EXAMINATION PROCEDURES

Visual acuity
Refractive error
Ocular alignment
Binocularity
Ocular motilities
Accommodation
Visual fields
Contrast sensitivity
Color vision
Photosensitivity
Ocular health

INFORMATION GATHERING

PATIENT HISTORY AND OBSERVATION

- Not just visual and medical history
- Visual and sensory functioning
- Current education or vocational status
- Activities of daily living
- Goal setting and expectations of the caregivers (parents, educators, therapists)

MEDICAL ALERTS

- Diabetes
- Swallowing difficulties
- Allergies
- Eating of inedibles (impact on small objects used as motivational targets)
- Breathing difficulties
- Seizure, shunts (impact on any testing requiring vestibular stimulation, strenuous physical activity and the administration of ocular drugs)

MEDICATIONS

- High prevalence of seizure, psychoses, and psychomotor abnormalities, as a result, systemic and ocular medications should be obtained
- Examples: antipsychotics such as chlorpromazine (Thorazine) and thioridazine hydrochloride (mellaril) on a short-term basis, have few lasting side effects, but on a long-term basis, create a dramatic increase of side effects, which may include retinopathy and optic nerve disease.
- Phenobarbitol (for seizures) with chronic use may precipitate nystagmus, paresis of the extra-ocular muscles and ptosis

MODIFICATION OF THE EXAMINATION

- Conditions such as Cerebral Palsy and spinal cord injury, interfere with fine and gross motor activities
- Severe hearing loss (associated with some syndromes including Rubella) require modifications in communication and sensory stimulation
- Greater emphasis should be placed on the tactual sense, but caution should be taken with children who are tactually hypersensitive
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REFRACTIVE ERROR

In general:

- This is better done in a trial frame rather than in a pheropter due to fearfulness and tactual hypersensitivity. However good facial and eye contact is needed and this is difficult with children who have cortical visual impairment, macular involvement or behaviors

- **Due to short attention span and behaviors, the viewing angles and accommodative postures are in a state of constant change. Cycoplegic refraction may be the best in those children with a question of high Hyperopia or strabismus. However, this technique reduces accommodative variability and may produce psychotic reactions. Also, in those situations (as in Down's Syndrome) there may be a contraindication for entubating incase of emergency**

VISUAL ACUITY

RECOGNITION ACUITY

- **General standard recognition charts such as Snellen, are not applicable to this population. This is generally attempted with any individual whose cognitive skills were at least at the three year old level**
- **Matching is useful if the person is non-verbal or unable to communicate with signing**
- **The best results are obtained if the person is initially binocular. This reduces the trauma of patching**
- **Disadvantages are that there is usually a short attention span and the practitioner may not be able to get monocular results in the same sitting**
- **In cases where amblyopia or other unilateral vision loss is expected, it may be necessary to have the child role play to build up tolerance to wear a patch for a later time**
- **Attention is more easily maintained when visual stimulus is within arms reach**
- **LEA symbols with matching puzzle and the Broken Wheel Cards are often used**

RESOLUTION ACUITY

- **The most clinically useful test for determining visual acuity in non-verbal patients is the forced choice Preferential Looking test**
- **Research has shown that infants when presented with a patterned stimulus and one with no pattern, will preferentially view the patterned one**
- **Technique: present 2 stimuli (1 unpatterned, 1 with black and white grating), both fields are of equal size and average luminance. If the child cannot detect the grating, both fields will appear not grated and the child will not know where to look. The viewing posture is observed through a peephole in the screen. The width of the stripes is diminished with subsequent trials and continues until there is no response**
- **However:**
    1. **Grating acuities do not always correlate with recognition acuities and may overestimate the acuity obtainable with the Snellen ototypes**
    2. **Grating acuities, such as Preferential Looking are typically performed at near, as compared to recognition acuities that can be performed at near or distance. Grating acuities may miss decreased visual acuities due to myopia or moderate astigmatism**
    3. **Acuities obtained with Preferential Looking have been found to be insensitive to the detection of strabismus and acuity loss due to**

macular abnormalities. They are, however sensitive to vision loss due to optic nerve or cortical involvement

DETECTION ACUITY

- **This test is done for those who do not respond to two-dimensional testing. This three dimensional test as in the Stycar Ball Test is designed to determine gross acuity by noting the smallest ball detected at the greatest distance.**
- **It is not as reliable since the test is dynamic and brings in to play the ability to track and scan and does not correlate with a standard test**
- **Also, if other motivating objects are used the factors involved are the responses that the child has ingrained to familiar and unfamiliar objects**

ELECTRODIAGNOSTIC TESTING

These tests are designed to measure the occipital cortical responses to gratings and flashed patterns presented to the patient.

- **They cannot however monitor higher cognitive functions or predict the difference between visual acuity data and visual functioning**

INVOLUNTARY VISUAL RESPONSE

Using an Optokinetic Nystagmus Drum (OKN), and individual has to respond visually if they can discriminate the series of bars moving across the field as the drum is rotated (gross visual acuity determined by the width of the bars that are detected)

- **A dynamic and not static visual acuity test**
- **Results may be more representative of peripheral acuity rather than central acuity**
- **Resolution may not be the function tested but rather a response of the brain**

LIGHT AND FORM PERCEPTION

This is done with individuals who show no response to any objects or patterns and to explore any responsiveness to light stimuli

- **Open hand wave toward the eyes to elicit a blink**
- **Pupillary response should be noted but is not always indicative of awareness of light**
- **Using an unusual light (flickering light…caution for seizures)**

OCCULAR MOTILITIES

Observations of:

- **Ocular tracking and saccadic skills (using flicker bulbs, favorite toys, preferred objects, edibles, favorite faces ***caution for seizure disorders and diabetes). If an individual exhibits acceptable tracking skills in the vertical meridian, but tends to head track after crossing midline in the horizontal meridian, a homonymous field loss should be considered as well a neurologic midline abnormalities. Saccadic tests will also provide the**

practitioner with information not only about ocular scanning, but also about possible field deficits

- **Are there limitations in any gaze**
- **Are movements smooth or jerky**
- **Eye tracking, head tracking or a combination of both**
- **Presence of nystagmus- monocular/binocular**
- **Midline problems**

OCULAR ALIGMENT AND BINOCULARITY

Motor findings have significant impact on cosmetic appearance it's the "How do I look"
Sensory findings impact visual development, orientation and mobility and behavioral responses it's the "What do I see"

MOTOR ASSESSMENT

- **Hirschberg test using light to see a reflection in each eye**
- **Cover test where the person needs to maintain accurate fixation**
- **Measurement is easier with a detailed object at near to control accommodation**
- **Information collected:**
  - **Onset-when first detected**
  - **Magnitude-measured in prism diopters**
  - **Type-eso, exo, hyper, hypo**
  - **Frequency-constant versus intermittent**
  - **Laterality-unilateral versus bilateral**
- **Motor assessment is difficult when there is variable fixation, poor pattern perception, eccentric viewing and no verbal feedback**

SENSORY ASSESSMENT

This is determination of:

- **Amblyopia- a microscopic defect in the wiring of the retina-to-brain connections that result from disuse of one eye from an early age**
- **Suppression-An image from one of the eyes that is ignored by the brain**
- **Diplopia- double vision**
- **Fusion- Image falls on 2 foveas. The impulses travel along the optic pathway to the occipital cortex where a single image is perceived**
- **Stereopsis- an impression of depth**
- **Anomalous retinal correspondence – each retina sees a different image**
- **Normal retinal correspondence**

VISUAL FIELDS

Best done with practitioner and assistant.

- **One person stands behind the child and one observes and draws the attention of the child in the front**

- **An object is brought from behind in all meridians and the observer notes eye turns, head turns, difference in behavior**
- **Tactual and auditory cues need to be considered**
- **An Arc Perimeter can also be used if the child can be attentive**

LIGHTING ISSUES: FAQs

QUESTIONS:

- What is the task that requires lighting?
- Should the light for this task be diffuse, spot, direct or indirect, natural or artificial?
- If the light is artificial should it be incandescent, fluorescent, halogen, etc.)
- What is the wattage of the bulbs being used?
- Does the task require a high intensity of light or a certain angle of light?

DISCUSSION:

Lighting for a near task need not be more than 60 watts. If you use a lamp with a flexible arm, you may move the lamp closer. Moving the lamp 1/2 of the distance closer doubles the intensity of the light.

Bulbs that are frosted or transparent can give 60 watts of light. Colored incandescent 60-watt lights provide an alternative for glare reduction without compromising intensity.

QUESTION:

- How far from the task and at what angle to the task is the light?

DISCUSSION:

While the placement of the light source behind the person's shoulder is a good angle for some it is not always the correct angle for each person. Some tasks, such as craftwork, may require a light source to shine directly on the person's hands. Using a "snakelight" can help a person to have both hands free to use a magnifier or to do some repairs. The "snakelight" can be worn around the person's neck or be wrapped around a pipe or pole.

Individuals requiring a greater intensity of light from overhead may require a visor to block the light from overhead while concentrating on the task in front of them.

Individuals who need a high intensity of light may experience increased glare. These people could use yellow or other ight colored light absorbing sunlenses

and in this way, decrease glare and increase contrast and comfort.

Two lights placed at opposite angles to the task sometimes serves to increase intensity while diffusing the light.

Generally, the task illumination should be 1/3 higher than the background. This helps to give greater contrast to the task. The person is not required to do much light adapting in this situation as s/he might if the task was much brighter than the background.

QUESTIONS:

- Is natural lighting preferred for the task? At what angle does the person use the light? (behind, side, front).
- At what time of the day does the person find natural lighting to be best? Worst?

DISCUSSION OF COMMON PROBLEMS:

Old incandescent and fluorescent bulbs have dimmed and may give brighter light when replaced. Fixtures themselves may be dirty or discolored with age and need to be replaced.

BuIbs used in devices may be dimmed from age and need to be replaced.

Overhead fixtures may be too bright causing glare and reflectance. Many times "bathing" the walls and the ceiling with light can brighten the ambiance of the room while more directed lights are used for tasks. Ceiling fixtures that direct the light up and wall sconces are used for this effect. If the paint used is reflective, "bathing" the ceiling and walls will create glare and reflectance.

Using paint with matte finish is most effective for lighting in most environments. Some students may have good lighting for tasks but experience glare because the light from the windows is not controlled. Light filtering curtains and shades can help in this situation -in the kitchen, over head lighting may be adequate, but the counters are dark. Using under the cabinet lights and non-reflective surfaces will brighten dark spots and help when a magnifier is being used (i.e. reading recipes, using a telemicroscope for determining the quality of food). Bathroom lighting is often a problem because the lights around the mirror shine into the person's face. A fixture on the wall over the mirror, which directs the light downward, seems to decrease the amount of glare experienced. Often the use of pink light bulbs also decreases glare and gives a "truer" color. A person using a bioptic for example may experience less glare in this lighting condition. Someone who is viewing eccentrically may find this lighting condition affords the greatest contrast to see his/her own face. Incorrect wattage of bulbs may be placed in fixtures and in low vision devices. Not only can this cause glare, but it may be dangerous with fixtures that have specific indications for wattage.

MAGNIFICATION: BACKGROUND INFORMATION FOR EDUCATORS

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Four Types of Magnification

A. Relative-size Magnification is accomplished by simply increasing the actual size of the object, thus increasing the size of the image on the retina. Large print materials are examples of relative-size magnification.

B. Relative-distance Magnification is accomplished by bringing an object closer to the eye, thus increasing the size of the image on the retina. As the object is brought closer to the eye, microscopic lenses, known as plus or convex lenses, are used to bring the image into focus. Microscopic lenses do not create magnification. Instead, they help the eye to accommodate for the closer working distance.

C. Angular Magnification is accomplished when viewing a distant object through a telescope. The system of lenses in the telescope bends light rays to increase the size of the image on the retina. The result is that the distant object is "perceived" as closer and larger than its' "actual" size.

D. Projection Magnification is accomplished when the size of an object is enlarged by projecting it on a screen. A closed-circuit television system (CCTV) uses electronic projection magnification. The Viewscan used fiber optics for projection magnification.

Important Definitions

A. Refraction: The bending of light rays as they pass from one medium to another.

B. Diopter: The unit used to measure refractive or bending power of lenses and prisms.

C. Accommodation: The process by which the lens of the eye changes shape or refractive ability to adjust for viewing objects at various distances. During the process of accommodation, the eyes converge and the pupils constrict.

Important Formulae

A. Changing Inches to Centimeters:

FORMULA: One inch = 2.5 centimeters

EXAMPLE: 10 inches = 25 centimeters (10 X 2.5)

B. Changing Magnification (X) to Diopter (D):

FORMULA: X = D/4 OR D = 4X

EXAMPLE: You are working with a low vision student who is using a 5X microscope. In order to determine the diopter equivalent:

Multiply 4 times 5 = 20 diopter

C. Determination of Focal Distance in Centimeters (cm): (when diopter value is known)

FORMULA: 100/diopters = focal distance (cm)

OR

focal distance (fd) = 100 cm/D

EXAMPLE: You are working with a low vision student who is using a +20.00 (20 diopter) microscope. In order to determine the theoretical* working distance in centimeters:

Divide 100 by 20 (diopters) = 5 cm

D. Determination of Focal Distance in Inches: (when diopter value is known)

FORMULA: 40/diopters = focal distance (inches)

EXAMPLE: You are working with a low vision student who is using a +20.00 (20 diopter) microscope. In order to determine the theoretical* working distance in inches:

Divide 40 by 20 (diopters) = 2 inches

***It is important to remember that this working distance is theoretical. Factors such as the student's refractive error and accommodative ability may influence the actual working distance.**

MAJOR ADVANTAGES AND DISADVANTAGES OF COMMON OPTICAL DEVICES

Advantages	Disadvantages

Hand-Held Magnifiers

1. Least expensive/most available
2. More cosmetically acceptable
3. Eye-to-lens distance is variable
4. More variations in eye, lens, head, and object movements
5. More lighting control; including built-in light sources

1. **Higher powers result in reduced field and closer working distances; lighting may be affected**
2. **Both hands cannot be used for other tasks**
3. **Astigmatism correction cannot be incorporated**
4. **May be difficult for students with motor problems, such as tremors and motor restriction**
5. **Distance between magnifier and task is fixed**

Stand Magnifiers

1. Inexpensive/available
2. Flashlight-types have built-in light source
3. Focal distance is set; useful for students with motor problems
4. Bar magnifiers are easy to use and effective for low magnification

1. **Book bindings present problems**
2. **May be large and cumbersome**
3. **Perpendicular alignment of eye-lens is sometimes hard**
4. **Illumination can be a problem, shadows can be created easily**
5. **Correct head and neck posture is essential to lessen fatigue**

Spectacle-Mounted Microscopes

1. Relatively inexpensive/available
2. Cosmetically, may look more like conventional glasses
3. Allows both hands to be free
4. Field of view is usually wider due to proximity to eye
5. Astigmatic correction can be incorporated
6. Lower powers may provide binocularity
7. Available in high powers

1. **Higher powers require very close working distance**
2. **May require more training**
3. **Maintaining focal distance may be difficult**
4. **Weight may be a factor**
5. **Higher powers result in monocularity**
6. **Difficult with head tremors**
7. **Person must remember to remove them for any ambulation**

Advantages	Disadvantages

Hand-Held Monocular Telescopes

1. Cosmetically, less conspicuous than spectacle mounted
2. Less expensive than spectacle mounted
3. Ocular lens may be placed very close to the eye
4. Either eye may be used
5. Hand-held may be angled to offer best viewing angle
6. Short focus telescopes allow intermediate range viewing

1. **One hand is usually needed to hold telescope; may cause fatigue**
2. **Very slight hand movements may affect target fixation**
3. **May require additional training such as focusing with one hand, etc.**
4. **Reduced field of view, particularly with high-powered telescopes**
5. **Difficult with frail individuals**
6. **Difficult when used in combination with high powered refraction**
7. **Person must never ambulate while looking through telescope**

Bioptic or Spectacle Mounted Telescopes

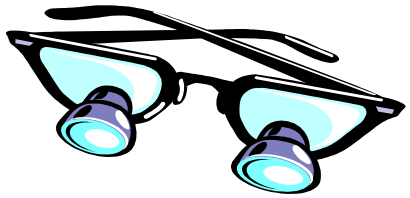
1. Both hands are free to perform tasks such as driving, playing musical instruments, etc.
2. Allows for reading at a longer working distance
3. Refractive corrections can be incorporated
4. Student is able to use a near and distance low vision device without changing glasses
5. Binocularity is possible
6. In some cases, telescope(s) can be removed for hand-held use

1. **More expensive**
2. **Not as readily available**
3. **More training required**
4. **To some, cosmetically unappealing**
5. **May be very heavy**
6. **More head scanning required due to fixed position**
7. **More care required**
8. **Difficult with head tremors**

Fresnel Prisms

1. Inexpensive
2. Increases peripheral awareness/early warning system
3. More cosmetically acceptable
4. Promotes visual scanning
5. Helpful in crowds and travel situations

1. **Image displacement**
2. **Slight drop in acuity/clarity**
3. **Not effective for depth-perception**
4. **May confuse distance judgment**
5. **Person may experience "crowding effect"**
6. **May increase motion sensitivity**



How to Use Any Low Vision Device

CONSIDERATIONS

What are the characteristics of the device?

- ❖ Hand held
- ❖ Stand
- ❖ Spectacle mounted
- ❖ Ergonomic handle
- ❖ Illuminated/Non-illuminated
- ❖ Battery/Electric
- ❖ Tinted

What is the focal distance of the device?

How do you move the device?

- ❖ Across the page
- ❖ Move print behind it
- ❖ Use head to move device
- ❖ Use hands to move device
- ❖ Other

Through which part of the device to you look?

What was the intention of the device (for what task was it recommended)?

What are the characteristics of the user?

- Child/Adult
- Steady hands/shaky hands
- Steady head/shaky head
- Motivated
- Employed and using for job
- Using for recreation
- Other health problems impacting use of device (i.e. heart, impacting height of arms; hearing, impacting understanding of instruction; memory, impacting retention of instruction, etc.,
- Does the user understand the characteristics of the device
- Does the user understand the techniques for using the device
- Can the student read
- Does the student understand how to manipulate the environment for optimum use of the device
- Other

What are the characteristics of the environment?

- Ambient lighting: glary, reflective
- Task lighting: glary, reflective
- Contrast of task to background
- Noticeable boundaries around task
- Visual clutter/noise clutter/other sensory clutter
- Safety