

A course in low vision practice

PART 7 – lighting and contrast

Barbara Ryan and Tom Margrain continue their series with a discussion of the best advice on offer regarding lighting and avoiding glare (Module C3516, one standard point)

ENSURING APPROPRIATE lighting for people with a visual impairment is particularly important because they are often functioning at their visual threshold and so improving illumination can improve visual performance.

As outlined in an earlier article, many low vision patients suffer from discomfort glare, so changing their use of lighting may also make them more comfortable. Many people are not aware of the inadequacies in their current lighting arrangements or the benefits that improved lighting can bring.

Two types of lighting should be considered in discussion: general and local.

General lighting

This is the lighting used in a home, or other indoor environments, that allows a person to get around and locate objects safely.

In the main, people with a visual impairment need increased ambient levels of illuminance. Cornelissen *et al*¹ found that for tasks such as recognising faces, chairs and cups, illuminances over 1,000 lux were required for optimal performance by people with a visual impairment while other non-impaired subjects had performed the task at 1 lux. However, care should be taken because too much light can cause glare and each case should be considered separately.

Optimising daylight can help improve general lighting during the day: draw back curtains, keep netting and windows clean and have light paintwork around the windows. Seating can be placed near the windows so that daylight comes over the shoulder and onto the task. Horizontal blinds are an effective way of controlling the amount of daylight coming in.

Artificial light can be improved by fitting higher wattage bulbs (checking light fittings are still safe to use), using angle or round, lighter-coloured lamp shades, and replacing ceiling lights with fluorescent tubes.

People with a visual impairment often have longer light-dark adaptation so it is important to try to keep even light levels throughout the home. Spotlights can cause marked differences in light levels and glare problems, so are best avoided as the only source of general light and wall lights and uplighters can cause glare and variations in light level.

Particular attention should be given to stairs and landings by ensuring they are well lit. Switches should be available at the bottom and top of the stairs.

Light colours on wall and ceilings allow more light to be reflected, providing higher levels of ambient illumination. Large areas of gloss paintwork result in glare, so matt or eggshell finishes are best.

Task lighting

As the distance of the light from the task doubles, the illuminance decreases by a factor of four, as shown by the following formula.

$$\text{Illuminance (lux)} = \frac{\text{Intensity (lumens)}}{d^2}$$

Where d is the distance from the light source to the working area in metres.

General lighting sources, such as ceiling lights, will therefore not usually produce enough illuminance for people with a visual impairment to do detailed tasks because they are positioned too far away. Localised task lighting will, therefore, usually be required for reading, around the telephone, over kitchen work surfaces, eating areas and work benches. Table and standard lamps which many people have in their homes as task lights are not useful in a low vision context because they cast light upwards as well as straight down (thus reducing the illuminance on the task and becoming a potential glare source) and cannot be adjusted.

Adjustable angle-poise type lamps are best for reading. They are available in many sizes, from small lamps that sit on a table to larger floor-standing models. Traditionally, low vision practitioners were taught that adjustable task lights should be positioned behind the person's shoulder. For people with low vision who are susceptible to glare and may be using magnifiers with small working distances, a better position is usually below eye level, between the person and what they want to see.

Incandescent tungsten lamps (filament bulbs) are very cheap and can be used in task luminaires that are not required for prolonged periods, such as over the telephone. Increasing the wattage increases the illuminance on the



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A COURSE IN LOW VISION PRACTICE

In this series of 12 articles, Barbara Ryan and Tom Margrain from the School of Optometry and Vision Sciences, Cardiff University outline some of the basic theory required for low vision practice. These articles are based on modules which were developed to train the optometrists and dispensing opticians who provide The Welsh Low Vision Service which has been developed and is funded by the Welsh Assembly Government

task. However, if used for a prolonged period, they can be uncomfortable to sit near because they get hot. Frosted or white glass bulbs give light that may be more comfortable than clear glass. Some companies recommend using daylight-simulation tungsten bulbs. There is no evidence that these are of benefit to people with a visual impairment and the blue tint used decreases the light output.

Energy-saving bulbs give off more light than conventional bulbs of the same wattage, last longer and do not get hot. However, they can take a few minutes to reach their maximum output so are not useful where good light is needed instantly, such as in the hall or over the stairs. Halogen bulbs are expensive, get hot and use a lot of electricity, but some people with low vision prefer them.

Many adjustable task lights are now available with compact fluorescent tubes. These are the bulbs of choice for prolonged reading tasks because they produce an even light and generate very little heat. Although they are more expensive to buy, they use less electricity and last about 10 times as long.

Fluorescent strip lighting is useful over work surfaces and a low ceiling lamp can be positioned over a dining table.

Some people may find it useful to carry a pen-torch in their pocket or handbag ▶

for seeing detail when ambient lighting is poor. The availability of cheap LED versions has increased the use of head-mounted torches as a portable light source by some people with low vision.

REDUCING GLARE

Visors and shields

Visors and shields obstruct the light from glare sources, while not obstructing the rays of light from the object being viewed and are of benefit to most people with low vision. Patients may wear sports peaks or a hat with a brim. Side shields are also useful but can be hard to achieve unless permanently attached to spectacles.

Tints

Prescribing tints for people with low vision is not easy. Many patients ask for a dark tint because they find bright lights outside distressing. However, the same people often need more light for near tasks and getting about safely. As a low vision practitioner, you have to juggle the need to reduce glare and improve comfort, while allowing enough light to function and not impede dark adaptation further. For a small number of patients who are photophobic, such as people with albinism, constant wear of tints may be needed. However, for the vast majority of low vision clients flexibility is required.

Photochromics give a varying tint and may seem like a flexible solution. But, they never go completely clear, suffer from delays in transmission change and will go dark in well-lit internal environments such as shops. Their use should, therefore, be considered with care. In the main, you should avoid tinting the pair of spectacles a person with low vision wears most of the time and choose tints as a solution to specific problems requiring separate spectacles. For most, the best approach is a cheap plano sunspec or overspec that has side and top shields and can be removed or put on quickly.

Tints for discomfort glare

Discomfort glare can be removed by reducing light with a tint. The patient should be allowed to choose the depth of a neutral density tint they like best, allowing them to walk outside during the trial. Use of side and top shields will aid performance.

Tints for disability glare

To reduce disability glare, and hence improve the retinal image contrast, a tint needs to absorb the light scattered in the eye, while ensuring unscattered light is not reduced. A grey neutral density filter will simply reduce all the light and hence not

change the contrast of the retinal image.

Blue light is scattered more than red light by the lens. Therefore, yellow, amber and brown tints, which absorb shorter wavelengths of light, have been suggested to be of benefit to patients with low vision who suffer from disability glare. Results of research into the success of these tints on improving visual performance in low vision patients is mixed: Bailey *et al*² found that they reduced reading performance; Wolffsohn *et al*³ found that yellow and orange tints increased contrast sensitivity in people with AMD. Dark red tints, that do not transmit any light less than 550nm, have traditionally been prescribed for people with retinitis pigmentosa and albinism. There is no objective evidence of their success over and above equivalent neutral density filters. It is difficult to make any definitive recommendations for tint prescribing for disability glare in low vision patients. Some people seem to subjectively prefer one of these coloured tints and some may show an improvement in objective measures.

A trial and error approach is probably best, ensuring the colour rendering requirements of the person are considered. Trying over-specs and clip-ons in everyday life situations first can allow this choice to occur without making costly mistakes. Those found to be useful can be transferred to spectacle lenses if desired.

UV and NOIR overshields provide an inexpensive option that gives the added benefit of top and side shields. Other manufacturers, such as Corning, produce specialist ranges, but they are expensive.

Typoscopes

A typoscope is a rectangular black card with a central slit. In the presence of high illumination the white background of a page of text reflects the light. In some cases this reflected light acts as a glare source and is scattered in the eye, thus reducing the contrast of the retinal image. This is particularly apparent in patients with media opacities. A typoscope reduces the amount of light from the background and so reduces the scatter and thus increases the retinal image contrast.

Typoscopes can also assist reading along lines, finding the next line or guide signing and writing.

IMPROVING CONTRAST

Many low vision patients have poor sensitivity to low contrast targets. Things can be easier to see by using more contrasting shades (luminance contrast) or different colours (colour contrast). When possible, optimising luminance and colour contrast is best.

To maximise luminance contrast requires a bright object on dark background or a dark object on a light background. In considering colours, it is

probably best to choose ones that are not beside each other in the colour spectrum, for example choose red and yellow rather than red and orange. There are hundreds of ways a person can improve contrast in their daily lives. Some examples are:

- ◆ Electronic aids, unlike optical low vision aids, enhance the luminance contrast of the object being viewed and offer the option of reversing contrast (namely, white print on a black background). They are rarely prescribed solely for this purpose because of cost constraints
- ◆ Writing with a black felt-tip pen on white paper produces higher contrast letters which are more visible than a ball point pen or pencil. Paper with thick black lines will also help to guide the person and placing the paper on a dark surface will allow the edge of the paper to be seen more easily
- ◆ Putting white strips on the edge of darkly coloured stairs will make them easier to see and painting the banister a lighter shade will further aid getting up and down stairs safely
- ◆ Walls, floors, ceilings and doors are easier to see if they are painted in shades or colours that contrast with each other. Painting door frames in a different shade or colour and having contrasting door knobs helps too
- ◆ Vegetables can be chopped on contrasting chopping boards, such as an onion on a red board and a tomato on a white board
- ◆ Pale crockery will allow food to be seen more easily and, if used on a dark tablecloth, will be easier to find on the table
- ◆ Clear glass is almost impossible to see. Glass shelves should be avoided, coloured drinking glasses used and sliding doors made more visible by using stick-on transfers
- ◆ Switches and dials can be marked with contrasting coloured bump-ons
- ◆ Garden tools with yellow handles will be easier to find than green ones.

ENVIRONMENTAL ADAPTATIONS

As outlined already, many adaptations can be made in a home to make things easier to see by improving lighting and contrast and making things bigger.

A detailed discussion of environmental adaptations is outside the remit of this text and those wanting to provide written information to their patients will find the *Making the Most of Your Sight* booklet produced by the RNIB helpful. Practitioners wishing to know more should refer to *Building Sight* by Barker *et al*.⁴

Since the introduction of the Disability Discrimination Act, there has been a dramatic improvement in adaptations to public places for people with a visual impairment including: tactile pavements;

talking, large print and Braille indication signs; and contrasting colour schemes.

Providers of optometric services under the same Act are required to make reasonable adjustments to their practices to make them accessible to people with a disability, including people with a visual impairment.

References

1 Cornelissen FW, Bootsma A and Kooijman AC. Object perception by visually impaired people at different light levels. *Vision Res*, 1995; 35: 161-168.
 2 Bailey IL, Kely K, Pittler G *et al*. Typoscopes and yellow filters for cataract patients. *Low Vision Abstracts*, 1978; 4: 2-6.
 3 Wolffsohn JS, Dinardo C and Vingrys AJ. Benefit of coloured lenses for age-related macular degeneration. *Ophthal Physiol Opt*, 2002; 22: 300-311.
 4 Barker P, Barrick J and Wilson R. Building Sight, 1995; London: RNIB/HMSO

Further reading

Dickinson C. *Low Vision Principals and Practice*. Oxford. Butterworth-Heinemann 1998.
Product Catalogue. RNIB.
 Cole RG and Rosenthal BP. *Remediation and Management of Low Vision*. St Louis. Mosby 1996.
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MULTIPLE-CHOICE QUESTIONS

1 What has been suggested as the minimum illuminance for recognition tasks by visually impaired people?

- A 1 lux
- B 10 lux
- C 100 lux
- D 1,000 lux

2 Which of the following best describes the usefulness of tints for disability glare?

- A Tints improve reading performance
- B Dark red tints improve acuity for certain conditions
- C The evidence for tints aiding the visually impaired is conflicting
- D A red tint is more useful than a neutral density filter

3 A patient suffering which of the following conditions is most likely to benefit from a typoscope?

- A Cataract
- B Retinitis pigmentosa
- C Macular disease
- D Glaucoma

4 Which of the following is not recommended around the home of a visually impaired person?

- A Contrasting edge strips along stairs
- B Glass shelves
- C Contrasting paintwork on doors and surrounds
- D Chopping boards that contrast with the food

5 How does illuminance change as distance from the source doubles?

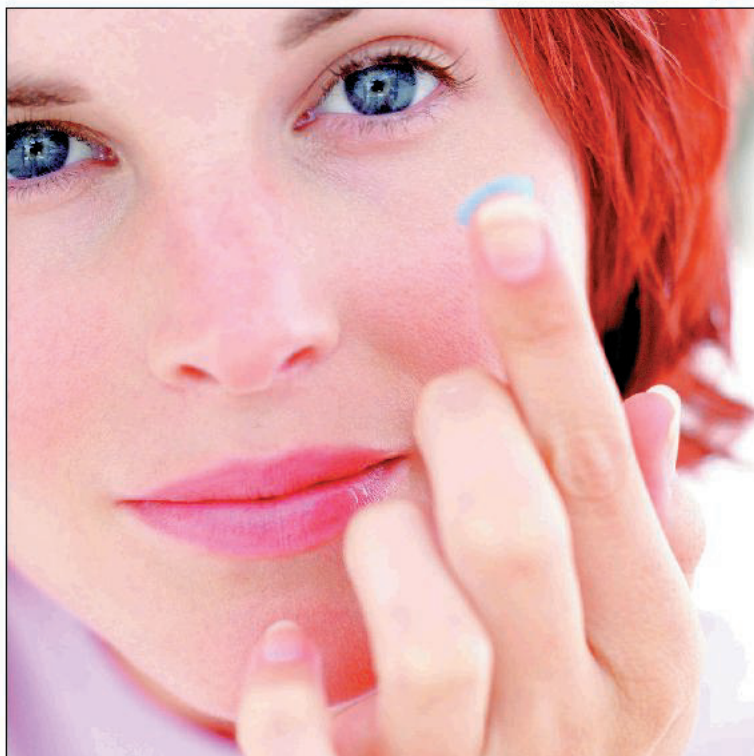
- A Stays constant
- B Halves
- C Reduce fourfold
- D Doubles

6 What is a disadvantage of an energy saving lamp?

- A They get hot
- B They use a lot of electricity
- C They take a while to reach maximum output
- D They are difficult to obtain

The deadline for responses is Thursday, April 13

Module C3516 To take part in this module go to www.opticianonline.net and click on the Continuing Education section. Successful participation in each module of this series counts as one credit towards the GOC CET scheme administered by Vantage and one towards the Association of Optometrists Ireland's scheme.



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 (That's one in the eye for the supermarkets)

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