The Power of Lenses and Prisms

Spectacle Prescribing Beyond Refractive Conditions

Philip C. Bugaiski OD FCOVD FCSO
Today’s Topics

• Model of Vision and Brief Review of Optics

• Prescribing for ...
  – Nearpoint Performance
  – Strabismus
  – Amblyopia
  – Head Trauma

• Lenses and Prisms in the Vision Therapy Room
Model of Vision

• Your use of lenses is based on your model of vision and your understanding of the visual process.

• A.M. Skeffington’s 4 Circles will serve as the basic model for this course.
Reviewing the circles

• Where am I?

• Where is it?

• What is it?

• How do I communicate it?
Clarifying Vision

• The Invitational Lens Symposium:
  – Vision is understanding what light tells us.
  – Vision requires learning and understanding the language of light.
  – Meaningful vision depends on what a person does in order to see, and how the person habitually looks and controls seeing.
Seeing is Active

• We provide a lens, and expect a response:
  
  – A patient’s response matches our expectation when the patient’s vision directs thinking and perception.
  
  – When visual flexibility and freedom are lacking, the patient ignores available visual information, and provides an unexpected response.
Common Examples

• +1.00 Hyperope
  – Accepts +0.50 spectacles
  – Rejects +0.50 spectacles

• Viewing thru -6 lens
  – Smaller and Closer
  – Smaller and Farther
“Vision’s purpose is to guide actions, growth, understanding, and the quality of life. The sensory component of vision is to serve as a feedback mechanism to evaluate the adequacy of our actions. Vision problems should be explained in performance terms.”
Prescribing Lenses

• Compensatory or Corrective

  – Compensatory lenses allow for a different response to light only when the lenses are being used.

  – Corrective lenses allow for a beneficial change in response even after the lenses are removed.
Prescribing for Common Visual Difficulties with 20/20 Eyesight

- Convergence Problems
- Poor Pursuits and Saccades
- Accommodative Problems

- Where is the problem...?
Therapeutic Performance Lenses

• Purpose:
  – guide action
  – build understanding
  – improve quality of life
What Lens Should I Try?

• Standard Testing
  – Refraction
  – NRA/PRA
  – Phorias
  – “Stress Relieving Lenses”

• Expanded Model of Vision
  – Low Plus
  – Low Prism
WHY???

• Properties of Lenses and Prism
  – Light Transformers
  – Low Power Lenses preserve 20/20, while shifting peripheral/central relationship
  – Encourage patient to make a change
Why “Low”? 

- Minimal Effective Dose 
- Easy to Wear 
- Low Risk of Dependence on Lens
Plus Lenses

- Convex Lens Expands Visual Space
Wearing Plus Lenses

- The prismatic effects of plus lenses require the eye to rotate more than the normal amount.
Wearing Minus Lenses

• The prismatic effects of **minus** lenses require the eye to rotate **less** than normal.
Plus and Minus Lenses

• Plus
  – Expands Visual Space
  – Allows increased awareness of Ground
  – Allows increased awareness of Periphery

• Minus
  – Constricts Visual Space
  – Allows increased awareness of Figure
  – Emphasizes Central Vision

• Potential Postural and Breathing changes
Prisms

• Effects are Not as simple as a Straight Line
3-Dimensional Effects of Prisms
Prisms Create Possibility for New Spatial Perception

• Prisms rotate the visual field
  – Base Expands Space
    • As if objects are further
  – Apex Constricts Space
    • As if objects are closer

• Prisms produce a gradient of simultaneous magnification and minification
Effects of Prisms

• Yoked prisms (left, right, up, down)
  – Cause shift and slant

• Opposing base prisms (BO, BI)
  – Cause distortions of space, distance, size
• When using lenses, both the optical transformation via the lens and the patient’s response to that transformation must be taken into account.

• An understanding of optics and perception is essential to use lenses to their fullest potential.
Dr. Phil’s Pre-made “Practice Glasses”

- +0.12, +0.25, +0.37, +0.50, +0.62
- 1° Base-Down, 1° Base-In
- +0.25 with 1° Base-Down
- +0.25 with 1° Base-In
We Are Observers

• Lenses optically transform light.

• The Patient’s response to the transformation may be very different than what we expect.
  – The individual viewing through the lens interprets the optical transformation with the context of their visual framework of the world.
Dr. Phil’s Favorite Tests

• Dynamic Retinoscopy

• Nearpoint of Convergence

• Pursuits/Saccades

• Stereopsis
Dynamic Retinoscopy Techniques

- Book
- Stress Point
- Monocular Estimate Method (MEM)
- Bell
Retinoscopy

• Use a Spot Scope

• Dynamic, Near

• At Patient’s Habitual Working Distance

• Not for “neutralization” of reflex
Retinoscopy

• Quality of Reflex (Be Still, “Just Look”)
  – Brightness
  – Color
  – Light Distribution
  – Location
  – Stability

• Keep Both Eyes Open
  – Watch patient’s face, body, posture, working distance
Retinoscopy

• Keep Your Ears Open
  – Listen to patient’s voice

• Reading Card Targets

• Practice, Practice, Practice
John Henry Newman

- “Nothing would be done at all, if a man waited ‘til he could do it so well that no one could find fault with it.”
Oculomotor Tests with “Probe Lens”

• Convergence Changes
  – Range, Release, Regrasp
  – Repeatability
  – Nearpoint of Discomfort
  – Pseudo-CI??

• Pursuits and Saccades
  – Head Movement
More Tests

• Stereopsis

• Streff Ball and Cap
  – Wolff Wand and Pen Cap
  – Fast
  – Various positions of gaze

• Walking

• Ball Rolling, Catching
Amblyopia
Recent Amblyopia Treatment Research

• Reduced Daily Eye Patching is Effective
• “79% of children in the 2-hour group and 76% of children in the 6-hour group could read at least two more lines on the standard eye chart.”
• “Parents of children who wore the patch for 6 hours were more concerned about social stigma than the parents of children who wore the patch for 2 hours.”
• Treatment over 4 months, 1 hour of near vision tasks per day
• National Eye Institute, May 2003
More Amblyopia Treatment Research

• **Older Children Can Benefit From Treatment**
  – Study included children 7 to 17 years old

• National Eye Institute, April 2005
Even More Research

• Atropine or Patching leads to Similar Improvement
  – 7 to 12-year-old children, moderate amblyopia
  – Approximately 1 in 5 attained visual acuity of 20/25 or better in the amblyopic eye

• Thanks to researcher Mitch Scheimann OD
• Archives of Ophthalmology August 2008
What Research???

• Most Pediatric Ophthalmologists are reluctant to patch for only 2 hours

• Same doctors reported no significant increase in prescribing near visual tasks during patching
Really?!?

• 60% of doctors prescribe MORE than 6 hours of patching/day

• 1/3 if doctors did not change treatment based on research
Implications of Research

• Why is Amblyopia?

• A “lazy eye”?

• An adaptation to a binocular problem?
Lens Treatment for Amblyopia

- A Binocular Treatment for a Binocular Vision Problem

- Refractive Anisometropia provides a great opportunity for lens treatment

- No patching!!
  - How Effective is Patching?
Plus Lens Penalization

• Least (not maximum) Plus to best visual acuity in amblyopic eye
• Plus to blur “good” eye to equivalent acuity of amblyopic eye (or one line worse)
• Binocular acuity usually 1-2 lines better than Monocular
• Goal: not 20/20; but 20/comfortable
Plus Lens Penalization

• If best acuity is 20/50 or worse, use contact lenses 2 hours/day
• Follow-up every 3 days
• Activities
  – Coins in Piggy Bank
  – Balloon Toss
  – Ball Catch
Follow-Up

- Expect an increase in acuity in amblyopic eye
- Expect increased hyperopia in “good eye”
- Repeat refractive testing, adjust the lenses
- Monitor more than only acuity
  - Stereopsis
  - Streff Ball and Cap
  - Dynamic Retinoscopy
Managing the Parents

• Communicate and Demonstrate when testing

• Phone Follow-up in one week

• Ask Parents to watch for changes:
  – Balance
  – Motor Skills
  – Posture
How Does it Work?

• Provides Opportunity to improve binocularity
  – Patching is a one-eye treatment, part-time

• Shifts balance between competing eyes
  – Decreases central input of “good” eye
  – Encourages central attention via amblyopic eye

• Analogous to “gentle” patching
Case Report: Amblyopia Treatment
5 y/o male referred for Amblyopia Tx

- OD +0.50  20/20 full chart
- OS +5.00  20/50 iso letter
- intermittent LXT ; 8 X’P
- No RDS stereopsis
- Spec Rx OD +0.50
  OS +3.00/+1.50 Add
- Plan: Rx VT, decrease patching to 30 min/day
after 16 sessions

- OS +3.00/1.50 20/50 line (improved from isolated letter)

- 4 XP; 5 X’P no XT!
age 7 yrs, inconsistent VT compliance

- OD +0.75 20/20+
- OS +4.00 20/50 (line)

- 12 L’XT (regression); 5 X’P

- 100 sec Wirt Circles, int OS suppression
Let’s Try Lens Penalization

- +1.00 over OD -> 20/50 monoc VA
- VA OU 20/30, no blur/distortion

- Spec Rx: OD +1.50
  OS +4.00

- Plan: wear the glasses, RTC 1 mos
4 months later...

- OD +1.50  20/15
- OS +4.25  20/40+

- 12 L’XT, 5 X’P (no change)

- 500 sec RDS shapes!!

- Plan: Rx OD +2.50 (monoc 20/40)  
  OS +4.00

- RTC 1-2 mos, sooner if spec rejection
2 months later...

It’s working!!

- OD +2.00  20/15  amps 14.50
- OS +4.00 20/25  amps 4.50
- 8 XP, 8 X’P
- Stereo 250 RDS, 25 Wirt Circles
- Spec Rx OD +2.50 (again)
  - OS +4.00 (still)
- Plan: enjoy Serbia, C U in Sept...
Plus Lens Penalization

• Hey, Where did that bifocal come from??
  – Consider asymmetric adds
  – Consider a monocular add
  – Use your favorite experiments...
    • Dynamic Retinoscopy (again and again and again)
    • Worth-Dot
    • Convergence Range, Release, Regrasp
    • ... fill-in-the-blank...
It Wasn’t a One-Time Thing

• Grant – referred in Jan 2007 for intermittent ET and amblyopia

• Over 2 years of VT (on and off), led to:
  – Distance ortho, low e’p, and 20/20- VA in amblyopic eye

• But NO RDS ... ever!!

• Returned 4 ½ years later, wearing the same “blur” lens and monocular bifocal – 6/6 RDS!
Summary

• Started with VT and refractive compensation (traditional approach)
• Poor compliance = slow progress and regression
• Since unable to resume VT, try “Lens Penalization”
Summary: Why does it work?

• Why is “Lens Penalization” better than patching?
  – Amblyopia is a binocular problem
  – Patching is a monocular solution applied part-time
  – Lens treatment is a full-time binocular solution
What I’ve Learned

• Start with Lens Treatment

• Save Vision Therapy for Later
  ... unless ...
Strabismus

• Infrequently only a Muscle Problem
  – Duane’s
  – Brown’s

• Surgery is a Muscle-only Treatment
  – Success often based on cosmesis
  – Low functional success rates
  – Frequent regression
Strabismus Surgery

• Recent Anatomical Discoveries
  – Richard Bruenech, OD, PhD
    • EOMs provide highest level of neuro-muscular proprioceptive feedback in human body

• Implications for Surgery
  – Feedback receptors at EOM insertions
  – Dr. Bruenech is not popular in certain circles
Strabismus and Patients’ Adaptations

• Suppression
  – An active process

• Anomalous Correspondence
  – A “yearning” for binocularity

• These are Neurological strategies to avoid diplopia
  – Aligning eyeballs without addressing protective adaptations can lead to regression
Lenses: the First Step to Treating Strabismus

• Prescribing Principles
  – Lowest power for maximum effect
    e.g. ET with Accommodative Component
    Maintain “room” for visual development
  – Plano can probably be avoided
  – Performance Testing
    • Binocular posture (gross observation, Cover Testing)
    • Worth-Dot (various distances, positions of gaze)
    • Dynamic Retinoscopy
Lenses to Treat Esotropia

• If no Accommodative Component, check near accommodative responses via dynamic ret

• FIND A LENS
  – At least relieve near vision stress
  – Use a lens as a carrier for binasal occlusion

• Plan to change Rx as part of treatment
Binasal Occlusion for Esotropia

• Streff Wedge
  – Dynamic Retinoscopy
  – Reading Aloud
  – Pen-in-cap

• Asymmetric is OK

• Binasal Occlusion with or without VT
Which EOM is missing?
One of Dr. Sanet’s Patients
Lenses to Treat Strabismus (ET and XT)

• Near Vision Lens for Strabismus
  – Consider asymmetric add
  – Consider monocular add

• Performance Testing
  – Dynamic Retinoscopy
  – Worth-Dot
  – Cover Testing

• Plan to change Rx as part of treatment
Exotropia

• Divergence Excess Type
  – Intermittent or Constant
  – Good outcomes via optometric vision therapy
  – Bifocal can be very helpful
    • Streff
    • Flax
  – There is often not a problem with convergence ranges at distance
Prescribing for Brain Injury

• Follow all-the-above Guidelines

• LESS is MORE
  – Fragile Visual Systems don’t “flex”
  – Consider +/-0.12 lens increments
  – Consider ½ prism-diopter
  – Narrow Binasal Occlusion
Prescribing for Brain Injury

• Visual Field Loss
• Visual Neglect
• Midline Shift
• Unique Prism Considerations
  – Yoked Prism
    • Remember “Less is More”
    • Patient response may be opposite Doc’s expectation
  – Sectoral Prism
    • Teach the patient to scan
Prescribing for Brain Injury

• Performance Testing & Retesting
  – Nearpoint of Convergence/Discomfort
  – Pursuits/Saccades
  – Dynamic Retinoscopy (surprise, surprise)
  – Walking
  – Midline Shift
  – *Subjective Responses*
Therapeutic Applications

• Some Demonstrations

• Using Lenses beyond “building muscle ranges”
Yoked 20^ Base-Right Demonstration
Some Basics

• Monocular Prism Saccades
  – Build awareness of small changes

• Fusion with Prism Bar

• Fusion with Loose Prism
Dissociated Prism Activities

• Oculomotor
  – Pursuits: Doubling Prism with 1 Wolff Wand
  – Saccades: Doubling Prism with 2 Wolff Wands
  – Patient is lying down
  – Move targets in various directions, speeds
  – Observe, observe, observe
Dissociated Prism Activities

• Squinchel
  – 30° Base-In
  – Link Touch and Hearing with Individual Visual Channels

• Vertical Dissociation with Dowel Rods
  – 6° or 8°
  – Explore “personal” near space and peri-personal space
Yoked Prism Activities

• 15-20°

• Up, Down, Right, Left

• Walking Rail or Balance Beam
  – Get on and off beam each time
  – Compare looking at feet vs. looking at target
Lens Activities

• Split Pupil Lens Rock
  – Use a Lens that creates conflict in accommodative system
  – One eye behind translucent occluder
  – Hold Lens at arm’s distance
  – View distant target out of lens and image within lens simultaneously
  – Note differences in size, clarity, distance, speed of motion...
Lens Activities

• Wach’s Mental Minus
• Clear a lens that causes conflict
• Fast response and release
• Do NOT clear the lens
• Clear and Blur with the lens
• Maintain accommodative response WITHOUT lens
• Prepare response BEFORE looking through lens
• Repeat, Bi-ocular