Estimation of LASIK Flap Thickness

We read with great interest the article by Brenner et al., which compares accuracy of visual estimation of LASIK flap thickness versus ultrasound measurements, and there are some concerns we would like to share.

First of all, if the percent of tissue altered (PTA) is considered, a customized residual stromal bed should have been estimated for each patient, instead of setting the “safe level” at 300 µm. For instance, for a preoperative 600-µm central corneal thickness (CCT) cornea, a 300-µm residual stromal bed means that the PTA is 50%, clearly beyond the safe zone.

Second, although it has been considered as a useful measurement to increase the safety of LASIK, ultrasound subtraction pachymetry is not as accurate as it was once considered to be. According to Realini et al., CCT measurements exhibit great variation, so a single CCT assessment is not adequate to characterize the corneal thickness. Therefore, to rely on subtraction pachymetry may be misleading due to the variability associated with this technique.

Moreover, the cornea suffers dehydration when exposed to the microscope light, especially after the flap is lifted, as demonstrated by Rosa et al., so measuring the residual stromal bed after flap lifting may overestimate the actual flap thickness. Changes on tissue hydration may also affect the visual estimation. Given these circumstances and all of the sources of error, we believe that neither visual estimation nor ultrasound subtraction pachymetry can be considered as accurate.

Instead, optical coherence tomography or ultrasound biomicroscopy measurements in several locations of the flap, performed at least 1 month after surgery (when major flap thickness changes have occurred, as demonstrated by Rocha and Krueger) may be considered. We propose, for a given flap target thickness, to measure a pool of flaps and see the performance of the particular femtosecond laser used. When the mean flap thickness and the standard deviation are known, the surgeon may assume that the flap obtained is within two standard deviations above the mean flap thickness obtained with that particular device.

We consider this a more reasonable approach because it considers the hypothetical worst-case scenario based on statistical data and is not subject to the high variability of intraoperative measurements.

REFERENCES


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The authors have no financial or proprietary interest in the materials presented herein.

Reply

We thank Drs. Parafita-Fernández and Teus for their interest in our study and their thoughtful comments. We agree that percent of tissue altered (PTA) should have been ideally estimated for each patient. At the time we initiated the study, PTA was not recognized as a factor in ectasia occurrence and was therefore not factored into our decision making. It is currently incorporated in our preoperative and intraoperative planning.

Drs. Parafita-Fernández and Teus state that a single central corneal thickness assessment is not adequate to characterize corneal thickness. Our study involved recording the lowest of three intraoperative measurements in an attempt to address this. We agree that a single reading can result in a widely different value based on centration.

They are concerned that dehydration of the cornea may lead to inaccurate measurements. Rosa et al. found that the deviation from intended was more with the femtosecond laser than with a microkeratome. This deviation in the femtosecond laser flaps was less when the flap was not lifted for 20 minutes, in theory allowing the flap hydration to equilibrate and obtain a more accurate reading. Although this is not practical, it does suggest that there is a component of dehydration in the use of the femtosecond laser. However, the authors did not attribute this to microscope light as suggested above. Rather they thought it may be from increased procedure time or a dehydrating effect of the laser itself (similar to what has been demonstrated with excimer lasers). Our study aim was to compare the visual estimation to subtraction pachymetry. Although the latter is not perfect,
we have clearly shown that it is superior to visual estimation.

Drs. Parafita-Fernández and Teus recommend evaluating the performance of a specific femtosecond laser and act accordingly. We respectfully disagree with this point. In our experience, the accuracy of a keratome and femtosecond laser changes depending on the blade used and does change over time with a specific femtosecond laser. We do measure all of our flaps and we often notice that the femtosecond laser is starting to cut thinner or thicker warranting recalibration. The suggested approach would also in theory miss 5% of patients who fall outside of a Gaussian distribution, but, more importantly, approximately 2.5% of those who fall above (thicker than intended), which is too high of a “miss rate.”

REFERENCES

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