Clinical symptoms, change, embeddedness and optometric testing

26th Annual JCTCO

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Symptoms...

- What is a symptom?
- Why do some not report symptoms?
- Why are some not affected by their vision problem?
- Patient report versus data collected versus behaviors observed
- What is missing from research and/or common sense?
What is a symptom?

- symp·tom (s m t m, s mp -). n. 1. A characteristic sign or indication of the existence of something else
- Propose: noticing something unusual and/or unpleasant
What is a symptom?

- Reference Sheedy: internal, external ocular symptoms
What is a symptom?

- Overarching model:
  - Symptoms are always the result of CHANGE
    - Internal
      - Structure
      - Function
    - External
What is a symptom?

- Overarching model:
  - Symptoms are always the result of CHANGE
    - Internal
      - Function
        - Use – abuse
        - “Hysteresis”
        - Sleep / fatigue
        - Nutrition (?)
        - Medication (?)
        - ...

What is a symptom?

Overarching model:

- Symptoms are always the result of CHANGE
  - Internal
    - Structure
      - Maturation
      - Adaptation
      - ...
What is a symptom?

- Overarching model:
  - Symptoms are always the result of CHANGE
    - External
      - Tasks
      - Methods
      - Environment
      - Lenses
      - ...

Why do some not report symptoms?

- Poor questions
- Poor reporters


- Filtering comments
- Denial
Why do some not report symptoms?

- Blissfully unaware
- “Sub-clinical”
- Pain threshold
- Adaptation / habituation...embeddedness
Why do some not report symptoms?

Adaptation and Habituation
- Work around / avoidance
- Compensation: maybe the problem is the solution
  - Suppression
  - Less supported, but interesting
    - Myopia
    - Astigmatism
    - Other function / syndrome modification
Why do some not report symptoms?

Adaptation and Habituation

“Normal and abnormal” short-term habituation

- Accommodation
- Vergence
- Symptoms
- Measurable problems
  - Transient RE change
  - Syndrome analysis
  - Etc
Why do some not report symptoms?

- Adaptation and Habituation / embeddedness
  - Long-term habituation
    - Let the games begin…
Reporting / Finding symptoms

Why do some not report symptoms?

- Adaptation and Habituation / embeddedness
  - Long-term habituation

**Adaptation**

Habituation of action to the point of operational efficiency, but not necessarily effectiveness
Adaptation

Habituation of action to the point of operational efficiency, but not necessarily effectiveness
Reporting / Finding symptoms

Systems under stress

Visual Efficiency

Time Under Visual Stress

Disorganization

Reorganization

Organization
B1 Degeneration Pattern

B2 Degeneration Pattern

Reporting / Finding symptoms
Reporting / Finding symptoms

B1 Degeneration Pattern

B2 Degeneration Pattern

Graphs showing the relationship between plus acceptance and time under visual stress for B1 and B2 degeneration patterns.
Reporting / Finding symptoms

B1 Degeneration Pattern

B2 Degeneration Pattern

40cm PRV Break and Recovery

40cm NRV Break and Recovery
Reporting / Finding symptoms

Why do some not report symptoms?

- Adaptation and Habituation / embeddedness
  - Embeddedness
    - Normal or less-than-ideal
    - Recall: embeddedness criteria
Concept: Instability of visual features tend to result in symptoms

- Symptoms and problem stability
  - Signs of visual stability ~ or no symptoms
    - If a problem is identified
  - No symptoms: current state is longstanding and/or stable
    - Within limits of reduced visual skills, “operational efficiency” is achieved or visual tasks avoided
  - May increase instability as poor, stable “embedded” habits are disrupted
    - Temporary increase of symptoms are possible in VT
Concept: Instability of visual features tend to result in symptoms

Comments: Embeddedness criteria

- Only analysis to look: stability (embeddedness) or instability (non-embeddedness)
  - Implies
    - How long a problem existed
    - How easily improvement may come
    - How stable things are expected to be
Concept: Instability of visual features tend to result in symptoms

- Embeddedness
  - Seven features are inspected
    - Five of seven confirm the pattern
    - Less than five: “indefinite”
  - Rigid, formal and “shortcut” methods
  - Language is NOT a selling point...

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<table>
<thead>
<tr>
<th>Embedded Syndrome</th>
<th>Yes?</th>
<th>Non-Embedded Syndrome</th>
<th>Yes?</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4 &gt; or equal to #7</td>
<td></td>
<td>#4 lower in plus than #7</td>
<td>X</td>
</tr>
<tr>
<td>#9 close or equal to expected (includes values of 6-10)</td>
<td></td>
<td>#9 excessively low, except in myopia, when #9 is high</td>
<td>X</td>
</tr>
<tr>
<td>#10 break low but recovery above or equal to expected</td>
<td>X</td>
<td>#10 recovery low</td>
<td></td>
</tr>
<tr>
<td>#11 break and recovery up; recovery &gt; or = expected</td>
<td>X</td>
<td>#11 break low, and recovery excessively low</td>
<td></td>
</tr>
<tr>
<td>#14b net &gt; or equal to #14a net</td>
<td>X</td>
<td>#14b net lower than #14a net</td>
<td></td>
</tr>
<tr>
<td>B1 case: #16b break low, with recovery &gt; or = expected.</td>
<td></td>
<td>B1 case: #16b recovery excessively low;</td>
<td>X</td>
</tr>
<tr>
<td>B2 case: #17b break low, with recovery &gt; or = expected.</td>
<td></td>
<td>B2 case: #17b recovery excessively low;</td>
<td></td>
</tr>
<tr>
<td>#19 and #20 are not both low, one high and one low</td>
<td></td>
<td>#19 and #20 both low</td>
<td>X</td>
</tr>
</tbody>
</table>

Sum of Met Criteria: 3

Sum of Met Criteria: 4
Concept: Instability of visual features tend to result in symptoms

Comments: Embeddedness

Embeddedness is intended to answer:

- How long has this problem been stable?
- How engrained is this case type, degeneration, refraction, etc?
- At any level of degeneration, has the patient gained operational efficiency within these deficiencies?
- What treatments measures will be necessary?
- How likely are they to be symptomatic?
Concept: Instability of visual features tend to result in symptoms

Related information:

- Instability can be implied via:
  - Relationships of vergence breaks and recoveries
  - Instability of accommodation at infinity
  - Significant or potential influence of vergence on accommodative function
  - Relationships of accommodative amplitude and PRA/NRA function
  - Recent refractive error progression
  - Potentially many others
Instability of visual features tend to result in symptoms.

Concept: Link between symptoms and problem stability

- Symptoms imply change
  - Structural changes
  - Functional control
  - Task requirements

- Signs of visual instability and/or recent change are expected to correlate with symptoms.
Adaptation

Habituation of action to the point of operational efficiency, but not necessarily effectiveness
Reporting / Finding symptoms

- Patient report versus data collected versus behaviors observed
  - Case History
  - Norm-referenced surveys?
Ciuffreda KJ. The scientific basis for and efficacy of optometric vision therapy in nonstrabismic accommodative and vergence disorders. Optometry 2002;73:735-62.
# Symptom-related conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage Prevalence</th>
<th>As frequency of patients seen</th>
<th>Per 100,000 patients seen</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Binocular Dysfunction</td>
<td>30.8 %</td>
<td>1/3.2</td>
<td>30800</td>
</tr>
<tr>
<td></td>
<td>21 %</td>
<td>1/4.8</td>
<td>21000</td>
</tr>
<tr>
<td></td>
<td>32.3 %</td>
<td>1/3.1</td>
<td>32300</td>
</tr>
<tr>
<td>Accommodative Excess</td>
<td>10.8 %</td>
<td>1/9.3</td>
<td>10800</td>
</tr>
<tr>
<td>Accommodative Insufficiency</td>
<td>9.3 %</td>
<td>1/10.8</td>
<td>9300</td>
</tr>
<tr>
<td></td>
<td>6.2 %</td>
<td>1/16.1</td>
<td>6200</td>
</tr>
<tr>
<td></td>
<td>19-25%</td>
<td>1/4 - 1/5.3</td>
<td>~22000</td>
</tr>
<tr>
<td>AE with CI</td>
<td>7.7 %</td>
<td>1/13.0</td>
<td>7700</td>
</tr>
<tr>
<td>Convergence Excess</td>
<td>7.1 %</td>
<td>1/14.1</td>
<td>7100</td>
</tr>
<tr>
<td></td>
<td>5.9 %</td>
<td>1/16.9</td>
<td>5900</td>
</tr>
<tr>
<td>Accommodative Infacility</td>
<td>5.0 %</td>
<td>1/20</td>
<td>5000</td>
</tr>
<tr>
<td>Convergence Insufficiency</td>
<td>7.0 %</td>
<td>1/14.3</td>
<td>7000</td>
</tr>
<tr>
<td></td>
<td>4.2 %</td>
<td>1/23.8</td>
<td>4200</td>
</tr>
<tr>
<td></td>
<td>4.6 %</td>
<td>1/21.7</td>
<td>4600</td>
</tr>
<tr>
<td>Basic Exo</td>
<td>2.8 %</td>
<td>1/35.7</td>
<td>2800</td>
</tr>
<tr>
<td></td>
<td>3.1 %</td>
<td>1/32.2</td>
<td>3100</td>
</tr>
<tr>
<td>Accommodative Spasm</td>
<td>2.5 %</td>
<td>1/40</td>
<td>2500</td>
</tr>
<tr>
<td>Basic Eso</td>
<td>1.5 %</td>
<td>1/66.7</td>
<td>1500</td>
</tr>
<tr>
<td>AI with CE</td>
<td>1.5 %</td>
<td>1/66.7</td>
<td>1500</td>
</tr>
</tbody>
</table>
Symptom-related data...

- Patient report versus data collected versus behaviors observed
  - Select evidence:
    - See Sheedy
    - Acc amplitude
      - See Chase: ill-sustained acc vs amplitude
      - Also: Sterner
Symptom-related data...

- Stepwise Regression Studies of Predictors of Asthenopia
  - Sheedy and Saladin performed two studies to identify the best discriminating comfort criteria
  - First study: Good pilot project
    - Opt school patients and students
    - VT patients as symptomatic group; selected students as the asymptomatic group
    - Stepwise analysis of many "standard" variables
    - Phoria, blur, break and recovery ranges, Percival's criterion, Sheard's criterion, vergence opposite the phoria, X and Y intercepts, the slope of the FDC.
Stepwise Regression Studies of Predictors of Asthenopia

- FDC values were so discriminating, became categories themselves
- All subjects were optometry students
- Only separated by symptomatology, not previous examination results
- Only potential downside: symptoms weren't as severe as those in the first study
- Variables were added: all pos. and neg. blur, break and recoveries figured individually, Sheard's and Perc's calculated on blur, breaks and recoveries, Ogle FDC types were added in
Symptom-related data...

- Stepwise Regression Studies

<table>
<thead>
<tr>
<th>All Subjects</th>
<th>Exophores</th>
<th>Esophores</th>
<th>Exo FDisp</th>
<th>Eso FDisp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheard blur</td>
<td>Y intercept</td>
<td>Percival break</td>
<td>Sheard blur</td>
<td>FDC slope</td>
</tr>
<tr>
<td>FDC type</td>
<td>FDC type</td>
<td>PRV Blur</td>
<td>FDC type</td>
<td>Percival recov'y</td>
</tr>
<tr>
<td>FDC slope</td>
<td>NRV break</td>
<td>NRV break</td>
<td>FDC slope</td>
<td>X intercept</td>
</tr>
<tr>
<td>NRV blur</td>
<td>Phoria</td>
<td>Percival recov'y</td>
<td>NRV blur</td>
<td>Percival break</td>
</tr>
<tr>
<td>Y intercept</td>
<td>Percival blur</td>
<td>FDC slope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRV blur</td>
<td></td>
<td>X intercept</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phoria</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>82% correct</td>
<td>92% correct</td>
<td>73% correct</td>
<td>76% correct</td>
<td>96% correct</td>
</tr>
</tbody>
</table>
Symptom-related data...

- Implications of these studies
  - Mechanical/Traditional Dx category thinking really doesn’t link well to data that correlate to symptoms
Implications of these studies

- Not all asthenopia-related questions are answered by these studies
  - Many variables not included
    - Only accommodative implications are prism "blur" values...indirect assessment
  - Not considering other analyses...just "simple" ones
Symptom-related data...

- Patient report versus data collected versus behaviors observed
  - Select evidence:
    - See Sheedy
    - Acc amplitude
      - See Chase: ill-sustained acc vs amplitude
      - Also: Sterner
Symptom-related data...

- **Push up amplitude**

  - **Evaluation:**
    - Hofstetter’s minimum = 15 – 0.25(age)
    - Application warning
    - Overestimates in ages 6-10

  - **Normative values:**
    - VERY age dependent
    - Generally, from age 6 onward, most sources show a minimum “normal” of 10 diopters through teens
    - Sterner: 7.7-11.7 YO: cutoff of 8.00 = 90% symptomatic below, 75% asymptomatic above
Symptom-related data...

- Minus lens method

  - Evaluation
    - NOTE: combine ALL dioptric demands!!
    - Normative values:
      - Difficult to find
        - Ages 8-13: 10.5 ± 1.7 (~9.00 cutoff implied)
      - Warning: age, population variability in norms
    - Compare OD, OS
    - Consider minimum requirement vs normative value
    - Consider balance against ability to reduce accom
    - Consider recovery vs blur or blur out
Symptom-related data...

- **Amplitude**
  - **Evaluation**
    - **NOTE:** NOT a normal distribution
      - Underestimates median and minimum “normal” performance
      - Using std distribution = many false negatives
Symptom-related data analysis...

- Patient report versus data collected versus behaviors observed

  - Common perspectives on Data
    - Comfort criteria
      - Sheard
      - Percival
      - Donder
    - Prescription criteria
      - Pratt
      - Saladin
Symptom-related data analysis...

- Patient report versus data collected versus behaviors observed
  - Common perspectives on Data
    - Comfort criteria
      - Sheard
      - Percival
      - Donder
    - Prescription criteria
      - Pratt
      - Saladin
Symptom-related data analysis...

- Patient report versus data collected versus behaviors observed
  - Common perspectives
    - Other
      - AC/A
      - ...
    - Easy
  - Artificial sense of confidence
  - LOTS of false negatives
Patient report versus data collected versus behaviors observed

A few comments:

- Why might Sheard “work”?
  - Contention: NOT for traditional rationale
Symptom-related data analysis…

- Why might Sheard “work”?

<table>
<thead>
<tr>
<th>Outside Temperature</th>
<th>Furnace Works</th>
<th>Furnace Doesn’t Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Cold Outside</td>
<td>OK</td>
<td>Maybe OK</td>
</tr>
<tr>
<td>Cold Outside</td>
<td>Maybe OK</td>
<td>Problem</td>
</tr>
</tbody>
</table>
Symptom-related data analysis…

- Why might Sheard “work”?  

<table>
<thead>
<tr>
<th>OK PRV</th>
<th>Low exo, no eso</th>
<th>Moderate or high exo</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td><strong>OK</strong></td>
<td>Maybe OK</td>
</tr>
<tr>
<td>Poor PRV</td>
<td>Maybe OK</td>
<td>Problem</td>
</tr>
</tbody>
</table>
Symptom-related data analysis…

- Patient report versus data collected versus behaviors observed

  - A few comments:
    - Why might Sheard “work”?• Double trouble, or “Two problems are bigger than one”
Patient report versus data collected versus behaviors observed

Prime dysfunctions related to symptoms

- Accommodation (!)
- A-V relationship
- Vergence
- Other
- Integrated function and perception
Symptom-related data analysis...

- Patient report versus data collected versus behaviors observed

  - Data collection:
    - What are you trying to measure?
    - When is it enough?
    - Data normal but symptomatic
Can always collect more information, or collect it in a different way
Symptoms…

○ What is missing from research and/or common sense?
  ➤ Testing methodology / actual protocol
  ➢ Suppression, anyone?
Symptoms…

What is missing from research and/or common sense?

Why does it matter?

- Best practices outcome-based solution versus detailed assessment
  - Example: with “reading headache”
    - 60% receive +0.50 to +1.00
    - 30% VT (with or without lenses)
    - 5% vertical prism / VT
    - 5% none of the above (referral?)