ISRS Externship Program: Case Report

What I Have Learned During My ISRS Externship

Treatment for high hyperopic astigmatism: LASIK can be an option:

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Introduction

- I applied for the ISRS externship program during my clinical fellowship at the Anterior Segment and Refractive Surgery Department of the Bordeaux University Hospital, formerly headed by Joseph Colin (Past ISRS President), now by David Touboul, MD, PhD. David Smadja, ISRS Board Member, was a Clinical Fellow during my residency and encouraged me to apply. I was looking forward to getting a thorough experience in a high standard refractive clinic in Europe. I am now running a private practice in Bordeaux, France, focused on Anterior Segment Surgery, Refractive Surgery and Glaucoma Surgery, after spending half a year as Attached Consultant in Dr Gatinel's Department.

- The Anterior Segment and Refractive Surgery Department is headed by Dr Damien Gatinel MD, PhD, ISRS Board Member, at the Fondation Ophtalmologique Rothschild in Paris, France. The externship lasted from September 2018 to the 2018 American Academy Congress in Chicago.

- I wanted to focus particularly on corneal refractive surgery activities, among the other areas of expertise of the department. The high flow of complex cases improved both my scientific and practical knowledge on how to handle those particular cases. The following case report is an illustration of what can be safely done at the boundaries of corneal refractive surgery.

Treatment for high hyperopic astigmatism : LASIK can be an option

A 22-year-old female patient was seeking for spectacle independence. Her preoperative uncorrected visual acuity (UCDVA) was 20/50 J7 and her best-spectacles distance visual acuity (BSCVA) was 20/20 J1 on both eyes with a refraction of + 7,50 (-2,50 x 165°) OD and + 8,50 (-3,50 x 160°) OS. Her cycloplegic refraction under cyclopentolate was + 8 (-2,50 x 165°) OD and + 9,50 (-3,50 x 160°) OS. Her scotopic pupillometry was 6,3 mm on both eyes. The corneal topography and tomography were compatible with the performance of refractive surgery by LASIK (Figure 1). The patient was informed of the benefits and risks of the surgery, including halos and starbursts, the need of further enhancement, regression due to epithelial compensation and dry eye disease. Iris registration and dynamic pupillometry were performed with the Topolyser.

The surgery was performed by an highly experienced surgeon (DG) under topical anesthesia, with a femtolaser-assisted flap creation (Wavelight FS200). The parameters of the flap were 9,6 mm at a 140 microns depth, with a decentration toward the vertex of 75 %. The Excimer Custom-Q treatment was subsequently delivered by the Wavelight EX-500 laser after iris recognition and cyclotorsion compensation using the personal nomogram for hyperopia and astigmatism correction (unpublished). It was necessary to convert the astigmatic component of the treatment to positive cylinder as the laser cannot treat above +6 D of sphere in its settings. The target Q was set to have a + 0,1 Delta Q (*id est* difference between initial and achieved Q factor). The maximum ablation depth was 129 µm on the peripheral cornea, while the central ablation was theoretically zero The surgery went uneventful (video available).

A complete follow-up was observed during 12 months, with UCDVA, BSCVA, topography, tomography and aberrometry recorded at each visit. Results are reported in Table 1, and figures 1 and 2.

Time after surgery	UCDVA OD	UCDVA OS	Subjective refraction OD	Subjective refraction OS	BSCDVA OD	BSCDVA OS
1 Day	20/15	20/20	plano	+0,50 -1,75 x 165°	20/15	20/20
1 Month	20/20	20/20	+0,25 -1 x 115°	+0,25 -0,75 x 180°	20/20	20/20
6 Months	20/20	20/25	+0,25 -1 x 135°	+1 -1,50 x 180°	20/20	20/20
1 Year	20/20	20/25	+0,25 -1 x 145 °	+0,75 -1,75 x 180°	20/20	20/20

Discussion and What I Learned

Lasik for hyperopia is a demanding technique(1), requiring large blend zones(2) to avoid regression and therefore large flaps. Femto-second laser like the FS200 can achieve large and deep flaps(3). A slightly thicker flap (140 microns) than usually used for myopic LASIK can allow the flap to follow better the underlying corneal profile, and to increase the distance between the stromal interface and the epithelial layer. This could lower the risk of regression following hyperopic LASIK(4). The risk of keratectasia remains very low even with a deep flap as hyperopic eyes tend to have thicker corneas, with the photoablation sparing the central cornea hence decreasing the biomechanical damage.

Correcting hyperopia requires more laser spots than correcting myopia, as there is much more corneal volume to photoablate(2). The volume dedicated to the realization of the transition zone is greater than that consumed by the optical zone to prevent regression(5). Therefore, tracking eye movements is of paramount importance, and it is necessary to have an efficient eye tracking system. Attention should be paid to any tilting of the head before and during firing laser, as the tracking system could allow the delivery of the treatment despite significant eye tilt. This can lead to significant decentration of the treatment. The repetition rate is also of paramount importance, as a longer photoablation time can lead to decentered treatment zone due to poor fixation, corneal dehydration, resulting in a lower refractive accuracy and ultimately in an alteration of the quality of vision. Motwani et al.(6) published some data confirming the previous results of moderate and high hyperopia treatments with the Wavelight laser(7).

The pupil of hyperopic eyes is often located nasally than myopic eyes pupil. The kappa angle is larger. Although it is controversial (8,9), the Excimer treatment was centered toward the corneal vertex (75% of the pupil center - vertex distance). It is therefore important to use a treatment centering technology to take these characteristics into account. The iris and pupil recognition, the location of the vertex are available on some of the most recent platforms, as on the Wavelight EX-500 we used for this procedure. Chord Mu(10,11) coordinates are available on the Topolyser Vario dynamic pupillometry report ($C = (x^2 + y^2)$).

The optical zone should match the mesopic pupil diameter and be increased by the distance corresponding to the shift oh the ablation center toward the apex.

One should seek to anticipate wound healing effect by epithelial hyperplasia within the inflexion zone at the junction between the optical zone and the transition zone(4). The asphericity can be adjusted using the Custom-Q module treatment, as reported before for presbyopia treatment (12). In order to reduce the corneal hyperprolacity induced by the corneal ablation for a high amount of hyperopia, we adjust the target asphericity using Custom-Q program mode. The asphericity adjustment allows to induce a steeper transition zone, inducing a larger functional optical zone without need to adjust the planned sphero-cylindrical ablation profile. In practice, targeting of a positive deltaQ (usually +0,2) induces a slight overcorrection of hyperopia. No adjustment of the sphere is made because the aim is to induce it. The interest of positive deltaQ rather than a modification of the sphere is to induce a modification which will concern more the peripheral cornea (where the regression occurs) than the center.

These refinements can extend the range of hyperopic patients elective for corneal refractive surgery, and should be confirmed by well-powered and built RCTs.

I learned many tips and tricks, both in consultation (patient selection), treatment planning and surgery. We even conducted a blind wine tasting with the residents. The externship helped to consolidate my first steps in refractive surgery, a path that I am following with David Touboul. Dr Gatinel welcomed me into his department as attached consultant in Glaucoma from September 2019 to February 2020 and I look forward to strengthening the bonds between Bordeaux and Paris.

Supporting Information

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12. Courtin R, Saad A, Grise-Dulac A, Guilbert E, Gatinel D. Changes to Corneal Aberrations and Vision After Monovision in Patients With Hyperopia After Using a Customized Aspheric Ablation Profile to Increase Corneal Asphericity (Q-factor). J Refract Surg. 2016 Nov 1;32(11):734–41.

Figures

Figure 1 : Preoperative topography and aberrometry (Orbscan, OPD-Scan and Pentacam)

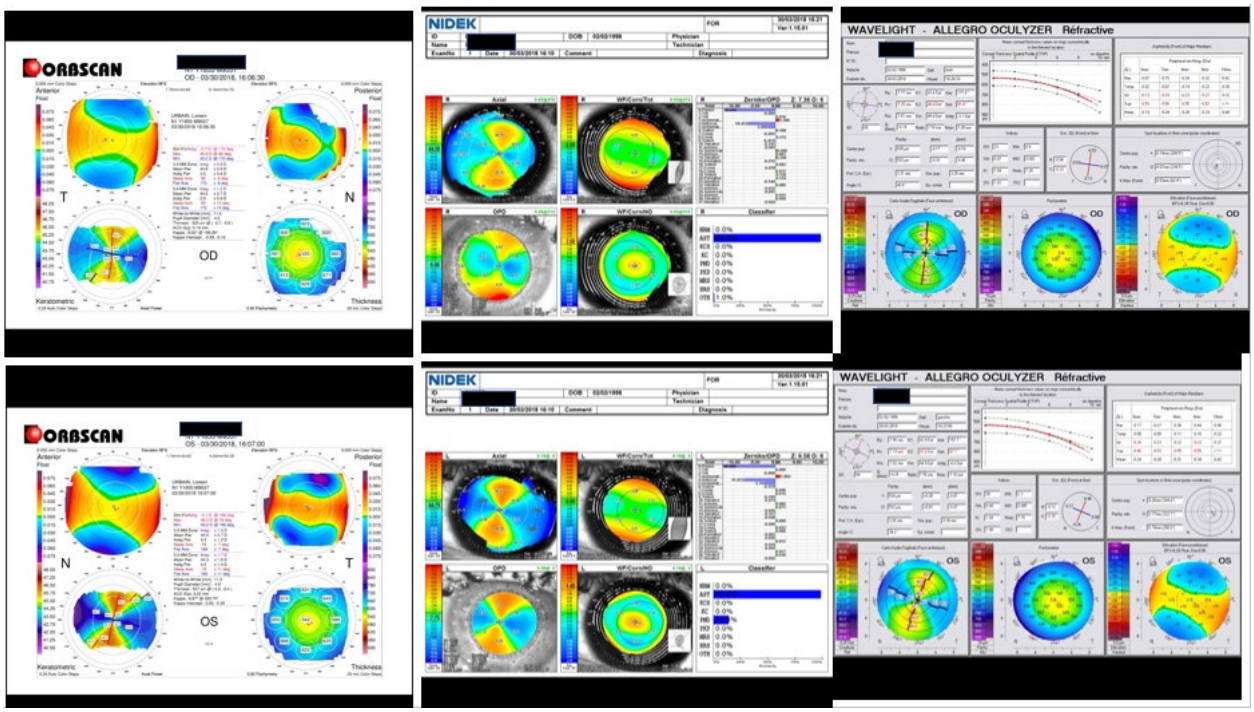

Figure 2 : Ablation profiles in the OR

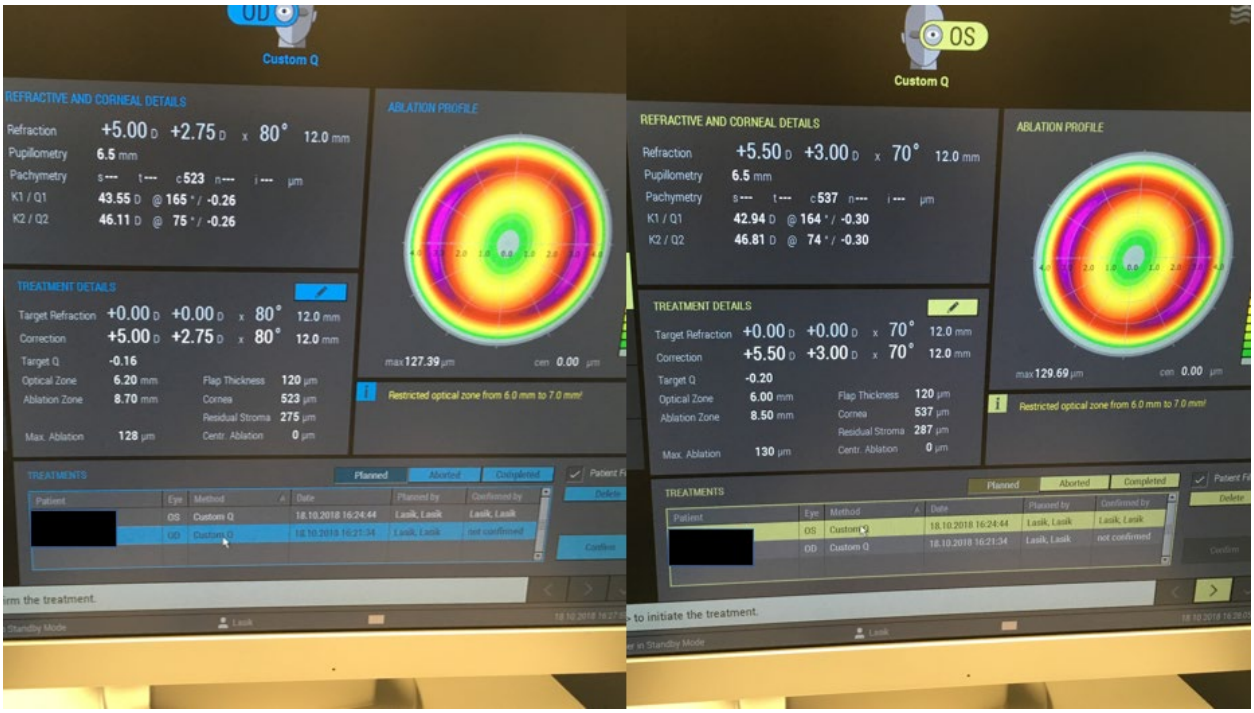

Figure 3 : Post op Day 1 on OPD-SCAN, with an oblate shape on the periphery of the central bump created by the positive deltaQ

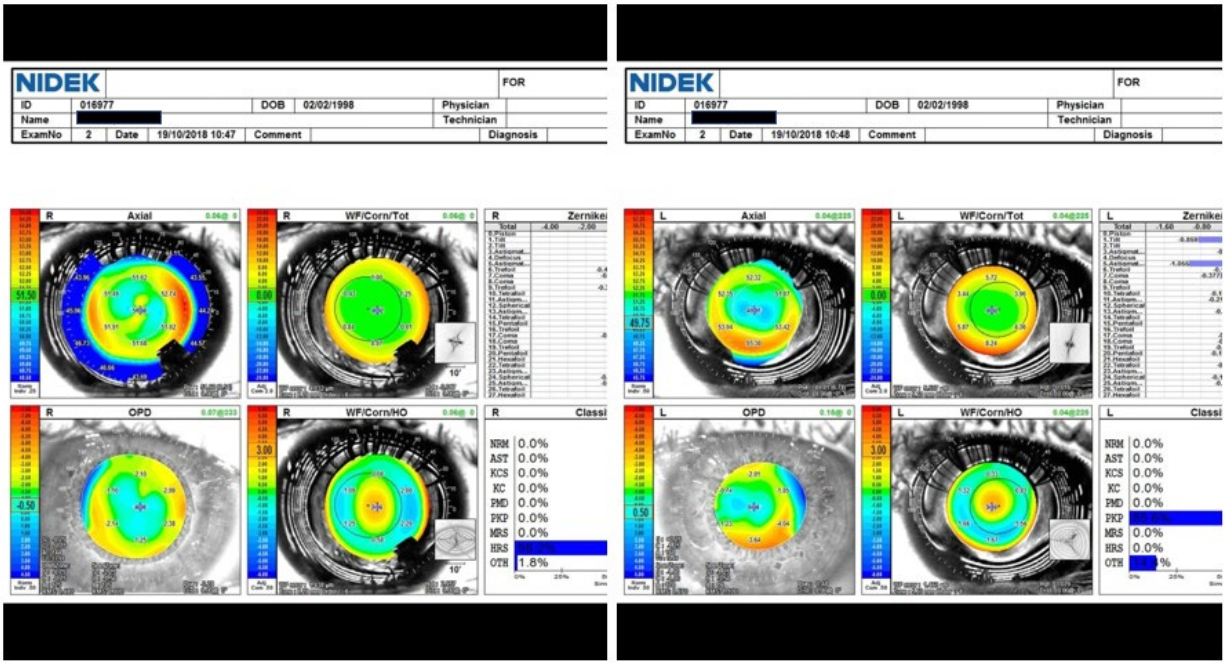

Figure 4 : Post op at 9 months : astigmatic regression is seen on the left eye, and the oblateness has disappeared because of epithelial hyperplasia.