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Overview of Clinical Aspects

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Introduction: The Optical Correction of Presbyopia

Presbyopia, an age-associated deterioration in the focusing ability of the eye for near objects, is a normal and expected feature of human visual physiology.

An age-related accelerating decline in the natural accommodative adjustment of the crystalline lens can be detected during adolescence, but it is only when an individual's near point has receded to an inconvenient distance that any remedial action becomes necessary. It is at this point, usually during the fifth decade of life, that the refractive condition becomes identified clinically as presbyopia. The practical inconvenience and any associated asthenopic symptoms (ie, eyestrain) are usually relieved by the provision of positive lenses, either as a spectacle-mounted magnifying aid or as a supplement to existing refractive correction.

It is important that the presbyopic optical correction be considered in relative terms, being subject to influences that include the individual's age, refraction, body dimensions, specific near-vision environment, and habitual close-range circumstances. The condition, although universal, is not necessarily suited to a universally applied correction.

Historically, it is likely that the earliest provision of eyeglasses (probably in the late 13th century) was for the correction of failing near vision. The arrival of the printing press in the late 15th century and the subsequent widening of the knowledge and skills bases within the general population gave added impetus to the need for the availability of near-vision aid. The strength of early eyeglasses mounted with positive lenses was usually determined by trial and error or it relied on the unqualified spectacle vendor's empirical recommendations based on the age of the intended user.[1] This approach, although still followed by many presbyopes today, is considered to provide an inferior correction compared with individually prescribed near-vision aids that are obtained by using clinical techniques.

This chapter will review several procedures that are available to the clinician for determining presbyopic optical correction.

The Amplitude of Accommodation

The amplitude of accommodation indicates the maximum amount of accommodation (ie, focusing ability) that an individual can exert. It is the dioptric difference between the far point (accommodation fully relaxed) and the near point (maximum accommodative effort); both are measured with reference to a common point, usually either the spectacle plane or the corneal apex.

In the case of emmetropes or fully corrected ametropes, the far point will be at optical infinity.

Pallikaris IG, Plainis S, Charman WN.
Presbyopia: Origins, Effects, and Treatment (pp. 11-20).

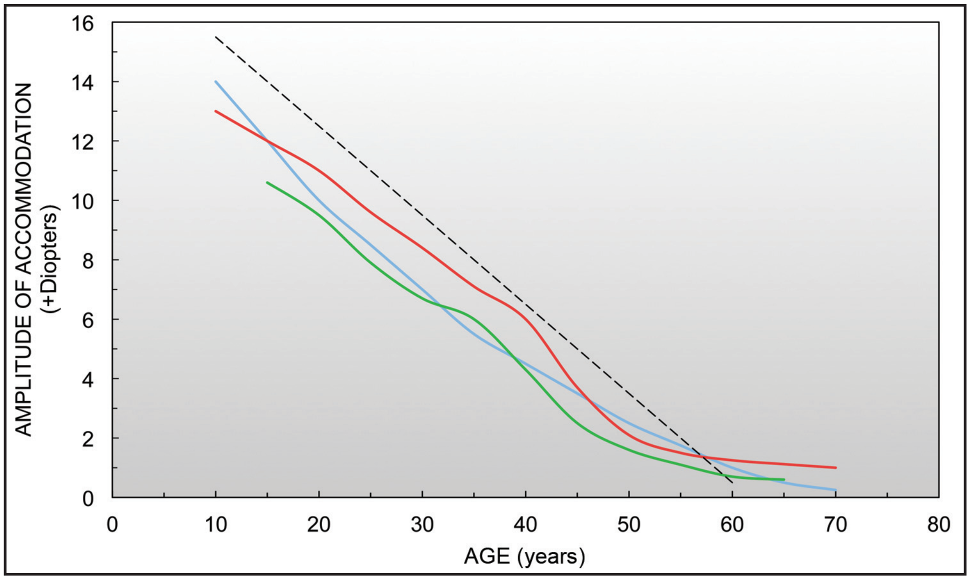

Figure 2-1. The declining amplitude of accommodation with advancing age, as determined by Donders[2] (blue line), Duane[3] (red line), and Turner[4] (green line): monocular values, referred to the spectacle plane. Also shown is a prediction of probable (mean) amplitude derived by Hofstetter[5] (dashed oblique black line) using the formula: Amplitude of accommodation (D) = 18.5 – [0.3 x AGE], where AGE refers to the patient's age in years.

Consequently, the determination of the near point (reciprocal of the near focus position measured in meters) will give a direct indication of the accommodative amplitude.

Because the amplitude of accommodation declines with age, close work eventually becomes difficult, and the use of reading spectacles is necessary to relieve the near-focus problem and associated symptoms. Knowledge of an individual's amplitude of accommodation can assist with the prescribing decision (see "'One-Half' or 'One-Third' in Reserve" section on page 16).

Age-Associated Changes

Donders[2] is credited with recording the first quantitative description of the protracted decline of the human eye's accommodative facility with advancing age. Donders' results have proven to be substantially robust when considered alongside the later and more extensive studies by Duane[3] and others[4,5] throughout the 20th century (Figure 2-1).

Typically, the amplitude of accommodation of an emmetropic 12 year old is approximately 14.00 D (ie, near point at 7 cm). However, by the time an individual is approximately 35 years old, this value has halved to *ca* 7.00 D (14 cm); 10 years later, accommodation has halved again to *ca* 4.00 D (25 cm); and, from a clinical perspective, accommodation has ceased by the age of 55 to 60 years. An accommodative amplitude of ≤4.00 D is frequently perceived as the clinical definition of presbyopia.

The selected amplitude of accommodation results shown in Figure 2-1 are typical of the many (almost exclusively cross-sectional) studies published over the years, and this material provides useful general guidance for the clinician when prescribing near refractive additions (see "Determining Near Addition" section). However, one must remember that subjective amplitude of accommodation measurements, typically recorded by several clinical methods described in the Measurements section, also include an element attributable to ocular (pupillary) depth of focus. This latter effect is most pronounced beyond the age of 50 years when age-associated pupillary miosis[6] becomes a relatively greater influence, hence the eventual nonlinearity of the previously linearly declining plots (see Figure 2-1) during the sixth decade of life. Any need for an individual's increased reading correction beyond the early 60s is to compensate for an age-associated decline in acuity,[7] rather than to counter any continued loss in natural accommodation. The introduction of increased positive lens power requires the adoption of a shorter working distance and thus increases the angular subtense and relative visibility of object detail.[8] This physiological-optical explanation of the amplitude of accommodation data highlights the necessity for clinical skill and judgment by the refractionist, rather than simple adherence to a formulaic approach to presbyopia vision correction.

Measurement Principles

The accommodative amplitude is typically measured by presenting a small card bearing several lines of printed text at 40 to 45 cm to the optically corrected

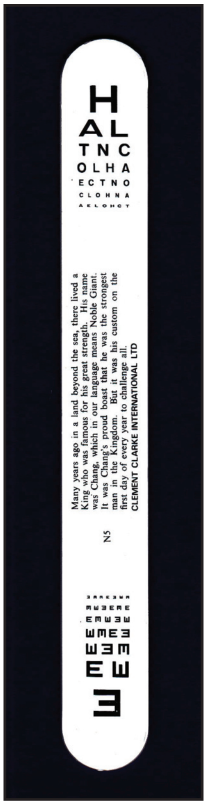

Figure 2-2. Commercially available near fixation stick displaying graded sizes of optotype at either end and a block of printed text (N5) in the center.

patient (Figure 2-2). The card is then moved toward the patient while he or she endeavors to maintain print clarity. The near point is exceeded when blurring of the text is reported. Repeating this procedure several times and taking the reciprocal of the average blur distance will adequately quantify the amplitude of accommodation for clinical purposes (see "'Push-Up' Method" and "'Push-Down' Method" sections on page 14). Although measurements in the binocular situation might pertain to the majority of patients, the recording of monocular and binocular amplitude assessments is usually indicated.

Inter-Eye Asymmetry

Within a small margin of error (typically <1.00 D), the 2 monocular accommodative amplitudes should be similar and slightly less than the binocular range; the convergence response under binocular conditions induces a small amount of additional accommodation.

An inter-eye accommodative asymmetry should prompt the clinician to seek an explanation for the difference, including rechecking the distance refraction and binocular balance. Alternatively, observation of the patient (signs) and any reported difficulties (symptoms) might already have alerted the examiner to a potential problem. Inflammation of the uveal tract or pathological or neurological disease processes associated with conditions such as glaucoma, metabolic disorders including diabetes, and oculomotor anomalies can compromise accommodative ability. A substantial interocular refractive difference and the visual deficiency associated with unilateral amblyopia[8] can also produce accommodative asymmetry.

Age-Related "Norms"

Expected values of monocular spectacle accommodative amplitude versus subject age, as determined by several investigators, are shown in Table 2-1. The linear relationship between these 2 variables[8] (see Age-Associated Changes section) has been utilized[5] to produce a regression equation that calculates the probable (mean) amplitude for any age:

$$\text{Average dioptric accommodative amplitude} = 18.5 - [0.3 \times \text{AGE}],$$

where AGE represents the patient's age in years.

The regression line fitting these calculated values is shown by the dashed oblique line in Figure 2-1.

Deviation from expected values, including reduced or asymmetric amplitudes, should alert the examiner to the possibility of undetected trauma or pathology. The clinician should also be aware of the adverse influence of certain ocular or systemic medications. An apparently otherwise normal visual system may present with accommodative deficiency. Environmental conditions, including climate, may also influence the accommodative amplitude; for example, it is possible that the onset of presbyopia occurs relatively earlier in individuals living in the tropics compared with individuals living in more temperate locations.[10]

Measurement Techniques

Several subjective and objective methods are available to facilitate the determination of the amplitude of accommodation across the age spectrum.

Adequate general room illumination, supplemented by adjustable nonglare spot lighting at the patient's shoulder, is necessary for nonretinoscopic methods. Distance and near visual acuity should have been established previously, and the optimal refractive correction should be left in the trial frame. With patients of middle age and older, the distance refraction must be supplemented by an additional convex lens to

TABLE 2-1. ***AMPLITUDE OF ACCOMMODATION VERSUS AGE***

	AMPLITUDE OF ACCOMMODATION (D)*			
AGE (Y)	DONDERS[2] Push-up	DUANE[3] Push-up	TURNER[4] Push-down	HOFSTETTER[5] Mean Formula Value+
10	14.00	13.00	-	15.50
15	12.00	12.00	10.60	14.00
20	10.00	11.00	9.50	12.50
25	8.50	9.60	7.90	11.00
30	7.00	8.40	6.70	9.50
35	5.50	7.10	6.00	8.00
40	4.50	6.00	4.30	6.50
45	3.50	3.70	2.50	5.00
50	2.50	2.10	1.60	3.50
55	1.70	1.50	1.10	2.00
60	1.00	1.20	0.70	0.50
65	0.50	1.10	0.60	-
70	0.20	1.00	-	-

**Monocular values, referenced to the approximate spectacle plane. Note: Compiled from sources as indicated.*

+Mean amplitude = 18.5 – [0.3 x AGE], where AGE refers to the patient's age in years.

ensure adequate near acuity; the positive power of this lens must then be subtracted from the measured dioptric value to arrive at the actual accommodative amplitude.

"Push-Up" Method

This popular technique is one with which the presbyopic patient can usually relate because the introduction of blur at near matches his or her primary presenting visual symptom. The test target can be presented in free space or, for ease of the linear measurement relative to the spectacle plane, mounted on a slider attached or adjacent to a calibrated ruler. The target usually comprises several lines of small print (typically N5; see Figure 2-2) of sufficient detail that even a slight defocus will be evident as the card is steadily moved toward the patient. The position of just-noticeable blur is recorded, and the forward target movement is continued to confirm blurring and then moved back slightly to restore clarity. The point between the first-blurred and first-clear positions is assumed to represent the subjective near point, acknowledging the spectacle plane displacement.

The procedure should be repeated several times on each eye as well as binocularly, with short breaks in between, and the average calculated.

"Push-Down" Method

The push-down method (sometimes termed *push-out*) is simply a variation on the push-up technique. The target card is initially placed well within the patient's anticipated near point, and it is consequently blurred as it is steadily moved away from the spectacle plane until the patient reports that the text is just legible. Again, it is advisable to repeat this procedure several times and take the average result, which will invariably be lower than the accommodative amplitude recorded with the push-up method. The average value of a combined push-up and push-down approach may give the best indication of accommodative amplitude under monocular and binocular circumstances.

Minus Lens Method

A lens-based technique favored by some clinicians for monocular amplitude determination involves placing the target card at 40 cm in front of the patient. The use of a phoropter is most suitable for this method. Negative lenses are introduced in −0.25-D increments until the patient reports just-noticeable and insuperable blurring of the text. The accommodative amplitude is given by the sum of the total negative lens power introduced and +2.50 D (reciprocal of 0.4 m) of necessary vergence power.

As with the push-up or push-down techniques, an additional positive lens element must be introduced to facilitate clear focus at 40 cm before testing of a presbyopic patient commences. This element should then be subtracted from the notional +2.50 D vergence power, in addition to the total value of the negative lens power introduced, to arrive at the amplitude of accommodation.

This method demonstrates an improvement in measurement accuracy compared with the push-up or push-down techniques as a constant-sized target is presented to the patient throughout the amplitude determination; thus, the pupillary aperture remains stable, and depth-of-field effects do not corrupt the result. Accommodative amplitude values are invariably smaller using this method primarily because of this refinement, combined with the reduction in proximal influences.[9] This point makes the minus lens method suitable for patients with amblyopia or binocular vision anomalies where proximal effects can prove especially distracting.

Dynamic (Near) Retinoscopy

It has long been recognized that the retinoscope can provide a quick and accurate measure of accommodative amplitude. It is especially useful in circumstances where verbal communication is difficult or where subjective assessment is likely to be unreliable (eg, with amblyopes).

The patient should be given his or her optimal distance refraction in a trial frame (not in the phoropter). To minimize spuriously low results and to enhance accuracy, the retinoscope beam intensity should be greatly reduced from the usual level, and multiple brisk lateral sweeps should be used to prevent the patient from fixating on the compelling visual (but poor accommodative) stimulus of a slow-scanning bright beam[9] and having the room lights only partially dimmed will assist with this endeavor. This illumination level will also permit the patient to view printed letters on a narrow vertically oriented card held toward him or her at 40 cm by the examiner and adjacent to the retinoscopy line of sight (see Figure 2-2). Starting at 50 cm and moving the retinoscope horizontally, the reflex in the patient's pupillary aperture should show an "against" movement, which will be neutralized as the examiner moves forward to behind the fixation card. The card itself is then moved forward closer to the patient, and if he or she is able to increase accommodation to maintain a clear view of the small printed letters, an against movement will again be seen. The procedure is repeated until the distance of retinoscopy reflex neutrality ceases to advance with further forward movement of the fixation card. The reciprocal of this distance (measured in meters) indicates the accommodative amplitude in diopters of the eye under examination. The procedure can then be repeated for the companion eye.

The accommodative response to a visual stimulus is typically slightly less than the dioptric target distance would suggest, with depth-of-focus providing sustained clarity. Surprising or relatively large measures of apparent accommodative deficit (lag) or excess (lead) may indicate procedural error, or the wearing of an inaccurate distance refractive correction at assessment, or accommodative instability rather than simply an inappropriate age-related accommodative amplitude (see "Age-Related 'Norms'" section on page 13). Such cases require repeat or further assessment.

Determining Near Addition

The clinical determination of near addition (add) is typically a 2-stage process—from a tentative evaluation that is determined on the basis of a combination of numerically derived estimates and clinical lens manipulation to a final prescribed add value.

Prerequisites for Accurate Determination

Three conditions must be met to facilitate the provision of a satisfactory and wearable add: (1) a precise and binocularly balanced distance refraction, (2) an accurate determination of the patient's amplitude of accommodation, and (3) a good knowledge of the patient's desired or habitual close working position(s).

A degree of flexibility of focus position on either side of the indicated near working point is desirable. As accommodative amplitude declines with increasing age and as the required add power increases, this margin of flexibility narrows, and the precision of determining the amplitude of accommodation becomes paramount for successfully prescribing a satisfactory near-refractive correction.

Preliminary Estimation of the Add

The determination of the preliminary or tentative add can be accomplished by using several clinically derived rules of thumb and specific refractive techniques. A methodology that derives a tentative result closest to the final prescribed add is the optimum approach.[11] However, the refractionist must remember that the final arbiter of success will be the visual satisfaction of the prescription wearer—the patient.

"One-Half" or "One-Third" in Reserve

A logical starting point for the determination of add power is the individual's amplitude of accommodation. Millodot and Millodot[12] reported that Landolt (1886) first discovered that an individual can sustain only a proportion of his or her amplitude of accommodation without experiencing asthenopic symptoms. Landolt suggested that one-third of accommodation should be held in reserve. Other relative amounts have been proposed, with one-half of accommodation in reserve being the most popularly applied ratio and possibly the best empirical estimate,[12] but one-third in reserve is probably more appropriate for younger presbyopes.

For example, consider the presbyopic patient who desires a working distance of 40 cm and has a measured amplitude of accommodation of 3.00 D; on the basis of one-half of the accommodation being held in reserve, the tentative add would be (2.5 – 1.5) or 1.00 D, whereas if one-third in reserve was considered sufficient, the suggested add would be (2.5 – 2.0) or 0.50 D.

Age-Expected Predictions

Two disadvantages associated with subjective methods of accommodative amplitude determination are (1) the time to administer the methods and (2) the unfortunate finding that they may not provide a sufficiently accurate or appropriate indication of the patient's required add.

Table 2-2. *Age-Expected Near Addition*

Age (y)	Tentative Add (D)
45	+1.00
50	+1.50
55	+2.00
60	+2.25

Note: Derived assuming a working distance of approximately 40 cm. (Based on data compiled from Pointer JS. The presbyopic add. Parts I-III. Ophthalmic Physiol Opt. *1995;15(4):235-253.)*

Hanlon et al[13] assessed the add values when rechecking the optical prescription of intolerant patients by using several tentative assessment techniques. The determination of the initial add simply on the basis of a reference table of age-expected values accounted for the least amount of prescribing errors (14%). By comparison, the one-half amplitude approach produced errors in 30% of patients, and the binocular-fused crossed-cylinder method (see "Fused Cross-Cylinder" section on page 17) was apparently inaccurate in 61% of patients.[13]

The efficiency of the age-expected add-prescribing approach has recently received further support[11] while acknowledging that the patient's near requirements are of paramount significance when establishing the final prescribed add value.

Table 2-2 shows suggested age-expected values for the tentative add (rounded to the nearest 0.25 D) for patients aged 60 years or younger; a working distance of approximately 40 cm is assumed. For a closer range or for a more relaxed working distance (eg, computer use), the dioptric value corresponding to the differential working distance will be added to or subtracted from, respectively, the tabulated values to arrive at a more suitable figure for the tentative add.

As previously stated, from approximately age 40 to 45 years, most individuals begin to show the signs or experience the symptoms of presbyopia. Certain ethnic groups, hyperopes, patients of small stature, or those who require a close working position may require their first near correction at an earlier age than

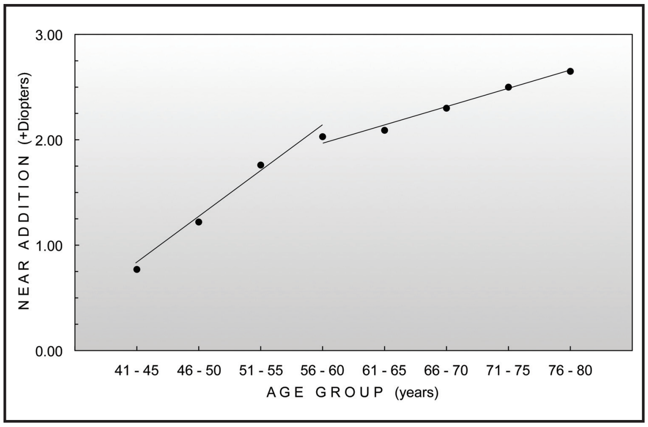

Figure 2-3. The mean near add versus patient age group. An initial steep increase in positive lens supplement is succeeded beyond the mid-50s by a much steadier requirement. (Based on data compiled from Pointer JS. The presbyopic add. Parts I-III. *Ophthalmic Physiol Opt.* 1995;15(4):235-253.)

myopes or longer-limbed persons.[1,12] Over ensuing years, the supplementary near refractive correction must be steadily increased to counter the age-related accommodative decline. This process continues up to the mid-50s, at which time the accommodative amplitude is effectively zero. Subsequent to this age, the near addition still needs to be increased, but at a reduced rate.[1,7] This clinical trend is illustrated in Figure 2-3.

This discontinuity in the progression of presbyopia necessitates a differential approach to the age-expected tentative add derivation. For patients younger than 60 years, reference to an evidence-derived source such as Table 2-2 should provide a useful prediction of the required add but is subject to slight adjustment when the desired working distance is substantially greater or less than 40 cm. Beyond the age of 60 years, knowledge of the patient's preferred working distance will more appropriately indicate the tentative add as being essentially the dioptric distance less a small amount to allow for depth of focus (this being typically 0.25 or 0.50 D, with higher adds requiring a slightly greater reduction than lower adds).[6]

Although Figure 2-3 provides some guidance when prescribing for the older presbyope, clinical experience combined with attention to the patient's near requirements and a knowledge of his or her current add will most usefully assist the add determination. It must be stressed that the habitual working distance requires careful estimation in what is an atypical (clinical) environment for the patient. The examiner should ensure that the patient is not relying on assumptions or being influenced by the practitioner's estimate of the required add or even resting his or her elbows on the consulting room chair.

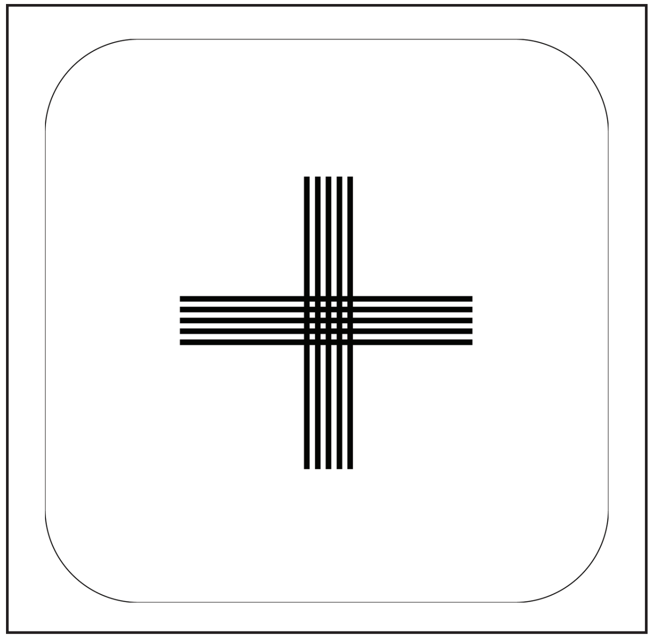

Figure 2-4. The multiple crossed-lines test target used in the fused cross-cylinder method for the determination of the tentative add.

Clinical Techniques for Add Estimation

Several subjective techniques have been devised as alternatives to the numerical approaches for the tentative determination of the near add. Although these techniques were developed for use with a phoropter as part of the instrument's refraction process, with care they can be used with lenses mounted in a trial frame.

Ambient light levels should not be too high for these methods. Lens changes should be brisk, especially when evaluating younger presbyopes who may still manifest a small accommodative response (relaxation) to the introduction of plus lenses and when testing under monocular conditions where a convergent accommodative response will be absent.

Fused Cross-Cylinder

The cross-cylinder and its manipulation will be familiar to refractionists. The same optical approach can be used under binocular and reduced ambient illumination to determine the near add.

The visual target is usually a cross-grid of multiple black lines on a white background (Figure 2-4). The patient views this target at his or her desired working position through paired cross-cylinders oriented with the negative cylinder axes in the vertical (90 degrees) meridian. The horizontal grid lines will appear bolder or darker to the optimally distance-corrected patient.

Pairs of plus lenses are then introduced to balance the intensity of the crossed sets of lines or, if the patient's decision on equality is doubtful, to produce a reversal of contrast orientation.

Some practitioners prefer to start by adding a pair of +3.00-D lenses to the distance correction. The patient will then usually report that the vertical lines are more prominent, and the binocular add is then reduced in 0.25-D steps until equality is achieved. This approach may give the patient more confidence at recognizing a switch in orientation intensity and influence subjective judgment of equality.

The test assumes that the patient's accommodation is stable, so results might be more accurate in advanced presbyopes than early presbyopes. A ±0.50-D cross-cylinder is usually adequate, but a larger astigmatic interval may be necessary where corrected acuity is poor.

Monocular testing may produce more variable results. Of course, this is the approach that is likely to be adopted when using loose lenses with a trial frame. Where anisometropia is present, monocular testing permits the determination of unequal accommodative demands and hence differing right and left add powers.

The cross-cylinder method has a tendency to indicate the highest plus power of all the tentative add techniques. Consequently, the practitioner should exercise caution when considering the application of the indicated power to the final near prescription, being especially mindful of the patient's desired working distance. Past experience suggests that overcorrection is usually tolerated less than undercorrection.

Duochrome Chart

Clinicians will be familiar with the format of this test from its application during the distance refraction procedure. In a manner similar to distance, a balance point at near is determined subjectively on the basis of the chromatic focal interval (*ca* 0.44 D) of the human eye. Shorter wavelength green light is refracted more than longer wavelength red light; therefore, the green focus will be anterior, and the red focus will be posterior to the retinal reference plane, assuming that a correct distance refractive correction is in place. A pair of identical stimuli (usually a bold optotype or Verhoeff's concentric rings) is displayed on adjacent red and green backgrounds (Figure 2-5). The color filters should be of equal luminance transmittance, with peak wavelengths at equal dioptric intervals on either side of the yellow sodium line (589.6 nm).

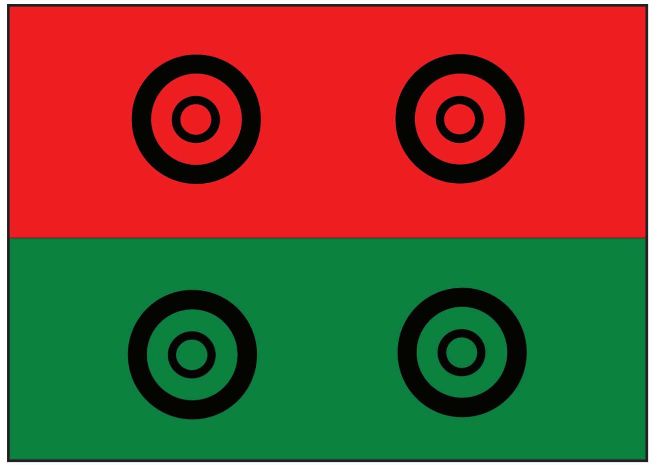

Figure 2-5. A duochrome chart with pairs of concentric ring test stimuli.

Color-anomalous individuals can satisfactorily perform the test—responding in terms of relative optotype clarity—although protans will probably report that the red background appears dimmer than the green.

The optimally distance-corrected patient views a hand-held duochrome chart under reduced ambient illumination at his or her chosen working position, and pairs of positive spheres are placed before the eyes until optotype clarity (or blackness) is balanced or just biased toward the green.[14] Alternatively, and especially if a trial frame is used, monocular determinations are made, leaving the result just on the red; binocular viewing is then permitted, and binocular adjustments are made by reducing the add by -0.25 D to produce equality or a slight green bias.

Occasionally, older patients find the test difficult to perform as age-associated crystalline lens changes may compromise their subjective judgment criteria.

It is conceivable that a combination of the fused cross-cylinder and duochrome methods might provide a useful tentative add determination technique. Recent evidence[15] has suggested that a bichromatic target background may moderate the tendency for the cross-cylinder technique to overplus the tentative add value.

Dynamic Retinoscopy

A retinoscopy technique has already been described (see "Dynamic (Near) Retinoscopy" section on page 15) with regard to measuring the amplitude of accommodation. To indicate the magnitude of the tentative add, the narrow fixation card is held at the patient's chosen working position, and plus lenses are introduced over the distance refraction until neutralization of the retinoscopy reflex movement is achieved. Use of the phoropter will facilitate binocular (laterally paired) lens changes.

The Presbyopic Prescription

To formulate the presbyopic prescription, the patient should view (under general room illumination) a page of graded-size printed text at his or her desired working position; the tentative add should supplement any distance refraction in the trial frame. The examiner can then refine the power of the addition binocularly to achieve clarity not only at the patient's preferred working position but also over a range on either side of this point. If these conditions are difficult to meet with a single near lens power, progressive addition lenses, an intermediate prescription, or (with the patient's agreement) a compromise prescription may be necessary.

The final lens power and any caveats should be recorded, together with near acuity and the range of clear vision, for future adjustments or subsequent prescription intolerance.

Avoiding Near-Prescription Intolerance

The key to providing a patient with an acceptable reading or close work prescription is to pay careful attention to his or her near-work requirements. The patient should demonstrate the necessary working distance to the examiner and indicate what tasks or activities he or she intends to undertake at that position. Without this knowledge, it is possible that valuable chair time will be spent determining the correct add for the wrong position.

Undercorrection will probably be more of a source of frustration to the patient rather than a cause of eye strain. The examiner should be aware of this potential prescribing error if the patient has early nuclear cataract changes that induce a myopic shift in his or her distance refraction; a cautious increase in the add above expected levels may be necessary in these cases.

In contrast, it is most likely that patients will be least tolerant of an overcorrection at near. In this situation, excessive convergence combined with a limited range of useful near focus will soon cause many patients to experience problems. The prescribing requirement is for the provision of the weakest optical assistance compatible with good near visual performance over a reasonable range.

The preferred approach to presbyopic prescribing is to use a trial frame and loose lenses. If a tentative near add has been obtained using a phoropter, it is worth double-checking the result with the indicated correction mounted in a trial frame before prescribing.

Persistent dissatisfaction with near focus, often accompanied by asthenopic symptoms, may suggest that the problem lies with the distance correction, to which the near correction is but a supplement. An equal add for each eye will be required in the majority of cases. If this is not the case, a back-to-basics check on the individual monocular distance prescription elements is indicated followed by a review of the binocular balance with the final prescription.

Spectacle lens corrections for extreme ametropia can be problematic. The angle of the line of sight is subtly different for distance versus near viewing, but usually this distinction proves to be of no practical significance. However, in cases of high astigmatism, an adjustment to the prescribed cylinder power (possibly a slight reduction in negative cylinder) may be necessary to achieve best near acuity. In addition, the small degree of excyclotorsion when the eyes are converged may necessitate the slight rotation of a high cylinder axis (especially if the latter is oblique) to sustain ocular comfort and acuity at near.

In extreme cases, a separate optical aid may need to be dispensed for close work. However, modern progressive addition lens designs are more forgiving of modest working position variation; therefore, appropriately corrected near vision remains an achievable goal for the majority of presbyopic patients.

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