What is Scoliosis?

- Lateral curvature of the spine $>10^\circ$
- 3D deformity
Scoliosis Detection

Detection...Bending test

- Feet shoulder width apart,
- Touch your palms together,
- Keep your arms straight,
- Keep bending until your palms are between your knees,
- Roll your spine forward beginning with the neck,
- Keep the legs straight

+/− 5 degrees is positive

Izatt M, 2012 Scoliosis 7(1):14
Thoracic hump

Lumbar prominence

Scoliometer app

- If more than 5 degrees:
  - refer to a Doctor for confirmation exam
  - Depending on risk may refer to scoliosis clinic

- Slide from neck to bottom of the spine as patient complete the bending test
- Keep perpendicular to ground
- Read max tilt to right and left
Update recommendations on Screening for Scoliosis

The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for adolescent idiopathic scoliosis in children and adolescents aged 10 to 18 years. (I statement).

No longer recommends against screening.

Adolescent Idiopathic Scoliosis

Structural Criteria

Vertebral Deformity  Trunk Asymmetry  Lateral Deviation with Axial Rotation

Lateral deviation with bone deformity (SRS > 10 Cobb) (+) Adams test

Normal vertebra  Rotated vertebra
Measurement of the Cobb Angle on Frontal radiographs

Scoliosis diagnosis: Cobb angle ≥ 10° = structural criteria

- Upper end vertebra of the thoracic curve
- Thoracic Apical vertebra (Apex)
- Transitional vertebra (lower end vertebra of the thoracic curve + upper end vertebra of the lower curve)
- Lumbar apical vertebrae (apex)
- Lower end vertebra of the lumbar curve

Cobb angle key points

End-vertebrae
- **Most tilted** vertebrae at each end of the curve.
- Use upper endplate of upper vertebra and lower endplate of the lower vertebrae to measure the Cobb angle

Apex vertebrae
- Most shifted (laterally displaced) vertebrae or disc.
- Usually most rotated.
- Used to label where the curve is located.  (see classification)
Axial Rotation: transversal plane radiological measurement

**Idiopathic Scoliosis**
Structural Criteria - Radiological

**+ Axial Rotation**

Nash&Moe

**IS**
Structural Criteria - Radiological

**+ Vertebral body deformity**

- Different orientation of end plates (transversal plane)
- Lateral concave wedging (coronal plane)
- Dorsal wedging (saggital plane)
Adolescent Idiopathic Scoliosis

- Prevalence among 10-16 years old:
  > 10°: 2 to 3%
  10 girls : 1 boy

Wait and See <20°
Bracing 20-40°
Surgery >45°

Bracing

**INDICATIONS and OBJECTIVES**
- >25° or earlier if curves are progressive to prevent/stop progression
Treatment success \((\text{did not progress to surgery <50°})\) was 72% after bracing, as compared with 48% after observation.

The trial was stopped early owing to the efficacy of bracing.

There was a significant positive association between hours of brace wear and treatment success \((P<0.001)\).

**Rigid Thoraco-Lumbar-Sacral Orthosis (TLSO)**

Or BOSTON style brace

- Most common
- To hold spine during risky growth period

**Full time (23hrs / day)**
- or part-time wear

PT can help promote brace wear

Wearing 13+ hrs/day was minimum required for >90% success

\textbf{In those prescribed full-time!}
**SPINECOR Brace**

Soft brace not offered by orthopedic surgeons in Alberta but some patients get it from chiropractors.

For smaller curves only.

Efficacy controversial.

*The effectiveness of the SpineCor brace for the conservative treatment of adolescent idiopathic scoliosis. Comparison with the Boston brace.*


---

**Scoliosis-Specific Exercise?**

- Not widely recommended in North America despite promising results in Europe
  - Prevent deformity progression
  - Improve quality of life
  - Improve posture
  - Improve muscle endurance
  - Prevent consequences during adulthood
Scoliosis-specific physical therapy

- Include all forms of outpatient physical therapies that have published positive effects

Aim
- Autocorrection in 3D,
- Training in activities of daily living
- Stabilizing the corrected posture
- Patient education

Classification for exercise planning

NO scoliosis 3c 3cp 4c 4cp
Schroth classification algorithm

Number of curves
=3

Level of curves
TH (apex T4 or T5)
Th (apex T8/T9)
Th L (Apex L1)

Direction of curves
From top to bottom
L (20°)
R (28°)
L (35°)

Trace the Cobb angles
Yellow top + bottom
White middle

Do you expect a prominent hip? YES
Where? Right

Do you expect Frontal imbalance?
Yes (C7 left of mid S1)
Scoliosis Detection

What does the patient see?

- Lateral deviation
- Shoulder asymmetry
- Rib hump
- Lumbar prominence
- Waist asymmetry
- Hip prominence

What does the patient see?
not the lumbar prominence, not the rib hump:
some hip prominence, waist asymmetry and ventral prominence

Is there hip asymmetry? yes prominent on right
Are the ribs more prominent on one side? yes
Why? anterior part of rib cage rotated to right so left lower ribs more prominent
Is the waist symmetrical? no waist angle more acute on the right.
Which side is C7 shifted?
Which side are the hips shifted?
Where is the rib hump?
Is there a lumbar prominence?
Is there a waist asymmetry?

Number of curves
Level of curves
Direction of curves
Trace the Cobb angles
Do you expect a prominent hip?
Where?
Do you expect Frontal imbalance?
Schroth Exercises

3 exercises daily for 30 mins.
1 visit per week
6 months.
Immediate effects of Schroth Exercises

Germany 1924

Alex Su
MSc student

Measurements
Immediate effects on curve angles

**Thoracic**

![Graph showing curve angle (degrees) for Standing and Prone Ex's for Thoracic curve with p=0.047]

**Lumbar**

![Graph showing curve angle (degrees) for Standing and Prone Ex's for Lumbar curve with p<0.01]

The immediate effect of Schroth Side-Lying Exercises

1. Natural Standing Position
2. Natural Side-lying position
Methods: Procedure

3. Side-lying position with passive Schroth correction (supports)

4. Side-lying position with active Schroth auto-corrections

5. Side-lying position with active Schroth auto-corrections with leg lift
Results

Thoracic Curves

Mean Curve Angles and [CI95] by Position

Lumbar Curves

* = p<0.05

Results

Natural Standing  Natural Side-Lying  Passive Side-Lying  Active Side-Lying  Active Side-Lying w/ Leg Lift

Mean Curve Angles and [CI95] by Position

Natural Standing  Natural Side-Lying  Passive Side-Lying  Active Side-Lying  Active Side-Lying w/ Leg Lift

* = p<0.05
Results

Max Thoracic-Lumbar Rotation Difference and [CI95] by Position

Active auto-correction (A Schroth example)
### Dosage

<table>
<thead>
<tr>
<th>Approach</th>
<th>In / out patient</th>
<th>Visits</th>
<th>Home program (min)</th>
<th>Program duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schroth intensive rehab.</td>
<td>In</td>
<td>6 /wk X5-6 hrs/day (30-45 min)</td>
<td>3-6 weeks</td>
<td>Outpatient F-up Repeat stay</td>
</tr>
<tr>
<td>Schroth</td>
<td>Out</td>
<td>2/wk X 2hrs, 5/wk X 4 hrs</td>
<td>None, 90 min</td>
<td>3mths, 6 weeks</td>
</tr>
<tr>
<td>SEAS</td>
<td>Out</td>
<td>1.5 hrs / 2-3mths, 2/wk x 40min</td>
<td>5min</td>
<td>Continuous</td>
</tr>
</tbody>
</table>

### Scoliosis-specific physical therapy

**Active auto-correction**

<table>
<thead>
<tr>
<th>Method</th>
<th>Elongation</th>
<th>Side-shift</th>
<th>Derotation</th>
<th>Rotation breathing</th>
<th>Stabilization</th>
<th>Kyphosis focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schroth</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>SEAS</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Scientific Exercise Approach for Scoliosis (SEAS Italy)

Autocorrection + Development of neuromuscular integration and balance reactions

RESEARCH ARTICLE
Schroth Physiotherapeutic Scoliosis-Specific Exercises Added to the Standard of Care Lead to Better Cobb Angle Outcomes in Adolescents with Idiopathic Scoliosis – an Assessor and Statistician Blinded Randomized Controlled Trial

The effect of Schroth exercises added to the standard of care on the quality of life and muscle endurance in adolescents with idiopathic scoliosis—an assessor and statistician blinded randomized controlled trial: “SOSORT 2015 Award Winner”


Schroth physiotherapeutic scoliosis-specific exercises for adolescent idiopathic scoliosis: how many patients require treatment to prevent one deterioration? – results from a randomized controlled trial - “SOSORT 2017 Award Winner”

Sanja Schreiber1, Eric C. Parent2, Doug L. Hill1, Douglas M. Hedden3, Marc J. Moreau3 and Sarah C. Southon3
Objective

• to determine the effect of 6 months of Schroth exercises added to standard of care compared to standard of care alone in adolescents with idiopathic scoliosis

Adolescents with Idiopathic Scoliosis (N=50):

• Inclusion
  – 10-18 years of age
  – Risser 0-5
  – curves 10° - 45°
  – with a brace or not

• Exclusion:
  – diagnosis of AIS
  – surgical candidates
  – history of scoliosis surgery
Study Design

Baseline + Randomization

Schroth + standard of care

5 individual sessions during first 2 weeks

Weekly supervised sessions + daily home program

3 months follow-up

6 months follow-up

Standard of care

Results

Dropouts (N=6; 12%)

Schroth+standard of care:

4 = 3 girls + 1 boy

Standard of care:

2 = 1 girls + 1 boy

Compliance

76% of visits + 73% home exercises
Results

Change in the Largest Curve from baseline to 6 months

Group
1. Standard of care
2. Schroth+standard of care

Baseline 6 months

Error bars = 95% confidence interval

Change in the Sum of all curves from baseline to 6 months

Group
1. Standard of care
2. Schroth+standard of care
### Result

<table>
<thead>
<tr>
<th></th>
<th>Schrot + standard of care</th>
<th>Standard of care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved (Cobb reduced by ≥5°), number (%)</td>
<td>4 (16)</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Deteriorated (Cobb increased by ≥5°), number (%)</td>
<td>3 (12)</td>
<td>10 (40)</td>
</tr>
<tr>
<td>Stable (Cobb change &lt;5°), number (%)</td>
<td>18 (72)</td>
<td>14 (56)</td>
</tr>
</tbody>
</table>

Risk ratio based on number deteriorated: RR = 0.30 (95% CI 0.09 to 0.96)

NNT= 4. Four patients need to be treated with by adding Schroth exercises to prevent one more case of progression (>50°) than with standard care alone.

Schreiber PLOS One 2016;11(12):e0168746.

---

**Change in hold time from baseline to 3 to 6 months**

- **Schroth**:
  - Baseline: 100 sec
  - 3 months: +32.3 sec
  - 6 months: +4.8 sec
  - Total change: +37.1 sec
  - Significance: p = 0.04
- **Control**:
  - Baseline: 100 sec
  - 3 months: 0 sec
  - 6 months: 0 sec
  - Total change: 0 sec
  - Significance: p = 0.89

From 3 to 6 months, the Schroth group experienced improvement compared to the control group.

Results

• No significant differences between groups were found in the other questionnaires’ scores.
  – SRS-22r Function / Total
  – All Perceived Spinal Appearance domains

Conclusion

- 6 months of Schroth exercises added to standard of care improved the radiographic, back muscle endurance, pain, self-image and postural outcomes in all 3 planes.
- Promising short term effects support research on long term effects.
Effect of stabilization exercise on back pain, disability and quality of life in adult with scoliosis: a systematic review.

Alanazi MH, Parent EC, Dennett E.


Adult Scoliosis

"A greater than a 10 degree coronal curve in a skeletally mature individual is considered adult scoliosis." 

Prevalence:
Affects 11% of adults.

- Idiopathic scoliosis
- Degenerative scoliosis
Exercise effective for Adults

- Compared to general physiotherapy, there is limited evidence that 20 weeks of active self-correction task-oriented exercises significantly improved
  - pain (12% difference between groups)
  - quality of life
  - disability levels.

- Our future research will also focus on adults with scoliosis.
Take home

- Detection of Scoliosis
- Discussing radiographs
- Planning autocorrection by analysing posture
- Effect of Schroth scoliosis exercises in AIS
- Effect of SEAS exercises in adults with scoliosis
- Outcomes assessments
  - Radiographic, pain, endurance, QOL, posture.

Acknowledgments

- Coordinator Kathleen Shaerer
- New Investigator Award SickKids Foundation of Canada
English- ISYQOL

- English Adaptation of the Italian Spine Youth Quality of Life scale
- 20 questions with 3 answer options
  - 13 questions completed by all patients
  - 7 questions for patients treated with a brace
- Scoring:
  - Items 5, 6, 10 and 13 are recoded
  - without a brace:
    - Sum the first 13 items (/26)
    - Convert to the RASCH scale score using table #1 from Carronni et al.
  - wearing a brace:
    - Sum all 20 items (/40)
    - Convert to the RASCH scale score using table #2 from Carronni et al.
- 100 indicates severe limitations in QOL


We want to evaluate your health with respect to your back problems (scoliosis, kyphosis, etc.). Please answer the following questions.

1. Are you afraid that your back problem may get worse?
2. Are you afraid that your back problem will cause back pain in adulthood?
3. Do you feel that your back problem is a drama?
4. Are you worried that, despite your all efforts to treat your back it will not get better?
5. Do you think that there are more serious health conditions than your back problem?
6. Despite your back problem, is your life normal?
7. Are you suffering now because of this back problem?
8. Do you feel uncomfortable when you look at your back?
9. Are you worried for your back health?
10. Do you sometimes think that your back problem is not so bad?
11. Are you ashamed to show your body?
12. Are you worried that your back problem may be visible?
13. Despite your back problem, do you live a happy life?

☐ never  ☐ sometimes  ☐ often
If you wear a brace because of your back problem, please answer also to the next questions.

14 Because of the brace, you cannot dress as you would like to?
15 Are you worried that the brace is visible under your clothes?
16 Do you feel down because you can not do what you used to do before you wore the brace?
17 Do you feel that your movements are restricted when you wear the brace?
18 Does it happen that you cry because of the brace?
19 Do you feel less accepted by others because you wear a brace?
20 Is it uncomfortable to wear your brace?

□ never  □ sometimes  □ often

---

**SRS-22r Scoliosis Research Society-22r**

- Most widely used QOL tool
- 22 questions with 5 response options
  - Total and 5 domain scores:
    - Function, Pain, Self-Image, Mental Health (5 questions each)
    - Satisfaction (2 questions)
- Scoring: sum of the answers available by the number of responses available
  - Need minimum of three questions answered
    - Scores vary from 1 (worst) to 5 (best) QOL
- Multiple translations, a scoring guide and bibliography available

http://www.srs.org/professionals/online-education-and-resources/patient-outcome-questionnaires
SAQ Spinal Appearance Questionnaire (2 domains version)

- 20 items patient version + 3 pictorial items
- 2 domain scores:
  - Appearance (items 1-10)
    • Max 2 items can be missing for Appearance
  - Expectations (items 12-15)
    • Max 1 can be missing for expectation
- Scoring:
  - sum /50 for appearance, or /20 for expectation
  - Low values reflect better perceived appearance
- Good measurement properties

9. I want to be more even.
10. I want to look better in clothes.
11. I want to have more even hips.
12. I want to have a more even waist.
13. I want to have more even leg length.
14. I want to have more even breasts.
15. I want to have a more even chest in the front.
16. I want to have more even shoulders.
17. I am self-conscious about my spine surgery scar.
   (Answer this only if you have had spine surgery)
18. Of questions 9 - 17, which one is most important to you?
   Very bad      Good
   question #    Very good
19. How would you rate your self image?
20. What would you most like to change about your body's shape and why?

21. Shoulder blade rotation
22. Shoulder angle
23. Head position
BIDQ-S Body Image Disturbance Questionnaire - Scoliosis

- 7 questions about back shape worries
  - worries
  - preoccupation with
  - experiences of feeling upset about
  - problems at school, or with friends and family caused by
  - problems with friends, family members, or dating caused by
  - activity avoidance
  - behavior avoidance

- Scoring
  - Mean of the items
  - From 1 to 5 (extremely concerned).

- English, simplified Chinese, and German have good properties


TAASQ Truncal Anterior Asymmetry Scoliosis Questionnaire

- 22 questions with 5 options each.

- 3 main domains:
  - Breast (Questions 4 a, b, c; 12; 13; 14)
    - Breast Location (Q4c, 13), Shape (Q4b, 12), and Size (Q4a, 14)
  - Appearance (Questions 5; 6; 7; 10; 11)
  - Clothing (Questions 1; 2 a, b, c, d, e; 3; 8 a, b, c; 9)
    - Clothing General (Q1, 3, 8a, 9) and Specific (Q2, 8b, 8c, 8d)

- Scoring:
  - Mean score for each domain and sub-domain
  - 5 = least amount of concern or asymmetry (5 = Best)

- Adequate measurement properties in surgical candidates

Lonner 48th SRS meeting, 2008 p13, Lonner AAOS, Vegas 2015, p556
Directions: This questionnaire will ask you how you feel about your front body appearance. Please answer each of the following questions by marking the choice that best represents what you think. It is important to answer these questions by yourself.

1. How do you think you look in clothes?
   - Very bad
   - Bad
   - Fair
   - Good
   - Very good

2. How do you think your following body parts look in clothes?
   - Front trunk
   - Breasts
   - Front rib hump
   - Hips
   - Waist

3. How do you think you look from the front, unclothed?
   - Very bad
   - Bad
   - Fair
   - Good
   - Very good

4. a. On a scale of 1 to 5, 1 meaning «Very different» and 5 meaning «Very matched», how would you rate your breasts? Would you say that your breasts are matched:
   - In size:
     - 1
     - 2
     - 3
     - 4
     - 5
   - In shape:
     - 1
     - 2
     - 3
     - 4
     - 5
   - In location:
     - 1
     - 2
     - 3
     - 4
     - 5

5. How often do you think about your front appearance?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very often

6. If you think any or many parts of your front body (such as breasts, ribs, hips, waist) are unmatched, how much does this bother you?
   - Not at all
   - Slightly
   - Mildly
   - Moderately
   - Severely

7. a. How much would you say you have changed your daily life activities (eating, dressing, shopping, walking etc.) as a result of your front body appearance?
   - Not at all
   - Slightly
   - Mildly
   - Moderately
   - Severely

8. a. When you choose the clothes you are going to wear, do you avoid:
   - Certain types of clothing?
   - Certain types of undergarments (bras or underwear)?
   - Certain types of bathing suits?
   - Other (specify)

9. a. Do you use clothing to hide your body shape?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very often

10. When you think about your front appearance, do you feel different from other girls?
    - Not at all
    - Slightly
    - Mildly
    - Moderately
    - Severely

11. If you had to spend the rest of your life with your current chest, ribs, waist, and hips as they are right now, how would you feel about it?
    - Very bad
    - Bad
    - Fair
    - Good
    - Very good

Thank you!
**SAQ Spinal Appearance Questionnaire (9 domains version)**

- 20 items patient version
- 9 domain scores:
  - General (items 9, 10, and 19)
  - Curve (1)
  - Prominence (2, 3)
  - Trunk Shift (4, 5)
  - Waist (11, 12, 13)
  - Shoulders (6, 16)
  - Kyphosis (7)
  - Chest (14, 15)
  - Surgical Scar (17)
- Scoring:
  - items are summed
- Each item is scored from 1 to 5
- Low values reflect better perceived appearance

Sanders. 2007 Spine 32:2719–22

---

**SAQ Spinal Appearance Questionnaire (2 domains version)**

- 20 items patient version + 3 pictorial items
- 2 domain scores:
  - Appearance (items 1-10)
    - Max 2 items can be missing for Appearance
  - Expectations (items 12-15)
    - Max 1 can be missing for expectation
- Scoring:
  - sum /50 for appearance, or /20 for expectation
  - Low values reflect better perceived appearance
- Good measurement properties

<table>
<thead>
<tr>
<th>Question</th>
<th>Not true</th>
<th>A little true</th>
<th>Somewhat true</th>
<th>Fairly true</th>
<th>Very true</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. I want to be more even.</td>
<td></td>
<td></td>
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<td>10. I want to look better in clothes.</td>
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<td>20. What would you most like to change about your body's shape and why?</td>
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<td></td>
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</tr>
</tbody>
</table>
Responsiveness of a new standardized clinical photographic posture assessment method in children and adolescents with idiopathic scoliosis

PI: Carole Fortin, pht, Ph.D.
Co-I: E. Parent, D. Feldman, M-E Poliquin
Collaborators: F. Cheriet, H. Labelle, S. Parent, D. Hedden, M. Moreau

Canadian Paediatric Spinal Deformities Study Group

University of Alberta
Clinical photographic posture assessment tool (CPPAT)

Fortin et al, Spine 2010; Fortin et al, Physiotherapy, 2012

- Excellent intra-inter-rater reliability for marker placement
- Good concurrent validity with spinal angles on radiographs and with 3D trunk posture indices from surface topography

Questionnaires

- Scoliosis Research Society-22,
- 7-point Likert Global ratings of change:
  - to determine retrospectively the perceived treatment effect on function, appearance and pain:

<table>
<thead>
<tr>
<th>Much worse</th>
<th>Slightly worse</th>
<th>No change</th>
<th>Slightly better</th>
<th>Much better</th>
</tr>
</thead>
</table>
Photo evaluation

- Participants will be assessed at each site by a physiotherapist
- Placement of adhesive markers on bony landmarks
- Standardized standing position and instructions
- Photo acquired with 1 digital camera:
  - front
  - left,
  - back,
  - Right
- Patient repositioned between each view
  - (star taped on ground 3m from Camera)
  - 30° feet open

Calculation of posture indices with CPPAT

- Frontal trunk list;
- Scoliosis angle;
- Scapula asymmetry;
- Waist angle;
- Frontal pelvic tilt;
- Head lateral tilt;
- Shoulder elevation;
- Head protraction;
- Thoracic kyphosis;
- Lumbar lordosis

Fortin et al, Spine 2010; Fortin et al, Physiotherapy, 2012
### Plane | Posture indices | Body angle calculation
--- | --- | ---
Frontal (Back) | 1- Scapula asymmetry | The angle formed by a line drawn from the left and right inferior angle of the scapula and the horizontal

| 2-Thoracic scoliosis | The angle formed by lines drawn from the upper end-vertebra to the apex of the thoracic scoliosis curve and from the apex to the lower end-vertebra of the curve

| 3-Lumbar scoliosis | The angle formed by lines drawn from the upper end-vertebra to the apex of the thoracolumbar or lumbar scoliosis curve, and from the apex to the lower end-vertebra of the curve

| 4-Left waist angle | The angle formed by lines drawn from the upper end of the waist to the center of the waist, and from the center of the waist to the lower end of the waist

| 5-Right waist angle | The vertical distance between a line from the center of one waist angle to the center of the other waist angle

| 6-Waist angle asymmetry * | The horizontal distance between C7 and a vertical line drawn from S1

### Variable | Definition
--- | ---
Frontal (Front) | 9- Frontal eyes obliquity * | The angle formed between a line drawn between the left and right eye, and the horizontal

| 10-Shoulder elevation | The angle formed between a line drawn between the left and right coracoid process markers, and the horizontal

| 11-Frontal pelvic tilt (front) | The angle formed between the line joining the two ASIS and the horizontal

Sagittal | 12-Gaze angle * | The angle formed between a line drawn from the canthus of the eye and the tragus of the ear, and the horizontal

| 13-Head protraction * | The angle formed between a line drawn between the tragus of the ear and C7, and the horizontal

| 14-Shoulder protraction | The distance from C7 to the acromion

| 15-Kyphosis | The angle formed between a line drawn from the upper end-vertebra of the curve and the apex of the kyphosis and a line from the apex to the lower end-vertebra of the curve

| 16-Lordosis | The angle formed between a line drawn from the upper end-vertebra of the curve and the apex of the lordosis, and a line from the apex to the lower end-vertebra of the curve

| 17-Sagittal pelvic tilt | The angle formed between the horizontal and the line joining the PSIS and ASIS

| 18-Sagittal trunk list * | Horizontal distance between the tragus and the greater trochanter
Table 2: Results of the G-study: Percentages corresponding to each of the sources of variance for each of the posture indices.

<table>
<thead>
<tr>
<th>Regions</th>
<th>Posture indices</th>
<th>n</th>
<th>Sources of variances (%)</th>
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<td></td>
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<tr>
<td></td>
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<td>Head protraction L</td>
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<td>Shoulder elevation</td>
<td>38</td>
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<tr>
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<td>Shoulder protraction R</td>
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<td>29</td>
<td>68.1</td>
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<td>Scapula asymmetry</td>
<td>36</td>
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<td>Waist angles asymmetry</td>
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<td>Thoracic kyphosis R</td>
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<td></td>
<td>Lumbar lordosis R</td>
<td>34</td>
<td>80.6</td>
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Table 3: Test-retest dependability coefficient (φ), standard error of measurement (SEM) and minimal detectable change at 90% (MDC90)

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<th>Regions</th>
<th>Posture indices</th>
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<th>φ</th>
<th>SEM</th>
<th>MDC90</th>
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**RESULTS: VALIDITY**

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<th>Validity</th>
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<td>3D system (r)</td>
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<td>Thoracic/Lumbar Scoliosis (*)</td>
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p < 0.01; † = p < 0.05

Fortin et al., Spine, 2010
### RESULTS: RELIABILITY

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<td>Lumbar lordosis</td>
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<td>Tibio calcaneum angles</td>
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Fortin et al., *Physiotherapy*, 2012
RESULTS

Sources of variance

- **Inter-persons**: is the major source of variance: 51 to 99%
- **Interaction between persons, evaluators and occasions (residual error)**: 1 to 28%
- **Interactions between PE, PO or EO**: 0 to 12%
- **Evaluators**: 0 to 5%, except for Q Angle and Tibio calcaneum Angle (7 to 19%)
- **Occasions et EO**: 0%

Scoliologic (Germany)

Activities of Daily Living (ADL) ex’s

Autocorrections
Scientific Exercise Approach for Scoliosis
(SEAS Italy)

Autocorrection + back OR abdominal stabilization

Side-shift and hitch (Japan)

Autocorrection
Shift
Single Thoracic

Hitch autocorrection
Single lumbar

Hitch-shift autocorrection
Double
Dobomed (Poland)  
Kyphosing progression with autocorrection

![Diagram of Dobomed (Poland)](image)

Enrollment
- Assessed for eligibility (n=2261)
  - Excluded (n=2061)
    - Not meeting inclusion criteria (n=1701)
    - Declined to participate due to lack of interest (n=360)
  - Randomized (n=200)

Allocation
- Allocated to intervention (n=100)
  - Received allocated intervention (n=100)
  - Did not receive allocated intervention (n=0)
- Allocated to control (n=100)
  - Received allocated intervention (n=90)
  - Did not receive allocated intervention (n=10)

Follow-Up
- Lost to follow-up (n=2)
  - Indicated
  - Travelled for >3 months during the trial
  - Discontinued intervention (n=0)

Analysis
- In intention-to-treat analysed (n=100)
  - Excluded n = 0
  - In per-protocol analysed (n=90)
  - Excluded n=4
SOSORT 2011 guidelines: exercise in combination with brace treatments

1. to stop curve progression at puberty (or reduce it),
2. to prevent or treat respiratory dysfunction,
3. to prevent or treat spinal pain syndromes,
4. to improve aesthetics via postural correction,

- The use of a rigid brace always imply the associated use of Physiotherapeutic Specific Exercises

SOSORT guidelines: Exercises alone

- Depends on Risser and Curve severity
  - Immature curves between 11° and over 30°
  - Mature patients, curves 11° to 45°
### SOSORT guidelines: Exercises alone or combined

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<th>Adolescent</th>
<th>Cobb degrees</th>
<th>0-10 + Hump</th>
<th>11-15</th>
<th>16-20</th>
<th>21-25</th>
<th>26-30</th>
<th>31-35</th>
<th>36-40</th>
<th>41-45</th>
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- all Risser
- Curves between 11° and over 50° if non-surgical

Negrini et al. Scoliosis 2012, 7:3
http://www.scoliosisjournal.com/content/7/1/3