OCULOMOTOR DYSFUNCTION
Technological Updates in Diagnosis and Treatment

Denise Alexopoulos, OD, FAAO
Instructor, Illinois College of Optometry
7/29/2019
Denise Alexopoulos, OD, FAAO

Instructor, ICO

- Dr. Denise Alexopoulos graduated from the Illinois College of Optometry in 2017 and completed the Pediatric and Infant Vision Residency at the State University of New York College of Optometry. She then joined the ICO faculty, where she supervises third and fourth year students in the Robert & Lena Lewenson Pediatric and Binocular Vision Service. She is also the Coordinator for the retinoscopy & refraction laboratory for first year students.

- Dr. Alexopoulos is a Fellow of the American Academy of Optometry. She is an enthusiastic InfantSee provider and an investigator for the Pediatric Eye Disease Investigator Group.
Financial Disclosures

• I have no financial disclosures.
Overview

- Oculomotor Dysfunction (OMD)
  - Background
  - Symptoms
  - Diagnosis**
    - Traditional Methods
    - King Devick on iPad
    - RightEye
- Treatment**
  - Traditional Orthoptic Procedures
  - King Devick
  - Track & Read
  - Sanet Vision Integrator (SVI), Vision Therapy System 4 (VTS4)
  - Vision Builder
  - HTS
Oculomotor Dysfunction

Background

- Today’s focus: Saccadic Dysfunction
- Demographics
  - *Children*
  - *Acquired Brain Injury*
    - Traumatic Brain Injury: 8 million/year (51.3%)
    - Cerebrovascular Accident: 500,000/year (56.7%)


https://bellevuesec.com/6-reasons-child-may-not-enjoy-school/
Oculomotor Dysfunction

Background

• Symptoms
  • Poor development of eye-hand coordination
  • Difficulty reading
  • Difficulty writing
  • Difficulty understanding written instructions
  • Difficulty in complex environments

Blignaut P, Janse van Rensburg E, Oberholzer M. Visualization and quantification of eye tracking data for the evaluation of oculomotor function. Heliyon 2019;5(1).
OMD DIAGNOSIS
OMD Diagnosis

- Traditional methods
  - *Observational*
    - NSUCO
  - *Psychometric*
    - DEM
    - King-Devick
- Technology Based Methods
  - *Psychometric*
    - King-Devick (electronic)
  - Computer-based
    - RightEye

Blignaut P, Janse van Rensburg E, Oberholzer M. Visualization and quantification of eye tracking data for the evaluation of oculomotor function. *Heliyon* 2019;5(1).

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0200907
OMD Diagnosis: King Devick on iPad

- Measures:
  - Oculomotor Function
  - Number automaticity
- Advantages
  - Engaging
  - Automatic timing
  - Automatic grading

Demonstration card

<table>
<thead>
<tr>
<th>3</th>
<th>7</th>
<th>5</th>
<th>9</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5</td>
<td>7</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>9</td>
<td>3</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Test I

<table>
<thead>
<tr>
<th>5</th>
<th>4</th>
<th>1</th>
<th>8</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>6</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

Test II

Test III
King Devick on iPad

In Association with Mayo Clinic
King Devick on iPad

King Devick on iPad
King Devick on iPad

Age: 10 years old
Duration: 41.2 seconds
Errors: 3
Number of Test Cards Completed: 3

Speed: 41.2 seconds = Pass

Accuracy: 3 errors = Pass

Overall Result: Pass
Results are based on meeting age-expected performance in speed and accuracy.
King Devick on iPad

Subject Details

[Diagram showing the interface of the King Devick test application on iPad, including options for menu, add a new subject, search for a subject, filter by status, subject list, record a K-D test, K-D test history, team membership, and edit subject details.]

OMD Diagnosis: RightEye

- Computer-based eye tracking technology
- Measures:
  - Saccades
  - Pursuits
  - Fixation
  - Sensorimotor Function
  - Eye-Hand Reaction
- 4 Different “EyeQ” Tests Available
  - Functional Vision
  - Brain Health
  - Reading
  - Sports Vision
RightEye

Functional Vision EyeQ™

NAME: Denise Alexopoulos
AGE: [ ]
DOB: [ ]
DATE OF TESTING: 04/04/2019 10:20 AM

My EyeQ: 88
DYSFUNCTIONAL

FUNCTIONAL

EXCEPTIONAL

Analysis
- Eyes: Not optimal for quick movements

Symptoms / Risks
- Fatigue, Slow Reaction and Processing
- Multi-Tasking Issues, Lack of Mental Clarity
- Reading Difficulties, Quicker to Anger
- Emotional Liability, Hypo/Hyper-Metria

Vision Indicators
- DRY EYE
- VISUAL FATIGUE
- BINOCULAR VISION ISSUE
- DISASSOCIATED PHORIA
- DISASSOCIATED TROPIA

EyeQ Trainer Assigned

Pursuits
My Score: 70  Percentile: 89

Saccades
My Score: 62  Percentile: 78

Fixations
My Score: 98  Percentile: 100

7/29/2019
Talking to Patients About Their EyeQ Results

Use these talk tips, along with your medical expertise, to have more productive conversations with your patients.

The “My EyeQ” number is the patient’s overall functional vision score, based on a combination of results from the tests run during Functional Vision EyeQ. This score provides a reference point for your patient compared to other people in their age range, and a point from which to baseline. Each test is measured with multiple metrics which are weighted and averaged for an overall functional score.

My EyeQ: 57

**TALK TIP:** “Your EyeQ Score appears to be just below the functional range, which is not bad, but you could be doing better.”
The following three areas are assessed during the Functional Vision EyeQ test. Below you’ll see a functional example of each to help you readily spot a potential vision issue.

**Pursuits**

**Saccades**

**Fixations**

**TALK TIP:** "When following a target, your eyes should follow the dotted line as closely as possible. In comparison, your eyes are..."

If the tracking ability is impaired, your patient could experience:

- Sensory disturbances
- Misjudging speed of objects
- Field of view differences

**TALK TIP:** "When looking back and forth between 2 targets, your eyes should follow the same path and should land as close to the center as possible. In comparison, your eyes are..."

If the eyes are unable to make quick, accurate movements, your patient could experience:

- Fatigue, slow reaction & processing
- Multi-tasking issues, brain fog
- Reading difficulties

**TALK TIP:** "When focusing on a still target, your eyes should land as close to the center as possible. In comparison, your eyes are..."

If the eyes are unable to fixate for an extended period of time, your patient could experience:

- Motion sensitivity, disorientation
- Nervousness, anxiety
- Sleep disturbances, fatigue
- Falling, clumsiness

If this box is checked, your patient would benefit from EyeQ Trainer exercises designed specifically for them.

**TALK TIP:** "To address your functional vision issues you’ve been assigned EyeQ Trainer exercises to do at home."

(Provide EyeQ Trainer Exercise Program handout)
OMD TREATMENT
OMD Treatment

- Traditional Orthoptic Methods
  - Hart Chart
  - Ann Arbor/Michigan Tracking
  - Perceptuomotor Pen
  - Mazes

1 2 3 4 5 6 7 8 9 10
1 OFNPVDTCHE
2 YBAKOELRXY
3 ETHWFMGBKAP
4 BXFRTOSMVC
5 RADVSXPETO
6 MPOEANCBKF
7 CRGDBKEMPMA
8 FXPMSADRLG
9 TMUAXSOGPB
10 HOSNCTKULZ

Hoft cain holby kelm croe peurot. lx rish. Op fult huris lim k@oh thoz t@bl krik nul @uar quim. Aun@tiquat rulk tyay su@ld m@ve neb p@d@ durat.
Ceth boft @nir non rem turz bured dir ench verf thay. F@rg chat @nte. Bague @uide t@e guck malf bache
deph le@ Wald mond newk pov fam
@emp snal fron. Me@ jop @onde b@2a

https://www.youtube.com/watch?v=cqsG9tRhCSc

https://www.annarbor.co.uk/index.php?main_page=index&cPath=253_14

https://abledata.acl.gov/review-status/approved?page=1512&pa...
OMD Treatment: Technology Based Methods

- Track & Read
  - Computer-based
  - Saccadic exercises with words and letters
    - Simulates real reading
  - Skills Addressed:
    - Saccadic eye movements
    - Span of recognition
    - Visual sequential memory skills
Track & Read
Track & Read
OMD Treatment: Technology Based Methods

- Sanet Vision Integrator (SVI)
  - Touch Screen
  - Saccadic exercises which involve hand-eye coordination
  - Skills Addressed:
    - Saccades
    - Fixation
    - Visual Search
    - Automaticity
OMD Treatment: Technology Based Methods

- Vision Therapy System 4 (VTS4)
  - Computer/TV-Based with hand controller
  - Skills Addressed:
    - Saccades
      - Directionality
      - Eye-hand coordination
    - Pursuits
    - Vergence
      - Base in, base out
      - Jump, smooth
Patient: *Demo Patient*
Session #: 1
Date: Wednesday, May 01, 2019

Duration: 0.2 Minutes
Time: 01:13 PM

Options: 
- Duration: 5 Minutes
- Display: Monitor

Target Type: Arrows
Viewing Distance: 30.0

Score:
- Percent Correct: 100.00
- Average Time per Response: 3.21
OMD Treatment: Other Technology Based Methods

- Vision Builder
  - *Both diagnosis & treatment through various programs*
- Home Therapy Solutions (HTS)
  - *Computerized binocular home vision therapy program*
Conclusions

- Oculomotor dysfunction is common and affects quality of life – diagnose & treat early!
- Technology Based Options (non-exhaustive)
  - **Diagnostic**
    - King Devick on iPad
    - RightEye
    - Vision Builder
  - **Therapeutic**
    - Track & Read
    - Sanet Vision Integrator
    - Vision Therapy System 4
    - Vision Builder
    - Home Therapy Solutions
Thank you!

- Questions will be taken during Question & Answer Segment at 3:45 p.m.

[Image: Boy standing in front of a chalkboard with question marks and exclamation points, with a link to a blog post about children asking difficult questions.]

[Link: https://www.twinparks.org/blog/when-children-ask-difficult-questions]