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Luigi Mosca

Femtosecond laser enhances safety and efficacy of keratoplasty procedures

Dermot McGrath
in Rome

THE femtosecond laser offers several clear advantages for lamellar and penetrating keratoplasty (PK) procedures, according to Emilio Balestrazzi MD, and Luigi Mosca, MD from Catholic University, Agostino Gemelli Polyclinic, Rome, Italy.

“The IntraLase femtosecond laser (AMO) is a dynamic surgical tool which enables surgeons to perform valid, safe and repeatable lamellar and penetrating keratoplasty techniques. However, we must nevertheless be cautious in the application of this exciting technology and remember that it is still a work in progress,” Dr Balestrazzi said, presenting their four-year experience with the femtosecond laser in a session of the 13th ESCRS Winter Meeting in Rome.

Before the introduction of the femtosecond laser, surgeons could choose between traditional PK and manual deep anterior lamellar keratoplasty (DALK), noted Dr Balestrazzi. While PK has a good track record, the unnecessary substitution of the healthy endothelium results in a life-long risk of eventual graft rejection.

By contrast, DALK has the advantage of preserving the endothelium layer and removing only the pathological stromal tissue, thereby preserving normal corneal thickness and shape.

There are, however, some drawbacks to DALK, said Dr Balestrazzi, including the difficulty of the manual intrastromal dissection and the fact that the procedure rarely achieves precision and may result in low visual acuity and poor optical quality, if Descemet's membrane is not reached using the Big Bubble technique. There is also a high risk of micro- or macro-perforation in DALK procedures, often necessitating an eventual conversion to PK.

Many of these drawbacks seem to have been addressed by the introduction of femtosecond laser-assisted deep anterior lamellar keratoplasty (femto-DALK) procedures, said Dr Balestrazzi.

“For keratoconus patients, the goal is to utilise a surgical option that could be compared in results to manual DALK, preserving the health and integrity of the corneal endothelium,” he said.

Describing the new technique they have realised, Dr Balestrazzi said, that there are

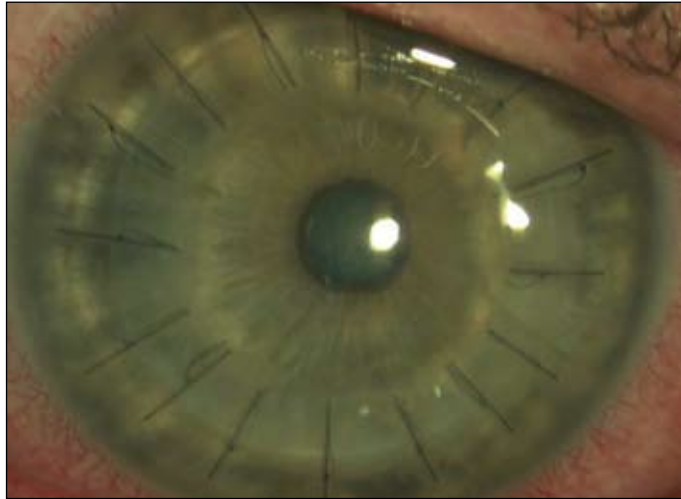


Figure 1: Digital slit lamp photograph. A clear graft is found one week after IntraLase-assisted DALK

two distinct surgical phases. The IntraLase femtosecond 60 kHz laser is first used to generate a deep stromal cut, leaving at least 100 μ , based on the pachymetric parameters of the patient. A +4.0 D spherical hyperopic PRK ablation and a 40 to 60 μ PTK ablation are then performed with an excimer laser on the residual stromal bed, to reach as much as possible of Descemet's layer. The second surgical phase then involves performing the donor cut followed by Descemet/endothelium layer stripping and corneal suturing using 16 radial 10/0 nylon stitches.

Dr Balestrazzi and Dr Mosca tested this approach on 16 eyes of 16 keratoconus patients and found that a clear graft was achieved in all patients one week after surgery (Figure 1).

The mean uncorrected visual acuity was 0.40 and the mean best-corrected visual acuity was 0.80 at the one-year follow-up mark (Figure 2).

Dr Balestrazzi noted that confocal microscopy evaluation showed no significant differences in pre- and postoperative endothelial pattern and density. In terms of complications, two patients experienced a perforation during the IntraLase cut which required a subsequent PK.

Turning to femtosecond laser-assisted PK, Dr Balestrazzi said that this technique is designed to create a simpler and repeatable surgical technique to generate less astigmatism, faster wound healing and faster visual recovery times.

With more surgeons making the switch to the femtosecond laser, Dr Balestrazzi said that IntraLase-assisted keratoplasty is relatively easy to learn and perform and results in high patient satisfaction (Figure 3).

He noted that the femtosecond laser-assisted approach overcomes many of the inherent drawbacks of traditional mechanical corneal transplantation

techniques such as delayed visual recovery, high risk of post traumatic wound rupture and the fact that many patients are left with residual postoperative astigmatism because the donor button and the receiving bed are not well aligned. Otherwise, IntraLase-assisted PK has longer operative times.

One of the key advantages of the femtosecond-assisted technique is that it allows the user to perform a variety of different cut patterns, customising the surgery to the single clinical case, noted Dr Balestrazzi. Discussing some of the newer cut profiles in more detail, Dr Balestrazzi cited the zigzag-shaped incision developed by Roger Steinert MD in order to provide a smoother transition between host and donor and a hermetic wound seal. This particular cut profile we use routinely in our practice results in an excellent anterior apposition and an extremely smooth graft surface, he said.

As well as the Christmas tree wound configuration, which adds more endothelium by increasing the posterior diameter, Dr Balestrazzi said that another interesting variation is the zig cube or zig square incision profile created by Sheraz Daya MD. The zig square offers the same advantages as the zigzag cut with

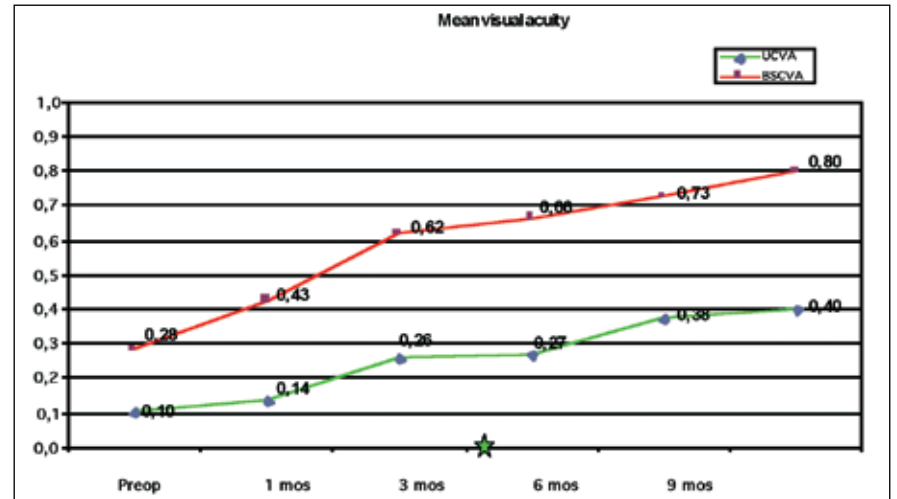


Figure 2: IntraLase-assisted DALK on 16 eyes of 16 patients. The graphic shows the UCVA and BSCVA during follow-up. The green star shows the mean suture removal time: a good visual recovery from the first month post-op that rapidly and progressively increase after suture removal

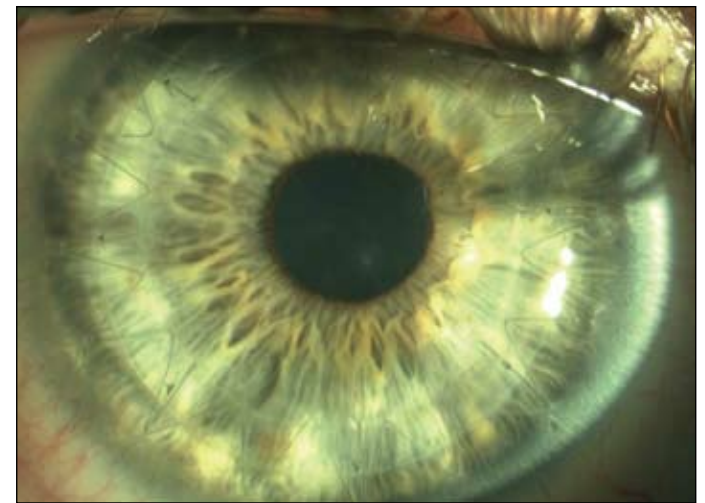


Figure 3: Slit lamp examination of an IntraLase-assisted penetrating keratoplasty with Mushroom shape for keratoconus, one year after surgery. Note the double diameter of trephination. 11mm for the epithelial and 9mm for the endothelial side

excellent anterior apposition, a watertight incision to protect the endothelium and larger posterior diameter. However, unlike the zigzag cut, the zig square is not positioned as close to the limbus, thereby theoretically reducing the risk of rejection.

Dr Balestrazzi concluded that the femtosecond laser is a dynamic and exciting technology that offers a wide variety of corneal therapeutic applications and enables surgeons to perform safe and reproducible lamellar and PK procedures.

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