Guest Editorial

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Femtolaser assisted cataract surgery (FLACS): Has it proved to be the new revolution in Cataract Surgery?

The introduction of femtolaser in ophthalmology in 2001 promised to revolutionarize the field with its high precision and safety level, and its multi-faceted utility. Used initially in the field of refractive surgery, its high-tech precision promised to bring a paradigm shift in the field of cataract surgery as well, ushering in the era of Refractive Cataract Surgery. Let us introspect how much of that has translated into reality.

The femtosecond laser is a focussed infrared laser having a wavelength of 1053 nm with ultrafast pulses of duration 100 fs (100 × 10-15 sec). The laser cuts the tissue through a phenomenon called photodisruption, in which light is absorbed by a nonopaque structure through which infrared light can penetrate, allowing for the generation of a plasma of free electrons and ionized molecules that rapidly expand, collapse, and create microcavitation bubbles. An acoustic shock wave is produced which separates and incises the target tissue. This is in contrast with the other commonly used laser in ophthalmology, the Nd:YAG laser technology, which uses longer pulse durations. The microcavitation bubbles produced with the femtosecond are much smaller, allowing for reduced collateral damage. The precision, minimal collateral damage and versatility make these lasers unique.

In cataract surgery, femtosecond laser platform has been used for making perfect circular anterior capsulotomy, well structured clear corneal incisions, nuclear fragmentation/ segmentation and softening, and creating limbal relaxing incisions for treatment of astigmatism. Although heralded as the dawn of a new era in cataract surgery initially, the femtolaser-assisted cataract surgery (FLACS) has also been much criticised in the literature for not offering any major advantage over manual phacoemulsification by an expert surgeon, particularly considering the high cost.[1,2] The anterior capsulotomy created by the laser was shown to be weaker compared to the manual curvilinear capsulorhexis, and more prone to tears intra-operatively.[3] Also, Okada et al. reported that postoperative refraction at 1 year was unrelated to centration or circularity of the capsulorrhexis.[4] No significant difference was found in postoperative surgically induced astigmatism and the induction of higher order aberrations between clear corneal incisions with the femtosecond laser versus manual techniques.[5] But the biggest challenge cited by surgeons is the financial factor. A survey of 1047 cataract surgeons indicated that over 70% believed the cost of this technology was a limiting factor to adoption.[6]

Despite these detractions, we acquired a Femto laser platform last year, and have performed over 500 FLACS in this period. Like every surgical technique, FLACS too has a learning curve, and it takes some time even for expert phacoemulsification surgeons to get the full advantage out of this new technique. In my opinion, the biggest advantage that the femtosecond laser offers is the 100% accuracy and centration of the capsulotomy. Despite what the literature has reported, we found the femtosecond laser created capsulotomy to be adequate in strength, and encountered only one case of intra-operatively torn anterior capsular margin over the last one year. The perfectly square structured corneal incisions do not just provide adequate wound sealing, but also serves as a barrier against external infection, protecting against endophthalmitis.

However, the undeniable edge which is provided by the FLACS platform is its unique nuclear management software, which gives the surgeon an option to fragment or soften the nucleus customised to the cataractous lens' need. This offers a huge benefit, particularly in hard cataracts which, once fragmented and softened by the femtosecond laser, can be easily emulsified using the phaco probe using much lesser phaco energy and time. The post-operative picture on day 1 shows a clear cornea, and reminds one why FLACS is the next generation technology.

There are certain special cases for which FLACS remains a big asset. One of them is posterior polar cataract. The femtodelineation technique described by Vasavada et al[7] creates a cushion of epinuclear plate as well as nuclear cylinder

like segments which provides adequate protection to the fragile posterior capsule and has transformed the outcomes of these high risk cases for the better.

Subluxated cataract is another ideal case for a FLACS, since the capsulotomy can be adequately centered on the lens, and it makes the rest of the management much easier.

Corneal endothelial cell loss has been reported to be significantly lower in FLACS compared to phacoemulsification.[8] This makes FLACS more suitable for fragile corneas such as post corneal transplant cases, endothelial dystrophies, or patients with low endothelial cell count.

Recently there have been reports of FLACS being used with advantage in difficult cases such as pediatric cataract, phacomorphic glaucoma, traumatic cataract, nanophthalmic eyes, and white hypermature cataracts[9-15], showing its versatile utility.

Every new invention or technology has to go through the acid test of time, and prove its utility and superiority to the existing conventional methods. While much has been said about low cost-benefit ratio of the FLACS technique in routine cases, its role in the management of complex cases cannot be denied. And for patients who can afford, the best of technology with superior safety and accuracy, the Femto Laser Cataract Surgery should be offered.

References

1. Al-Saleh AA. Is Femto cataract surgery here to stay? *Saudi Journal of Ophthalmology* 2015; 29:93–94.
2. Feldman BH. Femtosecond laser will not be a standard method for cataract extraction ten years from now. *Surv Ophthalmol* 2015; 60:360-5.
3. Abell RG, Darian-Smith E, Kan JB, Allen PL, Ewe SY, Vote BJ. Femtosecond laser-assisted cataract surgery versus standarphacoemulsification cataract surgery: outcomes and safety in more than 4000 cases at a single center. *J Cataract Refract Surg* 2015; 41:47–52.
4. Okada M, Hersh D, Paul E, van der Straaten D. Effect of centration and circularity of manual capsulorrhexis on cataract surgery refractive outcomes. *Ophthalmology* 2014; 121:763–70.
5. Nagy ZZ, Dunai A, Kránitz K, Takács AI, Sándor GL, Hécz R, et al. Evaluation of femtosecond laser-assisted and manual clear corneal incisions and their effect on surgically induced astigmatism and higher order aberrations. *J Refract Surg* 2014; 30:522–5.
6. Dalton M. Laser-assisted cataract surgery; bringing new technologies into the fold. *EyeWorld* 2011; 30–31. Available from: http://www.eyeworld.org/article-bringing-new-technologies-into-the-fold.
7. Vasavada AR, Vasavada V, Vasavada S, Srivastava S, Vasavada V, Raj S, et al. Femtodelineation to enhance safety in posterior polar cataracts. *J Cataract Refract Surg* 2015; 41:702-7.
8. Conrad-Hengerer I, Al Juburi M, Schultz T, Hengerer FH, Dick HB. Corneal endothelial cell loss and corneal thickness in conventional compared with femtosecond laser-assisted cataract surgery: three-month follow-up. *J Cataract Refract Surg* 2013; 39:1307–13.
9. Taravella MJ, Meghpara B, Frank G, Gensheimer W, Davidson R. Femtosecond laser-assisted cataract surgery in complex cases. *J Cataract Refract Surg* 2016; 42:813-6.
10. Dick HB, Schultz T. Femtosecond laser-assisted cataract surgery in infants. *J Cataract Refract Surg* 2013; 39:665-8.
11. Schultz T, Ezeanoskie E, Dick HB. Femtosecond laser assisted cataract surgery in pediatric Marfan syndrome. *J Cataract Refract Surg* 2013; 29:650-2.
12. Nagy ZZ, Kránitz K, Takacs A, Filkorn T, Gergely R, Knorz MC, et al. Intraocular femtosecond laser use in traumatic cataracts following penetrating and blunt trauma. *J Refract Surg* 2012; 28:151-3.
13. Kránitz K, Takács AI, Gyenes A, Filkorn T, Gergely R, Kovács I, et al. Femtosecond laser-assisted cataract surgery in management of phacomorphic glaucoma. *J Refract Surg* 2013; 29:645-8.
14. Nagy ZZ, Kranitz K, Takacs A, Filkorn T, Gergely R, Knorz, MC. Intraocular femtosecond laser use in traumatic cataracts following penetrating and blunt trauma. *J Refract Surg* 2012; 28:151–3.
15. Martin AI, Hughes P, Hodge C. First report of femtosecond laser cataract surgery in nanophthalmic eye. *Clin Experiment Ophthalmol* 2014; 42:501-502.

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