What’s New in Low Vision

Bryan M. Wolynski, O.D., F.A.A.O
Optometric CE
April 2017
Disclosures

OrCam Technologies
Low Vision History

• Sighted or Blind
• 1st Paper on Telescopic Lenses
• 1950’s Low Vision Term is Coined

• **Definition:** (WHO has acuities associated with this definition)
  – *Functional Vision Loss after best correction for refractive error*
  – *A visual impairment, not corrected by standard glasses, contact lenses, medicine, or surgery, that interferes with the ability to perform everyday activities.*
Medicine and Low Vision

- Sighted or Blind
- Cataract Surgery
  - Couching – 3rd Century in India
  - Dr. Jacques Daviel – 1747
- Glaucoma Treatment
  - Pilocarpine 1874
- Nutrition/Diet/Supplements
- Surgical Implants (Argus 2 / Telescope)
- Seeing an increased awareness of team effort with MD/OD/Rehab-LV Specialists/O&M/LV Facilities
  Improve Quality of Life
American Academy of Ophthalmology

- Preferred Practice Pattern®
  - Guidelines to Identify Best Practices
- 2012 Vision Rehabilitation Services
- 2016 Video Initiative
The Academy's Initiative in Vision Rehabilitation

- [https://www.aao.org/low-vision-and-vision-rehab](https://www.aao.org/low-vision-and-vision-rehab)
Evolution of Rehabilitation

• 1913, Perkins School for the Blind
• White Cane
• WWII & Rehabilitation
• Rehabilitation / Low Vision Centers
• Tele-Rehabilitation
Evolution of Technology

- 1892 – Braille Typewriter
- 1914 – Optophone
- 1928 – AFB Distributes Radios to the blind to access information
- 1935 – Talking Books come out on Phonograph
- 1936 – First Speech Synthesizer
- 1951 – Perkins First Brailler
- 1968 – First English Text-to-Speech System Developed
- 1976 – Handheld Speech Synthesizer Developed
- 1976 – Kurzweil Reading Machine
- 1977 – Adaptive Firmware Card – Permitted Alternate Keyboard
- 1983 – Dynavox – EyeTyper – Communicate with Eye Movements
- 1992 – Computer Operating Systems include Text-to-Speech Software
- 1999 – Web Accessibility Initiative
- 2010 – iPad with Apps for Accessibility
- 2012 – Perkins Smart Brailler
- 2013 – Wearable Technology
- 2016 – Smart Home Devices
Molyneux's Problem

• William Molyneux (1656 – 1698)
  – Irish Philosopher & writer on politics
  – Published papers on Optics

• John Locke (1632 – 1704)
  – English Philosopher & Physician (Considered to be the modern conceptions of Identity & Self)
  – An Essay Concerning Human Understanding

Can someone once blind recognize objects by sight, when only once done by touch
Molyneux's Problem

• Dr. Pawan Sinha
  – Professor at MIT
  – Studies Human Visual Cognition

In 2003, took on the problem
Found the Answer is “No”
Stem Cell Therapy

Potential uses of Stem cells:
- Stroke
- Traumatic brain injury
- Learning defects
- Alzheimer’s disease
- Parkinson’s disease
- Baldness
- Blindness
- Deathness
- Missing teeth
- Wound healing
- Bone marrow transplantation (currently established)
- Spinal cord injury
- Osteoarthritis
- Rheumatoid arthritis
- Amyotrophic lateral sclerosis
- Myocardial infarction
- Muscular dystrophy
- Diabetes
- Crohn’s disease
- Multiple sites: Cancers
Stem Cells and the Eye

- Self-contained
- Easy Access
- Easy to View Results and Measurable Acuity
- Compare Results to Untreated Eye
What is a Stem Cell?

a single cell that can...

...replicate itself, or...

...differentiate into many cell types.
Stem Cells

2 Types

Embryonic (Pluripotent)
- More Embryonic Stem Cells
- Any Cell Type
- Maintain and repair the tissue in which they are found

Adult (Somatic) Multipotent
- Any Cell Type
- Maintain and repair the tissue in which they are found
Challenges Using Stem Cells

• Challenges in the use of stem cells are present from the scientific, ethical, and political realms.
  – transplant complications
  – anatomically incorrect placement
  – concern for tumor-genesis
  – contamination by different types of cells
  – Using embryonic derived stem cells
Induced Pluripotent Stem Cells (iPSCs)

• Shinya Yamanaka from Japan in 2006 found a way to make Embryonic Like Pluripotent Stem Cells from Adult Cells
  – Takes away ethical concerns
  – Create cells to be implanted into the body
  – Less risk of rejection
  – Less Expensive
  – Create cells to be tested for therapeutic drug treatment
iPSCs

• iPSCs have same characteristics as embryonic stem cells, however not known clinically how they differ.
• Shown be tumor-genic when used.
• How should the cells be administered, cell replacement strategy?
Clinical Trial in Japan

• AMD using iPSC
  – 2014 Japanese Woman with Wet AMD
  – Received iPSC-derived RPE Cells Implanted
  – Study put on hold after finding genetic mutations in the cells
  – But success was based on no complications, tumorigenesis or rejection
Recent Findings for AMD Drug Treatment due to Stem Cells

• Saini, et al, Nicotinamide Ameliorates Disease Phenotypes in a Human iPSC Model of Age-Related Macular Degeneration.

Cell Stem Cell, Jan 26, 2017

– Dry AMD hiPSC derived RPE showed complement and inflammatory factors.
– Found that Nicotinamide (form of Vitamin B3) suppressed the production of these factors, as well as drusen proteins and VEGF in the cultured RPE.
– May be treatment for Dry AMD and slow Wet AMD
International Society for Stem Cell Research

• Over 600 Stem Cell Centers in US, promising too much
• Some clinics around the world (over 600 in the US) exploiting patients’ hopes without credible scientific rationale, transparency, oversight, or patient protections.
• New Snake-oil

• In 2016 ISSCR released new guidelines
Foundation Fighting Blindness
Website

• I HAVE RECENTLY BEEN DIAGNOSED WITH RETINITIS PIGMENTOSA. I AM 29, MARRIED WITH A 2 YT OLD DAUGHTER. I AM SCARED. I LIVE IN CORPUS CHRISTI TEXAS. CAN I GET INVOLVED IN A CLINICAL TRIAL AND HOW DO I GET SIGNED UP. PLEASE HELP ME

• We are looking for a Doctor to HELP my husband to get his vision back, or better than it is now.

• I am do afraid right now I do have retinitis pigmentosa, and I can’t deal with the fact that I am going blind. please pray for me.
Stem Cell Therapy for the Cornea

• Holoclar System

  – Developed in Italy
  – 1st Commercially Available Stem Cell Therapy and Only Clinically Approved Stem Cell Treatment for the Eye by EU.
  – The FDA has not approved this yet.
  – Indicated for treatment of Limbal Stem Cell Deficiency caused by thermal or chemical burns. Not Approved for genetic disorders.
  – If deep stromal damage, can be combined with corneal transplant
How does it work?

- Success of transplantation 72% and 92% who underwent repeated Holoclar treatment.
- 50% had improved vision
- 83% had improved vision if no stromal scaring
Stem Cell Therapy for the Optic Nerve

- Stem Cell Ophthalmology Treatment Study (SCOTS)
  - Largest ophthalmology stem cell study registered at the National Institutes of Health
  - Utilizes autologous bone marrow-derived stem cells in the treatment of optic nerve and retinal diseases.
Patient Results #1

• 32 y.o. Woman with Idiopathic Bilateral Optic Neuropathy (5 Years)
  – Treated in March of 2014
  – VA OD 20/800
    OS 20/4,000
  – After 4 Months
    OD 20/100
    OS 20/40
  – After 2 Years and another Treatment
    OD 20/40-2
    OS 20/30+2

Patient Results #2

- 54-y.o. woman with relapsing auto-immune optic neuropathy
  - VA OD 20/350
  - OS 20/70
  - VA (15 Months)
    - OD 20/150
    - OS 20/20

- Stem Cell Ophthalmology Treatment Study (SCOTS) for retinal and optic nerve diseases: a case report of improvement in relapsing auto-immune optic neuropathy.
  Neural Regen Res. 2015 Sep;10(9):1507-15
Stem Cell Ophthalmology Treatment Study (SCOTS): bone marrow-derived stem cells in the treatment of Leber's hereditary optic neuropathy

- Improvements in visual acuity and peripheral vision.
- CF to 20/100 and HM to 20/200
- Visual Field Improvements were noted.
- Macula Thickness or ONH Thickness was not a variable
- No adverse or serious events were seen.
- Conclude that autologous BMSCs as provided in SCOTS for ophthalmologic mitochondrial diseases including Leber's hereditary optic neuropathy may be a viable treatment option.

  – **Neural Regen Res. 2016 Oct; 11(10): 1685–1694.**
What’s Going On Here?

• Patients must pay $20,000
• Retina Associates of South Florida
• MD Stem Cells
• Allegations, SCOTS investigators deny
• Only theories on how it works
• Independent Study
• Lack of regulations and standards
• Only NIH approved for trial, not FDA approved
Stem Cell Therapy for Retina

• Neural Stem Cell Institute

• California Project to Cure Blindness

• UCLA Jules Stein Eye Institute and Broad Stem Cell Research Center
Neural Stem Cell Institute

- **Neural Stem Cell Institute**: Rensselaer, NY
  - Independent, non-profit stem cell research institute
  - Working on
    - Activating resident retinal stem cells to stimulate repair
    - Generating stem cells for replacement of damaged retina
    - Use stem cells to model retinal disease for drug discovery
California Project to Cure Blindness

• Because of restrictions on NIH funding, a number of states have established programs to fund stem cell research.

• California has allocated $3 billion over 10 yr to stem cell research.

• It is estimated that by 2020, over 450,000 Californians will suffer from vision loss or blindness due to the age-related macular degeneration (AMD)
• 2012, Dr. Steven Schwartz
• Main goal was to show safety of implanting human embryonic stem cell-derived RPE
• 18 patients with either Dry AMD or Stargardt’s
4 Year Results

• There was no evidence of adverse proliferation, rejection, or serious ocular or systemic safety issues related to the transplanted tissue

• 13 (72%) of 18 patients had patches of increased RPE

• What about their Visual Outcomes????

• Schwartz SD, et al, Subretinal Transplantation of Embryonic Stem Cell-Derived Retinal Pigment Epithelium for the Treatment of Macula Degeneration: An Assessment at 4 Years, Invest Ophthalmol Vis Sci. 2016 Apr 1;57(5)
Vision Outcomes

• 12 Month F/U (Baseline 20/200 to HM)
  – AMD (7 Patients)
    • 3 Eyes increased 15 Letters
    • 1 Eye Improved to 13 Letters
    • 3 Stable
  – Stargardt’s (8 Patients)
    • 3 Eyes improved by 15 Letters
    • 3 Stable
    • 1 Decreased by more than 10 Letters
www.clinicaltrials.gov

- Search of Stem Cell Research for the Retina
- 18 Studies Found
  - Withdrawn
  - Unknown
  - Recruiting (5)
  - Terminated
So What do we Tell our Patients?

• Some treatments and studies have shown promise
• So far studies have shown good safety
• There are trials, but can be costly to the patient

• American Academy of Ophthalmology
  – Avoid Unlicensed Clinics Offering Unapproved Stem Cell Therapy
Gene Therapy

- Gene therapy uses genes to treat or prevent disease.
  - Use engineered Viral Vectors (Adeno-Associated Viruses have shown to be good vector for the eye)
  - Replace or inactivate a mutated gene into a cell to stop it from producing an abnormal protein or to produce an inactive protein needed.
Gene Therapy for the Eye

- Retina is anatomically accessible
- Capable of being monitored at high resolution
- Immune-privileged status of the eye
Ethical Concerns

• Who decides which traits are normal and which constitute a disability or disorder?
• Will the high costs of gene therapy make it available only to the wealthy?
• Should people be allowed to use gene therapy to enhance basic human traits such as height, intelligence, or athletic ability?
• Germline gene therapy.
Gene Therapy & The Eye

- Lebers Congenital Amaurosis
- Achromatopsia
- Color Blindness
- Chorioderemia
Leber’s Congenital Amaurosis

- Mutation in an RPE gene (Important in Vitamin A metabolism).
- Autosomal Recessive (Both Parents are Carriers, and not necessarily have LCA)
- Patients with this mutation have
  - Marked photoreceptor dysfunction and degeneration
  - Severely reduced or absent ERG signal at birth or first presentation

- Early Studies showed worked in animal models
20 genes have been identified whose mutations lead to forms of LCA

1. CRX Cone-Rod Homeobox - LCA7
2. AIPL1 Aryl Hydrocarbon Receptor - LCA4
3. CRB1 Crumbs Homologue 1 - LCA8
4. GUCY2D Retinal Guanylate Cyclase - LCA1
5. LRAT Lecithin Retinol Acyltransferase - LCA14
6. RPE65 Retinal Pigment Epithelium 65 - LCA2 (Used in most Trials)
7. RH12 Retinol Dehydrogenase 12 - LCA13
8. RPGRIP1 RPGR-Interacting Protein 1 - LCA6
9. TULP1 Tubby-like Protein 1 - LCA15
10. CEP290 - LCA10 (Most Common, Large size prevents it from being used in Viral Vectors)
11. LCA5 Lebercillin - LCA5
12. IMPDH1 gene - LCA11
13. RD3 gene - LCA12
14. SPATA7 gene - LCA3
15. MERTK gene
16. IQCB1 / NPHP5 gene
17. KCNJ13 gene – LCA16
18. NMNAT1 gene (LCA9)
19. DTHD1 gene
20. PNPLA6 gene
LCA Studies/Trials

• Phase I and II Trials have shown
  – Improvements in photoreceptor function among some individuals
  – Patients continue to show retinal structural loss and degeneration
  – Younger Patients did better, Possibility of “Point of No Return”, however this differed in Animal Studies
LCA Trials / Spark Therapeutics

• Phase III Trials started in 2013 (Results announced in 2015)
  – Showed after 1 year increased functional vision by mobility testing
  – Better full-field light sensitivity
  – Visual acuity showed no statistically significant change
  – Safe

• Received breakthrough therapy designation’ in late 2014 from the FDA
Achromatopsia

- Autosomal Recessive
  - Infancy or at birth
  - Nystagmus
  - Photophobia
  - Reduced visual acuity
  - Poor color vision
- 50% of cases are associated with gene CNGB3
  - CNGA3
  - GNAT2
  - PDE6C: Responsible for Proper Cone
  - PDE6H: Phototransduction
Achromatopsia

- Animal models have shown increased Visual Function (Sheep > Dogs in Maze)
- Phase I/II clinical trials by AGTC is currently recruiting patients for a safety and efficacy caused by mutations in CNGB3
Color Blindness

- Dr. Jay Neitz and Dr. Maureen Neitz, at University of Washington have had success in treating color blindness in Monkeys.

- They are optimistic for Human Trials this year!
Chorioderemia

- X-linked recessive
- Affects 1 in 50,000 Males
- Gradual vision loss starting in childhood, starts with night blindness, then peripheral vision loss and then later central vision loss as an adult.
- Problem with CHM gene = Rab escort protein-1 (REP1)
- Absent REP1 causes degeneration of the choroid, RPE and neurosensory retina.
Choroideremia Trials


• Six patients (aged 35-63 years)
  – 1 Patient Gained 2 Lines VA
  – 1 Patient Gained 4 Lines VA
  – 4 Patients had Marginal Loss VA
CRISPR-CAS9 / Gene Editing

- Clustered Regularly Interspaced Short Palindromic Repeats
- CRISPER gene was found in bacterial genome
- CAS Genes which make CAS proteins (CAS9) to cut viral DNA and incorporate elements of it into its CRISPR sequence, protecting it from the virus.
- 2012 Dr. Jennifer Doudna and Dr. Charpentier Found how this happens.
- Able to delete or insert DNA into the area of their choice.
- Worries about engineering embryo’s, but shows promise for disease, to cut out and add in new genes.
- May be able to use CRISPR-CAS9 system on iPSC, engineering a healthy cell.
CRISPR at Work


- They generated a cellular model of LCA10, and used the CRISPR-CAS9 system to restore the expression of the normal CEP290 gene
What do we tell our patients?

• Gene Therapy
  – While promising more work needs to be done
  – Animal models for LCA have been promising showing increased visual function
  – No significant increase in visual acuity has been noted for LCA, but has shown in 2 pts with Choroideremia
  – Foundation Fighting Blindness has a registry, My Retina Tracker™
Surgery

• Second Sight – Argus 2 Retinal Prothesis
  – Indicated for Profound RP
  – Conceptualized in 1998 from Cochlear Implants
  – First Implant was in 2002 (Argus 1)

• CentraSight Implantable Telescope
  – Indicated for End-Stage AMD
  – 9 out of every 10 pts improved vision enough to meet or exceed the FDA-study’s effectiveness endpoint – an improvement of distance or near vision by at least 2 lines on the eye chart.
Argus-2 Retinal Prosthesis System

• “Bionic Eye”
• Indicated for use in those blind from RP
Argus 2

- The incidence of serious adverse events from Argus II implantation decreased over time.
  - minor changes in the implant design
  - improvements in the surgical steps

CentraSight Implantable Telescope

• 2.2X or 2.7X Telescopic Implant
• Implanted in one eye
• Projects image on 55° of the retina, giving field of view of 20°–24°
• Leaves the fellow eye to compensate for peripheral vision
  – Must be Phakic
  – 65 yrs and older
  – 20/160 – 20/800 (Bilateral Scotomas from AMD)
  – Must have disciform scaring or GA, Cataract and show at least 5 letter improvement with external telescope (Determined by a Low Vision Optometrist)
  – Must work with a low vision rehab specialist over a 3-4 month period after surgery
Long-term (60-month) results for the implantable miniature telescope: efficacy and safety outcomes stratified by age in patients with end-stage age-related macular degeneration.

• 217 patients (mean age 76 years)
• 20/80 – 20/800
• BCDVA improvement from baseline to 60 months was 2.41±2.69 lines in all patients
• 15 Pts Lost 2 Lines of Vision (Higher in Group 2, 75 yrs and older)
• Quality of life scores were significantly higher in group 1 (Ages 65-75)
• ECD loss at 5 years is comparable to placement of an IOL.

The Treatment Paradigm for the Implantable Miniature Telescope.

- Expectations must be managed both preoperatively and after implantation.
- Advised to not drive after implantation.
- ECD Loss is comparable to that after large-incision cataract extraction, but stable after 2 yrs.
- In the right patient, implant can make a profound positive impact in a patient (QOL) who is otherwise left without an alternative viable treatment option.

Low Vision Aids

- CCTV’s
- Topaz XL HD
Hand Held Electronic Magnifier

• Larger 7” & HD Screen
• PivotCam - offers a wide range of viewing modes for spotting, reading, writing, working on hobbies, distance viewing, and even a mirror-image self-view
• 2x–24x magnification
• HDMI port to connect to TV
• Save images and send to computer with USB port
• 20 high-contrast color viewing modes
Computer Accessibility Options

• Apple Products:
  – Taptic Time for Apple Watch
  – Color Adjustments (Expanding from their grayscale)
  – iOS Magnifier with Color Filters to increase contrast
  – iOS Audio Feedback for Typing
Computer Accessibility Options

• **Windows:**
  – Narrator Enhancements / More Responsive
  – New Keyboard Shortcuts and Layout
  – New text to speech voices and capabilities (Higher Speed Voice)
  – Audio Suggest Boxes
JAWS
Job Accessibility With Speech

- Most popular Screen Reader for Blind

- **Version 18 Released 10/31/16**
  - Interoperability with Zoom Text 11 Release
  - Able to Migrate Settings from older version and computer to computer.
  - Restrict Cursor for Dialog Boxes on WebSites
  - Mouse Echo Feature (off by default, meant for Low Vision Users)
  - Adding Voices, and more human sounding
  - Support speech for Right to Left languages
  - Accessibility with Microsofts Edge
Zoom Text

- Magnifier/Reader Software
  - New Toolbar
  - New Command Keys
  - Zoom to 1x
  - Spot Read Blocks of Text
  - Smoothing of Text Edges
  - Search & Skim through documents, web pages and email to instantly find any word or phrase
  - Jaws Compatibility
Smart Phones

• **Blind Shell** (Out of Czech Republic)
  – Touch Screen Smart Phone made for people who are blind or visually impaired
  – operated by simple gestures.
  – Feedback is provided by the built-in synthetic voice, vibration and additional acoustic signals.
    • Austria, Germany, Czech,
    • Finland, GB, Mexico, Norway
    • Latin America, Netherlands,
    • Poland, Slovakia, Sweden
APPS
KNFB Reader

• Available on iOS and Android

$100.00
Zoom Reader by Ai Squared

• Works with iOS device’s built-in camera
• App lets you magnify and read text by taking a picture of the text and using Optical Character Recognition (OCR) will then read the text back to you.
• Doesn’t work with any iPhones above 5
• $19.99
Magnifying APP

- The Optelec Magnifier app
- Basic Magnification & Contrast Functions
- Free
Money Identifier

• **LookTel**
  – NantMobile Money Reader
  – 21 Different Currencies
  – $9.99

• **Eye Note**
  – developed by the Bureau of Engraving and Printing (BEP)
  – EyeNote® is built for the Apple iOS
  – US Currency Only
  – Free
Object Recognition

• **TapTapSee**
  – Identify Objects
  – Free

• **AI Polly**
  – Object and Color recognition
  – Free

• **Be My Eyes**
  – iPhone / Android Coming Soon
  – Remote Assistance
  – Free
Color Recognition

• Color ID
  – Uses the camera on your iPhone to speak the names of colors in real-time.
  – Free
Navigation

• **Blind Square**
  – GPS application developed for the blind and visually impaired.
  – It describes the environment, announces points of interest and street intersections as you travel.
  – $39.99
Wearable technology
e-Sight

- E-sight: From Canada
- Video Camera that sends image to 2 LED screens in front of eyes
- Zoom up to 14X, patient is able to change contrast, color and adjust brightness
- Can see distance, watch TV, and read.
- Whose visual acuity has been dramatically improved (from a range of 20/200 to 20/1200 - to near 20/20)
- Cost $15,000
• Launched in 2016

• Uses technology from Osterhout Group (ODG), who is a company that makes head mounted gear for the military.

• ODG sells R-7 Smartglasses (Augmented Reality)
• Magnifies 1x – 12x
• Change Contrast and Color
• Voice Activated
• OCR (Coming Soon)
• Stream TV & Movies
• Wireless
• Works off of Android
• 1.5-2-hour battery life
• 10-hour battery pack
• 125 grams, iPhone 6 weighs 129 grams
NuEyes (2 Versions)

**NuEyes Easy**
- $5995
- Magnification 1x-12x
- Contrast and Color
- Voice Activated
- Wireless
- 2 Year Warranty
- Text-to-Speech (OCR) - Coming Soon
- Stream TV and Movies to the Glasses - Coming Soon**

**NuEyes Pro (Coming Soon)**
- $6195 (Coming Soon)
- Magnification 1x-12x
- Contrast and Color
- Voice Activated
- Wireless
- 2 Year Warranty
- Text-to-Speech (OCR)
- Stream TV and Movies to the Glasses
- Full Android Computer
- Internet Browser Email functions of an Android tablet with downloadable android apps.
- Social Media Applications
Cyber-Eyez

• Crystal City, Virginia
• Utilizes Google Tesseract OCR - eliminates the need to have any type of WiFi or cellular connectivity.
• Voice Control
• Text-to-Speech
• Up to 15x Magnification
• Bluetooth
• Bar Code Reader
• Full Android Device Features
  – Text Messaging, Email, Web Browser, Google Maps
• COST $1,997
• Intuitive wearable device with a smart camera
  - Reads Printed Text
  - Facial Recognition
  - Product Recognition
OrCam

- Developed in Israel
- Two Devices
- OrCam MyEye
- OrCam MyReader
- Available in different languages
- Studies
Brain-Port
Vision Rehabilitation

• American Academy of Ophthalmology
  – Recognizing the need
    • Collaboration
    • Referral

• VA
  – 13 BRC’s
  – VIST
    • Advanced LVC
    • Intermediate LVC
    • LOVIT Trials
LOVIT II

• Outcomes of the Veterans Affairs Low Vision Intervention Trial II (LOVIT II)
  – JAMA Ophthalmology, Feb 2017

• Question: Are low-vision devices with low-vision rehabilitation more effective than basic low-vision services.

• Both treatments were found to be effective.
  – However, LV rehabilitation increased the effect only for patients with BCDVA 20/63 to 20/200.
  – Basic LV services may be sufficient for most LV patients with mild visual impairment.
Tele-Rehabilitation
The Technology Assessment

- Functional Visual Status
- Patient Needs
- Psychological Aspects
- Cognitive Ability
- Home Life / Social Life
- Patient Abilities
- Cost

Perkins School for the Blind (Ike Presley)
Quality of Life

• 10-15% Depression in Elderly
• 26.9% - 33.7% Depression in Visually Impaired Seniors

• Many studies geared towards quality of life results
• Focus on Quality of Life
Conclusion
The Future