Editorial

Femtosecond Laser Cataract Surgery

Lately, cataract surgery has acquired a perfection level such that its anatomical and functional results are both highly predictable and reliable. In fact, nowadays we have better phacoemulsification machines, microincisions, topical and intracameral anesthesia, better viscoelastics, aspheric, multifocal, accommodative and toric IOL´s, and intraoperative aberrometry. All these advances, made us think that we had got such a perfection level in our surgeries that there was little room for further improvements.

We were wrong. By the end of 2010 we began to read on different journals multiple reports from surgeons about their experiences using the new femtosecond laser on cataract surgery. Simultaneously, at the ASCRS, ESCRS and AAO meetings we saw presentations regarding the experience obtained in different countries with very positive results using this new surgical technique.

We became interested in the topic, took a course on Europe and got several books (among them one by Stephen Slade and another by Louis Probst) which allowed us to learn the technological principles of the procedure.

Later on, at a meeting of the AAO, experts from Alcon presented us the characteristics and results of their LenSx machine. After this, and convinced of the effectiveness and advantages of this technique, we got our machine on June 2012 and started using it.

At this moment I´d like to briefly mention some of the characteristics of this new technology. Its name comes from the extremely short pulse duration which is one quadrillionth of a second, $1x10^{-15}$. This, will allow us to understand the way it acts, its effect on tissues and the great difference between this laser and the ones used in Ophthalmology for many years now. There are some lasers, such as Diode and Argon, that require of a pigmentary substrate to absorb the luminous energy and transform it into heat in order to obtain the desired effect. Other, such as YAG, don´t require of tissue pigment and work directly on the desired tissue by photodisruption. In both cases the desired effect is obtained but there is an inevitable damage to nearby tissues. This is an important difference with femtosecond lasers where the perfect micrometric focusing, the small spot, the very low intensity and the shortness of the shot make its effect precisely circumscribed to the treatment zone not damaging neighboring tissues. In femtosecond lasers the energy delivered is in microjules and the duration in femtoseconds.

The mechanism of action of the femtosecond lasers allows photodisruption to make precise incisions and tissue separation at the lens capsule, lens nucleus and the cornea. This takes place when the energy focused on the tissue is applied with an extremely short duration pulse which generates plasma. Plasma expands at great speed, separating neighboring tissues. When plasma begins to cool down cavitation bubbles are formed and a few microns of tissue are separated at the focal point of the laser without heath generation or neighboring tissue damage.

Femtosecond laser technology was initially used at the cornea to make LASIK flaps with parallel surfaces, later on for keratoplasty incisions, intracorneal segment tunnels, and later on to make intracorneal pockets for refractive discs and also for astigmatism control.

Different from the cornea which has a superficial location, minimum thickness, is transparent and avascular, all of which facilitate the use of these lasers. Cataract surgery is more complicated because a new system of energy emission is needed in order to apply it at an average focus depth of 8 mm so it was necessary then to modify the pulse intensity as it must be greater at the lens than at the cornea and a complex system for tissue visualization was required in order to aim the laser at the precise site. This was solved by incorporating a sophisticated and novel OCT system and a microscope which allow the surgeon to see precisely the different ocular tissues from corneal epithelium down to posterior lens capsule.

After 2 years' experience and hundreds of successful cases operated on with the Lensx (Alcon Labs, Fort Worth USA) we can say we are fully satisfied with the technique: capsulorexis is perfect allowing for a perfect centration of the IOL and avoiding vertical or horizontal decentrations, nucleus treatment permits an important decrease in the energy delivered and total ultrasound time, apart from precise and self-sealing corneal incisions which do not require hydration at the end of the procedure.

The use of the femtolaser in cataract surgery as well as many other important advances incorporated into Ophthalmology practice

has been received with skepticism and in many cases with open hostility by colleages arguing multiple reasons to do so. First of all, they have felt perfectly comfortable and satisfied with the results obtained in conventional phaco and do not understand the need for such a high cost investment on a new equipment. This reminds me of the arguments I heard long time ago when trying to convince my colleagues of trading the surgical loupes for the microscope, to switch from intracapsular to extracapsular cataract surgery and from there to phacoemulsification, of implanting IOLs not at the anterior chamber but at the posterior one, etc.

My argument has always been that in our practice we are marked by evolution and progress, that we must invest heavily both in time and effort in our profession to improve our knowledge and keep updated; also, to get new technology equipment which allow us to be every day more precise and effective at our patient´s treatments.

We are so convinced of the need to advance, that we have decided to periodically offer femtosecond laser courses, same as we have done for a long time with phacoemulsification, in order to get a growing number of surgeons to use this new technique and obviously, this goal includes our residents and fellows.

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