Diagnostic assessment of scoliosis: Radiological exam

By

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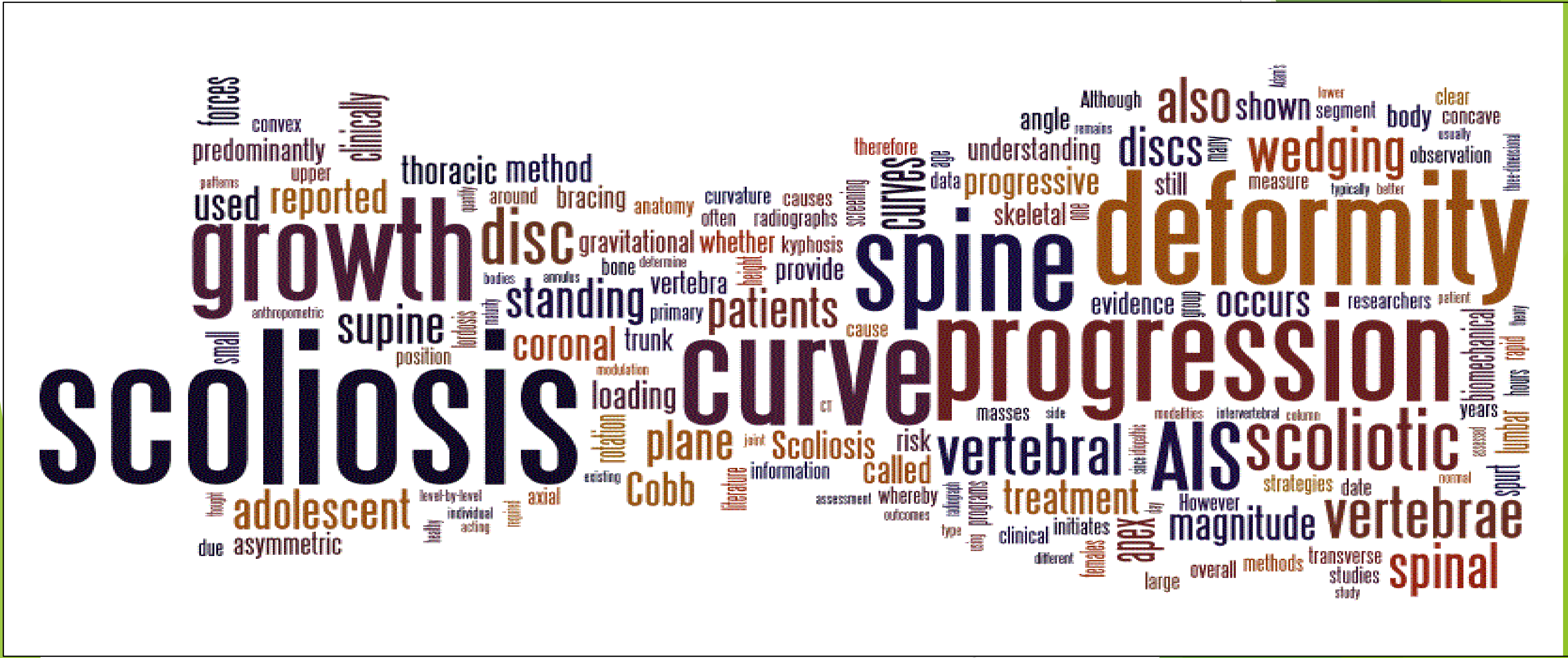
Scoliosis ?!!!!



scoliosis
growth
curve
progression
deformity
spine
disc
scoliotic
AIS
vertebral
vertebrae
spinal
magnitude
treatment
Scoliosis
plane
Cobb
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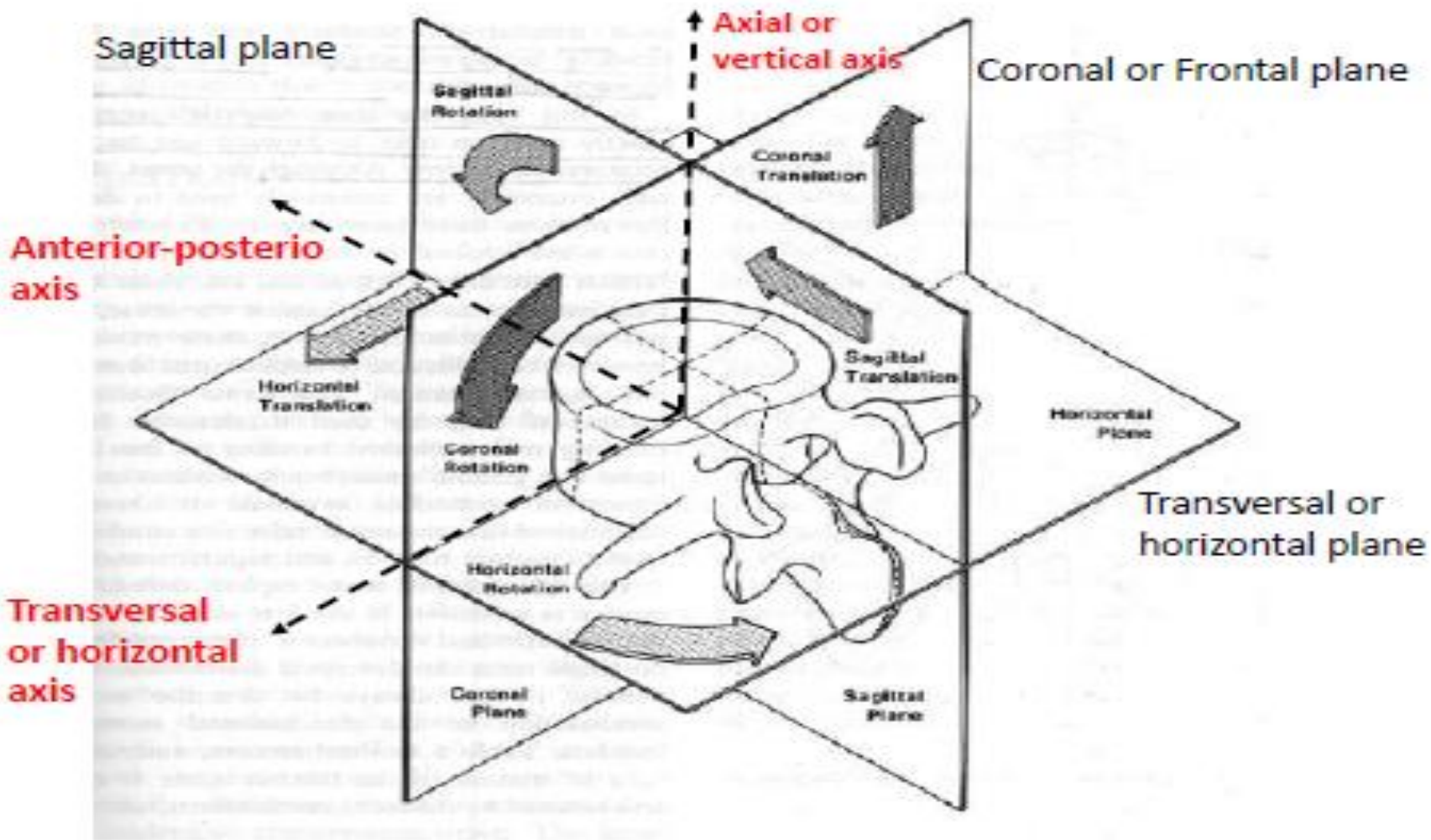
lordosis

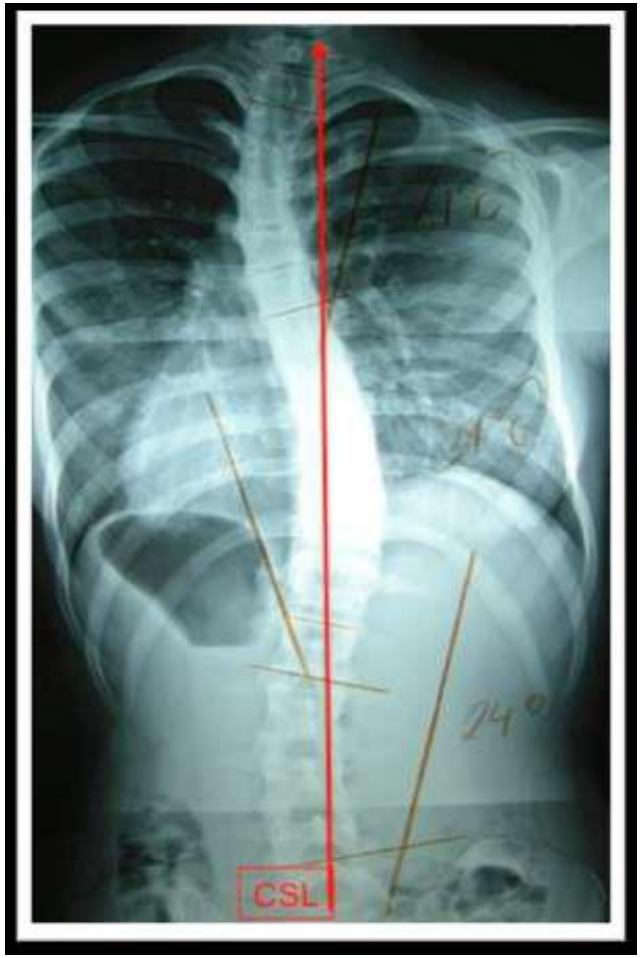
“Complex 3D deformity of the spine and trunk, which appears in apparently healthy children, and can progress in relation to multiple factors during any rapid period of growth, or later in life”
(Rigo et al.)

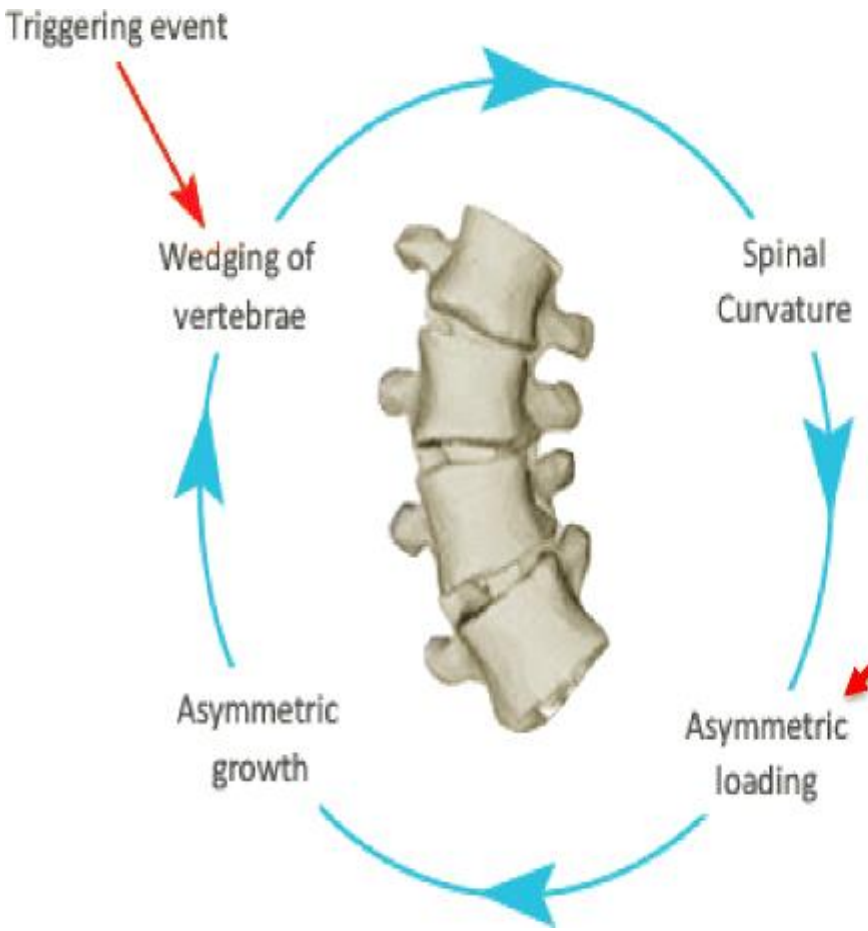
Planes and Axes

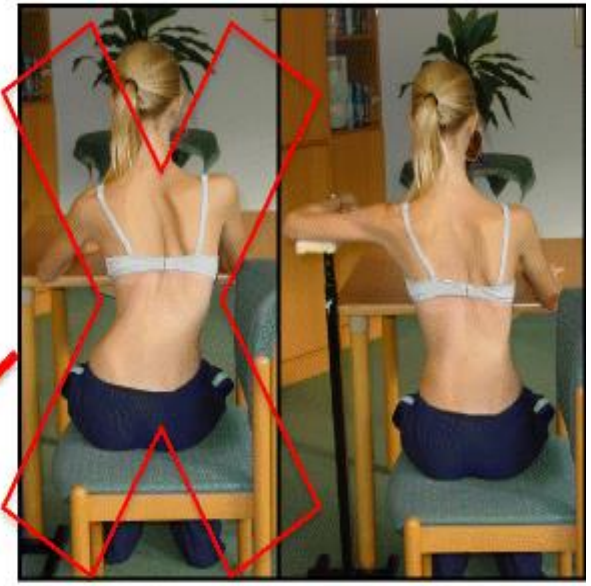


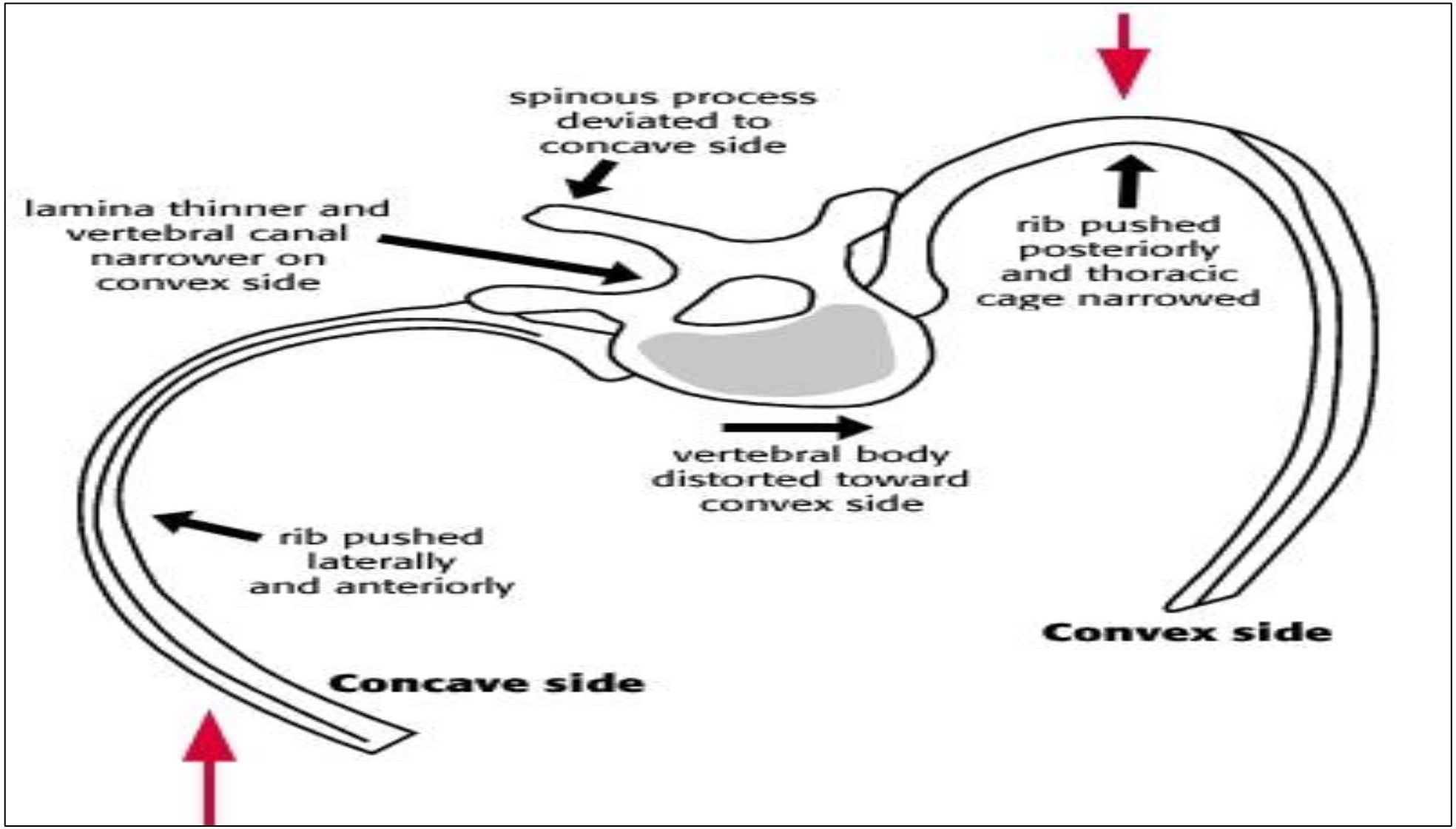
Biomechanical spinal growth modulation
(the 'vicious cycle' pathogenetic hypothesis).

Creating a 3-D Torsion in the Spinal Column:



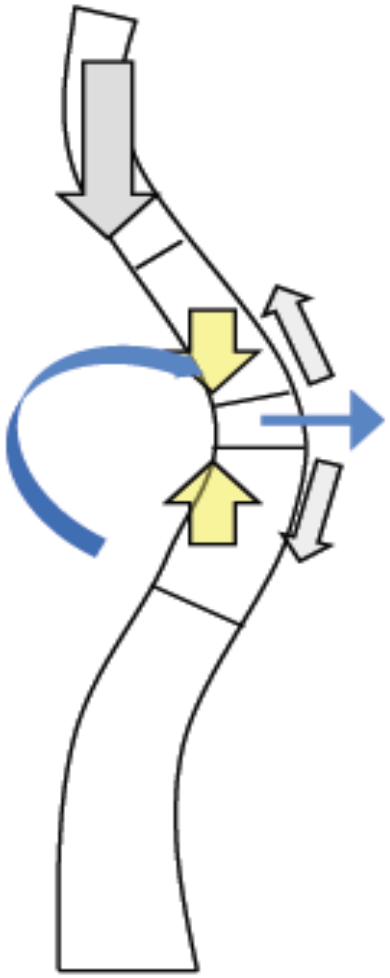






as the vertebral bodies rotate toward the convex side and the spinous processes rotate toward the concave side.

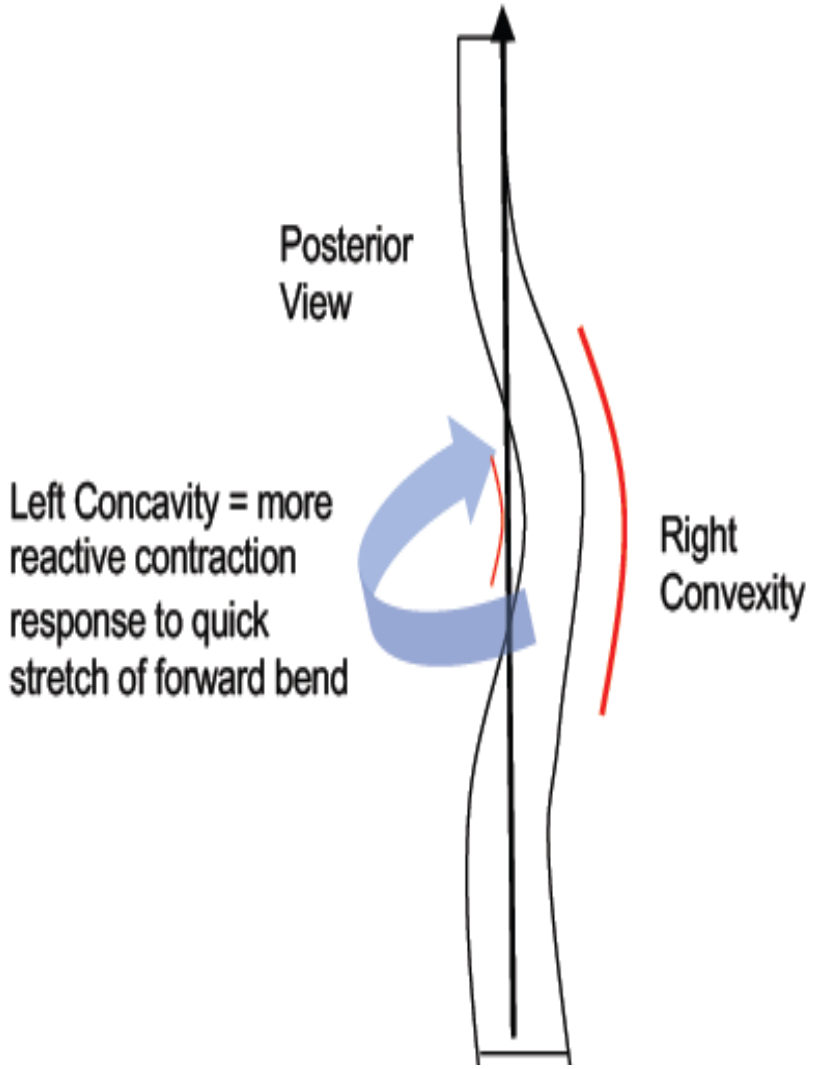
Gravity affects asymmetrical loading which promotes torsion



Forward Bending:

Create reactive contractions are greater on the concavities producing more torsion.

Lonstein and Carlson 1984; Bunnell 1982,1986; Duval-Beaupere 1989,1992,1996



01

Clinical exam

02

Radiological exam

03

Functional scales

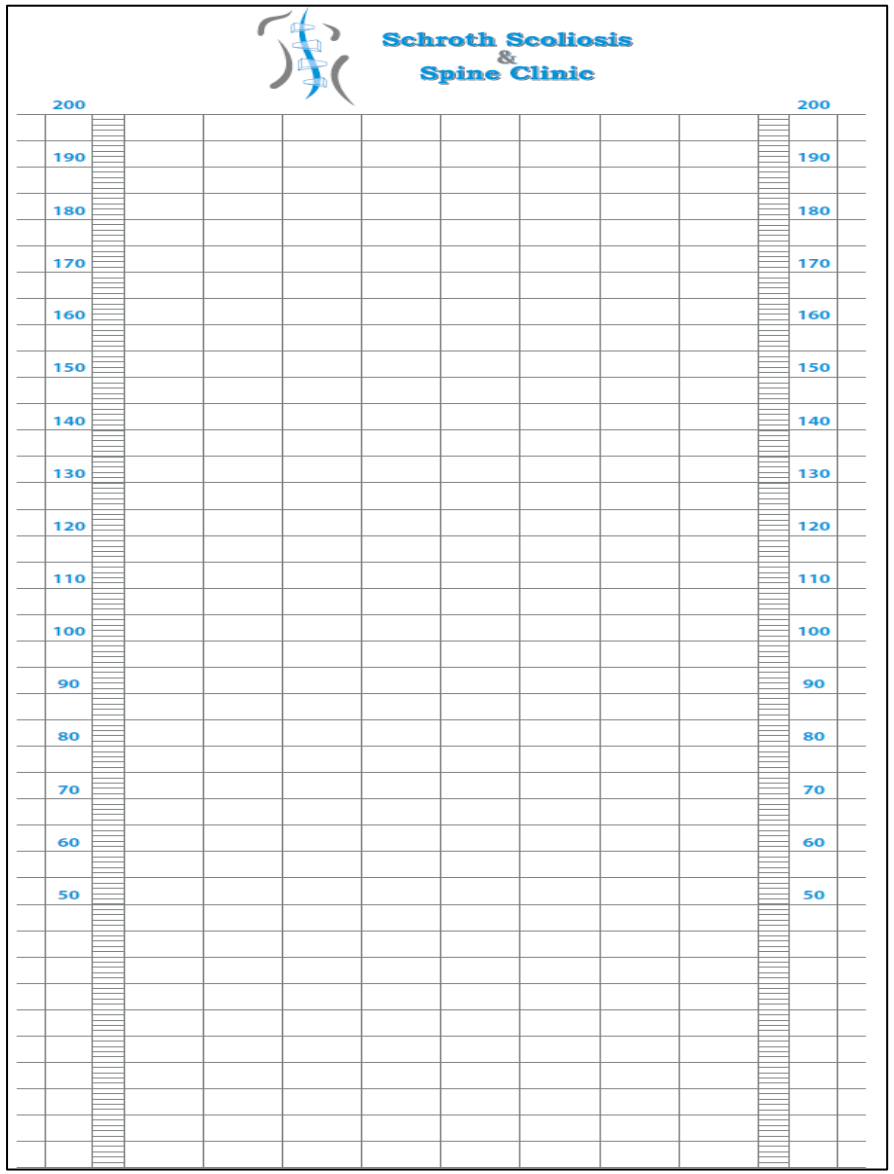


Fig. Adams Forward Bending Test


180
170
160
150
140
130
120
110
100
90
50

What to do if (+) Clinical Screen

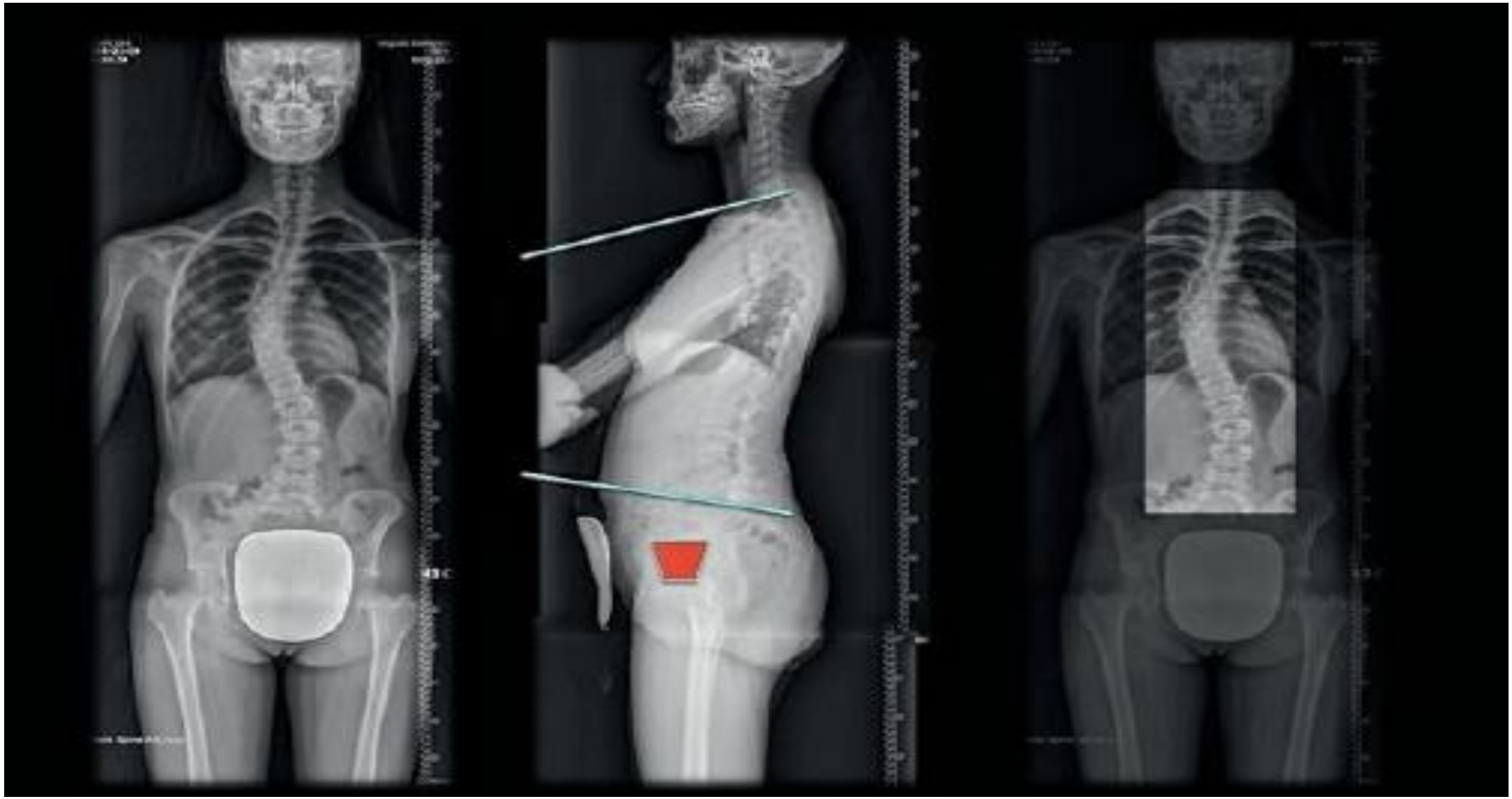
- Diagnosis of scoliosis must be made with a radiograph
- **Refer for x-ray:**
- SRS (Scoliosis Research Society) recommends that a 7 degree ATR warrants x-ray referral
- SOSORT (Society of Scoliosis Orthopedic Rehabilitation and Treatment) recommends that a 5 degree ATR warrants referral

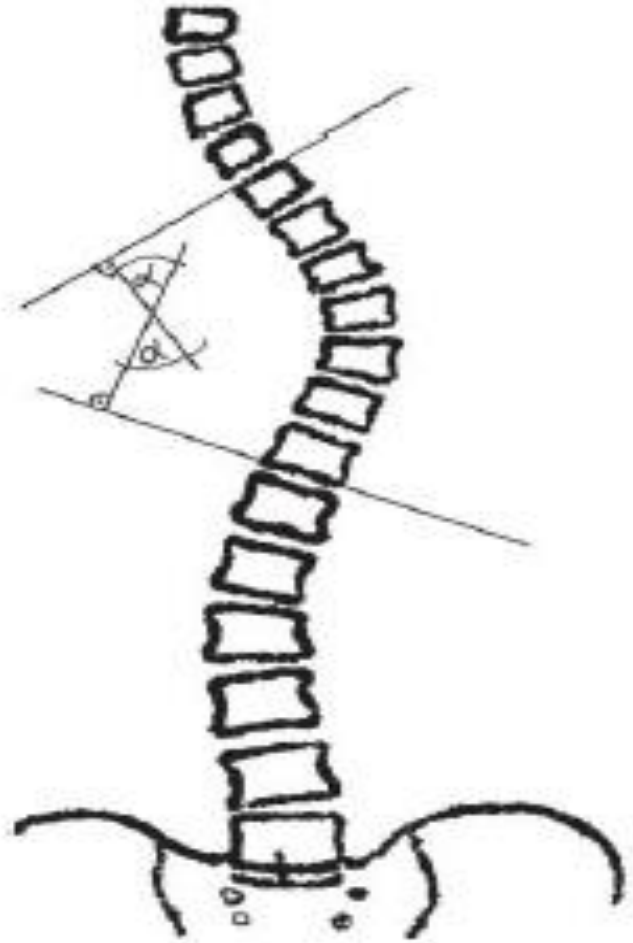
Cobb angle

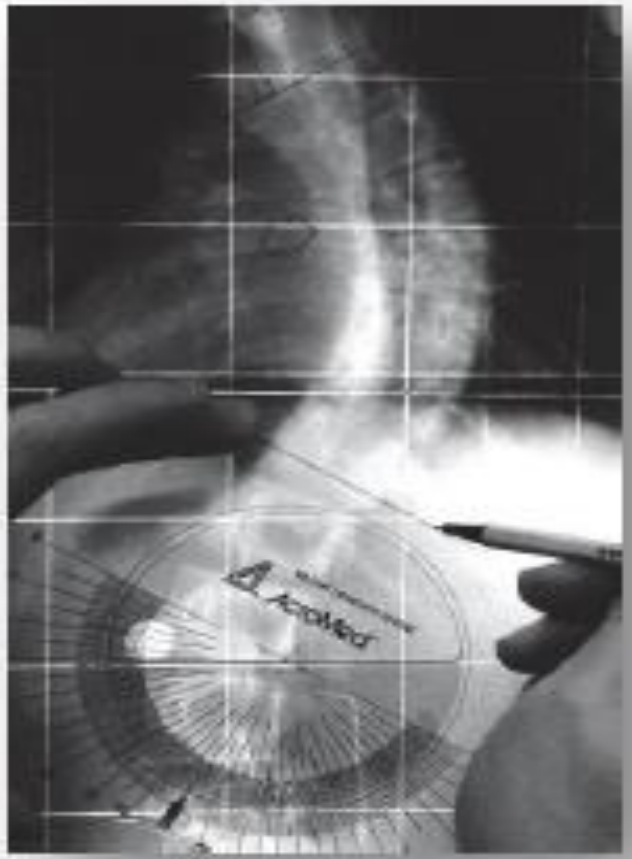
- In order to monitor spinal deformities, the Cobb angle (Cobb 1948) is the predominant method,
- although this only allows the three-dimensional spinal deformation to be measured in two dimensions.
- It is the standard measurement technique used to monitor scoliosis.
- The Cobb angle is the starting point for the treatment plan and is necessary for the creation of a prognosis, particularly with idiopathic scoliosis.

Cobb angle

- **The measurement of this angle is subject to error (Weiss 2000).**
- **During monitoring, differences in the position of the patient in front of the x-ray screen can contribute to inaccuracies in the measurements.**
- **the time of day when the x-ray is taken may play a role. the degree of curvature was 5° greater in the evening than in the morning,**
- **These results demonstrate the relativity of measured values.**
- **For these reasons, changes in the angle of less than 5° from the previous x-ray are considered to be insignificant.**





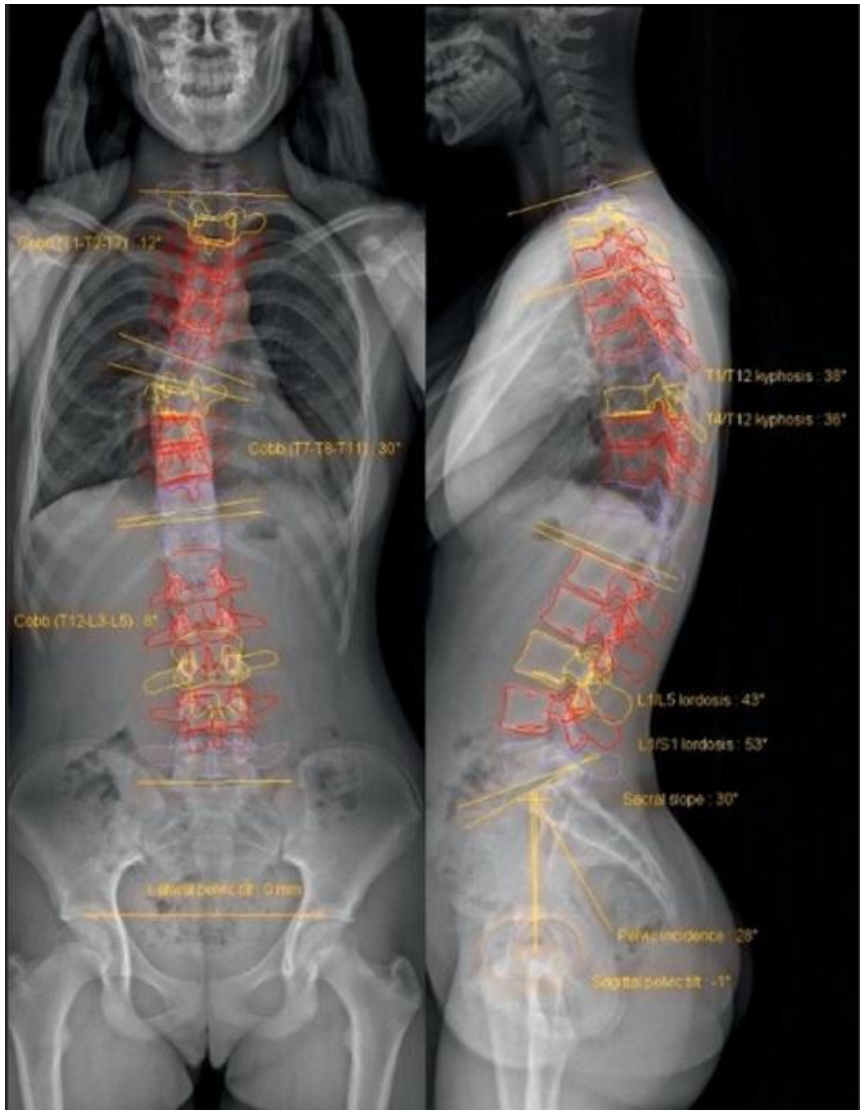

AccuMed

To minimize exposure to radiation, it is recommended:

- Minimize the rate of x ray exposure (3-6 months).
- PA view is prefferred than AP
- x-rays are limited to necessary sections of the spine (ROI, Region of Interest), and
- only take side-view images if information that is crucial for the treatment can be attained (Weiss and Seibel 2013).

The so-called EOS Imaging System enables a radiation-saving three-dimensional reconstruction of the spine and an automatic and thus objective measurement of the curvature angles.

It not only enables semi-automatic evaluation and measurement of the Xray images, but also semi-automatic documentation of the findings



However, the **high cost of this technology EOS Radiation system** has so far prevented widespread use of the system.

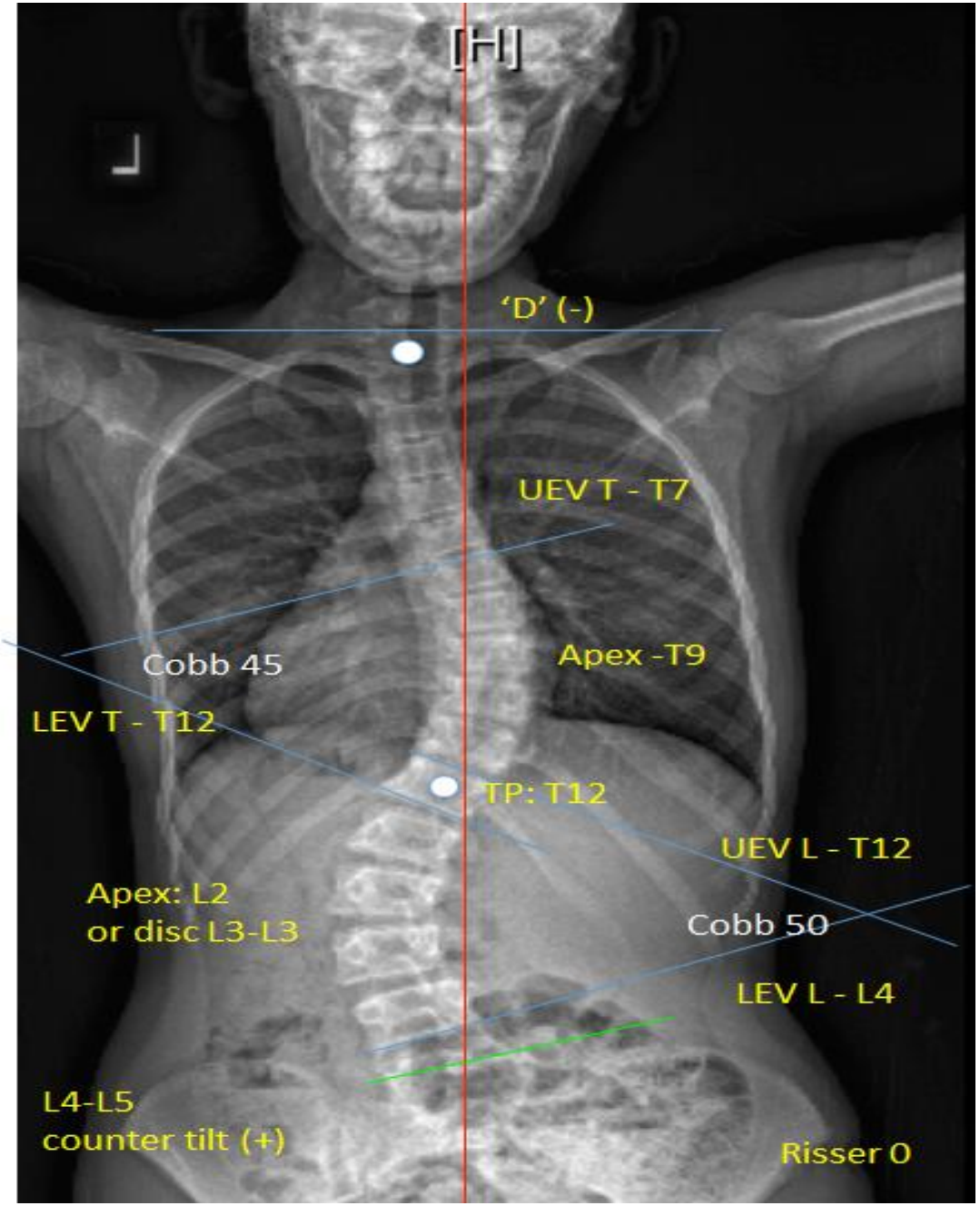
Radiation reduction leads to a 2-fold reduced risk of cancer as a result of radiation exposure. However, girls have a significantly higher risk of exposure than boys (Branchini et al. 2018; Law et al. 2018).

What to order on X- ray

- Standing full spine X-ray (From C1- Trochanters).
- PA, Lateral view (if needed).
- Report on cobb angle (frontal and sagittal plane).
- Report on risser score.
- Report on any other spinal anomalies.

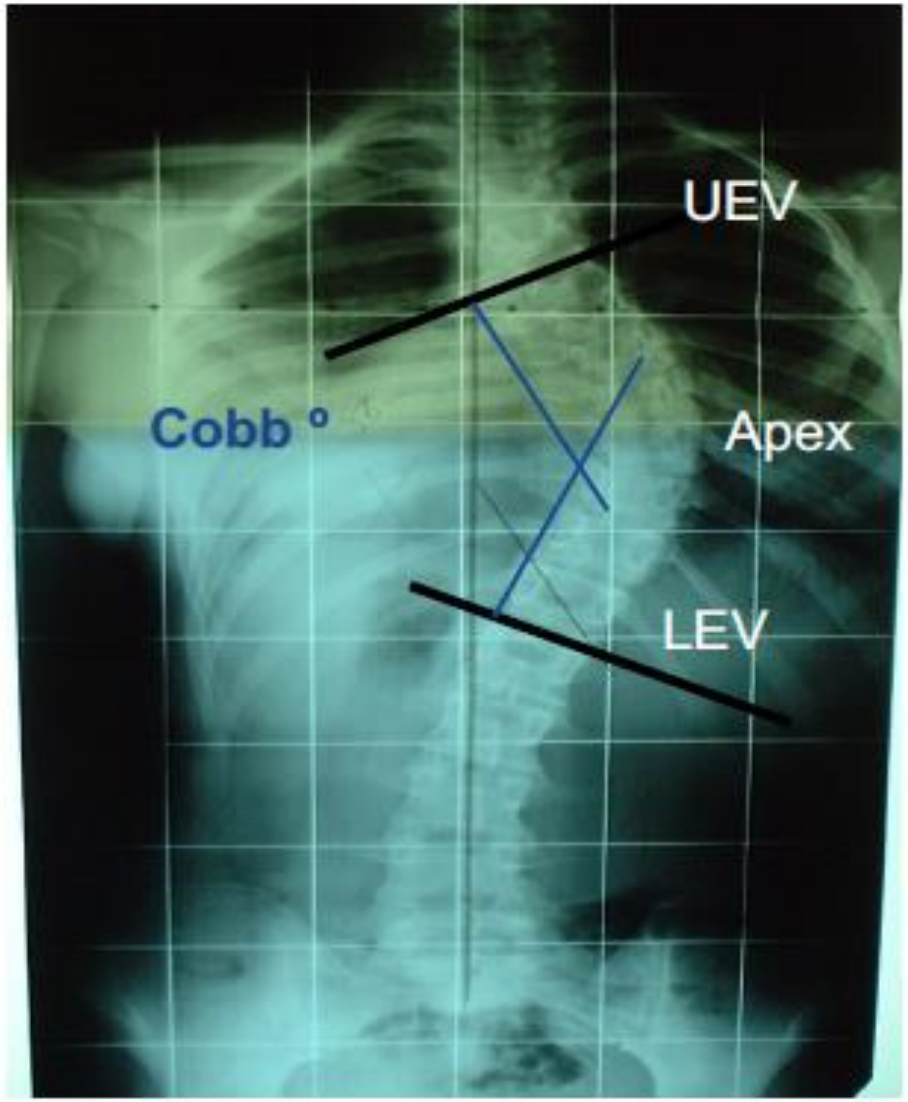
Radiological criteria for scoliosis

- Cobb angle > 10 degrees
- Vertebral body deformity
- Axial rotation

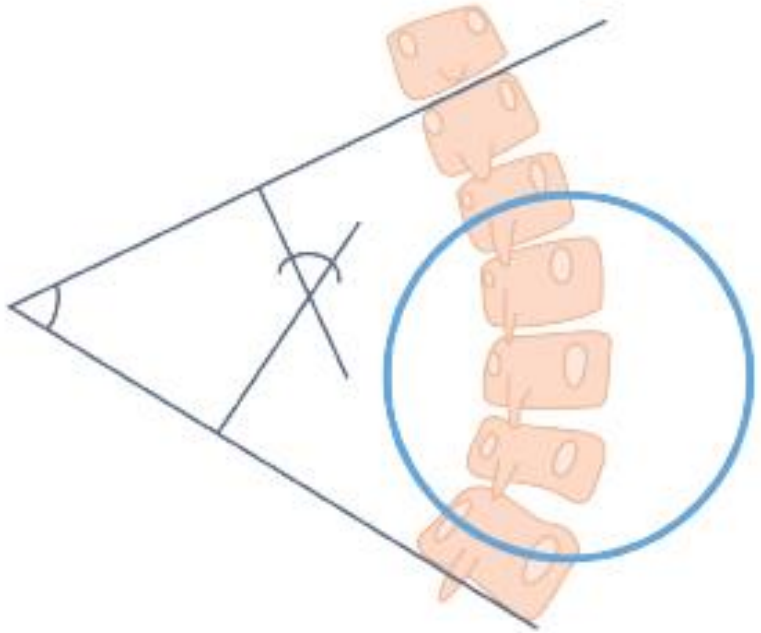

[H]
'D' (-)
UEV T - T7
Cobb 45
Apex -T9
LEV T - T12
TP: T12
UEV L - T12
Apex: L2
or disc L3-L3
Cobb 50
LEV L - L4
L4-L5
counter tilt (+)
Risser 0

To measure Cobb Angle

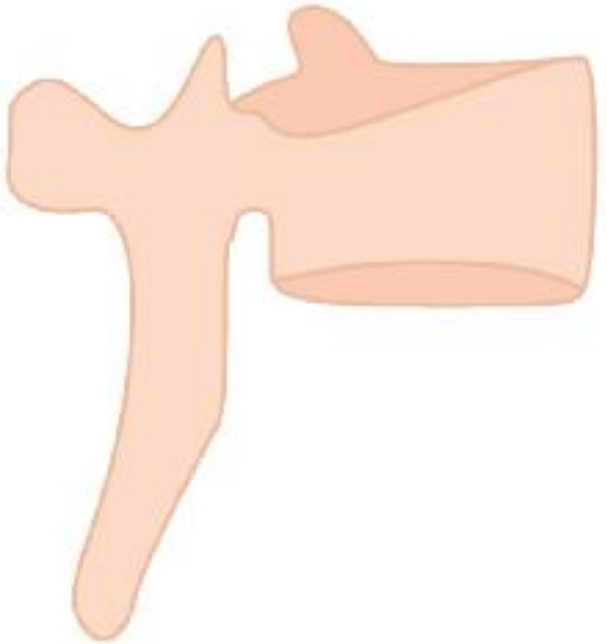
1. Find the Apex (most lateral vertebra)
2. Identify most tilted vertebra for each curve
3. Draw parallel to top of UEV and bottom of LEV
4. Draw perpendicular to those
5. Measure angle where perpendicular lines bisect



Cobb angle
over 10 degrees

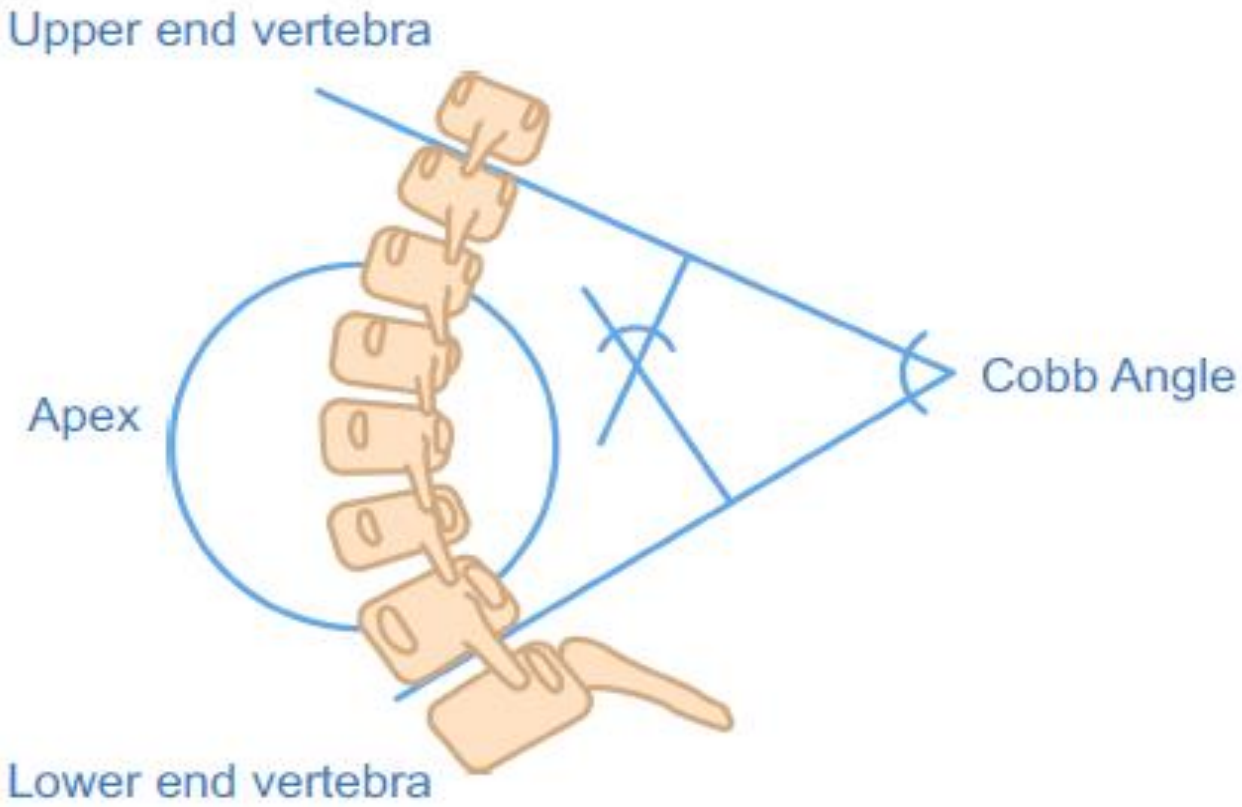


Axial rotation



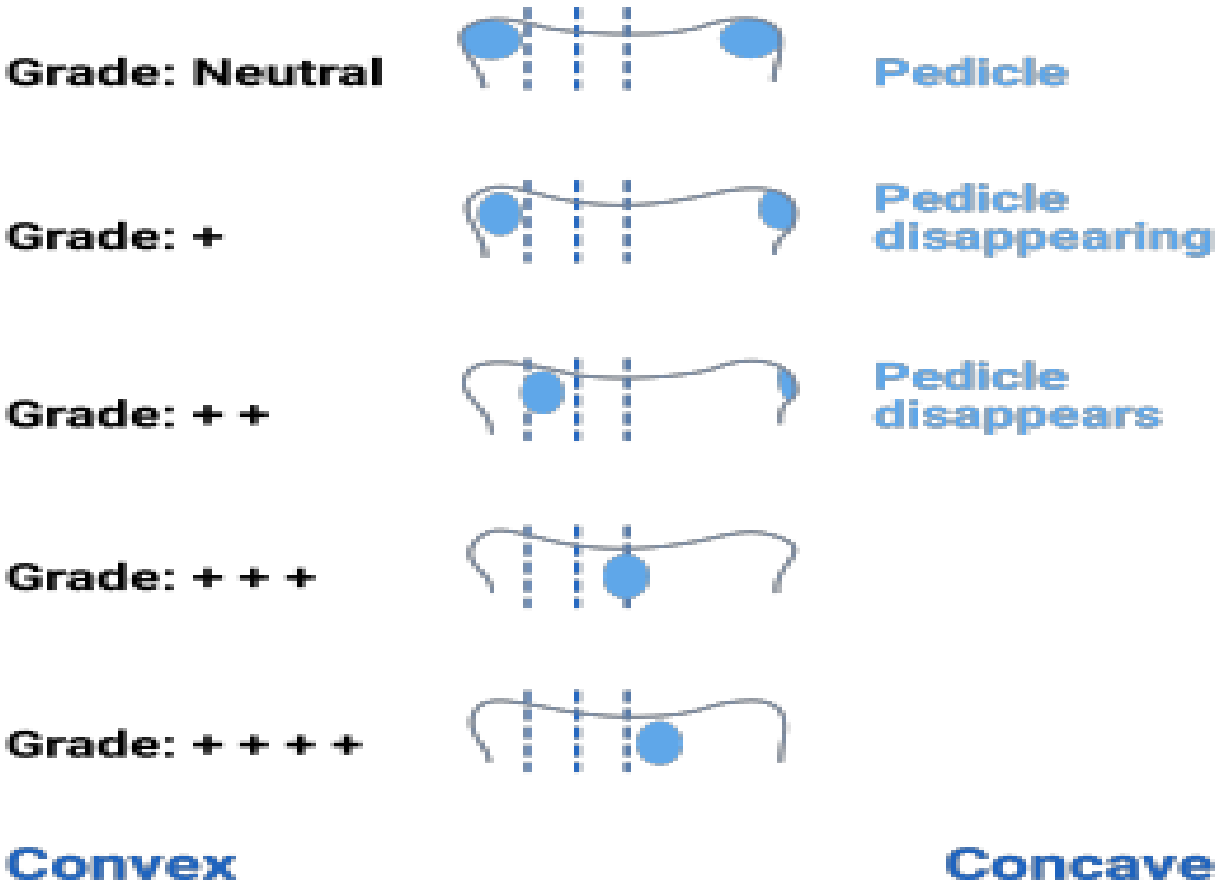
Vertebral body
deformity

There is vertebral rotation in scoliosis that occurs toward the direction of the convexity, creating an asymmetry in the vertebral pedicles when observed in the PA x-ray

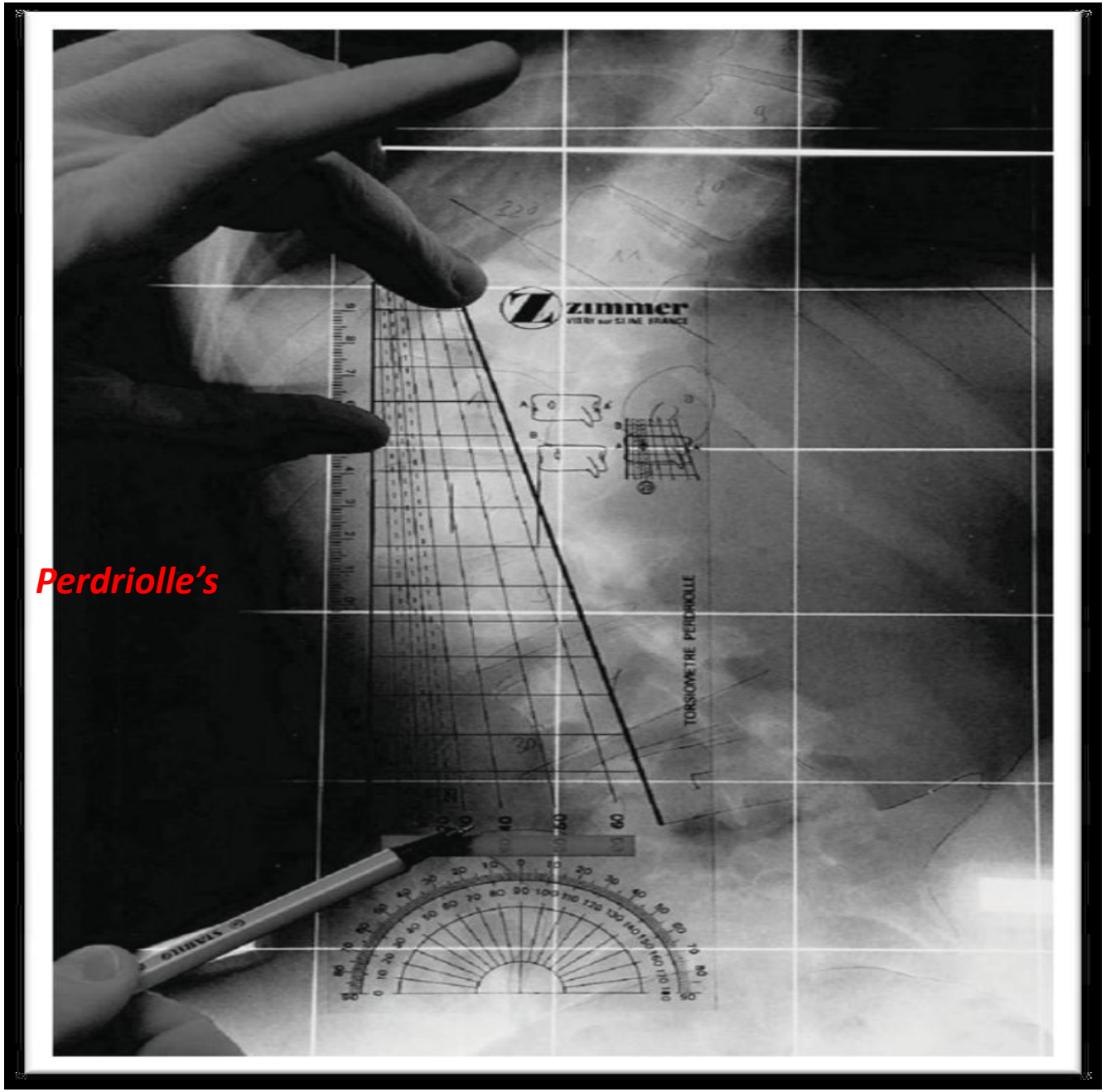


Left convex lumbar scoliosis with left vertebral rotation

- Rotation severity can be graded using Nash Moe or other methods by looking at the most rotated vertebra (the apex)



Investigation of the vertebral rotation using Perdriolle's measurement technique. The waists of the vertebrae marked with a vertical stripe are aligned with the thick black lateral limitation lines from the ruler; the pedicle marking in this image is relatively central which shows a rotation of 40° to be interpreted off the scale.



Perdriolle measurement, also known as Perdriolle's method or Perdriolle's angle, is used to assess vertebral rotation in cases of spinal deformities, particularly scoliosis. The method was developed by Dr. **Roger Perdriolle,** a French orthopedic surgeon.

In Perdriolle measurement, the rotation of the vertebrae is evaluated **based on the position of the pedicles.**

The technique involves taking a standing anteroposterior X-ray of the spine. To perform the Perdriolle measurement, the X-ray image is examined to identify the vertebrae that are most rotated in the scoliotic curve. The pedicles of these vertebrae are then traced on the X-ray image. Lines are drawn along the posterior borders of the pedicles, and the angle between these lines is measured. **This angle represents the degree of vertebral rotation.**

Perdriolle method allows for a quantitative assessment of vertebral rotation in scoliosis.

It is commonly used by orthopedic surgeons and radiologists to evaluate the severity of spinal deformities and to monitor changes in rotation over time.

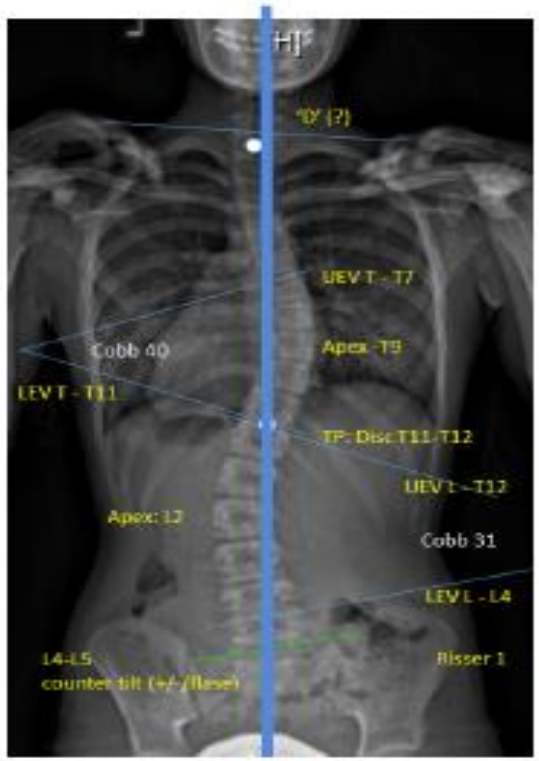
The information obtained from Perdriolle measurement can help guide treatment decisions, such as:

- **determining the need for surgical intervention or**
- **monitoring the effectiveness of conservative therapies.**

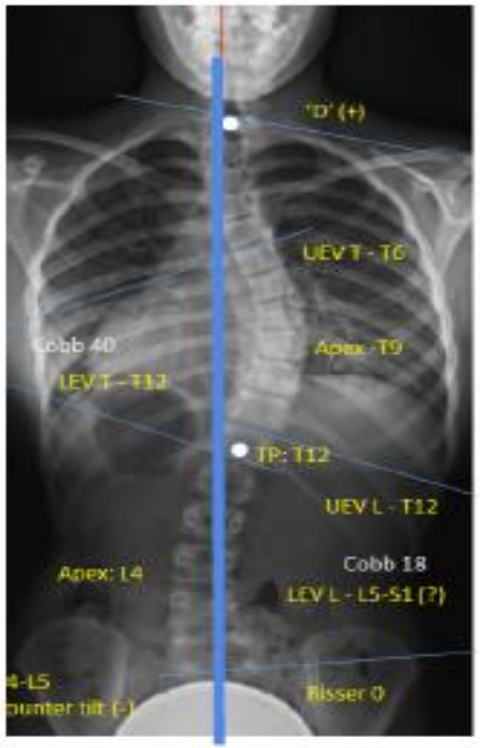
Central Sacral Line

Vertical line from center of sacrum upward used to determine balanced or imbalanced curve related to **transition point** of the curve

Curve imbalanced left



Curve balanced

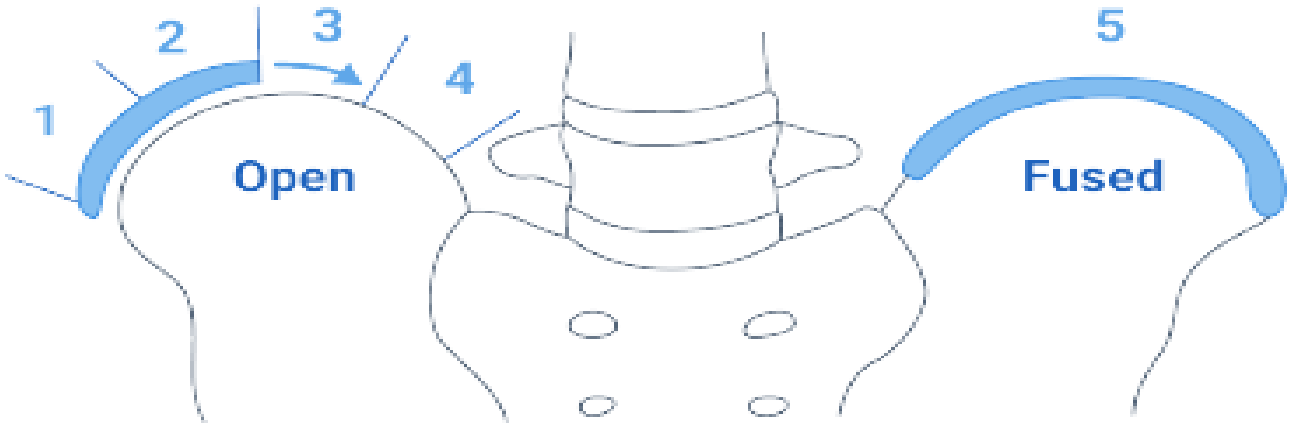


Curve imbalanced right

Transition point: point where curve changes direction

Risser Score is used in predicting skeletal maturity and remaining growth, which is important in treatment planning for scoliosis

- Risser score: measures Iliac crest growth plate seen in PA X-ray
- Graded 0 to 5 on American Risser Scale
  - 0 = open growth plate
  - 5 = fully fused



When monitoring a prognosis and planning for the treatment of scoliosis, the assessment of osseous maturity is essential.

A spinal deformation of 25° in an eleven-year-old patient with only the first signs of maturity is to be taken very seriously.

Girls who have not yet begun menstruation and boys whose voices are not yet broken usually have a Risser of 0, meaning the apex of the main growth spurt of puberty is still to come.

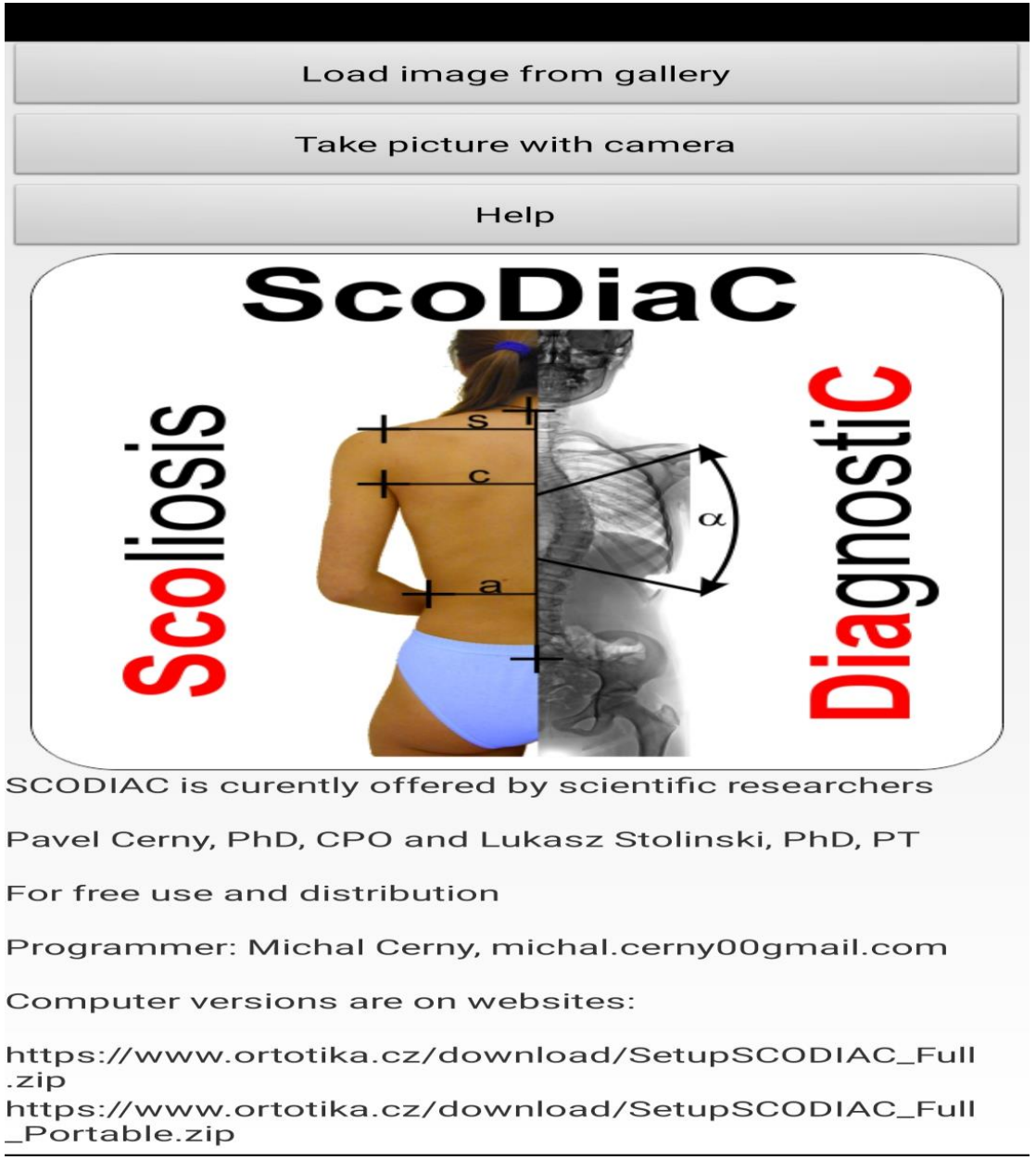
• For a patient with scoliosis, spinal radiographs should be scheduled at the following intervals

– For patients 0 to 5 years of age with early onset scoliosis: every 6 months
– For patients 6 to 12 years of age with juvenile scoliosis: every 6 months
– For patients 13 to 18 years with AIS, Risser Stage 0 -1: every 12 months
– For patients 13 to 18 years with AIS, Risser Stage 2 -3: every 12 months
– For patients 13 to 18 years with AIS, Risser Stage 4 to 5: every 18 months
– For patients 19 to 30 years with AIS, Post-growth surveillance: every 24 months

• A change in scoliometer reading and/or a change in appearance of trunk asymmetry should be the objective observations that trigger a scoliosis patient to receive a new radiograph

Scoliosis Classification according to apex

- Thoracic: T2-T11 (Disc T11-12)
- Proximal Thoracic: T3-4-5
- Main Th = T8; High Th: T6-7
- Low Th T9-11 (Rigo)
- Thoracolumbar: T12-L1
- Lumbar: L2-L4 (Disc L1-2)
- Lumbosacral: L5-S1 (Disc L4-5)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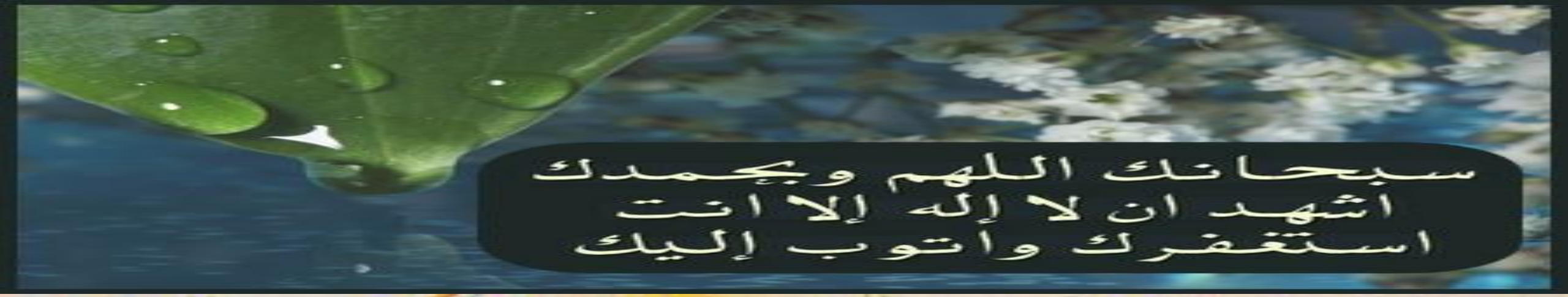
Radiological Leg Length Method


سبحانك اللهم وبحمدك
اشهد ان لا إله إلا انت
استغفرك واتوب إليك

Thank
You