Alcon Wavelight®

USER MEETING HIGHLIGHTS

16-17 March 2019

HONG KONG

The Alcon Wavelight® User Meeting was held on March 16 and 17, 2019 in Hong Kong. Experts and key opinion leaders in refractive surgery across the Asia-Pacific regions came together to share their experience and align with the latest developments in refractive surgery. The objectives of the meeting were to provide a forum to exchange best practices and technical experiences in topography-guided treatments, femtosecond laser and Contoura™ Vision. Keeping pace with innovation, upcoming new technologies such as Streamlight™ and ray tracing were discussed.

FROM TOPOGRAPHY-GUIDED TREATMENT TO CONTOURA™ VISION

The Need for Topography-Guided Treatments

Prof. Zhang Fengju

Conventional refractive surgeries have several limitations with a considerable proportion of patients experiencing visual symptoms such as night glare, halo, and decreased night vision, impacting night driving and working.[1] Higher order aberrations resulting from pre-operative corneal irregularities, increased coma due to decentered ablations and increased post-operative spherical aberrations (from small optical zones), are some of the common factors responsible for poor quality vision after conventional refractive surgeries.

Prof. Zhang Fengju, a leading expert in refractive surgery, explained that with technological advances, two main customized solutions, wavefront-guided and corneal topography-guided treatments, are now available. Wavefront-guided ablations use static measurements of the eye. However, human wavefront aberrations are dynamic and constantly changing with accommodation, while topography-guided treatments use information from corneal topography and do not change with accommodation.

Topography-guided treatment is designed to regularize the cornea. Indications for topography-guided treatment include irregular corneas, corneal scars, keratoconus, treatment of complications of previous refractive surgery such as decentered ablations, small optical zones, and irregular astigmatism.

Dr. Arthur Cummings
Consultant Eye Surgeon,
Wellington Eye Clinic
Consultant Ophthalmologist and Head of the Department of Ophthalmology
Beacon Hospital, Ireland

Dr. Dandapani Ramamurthy
Chairman,
The Eye Foundation, India

Prof. Zhang Fengju
Beijing Tongren Eye Center, Beijing Tongren Hospital of Capital Medical University, China

Dr. Ryu Ik Hee
Chief Director, B&VIIT Eye Center, Seoul, South Korea

Clinical Science Behind Contoura™

Dr. Dandapani Ramamurthy

The Contoura™ Vision is a topography-guided treatment on eyes that utilizes a placido ring based topographical system (Topolyzer VARIO or Allegro Topolyzer). The patient's eye is imaged and analyzed using 22 rings and 22,000 unique elevation points on the cornea.

This data is sent to the surgical planning computer to create an individualized ablation profile, following which a Wavelight® EX500 or Excimer Laser automatically adjusts laser pulse placement to match the topography-guided treatment.

Contoura™ Vision is performed either on EX500 or EYE-Q in conjunction with Topolyzer VARIO with the help of T-CAT software. The software calculates treatment plan combining manifest refraction data and corneal irregular shape data from topographer.

A minimum of 4 examinations are imported and the system calculates the median (corneal radius and asphericity), following which the HOAs are calculated, and finally the sphere and astigmatism estimation by the surgeon is added.

"During Contoura™, the elevated parts of the cornea are depressed, and the surrounding areas around the depressed parts are elevated. This bi-modal treatment results in reduced consumption of tissue and more regularization of the cornea" said Dr. Dandapani Ramamurthy.

Table 1: Pre-requisites for Contoura™ Vision

- High quality topography is essential
- Good correlation between topographic and refractive astigmatism is necessary
- Ablation profiles of T-CAT and wave front optimized should be compared
- Use of same target Q value as pre-operation value (0 to -1) is essential
- Proper patient alignment under the laser needs to be ensured

Dr. Ramamurthy shared his personal views and recommendations on pre-requisites to achieve optimal refractive and visual outcome with Contoura™ Vision (Table 1).

Contoura™ is a bi-modal treatment shaving off peaks and steeping the flatter areas of cornea providing optimal corneal curvature. It is static, reproducible, provides better peripheral data, and is not affected by age, pupil size and corneal opacity.

Managing Topography-guided Treatments in the Clinics

Dr. Ryu Ik Hee

With an experience of more than 1000 procedures using the Contoura™ Vision, Dr. Ryu Ik Hee shared his insights and provided valuable guidance on managing topography-guided treatments in clinical practice.

Topography-guided Contoura™ Vision is ideal for patients who need customized procedures, including those with irregular topography findings (superior or inferior steepening), and those with astigmatism by manifest refraction of >2D or when index of height decentralization (IHD) > 0.01, which is the most significant value during screening.

Abnormal topo map as seen from the Wavelight® Oculyzer™, should be considered suspicious for keratoconus (Table 2).

"I consider anterior float criteria >15 µm and posterior float criteria >20 µm suspicious for keratoconus (KCN) eliminating laser refractive surgery", explained Dr. Ryu.

Table 2: Consideration for Keratoconus using Wavelight Oculyzer™

1. Anterior float criteria
   - Normal values: < +12 µm (or 10 µm)
   - Suspicious: from 12 µm to 15 µm
   - KCN : > 15 µm
2. Posterior float criteria
   - Normal values: < + 17 µm
   - Suspicious: from 18 µm to 20 µm
   - KCN: > 20 µm

Capturing high-quality images with Topolyzer VARIO is another crucial determinant of treatment success. It is recommended to have at least 4-8 images before the day of surgery.

"Sometimes, the VARIO images do not work well when the cyclotorsion fails to register, in which case a manual marking or manual alignment (with the red cross-line projector under the EX500) of astigmatism is needed," added Dr. Ryu.

Another consideration for topography-guided Contoura™ Vision is to understand the biomechanical properties of the cornea. Patients with Tomographic/Biomechanical Index (TBI) > 1 should be excluded from laser refractive surgery.

TBI cut-off value of 0.79 provides 100% sensitivity for detecting clinical ectasia with 100% specificity.[2]

Adding accelerated cross-linking in borderline patients and converting to phaco surgery is the surgeon's personal preference, noted Dr. Ryu.

An active customer relationship management, ensuring patient satisfaction and results is another reason for selecting Contoura™ Vision. Dr. Ryu continued "My aim is to convert LASIK and PRK to customized ablation to provide accuracy and satisfaction to the patients".

A comprehensive pre-operative evaluation, excellent topography, appropriate patient selection, high quality images with Topolyzer VARIO and understanding biomechanical properties of the cornea are crucial for successful treatment with Contoura™ Vision.

Prof Chen Yueguo
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Comparison of Wavefront-optimized vs Topography-guided vs TMR LASIK *Prof Tae-Young Chung*

"The challenge with wavefront-optimized ablation is that the human wavefront aberration is dynamic and constantly changes with accommodation (leading to aspherical ablation), whereas topography-guided ablation aims to target the aberration at the anterior surface of the cornea, which is relatively constant regardless of accommodation. This is why we should treat corneal aberration rather than ocular aberration," said Prof. Tae-Young Chung.

However, since treatment of corneal HOA has an effect on refractive outcome, it is believed that treating refractive astigmatism and corneal HOA would result in over-correction or under-correction of refractive astigmatism depending on the axis difference.

Therefore, the concept of topography-modified refraction (TMR) was introduced, which involves treating corneal HOA and topography-based corneal astigmatism instead of treating corneal HOA and the manifest refraction (FDA-TG).

In addition, in sub-group analysis of TMR-TG, astigmatic over-correction was more when corneal astigmatism (CA) was greater than manifest refractive astigmatism (MRA).

Astigmatic over-correction was associated with pre-operative magnitude difference between CA and RA, which is quantified by ocular residual astigmatism (ORA).

"Since a higher ORA is associated with poor visual outcome it needs to be detected early to avoid suboptimal visual outcome," highlighted Prof. Chung.

When performing topography-guided LASIK, if CA< MRA, treating CA with TMR-TG is a preferred choice. If the CA > MRA, treating MRA with FDA-TG seems to be a more suitable option. Using modified TMR (treating midpoint between MRA and CA) when CA > MRA may also result in astigmatic over-correction.

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Clinical Evaluation of Contoura™ Vision outcomes

Dr. Sharif Hashmani

Dr. Sharif Hashmani provided an overview of the clinical outcomes with Contoura™ vision highlighting improvement in uncorrected visual acuity (UCVA) and uncorrected distance visual acuity (UCDVA), predictable refractive outcomes and reduced visual symptoms; safety, efficacy and patient satisfaction. Contoura™ FDA pivotal study results were presented.

Role of Topography Modified Refraction (TMR) in treating astigmatism was also discussed. Dr. Sharif touched upon the concept of phorcides, a new software based on vector analysis, which considers magnitude and axis of topographic and refractive astigmatism and ocular residual astigmatism (ORA) to predict the optimal axis to treat.

Clinical Outcomes of ContouraTM Vision vs. Amaris 750S

Dr. Pierce Lin Pi Jung

Topography-modified refraction (TMR) is a relatively new concept that involves adjustment of the clinical refraction based on topographic data.

Dr. Pierce Lin Pi Jung shared his personal clinical experience with Contoura™ Vision and SCHWIND Amaris 750S. Based on his experience with 144 patients (286 eyes), Dr Lin compared the predictability, accuracy, efficacy and safety of SCHWIND Amaris 750S (aberration free) versus EX500: WFO, Custom Q, Contoura™ (applying manifest refraction).

While SCHWIND Amaris 750S and EX500 (WFO and Custom Q) showed good predictability of spherical equivalent, cylinder distribution and accuracy, Contoura™ was associated with better post-operative UDVA and safety.

Another important consideration is TMR, where the amount and axis of astigmatism treated is based on topographic data. In a separate investigation, Dr. Lin explained that the definition of manifest refraction of Contoura™ was changed according to the axis difference; which was limited to manifest vs. measured axis ≤ 200.

The observations showed that predictability of spherical 1-month post-operatively was almost similar in both Amaris 750S and Contoura™, but Contoura™ seemed to be little better.

In more than 80% of cases, accuracy of Contoura™ was observed to be within 0.5D, and the UDVC (41.07%) and safety (37.5%) was thought to be superior with Contoura™ compared to SCHWIND Amaris 750S (8.82%) (Figure 1).

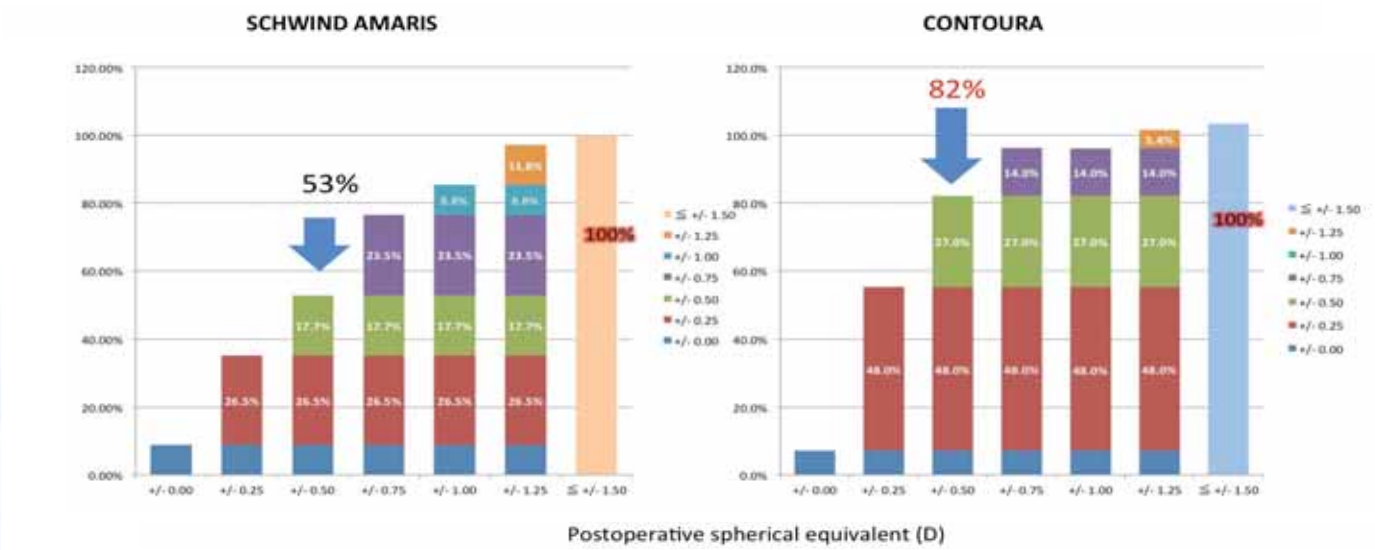

Figure 1: Contoura™ demonstrated higher accuracy when compared to SCHWIND Amaris 750S, as observed in Dr Lin's clinics

Even though these results were not published, these observations were consistent with the findings of a recently published study which state that topography-guided myopic astigmatism LASIK treated on the topography-measured anterior corneal astigmatism axis resulted in inferior refractive and visual outcomes compared to treating on the clinical manifest refractive astigmatism axis.[3]

Modified manifest refraction based Contoura™ Vision was observed to offer better predictability, accuracy and safety over SCHWIND Amaris 750S, based on experience from Dr Lin's clinics.

Contoura™ Vision in Ai-er Hospitals

Prof. Wang Zheng

Dr. Wang Zheng, a Hospital Director at the Ai-er Eye Hospital, shared his experience on improving efficiency and optimising results with Contoura™ Vision.

Physician education plays an important role in promoting Contoura™ Vision. Ai-er hospitals organize training courses for physicians on Contoura™, which is particularly useful in patients with irregular corneas compared to standard treatment.

"We encourage physicians to look at patient pre-operative maps to emphasize that irregular corneas are very common among patients", stated Dr. Wang

Dr Wang shared his personal experience based on the clinical procedures in his clinics. In using the Contoura™ Vision photorefractive keratectomy (PRK) plus cross-linking in 76 eyes under -6.0D with asymmetrical, irregular or very thin cornea, Dr Wang was able to observe an improvement to the UCVA and CDVA at 1-year post-operation (Figure 2).

Dr Wang observed that 89% of his patients had UCVA of 20/20 and 46% had UCVA of 20/16. It was further observed that 56% patients gained one line at 1-year. There was a slight increase in spherical aberrations and the corneal coma was reduced, while the ocular coma was increased after surgery. This was because ocular wavefront centres on the pupil, while the corneal wavefront centres on the vertex, explained Dr. Wang.

Reliable topography data, proper surgical design and registration are key aspects of successful Contoura™ treatment. Physician, technician and patient education are equally important to ensure optimal outcome. Contoura™ can be used in LASIK as well as surface ablation procedures. Fine-tuning in surgical design, especially the management of cylinder, can further improve the outcomes with Contoura™.

Figure 2: One-year UCVA and CDVA after Contoura™ Vision PRK plus cross-linking, based on observation by Dr Wang in Ai-er hospitals.

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Topography-Guided Treatment for Irregular Corneas

Dr. Arthur Cheng

Corneal ectasia, keratoconus, scarring, trauma and previous surgical procedures are some common causes of irregular cornea, leading to significant visual disabilities. "Topography-guided treatment that combines myopic and hyperopic ablations has demonstrated successful outcomes in patients with irregular corneas," said Dr. Arthur Cheng.

Keratoconus is commonly seen in the clinics. The treatment options for keratoconus include corneal collagen crosslinking (CXL), intraocular stromal ring and topography guided PRK plus crosslinking. Though corneal collagen crosslinking is effective in halting disease progression, it is not effective in correcting abnormal shape. Intraocular stromal ring has an unpredictable outcome and is not applicable to central cone. On the other hand, topography guided PRK followed by CXL has shown promising results, and better outcomes. The steps involved in performing Topography-guided PRK followed by CXL is explained in Table 3.

Table 3 : Procedure of Topography guided PRK followed by CXL

Step 1	PTK to remove uneven epithelium on corneal surface
Step 2	• Topography guided PRK to reduce irregularities of the corneal surface • Asphericity adjustment • Myopic compensation • Astigmatic compensation • Limited ablation depth to aim for stromal thickness of > 400 µm
Step 3	Crosslinking
Step 4	Application of mitomycin C to prevent scarring and reduce haze

"The idea of topography guided PRK is to reverse the disease progression in patients with irregular corneas; that is to reverse the myopia, reverse astigmatic change and reverse coning." added Dr Cheng.

Another important consideration in topography guided trans-epithelial PRK is the need for appropriate adjustment of spherical equivalent after correction of astigmatism. Spherical compensation can reduce the cone curvature and flatten the central cornea. "The extent of compensation depends on the steepest area and the underlying refractive error," explained Dr. Cheng.

Topography guided PRK is becoming increasing popular in the treatment of irregular corneas. It has shown improvement in better astigmatic correction, best-corrected visual acuity (BCVA), and enhancement of quality of vision.

Outcomes of the New Combined Treatments for Keratoconus

Dr. Aanchal Gupta

Young patients with progressive keratoconus, who are not satisfied with rigid contact lenses and a high degree of refractive error, are common in everyday practice. These cases are often complicated with very poor uncorrected and best-corrected visual acuity.

Dr. Aanchal Gupta's approach in these patients is keraring implantation followed by a topography-guided PRK (TG PRK) after 3 months. "The waiting time of 3 months is essential because there is a huge amount of regularization needed for such severe corneas," explained Dr. Gupta. "If the best-corrected visual acuity post keraring implantation is poor, then an ICL will not be suitable because patient still has a very irregular cornea."

Dr. Gupta's unpublished data on triple procedure including TG PRK with CXL post keraring implantation in keratoconus patients has been encouraging. The TG PRK was done using the topography-guided

The triple procedure has shown promising results in patients with keratoconus. Although cross-linking is excellent in terms of halting progression, there are un-answered questions on how much cross-linking is sufficient and whether combined modalities are safe and effective over longer duration of time. A long-term follow-up of a larger population study is required to validate the current findings.

custom ablation treatment (T-CAT) protocol modified by topographical neutralization technique (TNT) and refraction with WaveLight® EX500, along with a standard cross-linking protocol. A significant gain in UCVA and BCVA was seen with good stability at 12-month follow-up, highlighting the ongoing improvement in patient's vision beyond the initial laser treatment.

In addition, manifest astigmatism; steepest keratometry, refractive, keratometric and topographic data reached statistical significance after the triple procedure, thus highlighting the beneficial effect of cross-linking in keratoconus patients.

Effect of Astigmatism in Topo-guided Treatments

Dr. Rohit Shetty

One of the important considerations while treating astigmatism is understanding cylinders. Cylinders are made of higher and lower order aberrations (HOA and LOA) and GALILEI pie charts are a great tool to understand cylinders (Figure 3). "If there are two patients, both with high cylinders, but one has predominant astigmatism and other one predominant coma; the axis changes according to the dominance,' explained Dr. Shetty.

In case 1, when the patient has predominant astigmatism with LOA, the patient's axis and topolyzer axis match. In this situation a WFO-ablation would result in a superior quality visual outcome. However, in case 2, where the measured axis and patient axis are different, the GALILEI map shows both astigmatism and coma.

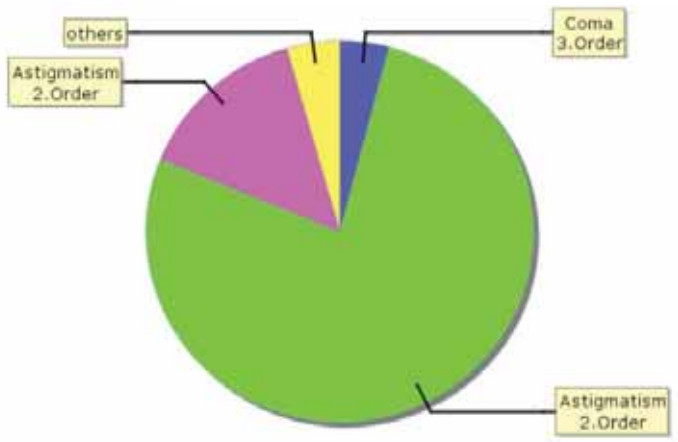
A WFO-ablation in this patient will have a residual cylinder of 90% coma and 5% astigmatism and hence poor quality of vision with glass correction.

"This is where Contoura™ plays an important role, where it corrects the HOA, and the resulting cylinder is predominantly 2nd order astigmatism explaining the superior quality vision", highlighted Dr. Shetty.
Another common confusion that occurs while treating astigmatism is when the patient accepts higher cylinder than that measured on topography. The reason for this confusion is explained by real-time aberrometry of lenticular astigmatism, which shows corneal astigmatism being balanced by the lens astigmatism. Prof. Shetty estimated that at least 10-12% of his ContouraTM patients have issues with higher cylinders than what is seen on topography.

A model of 3 Z's consisting of Zernike pyramid, zero rule and lens compensation by zonules, might allow better understanding of interplay of lens and cornea. Ray tracing, a new computer-based algorithm that uses data from several different measurements, is expected to provide individualized ablation profile for treatment of astigmatism in the near future.

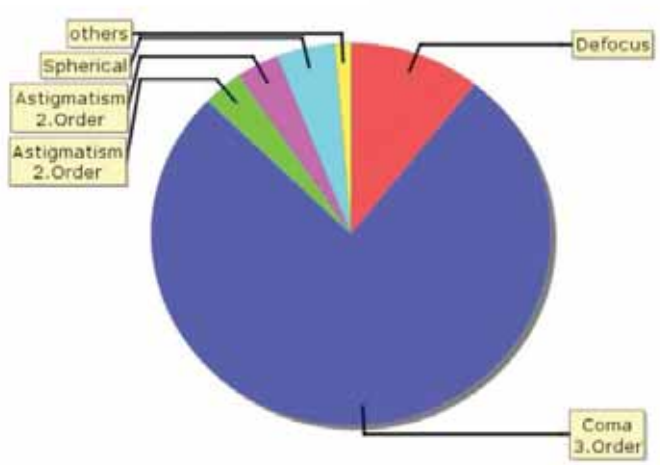
Good understanding of cylinders and dynamic relationship between lens and cornea is essential to ensure successful astigmatic correction with Contoura™. In future, use of the 3 Zs model and ray tracing technology is expected to provide further insights in topo-guided astigmatism treatment.

CASE 1



Cylinder with predominant lower order aberration

CASE 2



Cylinder with predominant higher order aberration

Figure 3: Galilei pie charts is a valuable tool to understand cylinders

Surface Ablation on post-SMILE Patients

Prof Chen Yueguo

Use of small incision lenticule extraction (SMILE) has shown promising results in treatment of refractive errors such as myopia, hyperopia, presbyopia, and astigmatism. SMILE offers advantages such as the ability to perform flapless LASIK and painless PRK. However, no customized cutting pattern, kappa angle and cyclotorsion compensation, steeper learning curve in lenticule dissection, and difficulty in enhancement procedure decision are some of the disadvantages of SMILE.

"According to a report published in 2017, about 3% of patients undergoing SMILE need an enhancement procedure within 1 or 2 years.[4] Post-operative complaints in SMILE patients are due to decentration or small optical zone" explained Prof Chen Yueguo.

Prof Chen explained through the case of a 20-year old patient with uneventful bilateral myopic SMILE who presented with glare, halo and double image, since post-operative day one. A topography guided LASEK enhancement was performed 23-months post-SMILE, which resulted in reduction of vertical and horizontal coma and spherical aberration within 2-month after the procedure. However, regression was observed over time, and it was believed to be due to epithelial thickening (Figure 4). In addition, post-operative hyperopic shift resulted in over-correction in the dominant eye.

Since mitomycin C was not available, a re-enhancement using wavefront optimized (WFO) Wavelight® EX500 was performed.

A significant improvement in UCVA, BCVA and refraction (6 month post-operative: 1.0+; plano and 8 month post-operative: 1.0; plano) was seen without any symptoms of glare and halo, thus showing that topography guided WFO ablation was successful in restoring irregularity of cornea.

Topography-guided ablation can restore the corneal regularity and is a safe and effective method for complicated SMILE cases. In procedure design before enhancement for SMILE, hyperopic shift and uneven epithelial thickness should be considered.

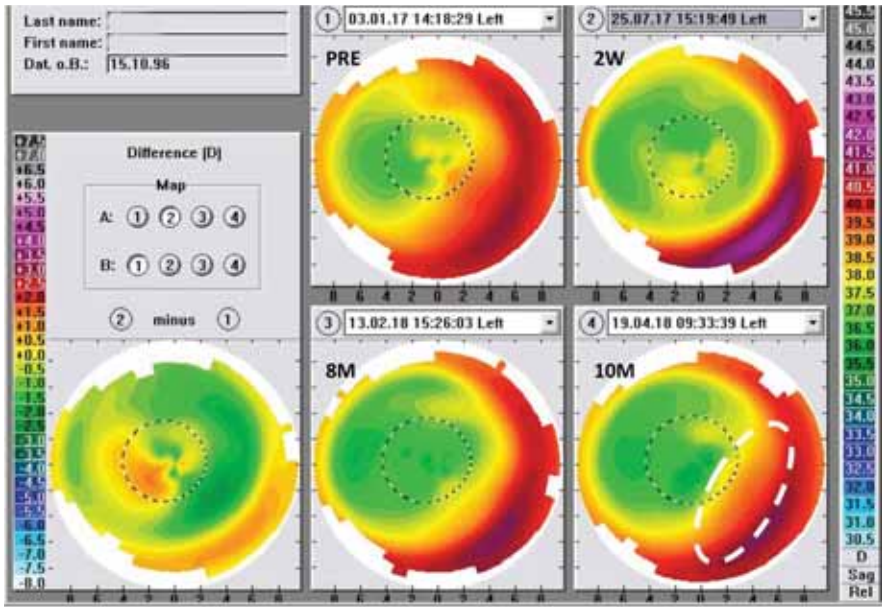


Figure 4: Post-operative regression and epithelial thickening

FEMTOSECOND LASER SURGERY

Clinical Pearls of Femtosecond Laser Surgery

Prof Rohit Shetty

Safety, precision, versatility and patient comfort are the greatest advantages of femtosecond laser (FS) and it has since established its place in high precision ophthalmic surgery.

"Ease of lifting the flap is one of the strongest advantages of using FS 200" said Prof. Rohit Shetty. Prof. Shetty shared clinical pearls on femtosecond laser surgery (Table 4).

Table 4: Clinical pearls of femtosecond laser
• Allows customization of flap thickness
• Provides strong flap healing and is less prone to displacement
• Allows customization of position of hinging
• Enables prediction of flap thickness is possible
• Allows individualized flap centration
• Useful in different types of keratoplasty
• Easily cuts through dense corneal scars (microbial keratitis, Buckler dystrophy)
• Minimizes potential intraoperative complications
• Provides faster visual and refractive recovery

Femtosecond laser is known for its precision, safety, versatility and patient comfort. Wide adjustment range of geometries and parameters, ability to create thinner and custom flaps and faster visual and refractive recovery are some the most important advantages of femtosecond laser. Due to its ability to create thinner flaps, biomechanical insult following femtosecond laser is believed to be minimal.

The Femtosecond Laser Flap: Managing complications

Dr. Alnette Lee Tan

While FS laser has provided significant improvement to ophthalmic refractive surgery, complications such as patient's eyeball movement, loss of suction, incomplete flaps, teary eye and accidental service settings on the machine can be encountered in routine clinical practice.

"Patient selection is the key aspect of FS laser" said Dr. Alnette Tan. In order to achieve suction and secure the applanation cone successfully, the patients need to be able to refrain from moving, jerking, or trying to squeeze eyes shut. "Eyeball movement, especially during the last second of side cut can result in an inadequate inferior side cut," explained Dr. Tan.

Loss of suction midway is another issue. Loss of suction can occur due to loose conjunctiva or due to patient movement during the procedure. It can be avoided by using caution while applying the interface and counseling the patient to stay still and avoid jerky movements.

The next common complication during FS surgery is incomplete FS flaps. Dr. Tan suggests that there are 3 ways of dealing with this complication (Table 5).

Dr. Tan explained that FS200 has a unique way of managing opaque bubble layer (OBL). By creating a tunnel to vent gas created during flap creation, the Wavelength® FS200 femtosecond laser minimizes OBL issues, the excimer laser treatment can be performed right after the flap is cut resulting in fast total refractive procedures.

Table 5: Techniques to manage Incomplete FS Flap
1. Recut with the same parameters ensuring the suction ring is at the exact position of the previous pass.
2. Recut right after with a bigger flap size and a deeper level, ensuring not to cut through the incomplete interface. The canal should be put at a different angle to prevent overlap with the previous canal. Following the dissection of the interface, the circumference of the flap should be scoured with a wider diameter to make sure that the second interface is completed.

Examination of the field and drying the areas of teary eye before applying the suction ring is an important step while performing FS laser.

"Drying the fluid and re-docking and sweeping away any loose or redundant conjunctiva." added Dr. Tan as an important step to avoid complications.

Patient selection is the key aspect of femtosecond laser. Eyeball movement, loss of suction, incomplete flaps, teary eye and accidental service setting on laser are commonly encountered issues during femtosecond laser.

The role of corneal epithelium in surface abalation

Prof Zhai Changbin

"Corneal wound healing reaction is one of the main determinants of surgical effectiveness and safety. The integrity of the corneal epithelium is necessary to maintain the balance between the epithelium and the stroma. In refractive surgery the integrity and vitality of corneal epithelium is important for the good healing of corneal wounds, avoiding complications and obtaining the best postoperative vision." - Prof. Zhai Changbin

Medium and Long-term Follow-up Observation of the Efficacy of FS-AK *Prof Bai Ji*

Astigmatic keratotomy is a useful technique for the treatment of astigmatism, amongst other options such as LASIK PRK, Toric IOL and SMILE . By virtue of its precision and versatility, femtosecond guided astigmatic keratotomy (FS-AK) makes the surgery more accurate while allowing individualization over conventional AK. Patients with thin cornea and those with shallow anterior chamber who are not suitable for intraocular lenses are ideal candidates for FS-AK.

Prof. Bai Ji presented the role of FS-AK combined with T-CAT in correction of myopic astigmatism. In the study, patients with myopic astigmatism treated with FS-AK showed relatively stable post-operative astigmatism 3 months after surgery, but without significant change in UCVA while there was a significant increase in HOAs (Figure 5).

Since AK was unable to correct myopia and led to increase in HOA, the need for refractive surgery enhancement was established and a follow-up T-CAT was the preferred choice. Following T-CAT, there was a significant increase in UCVA and a significant decrease in irregular astigmatism. 2-year follow-up showed that the cornea was normal, AK incision was visible, there was no

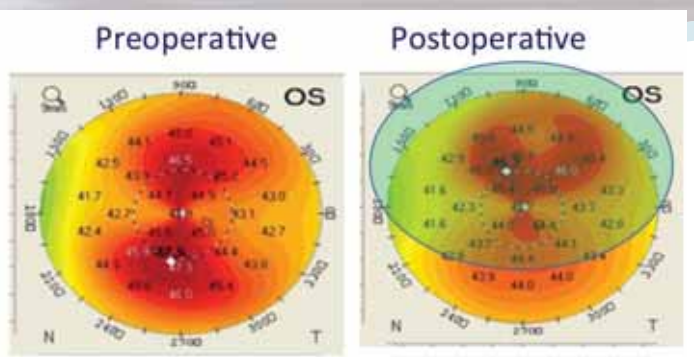


Figure 5: Post-operative HOA after FS-AK

abnormality under LASIK corneal flaps and there was no haze. "Though satisfactory visual outcome was achieved, further long-term studies in larger patient population are necessary to establish the role of FS-AK with T-CAT in myopic astigmatism." cautioned Prof. Bai.

FS-AK guided by corneal topography combined with T-CAT is safe and effective for myopic astigmatism correction and is especially suitable for patients with thin cornea and inadequate anterior chamber conditions for IOL.

Streamlight™ One-step Trans-Epi PRK
Dr. Arthur Cummings

StreamLight™ (EX500 transPRK) is the newest, no-touch, one-step technology used to perform Trans-Epi photorefractive keratectomy (Trans-Epi PRK) in patients who cannot have a LASIK flap. Unlike conventional PRK (Table 6), which is a 2-step procedure and involves removal of corneal epithelium followed by laser ablation, SteamLight™ is a one-step PRK followed by wavefront optimization (WFO).

StreamLight™ is usually applied to the thickest section of the epithelium resulting in the reduction of thickness and refractory change in the surrounding epithelium. Before using StreamLight™, epithelial mapping is a powerful diagnostic, therapeutic and planning tool to detect corneal abnormalities. "If you do not have epithelial mapping, my advice would be to do StreamLight™ only on virgin eyes, where we expect the epithelium to be regular", added Dr. Cummings.

Table 6: Conventional PRK vs. StreamLight™

Conventional PRK	StreamLight™
• PTK induces -0.75 more myopia	• PTK is neutral
• PTK followed by any treatment profile	• PTK followed by WFO optimized profile
• 2-Step Procedure	• 1-Step Procedure

While sharing his experience using StreamLight™, Dr. Cummings explained that the entire procedure is done below the body temperature. The cornea is chilled with balanced salt solution and PTK as deep as thickest epithelium in treatment zone to nearest 5µ is performed. The recommendation is to pause for 10 seconds, which allows the cornea to cool down by about 2 degrees and then perform the last part of the treatment, which is the PRK element with wavefront optimized profile without any adjustment.

Another important consideration while doing Trans-epi PTK is the use of Phorcides™, which is

a software designed to assist in calculations for Contoura LASIK treatments. "Phorcides has the potential to make Trans-epi PTK very predictable for irregular corneas by assessing the refractive effect of a PTK of given depth on a particular epithelial layer. It has the potential to regularize the cornea and achieve refractive predictability simultaneously", added Dr. Cummings.

StreamLight™ (EX500 transPRK) is the latest, no-touch, one-step technology used to perform Trans-Epi photorefractive keratectomy (PRK) in patients who cannot have a LASIK flap. Epithelial mapping should be used to determine corneal abnormalities before performing transepithelial PRK.

Early clinical experience with Streamlight

Dr. Rick Wolfe

Early clinical experience with StreamLight™, the latest no-touch, one-step technology used to perform trans-epithelial photorefractive keratectomy (Trans-Epi PRK) has been promising.

Potential advantages of StreamLight™ include faster surgery (2sec/D), better patient acceptance due to its no-touch mechanism, and quicker treatment with one-step technique. In addition, it has been shown to be associated with faster healing and less pain, with better or equivalent results compared to conventional PRK. Reduction in incidence of complications, particularly recurrent corneal erosion syndrome (RCES) (Figure 6) is an additional advantage,[5] stated Dr. Rick Wolfe.

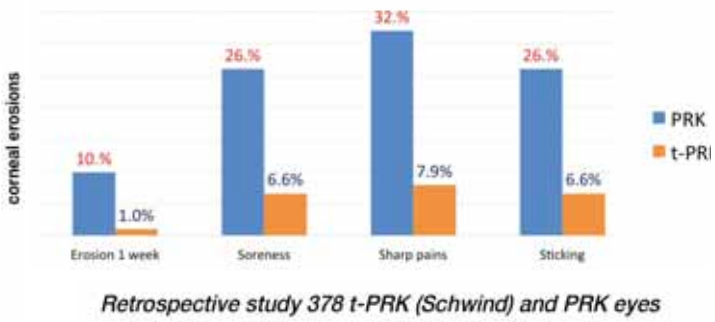


Figure 6: Reduction in recurrent corneal erosions with T PRK

A point to be noted during Trans-Epi PRK is the increase in local corneal temperature due to higher energy load. The normal corneal surface temperature is around 32.9 to 36 °C, and temperature above 40 °C may denaturize collagen proteins resulting in tissue damage and reduced refractive outcomes.

"This is an important issue and should be managed effectively," added Dr. Wolfe. A study of Trans-Epi PRK using 750 Hz excimer laser system showed that the maximum temperature reached was up to 39.7º, with the use of special software that reduced the thermal load.[6]

StreamLight™ transepithelial PRK results in quicker surgery, faster healing and better patient satisfaction. StreamLight™ should be used where wavefront optimized PRK profiles are planned. Special care of post-surgical eyes with thick and irregular epithelium is essential.

Custom Q for Presbyopes

Prof Zhang Fengju

Presbyopia is a loss of accommodative amplitude that occurs with age. Presbyopia can be treated by static methods (e.g. monovision, corneal inlays) that increase the depth of focus or by dynamic methods (e.g. scleral implants and accommodative IOLs), which try to restore accommodation.[7]

Normal cornea is aspheric in shape (prolate shape) that gradually reduces its refractive power towards periphery, merging all rays of light to a single focus and reducing the spherical aberration. On the other hand, the combination of monovision (central rays are focused in front of the retina) and a hyperprolate cornea (peripheral rays are focused behind the central rays) creates a larger depth of field, inducing a negative spherical aberration, by an adjusting the corneal asphericity factor (Q factor). This type of treatment is called the Custom Q, stated Prof. Zhang.

Though Custom Q allows the surgeon to customize target refraction and corneal asphericity, certain pre-requisites for Custom Q need to be followed to ensure successful outcome (Table 7).

"Besides the conventional pre-operative examination, the most important test before starting Custom Q is the tolerance test for monovision procedure. It is essential to counsel the patient, lower his expectation and inform about the possibility of enhancement." cautioned Prof Zhang.

Table 7: Pre-requisites for Custom Q LASIK
• Regular corneal curvature -0.4<Q<0 Cylinder <1.5D, sphere -6.0DD, <+5.0D
• Pupil size and sensitivity
• Simulate monovision with glass or contact lens in near/intermediate and distance
• Reproducible corneal topography
• Essential to make sure which eye is the dominant eye, and which one is non-dominant
• Q value for non-dominate eye to be chosen according to pre-operative value.
• Counsel patients to low expectation before the surgery
• Minimizes potential intraoperative complications
• Provides faster visual and refractive recovery

Custom Q LASIK can reconstruct the corneal aspheric surface and improve the visual acuity of presbyopic patients. The Q factor value, that determines the prolateness of the cornea is lower after Custom Q LASIK compared to the conventional LASIK.[8]

"Custom Q LASIK has been shown to provide safe, effective and stable corrections in hyperopia/ emmetropia subjects with presbyopia," added Prof Zhang.

Satisfactory results for presbyopia could be achieved by Q-adjusted customized strategy, safety, efficacy and stability of which, has been demonstrated in Custom Q LASIK.

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