Scoliosis Specific Exercise

Charter Rushing PT, ScD, PCS
Course Schedule

• 08:00 The Cause of Scoliosis
• 09:00 Imagining Interpretation
• 10:00 - 10:15 Break
• 10:15 Clinical Classification
• 11:00 Clinical Classification Lab
• 12:00 – 13:00 Lunch
• 13:00 Current Standard of Medical Treatment and Conservative Treatment
• 14:00 Scoliosis Specific Exercises
• 15:00 - 15:15 Break
• 15:15 Scoliosis Specific Exercise Lab
• 16:00 Course Evaluations
How would you treat this patient with exercises?
The Cause of Scoliosis
Types of Scoliosis

• Congenital
• Neuromuscular and Syndromic
• Idiopathic
Congenital Scoliosis

- Spinal deformity caused by vertebrae that are not properly formed
- Occurs in the first six weeks of embryonic formation
- Rarely inherited
- Often diagnosed in infants and toddlers period, but may not be discovered until adolescence or adulthood
- Upon skeletal maturation, it is anticipated that most mild congenital scoliotic curves will not progress or be associated with back pain in adulthood

http://www.srs.org-professionals/online-education-and-resources/conditions-and-treatments/congenital-scoliosis
http://emedicine.medscape.com/article/1260442-overview
Fig. 8. Defects of segmentation and formation. (Reprinted from... - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/7608357_fig7_Fig-8-Defects-of-segmentation-and-formation-R
Neuromuscular and Syndromic Scoliosis

• Neuromuscular
  • Cerebral palsy
  • Spinal muscular atrophy
  • Pediatric spinal cord injury
    • http://www.srs.org/patients-and-families/conditions-and-treatments/parents/scoliosis/early-onset-scoliosis/neuromuscular-scoliosis

• Syndromic
  • Myopathic
  • Connective tissue disorders
    • http://www.srs.org/patients-and-families/conditions-and-treatments/parents/scoliosis/early-onset-scoliosis/syndromic-scoliosis
Idiopathic Scoliosis

• A specific cause is not known
• 80% of cases
Idiopathic Types

- Infantile idiopathic scoliosis (0 to 3 years)
- Juvenile idiopathic scoliosis (4 to 10 years)
- Adolescent idiopathic scoliosis (11 to 18 years)
- Adult idiopathic scoliosis (older than 18 years)
Infantile Idiopathic Scoliosis

- Diagnosed between birth and 3 years
- 1% of all idiopathic scoliosis cases
- 60% are males
- Etiological theories
  - Intrauterine molding
  - Lack of prone positioning in infancy
- More progressive curves occur in Europe than US
- Risk of progression: curves greater than 30°
- [http://www.srs.org/professionals/online-education-and-resources/conditions-and-treatments/infantile-scoliosis](http://www.srs.org/professionals/online-education-and-resources/conditions-and-treatments/infantile-scoliosis)
Juvenile Idiopathic Scoliosis

• Diagnosed between ages 4 and 10
• 10-15% of all idiopathic scoliosis cases
• 20% of curves greater than 20° have underlying spinal conditions
  • Arnold Chiari malformation
  • Syrinx
• Younger curves
  • Boys more than girls
  • Left sided thoracolumbar curves
• Older curves
  • Girls more than boys
  • Right sided thoracolumbar curves
Juvenile Idiopathic Scoliosis

- Risk of progression: curves greater than 30°
- Treatment
  - Bracing
  - Casting
  - Traction
  - Surgery
- 95% will need surgical treatment at some point in time

[http://www.srs.org/professionals/online-education-and-resources/conditions-and-treatments/juvenile-scoliosis](http://www.srs.org/professionals/online-education-and-resources/conditions-and-treatments/juvenile-scoliosis)
Adolescent Idiopathic Scoliosis

• Diagnosed between 10 and 18 years of age
• Most common type of scoliosis (4 in 100 adolescents)
• 10:1 female to male ratio
• Etiological theories:
  • Hormonal imbalance
  • Asymmetric growth in spinal growth plates
  • Muscle imbalance
  • Genetic: 30% positive family history
• Risk of progression:
  • Curves greater than 25° in patients who are skeletally immature (Risser 0)
  • Curves greater than 45° in patients who are still growing
  • Curves greater than 50° in patients who are skeletally mature
Imaging Interpretation
Cobb Angle

• Standing posteroanterior (PA) radiographs of the full spine
• Most tilted vertebral bodies above and below the apex of the spinal curve
• Apex is the vertebral body or disk segment shifted the most lateral to the Central Sacral Vertebral Line
• Standard measurement inter-rater error 5 - 7°
• Progression of scoliosis is defined as an increase in 5° over 6 months
Lenke Classification

• Yes, the man is still alive
• He is a spine surgeon
• Classification is for surgical purposes
Curve Apex Locations

• Thoracic (T2 through the T11–T12 disc)
  • Proximal Thoracic (PT)
  • Main Thoracic (MT)

• Thoracolumbar/Lumbar (TL/L)
  • Thoracolumbar (T12 – L1)
  • Lumbar (L1–L2 disc through L4)

• Lumbrosacral (L5 – S1)
  • Not measured in Lenke classification
Quality of Curve

• Major
  • Structural
  • MT or TL/L, whichever is largest
    • MT - types 1-4
    • TL/L – types 5 and 6

• Minor
  • Other 2 curves
  • Non-structural
    • < 25° on the standing AP radiograph
  • Structural
    • ≥ 25° on the standing AP radiograph
      and do not bend out to < 25° on the side-bending radiographs
    • < 25° on the standing AP radiograph
      and regional sagittal profile kyphosis
      ≥ +20°
<table>
<thead>
<tr>
<th>Type</th>
<th>Proximal Thoracic</th>
<th>Main Thoracic</th>
<th>Thoracolumbar/Lumbar</th>
<th>Curve Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-Structural</td>
<td>Structural (Major*)</td>
<td>Non-Structural</td>
<td>Main Thoracic (MT)</td>
</tr>
<tr>
<td>2</td>
<td>Structural</td>
<td>Structural (Major*)</td>
<td>Non-Structural</td>
<td>Double Thoracic (DT)</td>
</tr>
<tr>
<td>3</td>
<td>Non-Structural</td>
<td>Structural (Major*)</td>
<td>Structural</td>
<td>Double Major (DM)</td>
</tr>
<tr>
<td>4</td>
<td>Structural</td>
<td>Structural (Major*)</td>
<td>Structural (Major*)</td>
<td>Triple Major (TM) §</td>
</tr>
<tr>
<td>5</td>
<td>Non-Structural</td>
<td>Non-Structural</td>
<td>Structural (Major*)</td>
<td>Thoracolumbar/Lumbar (TL/L)</td>
</tr>
<tr>
<td>6</td>
<td>Non-Structural</td>
<td>Structural</td>
<td>Structural (Major*)</td>
<td>Thoracolumbar/Lumbar-Main Thoracic (TL/L - MT)</td>
</tr>
</tbody>
</table>

**Minor Curve Structural Criteria**
- Side Bending Cobb $\geq 25^\circ$
- T2-T5 Kyphosis $\geq +20^\circ$
- Side Bending Cobb $\geq 25^\circ$
- T10-L2 Kyphosis $\geq +20^\circ$
- Side Bending Cobb $\geq 25^\circ$
- T10-L2 Kyphosis $\geq +20^\circ$

*Major* = Largest Cobb measurement – always structural.

Minor = All other curves – may be structural or non-structural.

§ In type 4 curves (triple major), either the MT or the TL/L curve can be major, depending on the largest Cobb measurement. If the MT and TL/L are equal in magnitude, the MT will be considered the major curve.
Bending measurements in parentheses on x-ray images

**Type 1 MT**
- 14 (11)
- 57 (18)
- 49 (4)

**Type 2 DT**
- 40 (30)
- 62 (47)
- 38 (24)

**Type 3 DM**
- 32 (21)
- 66 (46)
- 55 (30)
Bending measurements in parentheses on x-ray images

TYPE 1 MT

TYPE 2 DT

TYPE 3 DM
Lumbar Modifier

• Position of lumbar vertebrae in relation to the Central Sacral Vertical Line (CSVL)
  • A - CSVL between the pedicles of the apical lumbar vertebra
  • B - CSVL between the medial edge of the concave pedicle and the lateral vertebral body on the apical lumbar vertebra
  • C - CSVL does not touch the lateral edge of the apical lumbar vertebra
A: CSVL Between Pedicles (Apical Disc)

B: CSVL Touches Apical Pedicle (Apical Body)

C: The apical vertebral bodies are completely lateral to the CSVL (Apical Disc)

* See stacker algorithm on page 36
<table>
<thead>
<tr>
<th>Lumbar Spine Modifier</th>
<th>Curve Type (1–6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 (Main Thoracic)</td>
<td>1C°</td>
</tr>
<tr>
<td>Type 2 (Double Thoracic)</td>
<td>2C°</td>
</tr>
<tr>
<td>Type 3 (Double Major)</td>
<td>3C°</td>
</tr>
<tr>
<td>Type 4 (Triple Major)</td>
<td>4C°</td>
</tr>
<tr>
<td>Type 5 (TL/L)</td>
<td>5C°</td>
</tr>
<tr>
<td>Type 6 (TL/L - MT)</td>
<td>6C°</td>
</tr>
</tbody>
</table>
Curve Types For Success

• Types 1
  • Main thoracic (MT)
  • Typically right
  • PT and TL/L non-structural curves

• Types 5
  • Thoracolumbar/Lumbar (TL/L)
  • Thoracolumbar can be right or left
  • Lumbar typically left
  • PT and MT non-structural curves
Rigo Classification

• Yes, the man is still alive
• Medical Doctor/PhD
• Teaches scoliosis specific exercises
• Classification is for bracing
• Correlates with Lenke classification
<table>
<thead>
<tr>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical Criteria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pelvis translated to the concave thoracic side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Trunk imbalance to the convex thoracic side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Long thoracic rib hump going down into the lumbar region</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Radiological Criteria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Single Long Thoracic/Fractioned Lumbar</td>
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<td></td>
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<tr>
<td>• TP imbalance to the convex thoracic side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• T1 imbalance to the convex thoracic side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• L4 horizontal or tilted to the convex thoracic side</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Brace Design</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 3C 'Open Pelvis on the Convex Thoracic Side'</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A2</th>
<th></th>
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<tbody>
<tr>
<td><strong>Clinical Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>• Pelvis translated to the concave thoracic side</td>
<td></td>
</tr>
<tr>
<td>• Trunk imbalance to the convex thoracic side</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Noticeable Rib hump / No lumbar or Minimal Lumbar Prominence</td>
</tr>
<tr>
<td><strong>Radiological Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>• Single Thoracic/No or Minimal Functional Lumbar</td>
<td></td>
</tr>
<tr>
<td>• TP imbalance to the convex thoracic side</td>
<td></td>
</tr>
<tr>
<td>• T1 imbalance to the convex thoracic side</td>
<td></td>
</tr>
<tr>
<td>• L4 horizontal</td>
<td></td>
</tr>
<tr>
<td><strong>Brace Design</strong></td>
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<tr>
<td>• 3C 'Classical'</td>
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<table>
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</tr>
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<td></td>
</tr>
<tr>
<td>• Pelvis translated to the concave thoracic side</td>
<td></td>
</tr>
<tr>
<td>• Trunk imbalance to the convex thoracic side</td>
<td></td>
</tr>
<tr>
<td>• Noticeable Rib Hump / Minor Lumbar Prominence</td>
<td></td>
</tr>
<tr>
<td><strong>Radiological Criteria</strong></td>
<td></td>
</tr>
<tr>
<td>• Single Major Thoracic/Lumbar Minor</td>
<td></td>
</tr>
<tr>
<td>• TP imbalance to the convex thoracic side</td>
<td></td>
</tr>
<tr>
<td>• T1 imbalance to the convex thoracic side</td>
<td></td>
</tr>
<tr>
<td>• L4 tilted to the concave thoracic side / Negative L5-4 Counter-Tilting</td>
<td></td>
</tr>
<tr>
<td><strong>Brace Design</strong></td>
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<tr>
<td>• 3C 'Classical'</td>
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Classifying Spinal Rotation

• Vertebrae rotate in the direction of convexity
  • Right thoracic curve -> rotates right
  • Left lumbar curve -> rotates left

• Nash-Moe classification
Nash-Moe Rotation/Apical Vertebral Rotation (Apex of All Curves)

**Concave (left)**
- Pedicles are symmetric
- Pedicle is at the edge of the vertebral body
- Pedicle is disappearing
- Pedicle has disappeared

**Right Thoracic Scoliosis**

**Convex (right)**
- Neutral (0)
- Grade I
- Grade II
- Grade III
- Grade IV

**Left (concave)**
- No rotation (0) Pedicles in symmetric position
- Grade I rotation Pedicle slightly toward midline
- Grade II rotation Pedicle 2/3 toward midline
- Grade III rotation Pedicle is in midline
- Grade IV rotation Pedicle beyond midline

**Right (convex)**
- Pedicles are symmetric
- Pedicle is at the edge of the vertebral body
- Pedicle is disappearing
- Pedicle has disappeared

**Images**
- Neutral (0)
- Grade I
- Grade II
- Grade III
- Grade IV
Classifying Skeletal Maturity

• Tanner stages
• Menstrual cycle
• Risser sign (0-5)
  • 0 skeletally immature
  • 5 skeletally mature
• Tri-radiate cartilage
  • Open
  • Closed
• Olecranon, wrist, and hand ossification
Determinants of childhood growth

Infantile (15% of adult height)
- Nutrition
- Good health and happiness
- Thyroid hormones

Childhood (40% of adult height)
- Growth hormone
- Thyroid hormones
- Genes
- Good health and happiness

Pubertal (15% of adult height)
- Testosterone and oestrogen
- Growth hormone

Fetal (30% of adult height)
- Uterine environment

Height velocity (cm/year)

Age (years)
Breasts

Stage 1: No breast development.

Stage 2: The first sign of breast development has appeared. This stage is sometimes referred to as the breast budding stage. Some palpable breast tissue under the nipple, the flat area of the nipple (areola) may be somewhat enlarged.

Stage 3: The breast is more distinct although there is no separation between contours of the two breasts.

Stage 4: The breast is further enlarged and there is greater contour distinction. The nipple including the areola forms a secondary mound on the breast.

Stage 5: Size may vary in the mature stage. The breast is fully developed. The contours are distinct and the areola has receded into the general contour of the breast.

Pubic Hair

Stage 1: No pubic hair.

Stage 2: There is a small amount of long pubic hair chiefly along the vaginal lips.

Stage 3: The hair is darker, coarser, and curlier and spreads sparsely over the skin around the vaginal lips.

Stage 4: The hair is now adult in type, but the area covered is smaller than in most adults. There is no pubic hair on the inside of the thighs.

Stage 5: The hair is adult in type, distributed as an inverse triangle. There may be hair on the inside of the thighs.
Any non-fused remnant of the Triradiate Cartilage (TRC) is considered open.
Break
Clinical Classification
Clinical Observations

• One shoulder higher than the other
• One shoulder blade being more prominent than the other
• Larger space from arm to the side of the body when comparing both sides
Clinical Observations

• One hip higher than the other
• Head not centered over pelvis
• Uneven waist creases
• One hip more prominent than the other
Clinical Observations: Thoracic or Lumbar Prominence
Clinical Observations

• Hypokyphotic thoracic spine
• One shoulder blade being more prominent than the other
Clinical Curve Classification

• Originated by Lehnert-Schroth
• Augmented by Weiss and Parent
• Attempts to break the body into blocks/wedges
  • Shifted
  • Rotated 3 dimensionally
Figure 3 The original classification according to Lehnert-Schroth. On the left the Three Curve Pattern with the shoulder, thoracic and lumbo-pelvic block deviated against each other in the frontal plane and also rotated against each other. On the right the Four Curve Pattern with a separation of the lumbo-pelvic block into a lumbar and a pelvic block deviated against each other in frontal plane and also rotated against each other. Per definition: the pelvic block symbolises the lumbosacral counter curve and this curve is defined as the 4th Curve [12].
3CH (3 curve with hip prominence), 3CTL (3 curve with hip prominence thoracolumbar), 3C (curve balanced), 3CL (3 curve with long lumbar counter curve), 4C (4 curve double), 4CL (4 curve single lumbar), 4CTL (4 curve single thoracolumbar)
Spine observed from the back

LEFT

NO scoliosis

3c

3cp

RIGHT

4c

4cp
START HERE:

Pelvis unbalanced → yes → Pelvis coupled with lumbar spine, prominent hip on thoracic concave side

no → no → Pelvis uncoupled with lumbar spine, prominent hip on thoracic convex side → yes → 1cp

Pelvis balanced → yes → Pelvis uncoupled with lumbar spine, no prominent hip

→ yes → The rib hump larger than the lumbar prominence → yes → 3c

→ no → The lumbar prominence larger than the rib hump → yes → 4c

* when pelvis is balanced, a feature higher hip doesn't exist and lumbar spine is always uncoupled with pelvis.

Fig. 47 Rigo classification for BSPTS bracing and physical therapy
Fig. 46 (a, b, c, d): The BSPTS system of scoliosis curve classification illustrated with photographs and body block diagrams. The four scoliosis curve types in this classification system are 3C (a), 4C (b), N3N4 (c), and single lumbar or thoracolumbar (d). The 3C curve is a major thoracic scoliosis curve with a compensatory lumbar and pelvic shift (a). The 4C curve is a major lumbar scoliosis curve with a thoracic and lumbar shift (b). The N3N4 curve is a major thoracic scoliosis with or without a lumbar curve but with the pelvis in a neutral position (c). The single lumbar or thoracolumbar curve is a single curve scoliosis with an uncoupled pelvic shift and no thoracic curvature (d).
Clinical Classification Lab
How would you clinically classify this patient?

1) Lehnert-Schroth’s original classification
2) Parent's augmented classification with algorithm
How would you clinically classify this patient?

1) Lehnert-Schroth’s original classification
2) Parent's augmented classification with algorithm
Clinically Classify a Friend!
Lunch
Current Standard of Medical Treatment and Conservative Treatment
Standard of Medical Care

• Observation
• Bracing
• Surgery
• Based on risk of progression
Risk of Progression

- Curve type
- Progression factor
  - Curve magnitude
  - Age at diagnosis
  - Skeletal maturity (Risser Sign) at diagnosis
The incidence of progression for each of the curve patterns. The numbers to the right of the bars indicate the numbers of patients with each pattern, and the numbers in parentheses indicate the percentages that progressed.
Graph showing the incidence of progression related to the magnitude of the curve. There is a marked increase in the incidence of progression for the curves between 20 and 29 degrees. The numbers next to the data points indicate the per cent of curves that progressed.
Graph showing the incidence of curve progression related to the age of the child when first seen. The incidence gradually decreased as the patients' ages increased. The numbers next to the data points indicate the per cent of curves that progressed.
Graph showing the incidence of curve progression related to the patient's Risser sign when first seen. The incidence markedly decreased when the Risser sign was 2 or more. The numbers next to the data points indicate the per cent of curves that progressed.
Graph showing the incidence of progression according to the progression factor, which is calculated by the formula:

\[
\frac{\text{Cobb angle} - 3 \times \text{Risser sign}}{\text{chronological age}}
\]

for curves between 20 and 29 degrees. The numbers next to the data points indicate the number of curves that the data point is based on, and an averaging curve is drawn. Note that the data points at the upper end of the graph are based on a small number of curves.
Observation

• Curves <25° who are still growing
• Curves <50° in patients who have completed their growth
Bracing

- Curves that measure between 25° and 40° during their growth phase
- Goal is to maintain current curve magnitude and prevent progression
- Curve must be corrected in brace
- Patient wears until Risser 4 or 5, two years after the menstrual period
- Curve progression to 45° at the end of growth is considered successful and no surgery is recommended
Types of Braces

• **Night**
  - Worn at night when sleeping
  - Providence vs Charleston
  - Typically for mild lumbar or thoracolumbar curves
  - Over correct curve
  - Studies of effectiveness are inconclusive, but will likely be known in the next few years

• **Fulltime**
  - Worn 18 hours a day
  - Boston vs Custom
  - Any curve with a thoracic component
  - Corrects curve, but focus is on stabilizing curve in upright with 3 points of pressure
  - Bracing in Adolescent Idiopathic Scoliosis Trial (BrAIST) demonstrated bracing in moderate curves (20° to 40°) is effective
Night Time Bracing

Providence

Charleston
Fulltime Bracing

**Boston**
- Has been most popular for some time
- Prefabricated
- Correction is achieved by the placement of pads
- Does not attempt to correct rotation

**Custom**
- Gaining momentum
- Body is scanned and uploaded to a computer
- Corrections are made on computer
- CAD-CAM machine creates a model of patient out of foam
- Attempts to correct rotation
Boston Brace
Custom Brace
Surgery

• Curves > 45° while still growing
• Curves > 50° who are skeletally mature

• Goals
  • Prevent curve progression
  • Obtain some curve correction
  • Balance the spine frontal, sagital, and coronal

• Treatment
  • Fuse a selected number of spinal segments into one bone
  • Posterior spinal approach with rods and pedical screws most common
Posterior Spinal Fusion (Main Thoracic)
Anterior Spinal Fusion (Thoracolumbar)
Scoliosis Specific Exercises
Non-specific Exercises for Scoliosis

• 1985 Carmen et al, core exercises as an adjunct to bracing was no more effective in reducing curve progression than bracing alone
• 2015 Zapata et al, core exercises are effective in reducing low back pain and function in patients with scoliosis
Geographical Differences

**US**
- Exercises considered ineffective
- Bracing and surgery

**Europe (SOSORT)**
- Exercises considered adjunct to bracing
- Surgical intervention is not evidence based
Evidence Based Practice

• 2013 Romano et al
  • Cochrane Systematic Review,
  • Lack of high quality evidence to recommend treatment

• Previous studies did not stratify patient by curve type or skeletal maturity

• Current multi-center studies with SRS funding are underway focusing on effectiveness in mild, flexible, immature single curves
  • Karina Zapata, PT, DPT, PhD
    Scoliosis-specific exercises for at-risk mild adolescent idiopathic scoliosis curves: a multi-site preliminary randomized trial
    $49,780 - 2 Years

• Measuring compliance is difficult
Graph showing the incidence of progression according to the progression factor, which is calculated by the formula:

\[
\text{Cobb Angle} - (3 \times \text{Risser sign}) \\
\frac{\text{Chronological age}}{}
\]

**Figure 1**
The estimation of the prognostic risk to be used during pubertal growth spurt (modified from Lonstein and Carlson [33]). The numbers in the figure indicate the number of cases that each data point is based on. Note the small number of cases on which the upper margins of the graph are based. Lonstein and Carlson's progression estimation formula is based on curves between 20 and 29 degrees.
Schools for Scoliosis Specific Exercises

- Lyon from France
- Katharina Schroth Asklepios approach from Germany
- Scientific Exercise Approach to Scoliosis (SEAS) from Italy
- Barcelona Scoliosis Physical Therapy School approach (BSPTS) from Spain
- Dobomed approach from Poland
- Side Shift approach from the United Kingdom
- Functional Individual Therapy of Scoliosis approach (FITS) from Poland
2005 SOSORT Consensus on Components of Scoliosis Specific Exercises

• Autocorrection in 3D
• Training in ADL
• Stabilizing the corrected posture
• Patient education
Thoracic Mobilization in Side Lying
Costovertebral Joint Mobilizations in Prone
3D Autocorrection in Standing

Fig. 74 Patient with a right thoracic scoliosis curve demonstrates a sequence of Side Shift exercises with assistive correction in the standing position. The arrows in the diagram on the right illustrate the corrective movement of the spine during the Side Shift exercise.
3D Autocorrection
Lying Prone

- Autoelongation
- Traction/Counter-traction
- Opening of concavities
- Iliopsoas Activation
3D Autocorrection Utilizing Iliopsoas Activation

Fig. 52 Diagrammatic depiction of the activation of the iliopsoas muscle in a lumbar scoliosis curve. The arrows show the direction of activation from the origin to the insertion points of the iliopsoas, promoting curve de-flexion and derotation towards the right.
3D Autocorrection with Rotational Angular Breathing

Fig. 65 A diagrammatic depiction (right) of rotation angular breathing (RAB) exercises with the arrows showing the corrective direction of the ribcage is demonstrated by the patient (left) as she expands the lung on the concave side with the goal of reshaping the thorax.
3D Autocorrection with Yoga Pose

Figure 1 The classical iyengar side plank pose with the addition of the ribs raised vertically.
ADL Training

Fig. 2 Image on the left: The Vicious cycle, Dr. Stokes and Burwell hypothesized that the vicious cycle of scoliosis curve progression begins with a triggering event which leads to the formation of wedged vertebrae. Wedged vertebrae cause the spine to curve which results in continuous asymmetric loading on the spine. This in turn, can potentially promote asymmetric growth of the spine and progression of scoliosis curves as asymmetric growth increases the wedging of the vertebrae and perpetuates the cycle to continue. The image on the right shows a scoliosis patient sitting with increased asymmetric loading of the spine as described in Stokes’ Vicious Cycle. The large red “X” on the image indicates that this is not the desired posture. The image on the right shows the same scoliosis patient sitting with improved asymmetric loading of the spine as she performs scoliosis specific physiotherapy exercises in accordance with the Lyon approach.
Fig. 31 Patients performing Schroth 3D postural corrections in sitting and standing positions. These postural corrections are practiced during activities of daily living in order to change habitual default postures and improve alignment, pain, and curve progression.
Fig. 70 (a, b, c): “Hitch” exercise. A patient with a left thoracolumbar scoliosis curve seen on radiograph (a) stands in a neutral position (b). She is instructed to transition into the “hitch” position (c) by lifting her left heel on the same side as the convexity of the curve while keeping her hip and knee straight. The “hitch” position reduces the asymmetry of the patient’s waistline (c).
Fig. 71 (a, b, c, d): The “Hitch-Shift” exercise is indicated for patients with double scoliosis curves. A patient with a double scoliosis curve seen on radiograph (a) stands in a neutral position (b). She is instructed to transition into the “hitch” position (c) by lifting her left heel on the same side as the convexity of the lumbar curve while keeping her hip and knee straight. She then immobilizes the lumbar curve using her hand and “shifts” her trunk to the concavity of the thoracic curve (d).
Stabilizing Corrected Posture with Posture and Balance Training

Fig. 36 Assistive devices like balance boards are used at the beginning of learning the SEAS method
Stabilizing Corrected Posture with Biofeedback

Fig. 88 FITS sensory-motor balance training. With a video camera positioned behind her, the patient is able to see her posture on the screen in front of her in real-time while making postural corrections on the balance board.
Stabilizing Corrected Posture In Standing Using Isometric Contractions
Stabilizing Corrected Posture with Classic Core Stabilization Exercises

Fig. 72 Trunk stabilization exercises using the side-shift method. The “bird-dog” (left) and the plank (right) exercises are performed while maintaining the side shift position.
Patient Education
Using a Spine Model

Fig. 87 Physical therapist using radiographs and spine models to help the patient visualize and gain awareness of her trunk deformity caused by scoliosis
<table>
<thead>
<tr>
<th>Exercise</th>
<th>Picture</th>
<th>Curve type</th>
<th>Passive support</th>
<th>Movement type</th>
<th>Start dose*</th>
<th>Target dose*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Side-bending in side-lying</td>
<td>![Image](63x14 to 898x525)</td>
<td>3c, 3cp</td>
<td>Substantial</td>
<td>Static</td>
<td>2 min.</td>
<td>10 min.</td>
</tr>
<tr>
<td>2. Side-lying + shoulder counter-traction and muscle cylinder</td>
<td>![Image](63x14 to 898x525)</td>
<td>All</td>
<td>Substantial</td>
<td>Static</td>
<td>5 sets x 6 breaths</td>
<td>5 x 8</td>
</tr>
<tr>
<td>3. Shoulder counter-traction with psoas activity</td>
<td>![Image](63x14 to 898x525)</td>
<td>All</td>
<td>Substantial</td>
<td>Static</td>
<td>4 x 5</td>
<td>5 x 8</td>
</tr>
<tr>
<td>4. Sitting on a ball</td>
<td>![Image](63x14 to 898x525)</td>
<td>All</td>
<td>Medium</td>
<td>Static</td>
<td>4 x 6</td>
<td>5 x 10</td>
</tr>
<tr>
<td>5. Hip flexion in side-lying</td>
<td>![Image](63x14 to 898x525)</td>
<td>4c, 4cp</td>
<td>Substantial</td>
<td>Static</td>
<td>5 x 5</td>
<td>5 x 8</td>
</tr>
<tr>
<td>6. Hip Resistance</td>
<td>![Image](63x14 to 898x525)</td>
<td>3cp, 4cp</td>
<td>None</td>
<td>Static</td>
<td>5 x 5</td>
<td>5 x 8</td>
</tr>
<tr>
<td>7. Chest Twister</td>
<td>![Image](63x14 to 898x525)</td>
<td>3c, 3cp</td>
<td>Medium</td>
<td>Static</td>
<td>4 x 5</td>
<td>5 x 6</td>
</tr>
<tr>
<td>8. Hip flexion against a ball</td>
<td>![Image](63x14 to 898x525)</td>
<td>4c, 4cp</td>
<td>Medium</td>
<td>Static</td>
<td>3 x 6</td>
<td>3 x 8</td>
</tr>
<tr>
<td>9. Standing between two poles</td>
<td>![Image](63x14 to 898x525)</td>
<td>All</td>
<td>None</td>
<td>Static</td>
<td>5 x 4</td>
<td>5 x 6</td>
</tr>
</tbody>
</table>
Break
Scoliosis Specific Exercise Lab
How would you clinically classify and treat this patient with exercises?
How would you clinically classify and treat this patient with exercises?
Clinically Classify and Treat a Friend!
Course Evaluations
References

- www.srs.org
References


