جامعة المستقبل

كلية التقنيات الصحية والطبية

قسم تقنيات البصريات

Second Stage 2025-2026

REFRACTIVE ERRORS 3

Lecture Title

ANISEIKONIA

Lecture Number: 6 / course 1

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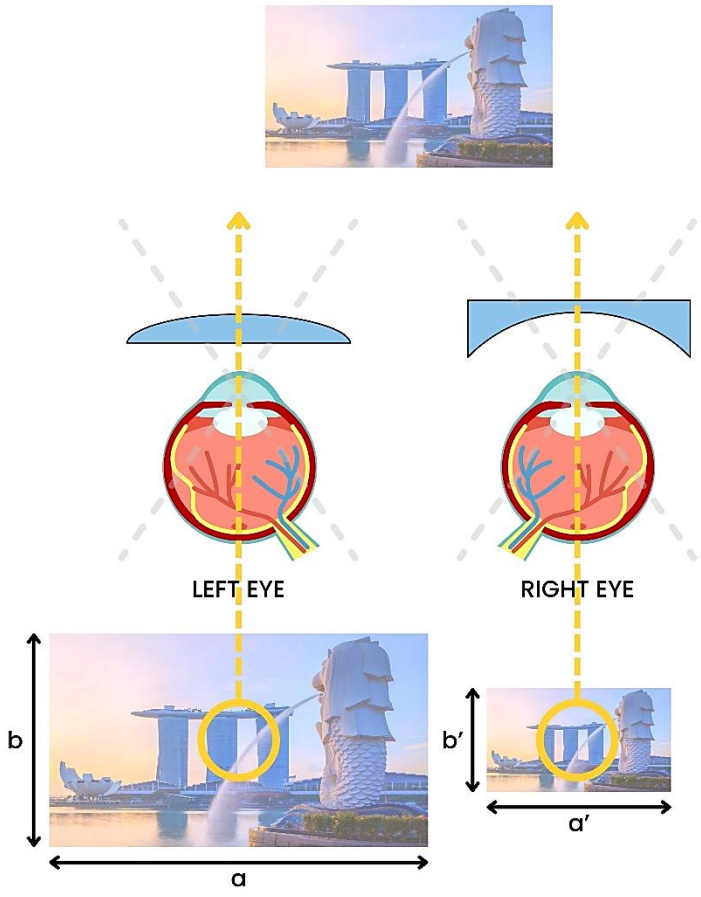
OPTOMETRIST

Aniseikonia

- **Definition:** Aniseikonia is a binocular image-size or shape mismatch between the two eyes, large enough to disturb fusion and comfort.
- **Clinical threshold:** Most people tolerate ~≤2–3% difference. >3–5% often symptomatic; >5–7% commonly intolerable.
- **Why it matters:** Size/shape mismatch → asthenopia, diplopia/suppression, reduced stereopsis, spatial disorientation, reading difficulty. Fixing it can be life-changing.



Useful Classifications

- **Physiological vs Pathological**
  - ✓ *Physiological:* tiny, normal differences that aid depth (well tolerated).

- ✓ *Pathological: due to optical/retinal causes; symptomatic.*

- **Static vs Dynamic**
  - ✓ *Static: size difference in primary gaze.*
  - ✓ *Dynamic (anisophoria): gaze-dependent disparity from unequal prismatic effects (esp. with anisometropic spectacles while looking off-axis).*
- **Symmetrical vs Meridional**
  - ✓ *Symmetrical: uniform magnification difference.*
  - ✓ *Meridional/asymmetrical: magnification varies by meridian (often with astigmatism/retinal distortion).*
- **Optical vs Retinal origin**
  - ✓ *Optical: anisometropia, lens differences, post-surgical optics.*
  - ✓ *Retinal: photoreceptor spacing change or macular distortion (e.g., macular edema).*

Main Causes

Optical

- **Anisometropia** (sphere/astigmatism); antimetropia.
- **Aphakia/pseudophakia asymmetry**, unilateral cataract surgery, unequal IOL targets.
- **Refractive surgery** done in one eye or with unequal outcomes; intentional monovision.
- **Spectacle factors:** vertex distance, base curve, thickness differences; frame fit asymmetry.

Retinal

Retinal causes of aniseikonia occur when retinal structures, especially the macula, are stretched, compressed, or elevated, altering the spacing of photoreceptors and thus changing the perceived image size.

- **Epiretinal membrane (ERM):** The macula is pulled or wrinkled → photoreceptors compressed → image appears *larger* (**macropsia**).
- **Macular edema:** Swelling spreads photoreceptors apart → image appears *smaller* (**micropsia**).
- **Central serous chorioretinopathy (CSR):** Fluid lifts the macula → image appears *smaller*.
- **High myopia with staphyloma:** Posterior retinal stretching → *micropsia*.
- **Post–retinal detachment repair (scleral buckle):** Retinal shape distortion → *unequal or distorted image size*.
- **Macular hole:** Retinal tissue stretched around the hole → *micropsia*.

Symptoms & Functional Impact

- **Asthenopia/HA**, peri-orbital or frontal ache; **photophobia**.
- **Binocular instability:** intermittent **diplopia**, **suppression**, degraded **stereopsis** → poor depth, clumsiness.
- **Spatial distortion/disequilibrium:** room appears tilted/warped; **dizziness**, mild **nausea**.
- **Reading stress:** losing place, "words jump," difficulty scanning lines (dynamic component).
- **Spectacle intolerance** after big Rx changes or unilateral surgery.

Clinical Detection (Practical)

- **History clues:** recent unilateral surgery; large Rx change; long-standing anisometropia; reading fatigue.
- **Simple in-office probes**
  - ✓ Ask: "Does one eye's image look **bigger/smaller**?"
  - ✓ **Monocular alternation** at distance/near to elicit perceived size shift.
  - ✓ **Pinhole** won't solve size mismatch (helps refractive blur only).

- **Quantification options**
  - ✓ **Direct comparison tests:**
    - **New Aniseikonia Test (NAT)** (anaglyph half-moons).
    - **Aniseikonia Inspector** (computerized, red/green).
  - ✓ **Maddox/Brecher variants:** compare line vs dots; add **size lenses** (afocal magnifiers) until alignment/subjective equality.
  - ✓ **Trial afocal magnifiers** at the phoropter: increase/decrease % until comfort/fusion peaks → practical target.
  - ✓ **Spectacle magnification estimate:** rough rule **~0.25–0.5% per diopter** anisometropia (depends on power, base curve, thickness, vertex).
  - ✓ **Target to correct:** reduce measured difference to **≤1–2%** (or patient-tolerated level).

Management Strategy

A) First, treat the cause when possible

- **Retina:** manage **edema (anti-VEGF/laser)**.
- **Cataract/pseudophakia asymmetry:** consider **second-eye surgery** or IOL exchange/adjustment if refractively very unequal.

B) Optimize the optical system for minimum magnification difference

1. **Contact lenses (CLs) — first-line for anisometropia**
   - ✓ On-eye correction **minimizes spectacle magnification** and **eliminates differential prism** in downgaze.
   - ✓ Options: full CL correction, or **hybrid** (CL on high-power eye + thin spectacles for both for residual power).
   - ✓ Especially powerful in **high myopes/hyperopes** and **interim unilateral surgery**.
2. **Iseikonic spectacles (size lenses) — when CLs not viable or as an adjunct**

- ✓ Adjust **shape factor** (front **base curve**, **thickness**) and **vertex** to alter magnification **without changing Rx power**.
- ✓ **For the smaller image eye:** steeper base curve, greater (appropriate) thickness, possibly slightly greater vertex → **increase magnification**.

  For the larger image eye, opposite adjustments.
- ✓ Use software to design; **verify subjectively** with trial lenses.

3. **Frame and fitting optimization**
   - ✓ **Minimize vertex** and **match vertex** OU; appropriate **pantoscopic tilt**; small, symmetric frames to reduce off-axis effects.
   - ✓ Choose **materials/index** to achieve thickness goals while controlling weight/cosmetics.

C) Surgical/Definitive refractive approaches (case-dependent)

- **Laser refractive surgery (LASIK/PRK/SMILE):** reduce anisometropia to near-zero → **erase optical aniseikonia**; useful when CL-intolerant.
- **Refractive lens exchange / staged bilateral cataract targets:** align refractive endpoints OU.
- **Secondary IOL** for unilateral aphakia to avoid massive spectacle magnification.
- **Last resort: functional monocularity** (occlusion/blur) only when binocularity cannot be salvaged.

Mini-Cases

- **Unilateral pseudophakia + fellow cataract (–5 D):** temporary CL on fellow eye; plan second-eye surgery → equal endpoints.
- **–8.00 / –2.00 myope struggles in specs:** CL on –8 eye; thin low-power specs for both → fusion restored.
- **ERM with micropsia OS ~3%:** manage retina; iseikonic +3% OS spectacles → reading comfort improves.

Exam/Clinic Pearls

- **Dynamic symptoms worse at near?** Suspect **spectacle-induced anisophoria**; CLs often cure it.
- **Don't "wait it out"** with large anisometropic spectacles—prolonged symptoms lead to **suppression** and patient non-compliance.
- **Write what you correct**: record **% target** and **design choices** (base curve, center thickness, vertex).
- **Partial fixes can be big wins**: reducing from 6% → 2% may eliminate symptoms.
- **Re-measure after interventions** (retina treated, second-eye surgery done, etc.).

HOME WORK

Questions

1. **Define aniseikonia** and explain how much image-size difference between the eyes is typically tolerated before symptoms occur.
2. **Differentiate between physiological and pathological aniseikonia.** Give one example of each.
3. **Explain the difference between static and dynamic aniseikonia.** What optical condition commonly causes dynamic aniseikonia?
4. **List two optical and two retinal causes** of aniseikonia and briefly describe how each alters image size.
5. **What are the main symptoms** patients experience with clinically significant aniseikonia?
6. **Describe how the New Aniseikonia Test (NAT)** or similar methods help in quantifying aniseikonia in the clinic.
7. **Why does a pinhole test fail** to correct or identify aniseikonia?
8. **Outline three optical correction strategies** for aniseikonia and explain the principle behind each (contact lenses, iseikonic lenses, and frame adjustments).
9. **Why are contact lenses often considered the first-line management option** for anisometropic aniseikonia?
10. **Discuss one clinical scenario (mini-case)** where retinal or optical aniseikonia occurs and describe the best correction or management approach.