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Optimizing Outcomes, Centration, and Corneal Cuts

Highlights from the Alcon WaveLight Users Meeting held in Hamburg on 19-21 June 2015.

OPTIMIZED WORKFLOW FOR EFFECTIVE CLINICAL OUTCOMES

Arthur Cummings, MD: When to Go In and When to Stay Out (Astigmatism Correction)

Dr. Cummings discussed the correction of astigmatism and the consideration of when to go in (toric IOL) and when to stay out (corneal surgery). He noted that implanting a toric IOL does not alter the cornea, if the corneal incisions are neutral. In contrast, corneal surgery includes managing surgical incisions and offers options such as opposite clear corneal incision (OCCI), limbal relaxing incisions, and excimer laser surgery. Before going the intraocular route, the surgeon will have to make IOL calculations, choose the IOL type, and determine the incision location: sclera, limbus, or cornea.

Omid Kermani, MD: Individual Patient Factors and Steps of Diagnosis (Pre- and Post-LASIK Issues)

The speaker addressed contraindications to LASIK such as incipient cataract or refractory glaucoma. Large corrections may cause corneal weakness regardless of the preoperative pachymetry. Dr. Kermani noted that corneal topography appears normal in 27% of ectatic patients after corneal refractive surgery.* Early postoperative complications, including infections and sterile inflammation as well as corneal dryness (sicca syndrome) need special attention and intervention. Complications may also include higher-order aberrations (HOAs) induced by irregular ablation. Another post-LASIK issue is epithelial ingrowth. It is more apparent in conventional microkeratome-based LASIK compared to femtolaser-assisted LASIK, and the highest risk seems to be after attempted re-LASIK and flap lifting. Flap lift 3 years or more after initial LASIK impart the highest risk to develop epithelial ingrowth, according to literature-based risk analysis.

Renato Ambrósio, MD: LASIK, IOLs, or Bi-Optics

Dr. Ambrósio discussed refractive procedures. Considerations include level of correction, age, patients' needs, corneal structure, health of the ocular surface, the anatomy of the anterior chamber, etc. Possible procedures fall into three categories: corneal (LASIK, PRK, SMILE, ICRS, cross-linking); phakic IOLs (ICL); and IOL implantation (aspheric, toric IOLs, multifocal IOLs). A combination of these procedures (bi-optics) may be the best option for a patient. The limits of laser vision correction include optical quality, corneal stability (structure), and refractive efficiency.

THE IMPORTANCE OF CENTRATION

Michael Mrochen, PhD: Definition of Optical References

Prof. Mrochen discussed optical references, namely line of sight, visual axis, apex, optical axis, pupil center, and cyclotorsion in the context of the importance of centration. The fundamental question is what is the right position on the cornea in order to achieve optimal corrections without causing new optical aberrations, ie, under or overcorrections, or induced astigmatism in the case of decentration. Prof. Mrochen's key message was that the only practical measurements are line of sight and the videokeratographer axis for defining the optimal centration for laser ablation.

Renato Ambrósio, MD: How to Interpret Optical References With Diagnosis

Dr. Ambrósio explained why advancements in refractive surgery technology are needed. Reasons include safety (screening candidates for laser vision correction); efficacy (planning/registering customized treatments); and expansion of applications to understand "architectural stability," susceptibility to ectasia, and ocular surface/tear film.

He noted that the topolyzer (eg, Topolyzer Vario from Alcon) is an indispensable tool in the preoperative screening of candidates for refractive surgery. It provides customized topography-guided laser vision correction and iris recognition. A key question is whether corneal topography can detect ectasia. Dr. Ambrósio explained that sensitivity and specificity must be taken into account, and that screening should aim to detect mild keratoconus (forme fruste), which is an incomplete/abortive form of keratoconus. Another tool is the WaveLight Oculyzer II, a diagnostic device that uses Pentacam high-resolution technology and is equipped with a rotating Scheimpflug camera. It measures without contact from the anterior surface of the cornea to the back of the lens. He also discussed the enhanced best-fit sphere[1] that allows better detection of keratoconus. The location of the thin areas—a hallmark of ectasia—are identified by building a pachymetric map. Dr. Ambrósio also presented the WaveLightAnalyzer II and the WaveLight OB820.

Theo Seiler, PhD: Centration and Alignment Management

Prof. Seiler discussed centration and alignment management. Misalignment during the surgical procedure is a major source of refractive surprise in relation to astigmatism. A cause of

misalignment is cyclotorsion (eg, from seated to supine position, turning of the patient's head). Another issue is the center of the pupil, the Purkinje image (reflection of the target, depending on the shape of the cornea), and the definition of centration for ablation. Prof. Seiler showed an example of centration before ablation by using the Topolyzer Vario.

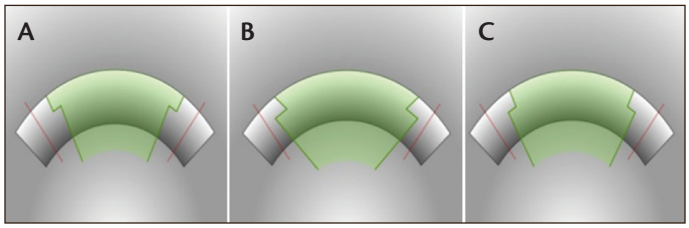
Wolfgang Riha, MD: WaveNet for Optimized Centration

Dr. Riha presented an overview of the WaveNet computer network, which connects the WaveLight systems (WaveLight EX500 excimer laser and WaveLight FS200 femtosecond laser) and a range of surgical diagnostics with the planning software. Smooth data flow and an enhanced patient flow will aid in planning and performance. The advantages are: (1) the network is not connected to the internet for safety reasons; (2) patient data has to be entered only once; (3) better standardized documentation; (4) improved efficacy of the laser technology, and (5) offsite treatment planning. Dr. Riha noted that customization and centration are the bases for any optomized corneal procedure.

THE CRITERIA OF PERFECT CORNEA CUTS

Ahmed Sedky, MD: Transition from Manual Technique to Femtosecond Laser

Dr. Sedky shared his experience of transitioning to using a femtosecond laser from the manual procedure. He reviewed the capabilities of the WaveLight FS200 femtosecond laser (Alcon). The WaveLight FS200 can create a standard LASIK flap within 6 to 8 seconds, with repeatable thickness and diameter. It is better suited for treating flat or steep corneas compared with a microkeratome, and it has a lower rate of postoperative complications. Second, implanting an intracorneal ring (ICR) has a shorter learning curve with a femtosecond laser and a much lower rate of ring segment extrusion or migration (2% and 1%, respectively) than with a manual technique (15% to 20% and 30%, respectively*). Third, regarding femtosecond laser-assisted keratoplasty, three patterns of laser cuts (in addition to the tube) have been described in the literature: mushroom, zig-zag, and top hat (Figure 1). These wound configurations create more surface area for healing and biomechanical strength compared with the traditional manual blade keratoplasty. In total, the keratoplasty procedure takes about 35 minutes (surgery itself, 15 minutes).



Courtesy of Ahmed Sedky, MD

Figure 1. The WaveLight FS200 femstosecond laser (Alcon) creates three patterns of laser cuts: mushroom (A), zig-zag (B), and top hat (C).

Tiago Monteiro, MD: Corneal Rings With WaveLight FS200

Dr. Monteiro notably touched on the role of ICR implantation in treating keratoconus (with nomogram); manual versus femtosecond laser-assisted ICR surgery; and a special application of the WaveLight FS200 laser in ICR surgery.

Because an ICR is a refractive and a therapeutic treatment, the type of ectasia must be classified in order to provide a "refractive" approach to disease management. An ICR can be combined with other procedures (ie, laser and phakic and pseudophakic IOLs. Treating keratoconus with an ICR is expected to improve a patient's distance UCVA and BCVA, help him or her gain lines of visual acuity, and possibly delay the progression of the disease and the need for keratoplasty.*

Dr. Monteiro showed his treatment nomogram for keratoconus. First, he evaluates the disease's progression and determines if corneal crosslinking is necessary. New nomograms are based on the eye's subjective refraction, axial curvature, aberrometry, corneal asphericity, and the location of the cornea's thinnest point. The disadvantages/difficulties of manual surgery in this context are (1) the centration of the intrastromal tunnel; (2) a low predictability of the intrastromal tunnel's depth; and (3) the depth of asymmetry between the two intrastromal tunnels. As a consequence, the refractive and therapeutic results are subject to variations.

In a study, the speaker investigated the difference between the intrastromal depth achieved as compared with the intended ICRs implantation,* both with manual surgery (n=96 eyes; depth=80% of the thinnest point inside the optical zone of the tunnel) and femtosecond laser surgery (n=20 eyes; depth=70% of the thinnest point inside the optical zone of the tunnel). In the manual technique group, the variation between the targeted value and the achieved value was 16% (=81.66 ±57.51 µm) vs. <1% in the femtosecond laser surgery group (=7.77 ±4.1 µm). In summary, the femtosecond laser-assisted procedure was more accurate and predictable compared with the manual procedure. The difference between the targeted and achieved intracorneal tunnel depth was clinically insignificant. Manual surgery, even performed by seasoned surgeons, is associated with a high rate of superficial implants (about one-third of surgeries). Special applications of this technique include the correction of keratoplasty-induced astigmatism, previous complicated ICR surgery, and the correction of irregular astigmatism unrelated to keratoconus. ■

1. Belin MW, Khachikian SS, Ambrósio R, eds. *Elevation Based Corneal Tomography*. 2nd ed: Jaypee-Highlights Medical Publishers, Inc.; 2012.

*Surgeon's personal data

Please refer to the user manuals for the WaveLight EX500 Excimer Laser and the WaveLight FS200 Femtosecond Laser for complete features and directions. Contact your local Alcon representative for information on the upcoming 2016 WaveLight User Meeting.