1. **Innovations in Cataract Surgery: Where Are We Going?**
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   Optometry’s Meeting 2014
   Philadelphia, PA

2. **Disclosures**
   - Josh Johnston, OD, FAAO received honorarium or research funding from Abbott (Speaker), Alcon (Speaker, Research), and Allergan (Speaker)
   - Walter Whitley, OD, MBA, FAAO has received honorarium or research funding from Alcon (Advisory Board, Research, Speaker), Allergan (Advisory Board, Research, Speaker), Bausch and Lomb (Advisory Board, Speaker), Biotissue (Advisory Board), Nicox (Advisory Board), TearLab (Advisory Board), Tearscience (Research, Speaker)

3. **Today’s Optometrists**
   "To be on the cutting edge of optometry, you need to be on the cutting edge of science and technology"

4. **Pearls on Optometric Co-management**
   - Get to know your surgeon
   - Convey patient preferences, observations and conditions to your surgeon
   - Inform your patients on your role in perioperative care
   - **Successful co-management is the result of continuous communication**

5. **Why Become Involved?**
   - 3 million cataract surgeries each year
   - By 2020 the U.S. population over 65 will double from current levels – 12.9% of total population
   - CMS allows ODs/MDs to bill for non-covered services
   - Tangible vs. Intangible benefits

6. **Basic Marketing Concepts**
   - Needs / Wants / Demands are underlying concepts of marketing
     - Needs are basic requirements of human beings
     - Wants are the form human needs take as they are shaped by culture and individual personality
     - Demand is want backed by buying power
   - **Patients need to see, want freedom from glasses, and have the means to invest in technology**

7. **The Baby Boomers**
   - Baby Boomers represent the generation with the greatest buying power in the history of our country
   - Account for a dramatic 40% of total consumer demand – even in a recession
   - **Find a way to appeal to us through our desire to stay young, act young, think young and feel young**
Optometric Opportunity
- Maintain a refractive mindset
- Direct to consumer advertising is here
- Who better to hear about these options from than their own optometrist?

IMAGE GUIDED SURGERY

TrueGuide™ by TrueVision 3D Surgical, Inc.
Computer-Guided Surgery
- TrueGuide provides digital guidance during cataract and cornea surgery. It utilizes state-of-the-art diagnostics for data acquisition to generate templates for astigmatism correction and advanced lens placement.
- TrueGuide software drives lowest residual astigmatism in precision outcomes for toric IOL alignment, limbal relaxing incision, incision placement and lens centration.

TrueGuide™ Surgical “Ecosystem”
Computer-Guided Surgery

Integrated Diagnostics for Surgical Planning
TrueGuide™ utilizes i-Optics Cassini topographer input with TrueCapture™ software for accurate corneal shape analysis and pre-operative diagnostics.
- Lowest error in Axis of astigmatism <3.5°
- Lowest error in Magnitude of astigmatism < 2%
- Submicron elevation mapping accuracy <0.8micron

Dynamic Optimization
TrueGuide™ software engine matches patient parameters in real-time to available treatment options specific to surgeon parameters and tendencies
- Auto-registration of pre-operative image to live surgery
- Real time calculation of predicted residual astigmatism
- Robust eye tracking – even during surgical maneuvers
- Precision algorithms for incision placement, astigmatism management, and lens centration

Precision Surgical Guidance
- TrueVision® Smart 3D displays surgical view with guidance overlay
- TrueGuide™ software is customized to individual surgeon preferences
- OR team sees everything the surgeon sees enhancing synergy
- Integrates with any surgical microscope
- Easily records and edits 3D surgical video

OR Team Sees Everything

Retrospective Analysis of 3D HD Visualization vs. Conventional Oculars During Cataract Surgery
- Method:
• Analyzed consecutive cases from adjacent OR for a single surgeon
• Routine cataract cases using two methods of visualization

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• Unplanned Vitrectomy rate was lower in TrueVision® 3D cases

17 TrueVision Refractive Cataract Toolset®

18

VERION™ Image Guided System

VERION™ Image Guided System
VERION™ Image Guided System
VERION™ Image Guided System
VERION™ Image Guided System

19

VERION™ Reference Unit

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VERION™ Reference Unit

21

VERION™ Reference Unit

22

VERION™ Digital Marker

23 Registration at the Scope

24 Incisional Plan

25 Capsulorhexis Plan

26 Toric Alignment Plan

27 “The Pipeline”: Future IOLs

28 ReSTOR Multifocal Toric

• Aspheric design
• Greater utilization among “non refractive” surgeons?
• Can treat up to 3 D of astigmatism
• Diffractive multifocality
• UV and Blue light filter

29 Synchrony IOL
• Dual Optic accommodating IOL
• 2 optics connected by spring haptics
• Temporary myopia initially after post op

30 Lenstec Tetraflex
• Hydrophilic closed-loop haptics with a 5-degree angulation
• Intended to enhance near vision
• 1.8D of accommodation
• Higher order aberrations add to near VA

31 Fluidvision
• Soft haptics store silicone fluid
• Accommodation forces fluid into central optic
• 5 D of accommodation?

32 Trifocal
FINEvision
• Aspheric diffractive trifocal
• 3.5D add for N and +1.75D for intermediate vision
• Great VA at D, I, N
• Less glare and halos
• Zeiss

33 Light Adjustable IOLs

34 Standard-of-Care Technology
• Photosensitive Silicone Material
• Precise, Non-Invasive Post Operative Adjustments
• > 2 Diopter Correction for Myopia, Hyperopia, or Astigmatism
• Non-Toxic, Biocompatible
• Foldable

35 Current Premium Lenses Require Compromises
• Imperfect distance vision
• Glare and halos at night
• Reading vision that is mediocre

36 Why the Light Adjustable Lens?
• Predictable correction of residual refractive error after lens implantation for optimal distance vision
  – Spherical and cylindrical errors up to 2D
• Customized presbyopia solutions for near and intermediate vision
  – Adjustable Monovision
  – Customized Near Add
  – Asphericity Control

37 LAL Procedure
• Conventional cataract surgery
• LAL is adjusted 1-4 weeks after surgery
• Light Delivery Device irradiates the LAL with a spatially profiled beam
• Over the next 24 hrs, the LAL changes shape to correct residual spherical and/or astigmatic error
• At 2-days to 1 week post-adjustment, patient returns for “lock-in” treatment

Light Delivery Device
Customized Treatment
• Standard slit-lamp footprint
• Unlimited flexibility for lens modification
• The heart is the digital mirror device (DMD), which allows customized generation of spatial irradiance profiles

Adjustment Profiles

Customized Presbyopia Solutions
• Adjustable Monovision
• Customized Near Add
• Controlled Addition of Asphericity

Pseudophakic Verification

Case Studies: ORA Improves Accuracy, Reduces Surgical Enhancements & Follow-up Costs

High Accuracy Real-time Advantage – Very Simple Integration
Sequential Wavefront (HOLOS)

HOLOS Analysis (IntraOp Example of Astigmatism)

High Accuracy Real-time Advantage – Qualitative & Quantitative

Real Time Refractive Value

Rotating a Toric IOL

Target Emmetropia

New Accommodating IOLs
• Currently 14 accommodating IOLs in the pipeline
• Future IOLs need to deliver distance, Intermediate AND near VA
• Less glare and halos
• Reduced loss of contrast sensitivity
**TRULIGN™ Toric IOL**

**Key Properties**
- 5.0-mm optic body
- Biconvex shape
- Rectangular hinged haptics
- Approved Dioptric power range from +4.00 to +33.00 D
- Cylinder powers 1.25, 2.00, and 2.75 D
- Round-to-the-right asymmetric polymide loops

**TRULIGN™ Toric IOL Insertion**

IOL insertion
- The Crystaldrop® IOL Delivery System requires a 2.85-mm opening for injection
- Use a cohesive viscoelastic for lubrication of the injector
- Verify that the IOL is right-side-up (refer to Directions for Use)
  - The round knob on the loop of the leading haptic should be on the right (remember “round to the right”)

**In Summary: A New Direction for Astigmatic Cataract Patients**

TRULIGN™ Toric is an advanced toric IOL
- A broader range of vision than standard toric IOLs
- Excellent visual acuity at intermediate and distance
  - UCVA ≥ 20/40: 97.8% of eyes
  - UCDVA ≥ 20/40: 97.8% of eyes
- Outstanding rotational stability
  - Rotation ≤ 5°: 96.1% of eyes
- Effective cylinder correction
  - Residual cylinder ≤ 1.0 D: 95.5% of eyes
  - 99.2% of patients reported no visual disturbances

**MIGS**

**MIGS PROCEDURES**

*Ab externo (outside in)*
- Express Shunt, Alcon
- Canaloplasty, iScience
- Endocyclophotocoagulation, Endo Optiks

*Ab interno (inside out)*
- Trabectome, Neomedix
- iStent, Glaukos –recently FDA Approved
- *CyPass, Transcend Medical
- *Hydrus, Ivantis
- *Gold micro-shunt, SOLX
  - *supraciliary microstent increases uveoscleral outflow
MIGS ADVANTAGES

iStent
- Titanium, L-shaped, trabecular microbypass stent
- Snorkle through TM
- Use Gonio to place it

iStent- (View with Gonio)
iStent
- Video

Trabectome

SOLX

The Femto Phaco Market

“L-A-Z-E-R”

Why Do We Need It?

Limitations of Traditional Cataract Surgery

Manual Clear Corneal Incisions
- Dynamics of wound architecture created with hand-held instruments¹
  - Imprecise tunnel length and geometry
  - Frequently require stromal hydration to seal
  - May result in cascading intraoperative difficulties (fluid control, anterior chamber maintenance)
  - Incisions may be unstable at low IOPs
- Recent literature suggests an increased incidence of post-op infection²

Effective Lens Position (ELP)
- “The key to highly accurate IOL power calculation is being able to correctly predict ELP for any given patient and IOL”¹
- ELP is assumed value, from empirical data
  - A constant and surgeon factor
- A significant source of IOL power error and key to post surgery refraction³
- Size of capsulorhexis effects ELP⁴

Factors Affecting IOL Predictability¹
- If IOL is 0.5 mm posterior to the assumed plane, a 21 D lens will produce only 20 D
of correction

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- If IOL is 0.5 mm anterior to the assumed plane, a 21 D lens will produce 22 D of correction

Laser Capsulotomy Results

Comparison of Manual vs. Femto

Laser Fragmentation

- Cylinder pattern, utilized for the softer lens, enables removal with I & A only, no phaco power
- Chop pattern efficiently fragments the lens for removal with reduced phaco power and time

Astigmatism More Prevalent than Recognized

Addressing Astigmatism

- Differentiate corneal cylinder from refractive cylinder
  - Corneal
  - Lenticular
  - Mixed
- Accurate / consistent measurements
  - Manual keratometry
  - Corneal topography
  - IOL Master
  - Lenstar

Arcuate Incisions

- Manually executed by “tracing” corneal marks with handheld diamond knife
- Inconsistent depth control
- Unpredictable effect due to imprecise wound architecture and depth
- No image-guided surgical planning or visualization

Prediction Error Distribution

Postoperative Considerations

- Normal postoperative course
  - One day
  - One week
– One month
– Three months
• Educate patients on postoperative expectations
  – Mild subconjunctival hemorrhage due to suction
  – Mild corneal edema at wound
  – Improved precision of the procedure

87 Femtosecond Laser Companies: Value Added Indications
• Cataract Surgery:
  – Anterior & Posterior Capsule Polishing
  – Posterior Capsulotomy
  – Paracentesis
  – Vitreolysis
• Glaucoma Surgery:
  – Goniotomy, Trabeculotomy & Trabeculoplasty
• Corneal Surgery:
  – DSEK: Stripping ring, Stromal polishing
  – Lasik Flaps, Intacs Tunnels, Intrastromal Ablation

88 Future Applications of Femtosecond Technology
• Presbyopia correction
  –
  • Corneal crosslinking
  •
  • Myopia correction
  •
  • Bleaching of crystalline lens
  •

89 OPD Scan III
• Auto refractor
• Keratometer
• Pupillometer
• Corneal Topographer
• Wavefront Aberrometer

90 Cataract

91 Vacuoles

92 Cortical Spokes

93 Qualifying Requirements for an IOL Patient
• Refraction
  • Keratometry
• Corneal Topography for Astigmatism
• Pupillometry – Photopic/Mesopic
• Eye Image – Visual Axis and Pupil Center
• Internal OPD (residual astigmatism and crystalline lens abnormalities).
• Spherical Aberration of Cornea
• Wavefront Aberration Analysis
• Night Vision Assessment

94 Which Type of IOL Do We Recommend for the Patient?
• There are many factors we need to assist us in selecting the best IOL for the patient
  – Spherical Aberration of the Cornea (Aspheric)
  – The amount of Astigmatism on the Cornea (Toric)
  – Angle Kappa (Multifocal IOLs)
  – Pupil Size (Photopic and Mesopic)

95 Aspheric IOLs
• The goal is to get the patient’s Spherical Aberration as close to zero as possible
• Measuring the SA of the cornea allows us to predict, within microns, the SA that will remain on the cornea when the cataract is removed

96 Aspheric IOLs
• Average cornea +.27μ SA
• AMO Tecnis® Z9000 - .27μ
• Alcon AcrySof® SN60WF - .20μ
• Hoya AF-1 iSpheric IOL (NTIOL) - .18μ
• Staar® Surgical (AQ2015) - .08μ
• B&L Sofport® (new Akreos™ AO) 0
• Spherical (monofocal) +.15μ

97 Average Cornea – No Previous Treatments

98 Post Hyperopic LASIK

99 Toric IOLs
• The OPD Scan III is the best unit on the market for Toric IOL selection and for pre and post op evaluations.
• The Retro Illumination image allows us to see if the IOL is aligned properly.

100

101 Axis Off One Day Post Op

102 Multifocal IOLs are Not for Everyone!
• When a measurement is taken, not only the auto-refraction, keratometry, pupillometry, corneal topography and wavefront aberrometry are taken.
• There is a wonderful piece of critical data we must not overlook for our multifocal patients...
– The Angle Kappa!
  • Why is it important?

103 Multifocal IOLs
104 Retro Shows Beautifully Centered ReStor
105 Retro shows an off-centered ReStor
106
107
108

109 Make this an exciting opportunity for your patients
  • This is a great time to have cataract surgery as we can offer you so much more than several years ago
  • This is your one opportunity to select your intraocular lens
  • You must do your homework
  • We will give you the information you need and help you make this important decision
  
  

110 Make this an exciting opportunity for your patients
  • As your primary care Eye Doctor, I will make a recommendation and help you make this important decision
  
  