

# Physical Therapy for the Orthopedic Pediatric Spine

Jessica Garfin, PT, DPT

Hannah Walter, PT, DPT

# Introductions

- Jessica Garfin has been a physical therapist since 1999 and has been with Rady Children's Hospital since 2008. She is the Orthopedic Lead and treats the orthopedic population.
- Hannah Walter has been a physical therapist since 2017 and has been with Rady Children's Hospital since 2020. She treats both the orthopedic and developmental population.
- Non-disclosure: Employed at Rady Children's Hospital.
- Special thanks to Suzi Collins.



## Poll

- What is your profession?
   A) PT
   B) PTA
   C) PT/A Student
   D) Other
- 2. What setting do you work in?A) Outpatient HospitalB) Outpatient Private PracticeC) InpatientD) In-Home services
- 3. What population do you work with?
- A) Adults
- B) Pediatrics
- C) Geriatrics
- D) Other



### **Objectives**

### By the end of the course, the participant will be able to:

- Understand at least three common pediatric spine diagnoses and how they relate to physical therapy.
  - Scoliosis, Scheuermann's kyphosis, spondylolysis, general low back pain
- Be able to prescribe and progress at least two appropriate PT interventions for the above-mentioned diagnoses.
- List two factors to consider when evaluating low back pain.



### Outline

- Evaluation
- Diagnoses
  - Scoliosis
  - Scheuermann's kyphosis
  - Spondylolysis
- Patient Presentation
- Treatment
- Other Considerations



Thomas, Dr. Liji. "Pediatric Spinal Deformities." *News*, 29 Dec. 2022, <u>https://www.news-medical.net/health/Pediatric-Spinal-Deformities.aspx</u>.



### **Evaluation**



Fletcher, Sian. "Posture & the Neutral Spine." Feelgood Fitness, 8 Dec. 2021, https://feelgoodfitness.org/2019/02/07/posturethe-neutral-spine/.

- Posture
- Strength
- Range
  - Tightness & weakness
  - Hypermobility<sup>1</sup>
- Movement Screen



### **Core - Functional Testing**

No gold standard for testing core stability<sup>2</sup>

- Sahrmann Core Stability Test<sup>3</sup>
- Double Leg Lowering Test (DLLT)<sup>4</sup>

### Planks – endurance

- Progressions
  - Closed Kinetic Chain Upper Extremity Stability Test (CKUEST)<sup>5</sup>



Andrew Powell a, et al. "Investigation of the Closed Kinetic Chain Upper Extremity Stability Test in Elite Canoe/Kayak Slalom Athletes." *Physical Therapy in Sport*, Churchill Livingstone, 8 Sept. 2020, https://www.sciencedirect.com/science/article/abs/pii/S1466853X20 305241.



### **Adolescent Idiopathic Scoliosis**



- **AIS:** "Multi-factorial, 3D deformity of the spine and the trunk which can appear and sometimes progress during any of the rapid periods of growth in apparently healthy children<sup>6</sup>
  - Measured by Cobb Angle on a posterior standing radiograph
  - "The Scoliosis Research Society (SRS) continues to define idiopathic scoliosis as a lateral deviation of the spine measuring 10° Cobb or more with a certain amount of rotation."<sup>6</sup>
- Risser classification: Used to grade skeletal maturity based on level of ossification and fusion of the iliac crest apophyses (Scale: 0-5)<sup>7</sup>



#### MEASURING THE COBB ANGLE



Source: e-radiography.net and core concepts





### **Adolescent Idiopathic Scoliosis**

COBB ANGLE	TREATMENT OPTIONS
20 degrees or less	PT: Use clinical judgment
20 – 40 degrees	PT: Indicated
45 degrees or more	PT: Indicated
	COBB ANGLE 20 degrees or less 20 – 40 degrees 45 degrees or more



Early diagnosis/referral can improve outcomes.9



## Physiotherapy Scoliosis Specific Exercises (PSSE)

- "Four randomized controlled trials...have provided strong proof that PSSE are indeed effective for treating AIS patients with mild and moderate curves"<sup>10</sup>
  - Schroth
    - "Correct spinal rotation and increase lung capacity with a rotational breathing technique. Help restore normal spinal position with pelvic corrections, breathing technique, and stabilizing isometric contractions. Improve your posture during routine daily living."<sup>11</sup>
  - Scientific Exercise Approach to Scoliosis (SEAS)
  - Functional Individual Therapy of Scoliosis (FITS)
  - Barcelona Scoliosis Physical Therapy School approach (BSPTS)





"Nonsurgical Treatment Options for Scoliosis -Orthoinfo - Aaos." OrthoInfo, https://orthoinfo.aaos.org/en/treatment/nons urgical-treatment-options-for-scoliosis/.

### Scoliosis Literature – What can PT Do?

- Stabilize, slow down spinal deformity<sup>12,13,14,15,16,17</sup>
  - Mild curve and lower Risser grade most likely to respond<sup>12</sup>
    - Cobb angle: 10-25 degree
- Improve QOL<sup>13</sup>

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- Improvements in respiratory function<sup>18,19</sup>
- Other considerations
  - Self-correct posture<sup>20</sup>
    - Stretching prior to posture maintenance should be avoided<sup>21</sup>
  - Long term vs short term?<sup>20,22,23,24</sup>
- Take away: PT goal is not to correct these skeletal changes
  - Setting expectations

Strikes, Iron. "Safe Exercises for Scoliosis." *The Orthopaedic Therapy Clinic*, 6 Nov. 2021, https://orthophysio.com/know-your-injury/physiotherapy/safe-exercises-for-scoliosis/.



- Schroth
  - Reduces angle of trunk rotation, Cobb angles<sup>13,25,26,27</sup>
  - Schroth more effective for correction of scoliosis and core stabilization more effective for peripheral muscle strength<sup>28</sup>
- "No studies that provide valid evidence that an exercise method prevents progression of adolescent idiopathic scoliosis in patients during their peak growth period"<sup>29</sup>



### **Scoliosis Patient**

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Irvine, Dr Paul. "A Scoliosis Journey: Week 1." Scoliosis Clinic UK - Treating Scoliosis without Surgery, 12 June 2019, https://scoliosisclinic.co.uk/blog/ascoliosis-journey-week-1/.

SUBJECTIVE	OBJECTIVE	TREATMENT
15 y.o. 2/10 pain at rest 6/10 pain at school with prolonged sitting or standing Self-conscious about aesthetics Worried about effect on sports Goal is to avoid surgery	<ul> <li>X-Ray: 30-degree thoracolumbar curve</li> <li>Posture <ul> <li>Adam's Forward Bent Test: + R Rib Hump</li> <li>R scapular winging</li> <li>R scapular elevation</li> <li>Scapular dyskinesis</li> <li>L lateral shift</li> <li>R iliac crest elevated &gt; L iliac crest</li> <li>Apparent LLD</li> </ul> </li> <li>Spinal Mobility <ul> <li>Hypomobile T-spine</li> </ul> </li> <li>L/S AROM <ul> <li>WNL forward flexion (+ pain)</li> <li>Decreased L rotation (+ pain)</li> <li>Decreased T-spine extension (+ pain)</li> </ul> </li> <li>Muscle flexibility <ul> <li>Decreased B hamstring</li> </ul> </li> <li>Strength <ul> <li>Core weakness</li> <li>Scap retractors and depressors: B 4-/5</li> <li>Gluteus medius: B 3+/5</li> </ul> </li> <li>Balance: 30" firm surface B, EO, hip drop</li> <li>Neuro: WNL</li> </ul>	<ul> <li>Iso floor press Shoulder rotations</li> <li>Piriformis cross over</li> <li>Quadruped rotations T-spine extension</li> <li>Standing overhead reach</li> <li>Modified side planks Scap perturbations Clams</li> </ul>



### **Scoliosis Patient: Treatment**

Piriformis crossover



Shoulder rotations



Isometric floor press



#### Standing overhead reach



T-spine extension







### **Scoliosis Patient: Treatment**

#### **Quadruped Rotations**



-`@ Manual resistance or overpressure

#### Thread the needle





### **Scoliosis Patient: Treatment**

#### Modified side plank



#### Modified side plank + clam



Modified side plank + scapular stabilization





#### Manual perturbations







# **Scheuermann's Kyphosis**





"Scheuermann's Kyphosis." OrthoPaedia, https://orthopaedia.com/page/Scheuermanns-Kyphosis.



"Scheuermann's Kyphosis (for Parents) - Nemours Kidshealth." Edited by Suken A. Shah, *KidsHealth*, The Nemours Foundation, Jan. 2022, <u>https://kidshealth.org/en/parents/scheuermann-kyphosis.html</u>.

Scheuermann kyphosis is a condition of hyperkyphosis that involves the vertebral bodies and discs of the spine identified by anterior wedging of greater than or equal to 5 degrees in 3 or more adjacent vertebral bodies<sup>30</sup>



### **Scheuermann's Kyphosis Patient**

SUBJECTIVE	OBJECTIVE	TREATMENT
<ul> <li>16 y.o.</li> <li>Mid-back and low back pain with sitting/standing with a neutral spine (3-4/10)</li> <li>Pain with sitting/standing &gt; 10 minutes (3-4/10)</li> <li>Ongoing, onset 4 years ago</li> <li>Previously worked out at gym 3x/week</li> <li>Goal to avoid surgery</li> <li>Too mature for bracing</li> </ul>	<ul> <li>X-Ray: 80-degree kyphosis T5-T13</li> <li>Posture <ul> <li>Forward head posture</li> <li>T-spine kyphosis</li> </ul> </li> <li>B lateral scapular protraction <ul> <li>Lumbar lordosis</li> <li>L hip &gt; ER at rest</li> <li>B pes planus</li> <li>LLD</li> </ul> </li> <li>Spinal Mobility (no TTP) <ul> <li>Hypomobile T-spine</li> <li>WNL L-spine</li> </ul> </li> <li>L/S AROM <ul> <li>Decreased forward flexion</li> <li>No pain</li> </ul> </li> </ul>	90/90 hold + SLS*
	<ul> <li>Decreased B pec major, hamstring and piriformis</li> <li>Strength         <ul> <li>Core weakness*</li> <li>Scap retractors and depressors: B 3+ - 4+/5</li> <li>Gluteus medius: B 4/5*</li> </ul> </li> <li>Balance: 30" firm B EO; 14-17" foam B EO, hip drop*</li> <li>Neuro: WNL</li> </ul>	Pec stretch - contract/relax Prone reverse angels Standing progressions



### Scheuermann's Kyphosis Patient: Treatment

#### 90/90 hold + SLS



Pec contract-relax



Prone reverse angels



<sup>-</sup> Option to add modalities

Standing progression





### **Low Back Pain**



Don't Ignore a Child Complaining of Back Pain - Spineuniverse. https://www.healthcentral.com/condition/back-pain/dont-ignore-childcomplaining-back-pain.

- Musculoskeletal
  - Muscle strain
  - Muscle imbalance
- Structural
  - Spondylosis, spondylolysis, spondylolisthesis
  - Disc
  - Facet joint dysfunction
- Neuropathic
  - Nerve compression



## Spondylosis, Spondylolysis, Spondylolisthesis

	SPONDYLOSIS	Abnormal wear on the cartilage and bones of cervical vertebrae		
	SPONDYLOLYSIS	Pars interarticularis stress fracture		
	SPONDYLOLISTHESIS	Fractured pars interarticularis separates and slips forward.	Pars Interarticularis "Spondylolysis and Spondylolisth	
	AINDER	<ul> <li>Grades: amount of slippage<sup>31</sup></li> <li>Grade I: 1-25%</li> <li>Grade II: 26-50%</li> <li>Grade III: 51-75%</li> <li>Grade IV: 76-100%</li> <li>Grade V: &gt; 100%</li> </ul>	https://orthoinfo.aaos.org/en/dis	
REIN				
	Repetitive microtrauma, hyperextension			



esis - Orthoinfo - Aaos." OrthoInfo, eases--conditions/spondylolysis-and-spondylolisthesis.



"Portraitsbytracylynne.com: Black Dancers, Dance Poses, Ballerina Poses." Pinterest, 5 Mar. 2019, https://www.pinterest.com/pin/532480355941456667/.



"Laura Zialor Great Britain Competes Womens Editorial Stock Photo - Stock Image." Shutterstock, https://www.shutterstock.com/editorial/image-editorial/laurazialor-great-britain-competes-women%27s-high-13034567dk.



### **Low Back Pain Patient**

SUBJECTIVE	OBJECTIVE	TREATMENT
<ul> <li>16 y.o.</li> <li>Pole vaulter and cheerleader</li> <li>PMH: Mild scoliosis</li> <li>Significant pain with pole vaulting (7/10), decreased with rest and returned with cheerleading (7/10)</li> <li>Tingling and weakness; MRI ordered</li> </ul>	<ul> <li>X-Ray: Spondylolysis with stable spondylolisthesis at L5, mild dextro-scoliosis thoracolumbar spine, mild levoscoliosis inferiorly</li> <li>MRI: Stable grade 1 spondylolisthesis of L5 on S1 secondary to B L5 spondylolysis, soft tissue edema</li> <li>Posture <ul> <li>L pelvic anterior rotation, R pelvic posterior rotation</li> <li>R scapula protracted</li> <li>Adam's Forward Bent Test: + R Rib Hump</li> </ul> </li> <li>Spinal Mobility: WNL</li> <li>L/S AROM <ul> <li>Flexion: WNL</li> <li>Extension: limited, end range pain</li> <li>Lateral flexion: WNL, end range pain</li> <li>Rotation: WNL, end range pain</li> </ul> </li> <li>Muscle flexibility <ul> <li>Hamstring - Popliteal angle: R: 134 deg; L: 152 deg</li> <li>Strength</li> <li>Glute med + max: 4/5</li> <li>Scapular retractors and depressors L: 4-/5; R 5/5</li> <li>Core: decreased activation + endurance, painful</li> </ul> </li> </ul>	Knee extensions Breathing, TA Pelvic tilts Adductor + bridge Physioball chops



### **Low Back Pain Patient: Treatment**

Breathing, transversus abdominis<sup>32</sup> Inhale: 4"/ Hold: 7" / Exhale: 8"(sh)



#### Adductor squeeze + bridge







Physioball chops w/ progression







### **Low Back Pain Patient: Treatment**

Supine Knee Extensions - Hamstring



**Standing Knee Extensions - Hamstring** 



### Low Back Pain

- Return to sport<sup>32</sup>
  - Rest: core initiation, bracing, mobility
  - Foundational: static stabilization
  - Recovery: dynamic stabilization, coordination
  - Functional: gradual return to activity
  - Return to Sport
- Timeline

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### **Home Exercise Program**

- Patient education
- Patient buy in "What are your goals?"
  - Intrinsically motivated (Motivational Interviewing)
  - Pediatric Caregiver driven
- Consistency
- Individualized approach<sup>33</sup>
  - 1-3 exercises
    - A/B days
- Body awareness
  - Independence taking control of their pain
    - "What exercises decrease your pain?"
  - Don't be afraid to take it slow





"Mental Health Assessment: Pre-Teens and Teenagers." Raising Children Network, 16 Nov. 2022, <u>https://raisingchildren.net.au/pre-teens/mental-health-physical-health/mental-health-therapies-services/teen-mental-health-assessment.</u>

## **Considerations**

- Female Sex<sup>34,35</sup>
- Breast size

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- Genetics<sup>35</sup>
- Lifestyle
  - Screen time, COVID
    - Unrestricted outdoor play has decreased by 50%<sup>36</sup>
    - Strength decrease in 10-year-olds<sup>36</sup>
  - Backpacks: conflicting evidence
    - "Perceived schoolbag load, duration of carriage, and method of transport to school were all associated with back and neck pain. However, physical activity in the form of walking or riding to school appeared to offset the potentially provocative effects of prolonged bag carriage."<sup>35</sup>
  - Competitive Sports<sup>35,37</sup>
  - Sleep<sup>35</sup>
- Psychological Factors/Mental Health<sup>35</sup>
  - Adverse Childhood Experiences (ACES) = increased risk for chronic pain<sup>38</sup>



Timesofindia.com. "Children's Mental Health among Top Concerns of Parents: Survey." *The Times of India*, Times of India, 3 Feb. 2023, <u>https://timesofindia.indiatimes.com/life-style/parenting/moments/childrens-mental-health-among-top-concerns-of-parents-survey/photostory/97576906.cms.</u>



### **Factors Associated with Adolescent Low Back Pain**



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### **Questions?**





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Childrens

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