Planar Flaps With the Carriazo-Pendular Microkeratome

To the Editor:

I would like to comment on the study by Stahl et al regarding anterior segment optical coherence tomography (OCT) analysis of thin IntraLase femtosecond (IntraLase Corp, Irvine, Calif) flaps, which was published in the June 2007 issue of the Journal of Refractive Surgery.

In the discussion, the authors comment that the Visante OCT (Carl Zeiss Meditec, Jena, Germany) has a high resolution. As mentioned in the article, the repeatability is high in measuring corneal thickness.

However, measurement of the flap thickness presents some difficulties. We reported our experience with the Visante OCT in measuring the planar flap of the Carriazo-Pendular microkeratome (SCHWIND eyes-tech-solutions, Kleinostheim, Germany) during the 2007 American Society of Cataract and Refractive Surgery annual meeting.

With the Visante OCT, the anterior and posterior cornea can be seen. However, the situation of the interface needs to be investigated, because in most cases it is difficult to identify details.

Some reflection pixels are observed due to the flap cut, but these are not a continuous line as seen in Figure 1 in the study by Stahl et al. In our experience, it was difficult to analyze the cut. Moreover, if the flap diameter in Figure 1 is 8.5 mm, it is not possible to see the entrance cut penetrating the epithelium and entering the stromal bed.

The line, which in some cases is discontinuous, is also difficult to determine as the resolution of the system is ±2 µm, meaning that when the interface line of the cut is selected, by moving it one pixel up or down in the Visante image, the results differ by approximately 12 µm, which is subject dependent.

Also, it is not statistically correct to assume standard deviations that are less than the resolution value of the system, therefore, we disagree with the 5-µm standard deviation of flap thickness reported in the results.

We agree with the authors that the system allows us to see whether a planar or meniscus-like flap has been produced. In our study, we achieved a planar flap with the Carriazo-Pendular microkeratome using the 110-, 130-, and 150-µm heads.

Diego de Ortueta, MD, FEBO
Recklinghausen, Germany

Reply:

We thank Dr de Ortueta for his comments on our article. Unfortunately, we did not see the presentation at the American Society of Cataract and Refractive Surgery annual meeting, and few details are available in the online abstract. The letter implies difficulty in identifying details of LASIK flaps created with the Carriazo-Pendular microkeratome (SCHWIND eyes-tech-solutions, Kleinostheim, Germany) using the Visante OCT (Carl Zeiss Meditec, Jena, Germany). Despite this difficulty, however, the flaps were determined to be planar-shaped.

When measuring LASIK flaps with the Visante OCT, the testing should be performed with the high-resolution corneal scans with 512 A-scans per line sampling and 0.25 seconds per line acquisition time (2048 scans per second). To optimize visualization of the LASIK flap interface, the polarization needs to be adjusted manually to determine what setting can best visualize the interface prior to acquiring the scan. In addition to optimizing polarization, the OCT image can be enhanced by adjusting noise, saturation, brightness, and contrast. The device performance should be evaluated with the verification test tool. The FDA Visante study demonstrated that the Visante has high sensitivity and specificity in detecting the LASIK flap from the first day after LASIK to 6 months postoperatively. With experience, technicians are able to acquire more quality exams to improve LASIK flap visualization. Training is also needed to ensure proper identification of the flap to distinguish between the flap interface versus corneal architectural changes.

As mentioned in our article, the commercially available Visante OCT requires manual (semi-automated) measurement. The Visante flap tool is a computer-controlled cursor that is placed on the corneal image at the desired location that automatically measures corneal thickness. Within this total corneal thickness measurement, the cursor is manually placed on the visualized flap interface. These manual measurements may be more subjective than an automated computer algorithm measurement method used in the study by Li et al. A study comparing the automated measurement algorithms to manual measurements would help answer this question.

Repeatability standard deviation of the Visante OCT in measuring LASIK flap thickness at the +1.00-mm location was 8.5 µm and at the −1.00 mm location was 8.7 µm. The standard deviations for combined flap and stroma thicknesses at these two locations were

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6.3 µm and 6.5 µm, respectively. We agree that there are limitations to all techniques that measure corneal thickness including the Visante OCT. However, we do not agree with the assertion that the resolution of the system is ±12 µm and that standard deviations reported less than this are not valid.

Jason E. Stahl, MD
Daniel S. Durrie, MD
Frank J. Schwendeman, OD
Allen J. Boghossian, DO
Overland Park, Kansas

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Custom Phototherapeutic Keratectomy and Autologous Fibrin-cultured Limbal Stem Cell Autografting: A Combined Approach

To the Editor:

We report the effectiveness of combined custom phototherapeutic keratectomy (PTK) with intraoperative topography and fibrin-cultured limbal stem cell autografting to treat limbal destruction of the left eye of a 67-year-old man due to alkali burn, which occurred 12 years prior to presentation.

Characteristics of both eyes are in presented in the Table. Impression cytology confirmed left limbal stem cell deficiency.1 Limbal biopsy was taken from the healthy right eye. Limbal keratinocytes were cultivated onto fibrin substrate2 and after 20 days the patient underwent a combined procedure.

Custom PTK followed by smoothing was performed with the NIDEK EC-5000 excimer laser (NIDEK Co Ltd, Gamagori, Japan) according to Vinciguerra et al.3 Manual dissection of the fibrovascular pannus followed, autologous fibrin-cultured limbal stem cells were placed on the prepared corneoscleral wound bed, and partial tarsorrhaphy was maintained for 24 hours.

The patient recovered best spectacle-corrected visual acuity of 0.65 (+2.00 diopters sphere). The Figure shows keratoscopy and corneal topography of the left eye obtained 13 months postoperatively. The patient’s cornea showed a transparent, normal-looking epithelium without vascularization, haze, or epithelial defects (Figs D-F).

Our approach to limbal stem cell deficiency highlights the value of combined use of custom PTK and fibrin-cultured limbal stem cell autografting to achieve successful corneal surface reconstruction and stable refraction.

Autologous fibrin-cultured limbal stem cells allow permanent restoration of corneal integrity in patients with severe limbal stem cell deficiency, avoiding large limbal withdrawal from the fellow eye.

Manual removal of the cicatrical pannus in preparation of autograft leaves an irregularly rough thin stromal surface with consequent persistent inflammation and postoperative astigmatism. These factors are frequently the cause of graft failure because the ocular surface roughness does not allow a proper adhesion of fibrin-cultured limbal stem cells, causing delays in stem cell proliferation and migration over the wound bed, neovascularization, fibrosis, and infections.4

In most cases, penetrating keratoplasty is required

| Characteristics of a Patient Undergoing Custom Phototherapeutic Keratectomy and Fibrin-cultured Limbal Stem Cell Autografting |
|---|---|---|
| Right Eye | Left Eye |
| BSCVA (decimal) | 0.9 | 0.5 |
| UCVA (decimal) | 0.6 | 0.05 |
| IOP (mmHg) | 15 | 13 |
| Crystalline lens | N2C1P0 | N2C1P0 |
| Endothelial cell count (cells/mm²) | 2832 | 862 |
| Pachymetry (µm) | 526 | 574 |
| Silt-lamp corneal image | Transparent, clear | Uneven corneal surface, corneal pannus, inferonasal NV |
| Immunostain positivity | CK3 <2% | CK19 = 20% |

BSCVA = best spectacle-corrected visual acuity, UCVA = uncorrected visual acuity, IOP = intraocular pressure, NV = neovascularization
to allow corneal reconstruction and visual rehabilitation through refractive improvement. Surgeons usually wait between 3 and 7 months after keratolimbal transplantation before performing penetrating keratoplasty to decrease rejection rate and improve prognosis.

Therefore, if limbal stem cell deficiency is accompanied by superficial stromal scarring, custom PTK has advantages over penetrating keratoplasty such as tissue sparing and surgical trauma reduction. The smoother stromal surface achieved by the excimer laser improves surface unevenness of the cornea, increases fibrin-cultured limbal stem cell adhesion, improves postoperative corneal transparency, and decreases postoperative scarring.5

Custom PTK with intraoperative topography allows intraoperative visual acuity measurement, refractive correction, and comparison of the treated eye refraction with the fellow eye refraction. In addition, transplantation of tissue-engineered epithelial sheets after excimer laser keratectomy can successfully prevent the development of corneal haze, which may eventually reduce postoperative visual acuity.

P. Vinciguerra, MD
E. Albè, MD
P. Rosetta, MD
Milan, Italy
E. Di Iorio, PhD
Venice, Italy
G. Pellegrini, PhD
Modena, Italy

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