



**Presentation for:
University of Bicocca**





UNIVERSITÀ DEGLI STUDI DI MILANO
BICOCCA

**Grand Rounds:
Vision Therapy: Poor Reading and Spelling**
(with emphasis on laterality and directionality)





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October 2021

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Grand Rounds Case:
Poor reading and spelling

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Confidentiality Protection...

o To protect patient privacy, the dates and identifying details are omitted or proportionately altered






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Key Information from Referral Examination

o Case History: General Vision Examination

- ✦ April 2016
- ✦ 8 YOF, no medications, no general health or development concerns
- ✦ Primary concerns: reading






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Key Information from Referral Examination

Test Name	Results (Gross)
Manifest	OD +1.00 -0.50 X 009
Refraction	OS +1.25 -0.50 X 175
40cm Induced Phoria	3-9 exo
40cm PRV	x/36/4
40cm NRV	x/24/8
PRA net	OD -1.50/-1.25
	OS -2.75/-2.00
NRA net	OD -2.25/-2.00
	OS +3.00/+2.25
Near Subjective	+1.00 DS OU

o Prescribed +1.00 DS OU and referred to vision therapy

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Vision Therapy Evaluation: Additional Case History

- o May 2016
- o Primary concerns: reading (losing her place, comprehension) and spelling
 - ✦ Paragraphs seem visually overwhelming
- o Reading glasses are helpful to partial degree

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Vision Therapy Evaluation

Test Name	Result
NPC	4/8 cm
Cover Test 6 m	Ortho
Cover Test 40 cm	6 xp
Maddox Rod	No vertical phoria
MEM	Unsteady 0.25 lag

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Vision Therapy Evaluation

Test Name	Results (Gross)
Manifest Refraction	OD +1.00 -0.50 X 009
	OS +1.25 -0.50 X 175
6m Induced Phoria	0-1 exo
40cm Induced Phoria	4-4 exo
40cm PRV	x/28/6
40cm NRV	x/24/4
PRA	OD -5.00/-4.00
	OS -5.25/+5.00
NRA	+2.75/+2.50
Vergence facility (8 BI/BO)	4-3-4-stopped test
Accommodative facility (+/-2.00)	6-6-5-6

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Testing saccadic eye movements (DEM)

- o Developmental Eye Movement Test (DEM)
 - ✦ Baseline - Pages A + B
 - ✦ Visual-Verbal Automaticity (VVA) for 80 characters
 - ✦ Baseline PLUS 79 horizontal saccades: Page C (80 characters)
 - ✦ Ratio to show saccadic skill: horiz/vertical

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Testing saccadic eye movements (DEM)

- o Developmental Eye Movement Test (DEM)
 - ✦ PROBLEM: If VVA is very slow, saccades may not significantly impact time, therefore the ratio is relatively insensitive to eye movement penalty
 - ✦ FALSE NEGATIVE POTENTIAL

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Testing saccadic eye movements (DEM)

- o Cutoffs:
 - ✦ With no symptoms: <16% in Ratio or Error scores
 - ✦ With saccade-related symptoms: <32%

Standard Deviations	Percentages	T scores
+2	2.14%	68
+1	7.98%	54
0	34.13%	40
-1	23.98%	26
-2	5.39%	12

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Testing saccadic eye movements

o Readalyzer (prior: Visagraph)

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Testing saccadic eye movements

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Vision Therapy Evaluation

Test	Subtest	Result	Target Value
NSUCO/Maples	Pursuits and Saccades	<i>(normal)</i>	
DEM (2 trials shown)	Vertical	25	68
[Percentiles shown]	Horizontal	<1	4
	Ratio	<1	<1
	Errors	36	48
Readalyzer (most representative of 3 trials) 90% comprehension, 1 st grade text	Fixations	259	155 (-67%)
	Regressions	55	35 (-57%)
	Words per minute	65	138 (-53%)
	Duration Fixation	0.35	0.28 (-25%)

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Vision Therapy Evaluation

o For background: Piaget Left-Right Awareness Test

o Basic (Natural) Left-Right Concepts

- ✦ Piaget's Right-Left Awareness Test
 - OEPF.org
- ✦ Patient's own left-right
- ✦ Projection of left-right on others
- ✦ Comparison of object positions relative to each other

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Vision Therapy Evaluation

o For background: Gardner's Reversal Frequency Test

o Correct Letter or Symbol Creation

- ✦ Gardner's Reversals Frequency Test
 - OEPF.org
 - Write numbers and directional letters as told
 - May be able to rely on motor memory to assist

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Vision Therapy Evaluation

o For background: Gardner's Reversal Frequency Test

o Correct Letter or Symbol Creation


- ✦ Gardner's Reversals Frequency Test
 - Cross out incorrectly oriented numbers or letters
 - May still try to rely on motor memory to assist

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Vision Therapy Evaluation

- o For background: Beery Visual-Motor Integration (VMI) Test
 - ✦ VMI: the ability to visually guide skilled motor behavior
 - ✦ VMI is developmental: it improves with maturation and practice
 - ✦ VMI highly correlated with early academic achievement
 - ✦ Beery VMI (Copy Forms) tests ability to analyze complex forms, then draw it with a pencil




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Vision Therapy Evaluation

- o For background: Test of Visual Perceptual Skills (Non-Motor)
 - ✦ 7-visual perceptual areas sampled by TVPS
 - Visual discrimination: perception of visually dominant features
 - Visual closure: recognizing a complete feature from fragments
 - Visual-spatial relations: perception of position of objects in space
 - Visual figure-ground: perception of object from background
 - Visual memory: recall of seen stimuli
 - Form constancy: recognition of same, but altered, form
 - Visual-sequential memory: recall sequence of objects in the correct order




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Vision Therapy Evaluation

Test	Subtest	Result
Gardner Reversal Frequency Test (percentiles)	Execution	99
	Recognition	10
Piaget Left-Right Awareness		Age 10 performance
Beery VMI	VMI	27
TVPS: all normal except these (percentiles)	Spatial Relations	16
	Sequential Memory	1
	Visual Closure	9
Dyslexia Determination Test	Borderline Normal Eidetic; Normal Phonetic	




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VT Evaluation Conclusions

- o Diagnoses:
 - ✦ Variable accommodative performance
 - ✦ Poor vergence recoveries
 - ✦ Vergence infacility
 - ✦ Saccadic eye movement dysfunction
 - ✦ Laterality-directionality perception development delay
 - ✦ Miscellaneous visual-perceptual development delays
 - Low-normal VMI
 - Borderline spatial relations
 - Low sequential memory and visual closure




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Recommendations

- o Recommendations:
 - ✦ Continue with current Rx, especially for extended nearpoint tasks
 - ✦ Vision therapy for problems on previous slide
 - "Strong chance" to normalize all of these areas
 - Estimate: 16-24 sessions with good participation



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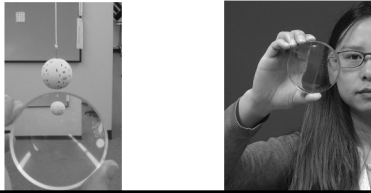
Vision Therapy Program

		SESSION NUMBER																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
split-pupil Rock	Near-Far Rock				Loose Lens Rock			Prism Facilities			BIM/BOP facility					BIM/BOP sustained reading			BIM/BOP Column saccades					
Kirschner Arrows	Slap-tap								Letters in a bag		Letter Transparencies		BDPQ Worksheet			Letter reversal worksheet							Mr. Stickman	
	Floor Mapping						Alphabet Writing with Correction																	"Memory" with hidden sequencing
Column saccades-far	4-Corner Saccades-Far								Percon Saccade Workbook					Michigan Tracking										Word Searches with memory
	Hart Chart Saccade Patterns								X's and O's			Saccadic Ladders		Symbol Counting								Dotting O's		Page Saccades

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Vision Therapy Program: Accommodation & Vergence

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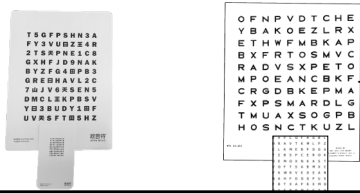


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Vision Therapy Program: Accommodation & Vergence

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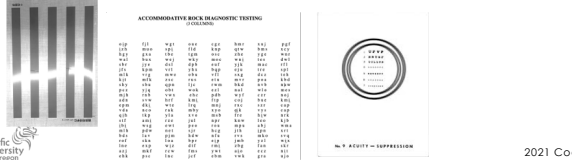


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Vision Therapy Program: Accommodation & Vergence

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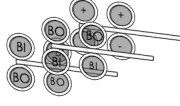
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Vision Therapy Program: Accommodation & Vergence

SESSION NUMBER																						
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split-pupil Rock	Near-Far Rock	Loose Lens Rock	Prism Facilitites	BIM/BOP facility												BIM/BOP sustained reading			BIM/BOP Column saccades			

Rank order for flipper arrangements:

- ◇ BOM / BIP
- ◇ BI/BO only, + / - only
- ◇ BIM / BOP



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Vision Therapy Program: Accommodation & Vergence

SESSION NUMBER																						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
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Vision Therapy Program: Accommodation & Vergence

SESSION NUMBER																						
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Split Rock	Near-Far Rock	Loose Lens Rock	Prism Facilities	BIM/BOP facility											BIM/BOP sustained reading	BIM/BOP Column saccades						

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Vision Therapy Program: Laterality-Directionality

SESSION NUMBER																						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Kirschner Arrows	Slap-tap	Letters in a bag			Letter Transparencies	BDPQ Worksheet		Letter reversal worksheet					Mr. Stickman									
Floor Mapping			Alphabet Writing with Correction				Hidden Pictures											"Memory" with hidden sequencing				

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Vision Therapy Program: Laterality-Directionality

SESSION NUMBER																						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
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Floor Mapping			Alphabet Writing with Correction				Hidden Pictures											"Memory" with hidden sequencing				

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Vision Therapy Program: Laterality-Directionality

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 ABCDEFGHIJKLMNOPQRSTUVWXYZ

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 S S S S S S S S S S

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PROGRESS CHECK: Vision Therapy Program: Laterality-Directionality

SESSION NUMBER						
1	2	3	4	5	6	7
Kirschner Arrows		Slap-tap			Alphabet Writing with Correction	
Floor Mapping		Alphabet Writing with Correction				

Test	Subtest	Session 7
Gardner Reversal Frequency Test (percentiles)	Execution	99
	Recognition	20

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Vision Therapy Program: Laterality-Directionality

SESSION NUMBER																							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Kirschner Arrows			Slap-tap			Letters in a bag			Letter transparencies			BDPQ Worksheet			Letter reversal worksheet			Mr. Stickman					
			Floor Mapping			Alphabet Writing with Correction									Hidden Pictures			"Memory" with hidden sequencing					
TRANSLATE IN THIS ROW																							

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Vision Therapy Program: Perceptual Skills

SESSION NUMBER																							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Kirschner Arrows			Slap-tap			Letters in a bag			Letter Transparencies			BDPQ Worksheet			Letter reversal worksheet			Mr. Stickman					
			Floor Mapping			Alphabet Writing with Correction									Hidden Pictures			"Memory" with hidden sequencing					
TRANSLATE IN THIS ROW																							

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Vision Therapy Program: Perceptual Skills

"Memory" with hidden sequencing

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Vision Therapy Program: Saccades

SESSION NUMBER																																																																																																																										
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Vision Therapy Program: Saccades

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Vision Therapy Program: Saccades

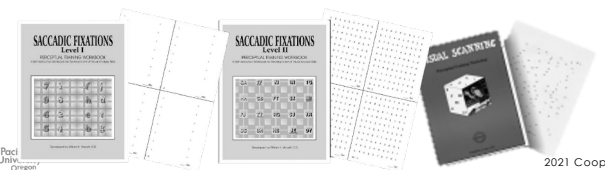
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Vision Therapy Program: Saccades

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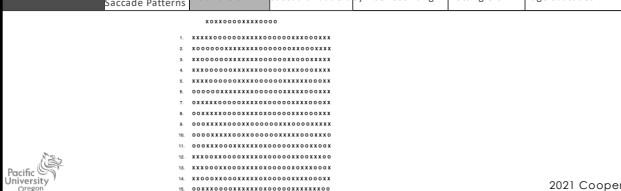


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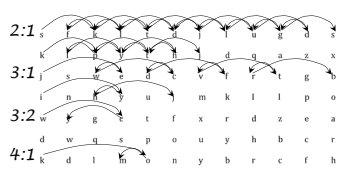


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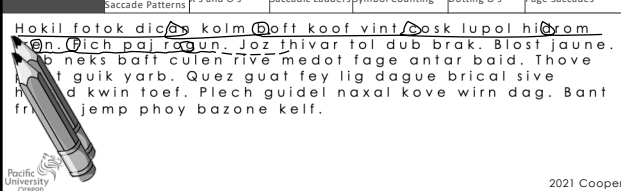


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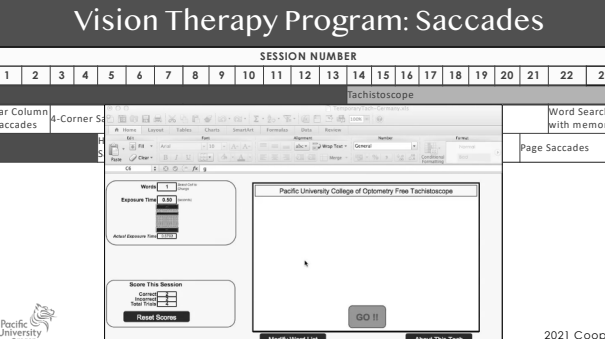


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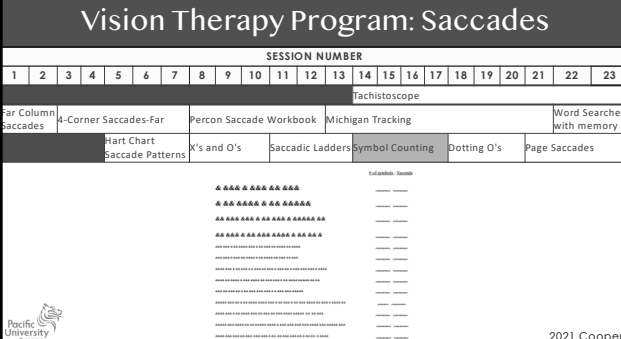


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Test		Subtest		Result																	
DEM [Percentiles shown]		Vertical		64																	
		Horizontal		9																	
		Ratio		3																	
		Errors		42																	

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Vision Therapy Program: Saccades																						
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DEM [Percentiles shown]		Vertical		64																		
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PROGRESS CHECK: Vision Therapy Program: Saccades																					
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Test		Subtest		Result		Target Value															
Readalyzer (most representative of 3 trials) 90% comprehension, 2 nd grade text		Fixations		175		155 (-13%)															
		Regressions		17		35 (+51%)															
		Words per minute		122		138 (-12%)															
		Duration Fixation		0.33		0.28 (-18%)															

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PROGRESS CHECK: Vision Therapy Program: Saccades																						
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Test		Subtest		Result																		
DEM [Percentiles shown]		Vertical		54																		
		Horizontal		28																		
		Ratio		36																		
		Errors		42																		

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Ending Weekly Therapy-Home Maintenance
<ul style="list-style-type: none"> o All patient's goals met o Numeric goals met <ul style="list-style-type: none"> ✦ A few initial tests not reassessed <ul style="list-style-type: none"> > Facility implied based on vergence recoveries > Visual Closure o Home maintenance: <ul style="list-style-type: none"> ✦ Continue progressing with tachistoscope >5 min/day ✦ Page saccades: 2 pages prior to recreational reading (>20 minutes per day) ✦ Create word searches with vocabulary words <ul style="list-style-type: none"> > Hide while searching > "Memory" with hidden sequencing

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Post-Vision Therapy Progress Check			
o 1 month post-VT follow-up			
Test		Subtest	Result
DEM [Percentiles shown]		Vertical	64
		Horizontal	53
		Ratio	64
		Errors	37

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Progress by Function Eye Movements




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VT Progress: Saccades

Test	Subtest	Initial	Session 15	Session 21	Session 23	1 Mo Post-VT
DEM [Percentiles]	Vertical	25 68	44	64	54	64
	Horizontal	<1 4	2	9	28	53
	Ratio	<1 <1	1	3	36	64
	Errors	36 48	54	42	42	37




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VT Progress: Saccades


Test	Subtest	Initial Eval (1st grade material)	Session 20 (1st grade material)	Session 22 (2nd grade material)
Readalyzer (Number and Percent from Target)	Fixations	259 (-67%)	133 (+14%)	175 (-13%)
	Regressions	55 (-57%)	17 (+51%)	17 (+51%)
	Words per minute	65 (-53%)	114 (-17%)	122 (-12%)
	Duration Fixation	0.35 (-25%)	0.39 (-39%)	0.33 (-18%)



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Progress by Function Accommodation and Vergence




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VT Progress: Accommodation and Vergence


Test Name	Initial Eval	Session 20
40cm PRV	x/28/6	x/39/22
40cm NRV	x/24/4	x/22/14
PRA	-5.00/-4.00	-7.75/-7.75
NRA	+2.75/+2.50	+3.00/+2.75



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Progress by Function Perception and VMI



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VT Progress: Perception and VMI																																
<table border="1"> <thead> <tr> <th colspan="7">SESSION NUMBER</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> </tr> </thead> <tbody> <tr> <td colspan="3">Kirschner Arrows</td> <td colspan="4">Slap-tap</td> </tr> <tr> <td colspan="4">Floor Mapping</td> <td colspan="3">Alphabet Writing with Correction</td> </tr> </tbody> </table>					SESSION NUMBER							1	2	3	4	5	6	7	Kirschner Arrows			Slap-tap				Floor Mapping				Alphabet Writing with Correction		
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Test	Subtest	Initial Eval	Session 7	Session 15																												
Gardner Reversal Frequency Test (percentiles)	Execution	99	99	99																												
	Recognition	10	20	45																												

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VT Progress: Perception and VMI			
Test	Subtest	Initial Eval	Session 19
Beery VMI	VMI	27	25*
TVPS: all normal except these (percentiles)	Spatial Relations	16	50
	Sequential Memory	1	98
	Visual Closure	9	NA
*Patient older on second test. No specific therapy intended to improve VMI was included in her treatment			

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