Environmental Vision (OPT 6051)

Computer Vision Syndrome II

Reference: Sheedy JE, Shaw-McMinn PG. *Diagnosing and Treating Computer-Related Vision Problems*. Butterworth Heinemann, 2003. ISBN 0-7506-7404-0.

PRESBYOPIA (Chapter 6)

Most presbyopes are corrected with bifocals or progressive addition lenses (PALs), but these normally don't work well for extended computer use because …

- the working distance for computers (usually 50-60 cm) is longer than the standard bifocal reading distance (40 cm), and
- computer monitors are usually located higher than the angle of gaze required for bifocal reading.

Sheedy describes the problems that you can expect when a patient tries to use his standard bifocal for viewing the computer (p. 91, 92).

> *A presbyope who tries to wear his or her "usual" multifocal correction at the computer either does not see the computer display clearly or needs to assume an awkward posture, resulting in neck and back strain. Most commonly, presbyopes need to inch closer to the screen and tilt their heads backward; the former is bad for the back, and the latter is bad for the neck. This is true for bifocal lenses and PALs. …*
>
> *Many, if not most computer workers who require multifocals for normal visual tasks also require a separate pair of spectacles for their computer work.*

Computer working distance

We are accustomed to measuring and testing for a near working distance of 40 cm, but not only in computer vision but in every case, you must prescribe for the actual working distance of the patient. In the case of a computer user you should know the distance to …

- the computer monitor and
- to any reading material.
- You should consider all other visual requirements as well, including how much the patient needs to see things at a distance.

It's best for patients to actually measure the working distances and bring the measurements with them to the eye exam. You can also have the patient sit at one of your office computers and simulate the distances, thereby allowing you to make the measurements in your office. If you can't measure the actual distance, you can estimate the computer viewing distance to be about 50 cm.

Computer viewing angle

Computer monitors are often located too high. This leads to several problems.

- The standard bifocal or progressive zone will be too low. This can lead to backaches and neck problems as described above.
- The intermediate zone of most PALs will be too narrow at the computer angle of gaze.
- The higher viewing angle will cause a larger palpebral aperture and increased corneal drying.

You can partially solve this problem by adjusting the computer monitor's position. You won't be able to place it as low as you would hold a book, but the monitor should be located slightly below eye level.

Prescribing

Quoting from Sheedy (p. 95):

> *The patient's intermediate needs, near viewing needs, and distance viewing needs should be determined by history, and the prescription and lens design determined*

accordingly. Although the primary visual needs are at the intermediate distance, nearly all computer users also have some viewing requirements at 40 cm. Distance visual needs are often considerably less important and can often be compromised in the interests of best meeting the intermediate and near needs.

Standard multifocals
First, since most patients will need standard PALs or bifocals anyway, they should see if those glasses are sufficient for their computer work. For limited or intermittent computer viewing, or for early presbyopes, they may be good enough. The most commonly prescribed standard progressive lenses at our clinics are the Varilux Physio and Hoya ECP.

> *In some cases the younger presbyope is able to successfully use PALs for computer work. Such a patient does not require the add for the intermediate viewing distance, something that can be determined in the demonstration process. The PAL can be successful in this case because the patient is able to use the distance portion of his or her lenses for work at the computer. The computer display should not be located too low on the patient's desk in this situation. The intermittent short-term computer user is another patient for which PALs are acceptable. (p. 106)*

Even if the patient plans to use his standard multifocals with the computer, you should educate him about the possible problems he may encounter. To see their best, most presbyopic patients need a separate pair of spectacles specifically designed for computer use. There are several computer vision options.

- Single vision
- Computer vision PALs
- Specially designed bifocals
- Trifocals
- Other creative options (clip-ons, inserts, etc.)

Single vision
One option that works especially well for early presbyopes are single vision lenses designed for the computer viewing distance. Usually +0.50 to +1.25 D over the distance Rx is sufficient to …

- correct at the computer distance,
- allow distance vision that is only slightly blurred,
- assist with normal reading at 40 cm, though the patient will still need to accommodate, and
- provide a wide field of view at the computer distance
- This is also the cheapest and simplest option.

You must, of course prescribe for the correct working distance. For example, if the patient views the computer at 50 cm, the intermediate Rx should have 0.50 D less plus than the standard 40-cm reading Rx.

> *Distance blur through this single vision prescription should be demonstrated to the patients. …Usually, vision for conversation with others and for walking around the immediate confines of the office is good. However, if the distance blur is disturbing to the patient, another design is indicated.* (p. 96)

Computer vision PALs
These lenses are not substitutes for normal PALs, since distance vision will be compromised in order to allow a larger, wider intermediate zone for computer viewing. Most of these lenses have no distance portion at all, but can be thought of as intermediate-near specialty PALs. Most major manufacturers offer a computer vision PAL. The most popular one at our clinics is the **SOLA Access** lens, so you should be familiar with this one. Other options mentioned in your textbook are the …

- Cosmolit Office by Rodenstock
- Gradal RD by Zeiss
- Interivew by Essilor
- Tact by Hoya
- Technica by AO
- Office by Shamir
- Computer lens by PRIO (designed by Shamir)
- Bowser by PRIO (designed by Zeiss)

Sheedy includes nice figures illustrating most of these lenses on pages 99-104. He describes them in the following way (p. 97).

> *All of the lenses provide the full near add (40 cm) in the bottom of the lens. The central portion of the lens provides an intermediate power for the patient, and the add power generally declines further toward the top of the lens. This allows the patient to look up and see at farther distances in their office environment. However, the top of the lens typically does not include the distance refractive correction (except the Technica [American Optical, Southbridge, MA] and Tact [Hoya, Bethel, CT], which provide a small area containing the distance correction).*
>
> *For the convenience of the practitioner, these lenses are prescribed by writing the usual distance prescription with the usual 40-cm add, and then specifying the lens design from those available … The lenses are characterized by having a lens power degression (i.e., the amount by which the add power decreases from the bottom to the top of the lens). The prescribed near power is provided in the bottom of the lens … and the power in the top of the lens is determined by the lens degression. In nearly all cases, there is some add in the top of the lens. The available degressions for each lens are listed in Table 6-1.*

Note that some of the lenses are available in more than one **degression power**. For younger presbyopes you will use the lower degression power, but for those who need stronger near adds or who have greater far-vision requirements, the higher degression may be better. Note that the degression is the difference between the full add power at the bottom of the lens and the power in the top of the lens. Although you may refer to the full distance power when ordering the lens, in many cases the lens will not actually have this power.

> *For example, some patients sit almost continuously at their computer workstations, and far-intermediate vision in the top of their lens is unimportant. A lower degression would be suitable in this situation. A higher degression is indicated for the patient who regularly navigates the office and has extensive far-intermeidate visual needs.* (p. 98)

You should read through the clinical example Sheedy gives on page 98.

Bifocal option 1 (intermediate-near)
Intermediate-near bifocals are another good option, but as with the computer PALs, the patient must understand that they are not intended for general use, but are specifically designed for computer use. Distance vision will be compromised in these lenses. On your prescription form, you should state that these lenses are for computer use.

The bifocal line can be set at the usual height (line at the lower limbus), but the top portion is designed for the intermediate viewing distance or slightly beyond. For example, even though the patient may view the computer at 50 cm, you may want to designed the upper portion for a viewing distance of about 57 cm, which has 0.75 D less accommodative demand than for 40 cm.

To design this lens, compute the standard near Rx (40 cm) for the bifocal portion. Compute the power for the top portion as 0.75 more minus. Order that power for the upper portion and specify an add power of +0.75 D. This is illustrated in Figure 1, below.

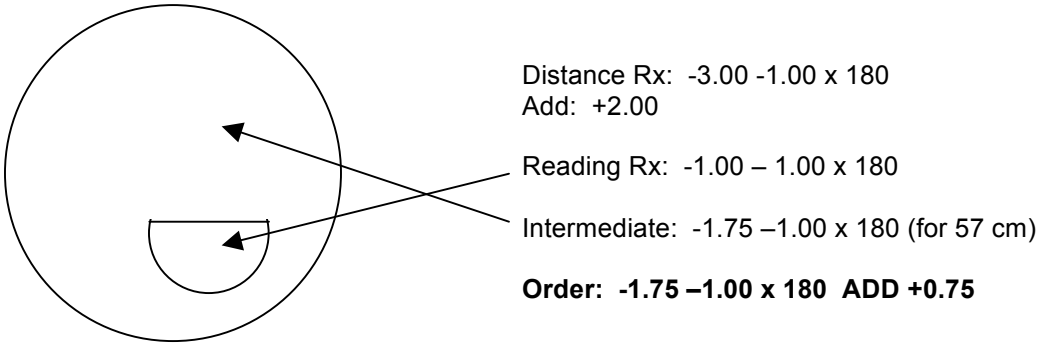


Figure 1. Example of a intermediate-near bifocal.

Bifocal options 2 (far-intermediate)
If the patients requires good distance vision, but has less of a requirement for near vision, you can prescribe a far-intermediate bifocal. In this case, you should set the bifocal line much higher that usual (mid pupil, etc.), and you may want to prescribe the intermediate power for a slightly closer distance than in bifocal option 1 above. For example, you could base the intermediate power on a 50-cm, rather than the 57-cm working distance. This is illustrated in Figure 2.

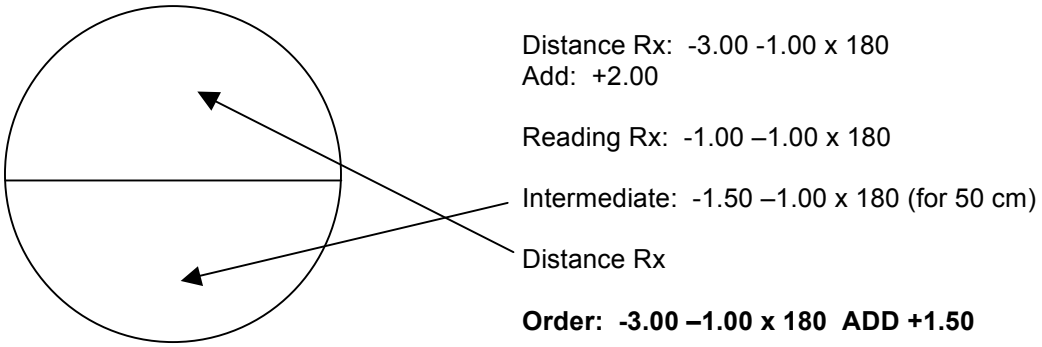


Figure 2. Example of a far-intermediate bifocal.

Trifocals
This may be an option if the patient must be able to see at all three distances (far, intermediate and near) and computers PALs don't work. You will probably want to order a wider-than-usual trifocal. Trifocals with a 10-mm or 14-mm vertical zone are available. In addition, Sheedy recommends ordering a 60% intermediate add, rather than 50%. See Table 6-2 (p. 105) for a list of example lenses.

Other creative options
By applying common sense and a knowledge of basic principles (working distance and viewing angle) you can come up with other creative options that allow the patient to see efficiently at the distances required by his or her work environment. For example,

- Clip-on lenses with the intermediate power, attached to normal PALs or bifocals
- Clip-on bifocal lenses with intermediate and near powers, attached to the single-vision distance Rx

- Insert- or drop-in lenses with the intermediate power slipped in behind the normal spectacle front (PALs, bifocals or single-vision distance Rx).

In addition, some patients may prefer to have a **slight pink tint** in their computer glasses to reduce sensitivity to flicker from overhead fluorescent lights or an **anti-reflection coating** to reduce annoying reflections from overhead office lighting that reflects off the back of the lenses.

Q. Would an anti-reflection coating help reduce reflections off the front of the computer monitor?

A.

SOLA *ACCESS*®

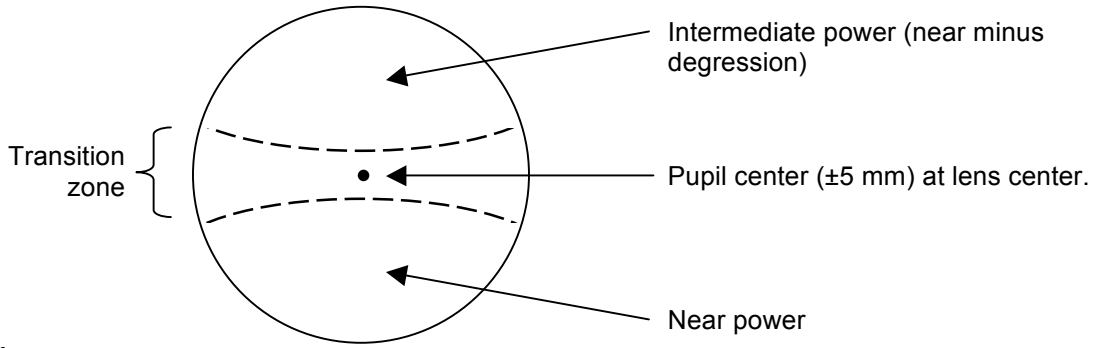
Every office should have one or two specialty computer PALs available, and you should be familiar with them. At this time the lens used by the College of Optometry is the SOLA *Access*, so you should be familiar with it. It is not necessarily the best lens for all patients, but it is the one we use, and it has been well accepted by patients. Many doctors speak highly of the *Access*, while other doctors prefer a different lens. Since our clinics will begin ordering more Hoya lenses, the Hoya *Tact* should become available soon. The *Tact* is one computer lens that is designed with a small distance-viewing portion at the top of the lens. We may also start using the two lenses offered by PRIO, the *Computer Lens (PCL)* and the *Browser*.

Lens design

The SOLA Access is an aspheric intermediate-near PAL, which is recommended for computer users, carpenters, musicians, hobbyists, etc. It does not have a distance vision zone and is not intended for general use (walking, driving, etc.). It does, however, provide a much wider field of view for intermediate and near viewing than standard PALs. It is specifically designed to provide good vision for distances between 40 cm and 10 feet. SOLA cautions that the Access is not recommended for non-presbyopes, but I know some doctors who prescribe them for children who need reading glasses.

It comes in a 75-mm blank in either polycarbonate or resin. The near power range is from +4.00 to –6.00 D sphere and cylinder powers up to –4.00 D. The right and left lenses are identical.

Figure 3. The SOLA Access lens. Minimum "B" (frame maximum vertical dimension) is 30 mm.



Ordering

- Calculate the near (reading) power.
- Select the degression: 0.75 for younger presbyopes (< age 50) or those with lower near add powers (< 1.50) or 1.25. Modify this according to the patient's specific needs.
- Select and fit frame. Eyes should be well centered; minimum "B" = 30 mm.
- Measure and record location of the pupil center. The frame center must be over pupil center (± 5mm)

Verification

- Center dot over pupil center
- Measure near power below the reference arc
- Measure intermediate power 10 mm above the center dot (near power minus degression)

For more specific questions on the Access, talk to our opticians, or call SOLA at 1-800-358-8258 (press 3).

Simplified ordering

- Determine if the patient needs a progressive computer lens such as the Access.
- Record the distance Rx and standard near add powers.
- Select a frame that centers well over the pupil.
- Ask he optician to calculate and order the appropriate Access lens.

DRY EYE (Chapter 7)

Once you have managed the distance refractive, accommodative and binocular needs of your patient, you probably also need to address the problem of dry eyes. Eye often dry out more quickly at the computer because …

- the blink rate normally decreases to about 1/3 of normal (average 22 times per min to about 7).
- The gaze angle to most computer screens is higher than for normal reading. This causes greater corneal exposure and greater tear evaporation

Make use of the following dry eye management options.

- Educate patient on cause of increased drying with computer work, and encourage him or her to try to blink more frequently.
- Minimize and sources of wind that may increase ocular surface drying.
- Encourage the patient to take regular breaks.
- Use artificial tears. B&L is marketing eye drops formulated specifically for computer users.
- Consider nutritional supplements containing Omega-3 fatty acids (fish, fish oils, walnuts etc.)
- Consider punctal occlusion

LIGHTING AND REFLECTIONS (Chapters 8, 9)

In addition to prescribing the proper spectacle correction or managing dry eye, you should be able to advise the patient on how to correct work environment problems that can lead to eye strain and other symptoms.

Lighting

As a basic principle, you should have no bright light sources in the field of view near the computer monitor. These cause …

- annoying glare
- interfere with visibility of the display
- Flicker of overhead fluorescent lights may be annoying if it's below the person's critical flicker fusion frequency (CFF).

Common sources of glare at computer workstations include

- Nearby windows

- Reflections off the screen

The patient should examine the work area for possible glare sources. For example, is the computer in front of a window? One good way to see bright screen reflections is to look at the screen when it's turned off. You can test to see if other possible glare sources are causing a problem by shielding eyes from glare sources, and see if it provides relief.

Possible solutions include:

- Shade windows or rearrange the workstation so the computer is not next to window.
- Turn off some lights. Most offices have too much light.
- Consider wearing a visor to block annoying surrounding glare sources
- Hood the screen.
- Reduce sensitivity to flicker by reducing retinal illuminance; reduce screen brightness or consider tinted lenses
- An anti-reflection screen can reduce glare and improve contrast, but it will also reduce brightness.

In addition to the problem of reflections, the phosphors in the computer monitor can be stimulated by outside light, and this reduces screen contrast. Traditional computer displays work by stimulation of phosphors that coat the inside of the glass screen. Unfortunately, light entering the monitor from outside can also stimulate the phosphor, reducing contrast. It is similar to what happens when you view a slide presentation with some lights on in the room. You can minimize this problem and improve screen contrast, and its visibility by,

- Hooding the screen to block glare sources.
- Use a glare or antireflection screen over the monitor. These reduce screen brightness slightly, but improve contrast. Note that an AR coating on spectacles won't help this.

WORKSTATION ERGONOMICS (Chapter 11)

It is generally more comfortable to view a computer monitor at longer-than-normal reading distances. The most comfortable distance is usually about 60 cm. Longer viewing distances can reduce problems associated with a lag of accommodation.

Computer monitors are often placed too high. You can significantly improve comfort simply by positioning the screen to allow a slight downward gaze (10-20 degrees or 4-9 inches below eye level). If it's too high, workers tend to bend their neck rather than raise their eyes, leading to neck strain. An internet search of "workstation ergonomics" will lead to many sites with specific information and figures describing ideal posture and positioning for computer users.

It is also more comfortable to keep the screen in front of the worker rather than to the side. Reference material should be near the screen and at approximately the same distance from the eyes as the screen.

SUMMARY

When providing care for your patients with CVS, consider and appropriately correct the following.

- Distance Rx
- Presbyopia or accommodative problems
- Binocular problems
- Dry eye
- Office lighting and ergonomics