PRESBYOPIA & PRESCRIBING NEAR GLASSES

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Presbyopia = Old Eyes

- Gradual loss of accommodative response resulting from loss of elasticity of the lens
- It becomes a clinical problem when the remaining accommodative amplitude (AA) is insufficient for the patient to carry out near-vision tasks
- Symptoms of presbyopia usually begin after age 40 years
- The age of onset depends on preexisting refractive error, depth of focus (pupil size) & the patient's visual tasks

Eur J Ophthalmol. 2015 Jul-Aug

Correlation between ocular biometry and amplitude of accommodation in early presbyopia.

Faramarzi A, Bagheri A, Karimian F, Shaianfar H, Razzaghi MR, Yazdani S

- There was no significant correlation between AA and any biometric parameter including KR, ACD, LT, VL, and AL measured by Lenstar using univariate and multivariate analysis in early presbyopic eyes

Accommodative Insufficiency

- Premature loss of accommodative amplitude
- Concurrent or post debilitating illness
- Reversible: Medications such as the parasympathetic used in treating some GI disorders or tranquilizing drugs
- Irreversible: neurologic disorders such as encephalitis or closed head trauma

Management

- Nonsurgical
  - near vision glasses (Add)
  - convergence exercise

- Surgical
  - Corneal Inlays(CAMRA)
  - Presbylasik
  - Monovision
  - Multifocal IOLs

Determining the Power of a Add

- Necessary information

1- Baseline refraction

2- Accommodative Amplitude (AA)

3- Patient's activities (reading, sewing, or computer use)

Baseline refraction

- The distance correction must be in place before the AA is measured, or else a myope would give a falsely high AA and a hypermetrope a low one

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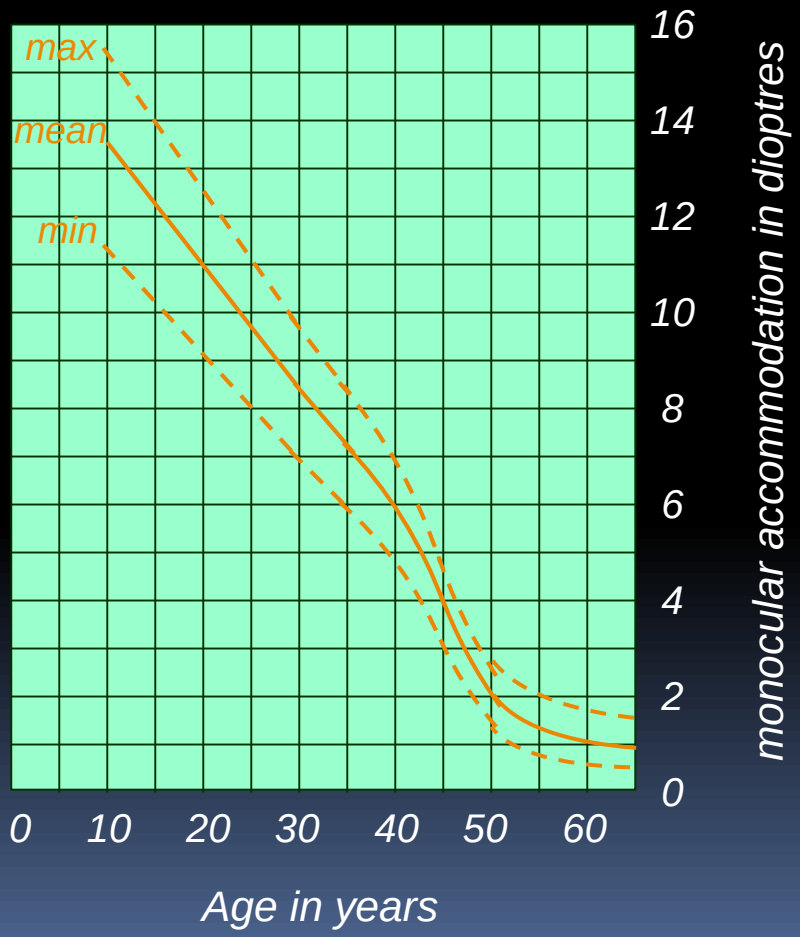
Amplitude of accommodation and age

Amp	Age
12	15
10	25
8	33
6	40
4	45
2	50
1	70



Measuring AA

1- Near point of accommodation with accurate refractive correction in place

2- Method of spheres

- Minus lenses at distance until the fixation target blurs (minus & plus lenses at near)

Near point of accommodation

- The simplest practical method is to have the patient fixate on a near and move the test card toward the eye until the print blurs (push-up test)

- Near point can be converted into diopters of AA

D = 1/ Near Point (m)

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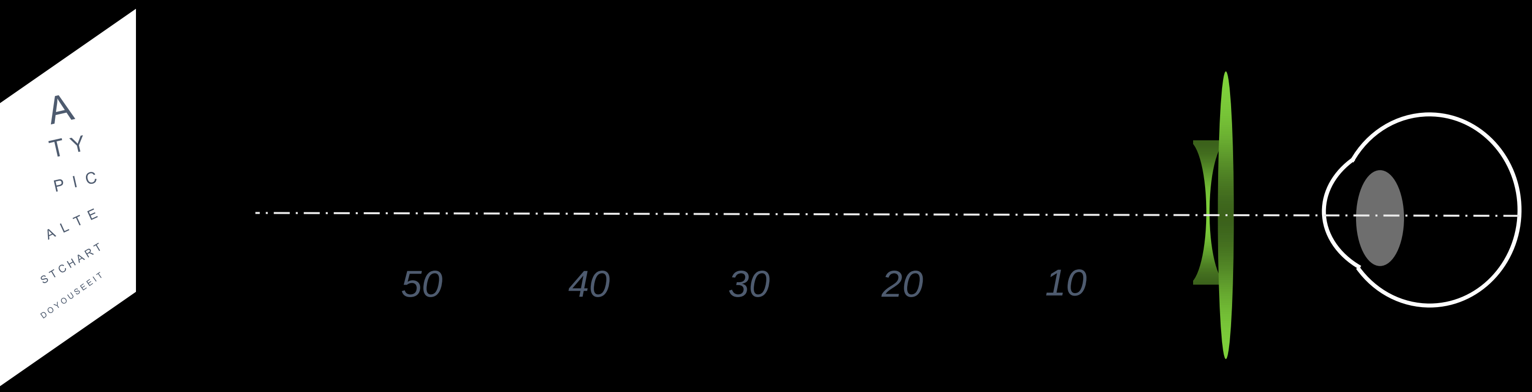
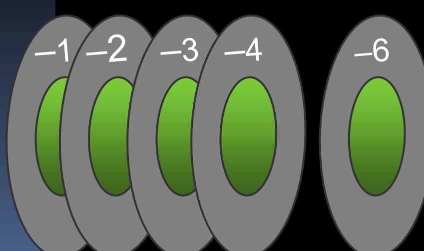
Measurement of amplitude of accommodation

The distance correction, if any is required, should be in place.

3. *Minus lens method: [illegible] signifying that the accommodation can no longer overcome the induced artificial hypermetropia.*





Selecting an Add

- Determine the amount of accommodation required for the patient's near-vision tasks (reading at 40 cm require 2.5 D of accommodation)

- From the patient's measured AA, allow one half to be reserve

- If the patient has 2.0 D of AA :

  2.50-1.00 = 1.50

Range of clear vision (Far point to Near point)

- The patient is directed to observe the smallest size that is readable with add
- Bringing the card closer until the print begins to blur

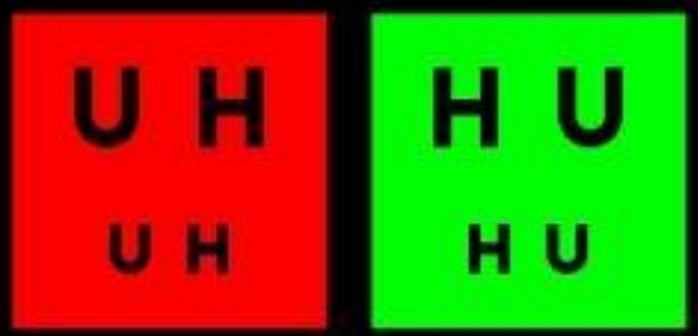
  repeated with the card moved further away
- These two positions should straddle the preferred position, with the greater part of the range on the far side

Should Prescribe Astigmatic Error in Near Add? YES

- Small uncorrected or residual astigmatic errors of the order of 0.50 D prevent sharp retinal imagery.
- As a result, the accommodation tends to fluctuate in search of best focus.

Duochrome test

- With the addition in place, the patient holds a near duochrome test
- Each eye is tested separately
- A slight clarity preference for **green** background or equality



Binocular AA

- Because binocular AA is usually 0.5-1.0 D > monocular AA, using the binocular measurement generally guards against prescribing too high an add

Full & Half Frame

- Reading glasses come in two main styles: full frames, and half-frames, the smaller "Ben Franklin" style

- Full reading glasses for people who spend a great deal of time concentrating on material close-up.

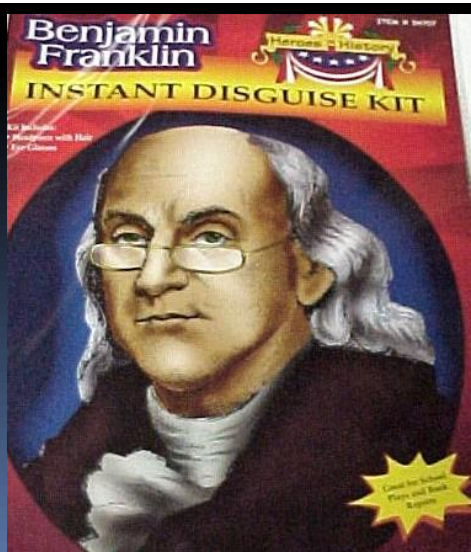


Figure 1: *A man wearing look-over reading spectacles. He looks through the near spectacle prescription lenses to read his book and looks over them to see things that are in the distance.*

Custom-made versus Ready-made near glasses

- Ready-made can be prescribed if:

- Both eyes have a similar refractive error

-The patient has comfortable vision with readymade spectacles

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Determination of the near addition

From measurement of the amplitude

Add = 1/D(m) – ½ Amp_S — *e.g. reads at 40 cm Amp_S = +2.00 D*

or Add = 1/D(m) – $^2/_3$ Amp_S — *requires near Add of +1.50 D*

From the patient's age

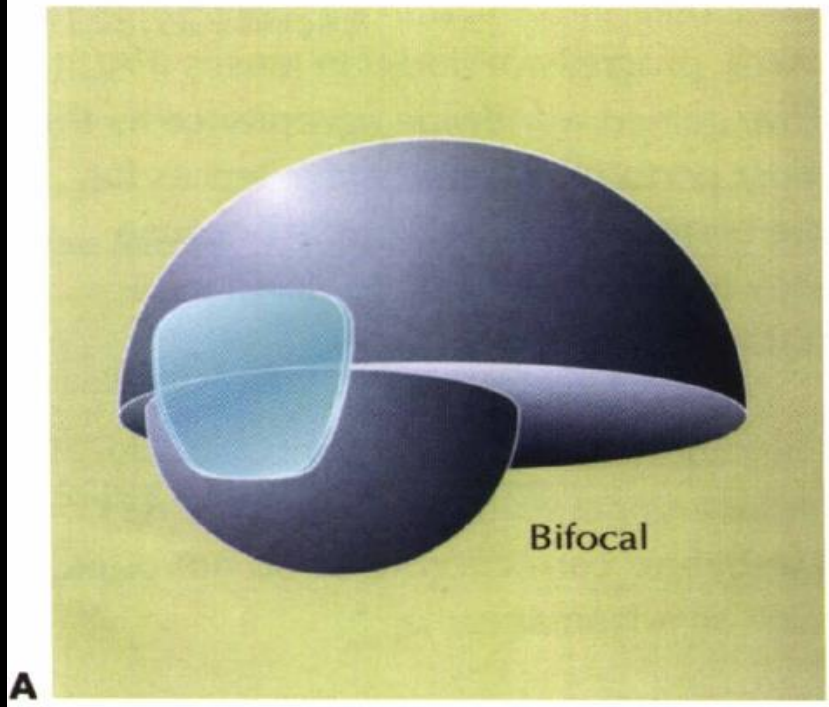
Age	Expected amplitude	Near addition
40	*6.00 D*	*–*
45	*4.00 D*	*0.00 – 1.00*
50	*2.00 D*	*1.00 – 1.75*
55	*1.00 D*	*1.50 – 2.25*
60	*1.00 D*	*1.75 – 2.50*

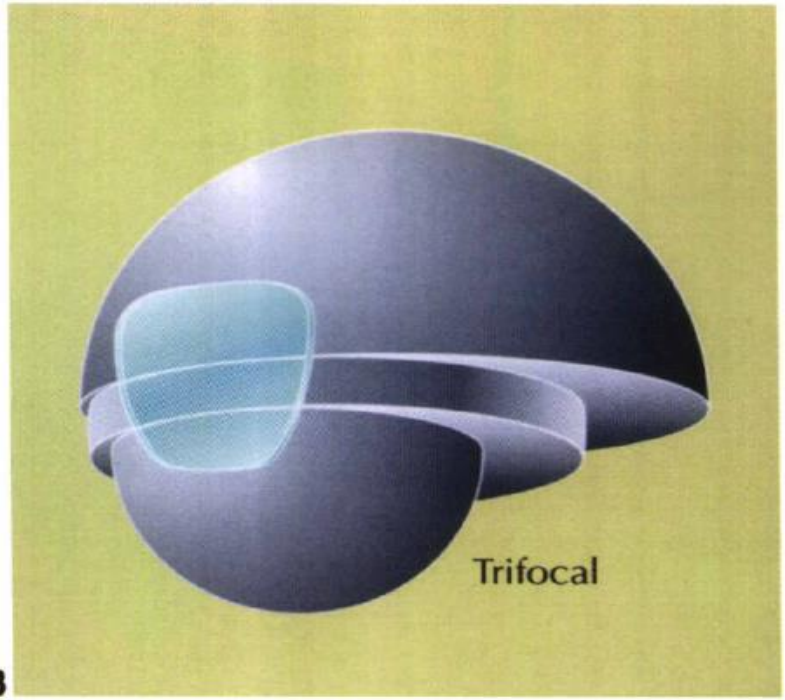
Various age-related formulae e.g. (Age – 35)/10

From the present spectacles: *If subject is relatively happy with present correction, do not change mean sphere.*

Other types of presbyopic glasses

- Bifocal
- Trifocal
- Progressive Addition Lenses (PAL)





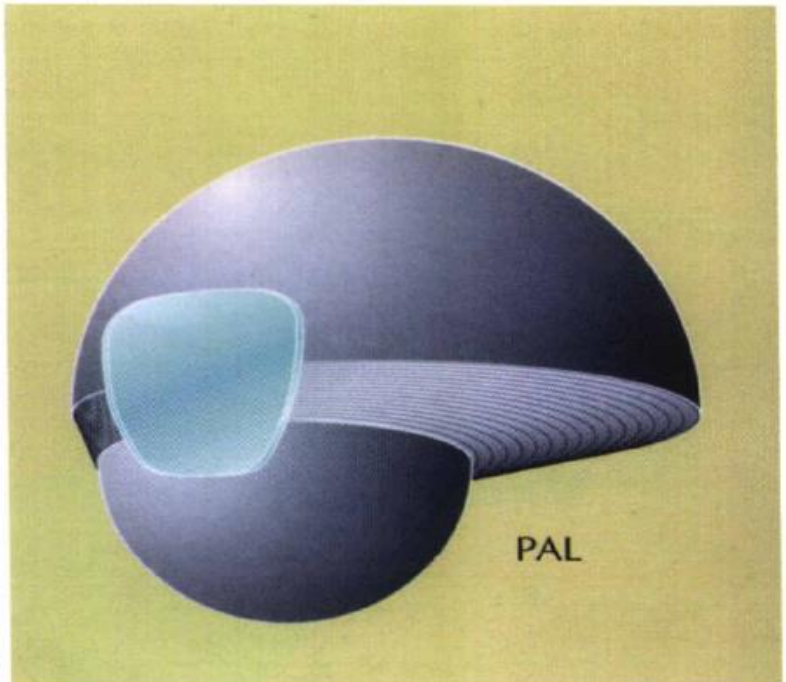


Figure 4-21 Bifocal, trifocal, and progressive addition lens designs compared. **A,** In a bifocal lens, the distance vision sphere is above the near vision sphere; they are linked by a single "step" that is seen as a single line. **B,** In a trifocal lens, an intermediate vision sphere is added between the distance and near vision spheres, producing 2 visible lines. **C,** In a PAL, an uninterrupted series of curves links distance, intermediate, and near vision parts of the lens with no visible separations. *(From Wisnicki HJ. Bifocals, trifocals, and progressive-addition lenses.* Focal Points: Clinical Modules for Ophthalmologists. *San Francisco: American Academy of Ophthalmology; 1999, module 6.)*

Types of Bifocal Lenses

- Fused Bifocals

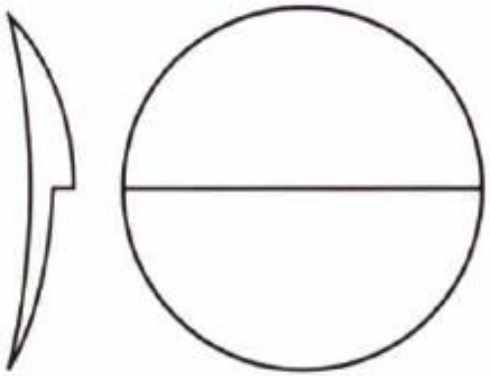
  - fusing a button of glass that has a higher refractive index

- One-piece Bifocals

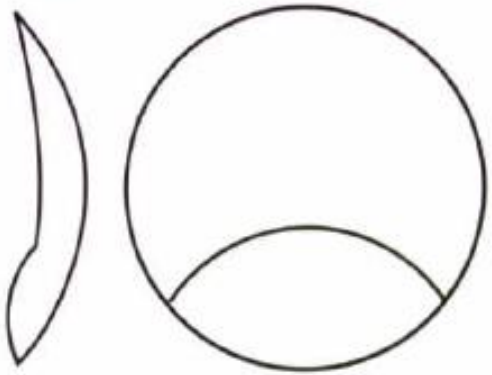
  - generating the different refracting surfaces on a single lens blank

- Round Top, Flat Top, Franklin Style(Split Bifocal)

ONE- PIECE BIFOCALS



Split lens (or "Benjamin Franklin") **bifocal.**
Correction for astigmatism is ground on the **concave** surface.

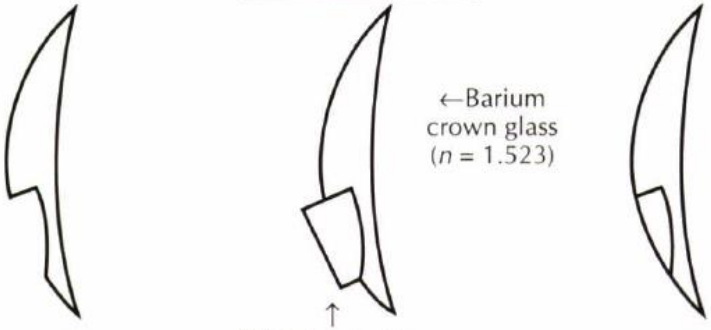


Ultex-type bifocals in segment diameters.

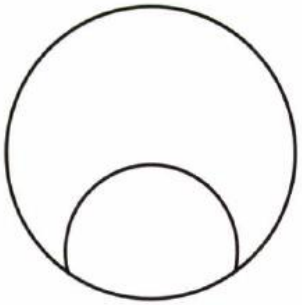
Ultex B	22 mm
Ultex E	32 mm
Ultex A	38 mm
Ultex AL	38 mm (up to 33 mm high)

Astigmatism correction is ground on the **convex** surface.

FUSED BIFOCALS

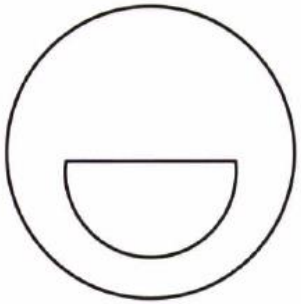


Round Top



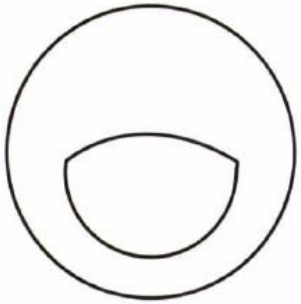
Usual segment diameter 22 mm
(from 13.22 mm)

Flat Top

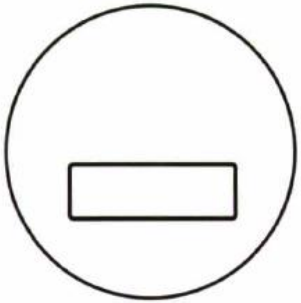


Segment diameter
20 22 25 28 35 45 mm

Curved Top



Ribbon Segments



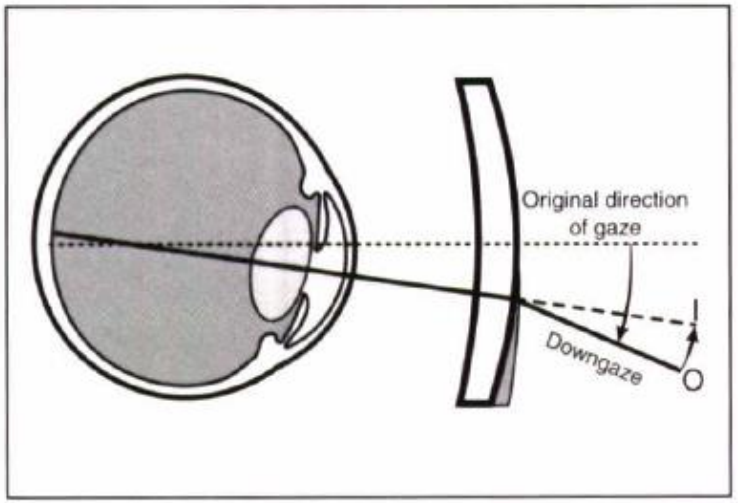
This fused bifocal is designed to permit distance vision viewing below the segment.

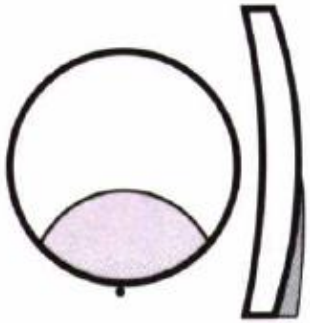
Image jump

- The usual position of the top of a bifocal segment is 5 mm below the optical center of the distal lens (Segment drop)

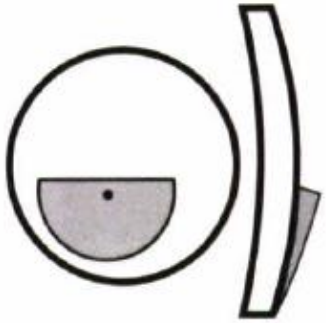
- When the eyes encounter the top of a bifocal segment, they meet a new plus lens with a different optical center, and the object appears to jump upward

The closer the optical center of the segment approaches the top edge of the segment, the less the image jump

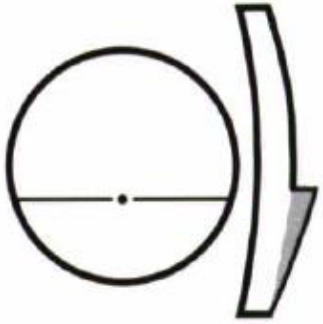




Round-top segment:
maximum
image jump

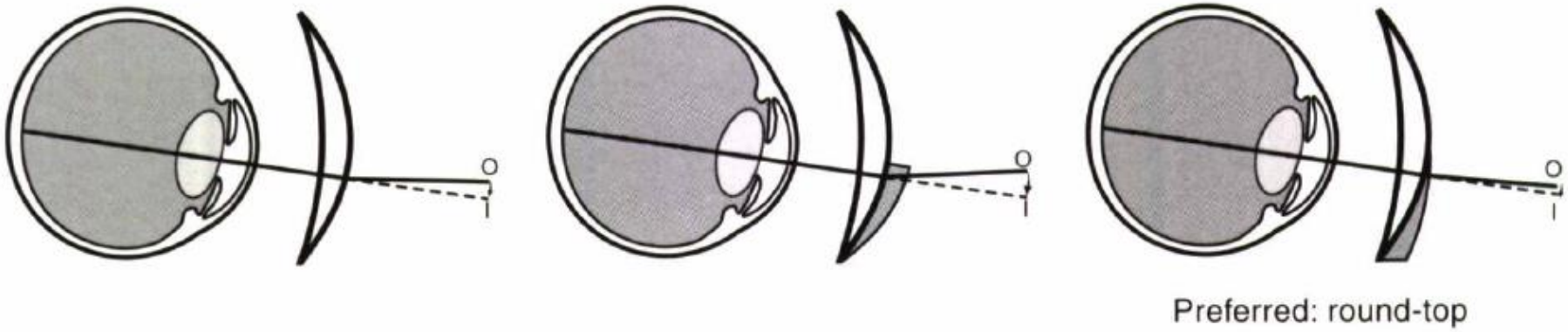


Flat-top segment:
minimal
image jump



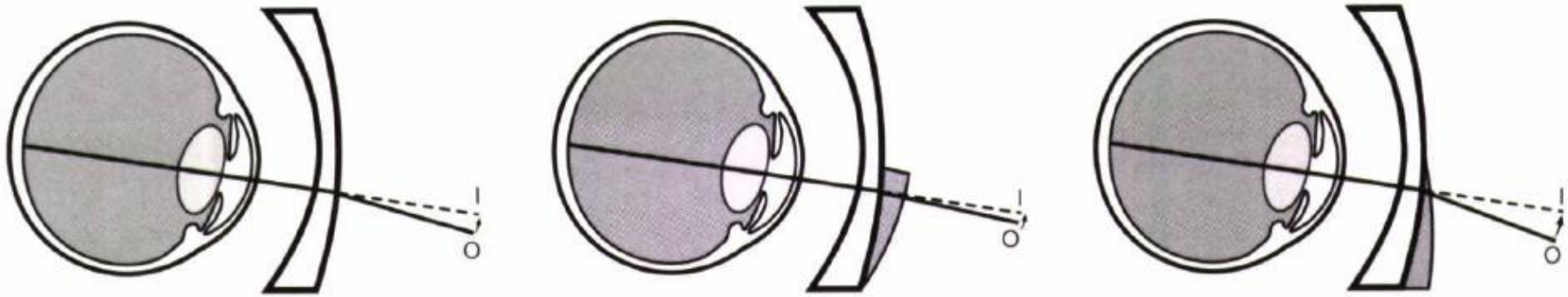
Executive-style segment:
no
image jump

With plus lenses:



Preferred: round-top

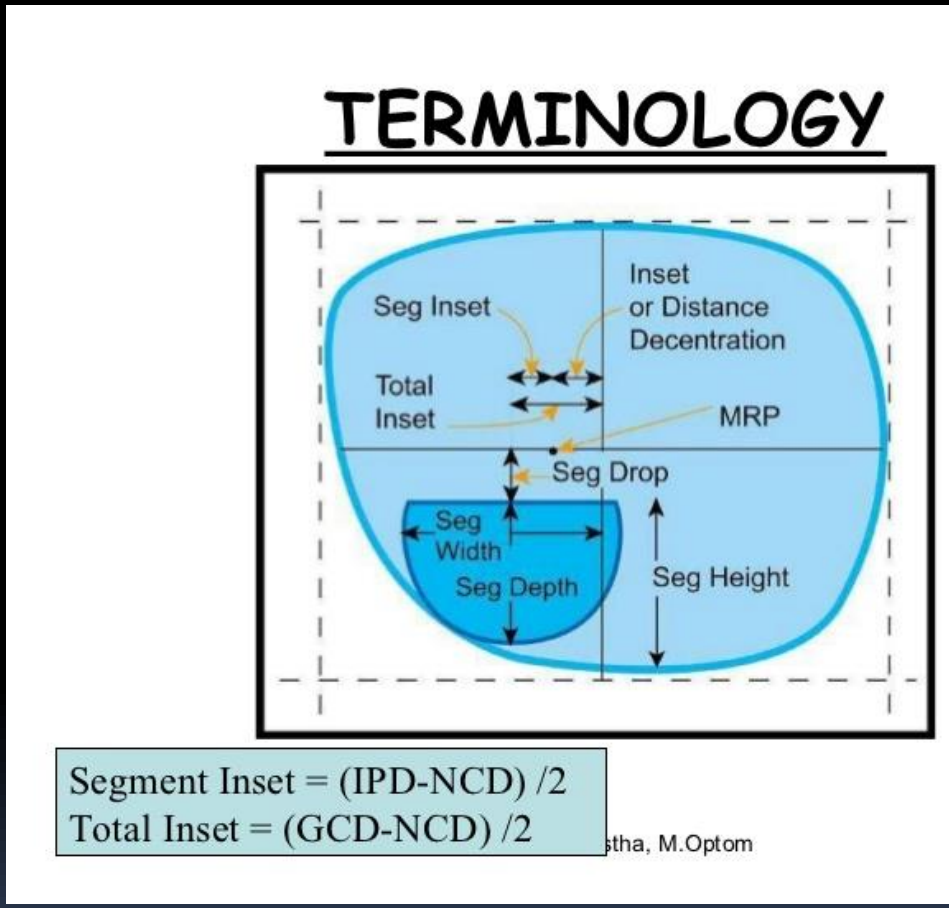
With minus lenses:



Preferred: flat-top

Lens design

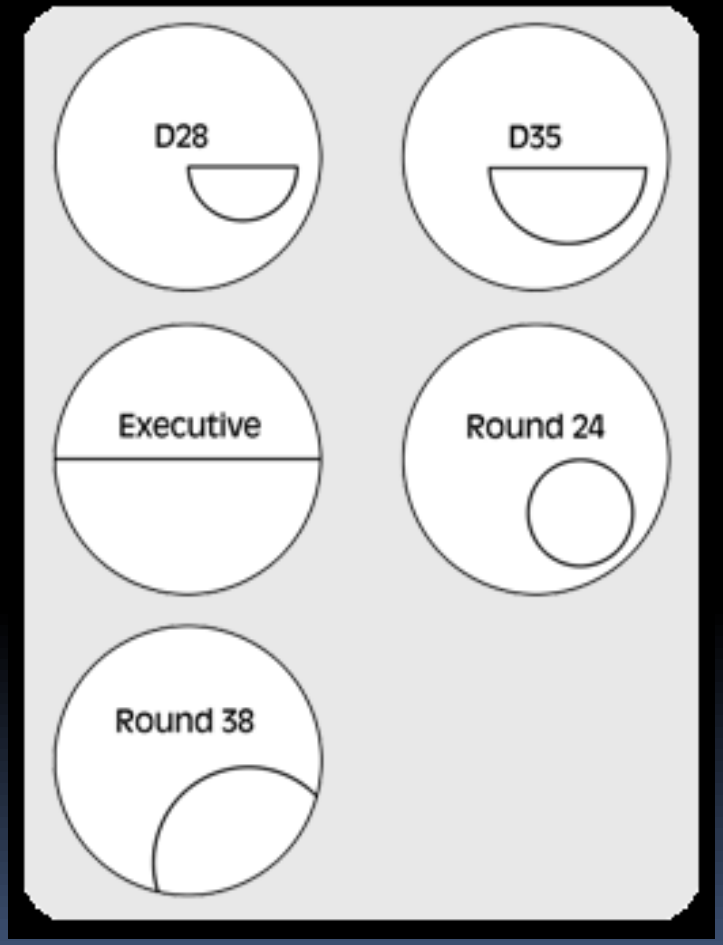
- The most important characteristic of the bifocal segment is the segment height & segment drop in relation to the patient's pupillary center
- The lenses will be unsuitable if the segment is placed too high or too low for the specific occupational need
- Segment width is substantially less important



Segment Decentration

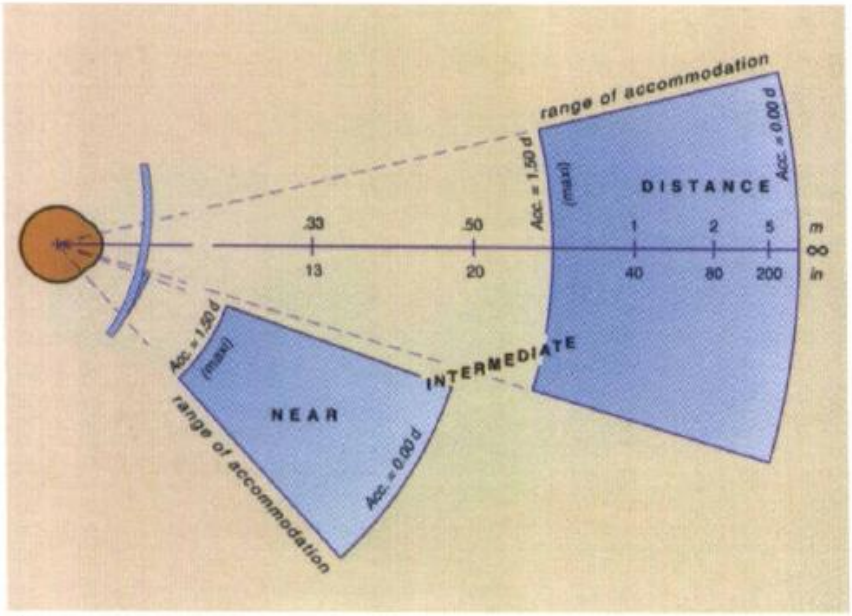
- To avoid inducing a base-out prism effect when the bifocal-wearing patient converges for near-vision tasks, the reading segment is generally decentered inward
- The amount of decenteration depends on:

  - working distance
  - interpupillary distance
  - lens power

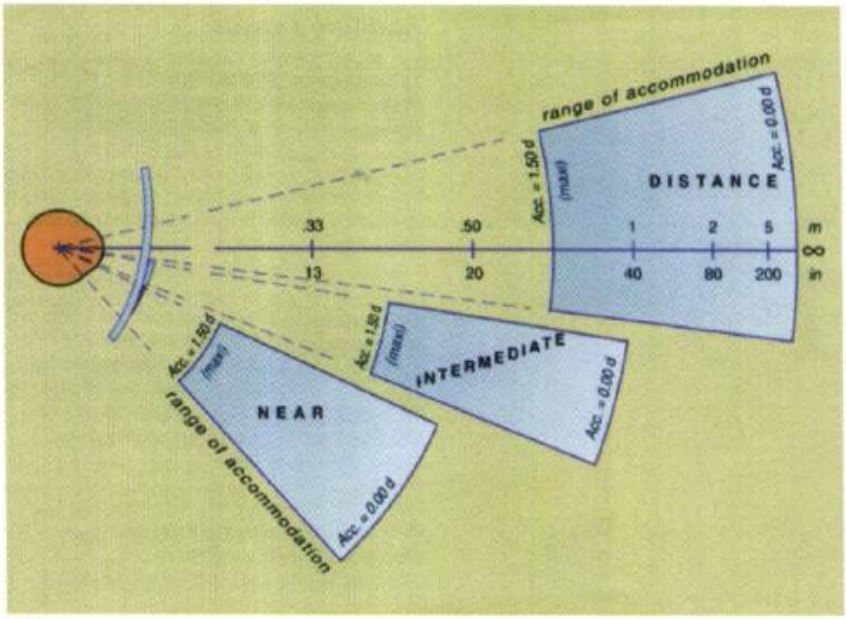


Trifocal Lenses

- With Bifocal lenses will not be clear in the intermediate range(at arm's length)
- Incorporation a third segment of intermediate strength (typically one half the power of the reading add) between the distance and reading segment
- Focus on objects between 1 meter and reading distance



A



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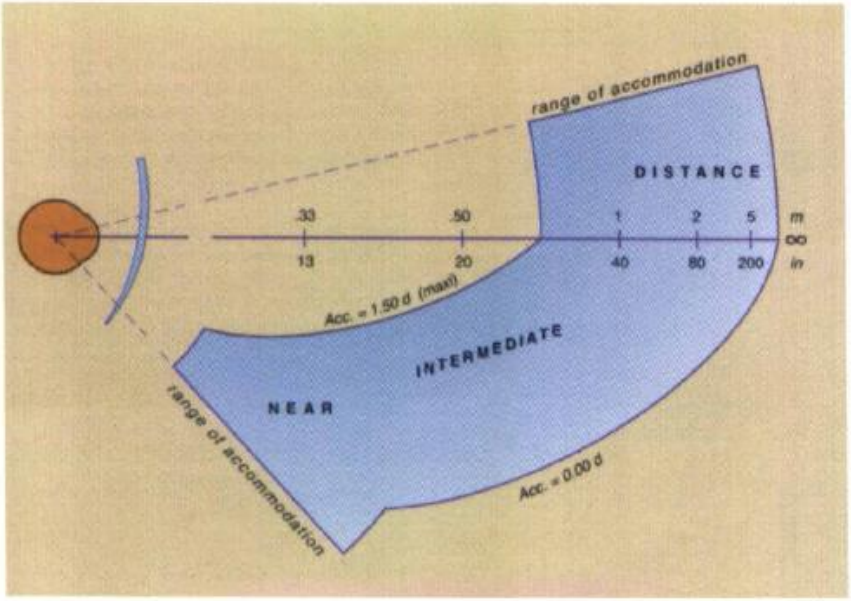


C

Figure 4-22 Fields of clear vision with bifocals, trifocals, and progressive addition lenses for a patient with 1.5 D of accommodative ability. **A,** Bifocal with a 2.00 D add. **B,** Trifocal with a 1.00 D intermediate add and 2.00 D reading add. **C,** PAL with a 2.00 add. *(From Wisnicki HJ. Bifocals, trifocals, and progressive-addition lenses.* Focal Points: Clinical Modules for Ophthalmologists. *San Francisco: American Academy of Ophthalmology; 1999, module 6.)*

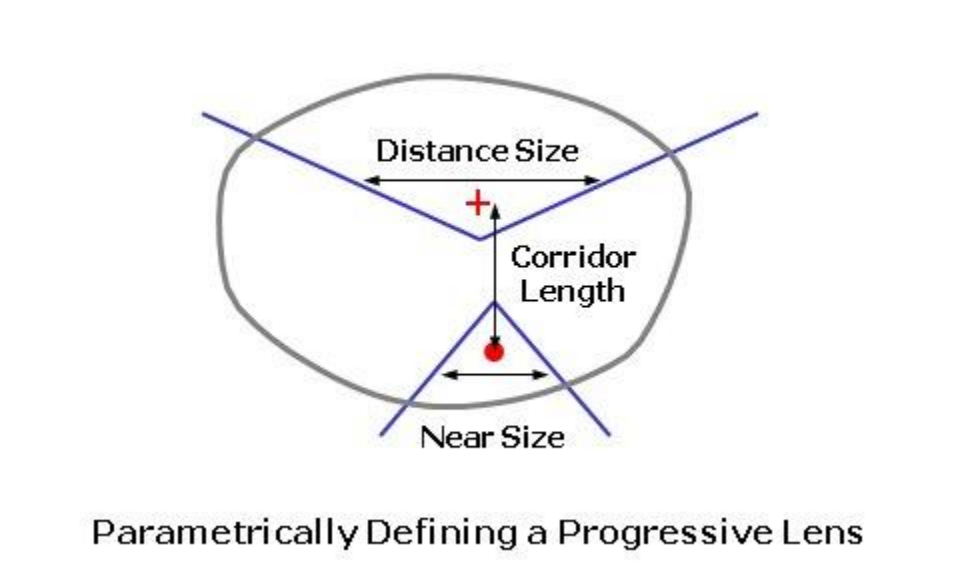
Progressive Addition Lenses: PAL

- Bifocals & Trifocals have
  Image jump & Diplopia
- PAL avoid these difficulties by supplying power gradually

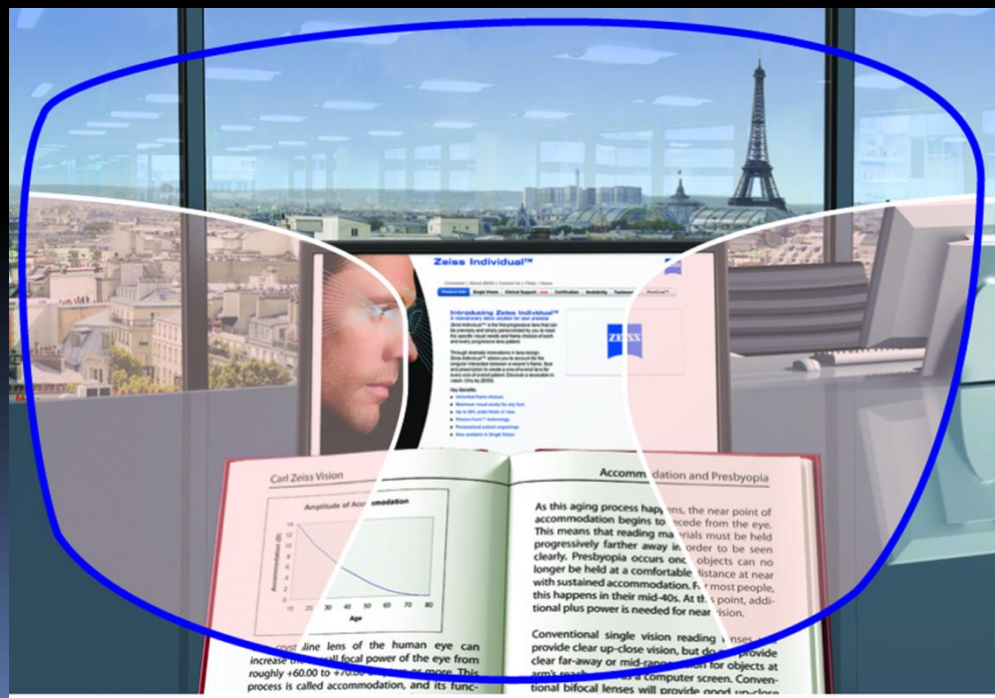
1- Offer clear vision at all focal distances

2- Lack of intermediate blur

3- Absence of any visible segment lines

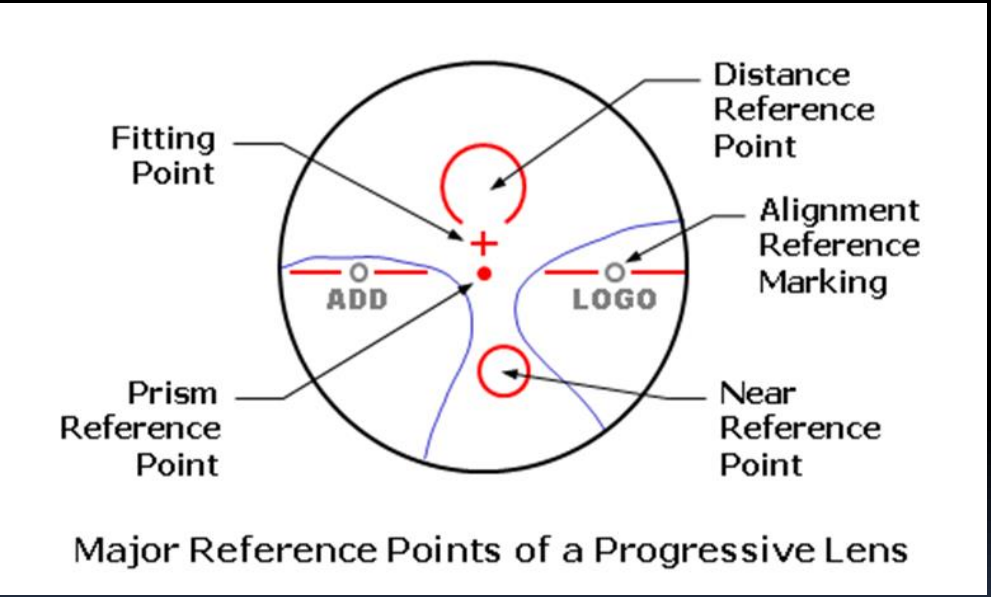


Parametrically Defining a Progressive Lens



PAL

- Has 4 optical zones on the convex surface
  - a spherical distance zone
  - a reading zone
  - a transition zone (corridor)
  - zones of peripheral distortion
- Progressive change in lens power on the convex surface of the lens
- Concave surface for the sphere and cylinder of the distance



Major Reference Points of a Progressive Lens

Best candidates for PALs

- Early presbyopia
- Have not worn bifocals
- Do not require wide near-vision fields
- Highly motivated patients

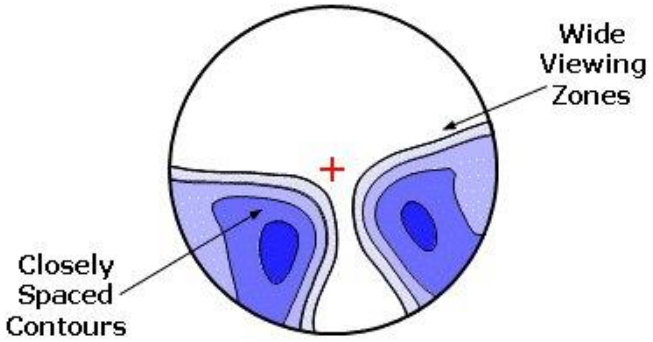
Drawbacks to PALs

- Some degree of peripheral distortion caused by astigmatism resulting from the changing aspheric curves, most pronounced in the lower inner and outer quadrants of the lens

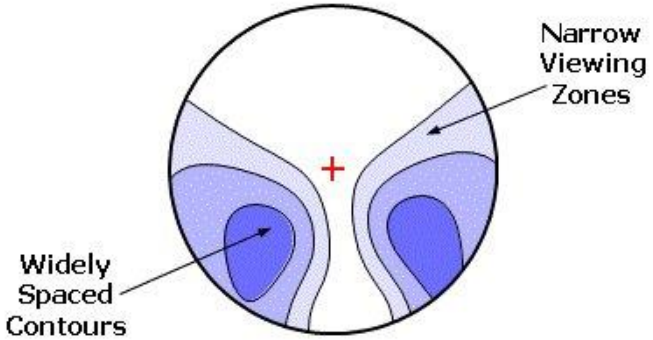
- Produce swimming sensation with head movement

Types of PALs

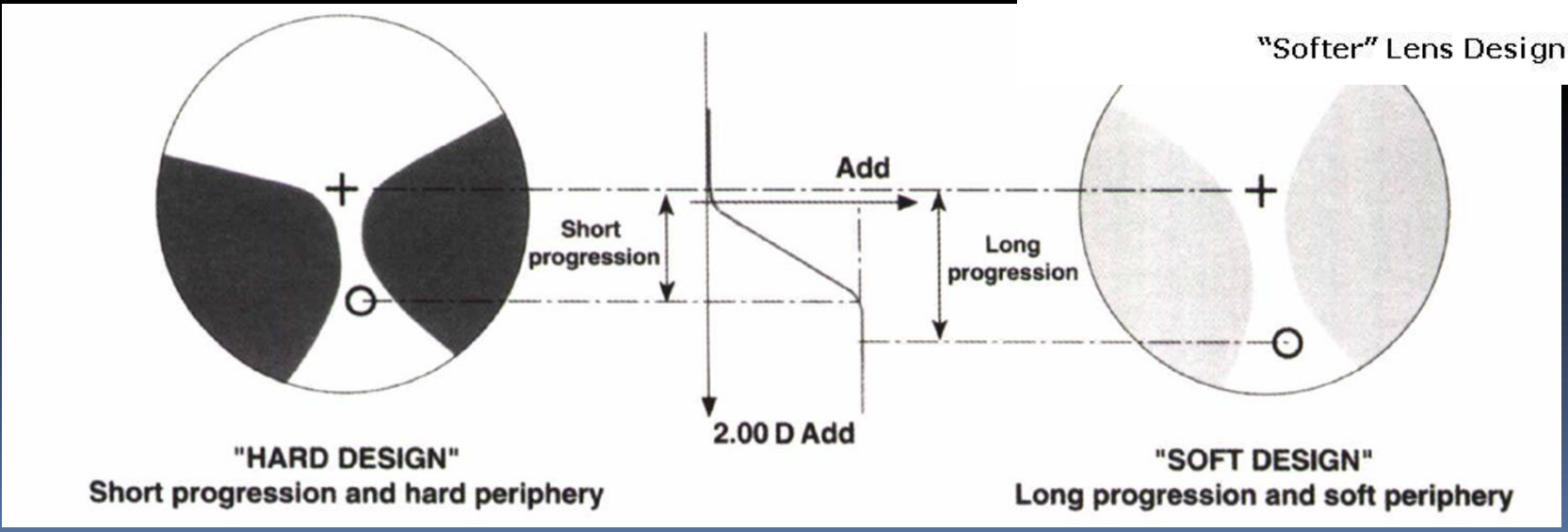
- Soft-design PALs: long transition corridor
- Hard-design PALs: short transition corridor wider fields of clear vision, at the expense of higher levels of swim, distortion, and blur
- Hybrid-design



"Harder" Lens Design

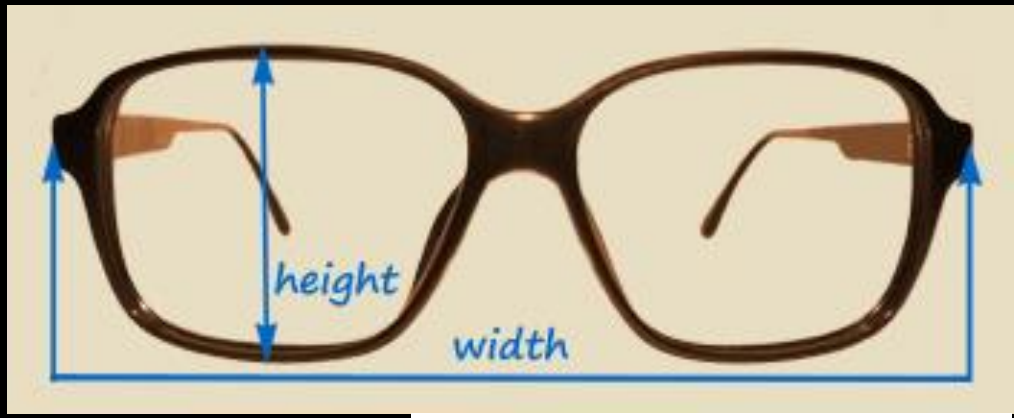


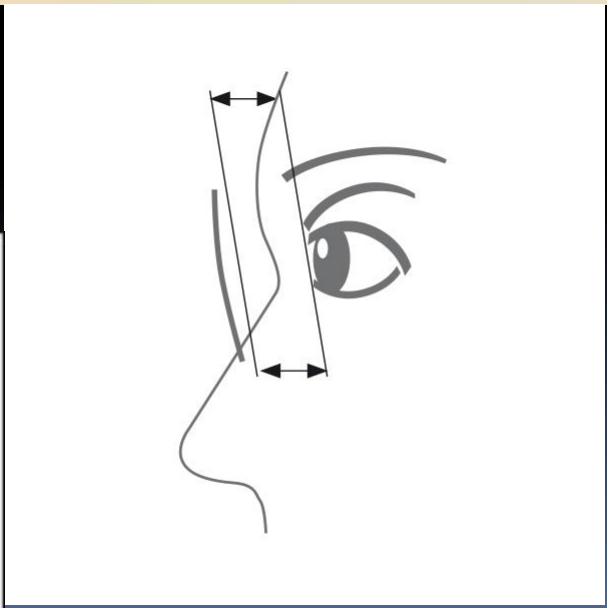
"Softer" Lens Design



Adjustment of the frame

- A minimum fitting height # 24 mm
- Vertex distance #14 mm
- Pantoscopic tilt 10-12 degrees

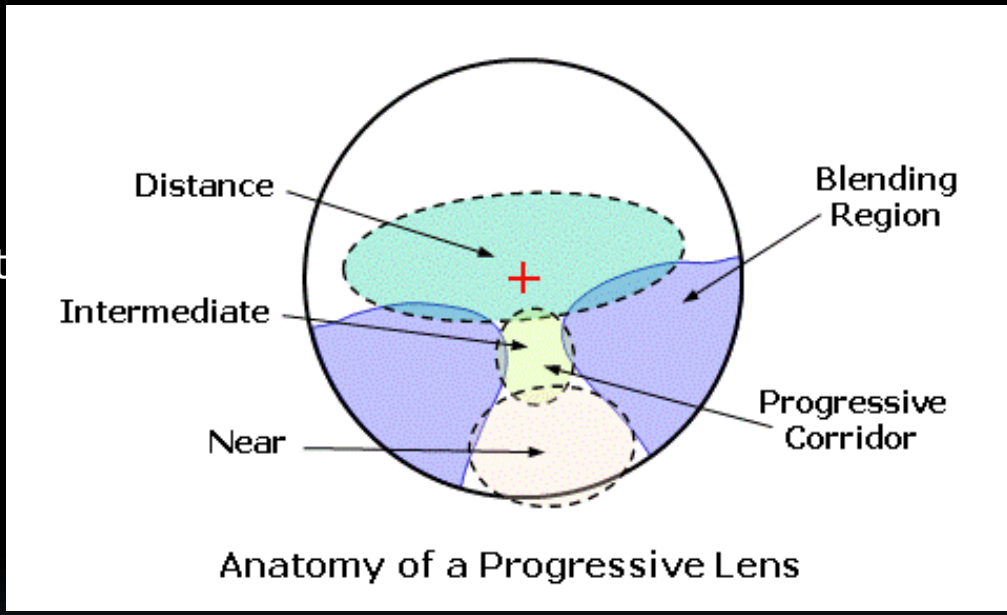




Prescription of the add power in PAL

- Overcorrected
  Early, it was common to prescribe add powers 0.25 to 0.50 D greater than bifocal
  - Theory: Stable near add is so low that patients needed

- The proper near add is limited to a small area surrounded by significant aberration



Anatomy of a Progressive Lens

- If under corrected the patient having to look down too far or roll the head back → Mild neckaches