جامعة المستقبل

كلية التقنيات الصحية والطبية

قسم تقنيات البصريات

Second Stage 2024-2025

REFRACTIVE ERRORS 2

Lecture Title

Low Vision

Lecture Number: 2 / course 2

Prepared by

Hassan A. Aljaberi

OPTOMETRIST

Low Vision الرؤية المتدنية

- Low vision refers to a significant visual impairment that cannot be fully corrected with glasses, contact lenses, medications, or surgery.
- People with low vision have a significant reduction in their visual acuity or visual field, which affects daily activities like reading, writing, or recognizing faces.

Features:

- Affects individuals of all ages.
- Often progressive in nature, depending on the underlying condition.
- Requires adaptive solutions and rehabilitation for better functioning.

World Health Organization (WHO) Definition:

Categories	Visual Acuity
Low Vision	6/18 – 3/60
Normal vision	6/6 – 6/12
Mild Vision Loss or Early Visual Impairment (EVI)	< 6/12 – 6/18
Moderate Visual Impairment (MVI)	< 6/18 – 6/60
Severe Visual Impairment (SVI)	< 6/60 – 3/60
Blindness (WHO definition)	< 3/60
Blindness (Welfare definition)	< 6/60

Types of Low Vision

1. **Central Vision Loss:** This type of low vision affects the central part of the visual field, which is responsible for detailed vision. It can make it difficult to recognize faces, read small print, or perform tasks that require sharp central vision.

Causes:

- Age-related macular degeneration (AMD)
- Diabetic maculopathy (DM)

2. **Peripheral Vision Loss:** Peripheral vision loss, also known as “tunnel vision”, refers to the narrowing of the visual field. People with this type of low vision have reduced side vision while maintaining central vision.

Causes:

- Glaucoma
- Retinitis pigmentosa

3. **Night Blindness:** or nyctalopia, is characterized by difficulty seeing in low-light conditions or at night. It can make it challenging to navigate in dimly lit environments.

hasan aljaberi

***Causes*:**

- retinitis pigmentosa
- uncorrected refractive errors
- corneal diseases
- cataracts.

4. Blurred Vision: A generalized reduction in visual clarity across the entire visual field. Difficulty reading or recognizing fine details.

Causes:

- Cataracts
- Uncorrected refractive errors
- Corneal diseases

5. Reduced Contrast Sensitivity: Contrast sensitivity refers to the ability to distinguish between different shades of gray and perceive subtle differences in brightness. Difficulty in low-contrast situations, such as driving in foggy conditions.

Causes:

- Diabetic retinopathy
- Optic neuropathy

Normal Vision

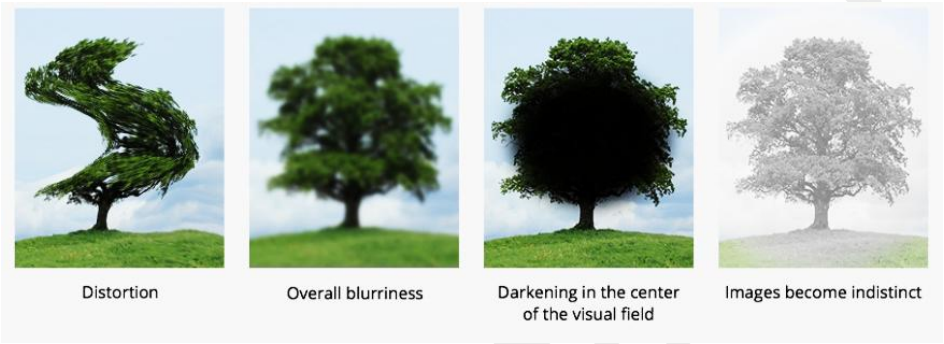
Vision with reduced Contrast Sensitivity and Glare Issues

hassan aljaberi

6. Visual Field Defects: Visual field loss refers to the loss of vision in specific areas of the visual field. It can manifest as blind spots or missing areas in the peripheral or central vision.

Causes:

- Retinal detachment
- Optic nerve damage (e.g., stroke-related)
- Glaucoma



Causes of Low Vision

1. Age-Related Conditions

- **Age-Related Macular Degeneration (AMD)**:
  - Damage to the macula, the central part of the retina, resulting in central vision loss.
  - Leading cause of low vision in older adults.
- **Cataracts:**
  - Clouding of the eye's lens, causing blurred or dimmed vision.
  - May lead to low vision if untreated or if surgery is not possible.
- **Glaucoma:**
  - Damage to the optic nerve due to increased intraocular pressure.
  - Causes peripheral vision loss, leading to "tunnel vision."

2. Diabetic Eye Diseases

- **Diabetic Retinopathy:**
  - Damage to retinal blood vessels due to diabetes, causing blurred or distorted vision.
- **Diabetic Macular Edema:**
  - Swelling in the macula due to leaking retinal blood vessels.

3. Hereditary and Congenital Eye Disorders

- **Retinitis Pigmentosa:**
  - A genetic condition leading to progressive peripheral vision loss and night blindness.
- **Congenital Cataracts or Glaucoma:**
  - Vision impairment present from birth.
- **Albinism:**
  - A lack of pigment in the eyes, leading to reduced visual acuity and sensitivity to light.

4. Refractive Errors

- **Severe uncorrected refractive errors such as:**
  - High Myopia (Nearsightedness)
  - Hyperopia (Farsightedness)
  - Astigmatism

5. Retinal Disorders

- **Retinal Detachment:**
  - Separation of the retina from its underlying layers, leading to partial or total vision loss.
- **Macular Holes:**
  - Small breaks in the macula causing central vision loss.
- **Central Serous Retinopathy:**
  - Fluid buildup under the retina leading to blurry vision.

hassan aljaberi

6. Neurological Conditions

- **Optic Neuropathy:**
  - Damage to the optic nerve due to trauma, tumors, or multiple sclerosis.
- **Stroke:**
  - Can lead to visual field loss or double vision.
- **Brain Injuries:**
  - Trauma or tumors affecting the visual cortex or optic pathways.

7. Corneal Disorders

- **Keratoconus:**
  - Thinning of the cornea leading to distorted and blurred vision.

Devices and Tools for Managing Low Vision

❖ Optical Devices for Near

- **Handheld magnifiers are compact and portable:** These devices are illuminated or non- illuminated, available in various powers starting from 2× magnification. Usual prescriptions range below 8× magnification, because the size of the optical lens reduces as magnification is increased.

- **Stand magnifiers offer hands-free reading:** Magnifiers placed directly on reading material for stability and ease of use. Useful for individuals with hand tremors or reduced hand coordination.

hassan aljaberi

- **Spectacle magnifier:** Reading glasses, also known as low vision reading aids, are designed to provide magnification by high-powered convex lenses for near tasks such as reading, writing. They are available in high-powered reading glasses the powers range from anything beyond 4 diopters.

- **Electronic magnifiers** use cameras and display screens to provide adjustable magnification levels and additional features like image enhancement and contrast adjustment.

1. Spectacle magnifier 2. Hand-held magnifier 3. Pocket magnifier 4. Bar magnifier
5. Stand magnifier 6. Dome magnifier 7. Fresnel sheet 8. Desktop magnifier
9. Video magnifier

❖ Optical Devices for Distance

- **Telescope:** They can be divided into: -

✓ **Galilean Telescope:** is a simple optical instrument designed for magnifying distant objects. It is commonly used in low vision rehabilitation to assist individuals in improving their distance vision. It includes of:

- Convex objective lens
- Concave eyepiece lens
- Lightweight, affordable, and compact by attaching it in the spectacles
- Provides low magnification range from 2X to 4X, making it suitable for moderate distance tasks
- Produce an upright, erect image
- It has a smaller field of view
- It can be monocular or binocular

✓ **Keplerian Telescope**: is an advanced optical device used to magnify distant objects. It provides higher magnification and a wider field of view compared to the Galilean telescope, making it particularly useful for low vision applications.

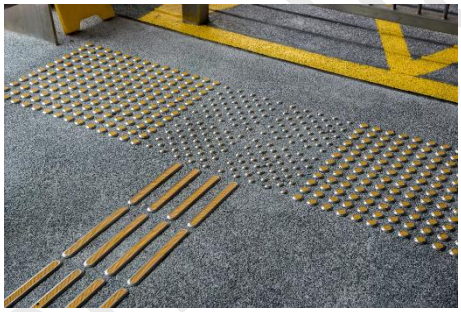
- Convex objective lens
- Convex eyepiece lens
- Typically, larger and heavier
- Provides high magnification range from 4X to 10X, making it suitable for moderate distance tasks
- Produce an upright, inverted image (requires prisms)
- It has a wider field of view

- **CCTV (Closed-Circuit Television):** It refers to an electronic magnification system that helps individuals with low vision read and view objects by magnifying and enhancing the image on a screen. Also, can be given up to **40X** magnification. These devices are expensive for many of our patients.

1. Hand-held telescope 2. Spectacle-mounted telescope 3. See TV glasses 4. Clip-on telescope 5. Iris Vision 6. E-Sight 7. NuEyes 8. Acesight 9. OxSight glasses

❖ Non-Optical Devices

- **Lighting Aids:** Adequate lighting is crucial for individuals with low vision. Various lighting aids are available, including adjustable desk lamps, magnifying lamps, and portable lighting devices. These aids provide focused illumination, reduce glare, and improve contrast, making it easier to see objects and read.
- **Large Print Materials** Books, magazines, and newspapers with enlarged fonts for easier reading.
- **Tactile Markers:** Tactile markers are small adhesive or magnetic labels that can be placed on objects, appliances, or controls to help individuals with low vision identify and locate them by touch. These markers are particularly useful for labeling kitchen appliances, medication bottles, and frequently used items.



- **Mobility Tools:** White canes, guide dogs, and mobility training for safe navigation and independent travel.

electronic Devices: Modern technology provides advanced solutions for low vision users:

- Smartphones and Tablets
- Computer Software
- Audio Books and E-Readers

hassan Jabri

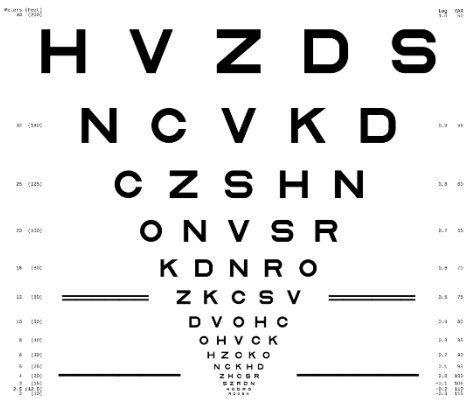
Vision Assessment for Distance in Low Vision Patients

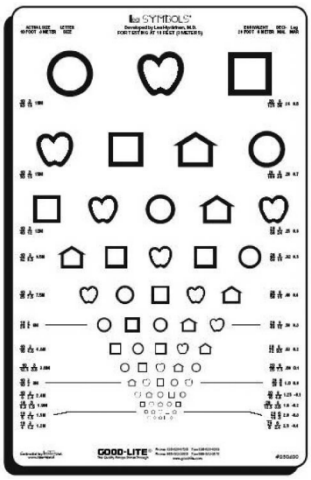
The acuity recording is different than the regular Snellen's charts. While measuring acuity counting, finger documentation is not the right way of recording the visual acuity in these patients.

1. Visual Acuity Testing (Distance and Near)

- **LogMAR Chart:** Preferred for low vision due to its precise measurement and logarithmic scaling.
  - ✓ Used to assess distance visual acuity at standard distances of 4 meters, 2 meters, or closer for patients with significant vision loss.
  - ✓ Provides a more precise measurement of visual acuity compared to Snellen charts.
- **Reduced Snellen Chart:** Used at shorter distances (e.g., 3 meters or 1 meter).
- **Tumbling E Chart:** For illiterate patients; measures the direction of the letter "E."
- **Picture or Symbol Charts:** Lea symbols or Allen cards for children or non-verbal patients.

These charts are made for use for 4 m. However, if visual acuity is lesser, the chart is brought closer to half the distance, that is 2 m, or still distance. Recording near visual acuity is also done with special low-vision charts.





2. Refraction Testing

- **Objective Refraction:**

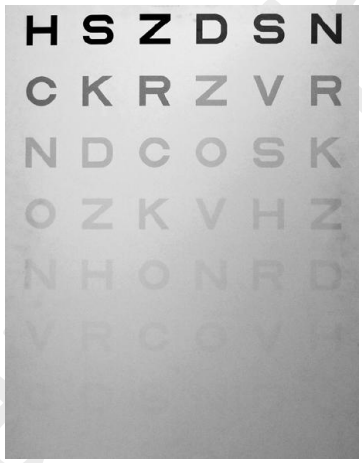
Performed using retinoscopy, which is more reliable than autorefractors for low vision patients.

- **Subjective Refraction:**

Bracketing techniques with larger lens step changes are used to refine prescriptions for clearer vision.

3. Contrast Sensitivity Testing

- Pelli-Robson Contrast Sensitivity Chart:
- Measures the ability to distinguish letters of decreasing contrast against a uniform background.
- Essential for assessing visual quality in low-contrast conditions, such as poor lighting or fog.

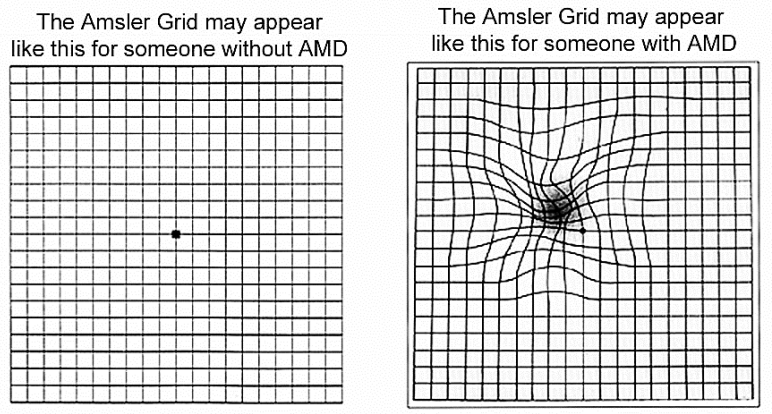


4. Visual field assessment

✓ **Goldmann Perimetry**: A manual test that maps central and peripheral visual fields, useful for detecting field loss from glaucoma, retinitis pigmentosa, or other conditions.

hassan jaberi

✓ **Amsler Grid Test:** A simple grid chart used to detect central field defects, such as scotomas or distortion from macular degeneration.



✓ **Confrontation Test**: A quick in-clinic method to screen for gross visual field defects by comparing the patient's field to the examiner's.

5. Depth Perception Tests

Depth perception tests evaluate the ability to perceive the relative distance between objects in a three-dimensional space. This ability relies on binocular vision and other visual cues.

Common Tests for Depth Perception

1. **Titmus Fly Test**:

- A common test for stereopsis.
- Uses polarized glasses to determine the ability to perceive depth in 3D objects, such as a fly or geometric patterns.

hassan aljaberi

2. **Randot Stereo Test**:

- Utilizes random dot patterns and polarized glasses to assess fine depth perception.

3. **Worth 4-Dot Test**:

- Assesses binocular vision to determine if depth perception is intact.

6. Color Vision Tests

Color vision tests assess the ability to distinguish between different colors, typically to diagnose color deficiencies.

Common Tests for Color Vision

1. **Ishihara Test**:

- Uses pseudoisochromatic plates with numbers or patterns visible only to individuals with normal color vision.
- Primarily detects red-green color blindness.

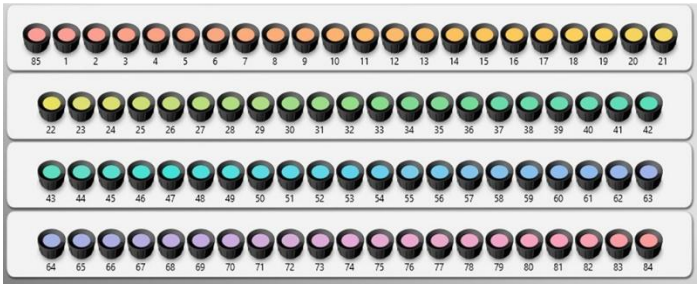
2. **Farnsworth-Munsell 100 Hue Test**:

- Requires the arrangement of color shades in order, testing color discrimination ability.

hassan aljaberi

3. **D-15 Test**:

- A simplified version of the Farnsworth-Munsell test.
- Suitable for quick screening of color vision defects.



Vision Assessment for Near in Low Vision Patients

A similar procedure is followed, but the individual is asked to hold the chart or reading material at a closer distance, typically around 14-16 inches (35-40 centimeters). The chart used for near vision testing may contain larger print or specific reading material, as it is designed to assess close-up visual tasks like reading or using electronic devices.

hassan aljaberi