

A practical approach to the management of low vision in the domiciliary setting.

Paper Two: Assessing & Prescribing Magnification

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Paper Two: Assessing & Prescribing Magnification

Introduction:

As with any eye examination, whether it be within a consulting room or within the domiciliary setting, is important to follow a well-constructed and methodical routine. We need to determine what it is that the patient wants to be able to do, and then take appropriate actions to meet those needs. This may include prescribing magnification, giving advice on lighting, or discussing further referral onto social services for rehabilitation strategies and daily living skills.

Setting Expectations

It is important to set expectations from the start. Ultimately, all low vision devices are a compromise to an individual who has previously had 'normal sight', and their use will be determined by the way in which the practitioner manages the consultation, the degree of patient motivation and of course, the patient's level of visual acuity.

Many low vision practitioners use questionnaires in advance of the assessment. Low Vision Quality of Life (LVQOL) questionnaires (Fig 1) have been in use for several years and may be posted out to the patient and their family in advance of the consultation. Practitioners may develop their own questionnaire based in line with their own patient base such as those patients who require domiciliary eye care.

It is also important to establish the patient's own level of understanding of the assessment and potential use of low vision devices. All too often a patient has the expectation of 'stronger glasses' and may need encouragement to consider using, for example, a hand held device. This is particularly important in those patients with dementia who have not previously used an aid.

A broad opening question gives the patient the opportunity to discuss their understanding of the service you are offering.

- *How do you think I can help you today?*

A significant loss of visual function will have impacted upon the patient's lifestyle. Build a picture of specific needs that may have arisen as a result.

- *Can you describe to me what sort of problems you have been having since your vision deteriorated?*
- *Do you live alone?*
- *How do you occupy the day?*
- *What level of assistance or support do you currently receive?*
- *Are you able to see the television from your chair?*

Establish the level of importance of each task discussed. For example, the inability to see the cooker dials may not hold any significance to a patient who lives within a care home where all meals are provided for. However be watchful of those patients who have become isolated as a consequence of their condition or as a result of poor advice and information.

Determine stability of the condition

Establish how well the patient understands their condition. If a patient believes that pending treatment will reverse rather than stop the progression of the disease process, then they may not be willing to use a device. The stability of a condition will also influence the type of aid given. For example, it may be inappropriate to dispense a complex aid if the patient is to undergo surgery in the next month.

- *Can you tell me what you know about your condition?*
- *How long has this been affecting you?*
- *Has it changed recently?*
- *Can you tell me what treatment you have already had?*
- *Do you have any further hospital appointments?*
- *Do you have any pending treatment?*
- *Have you been discharged from the hospital?*

Determine previous registration and social service communications

- *Have you been certified severely sight impaired or sight impaired?*
- *Have you had a visit from social services?*
- *What did they do for you?*
- *Did you find the advice/information/equipment useful?*

Perform a detailed task analysis: assessment of needs

Not all patients need to read the equivalent of N5 print. Some may only be interested in reading large print books for example. So a clear assessment of needs, to include the size, quality (e.g. contrast) and working distance of the task is important when considering how much magnification to prescribe.

- *What size of print can you manage to see at the moment?*
- *What size of print do you need to be able to see?*
- *What size of print would you like to be able to see?*
- *Can you describe to me the task in more detail?*
- *Where do you read this printed task?*
- *What lighting do you use?*

Review current aids in use

Ask to see all current spectacles and low vision aids during the assessment, whether they are in use or not. Often by simply increasing the addition in their current

spectacles, they may be able to use the aid they already have more efficiently.

- *Have you tried using a magnifier?*
- *Where/from whom did you get it?*
- *Did you find it useful?*
- *What can you manage to do with it?*
- *What can you not manage with it?*
- *Has your vision worsened since you were prescribed or bought the device?*
- *Can you show me how you use it?*
- *Do you use it with or without your spectacles?*

Establish the acuity reserve

Tasks can be categorised as either a spot task or a fluent reading task:

- Packets and sell by dates (*spot task*)
- Looking up a telephone number (*Spot task*)
- Newsprint and TV listings; novels, including large print books (*fluent reading task*)
- Post, letters and bank statements (*fluent reading task*)

Establishing the difference between the two is important, as this will have a bearing on the strength of magnification prescribed. For fluent reading tasks, patients require some acuity 'in reserve'. This acuity reserve is calculated as the ratio of the 'target acuity' (i.e. the size of print the patient is aiming to read), to the patient's 'threshold acuity' (the size of print that they can achieve with a device or spectacles).

For **spot tasks**, this acuity reserve ratio should be about 1:1.

Example: if the patient achieves N8 with their magnifier (threshold acuity), then they will be able to comfortably view an object of N8 size (target acuity). Working on threshold this way is sufficient for a brief view.

Note. Avoid prescribing excess levels of magnification. This will unnecessarily disadvantage the patient by reducing the working distance and field of view.

For **sustained reading tasks**, working on threshold becomes tiring. For comfortable viewing, an acuity reserve of 2:1 or 3:1 is recommended.

Example: if the patient is aiming to read a newspaper column of N8 print, then they should be able to achieve *at least* N4 print with their spectacles or low vision device.

Name _____

Date of Birth _____

Address _____

Date of Questionnaire _____



Distance Vision, Mobility and Lighting

How much of a problem do you have:	None	Moderate			Great	
With your vision in general	1	2	3	4	5	n/a
Getting the right amount of light to be able to see	1	2	3	4	5	n/a
With glare (e.g dazzled by car lights or the sun)	1	2	3	4	5	n/a
Seeing street signs	1	2	3	4	5	n/a
Seeing the television	1	2	3	4	5	n/a
Getting around outdoors	1	2	3	4	5	n/a
Crossing a road with traffic because of your vision	1	2	3	4	5	n/a

	Well	Poorly			Not Explained	
How well has your eye condition been explained to you?	1	2	3	4	5	x

Because of your vision, are you:	No	Moderately			Greatly	
Unhappy at your situation in life	1	2	3	4	5	n/a
Frustrated at not being able to do certain tasks	1	2	3	4	5	n/a

Reading & Daily Living Tasks

With your current glasses or magnifier, how much of a problem do you have:	None	Moderate			Great	
Reading large print (e.g. newspaper headlines)	1	2	3	4	5	n/a
Reading newspaper text and books	1	2	3	4	5	n/a
Reading labels (e.g. on medicine bottles)	1	2	3	4	5	n/a
Reading your letters and mail	1	2	3	4	5	n/a
Finding out the time for yourself	1	2	3	4	5	n/a
Writing (e.g. cheques or cards)	1	2	3	4	5	n/a
With your every day activities (e.g. house-hold chores)	1	2	3	4	5	n/a

Do you have any other concerns, not addressed by the previous questions?

Fig 1. A sample page from a simple Low Vision Quality of Life Questionnaire (LVQOL). Questions may be added or altered to suit the patient base or mode of practice.

Assessment of visual function

Some patients find a low vision assessment stressful, especially if there has been a recent drop in vision. Practitioners need to remain sensitive throughout the examination and it is important to keep any level of change in perspective. Test/retest repeatability is frequently inconsistent with advancing age and pathology and what may be perceived as a reduction in visual function by the patient may not be all that significant to the practitioner.

Recording LogMAR acuity

It is essential to be accurate. A small 'drop' in visual acuity caused by inaccuracy on the part of the practitioner, can easily be misinterpreted as a further loss in vision resulting from an underlying pathology.

LogMAR chart designs eliminate many of the inaccuracies of Snellen acuity charts, which are known to have limited value when testing patients with low vision. Furthermore, LogMAR charts are easily converted for use at different distances, and are therefore useful for patients within the domiciliary setting.

The Bailey-Lovie Word reading chart (Fig 2a) chart has all advantages of a logarithmic scale. It tests from N80 to N2 with a random selection of words, thus facilitating measurements of reading performance with a low vision device, as acuity reserve may be determined for those aiming for relatively small levels of print. However at the larger sizes there are a limited number of words available and therefore it is unfeasible to assess the quality of a patient's reading performance with this chart as the charts do not have blocks of text and use random words. Other charts widely used include the Keeler A-Series (Fig 2b) and MNREAD acuity charts.

The importance of measuring contrast sensitivity

Although an accurate measurement of near acuity is required for comparison between successive visits, many patients comment that the high contrast of the test chart ($\geq 90\%$) bears little resemblance to the quality of the print read at home. Most newsprint and paperback novels are printed in lower contrast (about 75%), which may be further reduced with age and use.

It is well understood that a single visual acuity measurement does not give a complete description of the patient's ability to detect large objects and low contrast in the real world. Contrast sensitivity function (CSF) is considered to be a more accurate measurement of a

patient's overall visual function. For example, a reduced sensitivity to contrast in a patient with an otherwise good Snellen acuity, may explain the difficulty that patient may have with steps and kerbs. The object may be large enough to detect, but the subtle difference in contrast between one step and the next may be below the patient's contrast threshold, and therefore the patient will be unable to see it.

The assessment of contrast sensitivity and the use of contrast reserve have also been shown to be of significant value in assessing the patient's reading performance and predicting the success of using low vision aids: the contrast of the print must be greater than the patient's own contrast threshold for comfortable viewing.

The **contrast reserve** is defined as the ratio between the print contrast and the patient's measured contrast threshold. For fluent reading tasks, a ratio of at least 10:1 is required, with 3:1 for spot tasks.



Fig 2a (top) The Bailey-Lovie Word reading chart Fig 2b (bottom) The Keeler A Chart. The A-System was originally designed to aid the practitioner in calculating the magnification required for low vision devices. One significant disadvantage is that the word separation does not bear resemblance to normal printed text.

Example: if a patient has a contrast threshold of 11%, and the contrast of the print that the patient needs to read is 75%, the contrast reserve will be ($75/11= 6.8$). As this is well below that estimated for sustained reading, the patient may find limited success. This patient, however, may benefit from an aid for spot tasks.

The traditional Pelli-Robson chart (Fig 3a) is considered to be a simple and efficient way to establish a patient's

contrast threshold. It is quick, simple to use and is easily understood by the patient.

Computerised versions are now widely available which makes them simple to incorporate within a domiciliary setting. (Figure 3b). Table 1 details the potential onward of patients who demonstrate low contrast sensitivity function measured in this way.



Figure 3a. A computerised version of a low contrast letter chart. Reproduced from the City 2000 PRO Computerised Test Chart (reproduced with permission, www.thomson-software-solutions.com)

Fig 3b Low Contrast letter Chart (application: Vision Pad) developed for the iPad by Roberto Iazzolino and Federico Bartolomei, www.eyetechnologiesgroup.com

Table 1 Evaluation of CSF Scores (% Contrast Sensitivity Score)

severe loss consider non-sighted	significant loss requires contrast enhancement	noticeable loss lighting evaluation	normal/near normal
90% - 31%	22% - 7.8%	5.6% - 1.9%	1.4% - 0.5%

Prescribing magnification for near tasks

Methods of calculating the required magnification vary between practitioners. However, most are based upon either of the two following methods:

Using the charts

There is a direct mathematical relationship between letter size notations on the Times New Roman Faculty of Ophthalmologists reading chart:

- N12 is half the size of N24
- N6 is half the size of N12
- N9 is twice the size of N4.5

Therefore it follows that if a patient sees N10 with their current spectacles then 2x magnification is required to see N5. Similarly, the Keeler A-Series (Fig 2b) several low vision near charts often give predicted magnification down one side of the text.

However, using the charts alone is not an accurate method to use when the visual acuity is poor. This method may be quick and useful for patients with relatively good distance and near acuities, or for those who are in for a follow-up appointment.

Using a methodical low vision 'routine'

The technique detailed below is will assess the magnification required for any given near task both quickly and efficiently. It gives a good foundation upon which the rest of the consultation is based. Every step by step of improvement with successive increased levels of magnification can be accurately monitored, which is important to follow in some conditions, such as macular degeneration

What is magnification?

In very simplistic terms, magnification is merely a method of comparison: a comparison between the sizes of two objects, or a comparison between one size of printed text with another

Alternatively, magnification may also be described as an increase in the size of the retinal image:

For example, if we cannot see the number plate of a car, we move up closer to it. If, say, we move in half the distance closer, then the size of the retinal image will increase by a factor of 2. This is termed 'relative

distance magnification' where we compare the distance of where we originally started (the old object distance), to the distance to which we move to (the new object distance):

$$\text{Magnification (M)} = \frac{\text{Old object distance}}{\text{New object distance}}$$

Magnification using a near device

When establishing near magnification with low vision devices, by convention we call the old object distance 25 cm. This now sets that standard by which all other distances are compared. For example, if a patient brings the object into a close 5 cm working distance, then the retinal image size is 5 times larger than it was when it had been held at 25cm:

$$\text{Magnification (M)} = \frac{25}{5} = \times 5$$

In the example above, a +20D lens with a focal length of 5 cm will be needed to focus the image on the retina. By setting the 'old working distance' to 25 cm, then magnification can be expressed as,

$$M = F/4$$

Thus, a +4D lens with the 25 cm focal length is termed 'unit magnification.' Each successive addition of another 4 dioptres adds another unit of magnification.

Routine:

- Begin by establishing the patient's baseline near acuity with a +4.00D addition at 25 cm (the focal length of the +4.00D lens).
- If the level of visual acuity is less than what the patient needs to achieve the desired task, then increase the addition in the trial frame methodically, in either +4.00D or +2.00D steps, until the desired acuity is met.
- When the desired near visual acuity is met, the magnification of the high reading addition so demonstrated (where $M=F/4$), will give the practitioner a *starting point* magnification with which to demonstrate the device of choice, such as a hand magnifier.
- With higher magnification, it is important to demonstrate that an increase in magnification means a smaller field of view and also a smaller magnifier.

Optical Low Vision Aids

After determining the magnification required for the task and making an assessment of the patient's visual performance, it is important to have clear strategy for prescribing. Relevant factors in considering the design of device to demonstrate to the patient are listed opposite.

In establishing as much detail about the patient's needs as possible, it should be possible to narrow the initial demonstration of devices to just a few. This avoids the need of going through a number of unsuitable devices, which may be upsetting for the patient.

- Does the patient need a device that is hands free or spectacle mounted?
- Does the patient have the ability to hold hand steady?
- Is there any factor such as arthritis that will affect the ability to hold a hand-held device?
- Is there a need for a flat surface?
- Is a close working distance acceptable?
- Is additional lighting necessary?
- Is cost important?



Figure 4a A +4.00 addition is used in the trial frame. The text is held at f' (25cm) and the patient reports achieving what level of near acuity.



Figure 4b The addition is increased in the trial frame until the desired level of near acuity is achieved. In this picture a +8.00 addition is used.

Conclusions:

It is often not possible to deal with all requests during the first visit. Similarly, it is not always possible to eliminate all fears. It is important to remember that, in the same way it is not always necessary to achieve 6/6, it is not always necessary to achieve N5. There is little point in giving the patient an excess of magnification to achieve N5 when N12 will do

The final **Table 2** details a full first assessment of a low vision patient, Mr DF.

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Table 2 Case Record Example

Patient Details:

Mr DF, Aged 87, lives with daughter. Retired teacher. Cricket enthusiast. Daughter also in attendance today. Housebound 18m. Minimal mobility.

Ocular History:

Age-related macular degeneration 4 years. No treatment. Discharged from the Hospital main clinic after 2 years of follow up. Registered Sight Impaired 3 years. One social services home visit 3 years ago, no follow up. Has Talking Books.

Current Spectacles and low vision aids:

Visited the hospital's low vision clinic 4 years ago. Given hand magnifier to help read newspaper. He still uses it but manages headlines only, with difficulty. Also had telescope to help with cricket score board at local ground. Managed well, but now housebound, rarely used.

Needs discussed:

Near tasks: Would like to read newsprint, and books (cricket biographies).

Distance tasks: Would like to be able to see grandchildren in the garden and TV. Still wearing bifocals- aware of little benefit but worn through habit.

Expectations & Motivation:

Realistic expectations- feels that he may benefit from a stronger magnifier and a little more light.

Motivation appears good.

Practitioner aims:

There have been several points raised during the initial discussion:

1. There is a clear need for the patient to get in touch with social services again. Mr DF has moved in with his daughter and thus his needs have changed. Although he has weekly day care, his visual needs have been forgotten. As his vision has also changed since his last visit, a Low Vision Leaflet would be appropriate here.

2. Reading a newspaper is classed as a fluent reading task. A print size of N8 (newspaper print size) will require a minimum of 2:1 acuity reserve. Ideally we should aim to achieve N4 with spectacles or a low vision device. He should have a minimum of 7.5 % contrast sensitivity (Pelli Robson) which would give a 10:1 reserve with text of 75% contrast.

3. Mr DF previously used a telescopic aid successfully. Given his motivation, it may be worth considering a similar device for watching his family in the garden. Not all telescopic devices are restricted for use by younger patients. Aim for 6/12-6/9 with a 1:1 acuity reserve.

Mr DF Cont:

Assessment of current aids and spectacles:

Bifocals 5 years old, condition - scratched

R	+2.75/-0.75x180	=	6/24 ⁺¹
LogMAR	0.58		
	Add +2.75	=	N12@30cm
L	+3.50/-1.25x175	=	6/60
LogMAR	1.00		
	Add +2.75	=	N24@32cm

Also in use,

Coil Windsor + 10.00D Hand magnifier (scratched)
= N10 fair (R eye) Handling good, but 'Not enough light'

Low Vision Assessment

R	+3.00/-1.00x165	=	6/24+2 LogMAR
0.54			
	Add +2.75	=	N10@ 30cm
	Add +4.00	=	N6@ 25cm
	Add +6.00	=	N5 part @ 17cm
	Add +8.00	=	N5 well @ 12cm
	Add +10.00	=	N4 fair @ 10cm
L	+4.00/-1.25x180	=	6/60 LogMAR
1.00			
	Add +2.75	=	N24@ 32cm
	Add +4.00	=	N24@ 25cm

Binocularly: Pelli Robson Contrast sensitivity 5.6%

Practitioner Comments:

1. Mr DF disliked the shorter working distance shown with the higher addition. This is not unusual for patients who have been used to reading a newspaper on their lap.

2. From the above low vision routine, he needs a minimum of a +10.00D lens to achieve N4. As the newsprint is approximately N8 in size, this would give him a minimum of acuity reserve of approximately 2:1.

Mr DF Cont:

Near Low Vision aids demonstrated:

Right eye, *With* bifocals:

+8D aspheric hand mag.	=	N6 well, ("too dark")
+8D illum. asph. hand mag.	=	N5 part ("nice")
+11.5D hand mag.	=	N4 well ("rather small")
+12D aspheric hand mag.	=	N4 well (prefers this, but a bit shaky)
+12D aspheric stand mag.	=	N4 with ease ("would like to try")

Right eye, *Without* bifocals:

+11.5D hand mag	=	N4 well (improved field by holding closer to eye) "ok" but prefers stand magnifier)
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Near Low Vision aids demonstrated:

Right eye with/without bifocals:

1.8 x finger ring telescope	=	6/12 easily, with good handling
4x monocular telescope	=	6/9 with difficulty locating object

Low vision aids prescribed:

For fluent reading tasks (Newspaper, N8 size) we prescribed the +12D aspheric stand magnifier. He found this easier to handle and felt that it kept the print in focus at all times. As Mr DF sat in a chair for much of the day, the use of a reading stand was also discussed to assist posture.

The finger ring telescope was prescribed for watching family in the garden. Limitations discussed but keen to try.

Additional advice and information given:

Mr DF was given a Low Vision Leaflet (LVL) which contained the address and telephone number of the local social services department. He was encouraged to get in touch so that he may have a second home visit and assessment of his needs.

He was also given advice on lighting and the use of colour contrast and information was additionally given on the RNIB's 'Big Print' newspaper.

Multiple Choice Questions

1. The term 'Acuity Reserve' is defined as
 - A. Print size relative to reading speed
 - B. Print size relative to acuity threshold
 - C. Reading speed acuity relative to contrast threshold acuity
 - D. Print contrast relative to contrast acuity
2. Which of the following statements about Contrast Reserve is *false*?
 - A. Contrast reserve is defined as the ratio between the print contrast and the patient's measured contrast threshold
 - B. If a patient's contrast sensitivity is measured (Pelli Robson) as 1.5%, then this will be sufficient to read a novel of 80% contrast.
 - C. If a patient has a contrast threshold of 44 %, and the contrast of the spot task 60%, the patient will require contrast enhancement to view the target.
 - D. If the patient does not have enough contrast reserve to see the print then additional magnification will be needed.
3. For a successful fluent reading task, a patient must be able to achieve the following reserves with a low vision aid:
 - A. An acuity reserve of 2:1 and a contrast reserve of 10:1
 - B. An acuity reserve of 6:1 and a contrast reserve of 3:1
 - C. An acuity reserve of 2:1 and a contrast reserve of 3:1
 - D. An acuity reserve of 6:1 and a contrast reserve of 10:1
4. For successful fluent reading of a piece of text, size N8, with a contrast of 80%, a visually impaired patient will need:
 - A. A device which helps him/her to see a minimum of N4
 - B. At least x10 magnification
 - C. A Pelli Robson contrast threshold of 80% or better
 - D. A device which helps him/her to see a minimum of N8
5. Which statement regarding the Pelli-Robson Letter Contrast Sensitivity Chart is *true*?
 - A. Pelli-Robson charts are easily converted for use at different distances, and are therefore useful for refracting patients with low acuity.
 - B. Recording Contrast Sensitivity is performed binocularly
 - C. The spacing between each row of letters is a logarithmic progression
 - D. Charts have a shelf life of ten years, after which they must be replaced.
6. A patient who manages N18 with his/her current bifocals will need
 - A. A minimum of X 1.75 magnification to read packet instructions (N8)
 - B. At least x20 magnification to fluently read a large print novel (N18 print)
 - C. A minimum of X3 magnification to see read newsprint (N6) fluently
 - D. At least X4 magnification to read a magazine column (N9) fluently.

To receive your CET point for this article, complete the attached
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