39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

(Femtosecond-)Laser-integrated Real-time Optical Coherence Tomography (LI-OCT) – An evolution in intraoperative Optical Coherence Tomography?

Presenting author: Sebastian Siebelmann, Germany

Session name: **Lasik and PRK in 2021**
Date and time: **08 October 2021, 17:15 - 18:45**
Presentation time: **17:15 - 17:21**
Location: **Hall 11**

Purpose:
Intraoperative optical coherence tomography was previously available in real-time as microscope-integrated, as well as hand-held forms. Recently, this technology has also become available in real time, integrated into a femtosecond laser device. The study presented here analyzes the potential of intraoperative imaging using OCT during surgical procedures of the anterior eye segment by using a femtosecond laser (FS).

Setting:
MVZ ADTC Erkelenz, Erkelenz, Germany, Ophthalmologicum Neuhann, Munich, Germany, Department of Ophthalmology, University Hospital of Cologne, Germany.

Methods:
In this feasibility study, retrospectively acquired videos of real-time imaging using femtosecond laser-integrated intraoperative OCT (LI-OCT) (Victus, Bausch and Lomb) were analyzed in 14 consecutive patients (14 eyes) regarding the feasibility and the gained information through the new imaging technique. The analyzed surgical procedures where FS-assisted cataract surgery, lamellar and penetrating keratoplasties, Laser-in situ keratomileusis, arcuate corneal incisions and the implantation of corneal ring segments.

Results:
All surgical steps of all procedures (14 of 14 eyes/ 100%) could be successfully visualized by LI-OCT. In corneal surgical procedures the depth and extent of the tissue dissection could be monitored. In cataract surgery the correct position of the capsulorhexis as well as the progress of the fragmentation of the nucleus could be followed. In addition, dynamic processes during FS-assisted surgery as e.g. gas formation within the lens, gas break through into the anterior chamber and even complications as an opaque bubble layer, could be assessed.

Conclusions:
LI-OCT represents a novel imaging technology that finally makes it possible to visualize and monitor the intraoperative steps of femtosecond laser-assisted surgery in real time. In the future, automatic image analysis systems based on artificial intelligence could be helpful to detect complications at an early stage and to automatically stop the laser process in relevant situations.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Analysis of the accommodation state in patients with hyperopia before and after femtolasik

Presenting author: Olga Kuznetsova, Russian Federation

Session name: **Lasik and PRK in 2021**
Date and time: **08 October 2021, 17:15 - 18:45**
Presentation time: **17:21 - 17:27**
Location: **Hall 11**

Purpose:
To analyze the state of accommodation before and after FemtoLASIK in patients with hyperopia.

Setting:
S.Fyodorov Eye Microsurgery Federal State Institution, Volgograd branch

Methods:
The results of prospective studies of accommodation in 114 patients with hyperopia (114 eyes) before and after FEMTOLASIK were analyzed.

Results:
According to the data of a prospective study after FEMTOLASIK, the 114 patients were diagnosed with false myopization syndrome in 42.1% of cases, which was caused by accommodation disorders pre-op. The following data were revealed pre-op: weakness of accommodation - 38.6%, habitually excessive accommodation stress (HEAS) - 22.8%, HEAS in combination with weakness of accommodation - 24.6%. A significant improvement in accommodation was noted after FEMTOLASIK: HEAS was detected only in 4.8% and combination disorders – in 9.5% of cases.

Conclusions:
Post-op false myopization syndrome was revealed in patients with hyperopia after FemtoLASIK. After the operation there was an improvement in the state of accommodation in the form of a decrease in the frequency of detecting HEAS (4.8%) and HEAS in combination with a weakness of accommodation (9.5%).

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Survival analysis of myopic regression after SMILE, LASEK, LASIK flap creation with mechanical microkeratome and with femtosecond laser in low and moderate myopia

Presenting author: Zhou Jihong, China

Session name: Lasik and PRK in 2021
Date and time: 08 October 2021, 17:15 - 18:45
Presentation time: 17:27 - 17:33
Location: Hall 11

Purpose:
Predictive factors of myopic regression for -6.0D to -0.5D myopia were identified using the Cox proportional hazards model in those who had undergone SMILE, LASEK, and LASIK flap creation with a mechanical microkeratome and with a femtosecond laser in low and moderate myopia for 24 months result.

Setting:
Beijing Aier-Intech Eye Hospital, Beijing, China.

Methods:
A retrospective comparative study. Patients with the manifest spherical equivalent from -0.5D to -6.0D myopia were recruited. Refractive outcomes were recorded at 1day,1week, 1, 3, 6, 12, and 24 months postoperatively. A Cox proportional hazards model was used to evaluate the four surgery methods and other covariates on postoperative myopic regression. Myopic regression was defined as residual myopia lower than -0.50 D and a higher than 0.50 D shift toward myopia during the follow-up visits.

Results:
The study enrolled 4168 patients (4168 right eyes, 325 in LASEK,1386 in the FS-LASIK, 845 in MM-LASIK, and 1612 in the SMILE). At 24 months, the survival rates were 79.9% in the FS-LASIK, 80.9% in the LASEK, 69.3% in the MM-LASIK, and 86.1% in the SMILE. The probability of myopic regression with an MM-LASIK was the highest group (HR=2.94), follow by FS-LASIK(HR=1.85), SMILE(HR=1.58) compares to LASEK during 24 months, while had no significant difference among four groups in multivariate analysis (P=0.054). Thicker central corneal thickness (HR=0.99, P=0.024) and deeper ablation depth (HR=0.98, P =0.005) may be decreased myopic regression.

Conclusions:
24 months postoperatively, MM-LASIK, FS-LASIK, SMILE, and LASEK had no significant difference for myopic regression. Thicker central corneal thickness, deeper corneal ablation would prevent myopic regression for -0.50D to -6.0D myopia correction.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Corneal Stroma Thickness Evolution after Myopic Laser Corneal Refractive Surgery

Presenting author: Jorge Alio del Barrio, Spain

Session name: Lasik and PRK in 2021
Date and time: 08 October 2021, 17:15 - 18:45
Presentation time: 17:33 - 17:39
Location: Hall 11

Purpose:
Evaluate the postoperative behavior of the central corneal stroma thickness after myopic femto-LASIK and SMILE by using a combined anterior segment OCT and placido disc topographer, and to compare the accuracy of both laser machines in predicting the actual stromal change.

Setting:
Cornea, Cataract and Refractive Surgery Unit, Vissum (Miranza Group), Spain

Methods:
Prospective, comparative, case series study. Visumax-500kHz as femtosecond laser (FS), and Amaris-750 as excimer laser were used for the correction of myopia with or without myopic astigmatism. Central and paracentral stromal thicknesses (ST) and 6mm-corneal aberrometry were obtained with MS39 topographer. Laser predicted stromal consumption was recorded (maximum lenticule thickness for SMILE and central ablation depth for LASIK). Visual and refractive outcomes were also evaluated. Total follow-up was 6 months.

Results:
77 LASIK-eyes were matched with 77 SMILE-eyes. Mean preoperative spherical equivalent (SE) was -3.92±1.67D for LASIK and -4.02±1.63D for SMILE; p=0.356. After LASIK, ST parameters showed a significant rethickening between months 1-3 (+4.38µm for central-ST; p<0.001), remaining stable thereafter. After SMILE, all ST parameters remained stable from month-1. Stromal consumption prediction was higher for SMILE compared to LASIK for all SE ranges, although postoperatively such differences were only significant for ametropias ≤4D. At 6 months, mean SMILE laser prediction error was -13.21±7.00µm, while LASIK prediction showed better accuracy (+0.92± 8.16µm; p<0.001)

Conclusions:
Accuracy of Amaris-750 excimer laser in predicting the stromal consumption after LASIK was better than the VisuMax-FS laser one for SMILE. While SMILE stromal thicknesses remained stable from month-1, after LASIK a mild stromal rethickening was observed up to the third month.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Reduction of corneal epithelial hyperplasia after Customised Corneal Wavefront-guided LASIK combined with accelerated Crosslinking (LASIK Xtra) for low, moderate and high myopic corrections

Presenting author: Samuel Arba Mosquera, Germany

Session name: Lasik and PRK in 2021
Date and time: 08 October 2021, 17:15 - 18:45
Presentation time: 17:39 - 17:45
Location: Hall 11

Purpose:
To evaluate the combination of Corneal Wavefront-guided LASIK and LASIK Xtra in reducing epithelial hyperplasia in low, moderate, and high myopic treatments. Better corneal contours produced by corneal topography or Wavefront-guided ablations and LASIK Xtra have both been separately reported to reduce corneal epithelial hyperplasia. Corneal epithelial hyperplasia has been implicated as one of the major factors in refractive regression post corneal refractive surgery. This study analyzes the corneal epithelial thickness pre-and post-operation after these two procedures are combined. The reduction in corneal epithelial hyperplasia will result in more accurate and stable corrections, especially in high myopes.

Setting:
Private practice, Jerry Tan Eye Surgery, Singapore

Methods:
This study included 489 eyes of 245 consecutive patients treated for low, moderate, and high myopia using Femtosecond LASIK with Customised Corneal Wavefront-guided treatments followed by accelerated corneal collagen crosslinking (LASIK Xtra). Corneal epithelial thickness was measured using Fourier-domain optical coherence tomography before and 3 months after treatment. Subjects were divided into 3 groups based on their level of myopia. Comparisons and statistical analysis were made sectorally in 25 zones up to a diameter of 9mm between the pre-operative and post-LASIK corneal epithelial thickness at 3 months.

Results:
Across all datasets, corneal epithelial thickening appeared to be dependent on corrected myopic power. With this combination of corneal wavefront-guided treatment and LASIK Xtra, hyperplasia induced only 0.4µm of central thickening per diopter corrected. A -2.00D correction would induce less than 1µm hyperplasia with the corneal wavefront-guided LASIK Xtra. As such, a -12.00D correction will induce less than 5µm hyperplasia with this technique. This will result in a 0.25D regression for a -12.00D correction. In addition, the amount of epithelial hyperplasia was significantly different (p=.0002) between the small (below 7mm) vs large (7mm and above) optical zone treatments.

Conclusions:
The combination of customized corneal wavefront-guided LASIK with a large optical zone combined with accelerated corneal collagen crosslinking (LASIK Xtra) appears to reduce corneal epithelial hyperplasia. This results in better post-LASIK refractive accuracy and stability in low, moderate, and high myopic corrections.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Customized versus standard epithelium profiles in Transepithelial PRK

Presenting author: Diego de Ortueta, Germany

Session name: **Lasik and PRK in 2021**
Date and time: **08 October 2021, 17:15 - 18:45**
Presentation time: **17:45 - 17:51**
Location: **Hall 11**

Purpose:
To compare the refractive outcomes of customized vs standard epithelium profiles in Transepithelial PRK

Setting:
Aurelios Augenlaserzentrum Recklinghausen

Methods:
This retrospective chart review (case series) compares 65 consecutive eyes treated customizing the epithelial thickness in a Transepithelial PRK treatment measured with the MS-39 (CSO Florenze, Italy)study cohort; versus 65 consecutive eyes treated using the standard epithelial thickness (55µm centrally; control group) of the SCHWIND AMARIS (Schwind eye-tech GmbH, Kleinostheim, Germany).

Results:
Preop CDVA was 20/18±4 in both groups (p=.1); postop UDVA was 20/17±3 in customised epithelium group and 20/19±4 in standard epithelium group (p<.0001). Postop UDVA was 0.0±0.6 lines different than preop CDVA in custom eptheliumi group and -0.4±0.7 lines worse than preop CDVA in standard epithelium group (p<.0001). The change in CDVA from preop to postop was +0.3±0.5 lines gain in the customized epithelium group, and -0.1±0.6 lines loss in the standard epithelium group (p<.0001). Deviation from intended target was -0.06±0.29D in the custom epithelium group, and -0.05±0.29D in the standard epithelium group (p=.2).

Conclusions:
Customizing the epithelial thickness measured with the MS-39 in a Transepithelial PRK treatment fort he SCHWIND AMARIS seems to offer some advantages in predictability, and no inferiority in safety.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Comparison of two different preservative free lubricant eyedrops on the ocular surface in the early post-op of PRK. A prospective, randomized, controlled pilot study.

Presenting author: Rafael Cañones-Zafra, Spain

Session name: Lasik and PRK in 2021
Date and time: 08 October 2021, 17:15 - 18:45
Presentation time: 18:00 - 18:06
Location: Hall 11

Purpose:
To compare the effect of a conventional preservative free (PF) artificial tear containing carmellose vs another one also PF, containing hyaluronic acid and hydroxypropyl-guar (HA+HP-guar), on the healing of the corneal epithelium and the ocular discomfort after bilateral photorefractive keratectomy (PRK) surgery.

Setting:
Clinica Novovision Madrid, Spain

Methods:
In this on-going randomized, dual-arm, prospective, interventional, single masked study, a total of 34 eyes scheduled to have PRK to correct myopia were randomized in two groups. 22 eyes in the (HA+HP-guar) group (study eyes) and 12 in the carmellose artificial tear group (control eyes). In both groups ocular surface was evaluated at post-op days 1, 4, 7 and at the 1 month, measuring the diameter of the de-epithelized cornea and the degree of fluorescein punctate staining using the Oxford scale. A Visual Analogic Scale (VAS) pain evaluation was performed by the patient at every post-op visit.

Results:
Both groups were comparable in terms of age, gender and preop refractive error magnitude ($p<0.05$). Statistically significant smaller de-epithelized area was observed at post-OP day 4 in the study group vs controls (0.13+/-0.4 mm vs 0.65+/-0.8 mm $p=0.03$). A statistically significant less ocular pain was observed at day 3 post-OP in the (HA+HP-guar) group (3.7+/-2.7 vs 5.3+/-2.3 $p=0.04$). No statistically significant differences were observed beyond post-op day 7 on the healing of the corneal epithelium and the self-perceived ocular discomfort between the two groups.

Conclusions:
The current ongoing study shows a faster healing of the corneal epithelium with the use of topical lubricants containing (HA+HP-guar) compare with the use of conventional carmellose artificial tears. This could be due to the trophic effect that the combination of hyaluronic acid and hydroxypropyl-guar could have on the epithelial cells of the cornea. This faster recovering seems to have a significant additional benefit reducing the ocular pain-discomfort in the first days after PRK surgery. Both artificial tears show no differences in the visual or refractive outcomes of the procedure.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Keratorrefractive LASER procedures: A comparative analysis of vision quality using the HD AnalyserTM®

Presenting author: Rita Vieira, Portugal

Session name: Lasik and PRK in 2021
Date and time: 08 October 2021, 17:15 - 18:45
Presentation time: 18:12 - 18:18
Location: Hall 11

Purpose:
To analyse and compare the objective performance in the quality of vision of three LASER procedures: Photorefractive keratectomy (PRK), Laser in situ keratomileusis (LASIK) with mechanical microkeratome and Femtosecond-assisted Laser in situ keratomileusis (FemtoLASIK) using the double-pass imaging system (HD AnalyzerTM, Visiometrics®).

Setting:
Refractive Surgery Unit of Ophthalmology Department of Centro Hospitalar Universitário do Porto, Oporto, Portugal.

Methods:
Retrospective analysis of patients submitted to PRK, LASIK and Femto-LASIK in the past 18 months at our department. Patients without HD AnalyzerTM evaluation prior to surgery were excluded. In addition to demographic data and visual outcomes, spherical equivalent (SE), sphere and cylinder values were collected at baseline, at one and three months after surgery. The objective quality of vision assessment evaluated the objective scatter index (OSI), the modular transfer function cutoff frequency (MTF) and the predicted visual acuities (decimal) within the 100% (PVA), 20% (PVA20) and 9% contrast levels (PVA9) before and after surgery. Statistical analysis was performed using SPSS®.

Results:
118 eyes (66 patients) were included; 40 in LASIK with mechanical microkeratome group, 43 in femtoLASIK group and 35 in PRK group. The mean age was 30.6±4,6 years old; 62% were female. There was a significant impact concerning the type of procedure in the objective quality of vision parameters analysis (Repeated measures ANOVA): the FemtoLASIK group showed lower OSI values overtime [$F(1,2)=4.566$, $p=0.012$, OSI 0.83±0.53 (FemtoLASIK) vs 0.87±0.47 (PRK) and 1.21±1.44 (LASIK)], higher MTF values [$F(1,2)=6.569$, $p=0.002$, MTF 40.17±8.33 vs 32.37±11.4 (PRK) and 30.26±10.28 (LASIK)], higher PVA [$F(1,2)=10.871$, $p<0.001$], PVA 20% [$F(1,2)=9.737$, $p<0.001$] and PVA 9% contrast levels [$F(1,2)=6.335$), $p=0.003$].

Conclusions:
In our study, Femtosecond-LASIK showed an excellent optical performance through the HD AnalyzerTM technology, with significantly lower OSI and higher MTF, PVA, PVA20 and PVA9 values. According to our study, this procedure seems to be superior to PRK and LASIK with mechanical microkeratome regarding visual quality objective parameters.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

One Year Results of Photorefractive Keratectomy for Myopia and Compound Myopic Astigmatism with 210 nm Wavelength All Solid-State Laser for Refractive Surgery.

Presenting author: Anna Roszkowska, Italy

Session name: **Lasik and PRK in 2021**
Date and time: **08 October 2021, 17:15 - 18:45**
Presentation time: **18:18 - 18:24**
Location: **Hall 11**

Purpose:
To assess clinical one year efficacy, safety and predictability of the Photorefractive Keratectomy performed with all-solid-state laser for refractive surgery.

Setting:
Cornea and Refractive Surgery Section, Ophthalmology Unit, Department of Biomedical Sciences, University of Messina, Italy.

Methods:
The study included thirty-four eyes of 19 patients (7 F, 12 M) aged from 21 to 52 years (34.32±8.27) with who underwent photorefractive keratectomy for myopia and compound myopic astigmatism with the solid-state laser (LaserSoft, Katana Technologies GmbH, Kleinmachnow, Germany). The patients were examined before and 1, 3, 6 and 12 months after the treatment and the main outcome measures considered for evaluation were UDVA and CDVA, refraction, central corneal thickness, corneal transparency. The efficacy, safety, predictability and stability were determined.

Results:
The mean UDVA changed from 1.20±0.43 to -0.08±0.11 at 12 months and the mean CDVA from -0.03±0.06 to -0.12±0.10 respectively. The mean SE changed from -4.90±2.11 to -0.38±0.68 after 12 months. The SE was within ±0.50 D of the intended correction in 85% and within 1.00 D in 97% eyes. No eye lost lines of visual acuity and 15 eyes gained one or more lines. Trace haze was registered in four eyes during the follow up period.

Conclusions:
The PRK with all solid-state laser for refractive surgery proved as a safe and effective procedure with good visual and refractive results after 12 months follow up. The solid-state technology might be considered as a valid alternative for the gas operating lasers for refractive surgery.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Single-Step Transepithelial PRK (tPRK) vs conventional PRK: Refraction, corneal aberrometry and densitometry comparison

Presenting author: Jaime Aramberri Agesta, Spain

Session name: **Lasik and PRK in 2021**
Date and time: **08 October 2021, 17:15 - 18:45**
Presentation time: **18:24 - 18:30**
Location: **Hall 11**

Purpose:
To describe and compare corneal densitometry, subjective refraction, visual acuity and corneal Higher Order Aberrations in patients after corneal refractive surgery: Single-step transepithelialPRK vs alcohol-assisted PRK

Setting:
Begitek Miranza Clínica Oftalmologica. San Sebastián, Spain

Methods:
This retrospective, observational case series comprised 260 eyes from 135 patients who underwent single-step transepithelialPRK (tPRK) or alcohol-assisted PRK (aaPRK). The WaveLight EX500 excimer laser (Alcon Laboratories, Inc.) was used in all cases. Mean age was 34.38± 10.68 years. Preop MRSE was -2.89 ± 1.64 D. Visual acuity, refraction and Pentacam HR measurements were performed at the pre-operative visit and at 3 months follow-up visit. Pentacam software was used to assess corneal optical densitometry in various ring-shaped zones for different corneal depths and anterior corneal higher order aberrations (6 mm area of analysis)

Results:
There were no statistically significant differences in visual acuity and postoperative refraction. Corneal densitometry did not show statistically significant differences in all areas studied except for the central 2mm zone in the anterior 120um layer (GSI 21.32±1.87 and 22.15±3.01 in aaPRK and tPRK respectively). HOA RMS showed statistically significant differences ($p<0.001$): HOA 0.55±0.15 µm and 0.66±0.20µm, and Z(4,0) 0.37±0.15 µ and 0.47±0.15 µ for aaPRK and tPRK respectively

Conclusions:
Both aaPRK and tPRK using a single-step, “no touch” technique, demonstrated comparable visual and refractive outcomes. Differences in anterior central corneal densitometry and HOA were observed, but these were not clinically relevant.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

First European Results LASIK Flap creation by Schwind Eye Tech Solutions ATOS femtosecond laser

Presenting author: Ivan Gabric, Croatia

Session name: **Lasik and PRK in 2021**
Date and time: **08 October 2021, 17:15 - 18:45**
Presentation time: **18:30 - 18:36**
Location: **Hall 11**

Purpose:
To evaluate clinical outcomes from patients who underwent LASIK flap creation using a Schwind ATOS Femtosecond LASER (SCHWIND eye-tech-solutions GmbH, Kleinostheim, Germany).

Setting:
University Eye Hospital Svjetlost, Zagreb, Croatia

Methods:
This non-randomized prospective cases series enrolled 230 eyes of 115 patients. All patients underwent uneventful LASIK flap creation by the same surgeon using the SCHWIND ATOS® femtosecond laser. All patients were evaluated preoperatively for suitability for laser refractive surgery and followed up for a minimum of 30 days. The excimer ablation was performed on the Schwind AMARIS 1050RS using the Aberration Free Profile by the same surgeon sequentially after flap creation.

Results:
The mean preoperative SE was -5.90 (SD ± 2.36) with mean UCDVA 1.35 logMAR (SD ± 0.24), mean preoperative BCDVA was 0.03 logMAR (SD ± 0.07). On post-operative-day 1 mean UCDVA was 0.02 logMAR (SD ± 0.05), on post-operative-day 7 mean UCDVA was 0.01 logMAR (SD ± 0.07), on post-operative-day 30 mean UCDVA was -0.04 logMAR (SD ± 0.06). The central flap thickness for all cases was set to 110 µm it was evaluated on day 30 mean achieved central flap thickness was 104,23 µm (SD ± 9,60).

Conclusions:
This new femtosecond laser platform (Schwind ATOS) provides a reliable and precise device for LASIK flap creation. Patients had a quick visual recovery and the UCDVA on day 30 was excellent for all patients in this non-randomized study. ATOS represents a new platform for both flap creation with very promising early results.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Refractive Outcomes including Vector Analysis in 3,997 consecutive SMILE procedures for spherical and compound myopic astigmatism

Presenting author: Alastair Stuart, United Kingdom

Session name: **Lenticular corneal surgery**
Date and time: **09 October 2021, 08:00 - 09:30**
Presentation time: **08:00 - 08:06**
Location: **Auditorium**

Purpose:
To report the outcomes of SMILE for myopia up to -9.00D in patients 40 years or younger.

Setting:
London Vision Clinic, London, UK

Methods:
This was a retrospective analysis of consecutive SMILE treatments performed at London Vision Clinic using the VisuMax femtosecond laser (Carl Zeiss Meditec). Inclusion criteria were attempted spherical equivalent refraction up to -9.00D, cylinder up to 5.50D, CDVA 20/20 or better, age 40 years or younger, and suitable for SMILE. A total of 3,997 eyes met the inclusion criteria. Patients were followed for 1 year. Standard outcomes analysis was performed using 12-month data where available or 3-month data otherwise.

Results:
Attempted SEQ was -4.61±1.84D (-1.00 to -9.00D) and cylinder -0.85±0.66D (0.00 to -5.50D). Preop CDVA was 20/16 or better in 67%. Postop monocular UDVA was 20/20 in 95% and 20/16 or better in 63% of eyes. Binocular postop UDVA was 20/20 or better in 99% and 20/16 or better in 82% of eyes. Postop SEQ was -0.14±0.30D, with 88% within ±0.50D. Change in SEQ between 3-12 months was -0.08±0.27D. There was 1-line loss of CDVA in 7% of eyes, and 2+ lines in 0.08%. Contrast sensitivity improved 0.05, 0.06, 0.07, and 0.06 log-units at 3, 6, 12, and 18 cpd.

Conclusions:
SMILE achieved excellent outcomes for myopia up to -9.00D with cylinder up to -5.50D for a large population in pre-presbyopic patients.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Analysis of the change in corneal spherical aberration induced by myopic SMILE grouped by optical zone in a population of 1,902 eyes

Presenting author: Timothy Archer, United Kingdom

Session name: Lenticular corneal surgery
Date and time: 09 October 2021, 08:00 - 09:30
Presentation time: 08:06 - 08:12
Location: Auditorium

Purpose:
To investigate the change in corneal spherical aberration after SMILE in a large population correlating with spherical equivalent treated and optical zone.

Setting:
London Vision Clinic, London, UK

Methods:
This was a retrospective analysis of SMILE treatments in 1,902 eyes using the VisuMax femtosecond laser (Carl Zeiss Meditec). A database review was undertaken to generate analysis bins with an equal distribution of spherical equivalent treated for each optical zone (in 0.25 mm increments). The preop to 3-month change in Placido topography based corneal spherical aberration was calculated in a 6.00-mm analysis zone (OSA). Linear regression analysis was performed to evaluate the correlation between spherical aberration and change in corneal spherical aberration for each optical zone group.

Results:
Mean SEQ was -7.79±2.85D, 6.00-mm zone (n=192); -7.94±2.33D, 6.25-mm zone (n=162); -7.10±3.09D, 6.50-mm zone (n=398); -6.44±2.47D, 6.75-mm zone (n=202); -4.11±2.31D, 7.00-mm zone (n=767); -3.01±1.61D, 7.25-mm zone (n=133); -2.90±1.52D, 7.50-mm zone (n=60). Linear regression slope, intercept and R2 were -0.069, -0.160, 0.714 (6.00-mm zone); -0.053, -0.114, 0.442 (6.25-mm zone); -0.051, -0.154, 0.652 (6.50-mm zone); -0.038, -0.121, 0.444 (6.75-mm zone); -0.037, -0.172, 0.448 (7.00-mm zone); -0.026, -0.095, 0.238 (7.25-mm zone); and -0.033, -0.110, 0.275 (7.50-mm zone). Postoperative corneal spherical aberration was 0.14±0.12 for 0-2D SEQ; 0.20±0.11 (2-4D SEQ); 0.34±0.12 (4-6D); 0.42±0.15 (6-8D); 0.55±0.17 (8-10); and 0.68±0.21 (10-14D).

Conclusions:
There was an increase in corneal spherical aberration after SMILE on average for myopia above -4.00 D, with a greater increase for higher corrections and smaller optical zones, however, there was a reduction in corneal spherical aberration after SMILE on average for myopia below -4.00 D for all optical zones.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

One-year outcomes of myopic astigmatism correction with Small Incision Guided Human-cornea Treatment

Presenting author: Samuel Arba Mosquera, Nepal

Session name: **Lenticular corneal surgery**
Date and time: **09 October 2021, 08:00 - 09:30**
Presentation time: **08:12 - 08:18**
Location: **Auditorium**

Purpose:
To evaluate refractive and visual outcomes of Small Incision Guided Human-cornea Treatment (SmartSight®, SCHWIND eye-tech-solutions, Kleinostheim, Germany) in the treatment of myopic astigmatism with the use of a new femtosecond laser system.

Setting:
Matrika Eye Center, Kathmandu, Nepal

Methods:
This retrospective, observational case series included 300 eyes of 150 patients who underwent SmartSight to correct myopic astigmatism and completed the 12-month follow-up. Procedures were performed with a SCHWIND ATOS femtosecond laser.

Results:
Preoperatively, mean spherical manifest refraction (MRSE) was -6.1±2.0 diopters (D) (-3 to -11.5D), and astigmatism was 1.0±0.6D (0.25 to 2.75D). Twelve months post-surgery it was +0.4±0.3D (-0.75 to +1D) and 0.3± 0.2 D (0 to 0.75D), respectively (both $p<.05$). Spherical equivalent correction within ±0.50D was achieved in 212 eyes (71%), and cylindrical correction in 252 (84%). Preoperative corrected distance visual acuity (CDVA) was 20/20 or better in 275 eyes (92%), and postoperative uncorrected (UDVA) was 20/20 or better in 287 eyes (96%). No eye had lost two or more Snellen lines of CDVA.

Conclusions:
Myopic astigmatism correction with SmartSight provided good results for efficacy, safety, predictability, and visual outcomes at the twelve months of follow up.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Prospective Evaluation of SMILE for high myopia between -9.00 and -14.00 D including Patient Reported Outcome Measures and Night Vision Questionnaire

Presenting author: Glenn Carp, United Kingdom

Session name: Lenticular corneal surgery
Date and time: 09 October 2021, 08:00 - 09:30
Presentation time: 08:18 - 08:24
Location: Auditorium

Purpose:
To report the outcomes of SMILE for high myopia between -9.00 and -14.00 D.

Setting:
London Vision Clinic, London, UK

Methods:
This was a prospective study (clinicaltrials.gov identifier: NCT02528123) of SMILE for high myopia using the VisuMax femtosecond laser (Carl Zeiss Meditec). Inclusion criteria were attempted spherical equivalent refraction between -9.00 and -14.00 D, cylinder up to 7.00 D, CDVA 20/40 or better, age 21 years or older, and suitable for SMILE. The sub-lenticule thickness was ≥220 µm, and the total uncut stromal thickness was ≥300 µm. Patients will be followed for 1 year. Standard outcomes analysis was performed using 12 month data where available or 3 month data otherwise.

Results:
187 eyes (114 patients) were included. 12-month data were available for 181 (96.8%), 3-month for 4 eyes and 2 eyes lost to follow-up. SEQ was -10.55±1.00D (-9.00 to -12.99D) and cylinder -1.19±0.83D (0.00 to -4.00D). Preop CDVA was 20/20 or better in 73%. Postop UDVA 20/20 and 20/25 or better in 57% and 82% of eyes. Postop SEQ was -0.22±0.48D. Change in SEQ 3-12 months was -0.08±0.34D. There was 1-line loss CDVA in 4%, and no eyes lost 2+ lines CDVA. Contrast was unchanged. Satisfaction out of 10 was 8 or higher in 94%.

Conclusions:
Outcomes of SMILE for myopia above -9.00 D at 3-12 months show excellent efficacy, safety, stability, and predictability.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

First European Results of a new Refractive Lenticular Extraction Procedure - SmartSight by Schwind Eye Tech Solutions

Presenting author: Maja Bohac, Croatia

Session name: Lenticular corneal surgery
Date and time: 09 October 2021, 08:00 - 09:30
Presentation time: 08:24 - 08:30
Location: Auditorium

Purpose:
To evaluate refractive and visual outcomes of Small Incision Guided Human-cornea Treatment (SmartSight®, SCHWIND eye-tech-solutions, Kleinostheim, Germany) in the treatment of myopic astigmatism with the use of a new femtosecond laser system.

Setting:
University Eye Hospital Svjetlost, Zagreb, Croatia

Methods:
This retrospective, observational case series included 60 eyes of 30 patients who underwent SmartSight to correct myopic astigmatism and completed at least 1-month follow-up. All procedures were performed by the same surgeon using the SCHWIND ATOS® femtosecond laser. All patients were evaluated preoperatively for suitability for laser refractive surgery and followed up for a minimum of 30 days. Analysis of visual and refractive outcomes, as well as Alpins Method for the analysis of Astigmatism has been performed.

Results:
This non-randomized prospective cases series enrolled 60 eyes of 31 patients. All patients underwent uneventful SmartSight lenticule extraction. Preoperatively, mean spherical manifest refraction(MRSE) was -4.9±1.7 diopters(D)(-3.25 to -7.5), and astigmatism was -0.62±0.33D(-2.00 to -0.25). Spherical equivalent correction within ±0.50D was achieved in 58 eyes (97%), and cylindrical correction in 58(97%). Postoperative uncorrected (UDVA) was 20/20 or better in 56 eyes(93%). No eye had lost two or more Snellen lines of CDVA. The central cap thickness for all cases was set to 130 µm it was evaluated on day 30 mean achieved central cap thickness was 124,23 µm (SD ± 11,60).

Conclusions:
This new femtosecond laser platform (Schwind ATOS) provides a reliable and precise device for refractive laser vision correction. Patients had a quick visual recovery and the UDVA on day 30 was excellent for all patients in this non-randomized study. ATOS represents a new platform for both flap creation and lenticular extraction with very promising early results.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Long-term efficacy and safety profiles following small incision lenticule extraction in eyes with ≥ 5-year follow-up.

Presenting author: Renato Papa, Spain

Session name: **Lenticular corneal surgery**
Date and time: **09 October 2021, 08:00 - 09:30**
Presentation time: **08:51 - 08:57**
Location: **Auditorium**

Purpose:
To evaluate the long-term efficacy, safety, predictability and stability (refractive and keratometric) of small incision lenticule extraction (SMILE).

Setting:
Instituto de Microcirugía Ocular (IMO), Barcelona, Spain.

Methods:
Retrospective review of all patients undergoing SMILE from January 2012 to December 2015. 42 eyes (23 patients) with ≥5 years of follow-up (F-U) were included. Variables analyzed were preoperative, 3-month, 1-year and last F-U uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), manifest sphere and cylinder refraction, refractive spherical equivalent (RSE), and mean keratometry. Descriptive statistics were performed for the collected variables and results reported following the Journal of Refractive Surgery Standard for Reporting Astigmatism Outcomes to include indices of efficacy, safety, predictability and stability.

Results:
Mean postoperative F-U was 5.98±0.9 years. Mean preoperative RSE was -5.26±1.22D (range -2.5D to -8.12D). Efficacy and safety indices were 0.86 and 0.98, respectively. Eighty-one percent of eyes achieved an UDVA ≥20/25. Five percent lost 1 line of CDVA, with no loss of ≥2 lines. Sixty-nine percent were within ±0.50D and 86% within ±1.00D of the attempted RSE correction. Ninety-one percent had ≤0.50D of postoperative astigmatism, and 71% were within ±15° from the intended correction axis. At the final F-U, a statistically significant myopic regression of 0.19±0.50D was observed (p=0.01). There were no intra or postoperative complications.

Conclusions:
Long-term results demonstrate that SMILE is effective, predictable and safe in eyes with ≥ 5 years of follow-up. SMILE has good stability, low regression, and no signs of corneal ectasia staging within standard criteria.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Flapless SMILE after flap-having LASIK

Presenting author: Tatiana Shilova, Russian Federation

Session name: **Lenticular corneal surgery**
Date and time: **09 October 2021, 08:00 - 09:30**
Presentation time: **08:57 - 09:03**
Location: **Auditorium**

Purpose:
To use the flapless refractive correction ReLEX SMILE for patients with myopic regression after LASIK with thick flap. To evaluate effectiveness and stability of results – for six years of observation.

Setting:
SMILE EYES Moscow, Russia

Methods:
Study included 11 eyes of 6 patients following LASIK with flap thickness more than 200 microns, the average thickness is 257 microns. SEQ was -1.25 – 3.75 D. Before SMILE we examined a geometry of the flap (OCT) and thickness of residual stroma's bed, check a keratotopography and aberrometry data. The diameter of the optical zone for SMILE was 0.5 mm smaller than the diameter of the flap. Neutral thickness was reduced to 10 microns, 2 mm entrance was made in the place of the hinge. Cap was 100 microns. The interval between LASIK to SMILE was on average 12 years.

Results:
In these cases, we had little tissue under the flap. Therefore, the technology of re-treatment with lifting was impossible due to the risk of keratoconus. Following LASIK thickness of residual stromal bed under the flap was 250 microns or less. SMILE was performed within the flap. We worked in an expert mode. The residual stromal bed is not manipulated, and ablation is conducted on the existing flap. This also prevented ingrown of the epithelium. At 6 years of follow-up, visual, topography and anatomical outcomes were satisfactory. Uncorrected distance visual acuity was 0.9 ± 0.25 D in all cases.

Conclusions:
For certain patients with a thick flap and thin residual stromal bed after LASIK, SMILE as re-treatment may be a good and safe option. It is possible to use a previously formed flap. This procedure does not increase the risks of keratoconus and dry eyes.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Refractive surgery induced epigenetic changes in LASIK and SMILE demonstrate unique signatures and its impact on outcomes.

Presenting author: Sneha GUPTA, India

Session name: Lenticular corneal surgery
Date and time: 09 October 2021, 08:00 - 09:30
Presentation time: 09:03 - 09:09
Location: Auditorium

Purpose:
Refractive surgery such as LASIK and SMILE induce a wound healing response which leads to significant corneal stromal remodelling relevant to obtaining good vision. We have shown that the protein profile immediately post surgery in the stroma changes dramatically. Hence, we studied the epigenetic changes that occur post surgery that may be relevant to long term ECM remodelling.

Setting:
Narayana Nethralaya, Bengaluru

Methods:
Donor globes(n=20) were obtained from the eye bank for this study.4 globes served as non-surgical controls while SMILE(-6DS) and LASIK surgery(-6DS) was performed on 4 globes each and incubated for 3 days and 2 weeks (n=4 per group per time point).After incubation at 37degC in DMEM media within a humidified incubator, DNA was extracted from the stroma, and were hybridised to an array containing 850,000 CpG methylation sites from the human genome (Infinium Human Methylation 850 EPIC array).Differentially methylated sites were identified by their CpG-level p-values using an FDR <0.05.Gene ontology (GO) analyses were performed for various group comparisons.

Results:
A large number of both hypo and hyper methylated CpG sites were observed in both surgeries compared to non-surgical controls. Significantly larger number of CpG sites showed differential methylation in both SMILE and LASIK at 2 weeks compared to 3 days. The GO analysis found MHC proteins, TCR and immunological pathways to be altered. These include chromatin remodelers, HLA proteins, cellular energetics, ECM related transcription factors and proteins. We also found a set of sites and genes that show clear differences between the two kinds of surgeries.

Conclusions:
Our data describes for the first time, the global epigenetic changes in human corneas occurring due to refractive surgery. The data reveals a variety of novel genes and pathways that may have relevance to the development of complications such as ectasia or haze. It also presents the opportunity to utilise drugs that regulate chromatin remodelling for optimal outcomes.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Topography-Guided LASIK vs. Small Incision Lenticule Extraction (SMILE) for Myopia and Myopic Astigmatism: 4 year data of A Randomized, Prospective, Contralateral Eye Study

Presenting author: Anastasios John Kanellopoulos, Greece

Session name: **Lenticular corneal surgery**
Date and time: **09 October 2021, 08:00 - 09:30**
Presentation time: **09:09 - 09:15**
Location: **Auditorium**

Purpose:
To compare the long-term safety and efficacy of topography-guided LASIK vs. contralateral eye SMILE for myopia and myopic astigmatism correction

Setting:
LaserVision Clinical & Research Eye Institute, Athens, Greece

Methods:
This prospective, randomized contralateral eye study included 44 eyes of 22 patients with bilateral myopia or myopic astigmatism. Treated eyes were divided into two groups: 22 eyes were treated with topography-guided LASIK and the fellow eye of each patient was treated with SMILE. The following parameters were evaluated preoperatively and up to 48 months postoperatively: uncorrected distance vision acuity (UDVA), corrected distance vision acuity (CDVA), refractive error, corneal keratometry, contrast sensitivity, and retreatments

Results:
At 48 months, 92.4% of the LASIK group and 79.2% of the SMILE group had UDVA of 20/20 (P<.002) and 62.3% and 34.5%, respectively, had UDVA of 20/16 (P<.002). Spherical equivalent refraction (±0.50 D) was 95.5% for the LASIK group and 76.3% for the SMILE group (P<.002). Residual refraction cylinder (≤ 0.25 D) was 81.8% for the LASIK group and 50% for the SMILE group (P < .001). Two eyes of the SMILE group underwent PRK retreatment for case 1: -0.75 sphere, – 0.50 astigmatism at 14 months and case 2: -0.25 sphere and -1.00 cylinder at 23 months

Conclusions:
Topography-guided LASIK was superior in all visual performance parameters studied, over long-term follow-up. The main difference between the two techniques likely derives from the eye tracking, cyclorotation compensation, and active centration control in the LASIK technology studied in contrast to the current technology available with SMILE-like procedures. Nomogram adjustment maybe required for accuracy improvement in myopic corrections over 6 diopters for SMILE.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Comparison of Wavefront Aberration Changes After Sterile Allograft Corneal Inlay Implantation in Emetropic Presbyopia

Presenting author: REYHAN HAZAL KAPLAN KORUK, Turkey

Session name: Lenticular corneal surgery
Date and time: 09 October 2021, 08:00 - 09:30
Presentation time: 09:15 - 09:21
Location: Auditorium

Purpose:
To analyze the wavefront aberration changes after implanted sterile allograft corneal inlay (ACI) (Transform, Allotex Inc. Boston, USA) for refractive treatment of presbyopia in patients

Setting:
Istanbul Medipol University, Faculty of Medicine, Ophthalmology Department, Istanbul, Turkey

Methods:
This prospective study included 34 eyes of 34 emmetrop presbyopia patients with a follow-up of 6 months. Sterile allograft corneal inlay shaped with an excimer laser. And provides +2.5D spherical aberration power for optical addition. A corneal flap (110 µm) was created with femtosecond laser for ACI implantation in all patients. ACI was implanted under the corneal flap by taking the pupil as the center in the nondominant eyes. Corneal aberrations were compared with iDesign wavefront aberrometry (AMO, Inc.. Santa Ana, California, United States) at preoperative and postoperative sixth month. Wavefront datas was analyzed with 5 mm pupil diameters. Values were anaylzed with Paired T Test and Wilcoxon Signed Ranks Test.

Results:
Among the patients with a mean age of 49.5 ±3.5 years,23 were female and 11 were male. Patients preoperative high order aberration root mean square (HOA-RMS), spherical aberration, cylindrical aberration at 0 and 45 degrees, defocus, vertical coma, horizontal coma, trefoil at 0 and 30 degrees values were 0.444±0.19, 0.082±0.06, 0.095±0.21, -0.040±0.16, 0.136±0.28, -0.007±0.08, -0.001±0.11, 0.015±0.08, -0.057±0.09 , after surgery it was found as 0.837±0.35, -0.126±0.10, -0.010±0.23, -0.008±0.15, 0.686±0.39, -0.034±0.17, 0.150±0.10,0.036±0.07, -0.059±0.11.While there was a statistically significant difference in the changes of HOA-RMS, spherical aberration and defocus ($p<0.05$), no difference was observed in the values of cylindrical aberration, coma and trefoil ($p>0.05$)

Conclusions:
We analyzed the wavefront aberometry results of patients implanted with ACI for presbyopia treatment, we recognized that although the HOA-RMS values increase, there is no change in parameters that seriously affect the quality of vision such as coma and trefoil. Therefore, we believe that sterile allograft corneal inlay implantation is safe in the refractive treatment of presbyopia.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Refractive Stability After TransPRK vs femtoLASIK

Presenting author: Juan G arbelaez, Oman

Session name: **Comparison of corneal refractive surgery / pkakic implantation**
Date and time: **10 October 2021, 13:15 - 14:45**
Presentation time: **13:15 - 13:21**
Location: **Auditorium**

Purpose:
To compare the refractive stability and visual outcomes in eyes with myopia/astigmatism, that underwent single step TransPRK versus femtoLASIK with an aspheric ablation profile.

Setting:
Muscat Eye Laser Center

Methods:
A retrospective analysis of 16,083 eyes from patients with myopia/astigmatism treated with the Schwind Amaris 1050RS using Aberration-Free aspheric ablation profiles centered in the corneal vertex with asymmetric offset, 4,129 eyes with TransPRK and 11,954 eyes with femtoLASIK (using the Ziemer LDV Z- series). The refractive stability was evaluated using the Sirius corneal topographer/tomographer. Refractive changes and visual outcomes were evaluated up to 4 years of follow-up.

Results:
4129 TransPRK cases and 11954 femtoLASIK cases have been retrieved. There were differences already observed at the preoperative data for both SEq and cylinder powers. Stability of SEq after TransPRK has been achieved between 1M and 3M postop, compared to POD1 after femtoLASIK. For cylinder, stability after TransPRK has been achieved between 1W and 1M postop, compared to POD1 after femtoLASIK. From 3M postop and up to 4Y, postoperative SEq was -0,06+-0.23D after TransPRK and -0,04+-0,22D after femtoLASIK (p=.2), whereas postoperative cylinder was 0,09+-0.24D after TransPRK and 0,05+-0,15D after femtoLASIK (p=.1).

Conclusions:
FemtoLASIK reached stability from POD1 for both SEq and cyl, much faster than TransPRK (about 1M). From 3M and up to 4Y postoperatively, results were stable and comparable between both groups.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Clinical outcomes of FemtoLASIK and TransPRK in low myopia

Presenting author: maria clara arbelaez, Oman

Session name: **Comparison of corneal refractive surgery / pkakic implantation**
Date and time: **10 October 2021, 13:15 - 14:45**
Presentation time: **13:21 - 13:27**
Location: **Auditorium**

Purpose:
To compare the refractive and visual outcomes and the induction of corneal higher order aberrations (HOA) in eyes with low refractive errors, that underwent femtoLASIK versus single step TransPRK with an aspheric ablation profile.

Setting:
Muscat Eye Laser Center

Methods:
A retrospective analysis of 5,588 eyes from patients with myopia/astigmatism and a most negative meridian less or equals to -2.50 diopters treated with the Schwind Amaris 1050RS using Aberration-Free aspheric ablation profiles centered in the corneal vertex with asymmetric offset, 4,381 eyes with femtoLASIK (using the Ziemer LDV Z- series) and 1,207 eyes with TransPRK. Clinical outcomes, refractive outcomes and corneal aberrations were evaluated at 12 months follow-up.

Results:
1207 TransPRK treatments and 4381 femtoLASIK treatments could be retrospectively retrieved. Postoperative UDVA was 0.0+/-1.2lines different than preoperative CDVA in TransPRK and +0.4+/-0.7lines better after femtoLASIK (p=.05). Change in CDVA was +0.2+/-0.6 lines gain in TransPRK and +0.5+/-0.6 lines gain after femtoLASIK (p=.1). Predictability of SEq was -0.13+/-0.27D undercorrection in TransPRK and -0.06+/-0.31D after femtoLASIK (p=.0006). Stability was reached after POD1 in femtoLASIK and after 1M in TransPRK. Postoperative refractive astigmatism was 0.08+/-0.24D in TransPRK and 0.03+/-0.12D after femtoLASIK (p=.2)

Conclusions:
In low myopic corrections up to -2.5D, there were no clinically relevant differences between TransPRK and femtoLASIK other than the time to reach stability (much shorter after femtoLASIK). From 1M of follow up, refractive and visual outcomes were comparable between both groups.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Comparative of Clinical and Patient Reported Outcomes for Different Wavefront Guided Ablation Technologies

Presenting author: David Teenan, United Kingdom

Session name: Comparison of corneal refractive surgery / pkakic implantation
Date and time: 10 October 2021, 13:15 - 14:45
Presentation time: 13:27 - 13:33
Location: Auditorium

Purpose:
To compare outcomes of iDesign 2.0, a new wavefront guided methodology, with previously released versions in a comparative population and setting

Setting:
Multi Disciplinary Refractive Surgery Centre

Methods:
Patients underwent bilateral LASIK procedures using one of 3 ablation technologies: Wavefront CustomVue, iDesign 1.2 or iDesign 2.0. A Simple Random Sample of 500 patients per cohort was extracted. Treatments carried out in the first year of respective technology implementation were included. Manifest refraction and monocular and binocular UCDVA were recorded 1 day, 1 week, 1 month and 3 months postoperatively. Patient questionnaire included domains for satisfaction, dry eye difficulty, and visual phenomena. Complications were recorded in the electronic medical record at any point in time.

Results:
Preop refraction was to -11.00D of myopia & to -5.00D of astigmatism. In early postop, iDesign 2.0 exhibited a mean shift in sphere towards hyperopia of approximately 0.25D. By 1 month postop this shift was absent, and iDesign 2.0 had statistically significant higher UCDVA levels with 99.4% of patients reaching binocular UCDVA of 20/20 or better and 100% 20/25 or better. This trend was maintained at 3 months. Loss of >2 lines BCDVA occurred in <0.2% with no statistical differences. The 3 cohorts had high levels of satisfaction, with iDesign 2.0 highest at 96.4% of patients “very satisfied” or “satisfied”.

Conclusions:
The 3 cohorts provide safe and effective wavefront guided treatments. A difference in the iDesign 2.0 healing pattern in early postop phase was noted. Percent of patients reaching 20/20 was higher for iDesign 2.0 at 1 and 3 month postop visit. Patient reported satisfaction was also higher in with iDesign 2.0.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Comparison of Corneal Biomechanical Factors after Small Incision Lenticule Extraction (SMILE) and Photorefractive Keratectomy (PRK)

Presenting author: Siamak Zarei-Ghanavati, Iran, Islamic Republic of

Session name: Comparison of corneal refractive surgery / pkakic implantation
Date and time: 10 October 2021, 13:15 - 14:45
Presentation time: 13:39 - 13:45
Location: Auditorium

Purpose:
To evaluate and compare corneal biomechanical properties after Small Incision Lenticule Extraction (SMILE) and Photorefractive Keratectomy (PRK).

Setting:
Noorafarin Eye Clinic and Mashhad University of Medical Sciences

Methods:
Seventy-three patients who were eligible for refractive surgery were allocated to PRK (36 patients) and SMILE (37 patients) groups. Corneal biomechanical properties were recorded and compared between the two groups, before as well as 1 and 3 months following surgery using a dynamic ultra-high-speed Scheimpflug camera equipped with a non-contact tonometer.

Results:
During three months post-operative follow up, corneal biomechanical factors changed significantly in both groups (all, $p<0.05$), except Velocity 1, App 2 length and peak distance in the PRK group ($p=0.276$, $p=0.10$ and $p=0.12$) and velocity 2 ($p=0.238$) in SMILE group. Three months postoperatively, patients in the PRK group showed significantly better results for deformation amplitude ratio ($p=0.031$) and Integrated Inverse Concave Radius ($p=0.027$).

Conclusions:
Both SMILE and PRK refractive surgeries significantly affect corneal biomechanical properties but the changes are less significant following PRK.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Ultra-high resolution polarisation sensitive OCT imaging of collagen fibers revealed novel changes after LASIK and SMILE surgery in patients

Presenting author: RITIKA MULLICK, India

Session name: Comparison of corneal refractive surgery / pkakic implantation
Date and time: 10 October 2021, 13:15 - 14:45
Presentation time: 13:45 - 13:51
Location: Auditorium

Purpose:
To assess temporal changes in collagen fibre orientation and distribution in LASIK and SMILE eyes using an ultra-high-resolution polarisation sensitive OCT.

Setting:
The study was approved by the institutional review board and patients were recruited following informed consent. It was conducted at a tertiary eye care centre in Bengaluru, India.

Methods:
Ten patients underwent myopic SMILE in one eye and LASIK in other eye. All eyes underwent preoperative imaging and postoperative imaging at 1 week, 1 month and 3 months after surgery. Additionally, all eyes were imaged intraoperatively after LASIK flap and SMILE lenticule cut was made but no tissue was ablated. To compare the changes with healthy eyes, twenty age matched patients were also imaged. A histogram of phase retardation(PR)and axis orientation(AO)for all the surgery eyes at all-time points were analysed. The same was analysed for the healthy unoperated eyes. Both PR and AO are representative measures of the "true" in vivo collagen orientation in human corneas

Results:
The mean area under PR histogram ranged changed from 144763 (pre-op) to 146240 (intra-op), 155940 (1-week), 137051 (1-month) and 152619 (3-month) in the LASIK eyes. Similarly, the mean PR changed from 142757 to 140814 (intra-op), 152245 (1-week), 143198 (1-month) and 165164 (3-month) in the SMILE eyes. Remarkably, the changes were similar between both refractive surgical groups ($p>0.05$). However, distinct changes were noted between the post-surgical eyes and healthy unoperated eyes.

Conclusions:
This is the first report of patient specific changes in collagen distribution of patient corneas after refractive surgery. These in vivo changes may assist in earlier detection of ectasia before frank topographic changes appear.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Prospective evaluation of LoVC Ciliary Body Inner Diameter based v1.0 and v2.0 formula for Implantable Collamer Lens (ICL) sizing using Artemis Insight 100 VHF digital ultrasound biometry

Presenting author: Dan Z Reinstein, United Kingdom

Session name: Comparison of corneal refractive surgery / pkakic implantation
Date and time: 10 October 2021, 13:15 - 14:45
Presentation time: 14:00 - 14:06
Location: Auditorium

Purpose:
To develop and further refine a model to predict vault lens separation of the Implantable Collamer Lens (ICL) (STAAR Surgical) using the Artemis Insight 100 very high-frequency (VHF) digital ultrasound (ArcScan Inc) biometry using novel input parameters.

Setting:
London Vision Clinic, London, UK

Methods:
A retrospective analysis of V4c EVO and EVO+ ICL procedures performed with sizing derived from VHF digital ultrasound. After an initial phase where sizing was performed using the published Kojima formula, stepwise multivariate regression analysis was performed to develop a model predicting lens vault. Regression model (v1.0) was used to select lens size for the subsequent 40 consecutive eyes. The regression analysis was then repeated and 77 eyes were treated with the size selected by v2.0 formula. The postoperative vault at 1-month was compared to the vault predicted by the formula.

Results:
Both v1.0 and v2.0 formulae, significant variables were ICL size, ICL power, ciliary-body inner diameter, STS lens rise, and scotopic pupil diameter. The primary 42 eyes achieved a mean(±SD) vault of 506±233µm, range (114-924µm) and IQR of 391µm. LoVC model v1.0, vault relative-to-target was +41±154µm, range (-278 to +403µm) and IQR 194µm. LoVC model v2.0, vault relative-to-target was +79±147µm, range (-235 to +768µm) and IQR 147µm. Attempted-versus-achieved: 33%, 50%, and 57% of eyes had vault ±100µm of the target respectively, and 74%, 95%, and 94% ±300µm. Number of eyes with a vault <200 or >1100µm was 9.5%, 0.0%, and 0.0%.

Conclusions:
The ciliary body inner diameter, a term first described by our group, proved to be more highly correlated with vault. The new models also found scotopic pupil size to be a significant predictor, which has to date had not been a part of any previously published sizing model. The increased accuracy of vault prediction has enabled the examination of attempted vs achieved vault outcomes for the first time.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Comparison of refractive and visual outcomes between image-guided assisted small incision lenticule extraction and wavefront-optimized femtosecond laser in situ keratomileusis in treatment of high astigmatism

Presenting author: bulent kose, Turkey

Session name: **Comparison of corneal refractive surgery / pkakic implantation**
Date and time: **10 October 2021, 13:15 - 14:45**
Presentation time: **14:06 - 14:12**
Location: **Auditorium**

Purpose:
To compare refractive and visual results of image-guided as-sisted small-incision lenticule extraction (IGA-SMILE) and wavefront-optimized femto-second laser in situ keratomileusis (FS-LASIK) in the treatment of high astigmatism.

Setting:
Department of Ophthalmology, Osmangazi Aritmi Hospital, Bursa, Turkey

Methods:
This retrospective case-matched study included 64 eyes that had un-dergone IGA-SMILE and 64 eyes that had undergone wavefront optimized FS-LASIK. The mean preoperative myopia and astigmatism were -4.05 ±1.98 diopter (D) and 3.11 ±1.06 D in the IGA-SMILE group and -4.21 ±2.23 D and -3.15 ±0.62 D in the FS-LASIK group. One year later, visual and refractive results were compared in the groups. Vector analysis based on Alpins method was done to evaluate astigmatic treatment.

Results:
At one year, the residual astigmatism was -0.21 ± 0.25 D in the IGA-SMILE and -0.21 ± 0.24 D in the FS-LASIK group (p=0.305). In the IGA-SMILE group, 57 (89.1%) eyes achieved uncorrected distance visual acuity (UDVA) of 20/20 or better, as did 56 (85.9%) eyes in the FS-LASIK group. Vector analysis results demonstrated that the difference vectors were 0.22 ±0.24 D and 0.21 ±0.22 D (p=0.230), the correction in-dexes were 0.95 ±0.08 and 0.95 ±0.08 (p=0.239), the indices of success were 0.08 ±0.09 and 0.08±0.09 (p=0.248), in the IGA-SMILE and the FS-LASIK groups, respectively.

Conclusions:
The combination of an image-guided system with SMILE resulted in high efficacy and safety indices that were comparable to FS-LASIK surgery

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Anterior and Posterior Vault Characterization and Evaluation throughout Time in Patients Implanted with Phakic Implantable Collamer Lens for Ametropia Correction

Presenting author: Jesús Beltrán, Spain

Session name: Comparison of corneal refractive surgery / pkakic implantation
Date and time: 10 October 2021, 13:15 - 14:45
Presentation time: 14:12 - 14:28
Location: Auditorium

Purpose:
When implanting Implantable Collamer Lens phakic IOL (ICL pIOL), it is of great importance to know its accurate position inside the eye in order to learn its relationship with surrounding structures. Anterior Vault (AV) is defined as the distance between pIOL and corneal endothelium. It is also defined Posterior Vault (PV) as the distance between pIOL and human lens. The purpose of the present study is to define AV and PV; to study stability of both VA and PV throughout time and to evaluate security and safeness of ICL pIOL in a 12 months-follow-up once implanted.

Setting:
Clínica Rementería Madrid, Spain.

Methods:
In this retrospective study, eyes that underwent refractive surgery implanted with ICL pIOL and operated all by the same expert surgeon, L.A.R.C., were analyzed. 1 month and 1 year Anterior Vault (AV) and Posterior Vault (PV) values were measured with Visante AS-OCT (Carl Zeiss Meditec, Inc., Ireland) postoperatively. All these data obtained were processed and analyzed by using IBM SPSS Statistics V25 Software (IBM, Armonk, New York, USA).

Results:
40 eyes were analyzed. 1m and 1y postop AV mean values were 2503.90±279.97 and 2560.40±278.43µm respectively with statistically significant differences ($p<0.05$). A positive correlation of $r=0.885$ with statistical significant ($p<0.001$) was found within both measurements. AV mean increased from 1m to 1y 56.50±134.19µm. 1m and 1y postop PV mean values were 496.63±169.96 and 432.67 ± 162.74µm respectively (statistically significant differences ($p<0.05$)). A positive correlation of $r = 0.862$ (statistical significant $p<0.001$) was discovered. PV decreased 63,95± 87.80 µm from 1m to 1y. Correlation within AV 1y and PV 1y was negative $r = -0.559$ and statistically significative ($p<0.001$)

Conclusions:
Considering Anterior Vault as the distance between endothelium and anterior surface of pIOL, the values obtained showed an increase throughout time from 1 month to 1 year postop. Posterior Vault, distance measure from human lens to posterior surface of pIOL, tended to decrease in time in this early months. All these data show that AV does not increase in the same amount that PV does decrease otherwise they vary in different proportion. Both AV and PV data exhibit an anatomical and functional security of ICL pIOL on time, proving that implanting ICL is a secure and predictable refractive procedure.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Validation of central vault prediction with machine learning in Caucasian eyes implanted with a phakic collamer intraocular lens

Presenting author: Felix Gonzalez Lopez, Spain

Session name: Comparison of corneal refractive surgery / pkakic implantation
Date and time: 10 October 2021, 13:15 - 14:45
Presentation time: 14:28 - 14:34
Location: Auditorium

Purpose:
To assess the predictability of the vault prediction in EVO Visian ICL phakic lens implants in Caucasian eyes based on a machine learning algorithm designed with Asian eyes, comparing the calculated predictions with the vault results achieved 1-month postoperatively in photopic and scotopic external ambient light conditions.

Setting:
Clínica Baviera, Madrid. Spain.

Methods:
This observational, retrospective non-randomized single-center study comprised eyes who underwent uneventful implantation of EVO Visian ICL phakic lenses. All surgeries were performed by the same surgeon (F.G-L.). Only the first operated eye was enrolled. Obtained data on the preop and 1-month after surgery were included on a spreadsheet. On the other hand, supplementary material obtained from Kamiya's recent paper (http://dx.doi.org/10.17632/ffn745r57z) and its machine learning algorithm was run in Matlab software under windows 10. Finally, statistical analysis was performed to analyze the sample distribution normality, mean differences according to pairwise comparisons and the correlation between variables in SPSS software.

Results:
Sixty-four eyes from 64 subjects were included. Mean age was 32±7 years and preoperative spherical equivalent was -10.18±3.16 diopters. ICL size distribution was 12.1mm in 2 eyes (3.1%), 12.6mm in 19 eyes (29.7%), 13.2mm in 40 eyes (62.5%), and 13.7mm in 3 eyes (4.7%). The mean central vault value obtained in Caucasian eyes was 412±178µm under photopic light conditions and 506±191µm in maximum mydriasis whereas mean central vault prediction according to Matlab algorithm for miosis and mydriasis was 547±80µm and 550±82µm, respectively. This represented a difference in miosis of 136±182µm ($p<0.001$) and in mydriasis of 45±118µm ($p=0.063$).

Conclusions:
Although the vault prediction based on machine learning algorithms is a promising technique for the near future, it is necessary to perform an adjustment of the different algorithms according to the anatomy of Caucasian eyes compared to Asian eyes to achieve foreseeable and effective predictions.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Astigmatism correction in Phakic Intraocular Lens implantation: Corneal incisions vs Toric ICL

Presenting author: Antonio Cano-Ortiz, Spain

Session name: Comparison of corneal refractive surgery / pkakic implantation
Date and time: 10 October 2021, 13:15 - 14:45
Presentation time: 14:34 - 14:40
Location: Auditorium

Purpose:
To assess the predictability, refractive and visual outcomes of low-cylinder astigmatism correction in myopic eyes with corneal incisions + spherical ICL vs Toric ICL implantation.

Setting:
La Arruzafa Hospital, Córdoba. Spain

Methods:
This prospective longitudinal interventional analytical single-center study comprised subjects interested in refractive surgery who meet the following inclusion criteria: Refractive astigmatism lower, ACD>2.8mm, age between 21 and 60 years, without previous ophthalmological surgeries. Subjects underwent a complete ophthalmological examination, including UDVA, CDVA, refraction, corneal topography (Pentacam) and optical biometry. They were divided into 2 groups: Group with opposite corneal incisions in the corneal steep keratometry meridian and spherical ICL implantation, and group with T-ICL implantation with incision at 0-180º meridian. One month after surgery, subjects were examined with Pentacam corneal topography, subjective refraction, UDVA and CDVA.

Results:
39 eyes were analyzed, 18 in the incision group(G1) and 21 in the T-ICL group(G2). Preoperative spherical equivalent was -8.00±2.42D in G1 and -8.35±3.11D in G2. Preoperative corneal astigmatism was 0.97±0.43D in G1 and 0.98±0.58D in G2. At one-month, spherical equivalent in G1 and G2 was +0.20±0.44D and -0.04±0.17D, respectively, and UDVA and CDVA were 0.94±0.29 and 1.04±0.17 in G1 and 1.05±0.18 and 1.07±0.16 in G2 respectively, which meant efficacy and safety indices of 1.02±0.25 and 1.14±0.13 in G1 and 1.05±0.17 and 1.17±0.16 in G2, respectively. The mean induced corneal astigmatism in G1 was 0.35±0.56D(p=0.03) and 0.11±0.91D(p=0.572) in G2.

Conclusions:
Both techniques are safe and effective, but T-ICL implantation seems to be more accurate and effective than corneal incisions astigmatism management with spherical ICL implantation. T-ICL group showed a higher Efficacy and Security index 1 month after surgery. Corneal astigmatism was reduced in Corneal incisions group by 0.35D.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Phakic intraocular lens explantation and causes at Fundacion Oftalmologica Los Andes in 2001-2020 period.

Presenting author: Cristobal Loezar Hernandez, Chile

Session name: **Comparison of corneal refractive surgery / pkakic implantation**
Date and time: **10 October 2021, 13:15 - 14:45**
Presentation time: **14:40 - 14:46**
Location: **Auditorium**

Purpose:
To describe the total number of implantations of three models of phakic IOLs (Artisan, Artiflex and ICL) and the main causes of explantation between 2001 and 2020.

Setting:
Fundacion Oftalmologica Los Andes, Santiago, Chile.

Methods:
Retrospective analysis of patients who underwent implantations of different models of phakic IOLS (Artisan, Artiflex and ICL) between October 2001 and December 2020. The medical records of patients with pIOLs explantations were evaluated and clinical data was retrieved for the analysis. The main outcome of the study was to describe the causes of repositioning and explantation with different models pIOL.

Results:
Two thousand five hundred ninety five pIOLs have been implanted (783 Artisan, 537 Artiflex, and 1275 ICL). There were 52, 11, and 48 explantations of Artisan, Artiflex, and ICL models, respectively. Cataract was the main reason for explantation in all models; 34(65%) in Artisan, 7(63%) in Artiflex, and 30(63%) in ICL. The second cause in Artisan/Artiflex group was a low endothelial cell count (27%, and 37% respectively), and hyper/hypovaulting in ICL group (29%). Four cases of keratoplasty for endothelial decompensation were observed in the Artisan group, and 3 cases of retinal detachment in ICL group.

Conclusions:
Cataract was the main reason for explantation of the pIOLs in our series, regardless of the implanted model. The second cause was different between groups, being low endothelial cell count (Artisan/Artiflex group), and hyper/hypovaulting (ICL group). Patients should be informed that the implantation of pIOLs is a time-limited surgery, and the reasons for explantation stated in this research had to be discussed in the preoperative counseling. The time from the implantation to the explantation procedure will be reported as median (range) in the final version of this research.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Post-surgical outcomes comparing two Alcon PCIOLs, Acrysof® IQ Vivity® and Acrysof® IQ PanOptix®

Presenting author: Antti Viljanen, Finland

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 11:30 - 11:36
Location: Hall 13 / Elicium Ballroom

Purpose:
To evaluate visual acuity at different distances after successful presbyopia correcting intra ocular lens (PCIOL) implantation of extended depth of vision IOL Acrysof® IQ Vivity® (Alcon model DFT015) and trifocal IOL Acrysof® IQ PanOptix® (Alcon model TFNT00) after successful cataract surgery or refractive lens exchange surgery.

Setting:
This is an observation study in the clinics of Medilaser and Silmaasema, Cor Group, Finland.

Methods:
The DFT015 was implanted in 29 eyes of 15 patients. The TFNT00 was implanted in 118 eyes of 59 patients. Post-surgery visit was at 1 month. The groups where equal in terms of gender (54/56 % female), age (59/57y) and need of near addition (2,2/2,1D). The main outcome parameters were LogMAR uncorrected visual acuity at distance (binocular UDVA 6 m), intermediate (binocular UIVA 63 and 100 cm) and near (binocular UCNVA 40 cm). The patients were selected to the Vivity® or PanOptix® group before surgery based in their need for spectacle free near tasks.

Results:
The difference between Haigis formula target and spherical refractive error at 1 month was 0.0D/0.1D (right eye/left eye) with Vivity®, and with PanOptix® difference was 0.01D/0.01D. At 1-month, binocular UDVA was equal, logMar -0.05 with Vivity® and logMar -0.04 with PanOptix®, p=0.33. UCNVA 40cm, PanOptix® was superior (logMar 0.07 vs 0.20, p<0.0001). UIVA 63cm, PCIOLs were equal (logMar 0.03 vs 0.03, p=0.41). UIVA 100cm, Vivity® was superior (logMar -0.01 vs 0.05, p<0.03).

Conclusions:
Both PCIOLs gave excellent uncorrected distance visual acuity. PanOptix® was superior at UCNVA 40cm, as expected. For uncorrected intermediate PCIOLs were equal at 63cm, and Vivity® was superior at 100cm. Haigis formula gave accurate refractive outcome for both PCIOLs. These results may help surgeons to decide what PCIOL to recommend fulfilling the patient´s individual needs.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Role of angle lambda on quality of life after trifocal intraocular lens implantation

Presenting author: Sultan Kaya Unsal, Turkey

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 11:36 - 11:42
Location: Hall 13 / Elicium Ballroom

Purpose:
To evaluate the effect of lambda angle on vision related quality of life (QOL) after trifocal intraocular lens (IOL) implantation by using the National Eye Institute Visual Function Questionnaire -25 (VF-25 QOL questionnaire) Turkish version.

Setting:
VENI VIDI GOZ EYE HOSPITAL

Methods:
In this retrospective study, 130 eyes of 65 patients who had bilateral trifocal IOL implantation between march 2019 to January 2020 were analyzed. The vision related QOL was assessed 3 months after the surgery. The VF-25 QOL questionnaire was used, with a grading scale of 1, no difficulty at all; 2, a little difficulty; 3, moderate difficulty; 4, extreme difficulty; 5, stop doing this because of eyesight. The patients divided into two groups based on the size of Lambda angle. Pre-and post-operative refractive factors, lambda angle and topographic parameters were evaluated and their influence on the outcomes were analyzed.

Results:
There were 37 (56.9%) females and 28 (43.1%) males. The mean age of the patients were 57.09± 7.08 years. The mean pre-operative lambda angle 0.64± 0.27 mm. Postoperative spherical equalent-0,09 ±0.35 D ,UDVA 0.10 ± 0.10 logMAR, uncorrected intermediate vision(UIVA) 0.20±0.08 logMAR, uncorrected near vision(UNVA) 0.17 ±0.08 logMAR. The two groups showed statistically significant differences in the incidences of going out to see movies, plays or sports events, driving at night and driving in difficult conditions. These were the most difficult tasks to perform with the mean values of the VF-25 QOL questionnaire being 1,65 ±0,76,1,62 ± 0,86 and 1.60 ± 0,82 respectively.

Conclusions:
The results of the VF-25 QOL questionnaire indicated that patients trifocal IOLs provided very satisfactory near, intermediate and distant vision acuities not affected by their angle lambda. However, when angle lambda was greater than 0.5 mm the patients dissatisfaction increase at night Pre-operative lambda angle should be checked and post-operative emmetropia should be targeted to decrease dissatisfaction after operation.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

From (Optical) Bench to Bedside: Laboratory and Clinical Experience with a Diffractive Trifocal Intraocular Lens Sutured to an Artificial Iris

Presenting author: Grzegorz Labuz, United States

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 11:42 - 11:48
Location: Hall 13 / Elicium Ballroom

Purpose:
Using a translational research approach, before realizing the procedure in a patient with iatrogenic aphakia and partial aniridia, we determined in-vitro whether suturing a trifocal intraocular lens (IOL) to an artificial iris (AI) degrades the IOL's optical quality.

Setting:
University Eye Clinic of Heidelberg, Germany.

Methods:
We analyzed optical quality by measuring the modulation transfer function (MTF) at 3.0mm aperture and at 50 and 100lp/mm. We assessed the FineVision Pod F GF IOL: in two powers, two +20.0D (IOLs 20A and 20B) and two +30.0D (IOLs 30A and 30B). IOL decentration in relation to the AI's center was evaluated. Laboratory results provided empirical evidence in the informed consent for surgical intervention in a patient with iatrogenic aphakia and iris defect in one eye. We measured clinical results using the parameter of corrected visual acuity plus a patient self-assessment of the cosmetic appearance of the operated eye.

Results:
The IOLs 20A and 20B demonstrated a mean MTF reduction of up to 1.1%, while the IOLs 30A and 30B showed a decrease of up to 5.2% for both spatial frequencies. All lenses showed good centration levels. In the clinical case, the patient showed corrected distance visual acuity, distance-corrected near visual acuity, and distance-corrected intermediate visual acuity of 0.20, 0.20, and 0.22logMAR, respectively. The patient was satisfied with the cosmetic outcome.

Conclusions:
There was merely a slight reduction in trifocal IOL optical quality after it was sutured to an AI. Clinically, the combined implantation of the AI and FineVision provided good functional and cosmetic outcomes.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Clinical Outcomes With a New Continuous Range of Vision Presbyopia-Correcting Intraocular Lens

Presenting author: Nikica Gabrić, Croatia

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 11:48 - 11:54
Location: Hall 13 / Elicium Ballroom

Purpose:
To evaluate the clinical outcomes including patient-reported outcome measures in a sample of eyes undergoing bilateral cataract surgery with implantation of a new model of presbyopia-correcting intraocular lens (IOL).

Setting:
University Eye Clinic Svjetlost, Zagreb, Croatia

Methods:
This non-randomized prospective case series enrolled 206 eyes of 103 patients undergoing phacoemulsification cataract surgery with bilateral implantation of the TECNIS Synergy IOL (Johnson & Johnson Vision). High and low contrast visual acuity, refractive, defocus curve, and patient-reported visual performance (Catquest-9SF questionnaire) outcomes were evaluated during a 3-month follow-up.

Results:
A total of 96.1% and 91.3% of patients achieved binocular postoperative uncorrected distance and near visual acuity of 0.00 logMAR.. Mean postoperative mesopic UNVA for both eyes was 0.14 ± 0.03 logMAR. Likewise, mean binocularUDVA and UNVA were 0.00 ± 0.03 and 0.04 ± 0.02 logMAR. An almost flat mean defocus curve was obtained. A reduction of contrast led to a limited but statistically significant change in UNVA in both eyes ($P < .001$). The Rasch calibrated scoring of item 2 and the Rasch calibrated mean score of the Catquest-9SF questionnaire increased significantly with surgery ($P < .001$).

Conclusions:
This new presbyopia-correcting IOL provides a continuous range of functional focus, with a limited deterioration under mesopic conditions, which is perceived as a satisfactory outcome by the patient if proper patient selection is performed.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Clinical evaluation of a diffractive continuous-range-of-vision Intraocular lens with the Salzburg Reading Desk

Presenting author: Isabella Baur, Germany

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 11:54 - 12:00
Location: Hall 13 / Elicium Ballroom

Purpose:
To evaluate the near and intermediate reading performance after binocular implantation of a novel presbyopia correcting IOL combining bifocal and extended depth of focus technologies on an electronic reading desk.

Setting:
This Investigator Initiated Prospective Interventional Study is conducted in a university clinic setting.

Methods:
In an ongoing clinical study, bilateral implantation of the TECNIS Synergy IOL (Johnson & Johnson, New Brunswick, NJ) is performed in 56 eyes of 28 patients during a refractive lens exchange procedure. The Salzburg Reading Desk is used to analyze unilateral and bilateral uncorrected and distance corrected reading acuity, reading distance, reading speed, and the smallest print size that can be read effectively at a set (40 cm/80 cm) and subjectively chosen near and intermediate distance. All patients were examined preoperatively and 6 months after refractive lens exchange surgery.

Results:
Uncorrected near reading acuity increased from 0.56 ± 0.2 logMAR preoperatively to 0.11 ± 0.10 logMAR postoperatively at the set near distance (40 cm) and from 0.58 ± 0.22 logMAR to 0.12 ± 0.09 logMAR at the subjectively preferred distance (39.34 cm and 39.60 cm). Uncorrected intermediate reading acuity was 0.29 ± 0.21 logMAR preoperatively and 0.12 ± 0.07 logMAR postoperatively at the set intermediate distance (80 cm). The preferred intermediate distance was 71.03 cm preoperatively and 76.49 cm postoperatively. Uncorrected intermediate reading acuity at the preferred distance was 0.34 ± 0.24 logMAR preoperatively and 0.12 ± 0.08 logMAR postoperatively.

Conclusions:
Uncorrected intermediate and near reading function considerably improved after bilateral implantation of the TECNIS Synergy IOL. Reading function was comparable for the set and subjectively preferred distance.

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Long-term patient reported dry eye symptoms and clinical outcomes following multifocal/EDOF intraocular lens surgery in a large population

Presenting author: Clare O'Donnell, United Kingdom

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 12:00 - 12:06
Location: Hall 13 / Elicium Ballroom

Purpose:
To report on the frequency of dry eye symptoms in a large group of patients up to 6.5 years after undergoing multifocal/EDOF intraocular lens surgery.

Setting:
Optegra Eye Hospitals, UK

Methods:
A questionnaire comprising 25 questions was sent to 2,427 patients that had undergone RLE/refractive cataract surgery between January 2011 and June 2017. In addition to aspects such as willingness to undergo the procedure again (if they knew then what they now know), perceived improvement to quality of life and overall satisfaction, the questions addressed visual stability throughout the day, fluctuations in vision, dry eye symptoms pre- vs post-surgery, and frequency of watery eyes. Results were stratified by age (Group 1 up to 59 years; Group 2 60-69 years; and Group 3 over 70 years).

Results:
Of the 728 respondents, 65% were female and the mean (+/- SD) age was 61+/-8 years (range 46-86 years). Overall, 89% reported they would have the procedure again if they needed it and 89% reported their quality of life improved following surgery. In terms of visual fluctuations, 40% experienced this. However, in most cases if fluctuation was present, “Evening” was most commonly when it was observed. 38% reported dry eye symptoms worse than experienced pre-operatively. 52% reported still experiencing watery eyes. Although there were differences in symptoms across the three age groups, in general these were not statistically significant ($p>0.05$).

Conclusions:
Overall, for the majority of respondents, the outcomes of surgery met or exceeded their expectations and were perceived to improve quality of life. However, almost 50% of respondents experienced dry eye symptoms. Therefore, mitigating dry eye is potentially a key variable to optimise patient satisfaction post surgery. Other variables related to vision are also likely to improve, when the tear film is optimised.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Novel Simulation Of Accommodation: Utility as a Predictive Tool for Central Optical Power

Presenting author: AnnMarie Hipsley, United States

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 12:15 - 12:21
Location: Hall 13 / Elicium Ballroom

Purpose:
To evaluate presbyopia treatments utilizing a Finite Element Model (FEM) translated into a Finite Element Model Animation (FEMA). This animation incorporates key anatomical structures involved in accommodation including the sclera, ciliary muscles, crystalline lens, lens capsule, zonules, and choroid.

Setting:
A novel physics-based computer simulation

Methods:
A 3-D model of the eye was constructed using meshing and FEM analysis was performed using advanced multi-physics simulation (AMPS) technology on representative 3D models of ocular structures. The FEM was translated into a FEMA to show three dimensional dynamic movements of accommodation using a proprietary method and Autodesk Maya. Simulations of laser scleral microporation (LSM) therapy were performed in the virtual presbyopic eye. Intraocular lenses (IOLs) were virtually implanted in the FEM. The simulation predictability was compared to reported outcomes using each modality.

Results:
Sensitivity analysis of the differences in accommodation between the “young/healthy” and “old/presbyopic” eye identified the age-related changes that contribute most to symptoms of presbyopia. The FEMA demonstrated the dynamic movements of the ciliary muscle, zonules, lens, sclera, choroid, and vitreous during accommodation. Successful treatment simulations were performed using IOL implantation and LSM therapy in a virtual presbyopic eye. Translation of these treatment simulations into the FEMA demonstrate the mechanism of action for LSM therapy and the behavior of IOLs after implantation. Predictive values were similar to reported outcomes. This may provide insight for future accommodating IOL development.

Conclusions:
The FEM was successfully translated into the FEMA. Virtual surgical and therapeutic simulations of IOL implantation and LSM therapy provide novel insight into their effectiveness to treat presbyopia. The FEM and FEMA also provide insight and predictive capabilities to new technology applications in presbyopia.

39th Congress of the ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Introduction of a web-based reading test for normal and low vision patients: Development and validation.

Presenting author: Eirini-Kanella Panagiotopoulou, Greece

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 12:21 - 12:27
Location: Hall 13 / Elicium Ballroom

Purpose:
Primary objective of this study is the development and validation of the web-based Democritus Digital Acuity Reading Test – wDDART, which is based on the previously developed and validated Windows-based DDART.

Setting:
The development of wDDART was carried out in the Department of Computer Science and Biomedical Informatics, University of Thessaly, Lamia, Greece, while the validation was conducted in the Department of Ophthalmology, University Hospital of Alexandroupoli

Methods:
This is a prospective, comparative clinic-based trial. wDDART displays sentences with text sizes from 1.3 to -0.5 logMAR for different patient-screen distances and automatically calculates: reading acuity (RA), maximum reading speed (MRS), critical print size (CPS) and reading accessibility index (ACC). It provides advanced text calibration features and monitors examination distance using computer vision techniques. For the validation, normal and low vision patients responded to wDDART and the Windows-based version DDART on the same day, at 40cm distance. wDDART-derived reading parameters were compared with the corresponding ones from DDART. Test-retest reliability of wDDART was evaluated in a 15-day time-window.

Results:
One hundred patients (normal vision group - NVG: 70 patients; low vision group - LVG: 30 patients) responded to DDART and wDDART. Non-significant differences between the two reading tests were found for all parameters in NVG and LVG. Intraclass correlation coefficients (ICCs) between the two tests demonstrated good or excellent correlation for RA, MRS, ACC and moderate correlation for CPS. Test-retest reliability was excellent for RA and ACC, while ICCs ranged between 0.715 and 0.895 for MRS and CPS.

Conclusions:
To our knowledge, wDDART is the first validated ophthalmological reading assessment tool that is available as a web application with many novel features. Study outcomes suggest comparable validity to the DDART reading tool and high test-retest reliability, making it sufficient for clinical and research settings for the evaluation of reading acuity and reading performance in normal and low vision patients. The potential uses of wDDART as a web-based diagnostic tool are numerous, including support for screening initiatives and application to remote health facilities.

39th Congress of the ESCRS
ESCRS
AMSTERDAM
8 – 11 October 2021

Refractive

Portable Wavefront Sensor for measuring refractive errors in post cataract surgery patients

Presenting author: Nuria Estebanez Corrales, Spain

Session name: **Advanced Oprics and visual performances evaluation**
Date and time: **11 October 2021, 11:30 - 13:00**
Presentation time: **12:27 - 12:33**
Location: **Hall 13 / Elicium Ballroom**

Purpose:
To evaluate a novel open-binocular low-cost handheld device (QuickSee), for measuring refractive errors in post cataract surgery patients.

Setting:
Tertiary referral hospital Fundacion Jimenez Diaz Madrid (Spain).

Methods:
Refraction was performed in 79 patients (69,81 +/- 7,66 years) who underwent uneventful cataract surgery 6 weeks ago. We measure autorefraction and subjective refraction to determine their eyeglass prescription. Three measures with QuickSee were taken in all patients. Differences in refraction values (Subjective Vs QuickSee) as well as the visual acuity achieved by the patients with each refraction method (Subjective Vs QuickSee) were used to evaluate the performance of the device in measuring refractive errors.

Results:
Bland-Altman analyses of the data indicated a bias and limits of agreement between subjective refraction and QuickSee of -0,15 +/- 0,949(M), 0,057 +/- 0,481 (J0) and 0,068 +/- 0,424 (J45). According to visual acuity, QuickSee refraction was equal or better than achieved by subjective refraction in the 77,20% of the patients.

Conclusions:
This study found agreement between the measurements obtained with the portable autorefractor and the prescriptions based on subjective refraction, only small differences between the visual acuity achieved by either method. these results suggest that the device is a useful autorefraction tool for post cataract surgery patients and has the advantages of being a low-cost, portable and open-field autorefractor, being especially useful in undeveloped countries

39th Congress of the ESCRS
ESCRS AMSTERDAM 8 – 11 October 2021

Refractive

Evaluation of daily change in high-order aberrations and tear break up time in long-term computer users

Presenting author: Medine Gündoğan, Turkey

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 12:33 - 12:39
Location: Hall 13 / Elicium Ballroom

Purpose:
Diurnal evaluation of high-order aberrations and tear break-up time(TBUT) in long-term computer users.

Setting:
Health Science University, Kayseri City Training and Research Hospital, Department of Ophthalmology, Kayseri, Turkey

Methods:
Thirty two eyes of 32 hospital staff using computers for at least 6 hours a day for more than 5 years were included in the study. Only the right eyes of the patients were included. TBUT and high-order aberrations were measured after a complete ophthalmologic examination of the patients. High-order aberrations (coma, trefoil, spherical aberration, tetrafoil) were measured with iDesign aberrometer (Abbott Medical Optics, Abbott Park, Chicago, IL, USA) device. TBUT and high order aberrations and total RMS values were measured twice a day, Monday morning before starting work, at 8 o'clock and at 16 o'clock after work.

Results:
The mean age of the patients was 31.90 ± 4.67 years. TBUT values were 14.68 ± 2.87 and 7.75 ± 3.46 sec in the morning and after work, respectively ($p<0.001$). Total RMS values in the morning and after work were 0.70 ± 0.45 and 0.77 ± 0.40, respectively. ($p= 0.030$). While there was no significant difference in terms of coma, trefoil and spherical aberrations, there was a significant difference in terms of tetrafoil aberrations. A negative correlation was found between the change in TBUT values and the change in total RMS values ($p = 0.004$, $r = -0.494$).

Conclusions:
Tear parameters and visual quality (high order aberrations) change significantly at the end of a working day in long-term computer users. Diurnal evaluation is important in terms of dry eye findings in these people.

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Refractive

Acusimx: A Novel Biomechanical Simulation and Artificial Intelligence Software for Prediction of Post-Refractive Surgery Corneal Stiffness

Presenting author: Pooja Khamar, India

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 12:39 - 12:45
Location: Hall 13 / Elicium Ballroom

Purpose:
To demonstrate the accuracy of AcuSimX, a predictive tool based on inverse finite element method (iFEM) and artificial intelligence (AI), for estimating postoperative (POSTOP) corneal stiffness (CS) after SMILE, LASIK and PRK

Setting:
Narayana Nethralaya, India

Methods:
AcuSimX was used to construct patient specific iFEM model using the preoperative (PREOP) Corvis-ST (OCULUS Optikgerate Gmbh, Germany) deformation data, Pentacam HR tomography 3-D volume (OCULUS) and intended aspheric ablation profile. Using inverse methods, AcuSimX estimated the corneal biomechanical properties from the PREOP measurements. Then, AcuSimX was used to compute the POSTOP CS using the PREOP corneal biomechanical properties and surgical 3-D mesh models specific to a surgery. The computed CS was further refined using an in-built population database (300 eyes) of post-refractive surgery CS outcomes (SMILE, PRK and LASIK) and Lasso regression AI.

Results:
The intraclass correlation (ICC) between measured and predicted POSTOP CS was 0.91 (LASIK=0.92, SMILE=0.91 and PRK=0.85). The difference between predicted and measured POSTOP CS was 4.02 [2.85, 5.2], 3.69 [2.36, 5.03] and 2.81 [1.16, 4.43] N/m for LASIK, SMILE and PRK, respectively. The ICC improved to 0.95 overall after Lasso regression based AI adjustment (LASIK=0.95, SMILE=0.93 and PRK=0.92). The AI also improved the difference to -0.27 [-1.25, 0.71], 0.27 [-0.87, 1.4] and 0.3 [-0.95, 1.55] N/m for LASIK, SMILE and PRK, respectively.

Conclusions:
Overall, the excellent ICC (greater than 0.9 overall) demonstrated the accuracy of the predictions of POSTOP CS. This established AcuSimX as the first biomechanical simulation software for use in the refractive surgery clinics and may provide the means to avoid ectasia completely.

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Refractive

Correlation between Internet search enquiries and incidence of Corneal, Cataract and Laser refractive surgery- predicting the future with Google?

Presenting author: Mohamed Ghali, Germany

Session name: Advanced Oprics and visual performances evaluation
Date and time: 11 October 2021, 11:30 - 13:00
Presentation time: 12:45 - 12:51
Location: Hall 13 / Elicium Ballroom

Purpose:
Analysis of internet search enquiries (ISE) may be a useful source of information in investigating public interest levels and medical need in corneal, cataract and refractive surgery. So far, first data exist regarding seasonal trends in ophthalmic diseases for ISE, but only few studies correlate these data to real data from the health systems. Aim of this study is to analyse ISE by using Google Trends data and correlate them to health system data from the German National Association of Statutory Health Insurance Physicians (KBV).

Setting:
University Hospital of Cologne, Department of Ophthalmology, Cologne, Germany; Hamburg University of Applied Sciences (HAW Hamburg), Hamburg, Germany; MVZ ADTC Erkelenz, Erkelenz, Germany; AOB Augenaerzte-Augenkliniken, Hamburg, Germany

Methods:
Data was queried from the German Registry of the National Association of Statutory Health Insurance Physicians (KBV) for patients who underwent ophthalmic surgical procedures from 2017 to 2019 in Germany. Data for refractive corneal laser procedures was queried from Statista GmbH (https://de.statista.com/) from 2010 till 2020. Google trends data was queried via the Google Insights for Search (http://google.com/trends) using specific terms related to the individual diseases and procedures from 2017 to 2020. These data were investigated over different time periods regarding the correlation between ISE and certain diseases and procedures relevant for corneal, cataract and refractive surgery through bivariable Correlation-Analysis.

Results:
ISE was significantly correlated to the incidence of ophthalmological diseases and procedures related to corneal transplantation ($r = 0.55$, $p < 0.05$), Cataract ($r = 0.59$, $p < 0.05$), and Laser refractive surgery ($r = 0.83$, $p < 0.05$) in Germany. Moreover, individual trends among the three fields were observed regarding the surgical procedures (e.g. in Descemet Membrane Endothelial Keratoplasty).

Conclusions:
The general interest and the incidence of ophthalmological diseases and surgical procedures within the population may be tracked by monitoring changes in ISE over time. These data are correlated to real health system data und may be used in the future for a now-casting or even forecasting. The use of these data may be in detecting the population's need and optimize the distribution of ophthalmological care in Europe.