Review of the Low Vision Assessment & Application of Magnification

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What is our objective with low vision rehabilitation?

Low vision rehabilitation gives you the tools in order to maximise or enhance your remaining vision - typically when all other options have been explored.

Motivation is a key factor in outcome.

Is most effective at the acceptance stage of vision loss.
The Low Vision Assessment
Assessment begins with information gathering...

1. Thorough case history
   ◦ Ocular history (including patient’s explanation of eye condition)
   ◦ Medical history
   ◦ History of device use
   ◦ Current devices used
   ◦ Funding history
   ◦ Other services accessed
   ◦ Goals for assessment - ***detailed
   ◦ Priority for visit
The Basics...

2. Distance acuities.
   ◦ Consider your choice of acuity chart.
   ◦ Avoid count fingers!!!

3. Near acuities (with add in place or +4.0D lenses if px presbyopic)
   ◦ Again consider your choice of acuity chart.
   ◦ Critical print size (CPS)
     ◦ Point just before patient’s fluency starts to decrease
   ◦ Threshold
     ◦ Absolute limit
   ◦ Not necessarily focal distance of the add!....so measure!
4. **Trial frame refraction.**

And typically includes a variety of other assessments:

1. Field assessment.
2. Binocularity testing.
3. Colour vision testing.
4. **Contrast sensitivity testing.**
Then.....

1. Selection of appropriate devices.

2. Demonstration of devices.
   - Training on use of device.
   - Loan of device?

3. Development of the rehab plan.....
   - Including referral for other services.
Determining device selection.....

ALL THE EQUATIONS YOU NEED TO KNOW
Distance
Determining initial distance magnification to prescribe (all ages):

- Target acuity for distance is typically ~20/40 (6/12).
- Simply divide the denominators of actual and target acuity to determine initial mag to demonstrate.
- Remember that numerators must match!!!

Example:
- Actual acuity 3/60, target acuity then 3/6
- Mag = 60/6 = 10X
Then....need to consider patient’s goals, environment and physical attributes
Near

PRESBYOPIE PATIENTS
Determining optimal initial near mag/EVP for presbyopic patients:

- Determine target near acuity (info obtained during case history).

Some common target sizes:
- Newspaper, some novels – 1.0M
- Mail, price tags, handwriting – 1.25 -1.6M
- Large print books – 1.6 – 2.5M
Determine magnification required

- Magnification = CPS/target print size  OR
- Magnification = $\frac{2 \times \text{Threshold acuity}}{	ext{target print size}}$

Need to build in an acuity reserve to allow for fluent reading

CAN’T STOP HERE!!!
Determine power of device required

Example:
Patient wishes to read newspaper (1M target)
Habitual threshold acuities are 2.5M at 20cm

Mag = 2 x 2.5/1 = 5x
Determining power using equations...

M = F/U
U = habitual working distance in dioptres (may be power of add)

5 = F/5
F = 25D
Determining power using relative distance....

- You know to achieve 5x magnification, your patient simply needs to hold material 5x closer.
- Started at WD of 20cm, 5x closer would be at a WD of 4cm.

\[
1/0.04 = 25D
\]
Kestenbaum’s method:

- Take the reciprocal of the distance acuity.
- The result is the EVP required to read 1M at threshold.

Example: Patient has 20/200 acuity

200/20 = 10D

Patient would require 10 D to read 1M at threshold.

BUT this doesn’t include an acuity reserve and assumes that the patient always wants to read 1M
What are most common low tech devices available to help with reading/near work?

- Microscopes/high plus adds
- Hand Magnifiers
- Stand Magnifiers
Choose the low vision device that will work best for your patient...

- Need to take into consideration patient’s needs/goals and limitations

- Example:
  - Hand tremor
  - Use of only one hand
Microscopes

❖ Choose power equal to EVP calculated.

❖ If using pre-fabricated devices – must take into account patient’s prescription.

If EVP = +26D and patient has -6D myopia you will look for a microscope that is ~ +20D
Hand Magnifiers

- Choose power = EVP estimated.
- If used without an add than the power of the magnifier is = EVP
- If used with an add keep in mind that the EVP decreases as you hold magnifier further away from the eye
Stand Magnifiers

- Choose magnifier with Transverse magnification = MAGNIFICATION calculated
- Emergent vergence $L' > F_{add}$
- Theoretically need to use with an add
Demonstrate low vision aids...

- Adjust the power of the magnifier appropriately to allow for patient to fluently read the target print size.
  - If patient not able to fluently read target size – increase power
  - If patient fluently reads few lines below target print size – decrease power

- Ideally want magnifier with least amount of power that gives optimal reading (fluency and acuity).

- Train patient how to use each device as it is demonstrated.
Training
Microscopes (FFMS, prism half eyes, high adds)

1. Have the patient put on the glasses.
2. For FFMS...power over one eye (which eye??)
3. Counsel patient that everything will be blurry around the room.
4. Hand patient the reading card and ask them to hold it very close to their nose.
5. Have patient pull the reading card back until the print is in focus.
6. Make sure lighting is appropriate.
7. Instruct patient to move the reading material from side to side instead of eyes if power great.
   ◦ Allows for use of center of lens at all times.
   ◦ Periphery of high plus lenses has distortion.
Hand Magnifiers

1. Give patient the magnifier and the reading material.

2. Make sure if using illuminated magnifier that light is on page and not directed into patient’s eyes.

3. Tell patient to place the magnifier on the reading material and then slowly pull it off until print is magnified and in focus.

4. Counsel patient that the closer they bring the system to their eye – the greater the field of view: “You will be able to see more words through the magnifier”

5. If bringing magnifier closer – try to direct magnifier over better sighted eye.
   ◦ Becomes a problem if it is not the dominant eye.
Stand Magnifiers

1. Give patient both the magnifier and reading material.
2. If using a lower powered magnifier – may be much bulkier – set reading material up on reading stand or on table.
3. Tell patient to place the magnifier directly on the reading material.
4. Theoretically need add in place for full appreciation of device.
5. Counsel patient that the closer they bring the system to their eye – the greater the field of view.
6. If bringing magnifier closer – try to direct magnifier over better sighted eye.
Example...

An 85yo lady with ARMD wishes to be able to read the newspaper. Her CPS is 3M. Her threshold acuity is 1.6M. Her habitual working distance is 20cm but is using a +3.50 add. She has a +2.00D hyperopia in the better eye.
Example continued...

Need to first **calculate** mag required:
Target print size for newspaper is 1.0M.

\[
\text{Mag} = \frac{\text{CPS}}{\text{target print size}}
\]
\[
= \frac{3\text{M}}{1\text{M}}
\]
\[
= 3x
\]

**OR**

Mag = 2x Threshold acuity/target print size
\[
= \frac{1.6\text{M}}{1\text{M}} \times 2
\]
\[
= 3.2x
\]
Example continued...

Then need to calculate estimated power.

\[
\text{EVP} = \text{Mag} \times \text{working distance (D)}
\]

\[
= 3 \times (1/0.2)
\]

\[
= 3 \times 5
\]

\[
= 15 \text{ D}
\]
Example continued...

Choose device and trial

Microscope = EVP

= 15D

◦ Need to take into consideration her Rx of +2.00D
◦ Need to demonstrate a microscope with ~ 17D if pre-fabricated
Example continued...

Hand Magnifier = EVP
= ~15D

Stand Magnifier with transverse magnification = 3x

If magnifier with exact EVP or mag does not exist, I start with the closest power that is a little lower than estimated.

For this example, I would start with a magnifier with F=+12D
Near

PRE-PRESBYOPIEIC PATIENT
Determining Optimal Near Magnification Device for Patients WITH Active Accommodation…(courtesy of S. Leat)

- Children and young adults often use relative distance magnification – use very short working distance.
- This often causes accommodative stress.
  - Can only read for short period of time
  - Experience increased visual fatigue
  - Symptoms of eye strain/ headaches
- Prescribing an add can help relieve this stress.
- Adds can also be prescribed if patient is not able to read target print size even with the shorter working distance.
Determining add power...

1. Use information gathered throughout assessment.

Determine target print size

- From case history
- For children:  K – G1  Target 3.2-4M
  - G2- G3  2.5M
  - G3- G6  1.6M
Determining add power...

Near acuities.
- CPS
- Threshold
- Habitual working distance

2. Calculate expected amplitude of accommodation for patient’s age
   - Remember patients with low vision often have reduced accommodation (but not always!)
   - Use formula for minimum accommodation.
     - Amplitude = 15 – ¼(age)
   - Able to use half of this amount. Need to leave half in reserve.
Determining add power...

3. Calculate add.
   ◦ Add = habitual working distance (D) – ½ amplitude of accommodation

4. Remeasure acuities.

If patient is able to read target print size comfortably --- This is the final add.
If not comfortable achieving target acuity...

1. Determine magnification needed to read target print:
   - Mag = New CPS/target print size
   - OR
   - Mag = 2x New threshold/target size
2. Determine new working distance required to achieve this.
   ◦ Remember relative distance magnification.
   ◦ New working distance = old \( w_d \)/ \( mag \)

3. Calculate new add.
   ◦ \( Add = \text{new working distance } (D) - \frac{1}{2} \text{ amplitude of accommodation} \).
Stand magnifiers

- Alternatively try a stand magnifier with $T_M = \text{calculated mag required}$.
- and a high emergent vergence
Example...

10yo child with oculocutaneous albinism working at a grade 4 level.
CPS is 5M and threshold acuity is 2.5M in the better eye with a habitual working distance of 12cm.

1. Calculate expected amplitude of accommodation.
   ◦ $\text{Ampl} = 15 - \frac{1}{4} \text{age} = 15 - \frac{1}{4} (10) = 12.5 \text{D}$
   ◦ Therefore, with leaving half in reserve – able to use 6.25D
Example continued...

2. Calculate add.
   ◦ Add = working distance (D) – ½ ampl of accommodation
     = 1/0.12 – ½(12.5)
     = 8 – 6.25
     = 1.75 D

3. Remeasure acuities.
   ◦ Patient now able to read CPS=4M and threshold = 2M
Example continued...

4. Determine mag required to read target print (~1.6M for Grade 4)
   ◦ Mag = new CPS/target = 4M/1.6M = 2.5x
   OR
   ◦ Mag = new threshold/target x 2
   = 2x 2M/1.6M = 2.5x
Example continued...

5. Determine new working distance required to achieve this.
   ◦ New \( wd \) = old \( wd / \text{mag} \)
     \[ = \frac{12}{2.5} \]
     \[ = 4.8 \text{cm} \]

6. Calculate new add.
   ◦ Add = new \( wd \) (D) – ½ ampl acc
     \[ = \frac{1}{0.048} - \frac{1}{2}(12.5) = 20.8 - 6.25 \]
     \[ = 14.5 \text{D} \]
   ◦ Would need to demonstrate monocularly since >+4D.
Example continued...

OR can choose to try stand magnifier instead of increasing the add:

• Choose stand mag with tranverse magnification = to magnification determined = 2.5X
Remember when prescribing an add, using estimated amplitude of accommodation.

Patient may have more than calculated.

May not need as high an add.

If child is reading smaller than CPS or is holding print even closer than habitual working distance – this may be the case.

Decrease add appropriately.
Recording...

- Recommend record everything demonstrated. Not just the devices that worked the best.
- Record acuity obtained with each device.
- Record patient’s impression of each device.
Remember-
- If trials do not work out as anticipated, reading involves more than just acuity
- Contrast sensitivity
- Scotomas – eccentric viewing ability
- Fields
You are on your way to development of rehab plan!