedes, Valencia

Cataract surgery performed by phacoemulsification is an elegant surgery, but recent advances in technology offer the potential to further enhance the cataract surgery experience for patients and ophthalmologists as well as improve outcomes. Certain steps of traditional cataract surgery performed by phacoemulsification may soon be performed with increasing frequency by the femtosecond laser.

Phacoemulsification can be traumatic to the corneal endothelium with increasing amounts of ultrasound energy. Femtosecond-assisted laser cataract surgery FALCS offers potential benefits over traditional cataract surgery including reduction in phacoemulsification time. (1,2)

Current femtosecond laser platforms operate with laser pulses that are 200 to 800 femtoseconds in duration.There are 4 femtosecond laser cataract surgery platforms currently available: Catalys, LenSx, LensAR (LensAR Inc.), and Victus. Elements of these platforms continue to evolve as more experience and feedback is incorporated into the software. There are 2 types of patient interfaces for the femtosecond laser, contact (applanating) or noncontact (fluid-filled interface); each offers advantages and disadvantages. In general, applanating interfaces create a larger increase in intraocular pressure (IOP) during the procedure, higher rates of subconjunctival hemorrhage, and a narrower field of view compared with the noncontact interface. Additional differences in platform include the presence of a bed that is fixed to the laser versus a platform that allows a mobile bed or stretcher to be used with the laser as well as the imaging modality of the anterior segment [optical coherence tomography (OCT) vs. non-OCT] and whether or not the patient's head must be secured to the stretcher.

Optimal candidates for FALCS include patients with clear corneas, some degree of corneal astigmatism that can be treated with an astigmatic correcting corneal incision, patients electing to have a premium intraocular lens (IOL) implanted, and patients who can lie still for at least 5 minutes while the laser treatment is performed. Certain patient characteristics may increase the likelihood of encountering difficulty, these include: Poor dilation: presence of corneal opacities or irregularities: glaucoma, positioning challenges, nystagmus, patient cooperation and comfort.

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The outcomes achieved with this new technology may include:

Capsulotomy Precision: Capsulotomies created by femtosecond lasers are more precise in size and result in less IOL tilt and decentration as compared with manually created continuous curvilinear capsulorhexis, yielding a more stable refractive result. (1,2)

Lens Removal: Less ultrasound energy is needed in FALCS. However the release of liquefied lens material presents its own challenges as that released material can shield penetration of the laser beam during lens fragmentation and can exert stress on the posterior capsule potentially resulting in rupture.

Multiplanar clear corneal incisions (CCIs) seem to be square and significantly more resistant to deformation and leakage with increased stability compared with manually created incisions. (3,4)

Limbal relaxing incisions (LRI) placement can be programmed reliably and precisely, and can be performed with either anterior penetrating or intrastromal incisions, based on the surgeon's preference

Visual Acuity: Visual acuity has been compared between femtosecond laser-assisted cataract surgery and conventional surgery but differences have not been statistically significant. (5,6)

Macular Edema: A study comparing macular edema after uncomplicated femtosecond laser assisted cataract surgery compared with conventional surgery showed small statistically significant differences between the 2 modalities with less edema in the femtosecond group.(6)

Learning curves have been described for a wide range of ophthalmic procedures when new technologies are introduced to a surgical field; in this technique a learning curve exists, even for the most experienced of surgeons. As with the introduction of phacoemulsification into resident education, the decision as to when, how, and whether to incorporate femtosecond cataract surgery into resident surgical training will be individualized at each residency program depending on multiple variables including access to the technology, patient population, teaching faculty experience and perspective, and curriculum.

The current price point for laser cataract surgery prohibits developing countries and even newly established ophthalmology practices in developed countries from entering the FALCS market. Estimates in the literature dating back to 2012 economic climate expect 500 cataract surgeries per year to justify the capital investment and upkeep costs. The initial purchase price of the laser, the size of the laser, which requires additional space in the operating room or a separate laser suite, and the added costs of repairs, upgrades, maintenance, and insurance are all considerations practices must examine before deciding to purchase a femtosecond laser platform.

In summary, with any new technology, there are significant issues that must be overcome prior to the general acceptance by the ophthalmic community. Femtosecond laser-assisted cataract surgery is becoming more widely available as an option for patients considering cataract surgery and will likely have future applications. The advantages over conventional surgery, including capsulotomy formation, incision creations, CCIs, LRI and lens fragmentation, appear promising. Controversies exist around determining the best platform for FALCS, as well as the potential global role and cost to the health care system of FALCS.

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