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Evaluating the Effectiveness of Presbyopia Corrections

Subjective Methods

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Presbyopia may be described as a condition in which the reduction of accommodative power of the lens begins to interfere with the need for near vision of the individual. This means that there are 2 aspects that need to be considered:

1. The optical aspect—how has the accommodative power decreased, and what is to be used to replace it?
2. The human aspect—what are the near vision needs of the individual and what are acceptable trade-offs?

Specific needs may require specific solutions; for example, the large print used in medieval missals probably served to compensate for the lack of reading spectacles for elderly priests.

Until we find a way to perfectly replicate the accommodative abilities of a young lens, all presbyopia corrections will represent a compromise between advantages and disadvantages. These factors have been discussed in previous chapters. Some factors are mentioned in Table 30-1. The trade-offs should remind us that what is appropriate for some individuals may not be appropriate for others.

Personal Preferences

It is important to consider the needs of the individual. An avid reader of small-print pocket books may not be satisfied with a solution that is quite acceptable for an occasional reader of materials with larger print. Most outdoor persons may place more emphasis on distance vision but not if they are botanists examining flowers. A housebound person may be more interested in near vision, with the TV being his or her most distant vision need.

These personal factors, obviously, are not amenable to standardized tests. Nevertheless, they may be the most important factors that determine personal satisfaction. A thorough discussion of the pros and cons, to make sure that the patient understands the trade-offs, is essential.

Reading Ability and Print Size Designations

For most patients, the ability to read is a primary objective. Although even the most avid readers may spend more hours of the day performing other tasks, reading is often used as a surrogate measure for other activities of daily living, which are less easily measured. Reading ability is usually expressed as the

Pallikaris IG, Plainis S, Charman WN.
Presbyopia: Origins, Effects, and Treatment (pp. 247-256).

TABLE 30-1. *ADVANTAGES AND DISADVANTAGES OF VARIOUS PRESBYOPIA CORRECTIONS*

CORRECTION TYPE	PROS	CONS
Single-vision lenses	Sharp focus for a specific distance in all directions of gaze	Need to change spectacles for different distances
Franklin bifocal	Sharp focus for 2 distances	No intermediate focus
No-line bifocal	No visible line	Lateral areas of compromised focus
Progressive	Focus for many distances	Maximum sharpness only in center corridor; needs more head movements
Multifocal contact or implant lenses	No need for reading spectacles	Not possible to improve by changing direction of view
	Focus for a range of distances is acceptable, but . . .	Focus for specific distances is less sharp than with single-focus lenses
Monovision	Good focus for 2 distances The brain can select one image or the other	Somewhat reduced binocularity Acceptance varies
Accommodating IOL	Continuously variable focus	Limited focal range

smallest print size that can be read comfortably with the patient's available correction. It can be expressed in such terms as can read small print, can read newsprint, can read headlines, etc.

Print sizes may be expressed on different scales.[1] Snellen defined a reference standard to report the size of optotypes or print as "the distance at which the character height subtends 5 min of arc." Louise Sloan, a low-vision pioneer at Johns Hopkins University, made Snellen's verbose definition easier to handle by introducing the term *M-unit*. One M-unit subtends 5 min of arc at 1 meter; it is 1.454 mm. The term M-unit to describe Snellen's definition is primarily used in the United States, where it reminds practitioners that it is based on the metric system, rather than on the feet system used for the 20/20 acuity notation. Snellen's unit is the only letter size unit that is well-defined and that applies to printed texts as well as to letter charts.

Another unit is the "printer's point." This unit originally referred to the slug on which letters used to be mounted; 1 printer's point (slug size) = 1/72 inch = 0.352 mm. Lower-case letters are usually about half the slug size, so that, for the average font, 1 printer's point (print size) = 1/144 inch = 0.176 mm. However, this differs for different fonts; a 12-point Times Roman font has the same size as a 10-point Arial font. Furthermore, the printer's point measurements do not apply to the optotypes used on letter charts. In Britain, the term *N size* is used to indicate printer's points. It is usually assumed that 8 points = 8 N = 1 M-unit = 1.454 mm.

Yet another set of letter size designations refers to reading samples published by various authors. Well-known are Jaeger's numbers, which were based on the reference numbers in a print catalogue in Vienna in 1856 and have no numerical value.[1] As others tried to reproduce Jaeger's samples with locally available fonts, the results varied from publisher to publisher and generally were larger than Jaeger's originals.[2] It is not unusual to find that different reading cards in the different lanes of the same office label the same print size with different Jaeger numbers. The result is that Jaeger numbers cannot be used as a reference standard. The same holds for other print samples, such as those of Niden in Germany and of Parinaud in France. Snellen's notation, on the other hand, can be verified anywhere at any time, as it is based on a physical measurement.

Reporting reading ability by specifying the print size a person can read indicates whether the reading needs of that person are met, but it does not inform us about the optical quality of the system, as it does not mention the reading distance. Two patients may both be able to read newsprint, but one may do it with a standard +2.50 D reading add, whereas the other requires a +6.00 D add. A third patient may read newsprint with the naked eye by simply removing his or her myopic correction.

VISUAL ACUITY

The preferred test to assess the quality of the optical image is visual acuity. It is important to point to the distinction between reading ability and visual acuity, as many clinicians use them as if they were interchangeable. Visual acuity calculations, whether for near vision or for distance vision, are based on a visual angle, which means that 2 numbers are needed; thus, we need to know not only the letter size, but also the viewing distance. The linear size of a given letter does not change when we move the letter chart, but the angular size changes when the viewing distance is changed.

For distance vision, where the viewing distance is several meters and is generally fixed by the layout of the examination lane, the relationship is expressed in Snellen's well known formula:

$$VA = \text{viewing distance/letter size} = m/M$$

where m = viewing distance in meters and M = letter size in M-units.

For near-vision, where the viewing distance is a fraction of a meter, is not fixed, and varies with the required reading add, a modified version is easier to use:

$$1/VA = \text{letter size x 1/viewing distance} = M \times D$$

where M = letter size in M-units and D = viewing distance in diopters (= 1/distance).

The 3 components of this modified Snellen formula each refer to clinically meaningful parameters; 1/VA refers to the magnification required to bring the patient to a standard performance, M refers to the letter size read, and D refers to the required reading add (or to the reading add plus available accommodation).

Two ways to deal with the reading distance are:

1. Test all patients at a fixed reading distance (usually at 40 cm = 2.50 D). This is easiest when a 40-cm cord is attached to the reading card. When this is done, care must be taken that the patient is appropriately corrected for the chosen distance.
2. Ask the patient to move the reading card to the distance where it is sharpest. Then, use a ruler to determine the actual reading distance. A ruler calibrated in diopters is easiest for use with the modified Snellen formula and allows a direct comparison of the reading add to the chosen reading distance. This method may relate best to the patient's needs, but does not provide a standardized measurement to compare various devices.

Different Reading and Letter Chart Designs

Snellen's original chart (1862) had small steps for good visual acuity (20/20 to 20/25 to 20/30 to 20/50) followed by 2 larger steps (20/50 to 20/70 to 20/100) and 1 very large one (20/100 to 20/200); there was nothing beyond 20/200. The decimal notation (Monoyer, 1875)[3] suffers from the same problem; the step from 0.1 to 0.2 is too large and the steps from 0.7 to 0.8 to 0.9 to 1.0 are too small.

In 1868, Green,[4] who had worked with Snellen in 1866, pointed to the advantages of a logarithmic (geometric) progression where all steps are equal. He was too early, and his work was ignored and largely forgotten. Today, Green's logarithmic progression has become an international standard, largely because the National Eye Institute (NEI), in the United States, used it for the charts developed for its Early Treatment Diabetic Retinopathy Study (ETDRS).[5] These charts became a requirement for all subsequent NEI studies.

Beyond the logarithmic progression, the ETDRS format also implemented a principle, first promoted by Bailey and Lovie,[6] namely that all sizes should have similar content. ETDRS charts have 5 letters on every line and form an inverted triangle. This is a break from the traditional rectangular chart formats where the number of letters and their spacing was determined by the available space.

The principle of paragraphs of equal length at all sizes has also been incorporated in newer reading tests, such as the MNread, Colenbrander, and Radner cards.

Clinicians have long expressed changes in a person's visual ability as "lines lost" or "lines gained." Such a notation is only meaningful if all steps are equal, which requires a logarithmic progression.

Two scales can be used. One is the logMAR scale, on which each 0.1-logMAR step gained indicates a line lost. The other is the Visual Acuity Score (VAS) where each letter read on an ETDRS chart equals 1 point, so that each line read equals 5 points. The logMAR scale is a scale of loss (20/20 = 0 logMAR = no loss); the VAS scale is a scale of functioning (20/20 = 100 = standard function).

A more detailed discussion of this and related topics can be found elsewhere.[1,3,7]

Contrast Sensitivity

After visual acuity, contrast sensitivity is an important parameter of visual perception. Any optical system that provides less-than-perfect focus will reduce edge contrast. Fortunately, the visual system is quite forgiving for a moderate reduction in contrast for large objects. For smaller objects, such as letters, the effect is more noticeable.

Early contrast sensitivity tests were modeled after the tests used for optical lenses, and they were based on sinusoidal gratings for which the contrast is expressed by the Michelson formula.[1] Ever since Pelli et al[8] introduced their letter chart test, clinicians have preferred tests based on letter recognition. Pelli used the Weber formula, which is more appropriate for nonrepetitive targets on a background. Others, however, continued to use the Michelson formula. Thus, the comparison of contrast levels measured with different charts may be confusing. For 0% and 100% contrast, both scales agree, but they differ for contrast in between. For the range of clinically important threshold values, Weber = 2x Michelson.

As with visual acuity, an abnormal contrast sensitivity value can result from many causes. Finding a contrast deficit, therefore, is not helpful in establishing a differential diagnosis, but it can be most helpful in explaining the complaints that patients may have when performing activities of daily living, especially if visual acuity is not affected.

Contrast loss may be the result of optical factors, such as refractive error, presbyopia, higher-order aberrations, or scatter, as from cataract and other opacities. Beyond the contrast reduction from less-than-perfect optical imaging, contrast perception depends on the sensitivity of the retinal receptors and on their neural connections.

Because presbyopia is an age-related condition, patients with presbyopia are also at risk for other age-related conditions. Macular degeneration may involve a loss of contrast sensitivity due to changes in the receptors. This loss is not predictable from the degree of visual acuity loss. Some patients have good visual acuity but poor contrast sensitivity; whereas others have poor visual acuity with good contrast sensitivity. In other conditions, such as glaucoma, optic neuritis, and multiple sclerosis (MS), contrast perception may suffer because of neural changes. The exact mechanisms are poorly understood. When recommending a specific type of optical correction for presbyopia, the possibility of such other conditions should be kept in mind.

The sharpest edges with the best contrast can be provided with lenses that have only 1 focal point. These may be single-vision spectacle or contact or implant lenses. For spectacle lenses, one has the option of providing different focal points for different directions of view, such as in bifocal, trifocal, or varifocal (progressive) spectacle lenses (see Chapter 13). For most contact lenses and for all implant lenses, a change of viewing direction does not change the focus. Some success has been achieved with bifocal contact lenses in which the lens moves vertically upward on the cornea during downgaze to allow vision through the near portion of the lens for reading (see Chapter 14).

Multifocal contact or implant lenses have 2 or more areas of good focus. The resulting differently focused images fall on the same retinal area. Therefore, unlike the situation in monovision, the brain cannot use suppression to separate overlapping images. The design of multifocal lenses is again a compromise: instead of providing the sharpest possible focus at a single distance, they provide an acceptable focus over a range of distances. Because of this, all multifocal lenses cause some contrast reduction. It may be wise not to prescribe these lenses for patients who already have contrast problems or who may be at risk of developing them (eg, based on family history).

Comparative Testing of Different Solutions

Given the wide variety of presbyopia solutions mentioned in Table 30-1, a test is needed that can be used to compare the effectiveness of different solutions in terms of both acuity and contrast.

Such a test is available in the Mixed Contrast Card Set available from Precision Vision (La Salle, IL; Figure 30-1). The set consists of 2 cards with

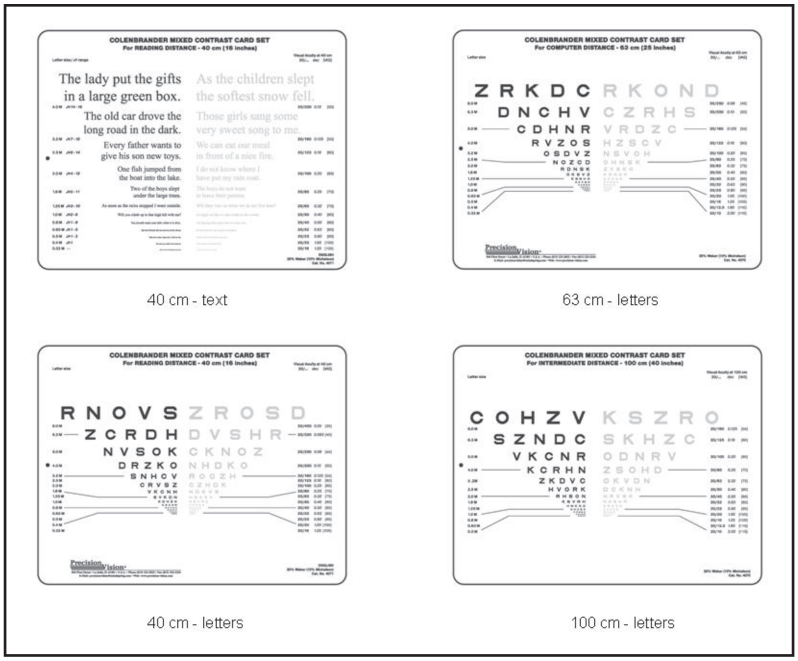

Figure 30-1. The Mixed Contrast Card Set.

4 surfaces; they offer high-contrast as well as low-contrast testing at each of 3 different distances. The cards can be used regardless of which correction modality is chosen. They can be used with unifocal, bifocal, trifocal, or varifocal spectacle lenses. They can also be used to demonstrate the effect of monovision or of multifocal contact lenses. The latter may be important before deciding between monovision and multifocal implant lenses.

The Mixed Contrast Card Set offers the following features:

- Each card comes with a cord attached so that the viewing distances are standardized. The tests are for 40, 63, and 100 cm. These distances were chosen so that each increment is equivalent to 2 lines on a chart with a logarithmic progression.
- 40 cm (2.50 D) represents a standard reading distance.
  63 cm (1.50 D) represents an average distance for viewing computer screens.
  100 cm (1.00 D) represents tasks at intermediate distances, such as viewing objects at one's desk or across a table. Each card is labeled with the visual acuity values for that distance.
- Each card offers high-contrast (HC) and low-contrast (LC) targets, side by side. This ensures that the HC and LC tests are always at the same distance and have the same illumination. The contrast level for the LC targets is an intermediate one: 20% Weber = 10% Michelson. This level was chosen because low-contrast tasks are more common in activities of daily living than are tasks requiring threshold contrast.
- A difference of 1 or 2 lines between HC and LC is normal. This is easily recorded as HC – LC = 2 lines. A greater difference points to contrast problems. Four or 5 lines of difference are not uncommon among AMD patients; even 10-line differences have been recorded. The HC-LC difference is independent of the visual acuity value. Furthermore, comparing patients' LC performance to their own HC performance can be more informative than only comparing their performance to a population average, as is done in most tests for threshold contrast, such as the Pelli-Robson[8] or Mars[9] tests.
- For patients with contrast problems, changing the illumination may have significant effects, especially for their LC performance. Retinal areas with a relative scotoma may function as nonseeing under low-light conditions and as seeing when the illumination is improved. The cards make this simple to demonstrate.
- The listed features make the test easy to administer as a routine test. If there is a large HC-LC difference, this is immediately obvious to the patient, who should then be warned to take precautions when dealing with low-contrast tasks.

Being careful when stepping off a low-contrast curb may prevent a broken hip.

- The 40-cm card has text on one side and letters on the other. In the majority of presbyopic patients, the retina will be normal. For them, testing with letters (available for all 3 distances) is adequate. For these patients, the VA value for 40-cm text and 40-cm letters should be the same. If the VA for 40-cm continuous text is worse than for 40-cm letters, this may point to scotoma interference from parafoveal scotomata, which may be a symptom of early AMD. In this case, a further retinal examination is indicated.

Although the test provides 3 standard distances, it does not mean that the performance has to be the same for each distance. Different distances may be of different importance for different patients.

The Mixed Contrast Card Set may point to more than optical problems alone. From a diagnostic point of view, it is valuable to have a simple test that may detect contrast problems even before surgery is undertaken. Because a cataract reduces both HC and LC acuity, its effect on the HC-LC difference should be minimal; a large HC-LC difference may point to retinal problems. A cataract alone should reduce the LC performance for text and letters by the same amount; a larger decrease for text may point to a scotoma problem.

OTHER TESTS

A wide variety of other near-vision tests are available. In choosing among tests, a question may be whether near vision should be evaluated by using a small letter chart or by using a reading card with continuous text. The choice depends on the condition to be evaluated. Testing with a letter or symbol chart evaluates only the foveal area where the letter or symbol is projected; it tells us nothing about the surrounding area. When dealing with an optical defect while the retina is known to be normal (as it will be in most younger presbyopes), this is sufficient, as optical deterioration of the foveal image predicts equal deterioration of the surrounding image.

However, if the retinal condition is unknown, as it may be in older presbyopes, a reading test is preferable because it covers a larger retinal area. A normal foveal acuity for letters does not rule out parafoveal involvement, as macular degeneration may start outside the fovea. The presence of parafoveal scotomata may interfere significantly with reading and with manual skills, such as writing.

A similar question can be asked about contrast testing. If the condition is purely optical, one may expect that visual acuity and contrast sensitivity will be equally affected. However, in older presbyopes, the presence of retinal contrast sensitivity changes cannot be excluded, even if the retina appears ophthalmoscopically normal. Therefore, assessment of contrast vision is a valuable addition.

Near-vision letter or symbol tests are available in both HC and LC versions. As patients switch from an HC to an LC card, they may inadvertently reduce the viewing distance, which makes the comparison unreliable. The same problem exists when Pelli-Robson or Mars cards are used to test the contrast threshold separate from the visual acuity measurement. The Mixed Contrast format avoids this by offering HC and LC on the same card. The MNread and Radner tests are available only in HC.

Reading Speed

Traditional reading tests usually have long paragraphs with small print and shorter ones with larger print. More recent ones follow the Bailey-Lovie principle and have paragraphs of equal length; these include the MNread, Colenbrander, and Radner cards. Standardized paragraphs allow one to compare the reading speeds for different paragraphs. The assessment of reading speed goes beyond an assessment of visual function (how the eye functions) to the assessment of functional vision (how the person functions) (Figure 30-2). When are such measurements most appropriate?

Reading is a complex function. It requires a proper retinal image and intact retina to send information to the brain. There, the information needs to be analyzed, first for letter and word recognition and then to understand the message. At the same time, sensorimotor coordination must happen to generate saccades and fixations that move the eye from word to word.

Recognition takes longer and reading speed slows down when not enough information enters the brain because the letters are blurred, are too small, or do not have enough contrast. Reading speed also slows down when the understanding is difficult, which is why reading one's mother tongue generally is faster than reading a foreign language. Radner cards have

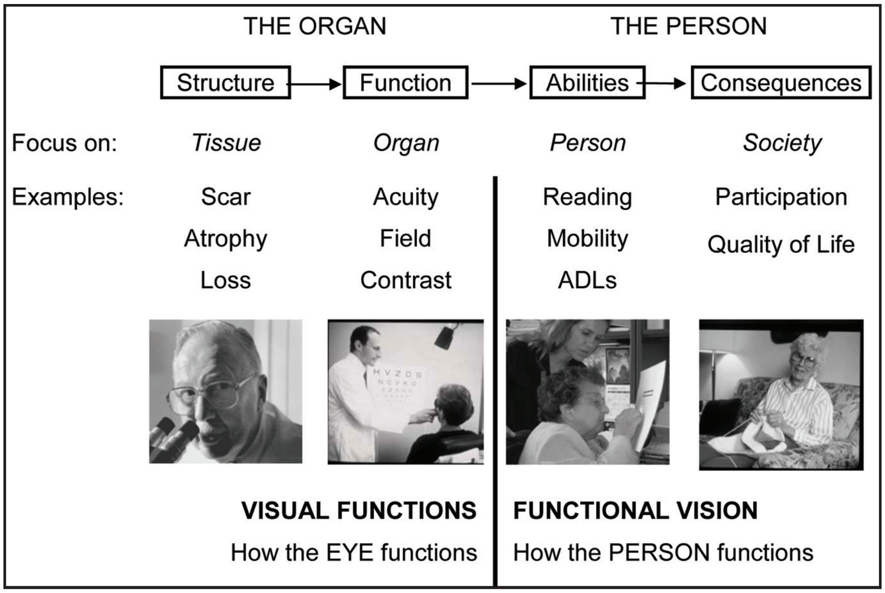

Figure 30-2. Aspects of visual functioning. (Reprinted with permission of August Colenbrander, MD.)

the most rigorously standardized sentence structure, which standardizes these cognitive tasks. It remains to be seen, however, whether reading speed measurements are more sensitive in detecting optical deficits than are visual acuity and contrast.

Plotting reading speed against decreasing print size allows the determination of a "critical print size." This is the point where the curve starts to dip. Beyond this point, the reading speed decreases further until the "threshold print size" is reached. By definition, 20/20 acuity allows threshold recognition of newsprint (1 M) at 1 meter, but most people prefer to read at 40 cm (2.50 D), which is 2.5 times above threshold. This difference between critical print size and threshold print size is also known as magnification reserve. The critical print size is important, as it provides the best reading speed with the least magnification and should be the target print size when prescribing magnification for patients with low vision.

For beginning readers and for small and low-contrast print, the cognitive task of letter and word recognition is the main limiting factor for reading speed. For established readers, reading speed is mostly limited by the sensory-motor task of scanning and moving fixation from word to word. Higher reading speeds can be obtained when eye movements are eliminated by flashing words in the same location (rapid serial visual presentation or RSVP).

Sensorimotor coordination is disrupted in retinal diseases that cause central or paracentral scotomata. Switching fixation to an eccentric preferred retinal locus (PRL), or pseudofovea, requires recalibration of all oculomotor reflexes. Reading speed measurements provide an important means for following the progress of this readaptation and the effect of training.

Even if the brain is able to recognize a blurred image for a short task, such as reading a letter chart, one may wonder whether the extra effort will result in fatigue and reduced endurance. Although it is well-known that individuals may vary considerably in the amount of time they can read comfortably, this is an aspect that has not been studied often. To test reading endurance, the International Reading Speed Texts (IReST)[10] test, which provides longer reading segments, may be most appropriate.

In summary, when only optical factors are involved, visual acuity and contrast tests probably provide the most informative parameters. When retinal factors are involved, or cannot be ruled out, reading of continuous text and reading speed measurements are important.

Additional Factors for Surgical Solutions

Solutions involving spectacle and/or contact lens corrections have the advantage that they can be tried and discarded when they are not satisfactory. For implant lenses and refractive surgery, this is not so simple. Deciding on a recommended surgical solution, therefore, requires very careful consideration of the fit between the recommended solution and the patient's expectations.

Many cases of postsurgical dissatisfaction can be attributed to differences in expectation between the surgeon and the patient and to inadequate communication about the trade-offs involved. One surgeon told an audience about a patient with a multifocal IOL who complained bitterly about glare in night driving. The surgeon decided to remove the multifocal lens and implant a monofocal one. The patient then complained that the problem of having to use reading spectacles was worse than the glare problem, so he underwent a third surgery to reimplant the multifocal lens. This story may not be common, but it points to the importance and the difficulty of adequately managing a patient's expectations.

The Mixed Contrast Card Set provides an easy way to clarify to patients the effect of various implant lenses by demonstrating the effect with spectacle or contact lenses.

The Mixed Contrast Card Set also provides a standardized platform to compare the effectiveness of various devices after they have been implemented. Knowing how the performance of various devices differs for different distances may support clinicians in customizing their specific recommendations for specific patients.

Subjective Factors

Thus far, we have discussed how to judge the optical performance of various presbyopia corrections. This is the aspect that can be most accurately measured and documented.

Ultimately, however, the goal is to help patients in performing their tasks and activities of daily living as easily as possible. We have already pointed to the fact that managing and satisfying patient expectations may be more difficult than predicting optical performance.

At this point, it may be helpful to discuss different aspects of visual functioning. Four aspects have been found to be most useful. Two of these aspects relate to the organ and 2 to the person. On the organ side, we speak of visual functions; on the person side, we speak of functional vision (see Figure 30-2).

First, we may consider various structural changes, such as scarring, atrophy, or loss. In the case of presbyopia, it is mainly the loss of flexibility in the lens. Here, the focus is on the tissue, and we need a pathologist to examine these changes.

However, the structural changes do not tell us how well the eye actually functions. We need to widen our view to the organ as a whole. We need a clinician to measure aspects of organ function, such as visual acuity, visual field, contrast sensitivity, etc.

Yet, knowing how the eye functions does not tell us how the person functions. So, we need to widen our perspective again, this time to the person level. We need to consider tasks, such as reading, mobility, and face recognition. When these functions are significantly impaired, we may need various low-vision professionals to work with the patient.

Beyond that, we need to look at the person in a societal context. Do these changes affect the person's participation in society, causing job loss, or a reduced quality of life? How can we be sure that the patient is satisfied, which should be the end goal of all our interventions?

Various activities can be viewed under more than one aspect. When considering reading, the threshold print size falls under organ function, but reading endurance (how long a person can read) falls under individual abilities, and reading enjoyment falls under quality of life.

Assessment

The various aspects also differ in the methods of assessment. For visual functions, we have well-established methods. Visual acuity is assessed with letter charts, where high-contrast letters appear on an empty background. Methods like this generally provide us a threshold value, defined as 50% above guessing.

To assess how the person functions, however, we need real-life situations where the background is never empty and the contrast rarely is as high as on a letter chart. We also are not satisfied with a brief performance at the 50% level; rather, we want near 100% performance at a sustainable level. The considerable margin between what we measure as threshold visual functions and sustainable functional vision for activities of daily living was mentioned previously.

To obtain data on sustainable performance, we mostly rely on questionnaire responses, which are not as objective as visual function tests, but are easy to obtain.

In recent years, there have been considerable advances in the construction of questionnaires and in their evaluation. To obtain a reliable score, it is no longer considered sufficient to just list some questions and to add the responses. The method that has been used most effectively is Rash analysis. It has been strongly promoted by Massof[11] for vision rehabilitation in general and by Pesudovs[12] for refractive surgery in particular.

Surgeons should abstain from developing their own questionnaire, as this makes comparisons difficult. Rather, they should use established questionnaires, which have been validated and standardized by comparison to established ones. For individual assessment, questionnaires should not only ask how difficult a certain task is, but also how much it is needed. A difficult task that is not needed for a specific person should not receive much weight, whereas a much-needed task that is only moderately difficult should receive more weight.

QUESTIONNAIRES

Most questionnaires in this area, even the well validated ones, contain only questions about certain tasks (eg, "How much difficulty do you have reading ordinary size print?") Such questions document the need for a near vision correction; they do not address the equally important question of what would be the best way to satisfy this need.

Public Health

At this point, an important dichotomy between public health needs and individual health care exists. Public health surveys, even in developed countries, have shown that an important percentage of visual impairment at all ages is due to uncorrected and undercorrected refractive error.[13] In the elderly, this is compounded by the problems of presbyopia, especially in developing countries where even access to inexpensive "drug store" spectacles may be nonexistent.

The numbers involved are far from insignificant. Adding uncorrected refractive error to the causes of visual impairment and blindness doubles the worldwide estimate from approximately 150 million to approximately 300 million.[14]

Resolving these problems requires the building of a better public health infrastructure, involving both availability and access. These problems are beyond the scope of this book. However, it should be noted that from a worldwide numerical perspective, this is by far the larger problem.

Individual Vision Care

The emphasis in this book is on individual presbyopia solutions for patients in developed countries who have access to advanced care. Rather than facing a lack of options, the problem is that they have an abundance of options and often do not have enough insight to make a truly informed choice, particularly about surgical solutions, which are difficult to reverse.

Here, patients need to be educated about presbyopia and about the various options for its correction. Eye care professionals need to be educated about the pros and cons of the various surgical and nonsurgical approaches so that they can advise their patients most appropriately. Surgeons need to be educated about the latest surgical techniques.

Although it is human nature to always be fascinated by the latest techniques, it is important to realize that the goal of the patient is simply to perform better, and this does not necessarily require the latest gadget.

FUTURE NEEDS

To better serve the needs of patients and professionals alike, several developments are desirable.

- Before deciding on surgery (which may be irreversible or difficult to reverse), patients should understand the pros and cons of each solution and the trade-offs involved.
- Better patient education and more accurate evaluation of patient needs and expectations through patient education, demonstrations, and questionnaires are required.

Often, the advantages of surgery are mentioned, but not convincingly demonstrated. Often, the trade-offs are not sufficiently explained. Quite often, patients have a limited understanding of the implications of their own choices, as demonstrated by the following:

> *A friend, who was about to have her second IOL implanted, decided that monovision would suit her best. Shortly before surgery, she changed her mind and requested two distance lenses, as that would allow her cheaper reading glasses. Soon after surgery she regretted her decision, as the cheaper glasses were not worth the hassle of always having to use reading glasses.*

After surgery, comparative evaluations of different devices should be made with standardized tests and with questionnaires that are standardized and validated. Unless such comparisons are standardized, results from different studies will not be comparable.

The questions asked of the patient should not just concentrate on the tasks to be performed, but should also address comparisons between different devices that accomplish the same task.

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