Specialty Contact Lens

And

Low Vision Rehabilitation Course

University of Michigan Department of Ophthalmology
and Visual Sciences
Contact Lens and Low Vision Services
Ann Arbor, Michigan,
USA

Clinical Faculty:

Sherry Day, OD, FAAO
Karen DeLoss, OD, FAAO
Carlton Foster, OD
Paul Grenier, OD
Amy Lagina, OD, FAAO
Helios Leung, PhD, OD, FAAO
Michael Lipson, OD, FAAO
Donna Wicker, OD, FAAO
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This purpose of the contact lens portion of this course is to teach the practitioner to choose and fit the proper specialty lens which will provide the best quality of vision and comfort for the patient who has a corneal disease or has had a surgical procedure on the cornea. Basic soft contact lens and gas permeable knowledge will be extremely helpful.

The purpose of the low vision sections is to teach the practitioner to evaluate the status of the low vision patient, calculate magnification required to achieve the patient’s visual goals, and to provide visual rehabilitation to help the patient with activities of daily living.
Section 2: Pediatric Aphakic Contact Lenses – Carlton Foster, OD

Introduction to Contact Lens Fitting in Aphakic Infants

Fitting contact lenses for aphakia presents unique challenges. In an overwhelming majority, adults undergo intraocular lens implantation concurrently with cataract extraction. However, when certain pathologies create a contraindication to an IOL implant, contact lens correction is the preferred alternative. Because there is no risk of amblyopia, adults can be fit later after surgery, when it becomes similar to any other high refractive error fitting. Infants and young children require immediate refractive correction to minimize amblyopia. Spectacle correction is reasonable in bilateral cases, but is often not well tolerated by infants who can remove the glasses themselves, and unilateral aphakia creates too much anisometropia for binocular vision to develop. There are several contact lens options; silicone elastomers, traditional hydrophilic materials, and rigid gas permeable lenses. The choice of lens type sometimes depends on the caregiver’s ability to insert/remove the lens, as well as the amount of cylindrical correction needed. Soft contact lenses are the preferred choice of contact lenses used in our clinic.

Soft Contact Lenses in Aphakic Infants

Soft contact lenses have been the primary mode of correcting unilaterally aphakic infants since the 1970’s. In more recent years the use of intraocular lenses has become more popular in correcting aphakic infants. The Infant Aphakia Treatment Study Group compared contact lenses to intraocular lens correction in terms of grating acuity and adverse events at one year of age. The study used 114 infants with a unilateral congenital cataract. In summary, at one year of age there was no statistical difference in grating visual acuity between the two groups but the intraocular lens group underwent more additional surgeries. In another study it was found that axial length increased more rapidly in eyes corrected with IOL’s during the first year of life. Another factor to consider is the cost of correcting aphakic infants with an IOL vs. a contact lens. It was found that during the first year of life, it cost $4000 more to correct with an IOL compared to a contact lens. This difference should decrease as the infant ages and more contact lenses need to be purchased. Until longer term results are available, soft contact lenses are the preferred way of optically correcting aphakic infants for most ophthalmologists at the Kellogg Eye Center.

How to Fit a Soft Contact lens

Contact lens fitting of the infant can begin in the operating room, with keratometry being performed, as well as trial lens insertion and an overrefraction while the infant is still sedated. Starting the fitting in the operating room may be difficult due to the need of having extra equipment such as a retinoscope, automated keratometer, trial contact lenses, and trial refracting lenses. Contact lens fitting can also be done in the clinic during a post-op visit. During the workup the ophthalmologist can get a rough uncorrected refraction to get a more accurate starting power for the contact lens. Based on the initial refraction, the power of the contact lens is determined by factoring in the vertex distance. Patients under the age of two years old are over-plussed by 2-3D making them slightly myopic. This is desirable since most of what children in this age range are interested in is at a close range. Most soft contact lenses that are used in fitting aphakic babies are made of a silicone elastomer material. Deciding on the base curve of these lenses can be difficult since there is so much difference in how each brand of lens fits. Regardless of which lens is used there are three characteristics that need to be assessed to
determine how well the contact lens fits. These characteristics are centration, coverage, and movement. When checking centration, you are making sure the optical zone of the contact lens, which usually is easy to see, is aligned over the pupil. For coverage you want a lens diameter which covers the entire cornea and that the edge of the lens is in contact with the sclera 360° around the cornea. Lastly you need to check for good movement of the contact lens. The movement is a good indicator of how tight or loose the lens is on the eye. The contact lens should move about 1 mm during a blink but does not cross the limbus. Another way to assess for movement is the push up test. Using a finger, push the contact lens slightly up using the lower lid. The lens should move relatively easily and return to position quickly. If the lens does not move easily it is too tight and if the lens slides off the cornea easily it is too loose.

Retinoscopy should be done over the contact lens to determine the final power. The most common lens used in the clinic here is the Silsoft Aphakic contact lens made by Bausch & Lomb. About 95% of our infants are fit in this lens. Of the infants that use this lens, the 7.5 BC with an 11.3 diameter is by far the most common lens used. Refer to the list below for how to troubleshoot common problems.

1) Lens does not move a lot with blink or with push up test; bubble under center of lens; difficult to remove: caused by base curve being too steep (tight)
2) Contact lens falls out easily, contact lens slides around on the eye a lot, lens buckles at the edge: caused by base curve being too flat (loose)
3) Patient rubs contact lens out of the eye easily: Try larger diameter to better enable lids to keep contact lens on the eye.

**Soft Contact Lens Types**

1) Silsoft Aphakic-Silicone Elastomer Material Made by Bausch+Lomb (Dk 340)
   - Powers: +12.00D+20.00D in +0.50D steps, +23.00, +26.00, +29.00, +32.00
   - Base Curves: 7.5mm, 7.7mm, 7.9mm
   - Diameters: 11.3mm in powers +12.00+32.00, 12.5mm: +12.00+20.00
2) Flexlens Pediatric/Adult Aphakic – Hydrogel by X-Cel Specialty Contacts
   - Powers: 0.00+50.00
   - Base Curves: 6.0mm-11.0mm in 0.1mm steps
   - Diameters: 8.0mm-16.0mm in 0.1 steps
3) Biofinity XR- Silicon Hydrogel By CooperVision. Monthly replacement daily wear
   - Powers: -20.00+20.00
   - Base Curves: 8.6mm
   - Diameter: 14.0mm

**Wearing Schedule and Cleaning**

The silicone elastomer contact lenses are worn for a week at a time and removed overnight for cleaning once a week. It is recommended that they be replaced every three months. Many multipurpose solutions as well as hydrogen peroxide based cleaning systems are recommended for cleaning. Check to see what the manufacturer’s recommendation is for each contact lens.
Disadvantages of Soft Contact Lenses

There are a few disadvantages to soft contact lenses. These lenses require caregivers to the infant to be able to insert and remove the contact lenses. The eye(s) must be checked multiple times throughout the day to make sure the lenses did not come out. Because the lenses are worn on an extended basis there is a higher risk for an infection. There are financial concerns as these lenses retail for around $250. If these problems cannot be overcome and IOL may become the better option.

References


Resources

http://www.optometryinpractice.org/filemanager/root/site_assets/3-1/the_contact_lens_management_of.pdf


Chapters 13 and 14

Section 3: Specialty Soft Contact Lenses – Amy Lagina, OD

Objectives:

Kerasoft IC lens:
- To evaluate a patient’s candidacy for the Kerasoft IC lens
- To educate the patient about advantages/disadvantages of the lens
- To interpret corneal topography images in aiding the fitting of the lens
- To determine the proper initial lens selection
- To proceed with the fitting based on the manufacturer’s guidelines
- To learn how to troubleshoot and make fitting adjustments as necessary

KeraSoft IC
As soft lens designed for Keratoconus and other irregular corneas

Ideal Patient Candidates:
- Keratoconus
- Pellucid Marginal Degeneration
- Post-LASIK (Laser Assisted In Situ Keratomileusis)/ Post-PRK (Photorefractive Keratectomy)
- Post PRP (Penetrating Keratoplasty)
- Contact lens intolerance to gas permeable lenses
- Irregular astigmatism

Advantages
- Increased comfort over gas permeable lenses
- Convenience for the patient
  - Supplied as a quarterly replacement lens
  - Original single lens is ordered during the fitting process, and then a 3-pack of lenses is dispensed for the rest of the annual supply.
- Increased patient compliance with replacement schedule
- Increased oxygen permeability of the lens material leading to less hypoxic conditions
- Simple maintenance and cleaning with hydrogen peroxide cleaning systems.
- Stable lens fit. Unlikely to dislodge from the eye

Disadvantages:
- Slight decrease in level of acuity attained compared to gas permeable lenses
- Increased fitting time/patient appointments
- Increased Cost

Corneal Topography/Corneal Profile and Initial Lens Selection
- Review corneal topography images for inferior corneal steeping, pellucid marginal degeneration patterns, or other corneal irregularities.
- To evaluate corneal profile:
  - Move the slit lamp illumination system to the side, use the widest beam possible, and ask the patient to look straight ahead.
Observe the profile from the side illumination system using the patient’s nose as the background.

- Compare to Corneal Profile Chart in fitting guidelines
- Select a lens based on the corneal profile. It is recommended to start with the Standard periphery for initial lens selection.

**Lens parameters:**
- **Base Curves:** 7.40mm to 9.20mm in 0.20 steps
- **Diameters:** 14.50 (Standard fitting set), Can be made to order in 14.00, 15.00, and 15.50 mm
- **Power Range:**
  - Sphere: +20.00 to -20.00D
  - Cylinder: -0.50 to -12.00D in 0.25 steps
  - Axis: 1° to 180° in 1° steps
- **Periphery Options:** Standard, Flat 1, Flat 2, Flat 3, Flat 4, Steep 1, Steep 2, Steep 3, Steep 4
- **Sector Management control:** can independently modify different sectors of the lens based on fit
- **Material:** Etrofilcon A, 74% water content, Definitive Silicone Lens material
- **Design:** Front surface aspheric sphere or aspheric toric prism ballast lens with spherical aberration control

**Fitting Steps:**
1) Select lens based on fitting guidelines and corneal profile
2) Insert lens and allow lens to settle for 5 minutes
3) Access lens fit according to the MoRoCCo VA fitting guidelines.
4) If fit is unacceptable, make adjustments accordingly.
5) Check vision and over-refract. If vision and over-refraction are unstable, make adjustments accordingly.
6) When fit and vision is acceptable, allow lens to settle 15-20 minutes, and re-check fit and over-refraction
7) Contact consultation department with manufacturer to place lens order.

**Fitting guidelines: MoRoCCo VA**
- **Movement (Mo):** Lens can move up to 2.0 mm upon blink
  - If less than 1.0 mm: lens may be too tight, adjust base curve by 0.2 flatter
  - If more than 2.0 mm, lens may be too loose, adjust base curve by 0.2 steeper
  - Excessive movement may be either too flat (change base curve by 0.4 flatter) or too steep (change base curve by 0.4 steeper)
- **Rotation (Ro):** lens marking should be at 6 o’clock position and should be stable upon blink
  - If rotated 10 degrees or less, adjust base curve by 0.2 flatter
  - Can be rotated up to 10 degrees, if adjustment of 0.2 flatter base curve does not solve problem
  - If rotated more than 10 degrees, continually flatten base curve
• If unstable rotation: lens may be too loose, adjust base curve by 0.4 steeper
• Centration (C): optical center of lens should be positioned over cornea
  • Minimal decentration is acceptable if vision is stable
  • If lens drops to the limbus upon upward gaze, then the lens may be too flat, adjust base curve by 0.2 steeper.
• Comfort (Co): good comfort
  • General lens awareness indicates a flat fit, adjust base curve by 0.2 steeper
  • If patient states lens awareness in one region, then this indicates a tight fit, adjust base curve by 0.2 flatter
• Vision (VA): consistent acuity upon blinking
  • Worse after blink, indicates a Flat fit, adjust base curve by 0.2 steeper
  • Clearer after blink, indicates a Tight fit, adjust base curve by 0.2 flatter

Special lens modifications:
• Sector management Control:
  • Two sectors of the periphery can be independently modified based on the fitting with a standard periphery
  • Applied very infrequently to lens fitting
• Adjustments to the periphery
  • To be used when one base curve provides good fit and another base curve provides good vision
  • Determine the lens that provides the best fit or BPF (Best Peripheral Fit)
  • Determine the lens that provides the best vision or BCF (Best Central Fit)
  • The adjustment made is the BPF minus the BCF. Consult the fitting guideline table for the adjustment required.
  • Options include a range of Flat 1-4 and Steep 1-4.
Fitting Manual: Contents

This fitting manual is best used in conjunction with KeraSoft® IC online training.
To register, please visit www.kerasofttraining.com

01 KeraSoft® IC Design - Outlines the KeraSoft® IC lens design and gives the parameters available to order.

02 Corneal Profile Chart - Explains how to observe and identify the corneal profile to assist in classifying the corneal shape to be fitted.

03 Initial Lens Selection - Suggests which lenses from the diagnostic fitting set to use as a starting point when the corneal shape has been identified.

04 MoRoCCo VA Introduction and Dynamic Assessment Routine - Introduces the fitting methodology for the KeraSoft® IC lens that uses the MoRoCCo VA fitting system.

05 MoRoCCo VA Hints and Tips - Shows how to use MoRoCCo VA to differentiate between optimal, tight and flat fitting lenses.

06 KeraSoft® IC Fit Assessment Guide - Explains how to use the MoRoCCo VA fit characteristics to assess the lens on eye using a simple, color-coded system.

07 Periphery Options - Explains how to change the whole periphery of the KeraSoft® IC lens.

08 KeraSoft® IC SMC™ Design - Introduces Sector Management Control™ (SMC), the system that allows up to two sectors of the KeraSoft® IC lens to be changed independently and at any angle.
Section 4: Specialty Gas Permeable Lenses

Corneal Rigid Gas Permeable Lenses – Helios Leung, PhD, OD, FAAO

Advantages of GP
1. automatically corrects all corneal astigmatism
2. masks corneal distortion
3. can customize parameters

Review of GP fitting basics
1. adjustable parameters:
   a. Base curve
   b. Power
   c. Diameter
   d. Peripheral curves
2. relationship between power and BC
3. relationship between diameter and clearance

Ideal GP fitting
1. centration, CL-cornea relationship, edge lift/tear exchange
2. how does change of BC and diameter affect fit?
3. factors that may affect CL-cornea relationship:
   a. Upper and lower lids
   b. Central corneal curvature
   c. Mid peripheral corneal curvature
   d. Weight of CL
   e. Thickness of CL

Bitoric CLs for high astigmatism
1. usually when > 3D corneal astigmatism
2. spherical GP rocks on an astigmatic cornea, causing it to decenter
3. bitoric CL adjusts BC and power of each principle meridian independently
   a. Break down corneal curvature and refractive error into optical crosses
   b. Fit ~0.75D flatter than vertical corneal curvature; ~on K for horizontal curvature
   c. Adjust power of each meridian if necessary
   d. Goal is to achieve overall alignment on a highly astigmatic cornea
4. Spherical power effect and cylindrical power effect
   a. When toricity in BC equals difference of powers in principle meridians, CL can rotate and does not affect effective power of CL. Vision is more stable.
   b. When significant internal astigmatism is also present, cylindrical power effect CL is needed. Improper rotation of CL can significantly affect vision.

GP for keratoconus
1. Rose K designs (Rose K, Rose K2, Rose K2 NC)
   -proprietary design that decrease optic zone when BC gets steeper
2. Achieve centration
   a. -CL tends to move to the steepest part of the cornea
   b. -starting lens: average K to slightly steeper
3. Central fluorescein pattern evaluation
   a. -ideal is feather touch to minimal clearance of cone

4. Evaluate peripheral edge lift
   a. -flat, standard, steep PC

![excessive edge lift](image1)

![insufficient edge lift](image2)

5. Changing diameter can further affect position of lens. Larger lens usually rides higher.
6. Over-refraction
   a. toric if significant internal astigmatism

Variations:
1. piggyback for better comfort
   a. Low power soft CL acts as cushion between GP and the cornea
2. aspheric design to minimize spherical aberration (Rose K2)
3. Rose K2 NC for small central nipple cones
4. different peripheral curve for specific quadrant—Asymmetric Corneal Technology design can selectively steepen inferior peripheral curve to eliminate excessive edge lift at 6 o’clock.

Additional fitting guides and tutorials can be found at:
1. www.blanchardlab.com
2. GPLI: www.pgli.info
Section 5: Scleral Lenses – Karen DeLoss, OD, FAAO

Objective: To provide a baseline understanding of clinical indications of scleral lenses, design options, fitting techniques, and common complications.

Goals:
- Obtain an understanding of ophthalmological conditions that warrant scleral fits including severe dry eye disease, corneal ectasia, complications of corneal transplantation and complications of refractive surgery
- Ability to have a baseline understanding of candidate selection
- Gain understanding of different types of scleral lenses and advantages and disadvantages of each modality
- Provide a baseline understanding of scleral lens fittings
- Understand common problems and knowledge of troubleshooting techniques
- Understand alternative treatments for patients unable to complete the fitting process

I. Introduction
   a. History of Scleral Lenses
   b. Types of Scleral Lenses
      i. Corneo-scleral
      ii. Mini-Scleral
      iii. Full - Scleral

II. Clinical applications of Scleral lenses
   a. Corneal Ectasia
   b. Ocular Surface Disease

III. Scleral Lens Complications
   a. Surface Issues
   b. Interior Surface Issues
   c. Other

IV. Care and Handling
   a. Common Cleaning Agents
   b. Common disinfecting Agents

Suggested reading materials:


Section 6: Reverse Geometry Lenses – Michael J. Lipson, OD, FAAO

**Purpose:** This course is intended to educate the participant on the indications, prescribing and evaluation of Reverse Geometry contact lenses. These special designs are a valuable tool in solving the challenges presented by unique corneal conditions.

**Goals:** To present clinical evaluations of Reverse Geometry designs to give practitioners experience in evaluating the contact lens options available to solve the visual and comfort challenges of unique corneal topography. Also, to make participants aware of corneal reshaping designs and characteristics.

**General Fitting/Design guidelines**

I. **Corneal RGP**
   a. Applications
      1. Post- LASIK
      2. Post-RK
      3. Post-Graft
   b. Overall Diameter - 10.0-11.5 mm
   c. Base Curve Radius - usually fit 0.50-2.00D steeper than central K
   d. Optic Zone Diameter – 7.0-8.0 depending on treatment zone diameter
   e. Reverse Curve Radius – about 3.00 – 4.00 D steeper than BC
   f. Reverse curve width – 1.0 - 2.0 mm

II. **Scleral Reverse Geometry**
   a. Applications
      1. Keratoconus – to avoid air bubbles
      2. Very steep overall corneal topography
      3. Post –graft – to help totally eliminate bearing on the cornea
   Used to bring the lens closer to the cornea when fitting a steep cone or very high central elevation of the cornea. It increases the overall sagittal depth of the lens.

   The reverse curve is usually 3-4 D steeper than the Base curve at a width of 0.5 to 2.5 mm just peripheral to the base curve

III. **Reverse Geometry Hybrid Lenses**
   a. Applications
      1. Keratoconus – to minimize central bearing of the lens on the peak of the cone
   Used to fit Keratoconus patients with a relatively flat central curvature combined with a steep reverse curve that supports the lens and lifts the center away from the cone.
   See
   [http://www.synergeyes.com/professional/ultrahealth/](http://www.synergeyes.com/professional/ultrahealth/)

IV. **Reverse Geometry for Overnight Corneal Reshaping**
   a. Applications – Refractive therapy to decrease myopia or hyperopia
   b. 4-5 back surface zones designed to effect a controlled change in corneal curvature that results in reduction of refractive error as lenses are worn while sleeping to allow for good unaided vision during waking hours.
c. Description of Curves
   1. Base Curve – prescribed flatter than K for myopic reduction
   2. Reverse Curve – to help with centration and to allow an area for epithelial tissue to move into from center
   3. Alignment Curve(s) – to provide an area of bearing and maintain centration
   4. Peripheral Curve(s) – to provide adequate edge lift

d. Numerous designs/brands

Reference Articles:
Group One – For fitting of unique corneal topography
Cornea 2000;19:320
Eye and Contact Lens 2005;31:127
Eye and Contact Lens 2008;34:71-75
Current eye Research 2010;35:9-16
Contact Lens and Anterior Eye 2007;30:67-70
Contact Lens and Anterior Eye 2007;30:84-90
Eye and Contact Lens 2003;29:44-47
Clinical and Experimental Optometry 2003;86:244-249
Cornea 2011;30:1510-1516
Contact Lens and Anterior Eye 2007;30:84-93
Eye and Contact Lens 2008;34:207-210
Eye and Contact Lens 2005;31:12-22

Group Two – For Overnight Corneal Reshaping
Optometry and Vision Science 2000;77:252-259
Optometry and Vision Science 2003;80:200-206
Optometry and Vision Science 2005;82:886-891
Investigative Ophthalmology and Vision Science 2011;52:2170-2174
Eye and Contact Lens 2005;31:209-214
Section 7: Hybrid Lenses – Paul J. Grenier, OD

Objective: To familiarize the clinician with the process and indications for fitting hybrid contact lenses.

Goals:
   i) To outline the different types of hybrid contact lenses available to the clinician.
   ii) Provide ability to recognize potential candidates for fitting variations of the SynergEyes brand of contact lenses.
   iii) Gain an understanding of the general guidelines of the fitting process for hybrid lenses.
   iv) Learn to manage associated complications and determine alternatives for difficult fits.

History of Hybrids
The first hybrid lens was launched in 1983. The idea was to combine the visual quality of an RGP with the comfort of a soft contact lens. The SoftPerm lens was based off of this initial design and is still available today. There were many problems with this design, and as a result, the SynergEyes line was created to improve upon these shortcomings. First available in the United States in 2005, they address the short-comings of both RGP and soft contact lenses by merging the strengths of each modality. The lens employs a reverse geometry design with a central RGP button made of high-DK Paragon HDS 100 material for breathability and stable tear interaction and a peripheral soft skirt allowing the central button to vault the cornea. Specifically, the Ultrahealth design uses a silicon hydrogel skirt for better breathability as well. There are many different modifications to fit different types of patients. Patients with Keratoconus and Pellucid Marginal Degeneration will benefit from this design, as well as post-surgical corneas. Those with dry eye and comfort issues in other contact lenses do well with these designs. Studies have shown that patients have improved vision and good comfort levels in SynergEyes lenses.

General Fitting Procedure
Optimal lens fit will demonstrate apical clearance over the RGP button, absence of large bubbles, alignment of the soft skirt over the peripheral cornea and sclera, and adequate lens movement.
   1. Analyze K readings/topography to obtain average K's.
   2. Convert to nearest base curve to select trial lens using Median skirt curve in one eye and Steep skirt curve in other eye to compare fit and comfort.
   3. If central bearing, steepen the skirt. If central pooling, flatten the skirt. Proper skirt will demonstrate slight central clearance and increasing clearance peripherally. Patient comfort will validate final fit.
   4. Over-refract to determine final power
   5. All adjustments are controlled by changes to the skirt, not the base curve of the lens.

Multifocal fits can be adjusted by using a smaller Add zone for better distance vision quality or a larger Add zone for better near vision. Possible serious complications noted in the literature include central corneal clouding associated with keratoconus patients. It is advised that careful observation of the cornea be practiced after approximately 5 hours of wear.
**Keratoconus**

**Post-Surgical**

**Multifocal**

**General Comfort/Dryness**

**Other Sources:**
Synergeyes Homepage: http://www.synergeyes.com/
http://www.allaboutvision.com/synergeyes/

**References:**
Section 8: Low Vision Evaluation

Optical Device Testing and Prescribing – Donna Wicker, OD, FAAO

Low Vision Services
Objectives: To gain understanding of vision impairment and its effects on activities of daily living. To evaluate vision function and to develop a plan to optimize functional vision using adaptive optical and non-optical devices and techniques.

Outline:
1. Low Vision History
2. Tests of vision function
   A. Visual Acuity
   B. Visual field
   C. Contrast sensitivity
   D. Optimal task lighting (Lux IQ)
3. Low vision refraction
4. Optical Devices
   A. Near tasks
   B. Distance tasks
5. Electronic Devices
6. Combining optical correction and technology

1. Low Vision History:

The low vision history is more detailed than the history needed for a general eye exam. It is called a functional history since we discuss details regarding how the patient functions in everyday life. We may start with a chief complaint such as difficulty reading. We then expand on this to describe difficulty specific reading goals. For many patients, this may be newsprint or telephone directory print. Others may have a chief complaint related to occupational needs such as forms for a social worker, car engine diagrams for an auto engineer etc. Distance needs may include reading street signs when driving, watching television and seeing sports or theater events.

Independence issues at work or school are discussed from the standpoint of visual demands in the visually impaired patient’s life. Hobbies and recreational needs are determined as well, and may include playing cards, sewing, painting or woodworking. The functional history on our low vision form includes driving, preparing meals and mobility. “Grooming/self-care/dressing” addresses issues of independence for the visually impaired patients that may include clipping fingernails, shaving, combing hair etc.

Overall, the low vision history includes what the patient would like to accomplish and what they are currently having difficulty with. We try to establish concrete visual goals for each patient.

Sample low vision history for patient with moderate age-related macular degeneration:

Low vision chief complaint: unable to read mail, bills or newsprint
Driving: none for 3 years
Meal preparation: minimal involvement, able to see microwave numbers
2. Tests of vision function

A. Visual Acuity

Distance visual acuity is checked with the current best glasses Rx. The projector chart can be used. However, if the vision is 20/200 or worse, we can switch to the Lighthouse handheld flip chart. The denominator of the acuity is on each page. The numerator is the testing distance in feet.

In a small low vision exam room, we may test an acuity level using a handheld chart of 8/300. If the patient brings in a form to be filled out, we can convert back to a Snellen equivalent.

8/300 = 20/x
Since 8 must be multiplied by 2 ½ to get 20, multiply the denominator by 2 ½ as well. 300 x 2 ½ = 750. Distance acuity of 8/300 would correspond to 20/750.

It is ideal to test near acuity using near cards with evenly spaced letters or word charts that match up with M notation. M notation measures a specific size print (just like point font size). 1M print subtends 5’ arc at 1 meter. A 1M Times Roman capital letter measures 1.45 mm height. The 1M letter is still labeled as 1 M regardless of the distance from the near card to the eye. Snellen acuity cards have a set working distance to be valid with the Snellen definitions.

Another advantage of the M notation is that the size is proportional to the numbers: a 5 M letter is 5 times as big as a 1 M letter. We can use this to figure out what strength magnification is needed because 1 M is roughly magazine or newsprint size. Although 1M is the most common goal (newsprint), most patients find it difficult to read efficiently at threshold. Consider targeting the patient to read .8M or .6M on the near card in order to read 1M fluently with comfort.

(With a Snellen near card, the 20/200 size letters are different on a card using a 13” reference distance when compared to a card set for a 16” reference distance. Snellen acuity refers to the size of retinal image, which varies depending on how far material is held.)

To convert from point size (computer font size) to M notation, approximately:
Point size / 8 = M

Magnification Prediction
If a patient can see 4M OD and 6M OS, we can use the acuity of the better eye to predict a 4X magnifier needed to read 1M newsprint. Since newsprint is gray and poor quality (harder to read than our testing card), we would try the 4X magnifier first and increase the magnifier power gradually until the patient can read newsprint.

Another way to determine the amount of magnification needed is the following:
Magnification ratio = present acuity / goal acuity

A patient wants to read using an Ipad with font size 2M. Current acuity is 6M. Magnification needed is 6M/2M = 3x

This method is practical since we can measure what the patient can currently read and what the patient wants to read. For example, a patient can read a large print letter that is 7.25 mm high and wants to read print that is 1.45 mm high. 7.25/1.45 = 5, which is the approximate level of magnification needed.

You can also use the denominator of the Snellen acuity and goal. Using Snellen is not as ideal since the working distance needs to be taken into account. However it is helpful if that is the only near card you have on hand and M notation is not available. Example: Snellen acuity at near of 20/200, goal of 20/50 Magnification ratio needed = 200/50 = 4x

B. Visual Field
Goldmann visual field testing provides information regarding peripheral fields to 180 degrees. This is needed when testing for driving. The Humphrey field analyzer can go to 60 degrees for details information about central fields. On the other hand, an Amsler grid is used to map out a central scotoma for patients with central vision loss from macular degeneration, macular edema, etc. Another test is now available for central fields called the California Central Visual Field test, which can more precisely map out scotomas. The results of the central vision tests help in rehabilitation using a peripheral retinal locus. In other words, the patient may use eccentric viewing to find the clearest image.

C. Contrast sensitivity
Contrast can be tested using the ETDRS low contrast acuity chart or the Pelli Robson contrast sensitivity chart. In low vision, the Pelli Robson chart is preferred because it separates contrast from acuity: all letters are the same size but in decreasing contrast order. The patient reads the chart and is scored by the last 2 of 3 correct in a given contrast level. The test may be performed monocularly to follow disease progression, or binocularly to predict functional vision deficits. Patients with poor contrast sensitivity have difficulty recognizing faces, seeing the edges of curbs and steps and seeing details with sub-optimal lighting conditions.

D. Task lighting
Lux IQ test allows patients to choose the brightness (Lux) and warmth of color (degrees Kelvin) for optimal task lighting. The subjective lighting levels may be entered in the Lightchooser website to give up to date suggestions of lamps and bulbs.

Low Vision Refraction
Refraction is performed on all low vision patients to determine best Corrected Visual Acuity (BCVA). If a patient has 20/100 acuity or worse, or has a central scotoma, a trial frame refraction is warranted. A trial frame allows for eccentric viewing and a more natural head and
eye position. Start with retinoscopy or autorefractor reading or previous glasses Rx. Retinoscopy or autorefractor accuracy may depend on the patient's diagnosis and presence of media opacities.

**Sphere:** use big differences for comparison

In the trial frame refraction, use an appropriate power for lens comparison. If a patient is 20/400, 4 diopter lenses can be used with +4 and -4 lenses, if the patient is 20/200 you could use 2 diopter lenses. For example, if a 20/200 patient prefers +2 over -2, then ask if better with the +2 or plano. If the +2 is still better, then you can try smaller difference of +1 compared to +2. This bracketing technique helps elicit a response by showing options with large differences.

**Cylinder:** use big differences with larger handheld cross cylinder, or turning axis is trial frame

Turning the cylinder dial of the trial frame can be used to identify the axis rather than using standard ±0.25 cross cylinder testing. We also use the higher power handheld cross cylinder held in front of the phoropter or the trial frame. We can use 0.50, 1.00 or 2.00 to give our visually impaired patients larger differences for comparison. Use 0.50 from 20/50 up to 20/100, 1.00 from 20/100 up to 20/160 and +2.00 for 20/200 or worse. If the patient's vision is too poor for this testing, then we have to just turn cylinder axis a large amount until the patients sees a change. If they can't tell the cylinder axis at 90 degree changes, then it is not critical to their prescription at this point.

3. **Optical Devices**
   A. **Near Tasks**

**Reading glasses**

Magnification for reading in glasses has the advantages of leaving hands free and is similar to what the patient has usually used in the past. The working distance gets closer as we provide more magnification. The working distance is the inverse of the add in meters. A +4 add will need to be held at ¼ meters or 25 cm. A +10 add will need to be held at 1/10 m or 10 cm.

When using reading glasses, take the Rx into account when figuring out the add. For instance, a 5 diopter myope using +5 readers has an equivalent of +10 add and a working distance of 1/10 meter. On the other hand, a 3 diopter hyperope using +8 readers is actually using a +5 add since +3 is used up correcting the hyperopia. This would require 1/5 m or 20 cm working distance.

**Predicting reading Add**

Magnification ratio = Present Acuity/Desired Acuity = letter size can read/letter size wants to read

Predicted Add = mag ratio x reference add

Example: Patient's acuity is OD 4M, OS 6M using her glasses with +3.00 add
Using better eye at 4M and goal of 1M, Magnification needed is 4x
Predicted add= 4x3= +12 add
(This is usually done in M notation with 1M newspaper as most common goal. You can also use near Snellen denominator if you don’t have an M near card)

The standard binocular prism readers are available in +4, +6, +8, +10, and +12 with higher power monocular microscope readers even up to +32. The binocular prism readers have base in prism to relieve the amount of convergence needed for the close working distances. There is also a doublet lens: 2 lenses cemented together to allow for less distortion, called Clear Image microscopes.

In the absence of standard prism readers, you can decenter the pupillary distance to induce the appropriate BI prism to relieve the convergence demand at the closer working distance. Decentration in mm = 1.5(add power)
If acuities differ for the 2 eyes, consider monocular reading using the better eye. Then no prism is needed.

**Stand and handheld magnifiers**
Conventional magnification of a handheld or stand magnifier can be thought of as lens power divided by 4.
\[ M = \frac{F}{4} \]
+ 16 lighted stand magnifier magnifies 16/4 = 4x

When a handheld magnifier is used, the patient can hold the reading material at the focal length of the lens. Then light rays leave the magnifier parallel, and no bifocal or accommodation is needed. The stand magnifiers, on the other hand, are set to rest closer to the reading material than the focal length. Light rays leaving the stand magnifier set closer than focal length are divergent. A bifocal or accommodation is needed with a stand magnifier. (When a bifocal is used, the magnification effect changes and \( \frac{F}{4} +1 \) is sometimes used. This is called rated magnification, and it is used by some manufacturers. One company may call a +16 magnifier 4x while another company may label it 5x.)
As you get closer to the magnifier, the field of view increases.

Handheld magnifier

Stand magnifier

<table>
<thead>
<tr>
<th>Book</th>
<th>Object at focal point of lens</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Book</th>
<th>Object closer than focal point of lens</th>
</tr>
</thead>
</table>

22
Basic lens maker’s equation:

\[ \frac{1}{u} + P = \frac{1}{v} \]

values are distance in meters

Vergence of object = \( U \)

distance of object from lens = \( u \) in meters

Vergence of image = \( V \)

distance of image from lens = \( v \) in meters

Power of lens \( P \)

Light vergence from object acted on by lens then equals light vergence of image

We set up our diagram with light traveling from left to right. Distance has negative sign to left of lens so our object distance has a negative sign

If an object is placed 5 cm (1/20 m) away from a +12 magnifier, where is the image? Note this is closer than the 1/12 (8 cm) focal length.

\[ \frac{1}{u} + P = \frac{1}{v} \quad \text{Magnification} = \frac{v}{u} = \text{image distance/object distance} \]

\[ u = \text{object distance in meters}, \quad v = \text{image distance in meters}, \quad P = \text{diopters power of lens} \]

To the left of the lens, the distance is minus. Set up diagram so that light travels from left to right.

\[ \frac{1}{-12} + 12 = \frac{-1}{20} + 12 = \frac{-8}{1} = \frac{1}{v} \quad \frac{v}{-1/8} = 12 = \text{meter, image is 12 cm behind lens} \]

Magnification = \( \frac{v}{u} = -1/8 / -1/20 = 20/8 = 2.5 \)

How far away from the eye should the patient hold this stand magnifier, if the patient is wearing a +2.50 add?

Inverse of 2.50 is 40 cm working distance. Image is 12 cm beyond the magnifier and the image needs to line up with the add focus. Hold this stand magnifier 40-12 = 28 cm from eye for ideal focus. Another option would be to change the add power to change the distance the magnifier is held for optimal focus.

Note: If magnification higher than 1.0, image is larger than object. If magnification <1.0, image is minified smaller than object. (Magnification 0.5 means image is one half the size of the object) If magnification has a negative sign, the image is inverted upside down.
Equivalent Power

**Combining 2 lenses: readers plus a magnifier**

Concept of Equivalent power: If you have a reading add plus a handheld magnifier, or you are using 2 different magnifiers at the same time, you can’t just simply add all the magnifiers if there is a physical space in between. If you do hold 2 magnifiers together touching each other, then you can more or less add those powers. However if you have readers plus a magnifier, there is a calculation to determine equivalent power. Equivalent power would be the power of an add that could replace the complex system of 2 optical lenses.

Equivalent power of 2 lenses

\[ \text{Fe} = \text{equivalent power, power of a single lens add that could replace the system of lenses.} \]

\( \text{Fe} \) does not include refractive error correction, just net add

\( F_1 = \) add in diopters

\( F_2 = \) magnifier power in diopters

\( Z = \) separation of lenses in meters

\[ \text{Fe} = F_1 + F_2 - z (F_1)(F_2) \]

Joe uses readers that are a +8 add and also a +20 handheld magnifier held 8 cm apart. What is \( \text{Fe} \)?

\[ \text{Fe} = F_1 + F_2 - z (F_1)(F_2) \]

\[ \text{Fe} = +20 + 8 - 0.08(20)(8) = +12.8 \]

round to +12.75

By using the 2 items together, it is as if he has +12.75 add

**Telescopes**

\( M = \) magnification
M = - Fe/Fo

Fe = power of eyepiece

Fo = power of objective

Galilean telescope

Keplerian or astronomical telescope

<table>
<thead>
<tr>
<th></th>
<th>eyepiece</th>
<th>objective</th>
<th>image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galilean</td>
<td>-</td>
<td>+</td>
<td>erect</td>
</tr>
<tr>
<td>Keplerian</td>
<td>+</td>
<td>+</td>
<td>inverted</td>
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</tbody>
</table>

Magnification of a Galilean telescope is positive which means that the image is erect. Magnification of a Keplerian telescope is negative which means that the image is inverted. Prisms or mirrors are used in the Keplerian telescopes to invert the image so that it is not viewed upside down. (Look at the Specwell 8x30 handheld monocular astronomical telescope with prisms and look at the Beecher telescope which has mirrors. Then compare with the Galilean 2.5x Selsi.)

Entrance and Exit Pupils:


The aperture of this system is the edge of the objective lens. The exit pupil is an image of it. Good eyepiece designs produce an exit pupil of diameter approximating the eye's pupil diameter, and located about 20 mm away from the last surface of the eyepiece for the viewer's comfort.
In an optical system, the entrance pupil is the optical image of the physical aperture stop, as 'seen' through the front of the lens system. Look through the objective telescope lens at the image of the eyepiece aperture. The entrance pupil of the eye is the anatomical pupil aperture as viewed through the cornea. Due to the power of the cornea, the entrance pupil of the eye is magnified and closer than the anatomical "real" pupil.

To use an optical instrument optimally, the entrance pupil of the viewer's eye must be aligned with the instrument's exit pupil. (The entrance pupil of the eye is the image of the anatomical pupil as seen through the cornea)

The exit pupil size can be calculated as the diameter of the objective lens divided by the magnification. Example: 7x50 binoculars have 7x magnification and 50mm objective lens. 
\[ \frac{50}{7} = \text{approx. 7 mm diameter exit pupil} \]

Why can't our patients read up close using their bird watching binoculars??

Accommodation demands through a telescope:

\[ T_a = T_n \times M^2 \]

Where:
- \( T_a \) = accommodation needed through telescope
- \( T_n \) = normal accommodation for that distance equal to \( \frac{1}{\text{distance in meters}} \)
- \( M \) = magnification power of the telescope

Example: Object at \( \frac{1}{3} \) m with 3x telescope
\[ T_a = 3 \times 3^2 = 3 \times 9 = 27 \text{D} \]

This accommodative demand is too high to be able to read with a distance telescope. Therefore, we use a “reading cap” on the objective lens of telescope (if you don’t believe this, try to read a newspaper with binoculars)

The power of the reading cap is the inverse of the working distance:
- +3 reading cap focus at \( \frac{1}{3} \) meter; +4 reading cap focus at \( \frac{1}{4} \) m

Therefore surgical near telescopes have a higher power in the objective lens than a distance telescope. It is higher by an amount equal to the inverse of the working distance.
Example: Dental loupes
Dentist decides magnification needed, keeping in mind that the higher the magnification, the smaller the field of view. Dentist also decides the working distance. Glasses Rx and PD also needed for custom loupes. Now dentists and dental hygienists encouraged to use dental telescopes to improve posture and consistent vision. (photo by Sheer Vision, internet source)

**Determine power of mystery magnifier or telescope:**
Mystery optical items brought in by patients may not be labeled. Some magnifiers may not fit well in your lensometer. You can still figure out the power of the mystery magnifier or telescope:

Mystery magnifying glass: Look through magnifier at distant target. Hold increasing minus lenses against the magnifier until you can view the distant target most clearly. That is the power of your magnifier. In other words, if a -20 lens held against my mystery lens gives me a distant focus, then my mystery lens must be +20.

Mystery telescope: measure in mm the diameter of the objective lens. Hold the telescope so that you are looking down the eyepiece and see the image of the objective, which is the exit pupil. Measure the diameter of your exit pupil.

\[
\text{Magnification} = \frac{\text{objective lens diameter}}{\text{exit pupil diameter}}
\]

Example: 20 mm objective lens, exit pupil 5mm  \( \text{Mag} = \frac{20}{5} = 4X \)

**II: Electronic Devices**

Increasing in popularity, electronic magnification systems offer zoom variable enlargement, high contrast options and even text to speech capability. The standard closed circuit TV(CCTV) allows the patient to put reading material under a camera and see an enhanced, enlarged image on a monitor. There is also a small handheld camera unit which plugs into the patient’s home TV. The zoom feature allows enlarging and the magnification effect depends on the size of the TV screen. It also allows you to reverse contrast, white letters on black background, to reduce glare and enhance contrast of the print. The latest model of CCTV has camera options to point at distance or near, plenty of space to write or cook, etc under the camera, as well as text to speech. The text capture button converts the written text to speech, with options to vary volume and speed.

Software for computers includes JAWS and Zoomtext, which provide increased magnification and speech. Text recognition software is relatively new, but has improved greatly in a short time. Voice control options are available using DragonSpeak programs. Patients now have a myriad of options when using computers: large monitor, enlargement accessibilities options standard in Windows or on Mac computers, other software to enlarge beyond standard options, in addition to the text to speech available.

Cell phone features allow our patients to capture and save an image, use touch screen or magnification to enlarge the image, or use text to speech apps to hear the information. The list of apps for the visually impaired is ever growing, and includes color recognition, money denomination recognition, etc.
Today we have technology options aimed at universal accessibility: reading or listening in various sized fonts or volumes. This concept, where someone with 20/20 vision may want to listen to a book in the car or emails while walking a treadmill, has led to a surge in tablets, monitors, computer programs and apps that assist all of us in accessing information and communication. While we still use optical correction such as higher power prism readers or handheld magnifiers, we can now combine lenses with larger or contrast enhanced font presentation.

A computer may be plugged into a large monitor, such as in a 42” TV pictured below. The writing on the screen has grown 3 times before even adding computer program enhancement such as Zoomtext or other enlarging, enhancing software options. Appropriate reading glasses may be added: net add +2.00 for ½ meter viewing distance, or +1.50 net add for 2/3 meter viewing distance.
One of the most reasonably priced options for electronic magnification is the portable electronic magnifier system by Mattingly. The pinhole style camera is plugged into the patient's home TV. Zoom magnification is available along with enhanced contrast and reversed polarity, white letters on black background. The handheld electronic reading aid is in the $200 range. Ruby 7 is a portable CCTV, and there are several companies producing these popular items (cost range $600-1200).

The desktop CCTV system pictured on the right has the screen attached with excellent lighting conditions. The standard CCTV allows patients to write or do an activity requiring two hands under enhanced magnification. The costs for desktop CCTVs range from $1700 to over 3000, depending on the size monitor and additional features such as a swivel camera that can be aimed at distance as well as near. A new CCTV option may include text to speech, and the patient may read in large font or scan and listen to the information.
Section 9: Low Vision

Adaptive Techniques and Rehabilitation Plan – Sherry Day, OD, FAAO

A. Lighting for Low Vision

As people age, increased lighting is needed to see. This is even more important for people with low vision. There are two types of lighting:

1. Overall lighting which lights up the whole room.
2. Task lighting used for an activity such as reading, writing or cooking. The Lux IQ test indicates the patient’s preference for task lighting in brightness (lux) or color (degrees Kelvin).

Lighting can be improved in several ways:

- Increase the watts or lumens for bulbs of lamps or light fixtures. Do not exceed allowed watts.
- Move the task light closer to the surface or activity
- Add more lighting in the home:
  - overhead lighting
  - torchiere floor lamps
  - task lamps
  - under-cupboard lights
  - stick-on lights for closets or pantries
  - motion sensor or timer controlled yard lights
  - night lights

Tips for indoor lighting:

- Provide light for the whole room with extra task lighting near the activity. This will cause less shadows.
- Try to keep all rooms evenly lit. It is difficult for your eyes to adjust from bright light to low light.
- Dimmer switches may be helpful to adjust light.
- Use window shades and sheers to control amount of sunlight coming in.

Glare
Glare is a common problem. It is often painful for persons with vision loss. Glare can also reduce the contrast, making bold images appear washed out. This is especially challenging for patients who already have impaired contrast sensitivity. When an image appears faded, it makes it hard to distinguish steps or faces, which do not generally have bold contrast to features.

To reduce glare:

- Use shades on lamps.
- Soften bright light from windows with blinds or sheer curtains.
- Arrange the chair and table so you don’t have to look at the light coming from the window.
- Shiny paper may create glare. Use low gloss or matte paper for reading and writing.
- Counter or table surfaces may be shiny. They can be covered with a non-shiny material to reduce glare.
- Filters (like sunglasses) can help reduce glare. They can be very helpful for some people. Lightly tinted filters can be used indoors. Darker tinted filters can be used outdoors.
- Filters can be bought on-line or in person from stores where eyeglasses, sunglasses or low vision equipment are sold.
- When outdoors, wear a hat with a brim.

There are different types of light. It is worth trying different types to find which works best for you.

Types of lighting:

1. **Incandescent** - This is a common bulb type for many types of fixtures. These light bulbs may cause glare and create shadows.

2. **Fluorescent** – This type of light creates an even light. It may cause less glare than incandescent bulbs. Some find this light to cause a strobe effect that is not good for them. This light is useful for overhead and task lighting. It may be attached under cupboards.

3. **Full Spectrum** – This type of bulb is closest to sunlight. It has a pure white light. These bulbs may cost more and be hard to find in stores. They often work well for those with low vision. You may want to talk to your Eye Doctor about wearing “blue blockers” for sunlight and full spectrum lighting. Some eye diseases can be affected by the blue rays of light that come from these sources.

4. **Halogen** – This light offers a bright even white light for task and room lighting. Some torchiere lamps have halogen light. Halogen light is very hot; use with caution. Do not put close to skin or anything that may burn. Do not recommend for task lighting that is close to the patient.

13 watt full spectrum = 60 watt incandescent
20 watt full spectrum = 100 watt incandescent

Here are some pictures of different types of lighting:

Task lighting with fluorescent desk lamp

Task lighting with incandescent desk lamp
B. Using Contrast

With low vision, one may have problems seeing areas that are alike in color. Examples could include curbs and sidewalks or a white commode sitting on a white tile floor. Below is an example of low contrast with writing.
Increasing contrast around your home can help to the use your vision for everyday tasks.

Here are some hints to help your vision:

- **Bathroom**
  
  If your bathroom is white lay a colored towel over the edge of your tub
  
  Use a dark colored soap dish, toothbrush and cup on a light colored counter or use white soap dish, toothbrush and cup on a dark counter
  
  Use a dark colored toilet seat to add contrast to a toilet
  
  Use a light colored bottle for shampoo and a dark colored bottle for conditioner
  
  Use colored wash cloths or towels if your bathroom is light colored

- **Kitchen**
  
  When eating, use a dark placemat or tablecloth for light colored plates
  
  Use light colored dots or stickers to mark dark dials on ovens or microwave and dark dots on light dials
  
  When measuring items like sugar use dark measuring cups/spoons Use white cups/spoons for measuring coffee
  
  Avoid clear drinking glasses for liquids. Use dark glasses for light colored liquids like milk. Use light or white glass for dark liquids such as coffee

- **Around the house (inside)**
  
  In a room that has dark furniture and dark floors, use light pillows or throw blankets
  
  Use contrast tape to mark the edge of stairs
  
  Use dark tape to mark the outlines of outlets, light switches and thermostat controls on light colored walls
  
  For light colored carpet in the bedroom use a dark bedspread
  
  Use telephones with lighted dials or mark the #5 with a dot to help with dialing
  
  Use dot marking for TV remote controls
• **Around the house (outside)**
  
  Use dark tape to mark thresholds and outdoor steps
  
  Use dark tape or paint to outline edge of outdoor steps
  
  Use light landscape stones or fencing to tell between lawn and landscape beds
  
  Use lighted garage door controls

B. **Phone or tablet Applications (updated 2016)**

Patients who carry cell phones love apps! Since many of us always carry a phone, we can also have access to tools and info. Following is an app list. There are usually iphone and android versions for apps.

For providers:

1. **Eye handbook: testing charts, photos, ophthalmic dictionary etc**
2. **Vision Sim by Braille Institute**: show family members what it looks like to have certain eye diseases

For patients:

**Low Vision App List for iPad/iPhone**

**Color ID Free** by GreenGar Studios  Uses the device camera to speak the color for you. It offers a setting for basic colors, such as "pale green" or more advanced colors such as "strong greenish yellow."

**Light Detector**-$1.99  by EveryWare Technologies  Using your iPhone camera, this app emits higher or lower sound depending on the intensity of light. Light Detector can help find any lights left on or locate windows or exits.

**Uber**-free by Uber Technologies, Inc.  Voiceover accessible transportation service. Fare estimate provided and fares are charged automatically to credit card on file.

**Voice Brief**-$2.99  by Dong Baik  Voice Brief can read your email, Twitter feed, weather, stock prices, RSS and Facebook feeds. This app is fully configurable and the voices are natural and clear.

**HeyTell**-free by Voxilate  HeyTell is a cross between walkie-talkies and texting. Allows you to send and receive voice messages with other Hey Tell users with the press of a button.

**List Recorder**-$0.99  by Sixth Mode Solutions  Allows users to record and organize lists using audio or text. List Recorder is designed to integrate with VoiceOver as well as Braille displays. Replay, sort, delete or email recordings with ease using custom gestures and motions.

**Evernote**-free  by Evernote  Stores voice notes, photographs, and text so that they can be accessed from multiple devices. Photographs are scanned for text which can then be searched. Evernote has VoiceOver support.
Urbanspoon—free by Urbanspoon Uses the GPS on your device to find a restaurant near you. Urbanspoon allows searching by type of food, ratings or distance, or price. Has full VoiceOver support.

Dragon Dictation—free by Nuance Communications
Easy-to-use voice recognition application that allows you to easily speak to dictate your text or email messages. This app has a small learning curve.

Awareness! The Headphone App—$6.99 by Essency
It allows you to listen to your headphones while also hearing the sounds around you. It uses the microphone to feed in noises as you listen to music or use another app.

Alarmed ~ Reminders, Timers, Alarm Clock—free by Yoctoville
This app has a multi-feature timer, alarm clock with snooze and a sleep timer. It also has a flashlight. Through an in-app purchase you can access other features such as the ability to set interval timers for doing repetitive activities, such as laundry or cooking.

WeatherBug—free by WeatherBug
WeatherBug offers up-to-date weather reports and a forecast for the next 24 hours or the next week.

AutoRingtone Pro Text-To-Speech Ringtones for Talking CallerID—$4.99 by No Tie, LLC
Can personalize ring tones for each of your contacts and have the ring announce the caller. You can choose from different voices and control the speed that the voice speaks.

Talking Scientific Calculator—$4.99 by Adam Croser
Talking Scientific Calculator is just that, a talking scientific calculator. It works with VoiceOver or has a high contrast options for those with low vision.

Capti Web Player—$2.99 by Charmtech Labs, LLC
Use Capti to listen to news, blogs, online books, encyclopedias, and other web pages. You will be able to browse the Web with a built-in browser, add web pages to Capti’s playlist, and listen to them at your convenience. It is fully accessible with VoiceOver.

VisionSim—free by Braille Institute
This app turns on the camera of the iPhone with filters the lens with distortion that mimics the selected eye condition.

Chime—free by Blacktree
It has the option to chime on the quarter, half or hour and there are different alerts to choose from.

Glucose Buddy Pro—$6.99 by Azumio Inc
This app allows users to manually enter their numbers, exercise and food consumption into a log that is uploaded to a private account at GlucoseBuddy.com. The online web site also has other features such as an A1C estimator.

Ariadne GPS—$5.99 by Giovanni Ciaffoni
This is a voice controlled GPS. Settings and alerts can indicate street crossing, favorite points, and bus stops. Alerts include sound, voice and vibration. Works anywhere Google Maps are available.

Dragon Dictation-free by Nuance Communications
Allows you to easily speak and instantly see your text or email messages. The app recognizes standard diction commands such as new line, new paragraph, question mark, and much more. The app has email, Twitter and Facebook sharing options.

LookTel Money Reader—$9.99 by IPPLEX
Announces the denomination of paper money.
Learning Ally Audio-free  By Learning Ally  Provides access to Learning Ally’s library of more than 65,000 audiobooks is considered the best source for K-12 and college-level textbooks. A Learning Ally membership is required and is free to those with print disabilities, including visual impairments and dyslexia.

Read2Go-$19.99  By Benetech  From within Read2Go, you can browse, search, download, and read books directly from Bookshare using your Bookshare membership, as well as read DAISY books from other sources. The app gives you full control over visual choices for font size and color, background and highlighting color, and text-to-speech preferences.

Zoom Reader-$19.99  By Ai Squared  In combination with your iOS device’s built-in camera, ZoomReader lets you magnify and read printed text by first taking a picture of an object like a book or menu, then converts the image into text using state-of-the-art Optical Character Recognition (OCR) technology.

Magnifying Glass with Light- free  
By Falcon in Motion LLC  
Uses the built in camera to enlarge objects and provide LED illumination.

Fleksy - free  
By Fleksy, Inc  
Fleksy is a text input system designed so that you can type without even looking at the screen. Uses tap and swipe functions for punctuation and custom words.

Be My Eyes – free  
By Be My Eyes  
Using the built in camera, users can be connected to sighted helpers for help in identifying objects or getting around through a live audio-video feed.

KNFB Reader - $99.99  
By Sensotec nv  
Using the built in camera, the app converts printed text to speech. Multiple reading modes are available for books, articles and labels, bills and memos.