### Sports Vision Grand Rounds

Graham B. Erickson, OD, FAAO, FCVO
Fraser C. Horn, OD, FAAO
Pacific University College of Optometry

Dr. Erickson is a consultant for Nike & ZeaVision
Dr. Horn is a consultant for Nike

### Professional Baseball

![Image of a baseball game](image)

### History

- No complaints, no perceived difficulties
- Sent by the coach for a pre-season evaluation

### Profile

**Uncorrected static VA’s (BVAT C’s)**

<table>
<thead>
<tr>
<th></th>
<th>FAR</th>
<th>NEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD</td>
<td>20/15 (+2/6)</td>
<td>20</td>
</tr>
<tr>
<td>OS</td>
<td>20/25 (-2/6)</td>
<td>20</td>
</tr>
</tbody>
</table>

**Uncorrected dynamic VA’s (Rotator)**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OD</td>
<td>20/40 at ~62 rpm</td>
<td></td>
</tr>
<tr>
<td>OS</td>
<td>20/40 at ~45 rpm</td>
<td></td>
</tr>
</tbody>
</table>

### Profile

**Subjective Refraction (Dry):**

- OD  +0.25 -0.25 x 075  20/15 (+2/6)
- OS  +0.25 -0.75 x 083  20/20 (-2/6)

**Oculomotor skills:** WNL
**Accommodative facility:** WNL
**Sensory & Motor Fusion:** WNL
**Depth Perception:** 60 arc sec on BVAT (LD)
**Contrast Sensitivity Function:** OS reduced at high spatial frequencies (12 & 18 cpd)
**Glare recovery:** WNL
Profile

• Visual Motor Reaction Time: WNL
• Visual Balance Reaction Time: WNL
• Visual Anticipation: WNL

DOCTOR’S DECISION

• If you prescribe a refractive correction, what is the recommended wear time?
  – A. FULL TIME
  – B. PART TIME DURING BASEBALL

DOCTOR’S DECISION

• Would you prescribe a refractive correction for this athlete?
  – A. YES
  – B. NO

DOCTOR’S DECISION

• What is the preferred timing for initiating use of the new prescription?
  – A. IMMEDIATELY (Beginning of season)
  – B. WAIT A FEW WEEKS INTO THE SEASON
  – C. WAIT UNTIL OFF-SEASON

DOCTOR’S DECISION

• Which is your preference to deliver a refractive correction for this athlete?
  – A. SPECTACLES
  – B. SPORTS PROTECTIVE GOGGLES
  – C. CONTACT LENSES
  – D. REFRACTIVE SURGERY

Results

• Fit with SCLOS (toric daily disposable) during off-season.
  – Improved VA’s in OS
  – CSF improved at higher spatial frequencies
  – Distance stereo improved to 15 arc sec (3/4)

• Subjective reports of seeing the ball better, therefore improved ability to judge pitches and make fielding decisions.
REFRACTIVE COMPENSATION FOR ATHLETES

Refractive Prescribing for Athletes

When to prescribe ...
- Based on VA's and/or effort to achieve clarity
- Based on sport demand
- Based on refractive error guidelines

Refractive Prescribing for Athletes

Prescribing Guidelines: “Raising the Bar”
- Myopia: beginning at -0.25D
- Hyperopia: beginning at +1.00D
- Astigmatism: beginning at -0.50D
  - WTR VS ATR VS OBLIQUE
- Anisometropia: beginning at 0.50D if uncorrected
  - 0.25D if corrected
- Bottom Line: Maximize VA & Balance

Refractive Prescribing for Athletes

Other considerations for the Rx
- Timing of first prescription
- Value of over-minusing (CSF, Twilight)
- Re-evaluate visual performance with new Rx
- Prescribing modalities:
  - Sports Protective Eyewear
  - Sports Sun Eyewear
  - Contact Lenses
  - Laser Refractive Surgery

Performance Contact Lenses

CONTACT LENS DESIGN FACTORS
- Selection of Material & Modality
- Nuances of fitting athletes
- Adjustments for environment
- Issues & performance of enhancement tints
- Orthokeratology (CRT)
Laser Refractive Surgery?

• Criteria: Who is a candidate
• Visual Effects
  – SVA post-surgery = SVA pre-surgery with Rx?
  – Where is the bar to be set for VA & Aniso?
  – Dry Eye symptoms? Glare & Halo?
• Physical Effects: surgical options
  – Surface procedures vs LASIK
• Clinicolegal Issues & Sports Eye Protection

History

• 19 yo male - Plays on a NCAA Div II golf team
• Feels like he hits the ball well, but struggles on the greens
• Spends a lot of time practicing putting.
• In really bright conditions, struggles
• Wants to know if we can help with tinted sunglasses

How Does This Break?


Profile

• Uncorrected static VA's (BVAT C's)
  – FAR
    OD 20/15
    NEAR RS 20/20
    OS 20/15
    RS 20/20

• Subjective Refraction(Dry):
  – OD +0.25 DS 20/15
  – OS +0.50 DS 20/15

Profile

• Depth Perception: 20arc sec BVAT (LD)

• Contrast Sensitivity (Vistech):
  – 28 total plates
    • Reichow and Coffey: Average for athletes = 32.4 ± 4.3
DOCTOR’S DECISION

• Would you prescribe refractive or prismatic compensation for this athlete?
  – A. YES
  – B. NO

DOCTOR’S DECISION

• Which of the following filter options may benefit this athlete in bright sunlight?
  – A. POLARIZED FILTER
  – B. NEUTRAL-GREY FILTER
  – C. AMBER-RANGE FILTER
  – D. NO FILTER IS INDICATED

RESULTS

• Trial with neutral gray vs. “golf-specific” tint
  – Given adequate time to adapt and try in multiple bright settings
  – Offered tinted contact lenses
• Discussed home training with “masking” of detail

RESULTS

• VA of 20/15 OD, OS, OU
• Excellent CSF at higher spatial frequencies
• Subjective reports of improved ability to handle bright conditions

DOCTOR’S DECISION

• Would you recommend visual performance training for this athlete?
  – A. YES
  – B. NO

Performance Enhancement Tints
Filter Types & Sport Applications

- Different athletes may prefer different tints in similar lighting conditions.
- Athletes may need to change tints with changes in lighting conditions.
- Some filter choices are logical based on the figure-ground demands of the sport:
  - Neutral grey and brown filters
  - Polarized filters
  - Yellow range filters
  - Green range filters
  - Red range filters

Profile

- Uncorrected static VA's (BVAT C’s)

  FAR | NEAR
  --- | ---
  OD  20/200 | RS 100
  OS  20/15  | RS 20

- Subjective Refraction (Dry):

  OD  +2.75DS  | 20/70 (+1/6)
  OS  +0.25 -0.25 x 180 | 20/15

NBA Basketball

Profile

- Wet Refraction:

  OD  +3.25DS  | 20/80
  OS  +0.50 -0.25 x 180  | 20/20

- Depth Perception: none on BVAT (LD&RD)

History

- His right eye does not see very well
- He tried to wear glasses that were prescribed when he was a teenager, but they bothered him too much
- No complaints, but is not performing up to the level expected of him (point guard)

DOCTOR’S DECISION

- Would you prescribe a refractive correction for this athlete?
  - A. YES
  - B. NO
  - C. ONLY IF HE WANTS TO TREAT HIS AMBLYOPIA
DOCTOR’S DECISION

• Which is your preference to deliver a refractive correction for this athlete?
  – A. SPECTACLES
  – B. SPORTS PROTECTIVE GOGGLES
  – C. CONTACT LENSES
  – D. REFRACTIVE SURGERY

DOCTOR’S DECISION

• What is the preferred timing for initiating use of the new prescription?
  – A. IMMEDIATELY (Beginning of season)
  – B. WAIT A FEW WEEKS INTO THE SEASON
  – C. WAIT UNTIL OFF-SEASON

DOCTOR’S DECISION

• Would you also prescribe sports protective eyewear?
  – A. YES
  – B. NO

DOCTOR’S DECISION

• If you prescribe a refractive correction, what is the recommended wear time?
  – A. FULL TIME
  – B. PART TIME DURING BASKETBALL

Results

• Fit with SCL OS (daily disposable) during off-season
• Direct occlusion regimen of 2-4 hrs/day
• Active stimulation activities prescribed
• Active VT program initiated 6 weeks after CL prescription to enhance binocularity
• Dismissed from VT after 10 weeks with:

VT Results

• VA in OD of 20/20 (-1/6) full chart
• Excellent CSF at higher spatial frequencies
• Distance stereo improved to 30 arc sec (4/4)
  – Speed of Stereo: 8/9 on 30" for 30 sec
• Subjective reports of improved ability to judge spatial relationships on the court, e.g., spacing of players and basket distance.
LENS DESIGN FACTORS

- "Street" glasses should never be used during sports activities
  - ANSI standards do not apply to sport
- Sports goggles and frames must meet ASTM safety standards
  - Traditional designs
  - Wrap-around style
  - Protective eyewear
- Prescribe protection for athletes following eye trauma or ocular surgeries when the ocular tissues have been weakened
  - e.g., keratoplasty, retinal detachments

Functionally Monocular Athletes

- Criteria: <20/40 (6/12) best corrected
- Risk of blindness increased by >15x
- Risk is averted with protective eyewear use
- Discourage participation in sports with a risk for serious eye injury in which an effective method of eye protection does not exist
  - Examples: boxing, wrestling, martial arts

LENS DESIGN FACTORS

- Other Goggle designs
  - Ski goggles
  - Swimming goggles
  - Diving masks

Amare Stoudemire

Professional Hockey Player

LENS DESIGN FACTORS

- ASTM Certified Sports Protective eyewear
  - F803 basketball, baseball fielders, racquet sports, field hockey and women's lacrosse
  - F910 helmet shield, youth baseball batters/runners
  - F513 shields for ice hockey
  - F1776 protection for paintball
  - F659 skiing goggles/shields
History

- Blind-sided hit 3 weeks prior
- Diagnosed with concussion
- Has not been able to go into stores due to feeling overwhelmed
- Does not have an estimated time to return to play

Back to the case...

- Uncorrected static VA’s (BVAT C’s) – all with effort
  - FAR
    - OD 20/20
    - OS 20/20
- Near
  - RS 20/20
- Subjective Refraction (Dry):
  - OD +0.50 DS 20/15
  - OS +0.25 DS 20/15

Exam Data

- Depth Perception: 200 arc sec BVAT (LD)
- Vertical = 2 p.d BD OD
- Wet Refraction:
  - OD +1.50 DS
  - OS +1.25-0.25 x 180

Doctor’s Decision

- Would you prescribe a refractive correction for this athlete?
  - A. YES
  - B. NO

- Which is your preference to deliver a refractive correction for this athlete?
  - A. SPECTACLES
  - B. SPORTS PROTECTIVE GOGGLES
  - C. CONTACT LENSES
  - D. REFRACTIVE SURGERY

- If you prescribe a refractive correction, what is the recommended wear time?
  - A. FULL TIME
  - B. PART TIME DURING HOCKEY
DOCTOR’S DECISION

• What is the preferred timing for initiating use of the new prescription?
  – A. IMMEDIATELY
  – B. WAIT UNTIL HE RETURNS TO PLAY
  – C. WAIT UNTIL OFF-SEASON

DOCTOR’S DECISION

• Would you recommend visual performance training for this athlete?
  – A. YES
  – B. NO

RESULTS

• Fit with glasses with prism and protective goggles if going on ice
• Vertical deviation therapy
  – Active VT program initiated binocular stability
  – Then fit with CLs for sport

Concussion Background

• Classification History
  – There has been over 20 different classification systems
    • Some included grades of concussion
    • One included up to 16 levels
    • Most scales were based on loss of consciousness
  – There was no regard to symptoms, just return based off of the grade!

Concussion Background

• Classification – Present day
  – You have it or you don’t
  – Now discussed and defined at the International Symposium on Concussion in Sport

Concussion

• Definition:
  – Complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces.
Concussion

- Visual symptoms:
  - Blurred Vision
  - Photopsia
  - Diplopia
  - Photophobia


Concussion

Symptoms include...

- Amnesia
- Headache
- Nausea
- Vomiting
- Feeling mentally foggy
- Balance difficulty
- Slowed reaction time
- Concentration difficulty
- Changes in emotions or behavior

Concussion

- Other concerns...
  - The cumulative effect of head trauma (*not concussio*n) can lead to chronic traumatic encephalopathy (CTE)
  - Caused by abnormal level of the protein Tau in the brain

Concussion

- Other concerns...
  - Second Impact Syndrome
    - If the brain has not fully healed from initial injury, it is highly susceptible to a 2nd and more severe injury
  - Concussions have a cumulative effect

Concussion

Return to Play

- Because of all of the possible concerns (2nd impact, CTE, etc.), most athletes are not able to return to play until they have...
  - No symptoms
  - Concussion testing returns to baseline

Concussion

- Washington State (EHB 1824 - 2009-10)
  - On a yearly basis, a concussion and head injury info sheet shall be signed and returned by the youth athlete and the athlete’s parent and/or guardian prior to initiating practice or competition.
  - A youth athlete who is suspected of sustaining a concussion or head injury in a practice or game shall be...
    - Removed from competition at that time
    - May not return to play until the athlete is evaluated by a licensed health care provider trained in the evaluation and management of concussion
    - Athlete and parents must obtain written clearance from the health care provider.

Concussion Laws

• Oregon (Max’s Law - OAR 581-022-0421)
  – All coaches must receive annual training in recognizing the symptoms of concussion.
  – Students suspected of having a concussion must be removed from play.
  – Students suspected of sustaining a concussion must be evaluated by a properly trained medical professional.
  – A student may return to play when all symptoms have resolved, at least one day has elapsed since the injury, and a medical release has been obtained.

http://www.ohsu.edu/xd/outreach/programs/thinkfirst/ocampguide.pdf

Concussion Laws

• To find out more from each state, visit:


PROFESSIONAL FOOTBALL

History

• Very high draft pick into NFL
• 2 seasons has not performed up to expectations
• Receiver: too many dropped passes; inconsistent
• Speed of game has been the most significant adjustment between NCAA & NFL
• LEE: Never

Assessment Tool

Profile

• Static Visual Acuity: OD 20/12 OS 20/12
• Contrast Sensitivity: 63%tile OU
• Refraction: Emmetropia OU
• Stereopsis: 1° 12” Rt Gaze 12” Lt Gaze 36”
• Accommodative & Vergence Function: 58%tile
Profile

• Dynamic Visual Acuity: 72%tile
• Speed of Recognition: 32%tile
• Central Visual-Motor Reaction Time: 76%tile
• Peripheral Eye-Hand Response Speed:
  – Eye-Hand Coordination: 37%tile
  – Go/No-Go: 26%tile

Supplementary Testing

• Cover Testing in Different Gaze Positions at far:
  – Primary Gaze = Ortho
  – Up Gaze = Ortho
  – Up-Right Gaze = Ortho
  – Up-Left Gaze = 2-4 Δ EP

DOCTOR’S DECISION

• Which of the following filter options may benefit this athlete?
  – A. POLARIZED FILTER
  – B. YELLOW-RANGE FILTER
  – C. RED-RANGE FILTER
  – D. NO FILTER IS INDICATED

DOCTOR’S DECISION

• Would you recommend visual performance training for this athlete?
  – A. YES
  – B. NO

DOCTOR’S DECISION

• Would you prescribe refractive or prismatic compensation for this athlete?
  – A. YES
  – B. NO

Recommendations

• To Rx or not to Rx?
• Filter recommendations?
• Vision Performance Training?
Results

- Stereopsis: 1° 12” Rt Gaze 12” Lt Gaze 12”
- Speed of Recognition: 66%tile
- Peripheral Eye-Hand Response Speed:
  - Eye-Hand Coordination: 72%tile
  - Go/No-Go: 56%tile

VISUAL PERFORMANCE ENHANCEMENT TRAINING

VISUAL PERFORMANCE TRAINING

- Remediation of vision inefficiencies that may impact performance consistency
- Enhancement of vision skills deemed critical to optimal sports task performance
- Enhancement of visual information processing skills to facilitate rapid utilization of critical visual information
- Enhancement of visuomotor proficiency for sports task performance
- Enhancement of critical cognitive functions for visual decision making

Speed & Accuracy of Depth Perception

- Brock string at far (gazes, prism, balance)
- Vectograms / Tranaglyphs (JND at far)

Speed & Accuracy of Depth Perception

- Howard-Dolman Type Device

Speed of Recognition

- Nike SPARQ Vapor Strobe
  - Also develops attention, anticipation timing, visualization, balance, peripheral vision
QUESTIONS & DISCUSSION

REFERENCES


- Daniels, T. He Got His Bell Rung...What's The Big Deal? Current thoughts on concussion management. AOA Sports Vision Section Summer Newsletter. 2011