


OCTOBER 12, 2019

Sports Considerations, Post Operative Considerations, and Scoliosis Specific Exercises

Michele Kohl, PT, DPT
Children's Hospital Colorado
Schroth-Barcelona Institute C1 and C2 Certified




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Objectives


- 1 Participants will learn about sports participation for patients with AIS and post operative considerations
- 2 Participants will learn the background on Schroth-based Physiotherapeutic Scoliosis Specific Exercises
- 3 Participants will be aware of PSSE fundamentals and which patients are appropriate for PSSE



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Review: What is AIS?


- Cobb angle 10° or more (frontal plane)
- Scoliometer 5° or more angle of trunk rotation (transverse plane)
- Hypokyphosis thoracic spine (sagittal plane)
- Adams Forward Bend Test
 - Left to right asymmetry
 - Spinous processes not in line
 - Loss of normal arc of flexion
- Identified during pre/pubertal growth spurt, age 10-18



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Scoliosis and Sports




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Scoliosis and participation in sports and activities

- What is the role of environmental factors such as exercise or sports activities?




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Factors to Consider in Athletes

- High repetitions of asymmetric forces across growth cartilage of the spine, particularly before and during puberty
- Low body mass and intense training premenarche
- Exercise related stress on spine due to hyperlordotic positions
 - dance
 - gymnastics
- Asymmetric torque forces
 - serving (tennis, volleyball)
 - single arm throwing sports (baseball, softball)
- Hyperkyphotic forces in swimming; BUT swimming helps flexibility, strength, and endurance
- Scoliosis is noted more in dancing, ballet, swimming, javelin, table tennis, gymnastics



D'Hamecourt, Kenandis et al, Green et al 6

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Conclusions for sport and activity participation

- Exercise is probably not associated with development of AIS
- *Potential* association between sport specific elite athletes at an early age and increased prevalence of scoliosis
- Scoliosis *might* be aggravated by excessive sports, but this effect is minimal
- No evidence that sports/exercise will worsen the curve beyond the natural progression
- No clear relationship between a particular sport causing or contributing to scoliosis
- Sports participation does not seem to affect the degree of the main scoliotic curve
- Scoliosis is not a contraindication to participation in most sports

- Athletes are encouraged to continue participation in sports, for physical and psychologic well being
- Non athletes are encouraged to exercise for functional aerobic exercise capacity

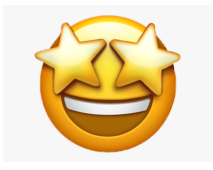
*terms exercise, sports, and athletes were not consistently defined between articles
Konanidis et al, Green et al, d'Hemecourt, Sperandio et al 7



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Activity Recommendations:

Be active, healthy, fit, and participate in the activities you enjoy



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Recommendations for sports and activities


- Determine magnitude of curve and risk of progression
- Flexibility of hamstrings, thoracolumbar fascia
- Cross training
- Strength entire core, gluteals, hamstrings, paraspinals, periscapular muscles *in best possible postural alignment
- If braced, remove brace for sports and activities



d'Hemecourt, Green et al, Schmid et al 9

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Considerations for Sports After Spine Fusion



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Considerations for Sports after Posterior Spinal Fusion (PSF)

2002:

- Extent of spinal curvature correlated with lower sports activity, but extent of the fusion did not correlate with lower sports activity
- Some patients reduced physical activities due to functional limitations and back pain, but those who continued sports "did so at the same level of age matched controls, regardless of number of fused segments"
- "Return to play is encouraged but the level of participation in sports with collision or extremes of motion may be curtailed on an individual basis"

Parsch et al, d'Hemecourt 11

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Considerations for Sports after PSF

2012:

- Distal level of fusion, Lenke classification, post op SRS-22 scores each predicted rate of return to pre operative athletic activity
- Consider the distal level and extent of fusion with return to sports
- Stepwise decline in % of patients returning to pre-operative level of athletics as the distal level of fusion progressed from T11 to L4
- Decrease in return to cheer, gymnastics and ballet due to high level of trunk flexibility needed
- In line sports A-P (running, swimming) and lateral (basketball, tennis, lacrosse) continued to be primary activities after fusion

Fabricani et al 12

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Considerations for Sports after PSF

2015:

- Progressively distal lowest instrumented vertebra = fewer surgeons advised return to collision sports
 - 12% said no collision when fused to T12/L1
 - 33% said no collision when fused to L4
- Pedicle screw instrumentation allows earlier return to contact and noncontact sports
 - 3 months run
 - 6 months contact and noncontact sports
 - 12 months collision sports

2017-present at CHCO:

- If good evidence of healing at 4-6 week postop check up, cleared for return to activities, self limiting

Lehman et al, Christman and Li 13

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Opportunities for future research: Readiness for return to sport after PSF

Consider subjective readiness, tissue healing, ROM, strength, functional testing. Time based vs criterion based

What reliable and valid functional tests or measures can PTs use to aide readiness for return to play based on the athlete's sport specific context?

- Endurance plank test is valid and reliable for assessing global core muscle function (Tong 2014)
- Plank isometric hold is valid and reliable for assessing torso muscle endurance in kids 8-12 years old (Boyer et al 2013)
- Combination of other tests? Running, jumping, leg strength, cardiovascular fitness

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Return to Sport After Posterior Spine Fusion

Clinical Trials.gov
 Status: recruiting, estimate study completion 8/1/2020
 Sponsor: University of Colorado Denver
 Purpose: "to determine when adolescent athletes with idiopathic scoliosis are able to return to sports participation after posterior spine fusion surgery"

Prospective cohort of 50
 Standardized activity questionnaires monthly to see how long it takes to return to play without restrictions
 Self assessment surveys to see how long it takes to return to pre-surgical levels of performance

ClinicalTrials.gov NCT03513120 15

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Physiotherapeutic Scoliosis Specific Exercises (PSSE)

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Objectives for SSE section:

Only to provide background information and general awareness of SSE

I am not a certified Schroth teacher.
I am not teaching you how to assess a curve or how to prescribe these exercises.
You must be certified to assess curve patterns and instruct patients on exercises

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What is Schroth?

- Katharina Schroth 1920s
- Christa Lehnert-Schroth PT 1960s
 - 3D postural corrections and exercises that include breathing
 - Schroth Klinik™ in Germany inpatient rehab & training center 4-5hr/d, 5-7 d/wk x 4-6 wks
- Schroth-based courses in USA 2003
 - Desire for conservative management options for AIS
 - PSSE: Schroth name protected
- Schroth-Barcelona Institute 2008
 - Dr. Manuel Rigo
 - Courses approved by Christa Lehnert-Schroth
- SOSORT accepted PSSE treatment 2011
 - International Society of Scoliosis Orthopedic Rehabilitation & Treatment

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SSE Recommendations

SOSORT Recommendation: Bracing plus SSE

- Together can reduce progression of scoliosis curves and angle of trunk rotation, while improving aesthetics and health related quality of life (Negrini 2009, 2014)
- Helps avoid loss of correction after brace wearing completed (Zaina)

“Not just general exercises, rather specific methods to address unique curve by trained and certified physical therapists” (Mullender)



Negrini et al 2009, Negrini et al 2014, Zaina et al 2009, Mullender et al 19

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SOSORT 2016

		Low		Moderate		Severe	
		Min	Max	Min	Max	Min	Max
Infantile		Obs3	Obs3	Obs3	TTRB	TTRB	Su
Juvenile		Obs3	PSSE	PSSE	FTRB	HTRB	Su
Adolescent	Risser 0	Obs6	SSB	HTRB	FTRB	TTRB	Su
	Risser 1	Obs6	SSB	PSSE	FTRB	FTRB	Su
	Risser 2	Obs6	SSB	PSSE	FTRB	FTRB	Su
	Risser 3	Obs6	SSB	PSSE	FTRB	FTRB	Su
	Risser 4	Obs12	SIR	PSSE	FTRB	FTRB	Su
Adult up to 25 y		Nothing	PSSE	Obs12	SIR	Obs6	Su
Adult	No Pain	Nothing	PSSE	PSSE	SIR	Obs12	HTRB
	Pain	PSSE	SSB	PSSE	HTRB	PSSE	Su



Negrini et al 20

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Which patients are appropriate for SSE?

- Adolescent Idiopathic Scoliosis
- Cobb angle between 10 and 50 degrees
- Considerations
 - Progression
 - Risser
 - Best during rapid growth phase (6 months before 1st period)
 - Minimum age: girls 10 years old, boys 11 years old
- Agree to perform SSE at home 30 minutes/day, 5 days/week
- Equipment and exercise space at home



SOSORT, BSPTS SB21

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Equipment

- Yoga mat
- Wedges and rectangle pads
- 2 yoga blocks
- Pelvis belt and traction strap
- Door anchor
- Towel roll
- Wall bars
- Doorway pull up bar
- Quiet place at home

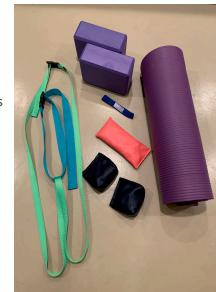


photo M Kishi 22

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Goals of SSE Intervention at CHCO

- Stretch and strengthen specific postural muscles
- Patients learn about their curve(s) and how to achieve best possible posture independently
- Improve comfort of brace to increase brace wearing compliance
- Reduce pain
- Future research will determine additional goals

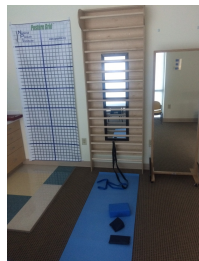


photo M Kishi 23



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Orthopedic Physician Examination

- History
- Systems screen
- Height (stand) and Weight
- Posture
- Adams Forward Bend Test
- Scoliometer
- Gross strength and flexibility
- Neurological signs
- X ray: curve magnitude, Risser
- Recommendations based on findings



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PT Exam

- Subjective / History
- SRS 22, PSFS
- Systems screen
- Height (stand and sit)
- Posture, movement patterns
- Adams Forward Bend Test
- Scoliometer: angle of trunk rotation
- Vestibular
- Spirometer
- ROM/Flexibility
- Strength
- Soft tissue mobility, joint mobility, neural mobility
- Neuro screen
- X ray: curve magnitude, Risser
- Recommendations based on findings

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PT Exam

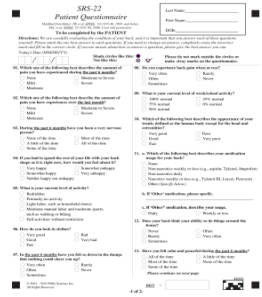
- Subjective / History
- Age at diagnosis
- Menarche status
- Family history
- Interventions to date
- Activities
- Pain
- Patient and family share their story



image from hayneedle.com 26

PT Exam


- SRS22 domains
- Function
- Pain
- Self image
- Mental health
- Satisfaction with management
- Patient Specific Functional Scale (PSFS)



Srs.org 27

PT Exam

- Systems screen
- General health
- Musculoskeletal
- Neuromuscular
- Cardiopulmonary
- Integumentary
- Gastrointestinal/Urinary
- Hearing and Vision
- Cognition / Communication
- Social/Emotional



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PT Exam


- Height
- Stand
- Sit = trunk height



photo M Kishi 29

PT Exam

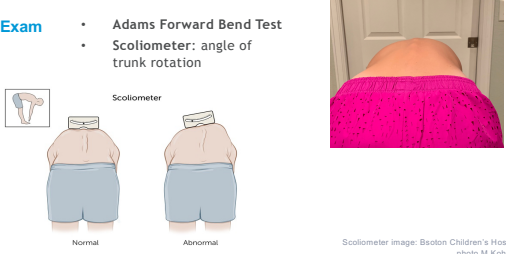
- Posture and Movement Patterns
- Stand
- Sit
- Squat
- Single leg balance
- Single leg squat



XRAY IMAGE IS FILIPPED photos M Kishi 30

PT Exam

- Adams Forward Bend Test
- Scoliometer: angle of trunk rotation

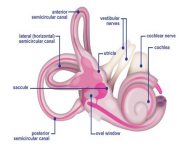


Scoliometer image: Boston Children's Hospital photo M Kohli '31

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PT Exam


- Vestibular
- Possible relevance of vestibular asymmetry to AIS (Shi et al 2011)
- Vestibular dysfunction in patients with AIS (Pialasse et al 2013 and 2015)
- Head Impulse Test/ Head Thrust Test for Vestibulo-Ocular Reflex (VOR)
- indicates vestibular hypofunction



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PT Exam

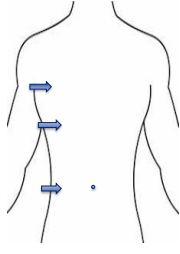
- Spirometer
- Measures forced vital capacity (FVC) or total amount of air exhaled
- Spiropet Spirometer
- Air flow powered precision gear to indicate air volume



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PT Exam

- ROM/Flexibility
- *Rib cage excursion: axilla, xyphoid, umbilicus
- Upper extremities functionally
- Pectoral muscle length
- Hamstring length
- Hip flexor (Thomas)
- Quadriceps (Ely)
- Dorsiflexion
- Hip internal/external rotation
- SFMA



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PT Exam

- Strength
- Upper extremities
- Lower extremities
- Deep neck flexors/deep cervical stabilizers
- Abdominals
- Trunk extension
- Middle trapezius/rhomboids
- Lower trapezius





image from stylecraze.com 35

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PT Exam

- Soft tissue mobility
 - Erector spinae
 - Quadratus lumborum
 - Thoracolumbar fascia
 - Latissimus dorsi
- Joint mobility
 - Thoracic
 - Lumbar
 - Sacrum/sacroiliac
- Beighton Index
- Neural mobility
 - UE and LE
- Neuro screen
 - DTR, dermatomes, clonus, babinski




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PT Exam/Eval

- X Ray
- Classify the curve by correlating clinical findings with x ray




Schroth-Barcelona certification coursebook 37

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Radiologic findings

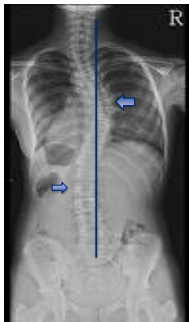
- **Central Sacral Line (CSL)**
- Apex
- Upper End Vertebra (UEV)
- Lower End Vertebra (LEV)
- Cobb Angle
- Transition Point
- T1
- D-modifier
- Counter tilt
- Risser
- Rotation (Nash & Moe)



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Radiologic findings

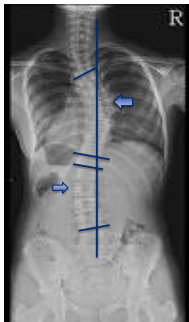
- Central Sacral Line (CSL)
- **Apex** T7 and L2
- Upper End Vertebra (UEV)
- Lower End Vertebra (LEV)
- Cobb Angle
- Transition Point
- T1
- D-modifier
- Counter tilt
- Risser
- Rotation (Nash & Moe)



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Radiologic findings

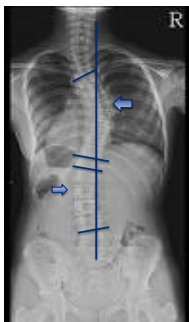
- Central Sacral Line (CSL)
- Apex T7 and L2
- **Upper End Vertebra (UEV)** T4 and T12
- **Lower End Vertebra (LEV)** T12 and L4
- Cobb Angle
- Transition Point
- T1
- D-modifier
- Counter tilt
- Risser
- Rotation (Nash & Moe)



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Radiologic findings

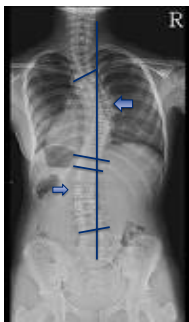
- Central Sacral Line (CSL)
- Apex T7 and L2
- Upper End Vertebra (UEV) T4 and T12
- Lower End Vertebra (LEV) T12 and L4
- **Cobb Angle** 38 and 23
- Transition Point
- T1
- D-modifier
- Counter tilt
- Risser
- Rotation (Nash & Moe)



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Radiologic findings

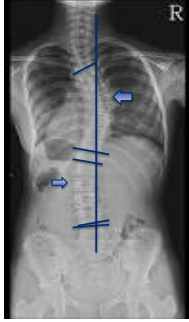
- Central Sacral Line (CSL)
- Apex T7 and L2
- Upper End Vertebra (UEV) T4 and T12
- Lower End Vertebra (LEV) T12 and L4
- Cobb Angle 38 and 23
- **Transition Point** T12 to concave thoracic side of CSL
- **T1** to concave thoracic side of CSL
- D-modifier
- Counter tilt
- Risser
- Rotation (Nash & Moe)



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Radiologic findings

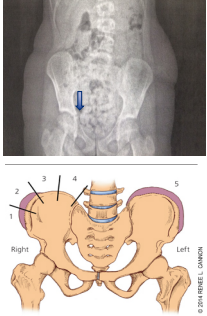
- Central Sacral Line (CSL)
- Apex T7 and L2
- Upper End Vertebra (UEV) T4 and T12
- Lower End Vertebra (LEV) T12 and L4
- Cobb Angle 38 and 23
- Transition Point T12 to concave thoracic side of CSL
- T1 to concave thoracic side of CSL
- **D-modifier** no, T1 not tipped or rotated
- **Counter tilt** L4-L5
- Triradiate Cartilage, Risser
- Rotation (Nash & Moe)



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Radiologic Findings

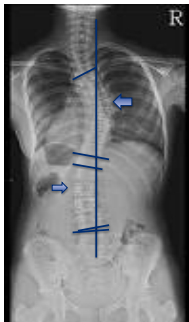
- Central Sacral Line (CSL)
- Apex
- Upper End Vertebra (UEV)
- Lower End Vertebra (LEV)
- Cobb Angle
- Transition Point
- T1
- D modifier
- Counter tilt
- Triradiate Cartilage
- Risser
- Rotation (Nash & Moe)



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Radiologic findings: Summary

- Right Thoracic T4-T12, 38 degrees, Apex T7
- Left Lumbar T12-L4, 23 degrees, Apex L2
- Transition Point T12 and T1 to concave thoracic side of CSL
- No D-modifier
- Counter tilt L4-L5
- Triradiates closed
- Risser ?
- Right4C type curve



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Physical Therapy Recommendations Home Exercise Program, Frequency & Duration

- Home exercise program 15-30 minutes per day, 5 days a week
- Burst of 4 visits for initial instruction
- Follow ups quarterly or after orthopedic imaging visits





photo M Koshi 46

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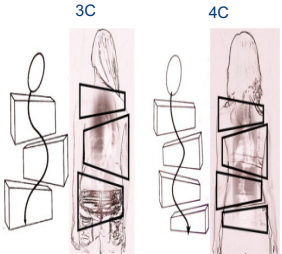
Curve Types



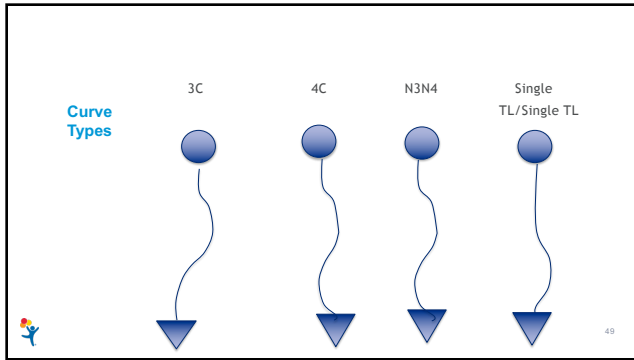
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Curve Patterns

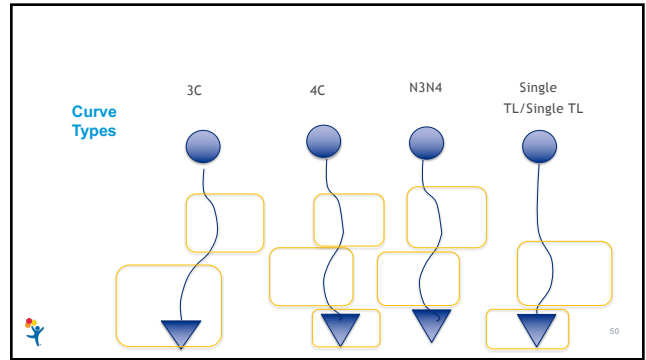
- 3 Curve
- 4 Curve
- Non 3 Non 4
- Single Thoracolumbar
- Single Lumbar
- Different curve types get different exercise prescription



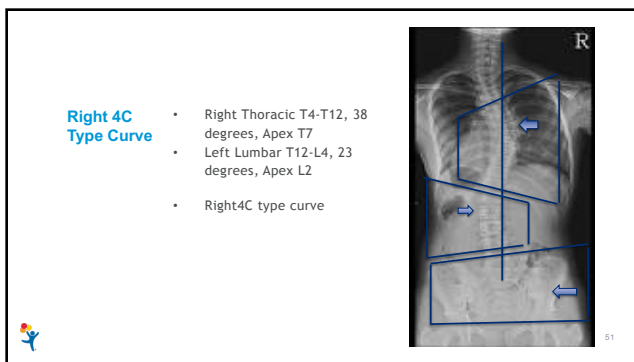
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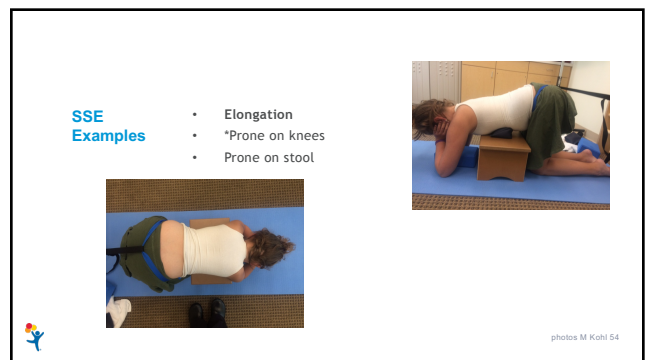
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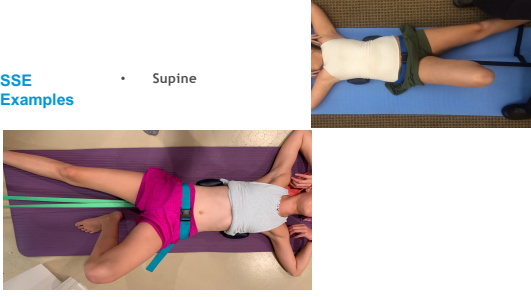
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SSE Examples

- Supine

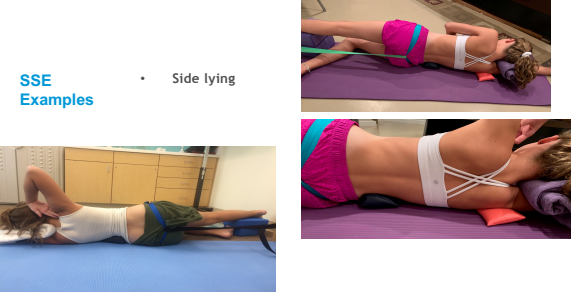


photos M Kahl 55

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SSE Examples

- Side lying



photos M Kahl 56

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SSE Examples

- Standing posture/ dynamic coordination activities
- Neutral, centered pelvis
- Grow tall
- Restack
- Expand
- Bounce bounce/toss toss
- Armpit circles
- Schroth Walk
- Conscious Walking
- Single leg balance ankle circles, leg circles
- Swimming Arms
- Advanced Exercises for certain curve types
- 50 per
- Stand with poles
- Muscle cylinder (stand or kneel)

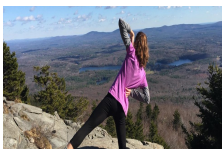


image from scoliosis3DC.com 57

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Negrini S, Atanasio S, Fusco C, Zaina F. Effectiveness of complete conservative treatment for adolescent idiopathic scoliosis (bracing and exercises) based on SOSORT management criteria: results according to the SRS criteria for bracing studies. *Scoliosis and Spinal Disorders*. 2009

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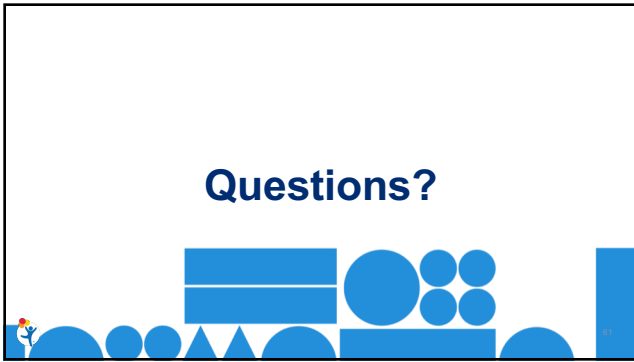


Thank You!



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Questions?



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Post Test



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