

# Femtosecond laser delivers precision cuts for PK procedures



Sheraz Daya

Dermot McGrath  
in Athens

USING a femtosecond laser (IntraLase) provides a safe and predictable means of performing a customised cut in penetrating keratoplasty procedures, according to Sheraz Daya MD, FACS.

Addressing delegates attending a dedicated session on femtosecond lasers held during the ESCRS Winter Refractive Meeting, Dr Daya said that using a femtosecond laser offers several advantages over traditional approaches to penetrating keratoplasty.

"The IntraLase femtosecond laser is a very sophisticated device that allows for greater precision to match the exact shape of the removed and donated tissue segments. In addition, any cut configuration and angulation can be chosen, the cut quality is excellent and the prepared donor transplant nestles perfectly in the recipient eye. This is usually not the case when we perform traditional penetrating keratoplasty with a cylindrical trephine," said Dr Daya, director and consultant, Corneoplastic Unit and Eye Bank, Queen Victoria Hospital, East Grinstead, UK.

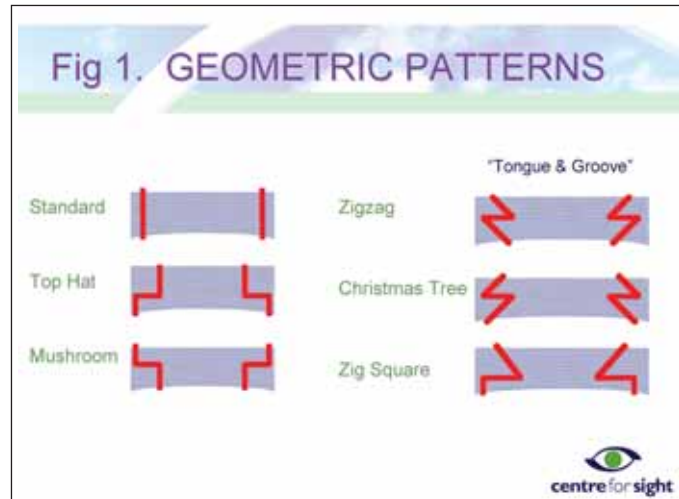
Other theoretical benefits from femtosecond-assisted penetrating keratoplasty include greater biomechanical stability, better wound healing, a reduction in induced astigmatism and faster visual rehabilitation, added Dr Daya.

Dr Daya said that the latest software version of the IntraLase FS60 laser gives surgeons the option to generate complex customised incisions with advanced edge profiles, helping to establish secure grafts that require less suture tension.

Discussing some of these cut profiles in more detail Dr Daya cited the mushroom-shaped incision, which preserves more host endothelium than the traditional trephine approach. Another variation, he said, is the top-hat-shaped incision that allows for the transplantation of large endothelial surfaces, as well as a lamellar step for stronger healing.

Yet another incision profile, popularised by Roger Steinert MD, is the zigzag-shaped incision providing a smooth transition between host and donor tissue and allowing for a hermetic wound seal. This type of incision provides oblique planes of contact and may potentially improve the strength of wound healing, said Dr Daya.

"One of the biggest advantages of the zigzag profile is that the anterior apposition is absolutely fantastic. It is a bit like the LASIK flap, with no evidence of elevation when the sutures have been placed. After one week, the graft interface is nice and smooth, there is less chance of graft override and underide and the procedure is watertight, which helps to



protect the endothelium and the graft," he said.

The disadvantage of this technique, said Dr Daya, is that the surgeon has a smaller posterior surface. "This may be problematic in cases where you need endothelial replacement such as pseudophakic bullous keratopathy and Fuch's dystrophy. Surgeons also need to be aware that the tongue can be fragile and tear quite easily," he said.

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In order to address some of these shortcomings, Dr Daya and his team have experimented using a refined zig-square incision profile, with good results thus far.

"The zig-square profile takes into consideration the posterior aspect and endothelial replacement. We have a large diameter to work with and it is certainly better for patients with Fuch's dystrophy and pseudophakic bullous keratopathy. While there may be some concern that going out further to the limbus will lead to an increased risk of graft rejection, only time will tell how this approach compares to other existing techniques," he said.

Dr Daya said that since June 2006 he has performed five femtosecond-assisted penetrating keratoplasties: two patients with keratoconus, two with Fuch's dystrophy and one patient with pseudophakic bullous keratopathy. The first patient was treated using the zigzag incision profile and the subsequent four patients using the zig-square pattern.

In terms of surgical technique, Dr Daya said that it is important to carefully monitor the posterior square ledge when creating the donor button in order to avoid tearing. "Remember the posterior lamellar tissue is not as strong as the anterior lamellar tissue and it can tear off at the wrong place quite easily. Also to ensure the endothelium stays viable it is good to use quite a lot of viscoelastic when preparing the anterior chamber maintainer," he said.

To avoid any likelihood of spontaneous wound dehiscence, Dr Daya said that IntraLase is now advising surgeons to perform non-continuous cuts.

"This makes the removal of the tissue a little bit more difficult because it can tear, but it is an important added feature to keep things secure. I would also advise performing this procedure in an operating theatre where you are prepared to deal with any unexpected problems that might occur," he said.

After six months, Dr Daya reported that endothelial cell count registered around 30 per cent loss, which is about the same



as traditional penetrating keratoplasty. Visual rehabilitation was good, with three out of four eyes recording 20/40 or better best-corrected visual acuity after six months.

Summing up, Dr Daya said that the femtosecond laser is an exciting technology that offers a wide variety of corneal therapeutic applications

"The cuts are super precise but we still have to decide what the most appropriate approach to adopt for individual patients is, depending on their disease condition. We also need to find a way of optimising biomechanical stability with these patients. The procedure is rapid to do and is definitely less challenging than a regular penetrating keratoplasty. However, this technology is still in its infancy and that it why we need more studies to properly assess its efficacy and safety over the longer term," he said.

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