Low Vision Optometric Examination

Optometry, School of Medicine, Deakin University

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Deakin University CRICOS Provider Code: 00113B

Outline

History

Begin before the consultation by observing appearance, mobility and posture from the waiting room to the examination room.

For the patient with low vision, your history should be...

Task and goal oriented

What would the patient like help with?

What practical functions and tasks do they need help with?

Person centred

What is important to the patient?

What is most important?

How independent do they want to be?

Respect their needs and decisions.

By the completion of the case history, the clinician should have an impression of the patient's objectives and goals, whether or not they are realistic, the patient's reaction to the vision loss, and discern how much time to spend with the patient.

Examiner should sense what can and cannot be covered during the initial evaluation without fatiguing the patient.

I. Ocular History

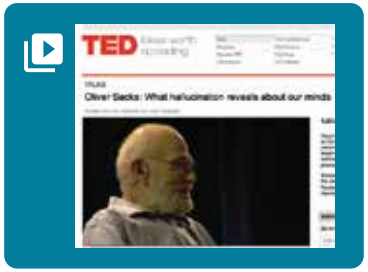
- Diagnosis and onset of symptoms
- Current ophthalmologist
- Past, current, or planned surgeries or treatments
- Stability of vision
- Family history of eye disease
- Previous history of eye disease or vision problems
- Current or previous use of spectacles, contact lenses, or low vision aids
- Patient's understanding of vision condition and implications for functioning.

II. Visual Functioning

- Ability to read print and specific reading needs
  (e.g., newsprint, bank statements, bills, magazines, medication labels, food product/nutrition labels)
- Other near visual abilities and needs
  (e.g., writing, sewing)
- Intermediate visual ability and needs
  (e.g., recognising faces, use of computer, reading music)
- Distance visual ability and needs
  (e.g., recognising faces, television)
- Activities of daily living
  (e.g., cooking, grooming, cleaning, using a phone, telling time)
- Independent travel ability and needs
  (e.g., driving and use of public transportation)
- Photophobia, glare sensitivity, dark and light adaptation, and lighting requirements

www.ted.com/talks/oliver_sacks_what_hallucination_reveals_about_our_minds.html

III. Medical History



- General health review
- Current medications
- Name and contact details of GP
- Hearing impairment or other impairments
- Falls
- Visual hallucinations – Charles Bonnet Syndrome

> - *Formed visual hallucinations due to disturbances of vision in patients who are otherwise mentally normal*
> - *Usually older persons*
> - *Under-reported by patients for fear of negative consequences and often under-diagnosed*
> - *Some see colored shapes or organized patterns or they may even see vivid images of people, animals or flowers*
> - *Unless asked most patients will not inform their clinician, despite the fact that they are concerned about why they are experiencing this*
> - *Patients very reassured when the nature of the hallucinations is explained to them*
> - *28% of patients cease to experience these hallucinations after 1 year (Jackson and Bassett, 2010).*

- Psychological considerations
  (e.g., denial, depression, codependency, or suicidal tendencies)
  e.g. Patient Health Questionnaire-2 (PHQ-2; Kroenke et al., 2003)

During the past 2 weeks, how often have you been bothered by feeling down, depressed or hopeless?
During the past 2 weeks, how often have you felt little interest or pleasure in doing things?

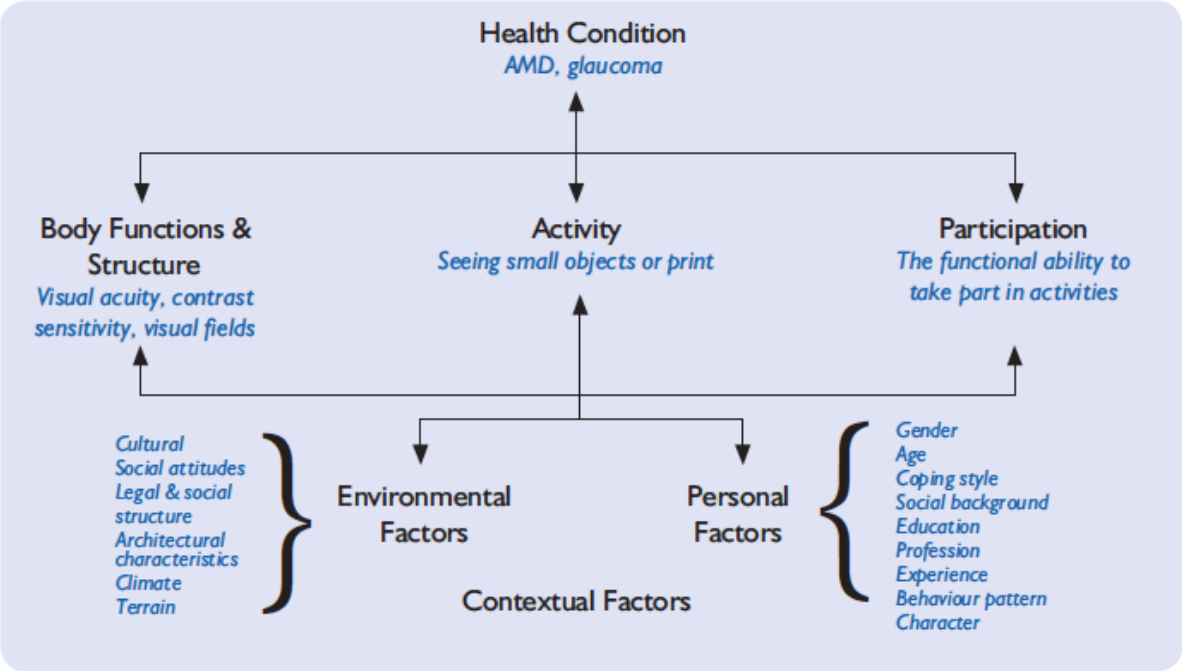
IV. Social History

- Living arrangements *(e.g., lives alone, assisted living etc.)*
- Support systems
- Family interactions
- Employment issues
- Educational concerns
- Recreational concerns
- Pensions or benefits

V. Specific Goals or Needs

- Needs as stated by the patient
- Needs as determined by the history
- Needs as identified by the employer, teacher, family, or caregiver
- Realistic patient goals

(an ongoing process developing during the course of the examination and exploration or rehabilitation options)



Intake form for low vision organisation

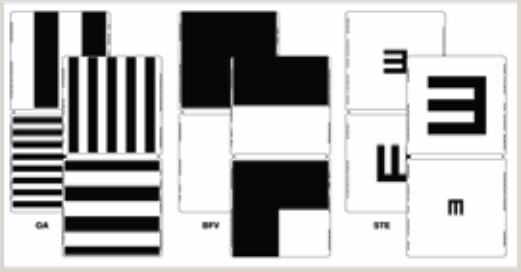
Assessment details				
Date:				
Optometrist name:				
Appointment type:	Initial	Long Review	PUS	Review
Medicare billed:	10905	10914	10918	10942
	HPG Clinic – items recorded but not billed to Medicare		None – dispensing only	
History				
Diagnosis one:				
Diagnosis two:				
Diagnosis three:				
History				
Client Needs				
Reading Needs – tick only those needs that are relevant:	Personal mail/bills	Newspapers	Magazines	Books/text books
	Large Print books	Price tags/labels	Computer screen	
Writing Needs – tick only those needs that are relevant:	Writing letters	Writing notes, shopping lists	Crosswords, Puzzles	Filling out forms
	Cheques	Signature		
Distance Activity needs – tick only those needs that are relevant:	Signs, traffic signals, train/plane indicator boards	Bus/tram numbers	Overhead projectors, Powerpoint presentations	
Glare needs – tick only those needs that are relevant:	Sensitivity to glare – outdoors	Sensitivity to glare - indoors		
Lighting and Adaptation needs : tick only those needs that are relevant:	Lighting poor at home	Lighting poor at work	Lighting poor at school	Difficulty seeing at night/in the dark
	Difficulty adapting to changes in lighting			
Information needs – tick only those needs that are relevant:	Eye condition	Visual hallucinations	Driving	Benefits and entitlements
Social/Recreation needs – tick only those needs that are relevant:	Recognising faces	TV	Craftwork (specify below)	Sport (specify below)
	Theatre, galleries, museums (specify below)			
Other comments/needs (specify):				

Vision measurement

- Measure precisely using a logMAR chart
- Test R and L and binocularly
- Unaided and habitual
- No count fingers (CF) (or hand movements [HM])!!! This is approximately equivalent to 1/60 and measurable
- Move the chart to a closer distance, preferably a distance consistent with the logMAR progression of letter sizes e.g. 3 m, or 2.4 m or 95 cm (~1 m)
- If not able to see any letters on a chart at 1 m, test using Berkeley Rudimentary Vision Test (BRVT) or for 'light projection' and if no response, 'light perception (LP)' before deciding a patient has 'no light perception (NLP)'

Vision measurement

- If the patient was not able to see the 60 m letter at 6 m, record the test distance / letter size read
- e.g. If the patient could see 60 m letters at 3 m, this would be 3/60, which is equivalent to 6/120
  (This is determined by asking 3 x ? = 6, answer 2, so 2 x 60 gives 120; hence 6/120)
- Or count steps on logMAR progression; 3 to 6 is 3 steps and counting 3 steps from 60 gives 120; hence 6/120
  (x1.26 progression)



Berkeley Rudimentary Vision Test

SINGLE TUMBLING E CARD-PAIR: *used at viewing distances of either 1 meter or 25 cm.*

This has 4 Single Tumbling E's as the test targets. The STE letter sizes are 100M and 25M on the outsides, and 63M and 40M on the insides. The patient identifies the direction in which the legs of the E are pointing. (up, down, right, left)

At 1 meter, the STE visual acuity levels are STE LogMAR = 2.0. 1.8, 1.6 and 1.4
(VAR = 0 to 30, 6/600 to 6/150, 20/2000 to 20/500, or 0.01 to 0.04)

At 25 cm, the STE visual acuity levels are STE LogMAR=2.6. 2.4, 2.2 and 2.0
(VAR = -30 to 0, 6/2400 to 6/600, 20/8000 to 20/2000, or 0.0025 to 0.01)

GRATING ACUITY CARD-PAIR: *used only at a viewing distance of 25 cm.*

This has 4 gratings as the test targets. The size of the stripes are 200M and 50M (60 &15 mm) on the outsides, and 125M and 80 M (38 & 24 mm) on the insides. The patient identifies the orientation of the stripes. (horizontal or vertical)

At 25 cm, the Grating Acuity levels are GA LogMAR=2.9. 2.7, 2.5 and 2.3
(VAR = -45 to -15, 6/4800 to 6/1200, 20/16000 to 20/4000, 0.00125 to 0.005, or 0.038 to 0.15 cpd)

BASIC VISION CARD-PAIR: *used only at a viewing distance of 25 cm.*

Black White Discrimination (BWD)
When folded one way, one of the card surfaces is all black, and the reverse side is all white.
This tests whether the patient can discriminate an all-black from an all-white field of this angular size (53° square)

White Field Projection (WFP)
When folded the other way, one card face is half-black and half-white, and the other card face is black with one white quadrant. This tests whether the patient can identify the direction or location of the white field as being to the left, right, top or bottom for the 26° wide hemi-field, or the 26° square quad-field.

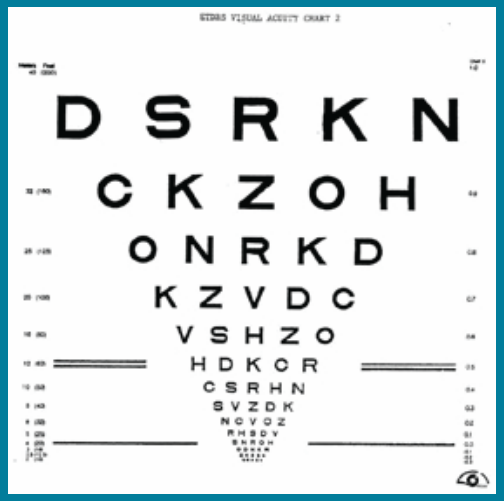
Bailey IL, Jackson AJ, Minto H, Greer RB, Chu MA. The Berkeley Rudimentary Vision Test. Optom Vision Sci 2012. 87;9:1257-1264.

Conversion Table for Visual Acuity Scores

MAR*	LogMAR	VAR	Snellen (metric)	Snellen (imperial)	Decimal*
0.50	−0.30	115	6/3	20/10	2.0
0.63	−0.20	110	6/3.8	20/12.5	1.60
0.80	−0.10	105	6/4.8	20/16	1.25
1.00	0.00	100	6/6	20/20	1.00
1.25	0.10	95	6/7.5	20/25	0.80
1.60	0.20	90	6/9.5	20/32	0.63
2.0	0.30	85	6/12	20/40	0.50
2.5	0.40	80	6/15	20/50	0.40
3.2	0.50	75	6/19	20/63	0.32
4.0	0.60	70	6/24	20/80	0.25
5.0	0.70	65	6/30	20/100	0.20
6.3	0.80	60	6/38	20/125	0.16
8.0	0.90	55	6/48	20/160	0.125
10.0	1.00	50	6/60	20/200	0.10
20	1.30	35	6/120	20/400	0.05
40	1.60	20	6/240	20/800	0.025
100	2.00	0	6/600	20/2000	0.01

*Numbers rounded to simplify sequences.
MAR, minimum angle of resolution; VAR, visual acuity rating.

From Elliott DB. Introduction to the primary eye care examination. In: Elliott DB ed. Clinical Procedures in Primary Eye Care. 3rd ed. New York: Elsevier/Butterworth Heinemann; 2007:33. See also Bailey IL. Visual Acuity. In: Borish, W. J. (ed). Borish's Clinical Refraction. 2nd ed. St Louis: Butterworth Heinemann; 2006: 222.



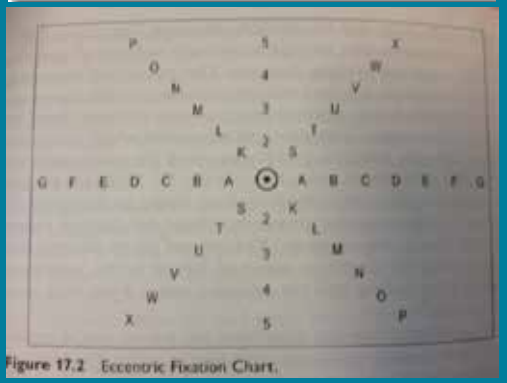


Figure 17.2 Eccentric Fixation Chart.

Eccentric viewing

- Patients with central vision loss, such as from AMD, need to use eccentric fixation when viewing (i.e. use an intact more peripheral retinal location for viewing, called the preferred retinal locus [PRL])
- Many do this very successfully, even without training
- You will see them moving their head or looking in a particular eccentric direction when reading the distance VA chart
- Patients can benefit from being given an understanding of how different areas of the retina perform, followed by a practical demonstration to find which area(s) perform best for them, in each eye

> - Explain that only the macula gives 6/6 VA, which drops with distance from the macula
> - Mapping the central scotoma on the Tangent screen can help the patient to understand their central scotoma
> - Use an eccentric fixation chart

- Patient asked to look directly at the central target, which should disappear in the case of a patient with central vision loss, and report which character or characters are clearest
- This establishes the direction and angle of eccentricity required
- Patient is then asked to fixate centrally on an identical character diametrically opposite their chosen character; this character will now disappear into their scotoma, and the central target should come into view
- Do binocularly and monocularly
- Patient can then be trained to use eccentric viewing in any context, including reading (Palmer et al.,Br J Ophthalmol 2010; Seiple et al., Invest Ophthalmol Vis Sci 2011)
- However, evidence for such training is limited (Stelmack et al., J Rehabil Res Dev 2004)

Binocularity

Most low vision patients lack the highest form of binocularity (stereopsis)

It is important to evaluate if the patient has motor and sensory binocularity

- Ocular motility
- Convergence
- Cover testing
- Worth 4 dot test
- Maddox rod
- Stereopsis

Refraction

Retinoscopy

- Essential starting point to minimise fatigue by difficult and often long subjective refraction
- Indicates clarity of ocular media
- Radical retinoscopy: almost totally darkened room and close working distance to improve image brightness may help, but ensure you compensate for the working distance used
- Full aperture trial lenses useful

Trial frame refraction

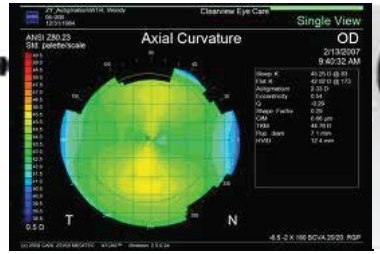
- Trial frame with use of full aperture lens allows you to assess eye movements and fixation of patient (also easier for Px to eccentrically fixate)
- Vertex distance, pantascopic tilt, horizontal and vertical centration should be optimal and resemble the final prescription
- Halberg clips over high power corrective spectacles can be used to perform an over-refraction

Trial frame refraction

- Use consistent and clear terminology; patience and encouragement a must
- Start with large steps (±2.00/±4.00 D)
- Reduce steps as appropriate depending on VA and patient confidence
- Rarely any point using ±0.25 D steps for a patient with low vison
- Use higher power JCC (±0.75/±1.00); but lower powers where cyl axis and power is nearly correct; work in 20o steps to start and ±1.00 D power steps
- An improvement of two logMAR lines or more is likely to be worth prescribing, at any level on the chart (Bailey, Optometric Monthly, 1978)
- Perhaps conclude with PH check, keeping in mind that those with central scotomas will find this test difficult

Keratometry / corneal topography / stenopaic slit refraction / fan and block / high cyl for patient to rotate

- May occasionally assist with determining high astigmatic refractive errors



Near vision evaluation

Near VA measurement

- Record habitual near VA and VA with +4.00 D addition
- +4.00 D chosen arbitrarily, as it provides unit magnification when the object is placed at 25 cm
- Adequate auxillary lighting should be available
- Note should be taken of both reading speed and accuracy
- Record monocular and binocular near VA (NVA better or worse with 2 eyes?)
- A number of methods are available for calculating the near add required to achieve a given acuity
- However, actual acuities achieved are often slightly poorer than predicted
- Most methods are based on enlargement ratio (near VA recorded through a given add / near VA required)

Near / reading VA measurement

- For 'fluent' reading, the patient with low vision needs to be presented with text that is ~2 times larger and 10 times higher in contrast than at threshold, which can be done through magnification and lighting (Lovie-Kitchen, 2011)
- So we need to provide sufficient enlargement so that the patient has 'acuity reserve' of 2 to 3 logMAR lines

Reading performance with magnification	Minimum acuity reserve	Required threshold size to read N8	Required threshold size to read N20 (large print)
Spot	1.3:1 (1 line)	N6	N16
Fluent	2:1 (3 lines)	N4	N10
Maximum or near maximum	3:1 (5 lines)	N2.5	N6

Bailey IL, Jackson AJ, Minto H, Greer RB, Chu MA. The Berkeley Rudimentary Vision Test. Optom Vision Sci 2012. 87;9:1257-1264.

Charts

logMAR / N print
Word acuity (Bailey-Lovie Chart)
Continuous text (MN Read chart)

Near visual acuity conversion table (40 cm)

Table 3.3 Near visual acuity conversion table.

N-scale	M-units	Equivalent Snellen (imperial)	Equivalent Snellen (metric)	Common usage
2.5	0.32	20/16	6/5	
3	0.40	20/20	6/6	Medicine bottle labels
4	0.50	20/25	6/7.5	Medicine bottle labels
5	0.60	20/30	6/9	Footnotes, bibles
6	0.75	20/40	6/12	Telephone directories
8	1.0	20/50	6/15	Newspaper print
10	1.2	20/60	6/18	Magazines, books
12	1.6	20/80	6/24	Books
16	2.0	20/100	6/30	Children's books
20	2.5	20/125	6/36	Large print books
25	3.2	20/160	6/48	Large print books
32	4.0	20/200	6/60	Sub-headlines
40	5.0	20/250	6/75	Sub-headlines

Numbers rounded to simplify sequences.

From Elliott DB. Introduction to the primary eye care examination. In: Elliott DB ed. Clinical Procedures in Primary Eye Care. 3rd ed. New York: Elsevier/Butterworth Heinemann; 2007:40. See also Bailey IL. Visual Acuity. In: Borish, W. J. (ed). Borish's Clinical Refraction. 2nd ed. St Louis: Butterworth Heinemann; 2006: 222.

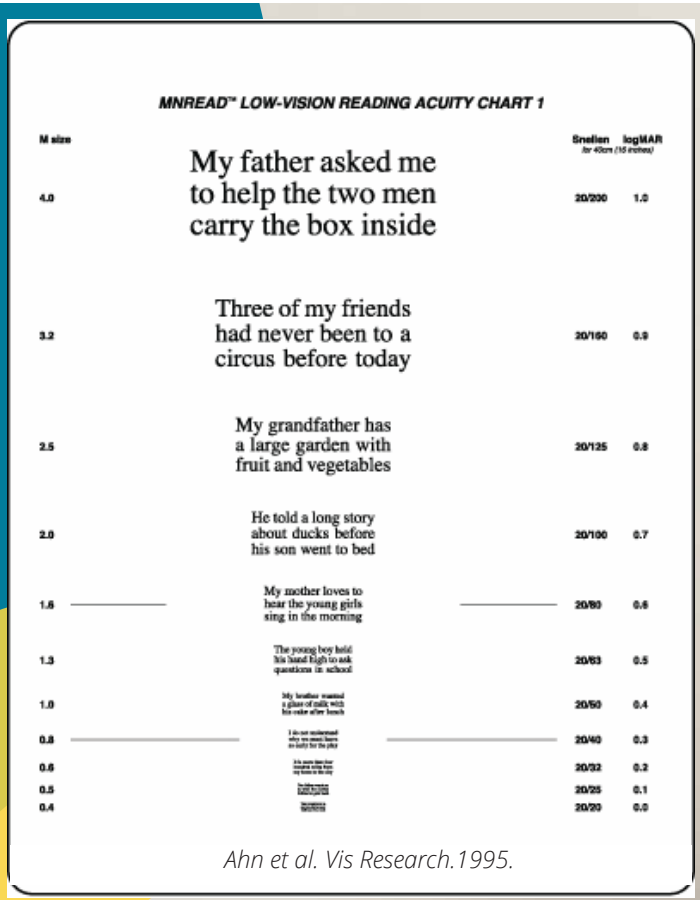
Reading distance (cm) Equiv distance	Dioptres Equiv power	Enlargement ratio (magnification) (at 40 cm)	(at 25 cm)
50 cm	2.0	0.8	0.5
40	2.5	**1.0**	0.63
32	3.2	1.25	0.8
25	4.0	1.6	**1.0**
20	5.0	2.0	1.25
16	6.25	2.5	1.6
12.5	8.0	3.2	2.0
10	10	4.0	2.5
8.0	12.5	5.0	3.2
6.3	16	6.3	4.0
5.0	20	8.0	5.0
4.0	25	10.0	6.3
3.2	32	12.5	8.0
2.5	40	16.0	10.0
2.0	50	20.0	12.5

Table 3. Columns 1 and 2 link reading distance with dioptric power of a near spectacle lens addition or accommodation demand F_e. Columns 3 and 4 show ER for the two commonly used reference distances, 40 cm and 25 cm, when a closer reading distance is required for a larger F_e. Dioptric power and ER increase in 1.26x steps.

N print (points)	M units (Sloan)	logMAR (40 cm)	(25 cm)	'Equivalent' VA (@40 cm)	(@25 cm)
80	10.0	1.4	1.6	6/150	6/240
64	8.0	1.3	1.5	6/120	6/190
50	6.3	1.2	1.4	6/95	6/150
40	5.0	1.1	1.3	6/75	6/120
32	4.0	1.0	1.2	6/60	6/95
25	3.2	0.9	1.1	6/48	6/75
20	2.5	0.8	1.0	6/38	6/60
16	2.0	0.7	0.9	6/30	6/48
12.5	1.6	0.6	0.8	6/24	6/38
10	1.25	0.5	0.7	6/19	6/30
8.0	1.0	0.4	0.6	6/15	6/24
6.3	0.8	0.3	0.5	6/12	6/19
5.0	0.63	0.2	0.4	6/9.5	6/15
4.0	0.5	0.1	0.3	6/7.5	6/12
3.2	0.4	0.0	0.2	6/6	6/9.5

Table 4. The progression of print size and logMAR scores for the Bailey-Lovie near reading card viewed at 40 cm and 25 cm. Equivalent Snellen fractions are also shown for these viewing distances.

Bailey, IL and Lovie, JE. Am J Optom Physiol Opt .1980.



Ahn et al. Vis Research.1995.

Determination of equivalent power / enlargement

- Measure near VA at 25 cm with +4.00 D addition
- Determine how many steps of increase in print size are needed to reach the goal NVA
- Increase near add and decrease reading distance by the same number of steps (or two to three more to allow for spare capacity and more fluent reading (Table 3 previous slide)
- Counting from 1.0 for 25 cm, use this same number of steps to determine the enlargement provided at the new reading distance in Table 4
- Note similarity between progression of point size, reading distance, dioptric power and VA in Tables 3 and 4, so all we need is the one set of numbers printed on the reading card

Figure 6A. OAA logMAR near visual acuity card

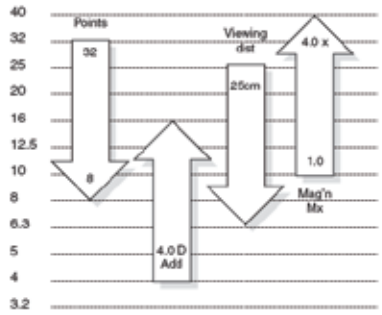


Figure 6B. How equal 'steps' of change in point size, near spectacle lens addition, viewing distance and magnification are related. In this example, our patient reads N32 at 25 cm with +4.0 D, but goal VA is N8. The arrows indicate the six steps to N8 print: add +16 D at 6.3 cm giving magnification of 4x.

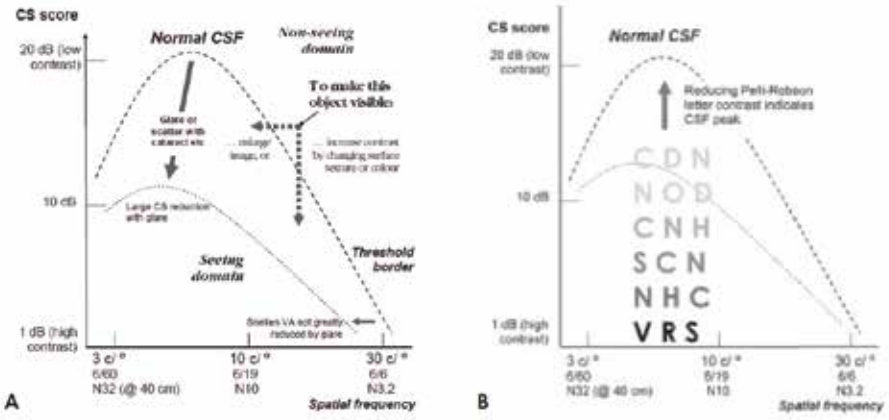
Johnston AW. Low Vision Primer. Pharma. Carlton VIC, OAA: 2013

Contrast sensitivity

Vast majority of our visual interaction with the world involves resolving low contrast detail (e.g. newsprint, gutters, steps).

Our sensitivity to a contrast task is dependent on task luminance, glare, retinal adaptation level, intraocular scatter, as well as task size.

Contrast Sensitivity; better test of visual function than visual acuity, predicts illumination, contrast and magnification need, also helps predict success with optical devices.



Figures 9A and 9B. Gratings targets that vary in spatial frequency and contrast give the characteristic inverted 'U'-shaped curve. The graph shows how changing target size, target contrast and target illuminance interact to improve vision.

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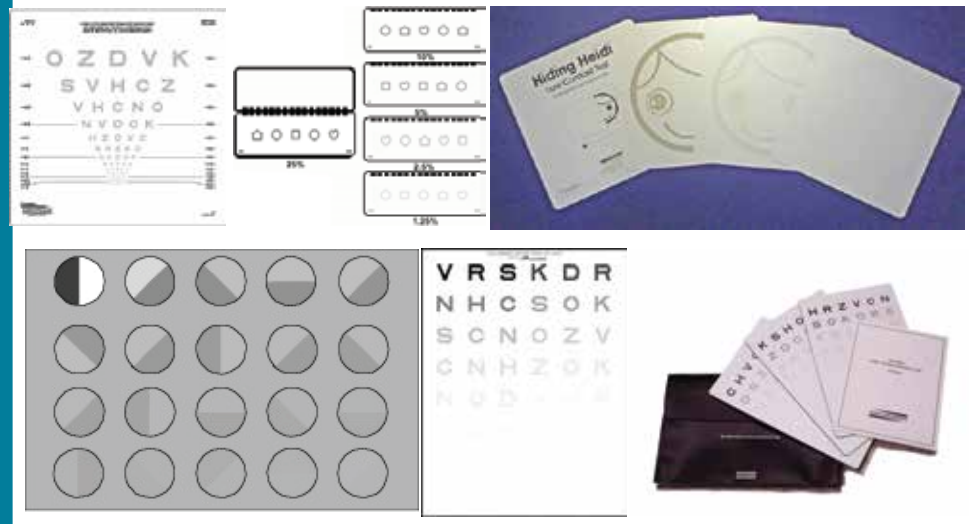
Contrast sensitivity

Peak of CS curve

Pelli-Robson Chart (logCS units; 1 m; Pelli and Robson, 1988)
Melbourne Edge Test (dB; near; Verbaken and Jacobs, 1985)
Mars Test (log CS; near; Arditi 2005)

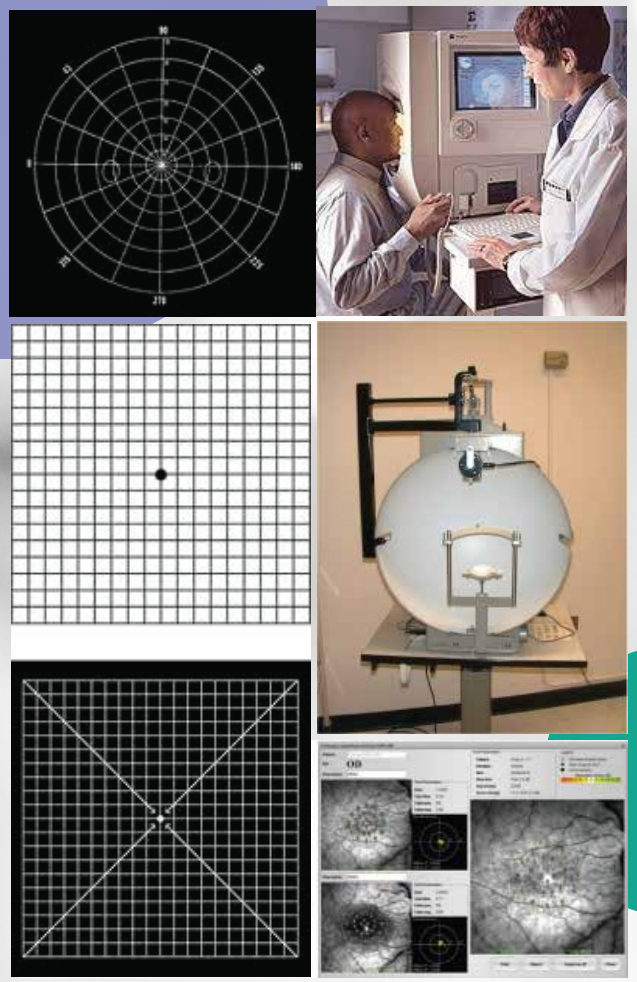
Other contrast tests

- ***10% Weber contrast***
- ***Lea Symbols***
- ***Computer-based***
- ***Hiding Heidi***



Haymes and Chen, OVS 2004; Haymes et al., IOVS 2006

Visual fields



In conventional primary optometric care settings, visual fields are usually assessed to detect early disease (e.g. glaucoma), or progression of disease.

In low vision care settings, visual fields are assessed to determine magnitude of loss and, to equate functional loss with disability (visual field loss is associated with reduced orientation and mobility [Haymes et al., 1996; Lovie-Kitchin et al., 2010]). What test will tell you the most about how the patient functions in the real world.

Simple suprathreshold visual field tests are preferred for assessing functional vision.

Confrontation
Tangent screen
(central visual fields, may need large fixation target or cross to assist with fixation)
Goldmann perimeter
(full visual fields)
Humphrey and Medmont
(full visual fields, screening strategies, Esterman)

- Amsler grid (for evaluating subjective quality of central field for reading)
- Central automated programs can be useful for mapping the size of the central scotoma in some patients (e.g. Humphrey central 10-2)
- Microperimeters map the pattern of a patient's retinal sensitivity onto an image of that individual's fundus. They measure the patient's response to light stimuli at various retinal points and superimpose that data on an image captured by scanning laser ophthalmoscopy (SLO) or fundus photography to precisely identify areas of impaired or preserved function, helpful in identifying the PRL.

Colour vision

Colour matching tests are most appropriate for patients with low vision to detect and differentiate acquired colour vision losses

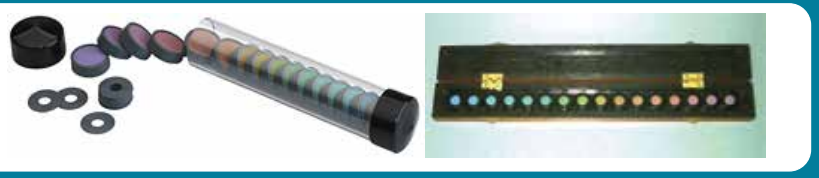
- Farnsworth Panel D15
- Jumbo D15 of PV16

Remember an acquired defect might be imposed on a congenital defect.

Advice on the nature of any defect and how to compensate is invaluable (e.g. avoid certain pairings in colour coding etc.).

Demonstrate devices

- Having gained an understanding of the patient's visual function and determining the equivalent viewing power or enlargement required, demonstrate low vision devices that might be appropriate for the target goals and tasks.
- Be patient with the patient! Try to get them to be patient with themselves (devices require practice).
- Explain the advantages and disadvantages of various devices.
- Take time to provide clear instructions.
- Demonstrate using the goal task (e.g. newsprint, medicine label etc.).
- Remember to address glare problems. If the patient would like sunglasses for outdoors, take him or her outdoors to find the suitable transmission and colour.



Options

Distance vs. intermediate vs near tasks

- Spectacle magnifiers
- Hand magnifiers
- Stand magnifiers
- Telescopes
- Electronic vision enhancement
- Glare filters
- Lighting

Low vision management needs to be put in context with the overall health of an older person. Those with cognitive impairment may not be able to manage devices and might do better with practical, large high contrast solutions. Those with Parkinson's may benefit from a stand magnifier.

Ocular health

Ocular health remains important.

- Ensure an accurate and thorough diagnosis has been made
- There can be more than one problem
- Ocular health can change!
- Do not assume someone else is managing the problem
- Ensure the patient understands the need for regular ocular health reviews

- Anterior eye examination
- Ocular fundus examination
- Tonometry

Management and follow-up

- Create a goal oriented management plan
- Explain fully to patient and carer/s
- Provide information
- Report to ophthalmologist and GP where appropriate
- Refer to a low vision organisation if other services are required and the patient would like them
- Schedule the patient for review – follow up!
- If the prognosis for optometric management is poor, if the patient has unrealistic goals, are poorly motivated, has dementia, then withdraw gracefully. Leave the door open for them to return when circumstances change or their acceptance of the situation improves.
  (Johnston, 2013)

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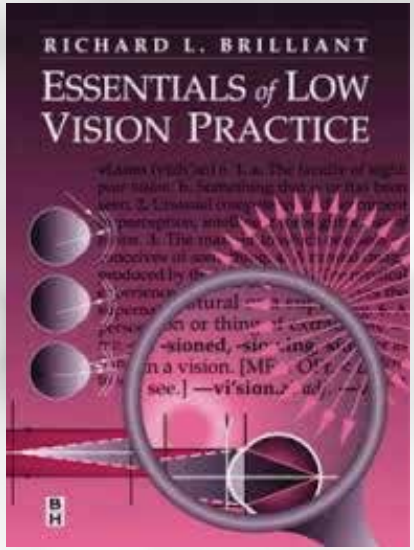

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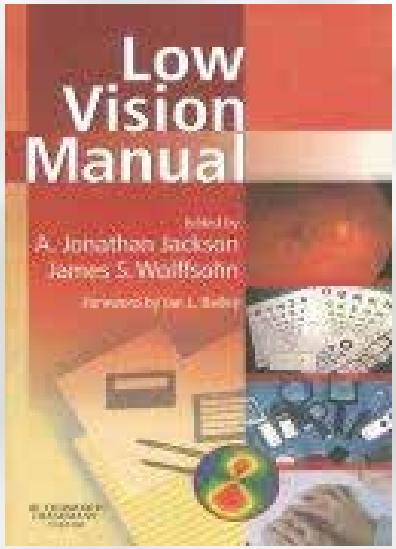

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