Contact Lenses Didn’t Work! Now What?
Evaluation and Treatment of Aniseikonia

Andrew J Toole, OD, PhD, FAAO
The Ohio State University
College of Optometry
Disclosure Statement:
Nothing to disclose
Aniseikonia – A relative difference in size and/or shape of the ocular images.
Symptoms of Aniseikonia

- HA
- Asthenopia
- Diplopia
- Photophobia
- Tearing

- Fatigue
- Space distortion
- Size difference – Only with large amounts of aniseikonia
- Monocular occlusion brings relief

Similar symptoms to the more common binocular vision disorders.

Should perform sensorimotor testing and treat other BV issues prior to concentrating on aniseikonia.
Causes of Aniseikonia

• Refractive
  • Anisometropia
  • Astigmatism
• Retinally Induced
Correcting Anisometropia

Remember Knapp’s Law!

• Corrective lens placed at anterior focal point of eye creates retinal image size equal to an emmetropic eye.
• Only true for axial ametropia

Axial Anisometropia

• Clinical Findings:
  • Equal K’s
  • Unequal axial length

• Knapp’s Law says:
  • Glasses $\rightarrow$ equal image sizes
  • Contacts $\rightarrow$ unequal image sizes

Refractive Anisometropia

• Clinical Findings:
  • Unequal K’s
  • Equal axial length

• Knapp’s Law says:
  • Glasses $\rightarrow$ unequal image sizes
  • Contacts $\rightarrow$ equal image sizes

• Correct where the error occurs!
Correcting Astigmatism

- Astigmatism is nearly always refractive.
- Correcting Astigmatism with glasses can cause image differences.
- WTR & ATR usually only a problem if significant differences in power or axis.
  - Ex:  +2.00 -4.00 x 180 OU
Correcting Astigmatism

- Correcting Oblique astigmatism with glasses nearly always causes image size differences.

R: -1.50 -3.50 X 110
L: -1.50 -2.50 X 070
Prismatic effects of correcting anisometropia with glasses

- Regardless of axial or refractive cause, contact lenses usually the most successful correction for anisometropia.
Retinally Induced Aniseikonia

- Any condition that distorts photoreceptor spacing will effect perception and cause aniseikonia.
  - Epiretinal membranes
  - Retinal detachment
  - Macular holes
  - Macular edema
  - ARMD
Retinally Induced Aniseikonia

• Wide range of image size differences.
  • 5 to 28% size difference
  • Can be macropsia or micropsia
  • Symptoms often include a size difference
• Typically aniseikonia is field dependent.
  • Large image size differences centrally, smaller or no size differences in periphery
  • Makes treatment very challenging
Measuring Image Size Difference

• Awaya (New Aniseikonia Test)
  • Direct Comparison Method
  • Prism can be used to align images (neutralize fixation disparity)
  • Can rotate book to assess horizontal or oblique orientations
  • Can increase test distance to decrease angular size of targets
  • Must encourage pt to observe for subtle differences.
  • Bernell: $360
Measuring Image Size Difference

- Aniseikonia Inspector
  - Automated computerized testing
  - Direct comparison Method (similar to Awaya)
  - Can test hor, vert, and 2 oblique meridians
  - Multiple angular sizes available
  - Can assist with lens design
  - $440 - $550
Determining Best Treatment

• Key Points to Keep in Mind:
  • Correct for “more standard” BV problems first – Verticals!
  • 5% overall is about maximum obtainable through lens design
  • Field dependency can be significant barrier to successful image size correction
  • Typically under correcting measured size difference is best option
    • An in office trial with afocal magnifiers can be very helpful
      • Plano lenses that magnify the image (size lenses)
        • 2%, 3% overall; 1%, 2% meridional
  • The placebo effect can be strong in these patients
When Magnification is **NOT** the Answer

- Often this is the case with retinally induced aniseikonia **But Not Always.**
- A patch eliminates BV symptoms.
- Monocular Blur is usually a better option than a patch.
  - Dioptric blur: consider monovision (glasses or CL), or blurring affected eye for all distances
  - Blur induced by Fresnel Prism
  - Bangerter Foils
  - Tape
Rational for Monocular Blur

• Blur reduces the interference occurring with central vision.
• Blur has minimal effect on peripheral vision.
  • Allows for peripheral fusion
  • Maintains functional field of view
• Best option: minimum blur to reduce/eliminate symptoms.
Alternative to Dioptric Blur

• Fresnel Prism
  • Correct deviation (vertical!) & induce blur
  • Large range of powers: 1 – 40 prism diopters
  • $20.50 (Bernell)

• Bangerter Foils
  • Minimal blur to NLP
  • Bangerter Bar: $60 (Bernell)
  • Individual Foils: $5.25 (Bernell)

• Tape
  • Scotch - Satin
  • High level of blur – cosmetically not bad
When Magnification IS the Answer

• Correct for size differences by manipulating spectacle magnification.

\[
S.M. = \frac{1}{1 - \left(\frac{t}{n}F_1\right)} \cdot \frac{1}{1 - h(F_v)}
\]

[shape] [power]

• The shape factor is what we really target.

- t: Center Thickness (m)
- F_1: Base Curve
- h: lens to entrance pupil distance (m) ~ vertex distance + 3 mm
- F_v: Power of Lens
Manipulating the Shape Factor

- Base Curve: To increase magnification steepen BC (more +)
- Center Thickness: To increase magnification increase CT (thicker)
  - Want more mag? Go steep and thick.
  - Want less mag? Go thin and flat.
- It’s really that simple! The nomograph will tell you how much mag you obtained (due to the shape factor).
Some Constraints to Consider...

• Minimum CT = 2.0 mm
  • Higher + lenses will need to be thicker.
  • Rule of thumb for higher plus lens: Minimum CT = Lens Power + 0.5 mm
    • Ex: For +5 D lens minimum CT = 5.5 mm

• Minimum BC = +1.00 D
  • Will want to keep a minus (concave) back surface as well – can be an issue with + lens
  • Rule of thumb for plus lens: Minimum BC = Lens power + 2
    • Ex: For +5 D lens minimum BC = +7.00 D
How Much Mag are we Shooting For?
2 ways to determine this

• Method 1: Through testing and/or trialing of afocal magnifiers (only good option if retinally induced).
  • Ex: Determined that pt needs 2% overall magnification OD
  • This means the shape factor will need to be 2% HIGHER in the right eye than the left eye.
    • i.e.  Shape factor OS = 1%  Shape factor OD = 3%
How Much Mag are we Shooting For?  
2 ways to determine this

• Method 2: Based on the spectacle Rx.
  • Increase mag in most minus (least plus) eye.
  • Correct 1% for every diopter of anisometropia
    • Ex: OD -4.00 D   OS -2.00 D
    • This means the shape factor will need to be 2% HIGHER in the right eye than the left eye.
      • i.e. Shape factor OS = 1%  Shape factor OD = 3%
Case

• 64 YO WM
• CC: 18-20% larger image OD
• HPI: Constant, 6+ months, ERM OD, removing glasses at near used to help but not so much any more
• ROS: high cholesterol
• FHx: + hypertension, +cancer
• SHx: social drinker, never smoker, profession = engineer
Objective

- VA c current Rx: OD 20/20-, OS 20/15-, OU 20/20-; Near: 20/20 OU
- Pupils, EOM’s normal
- CT: Distance Ortho; Near Comitent 10 pd exophoria
- Maddox Rod: Ortho vertical
Refractive Error

- Current Rx:
  - OD: -2.00 -0.75 X 100
  - OS: -1.75 -0.75 X 067
- Subjective Refraction
  - No Significant change
Image size testing - Awaya

• 40 cm:
  • 8% +/-1% Left X 180
  • 6.5% +/- 1.5% Left X 090

• 1 m:
  • 12.5% +/- 1.5% Left X 180
  • 9.5% +/- 3.5% Left X 090
Demo of Size Lenses (afocal magnifiers)

• 5% Left overall
  • “Wow! That is instantly better!”
  • Not placebo

• 3% Left overall
  • “I think I like this one better than the other one. Things seem more even between the eyes.”
  • However with longer trial pt ended up preferring 5%
Thought Process

• Pt likes 5% left overall magnification. So ultimate goal is to make shape factor OS 5% larger than shape factor OD.

• 5% is a bunch! So down graded goal to obtaining the most mag we could while keeping the glasses wearable and reasonably priced.
Goal: **Big mag OS, Small mag OD**

- Small mag OD means we need to go thin and flat.
  - So we used the minimum CT and BC
  - CT = 2.0 mm; BC = +1.00 D
  - The nomograph gave us the shape factor...
Shape factor = 0.1%
Goal: **Big mag OS**, Small mag OD

- Shape factor OD = 0.1%
- To obtain 5% more OS would need 5.1%. Instead will go as high as we can and keep the cost and cosmesis acceptable.
- Need big mag OS so want steep and thick.
- Knew from prior contact with lab that going steeper than +8.50 D = significant increase cost. Thus will go with base curve +8.50 D.
- How thick can we go? We decided to push CT up to 7.0 mm (this is the thickest I have ever ordered).
- To the nomograph to get the shape factor!
Shape factor = 4.0%
Would have required 9.0 mm CT to obtain 5.1% or going through a specialty lab to get steeper base curve.
Rx Prescribed

• Occupational flat top (distance and computer):
  • OD: -2.00 -0.75 x 100     BC +1.00, CT 2.0 mm   Add +1.00 OU
  • OS: -1.75 -0.75 x 067      BC +8.50, CT 7.0 mm  Bevel closer to front surface
    • Gave shape factor OD 0.1%, OS 4.0% so net effect of 3.9%
The Result

• “The fit on the glasses was incredible. I've worn them for three days now and they are quite wonderful. The magnification factor was a good compromise for my vision. My depth perception and 3D clarity are much improved.”
What if only needed 2% mag OS?

- Can use the same BC & CT as before for the right eye: BC = +1.00; CT = 2.0 mm
  - Gives shape factor of 0.1%
What if only needed 2% mag OS?

- Shape Factor OD = 0.1%
- Need shape factor OS to be 2% more than OD → 2.1%
- Now can set mag at 2.1% on nomograph and see easily what combinations of BC and CT will give this mag.
Any of these options will work.
How to Design an Afocal Magnifier

• Determine what magnification needed. Say 2% overall.
• Find a Base Curve and Center Thickness on Nomograph that gives this mag.
SHAPE MAGNIFICATION NOMOGRAPH

FOR RELATION

\[ M = \frac{1}{1 - \frac{t}{n F_1}} \]

M = Magnification
F_1 = Front Curve
\( t \) = Center Thickness
\( n = 1.523 \)

BC: +6.00 D
CT: 5.0 mm
How to Design an Afocal Magnifier

- Determine what magnification needed. Say 2% overall.
- Find a Base Curve and Center Thickness on Nomograph that gives this mag.
  - BC: +6.00 D; CT: 5.00 mm
- Order these parameters as a plano lens. Can simply be a non-edged blank.
In Conclusion....

Don’t fear the aniseikonia!!!!!
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