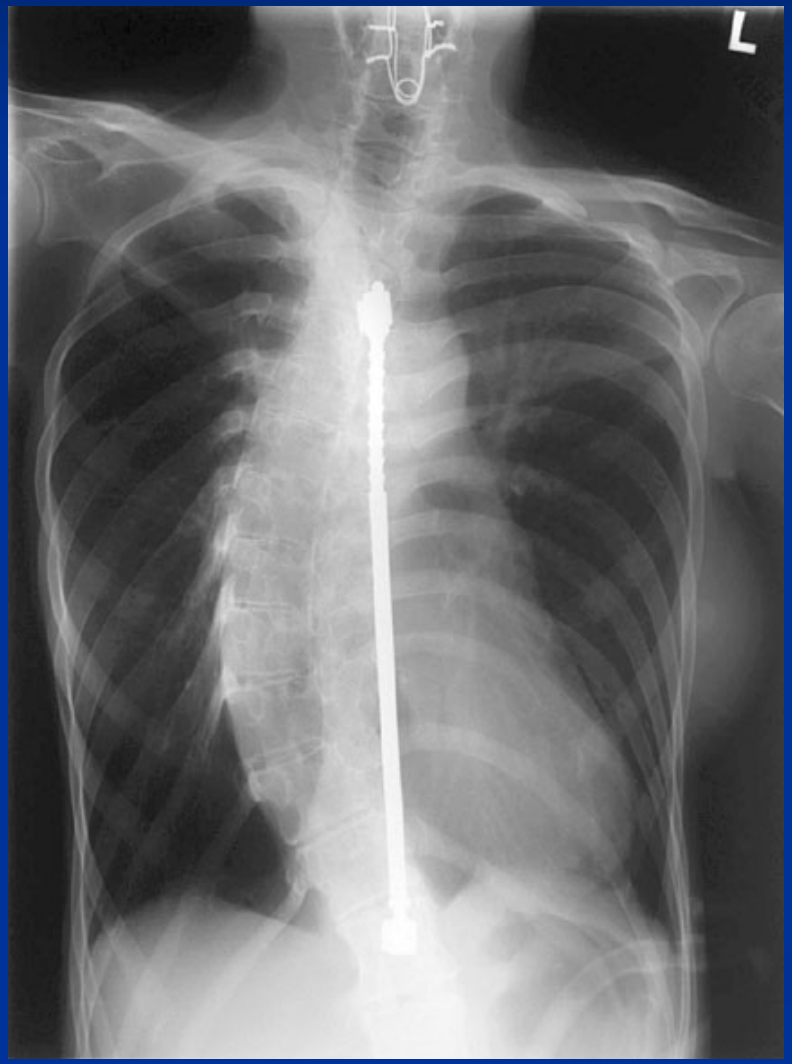
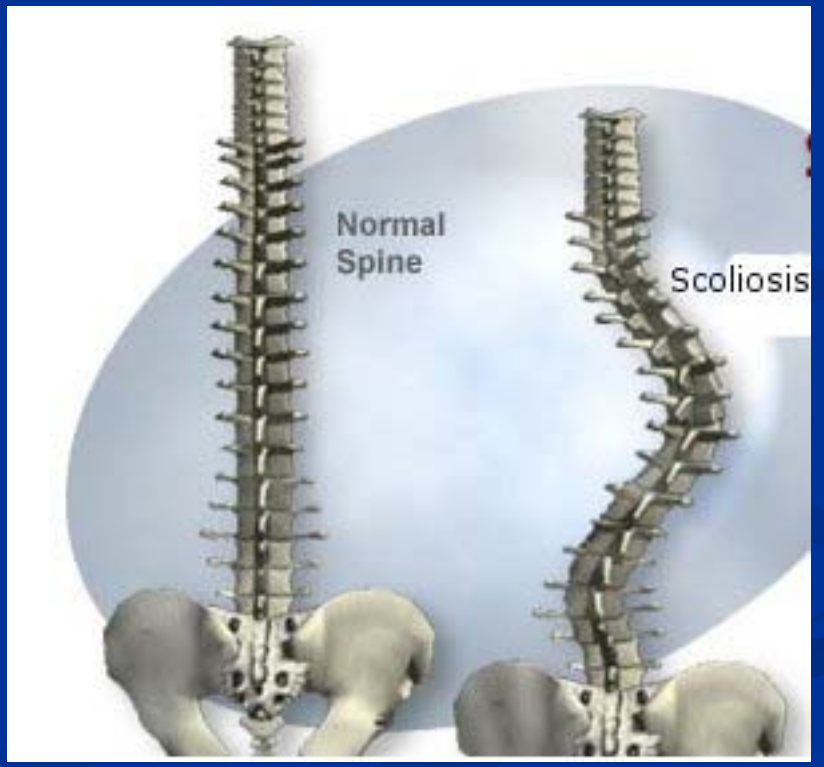
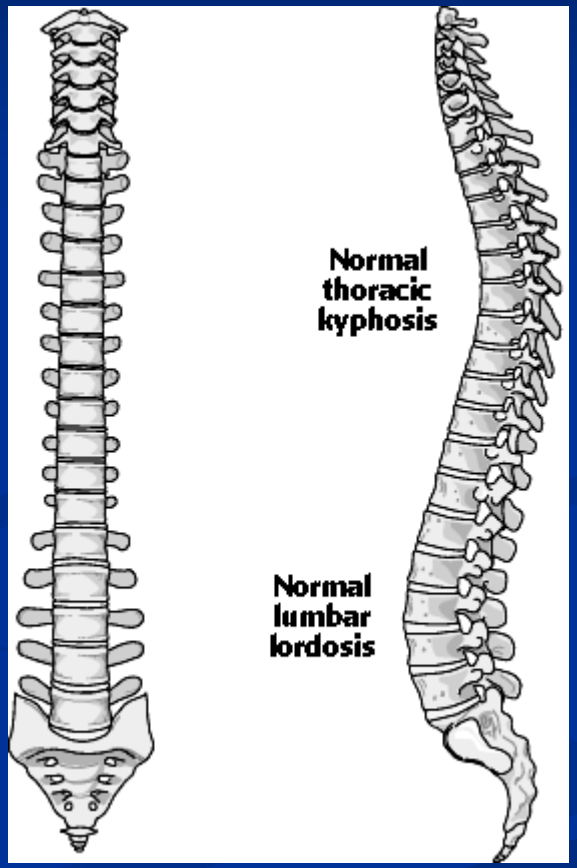
Scoliosis

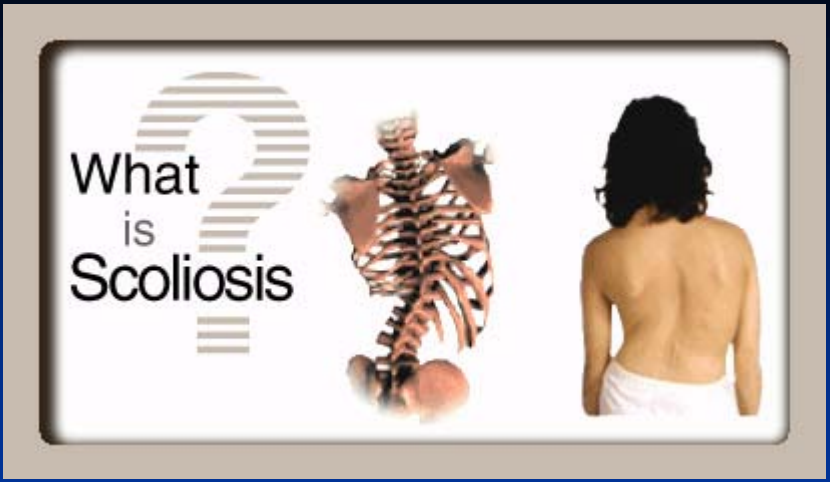




The normal spine

The normal thoracolumbar spine is relatively straight in the sagittal plane and has a double curve in the coronal plane. As shown below, the thoracic spine in convex posteriorly (kyphosis) and the lumbar spine is convex anteriorly (lordosis). Normally there should be no lateral curvature of the spine.

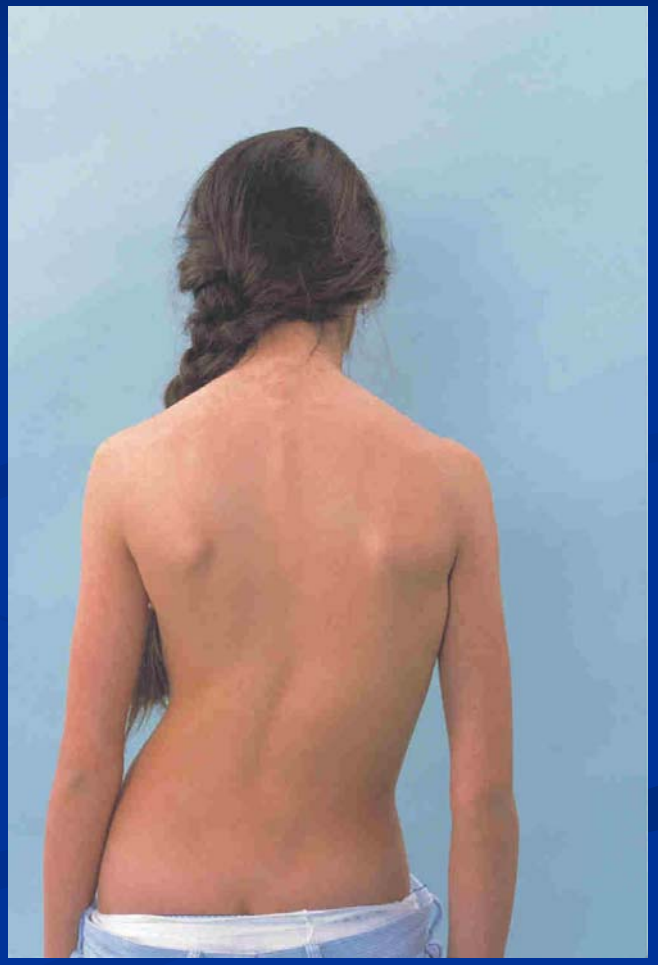




A scoliosis is a lateral or sideways curve in the spine that is apparent when viewing the spine from behind. A mild degree of scoliosis is common, occurring in up to 50 per cent of the population. Scoliosis generally does not require any specific treatment. However, severe scoliosis does indeed need treatment. Scoliosis occurs mainly in the thoracic and thoraco-lumbar regions. There are two basic types of scoliosis, structural and functional.

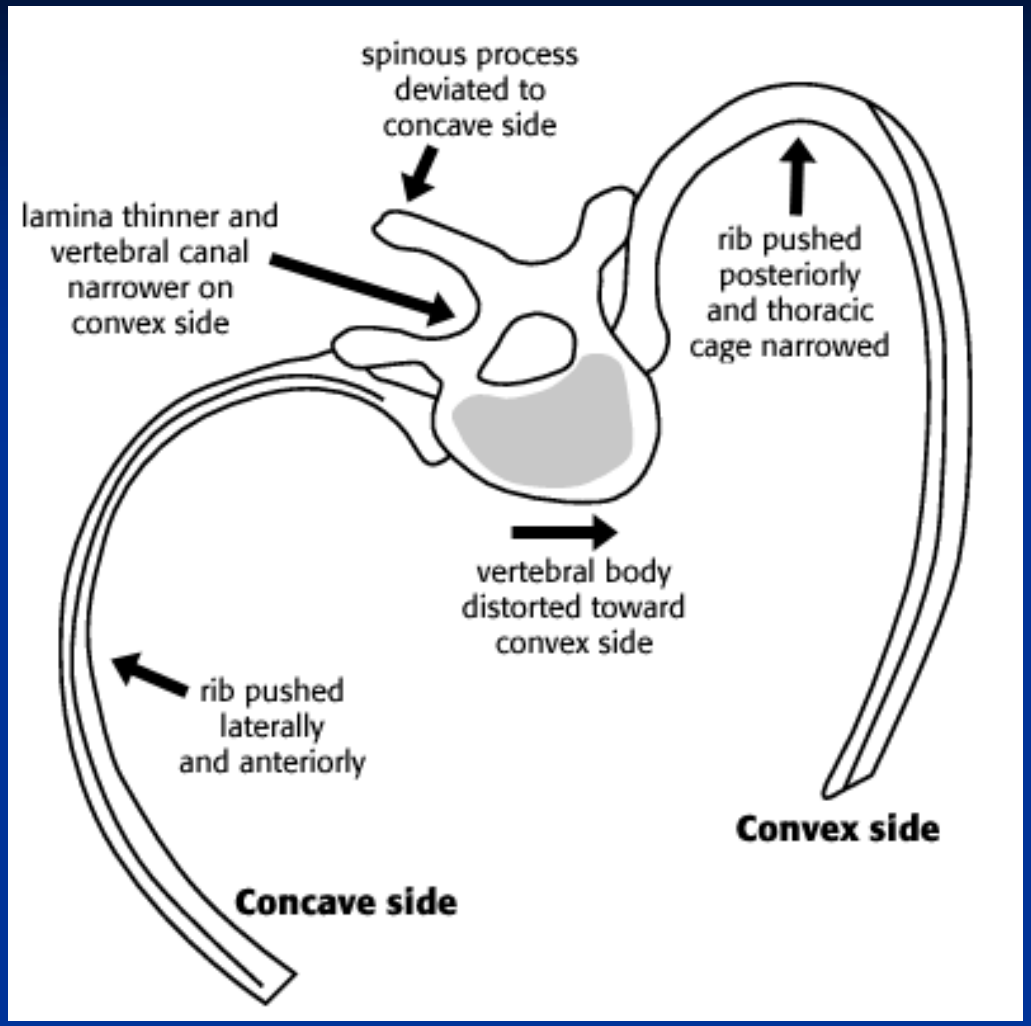
Scoliosis

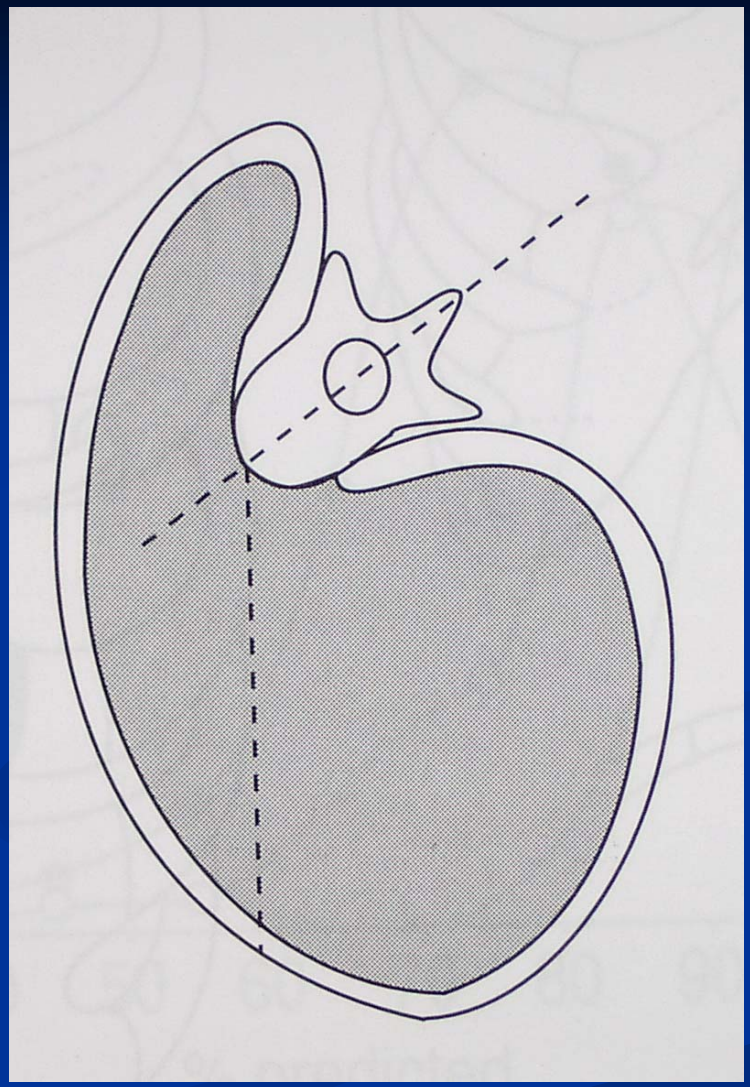
Scoliosis is a complicated deformity that is characterized by both lateral curvature and vertebral rotation. As the disease progresses, the vertebrae and spinous processes in the area of the major curve rotate toward the concavity of the curve. On the concave side of the curve, the ribs are close together. On the convex side, they are widely separated.



Scoliosis

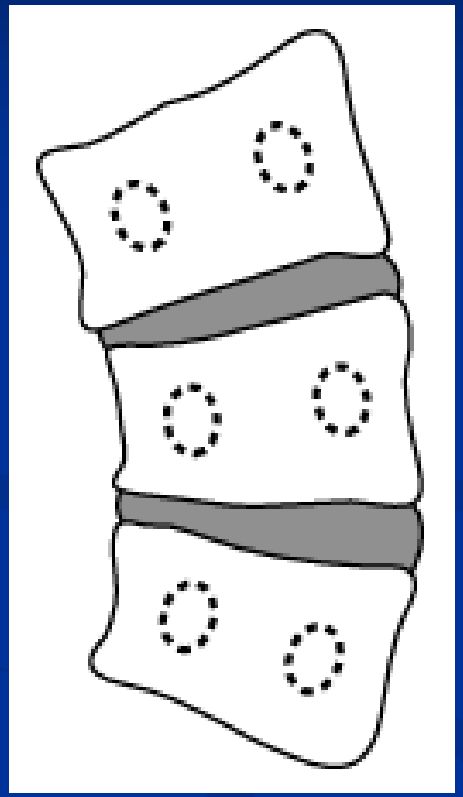
As the vertebral bodies rotate, the spinous processes deviate more and more to the concave side and the ribs follow the rotation of the vertebrae. The posterior ribs on the convex side are pushed posteriorly, causing the characteristic rib hump seen in thoracic scoliosis. The anterior ribs on the concave side are pushed anteriorly.





Typical distortion of vertebra and ribs in thoracic scoliosis

- Scoliosis also causes pathologic changes in the vertebral bodies and intervertebral discs.
- The vertebrae and intervertebral discs are decreased in height on the concave side.



Classification of scoliosis

- **Nonstructural scoliosis**

  postural scoliosis

  compensatory scoliosis

- **Transient structural scoliosis**

  sciatic scoliosis

  hysterical scoliosis

  inflammatory scoliosis

Classification of scoliosis

- Structural scoliosis
- idiopathic (70 - 80 % of all cases)
- congenital
- neuromuscular
  - poliomyelitis
  - cerebral palsy
  - syringomyelia
  - muscular dystrophy
  - amyotonia congenita
  - Friedreich's ataxia

Classification of scoliosis

- neurofibromatosis
- mesenchymal disorders
  - Marfan's syndrome
  - Morquio's syndrome
  - rheumatoid arthritis
  - osteogenesis imperfecta
  - certain dwarves
- trauma
  - fractures
  - irradiation
  - surgery

Idiopathic scoliosis

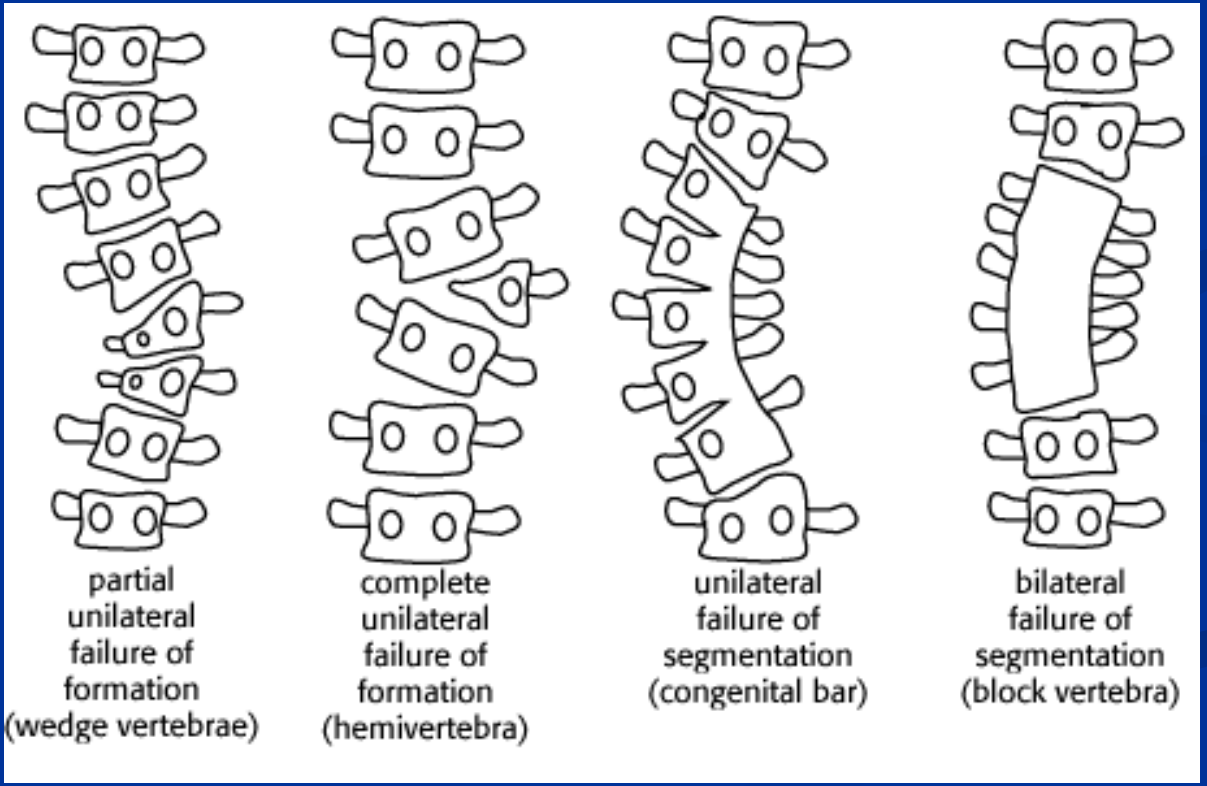
Idiopathic scoliosis accounts for about 80 % of all cases of the disorder, and has a strong female predilection (7:1).

It can be subclassified into infantile, juvenile and adolescent types, depending upon the age of onset.

The most common of these is adolescent scoliosis, which by itself is by far the most common type of idiopathic scoliosis.

Congenital scoliosis

Scoliosis can result from congenital vertebral anomalies. Discovery of these anomalies should prompt a workup for other associated cardiac, genitourinary or vertebral anomalies.



Scoliosis – age at the onset

- Infantile – less than 3 years
- Juvenile – between 4 and 10 years
- Adolescent – more than 11 years

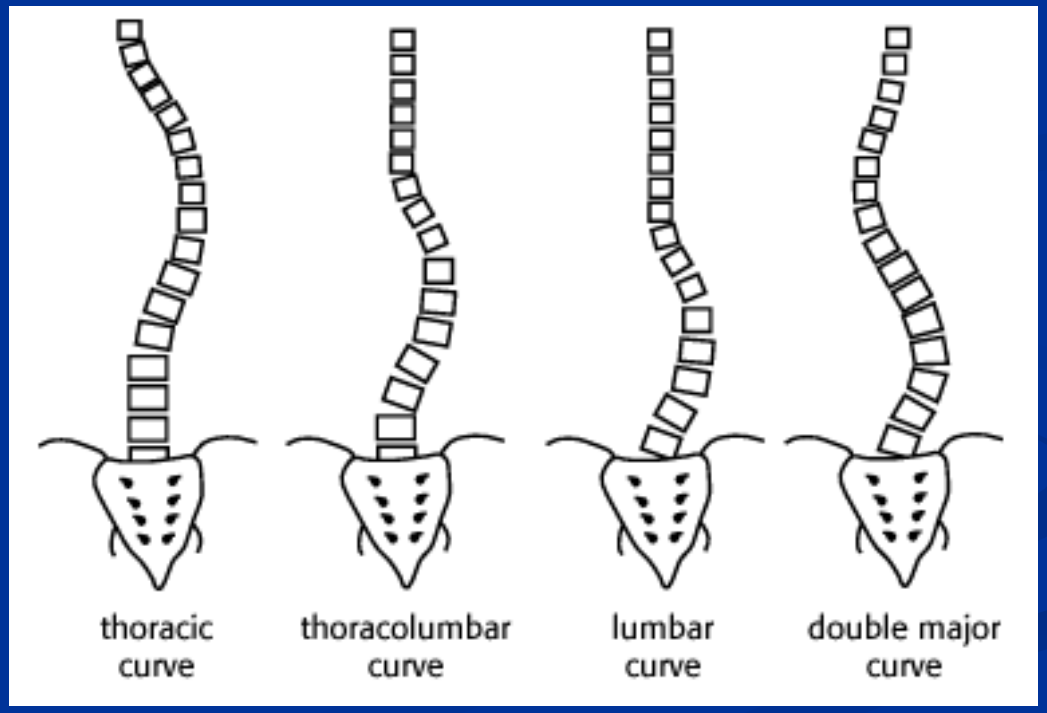
Radiographic assessment of the scoliosis patient

The radiographic assessment of the scoliosis patient begins with *erect* anteroposterior and lateral views of the entire spine (occiput to sacrum). In addition, the examination should include a lateral view of the lumbar spine to look for the presence of spondylolysis or spondylolisthesis (prevalence in the general population is about 5 %).

The scoliotic curve is then measured from the AP view. The most commonly used method is the Cobb method. The Cobb method has several advantages over other methods, including the fact that it is more likely to be consistent even when the patient is measured by several different examiners. An alternative system, known as the Risser-Ferguson method, is used far less commonly.

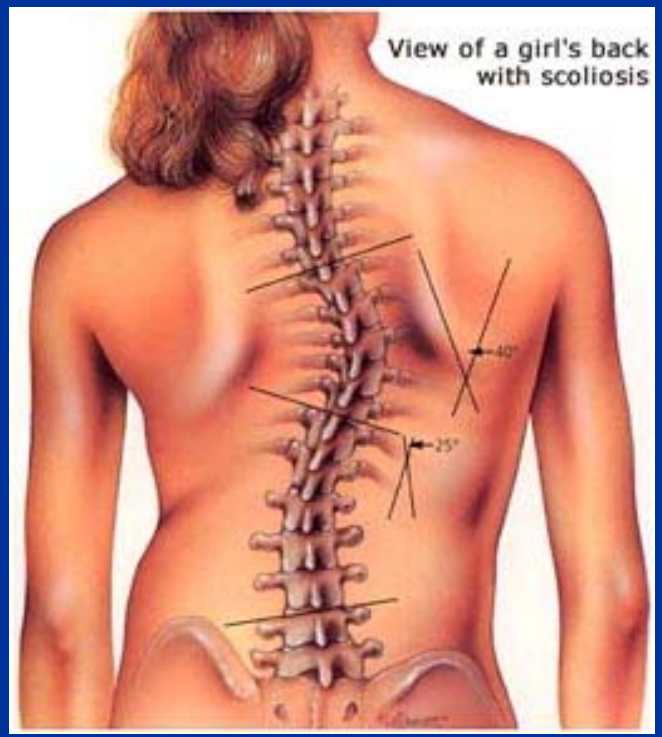
Patterns of scoliosis

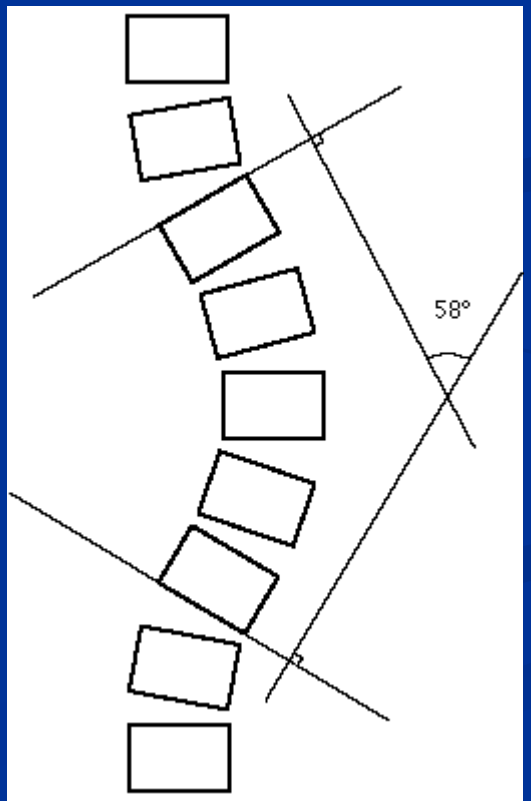
The curvature may be acute, such as seen with a fracture or hemivertebra. More often, it is smooth and arcuate. The presence of any vertebral or rib anomalies should be reported. Scoliosis is generally described as to the location of the curve or curves.



The Cobb method

To use the Cobb method, one must first decide which vertebrae are the *end-vertebrae* of the curve. These end-vertebrae are the vertebrae at the upper and lower limits of the curve which tilt most severely toward the concavity of the curve. Then draws a line along the upper endplate of the upper body and along the lower endplate of the lower body as shown below.

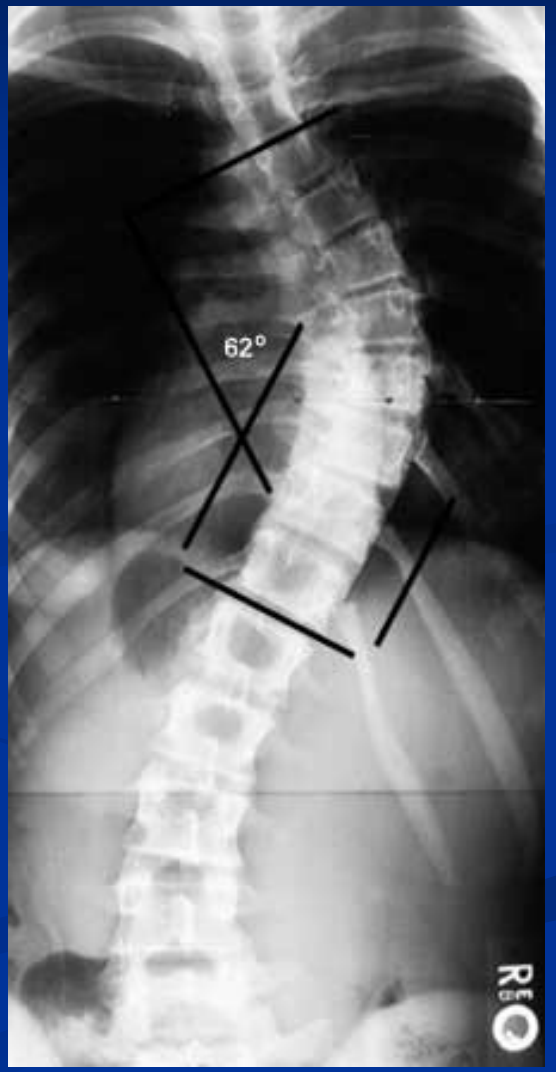




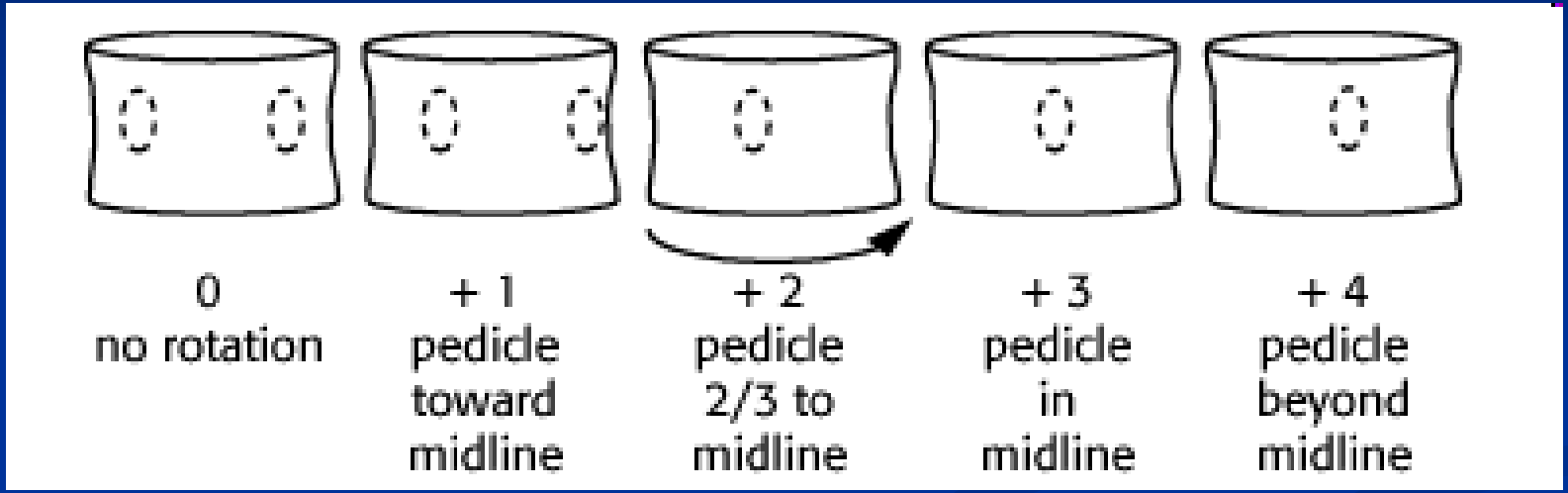
The angle of interest is simply the angle between these two lines.

The Cobb method

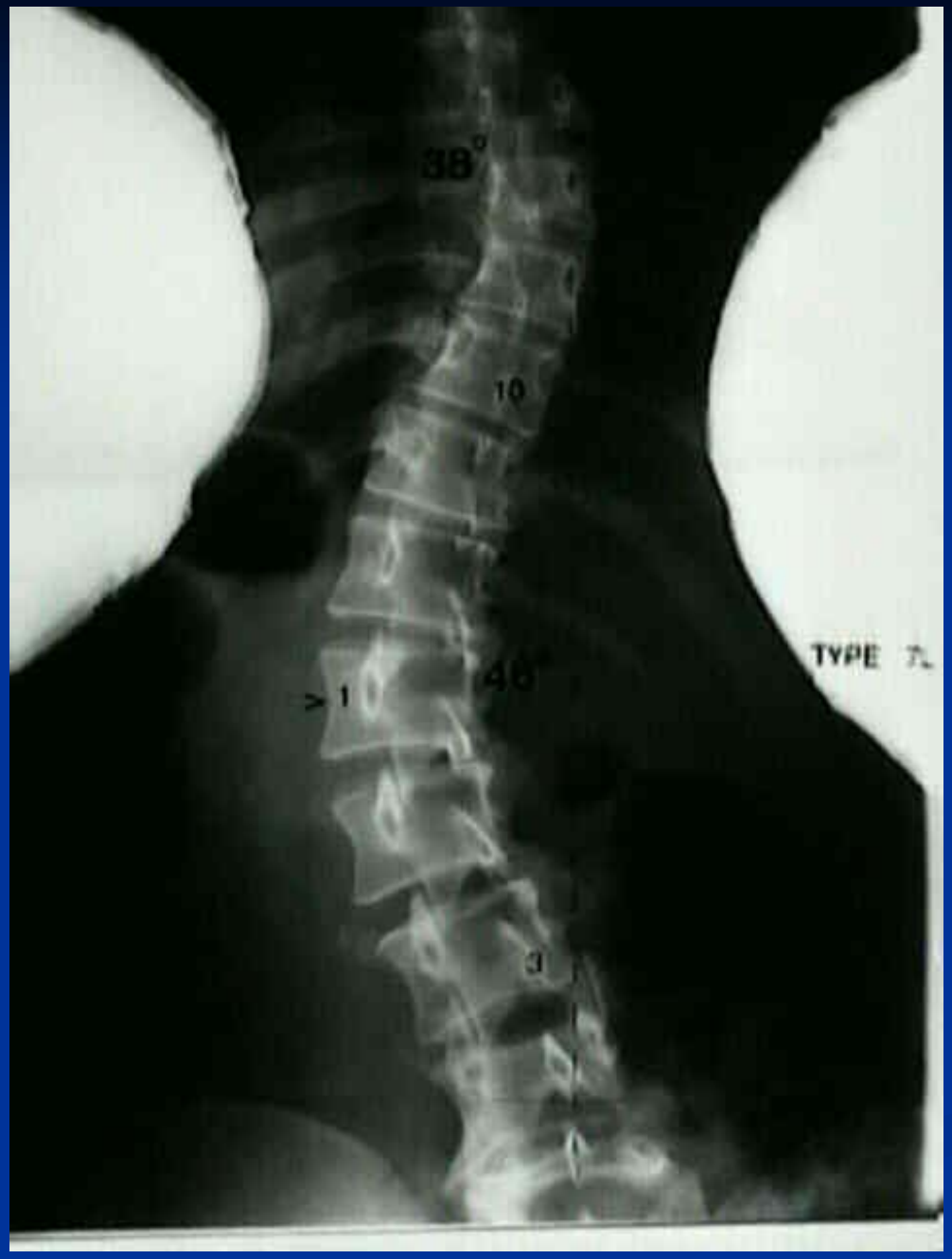
When reporting the result of measurement, it is important to mention that one is using the Cobb method and also which end vertebrae were chosen for the measurement. This latter data is especially important, since once chosen, the same levels should be used from then on to measure curvature on follow-up films. This information should be in the radiographic report, since it becomes part of the patient's chart and therefore lasts far longer than the radiographs, which are often recycled after 5 years or so.



Measurement of rotational component of scoliosis



Estimation the degree of rotation of the vertebra at the apex of the curve by looking at the relation of the pedicles to midline.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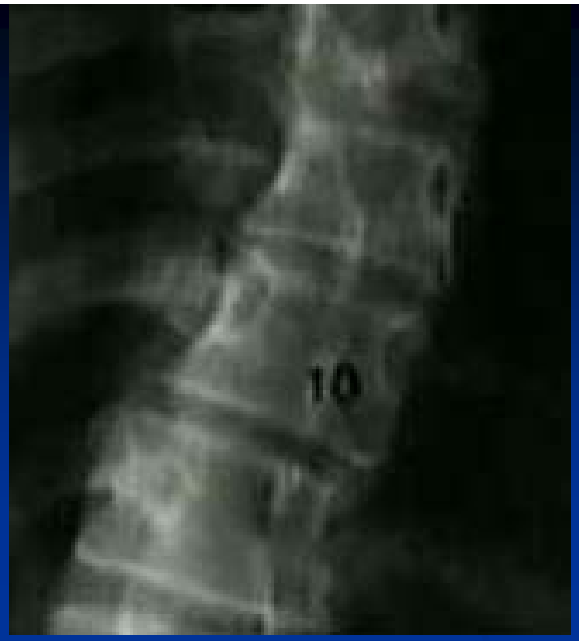
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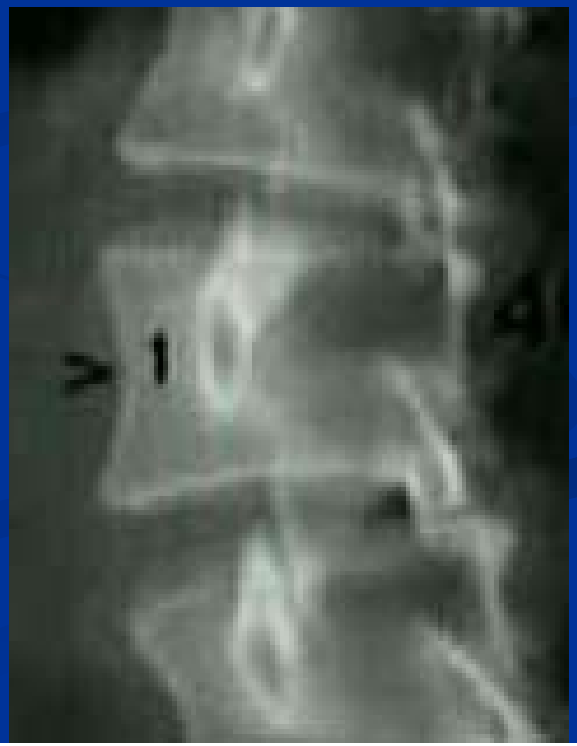
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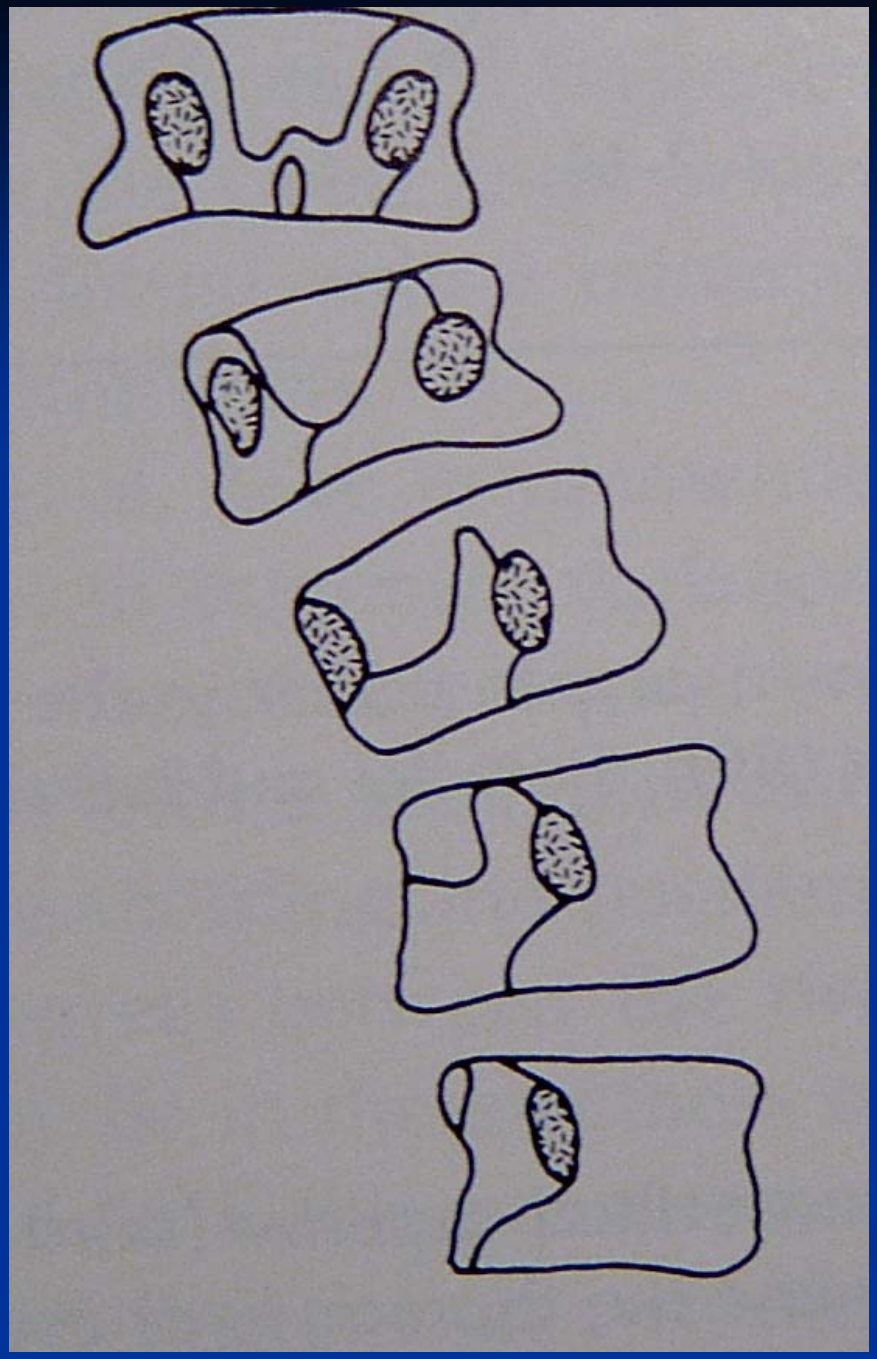

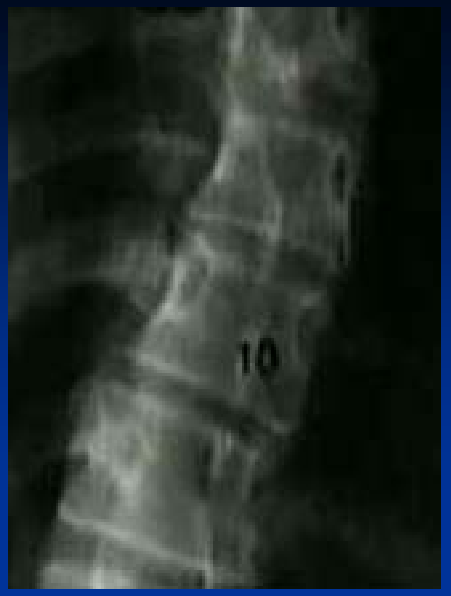
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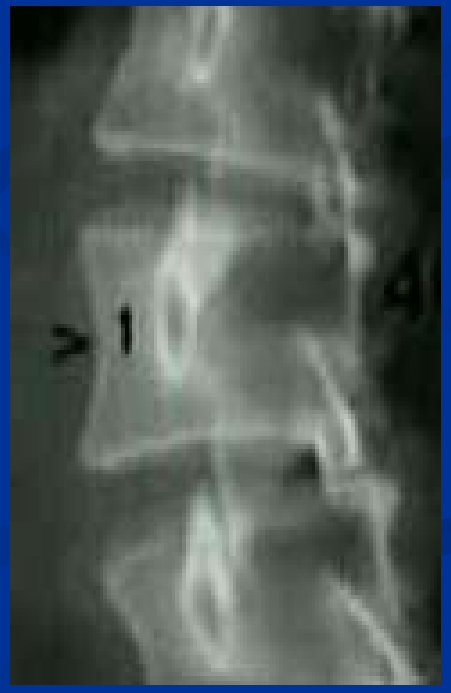
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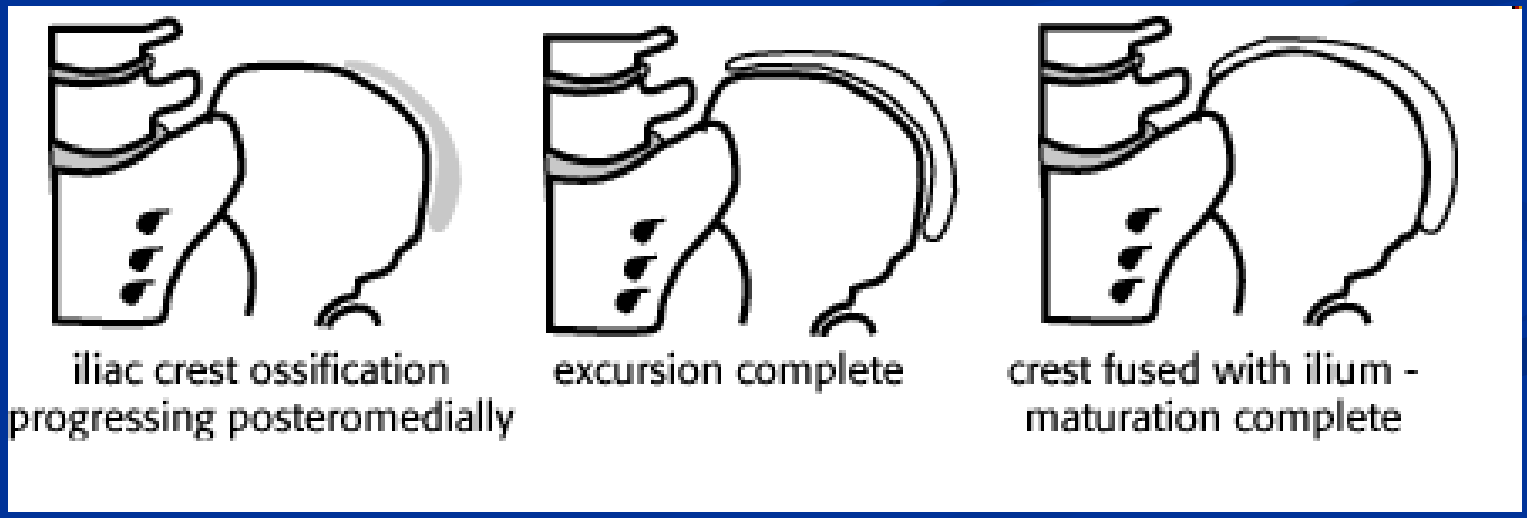
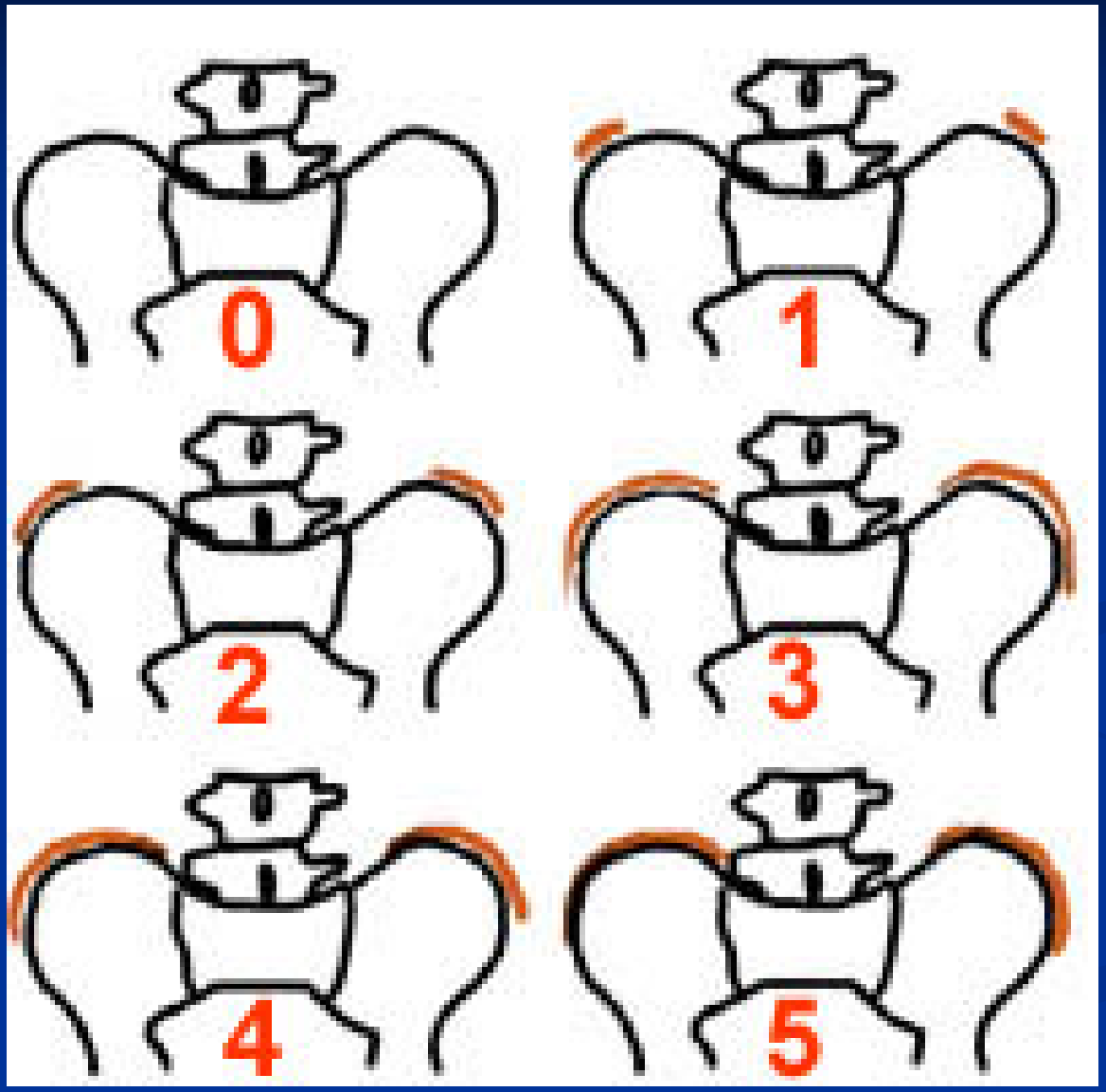
Determination of skeletal maturity

A single AP view of the left hand and wrist can be compared to standards in the Greulich and Pyle hand atlas. Since the iliac crests are usually present on a scoliosis study, they provide a convenient index of skeletal maturity. When the iliac crest apophyses meet the sacroiliac junction and firmly seal to the ilium, maturation is nearly complete.

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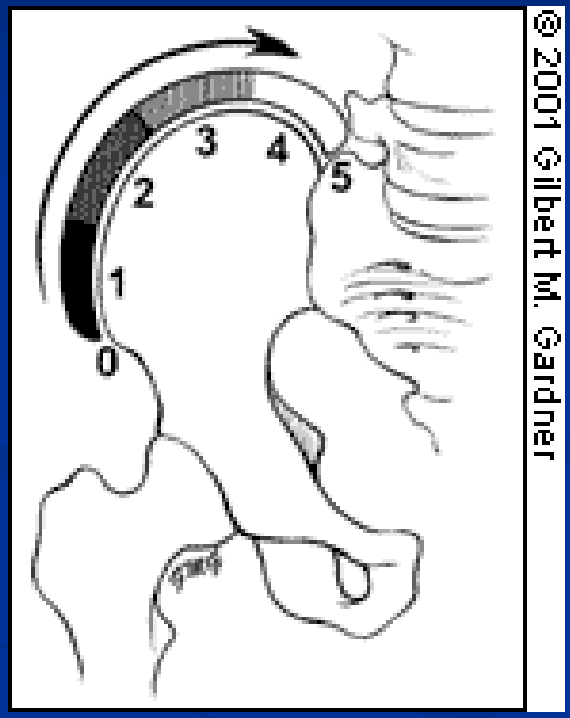
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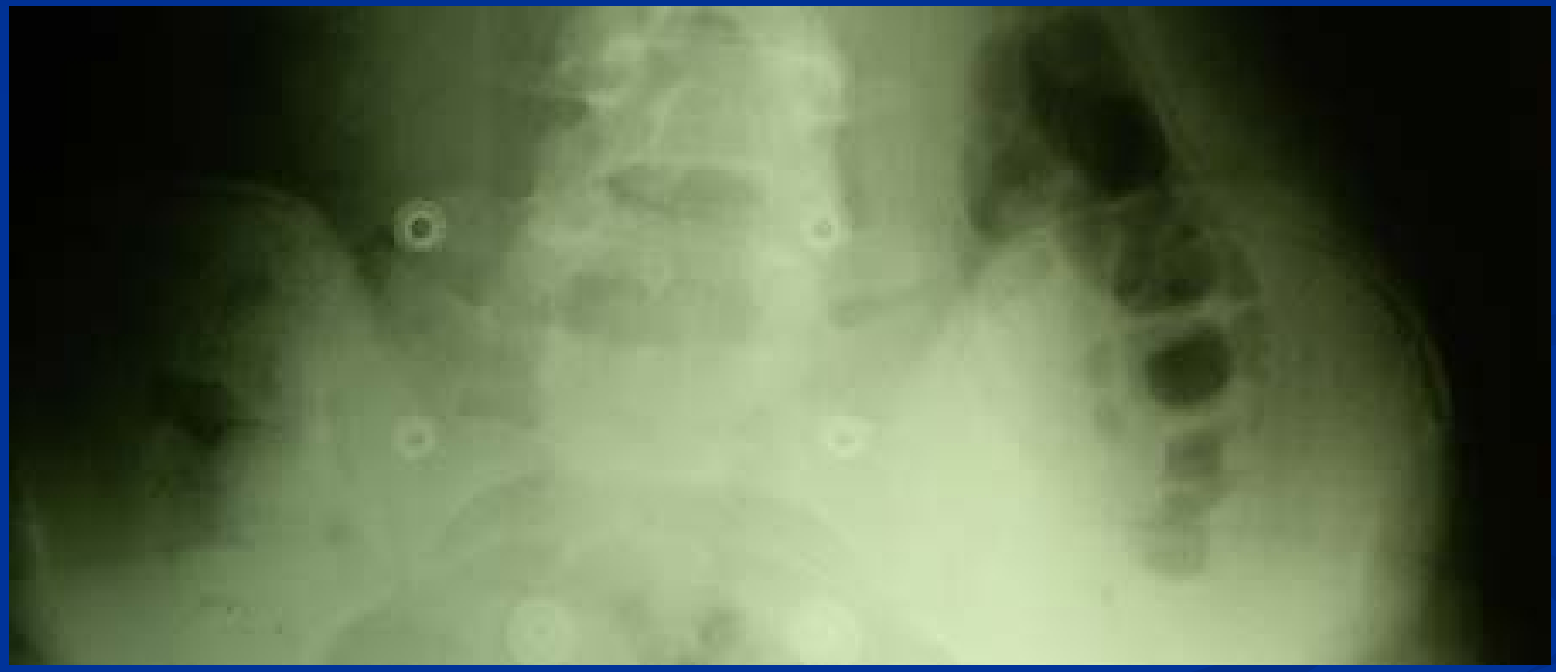
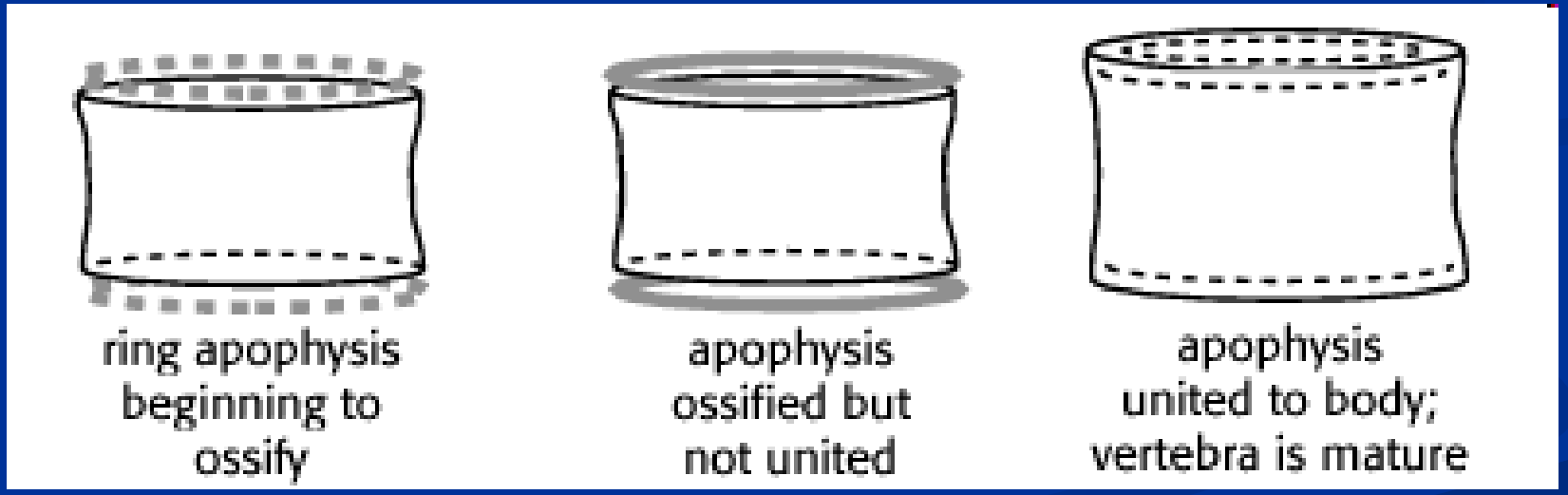
Determination of skeletal maturity



Determination of skeletal maturity

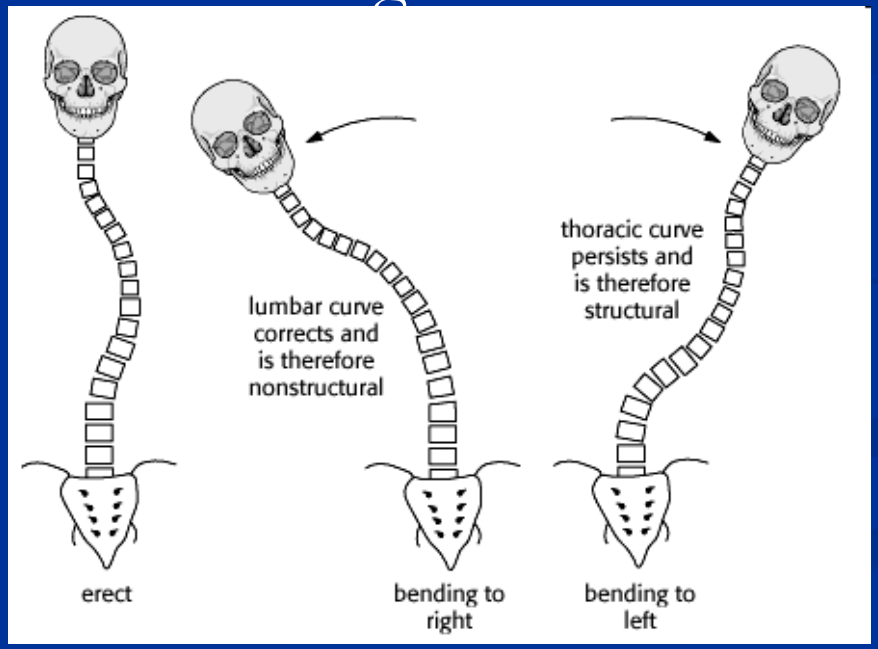
The plates blend in with the vertebral bodies to form a solid union, maturation is complete.



Differentiation structural from nonstructural curves

Prior to surgery, a set of lateral bending films are often taken to assess the rigidity or flexibility of the curves.

Example - the thoracic curve is the major curve and the lumbar curve is simply a compensatory curvature. This is shown by the lateral bending films.

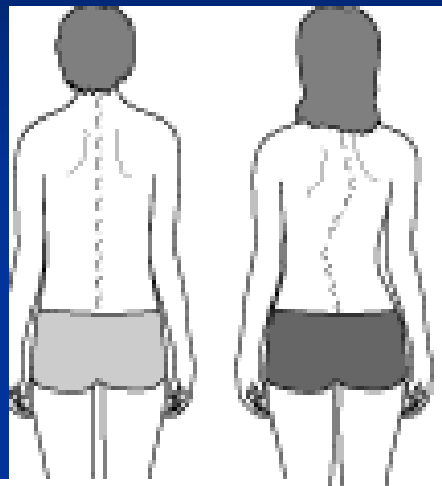


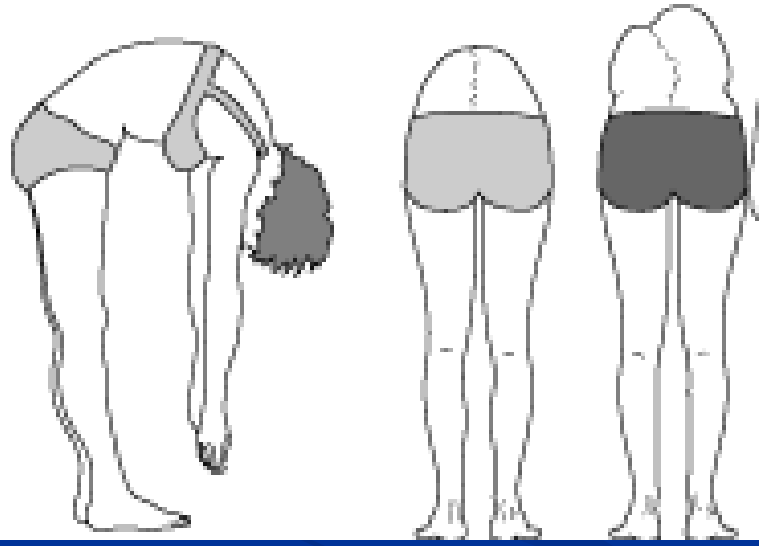
Typical x-ray description

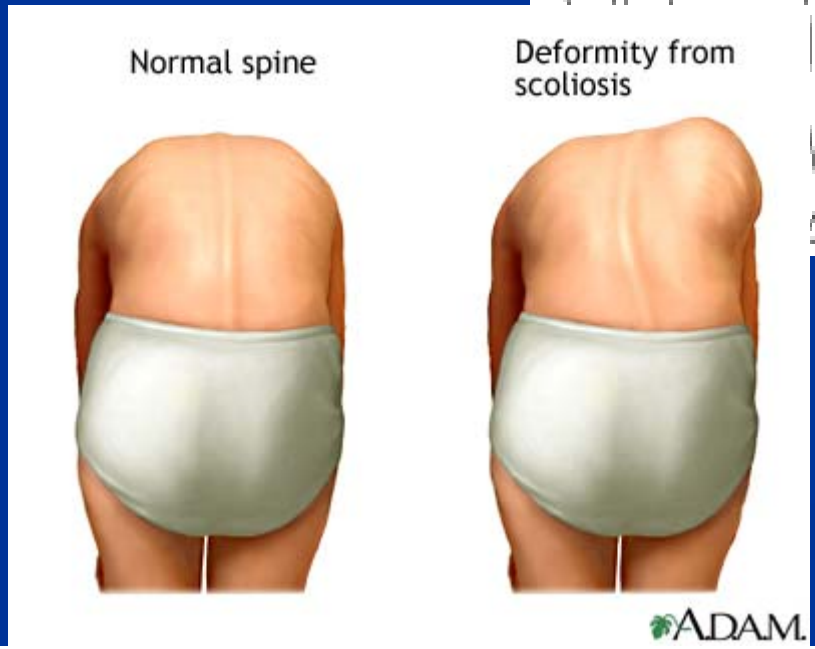
Standing AP and lateral views of the entire spine demonstrate an arcuate thoracolumbar scoliosis with a rightward convexity. No associated vertebral abnormalities are noted. Using the Cobb technique, and measuring from the top of the T9 and the bottom of the L3 vertebral bodies, this angle measures approximately 27 degrees. The apex of the curve is at the T12 vertebral body and demonstrates grade 3 out of 4 rotation to the right. Lateral bending films show persistence of the curvature with bending to the right and increased curvature with bending to the left. This indicates that the thoracolumbar curve is structural and major. The iliac apophyses are complete along the iliac crests, but have not yet fused with the ilium, indicating that the patient has not yet reached skeletal maturity.

Physical examination

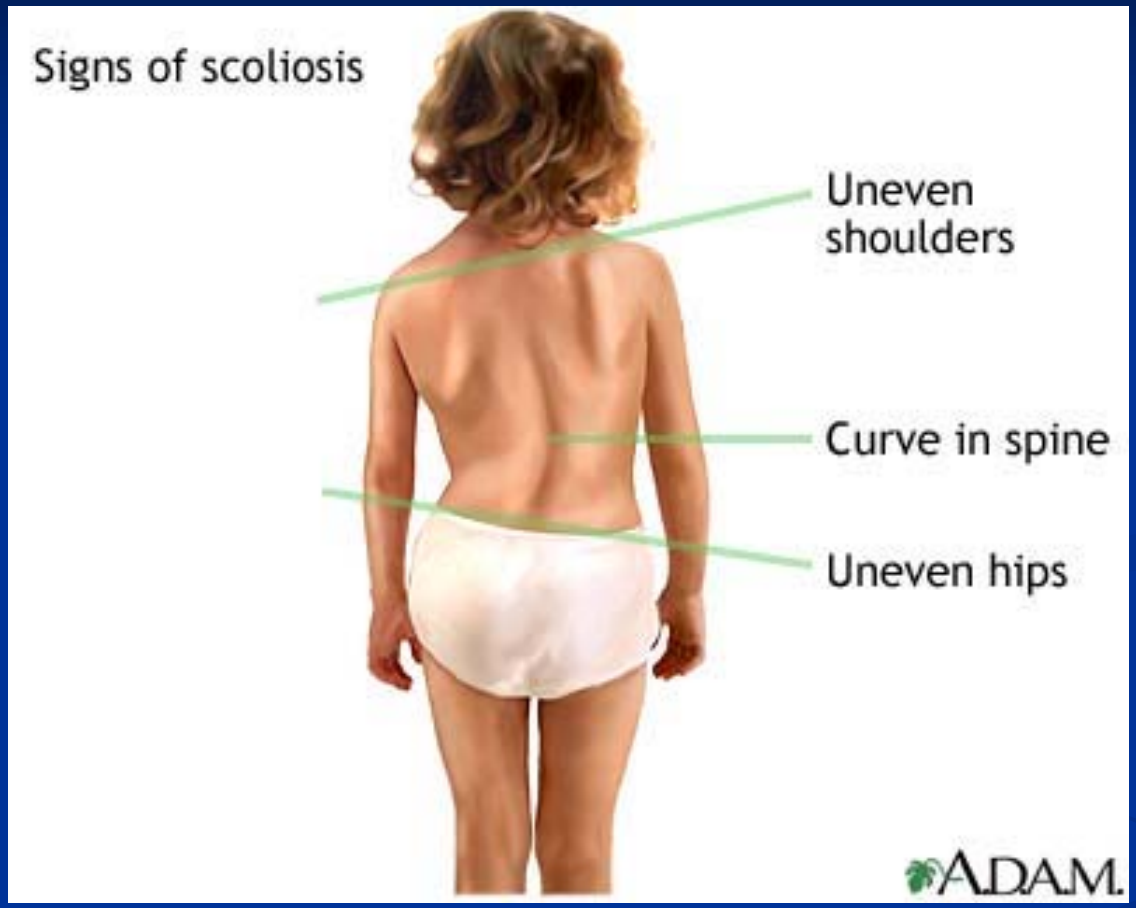
the back bend test







Physical examination



Scoliosis may be suspected when one shoulder appears to be higher than the other, there is a curvature in the spine, or the pelvis appears to be tilted.

Physical examination

An adolescent female has a right thoracic idiopathic scoliosis. Her rib prominence is most obvious upon her bending forward. The radiograph demonstrates a right thoracic scoliosis

What happens if the severe scoliosis is not treated?

If it is not treated the degree of scoliosis will usually become worse due to the continual loading on the spine during normal daily activities. The spine will buckle under the added load and the curve will become worse. Women have a further aspect to consider. During pregnancy the load on the spine increases dramatically, and the best way to prevent future problems associated with pregnancy is to deal with the scoliosis when it reaches a significant level during these earlier years. The untreated severe scoliosis is a substantial problem. Studies indicate that the quality and length of life are markedly effected by scoliosis. The prevalence of backache is twice that of the normal population, unemployment and the rate of disability pensions are high, poor self-image is common, and the majority do not marry. Respiratory and cardiac problems also become common, causing further severe disability and reduced life expectancy.

What happens if the severe scoliosis is not treated?

- If left untreated, scoliosis exceeding 50 degrees can be problematic in the long-term. Progressive deterioration of the curve can occur, which in some cases can lead to diminished lung capacity and the development of restrictive lung disease. Cosmetic concerns are significant to many patients. The incidence of back pain among patients with scoliosis approximates that of the general population.

Management of Scoliosis

The management of a scoliosis is determined by the extent of the scoliosis. A number of methods are used to decide upon the most appropriate treatment. In most instances a mild scoliosis requires no specific treatment. Advice in regard to posture and exercises may be offered. If the scoliosis is more severe it must be treated.

The extent of the scoliosis :

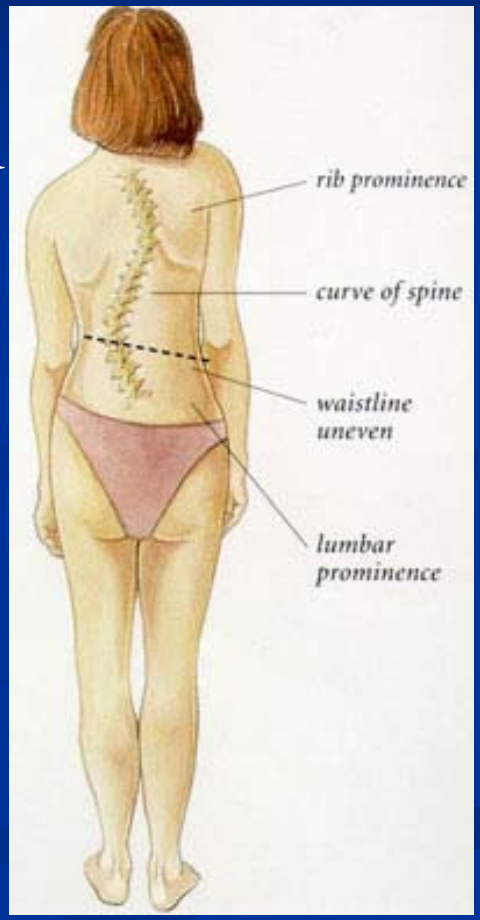
- I ≥ 20 degree ,
- II 21 ≤ 40 degree,
- III ≤ 41 degree

The treatment options:

- observation,
- bracing,
- physiotherapy,
- surgery

Management of Scoliosis-observation

This option is appropriate when the curve is mild (less than 20 degrees) or if the child is near skeletal maturity. However, the doctor will want to recheck the curve on a regular basis to see that it is not progressively getting worse. You may be asked to return every 3 to 6 months for re-examination. Most cases of scoliosis referred through school screening will fall into this category.



Management of Scoliosis - bracing

- is still growing and has an idiopathic curve that is more than 25 to 30 degrees;
- has at least 2 years of growth remaining, has an idiopathic curve that is between 20 and 29 degrees, and, if a girl, has not had her first menstrual period; or
- is still growing and has an idiopathic curve between 20 and 29 degrees that is getting worse.

Management of Scoliosis - bracing

The goal of bracing is to prevent curves from getting worse. Bracing can be effective if the child is still growing and has a spinal curvature between 25 and 45 degrees. There are several types of braces, most being underarm. Wearing a brace does not affect participation in sporting activities. Time out of brace is allowed for these activities.

How long should be it worn?

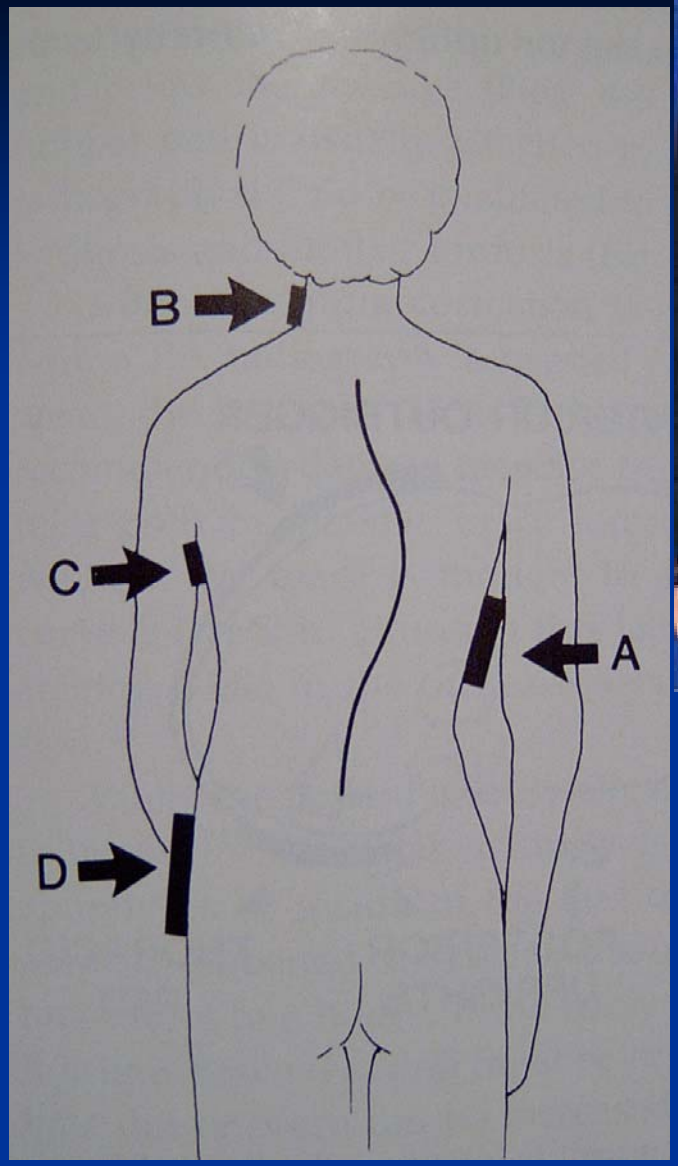
Management of Scoliosis - bracing

Although a definite inconvenience, bracing is sometimes necessary, and may prevent the need for surgery. A recent study has shown that bracing is effective in stopping the progression of the curve in about 80 per cent of patients, until the age of 16. A variable degree of relapse of the curve does occur after the cessation of bracing, usually at the age of 15 - 16. However, those children who have been braced generally still have curves within the acceptable range, which should not carry any particular disadvantage into adulthood.

Management of Scoliosis - bracing

- **Milwaukee brace**-Patients can wear this brace to correct any curve in the spine. This brace has a neck ring.

- **Thoracolumbosacral orthosis (TLSO)**-Patients can wear this brace to correct curves whose apex is at or below the eighth thoracic vertebra. The TLSO is an underarm brace, which means that it fits under the arm and around the rib cage, lower back, and hips.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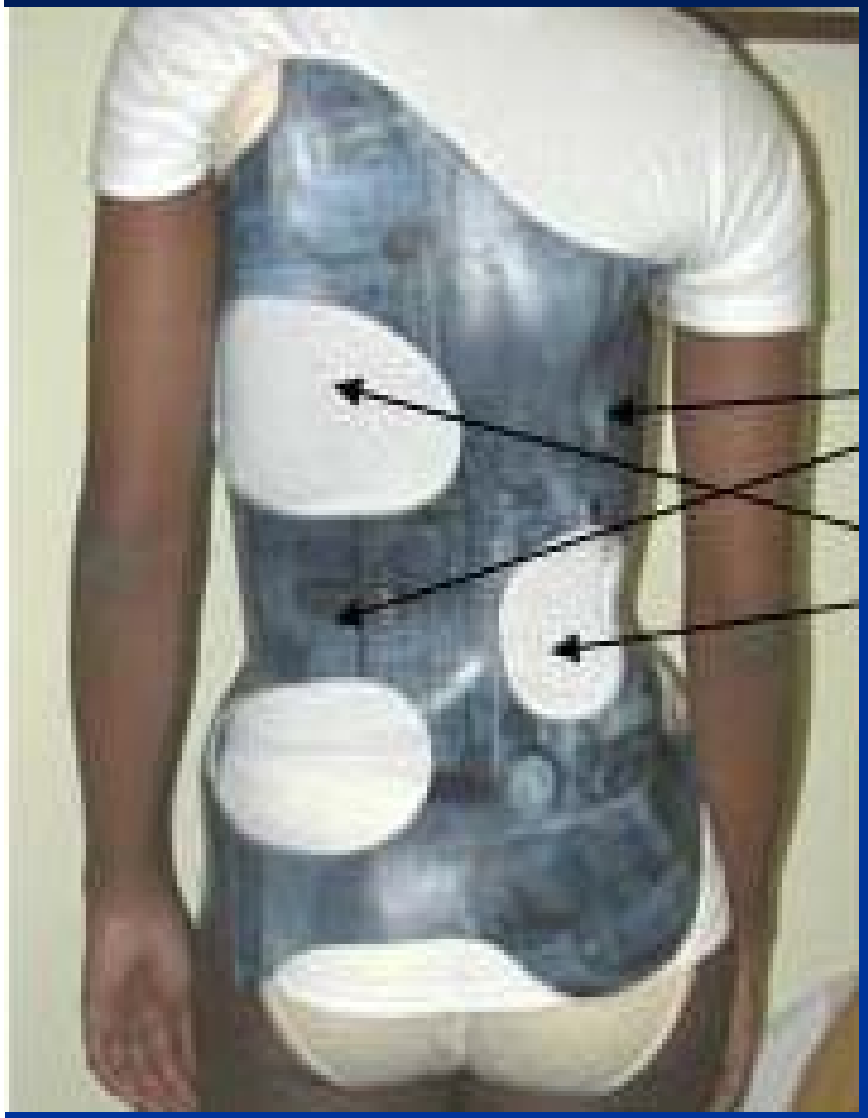

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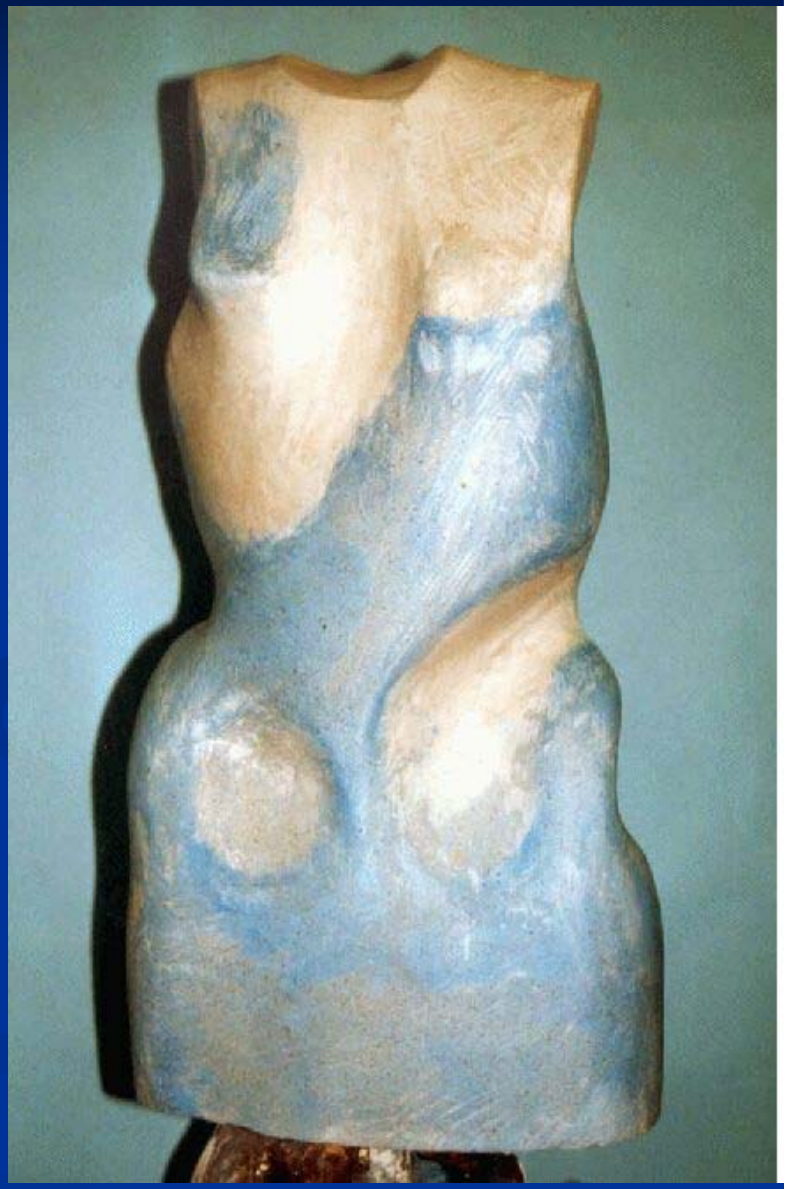
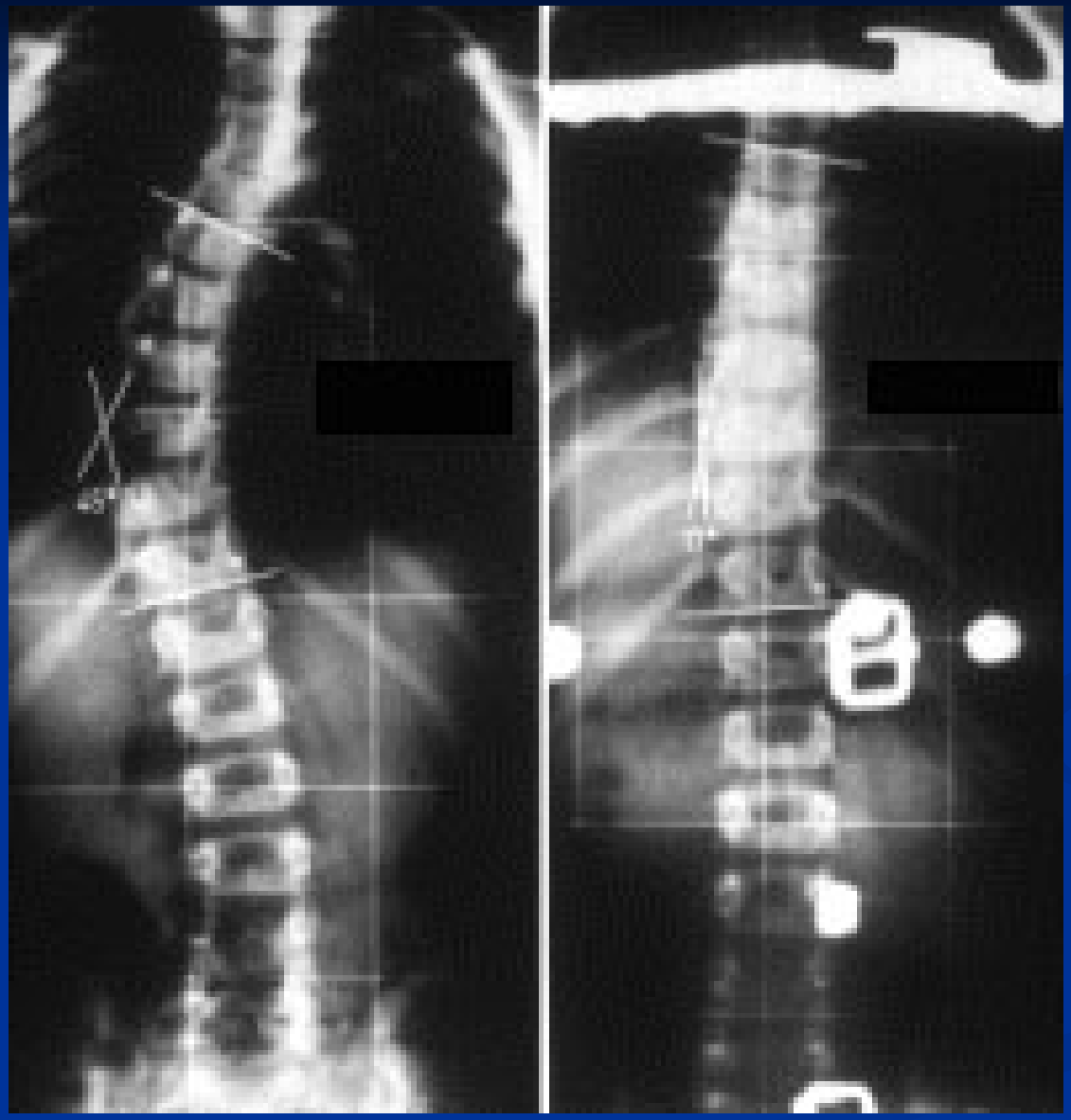
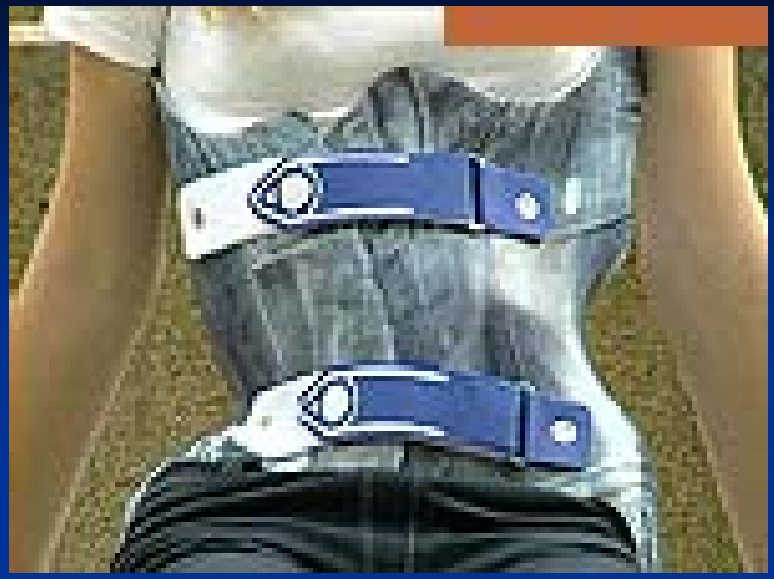


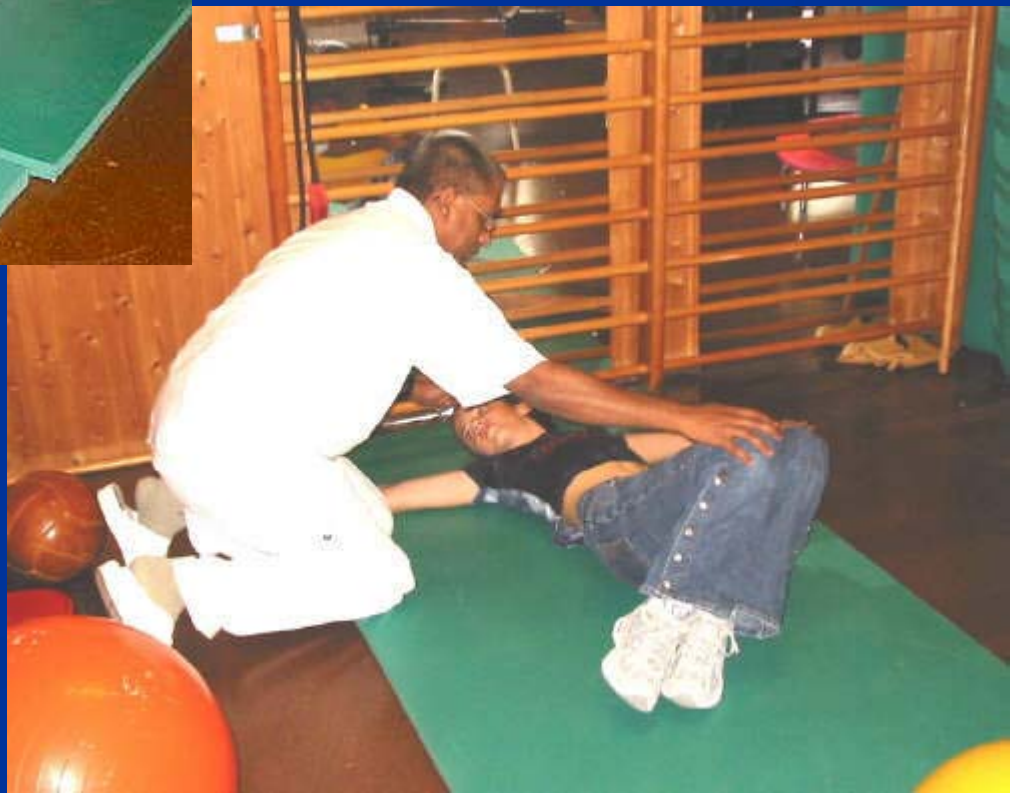


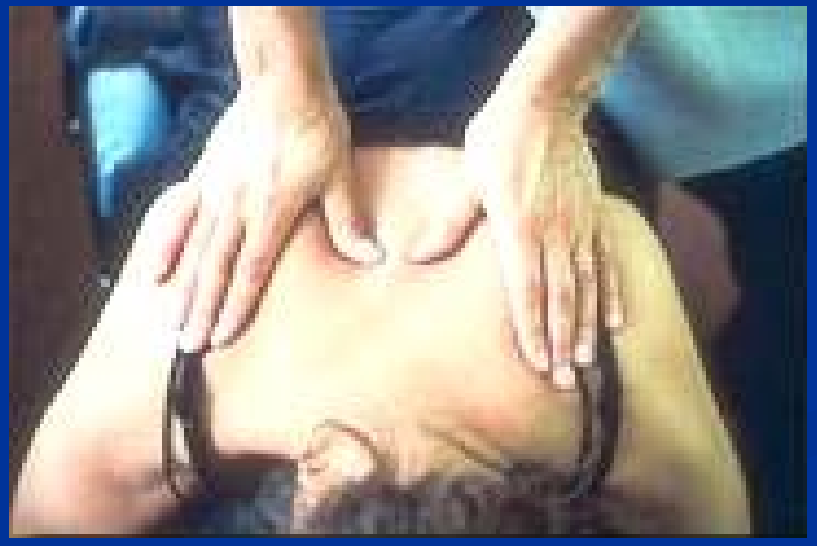


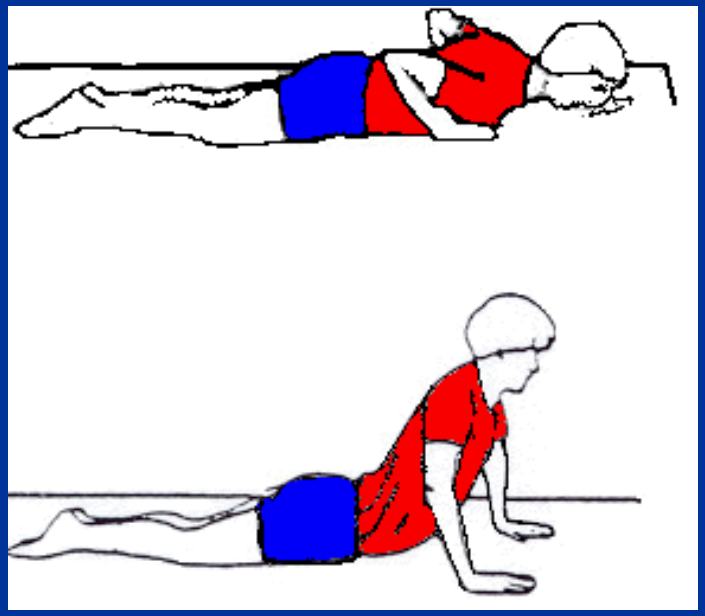
Management of Scoliosis - physiotherapy

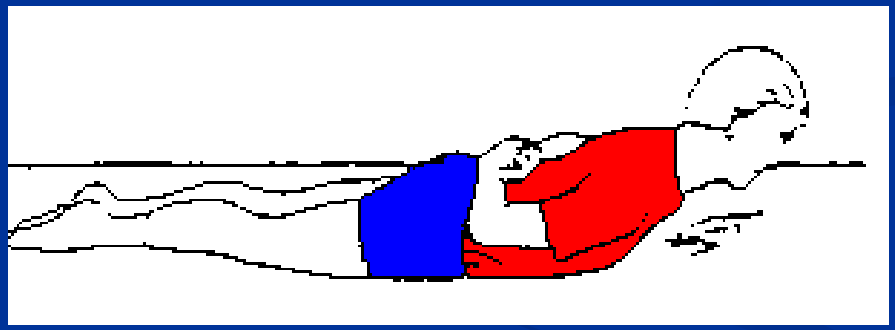
Surface electrical stimulation has now been discredited as a treatment, and studies have shown that the children treated in this way do no better than those left untreated. Treatment such as manipulation has no place in the management of the mechanical defect in scoliosis, although manipulation and physical therapies can help any low back pain that occurs in association with a scoliosis.

Exercises can be prescribed, but they will probably not effect the progression of a curve. If a brace is required, an exercise programme will also be prescribed, but if not required, instruction regarding review of the scoliosis and exercises will be provided.







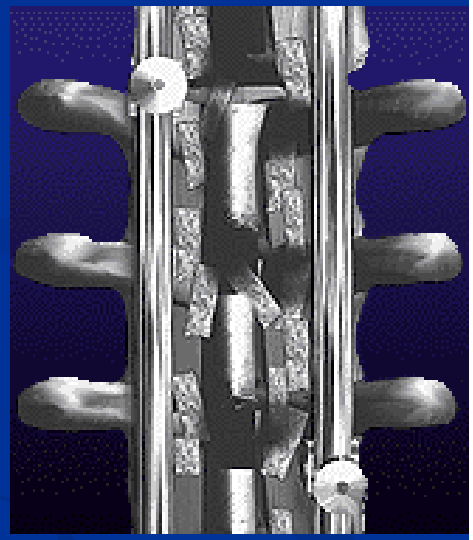


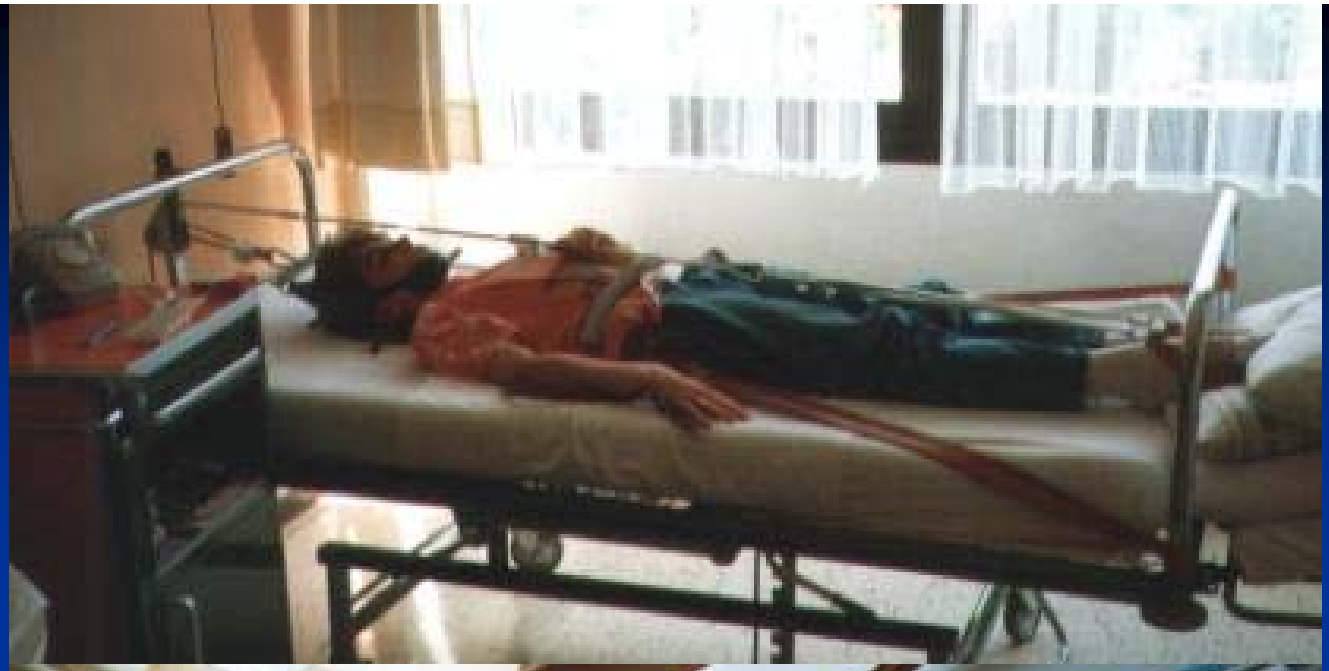
Management of Scoliosis – surgery

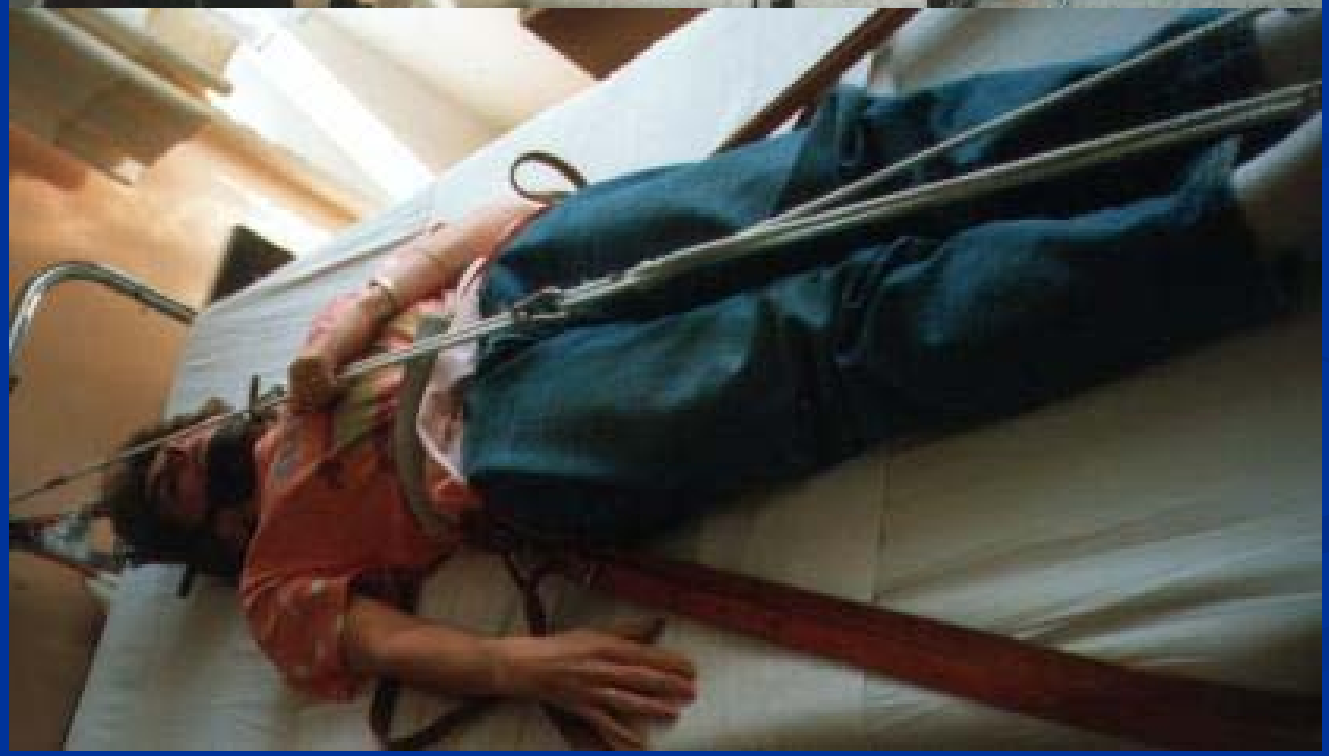
Why Surgery?

Surgical treatment of scoliosis may be indicated for any of the following reasons:

- To prevent further progression of the curve.
- To control the curve when brace treatment has failed.
- To improve an undesired cosmetic appearance.
- For reasons of discomfort or postural fatigue.







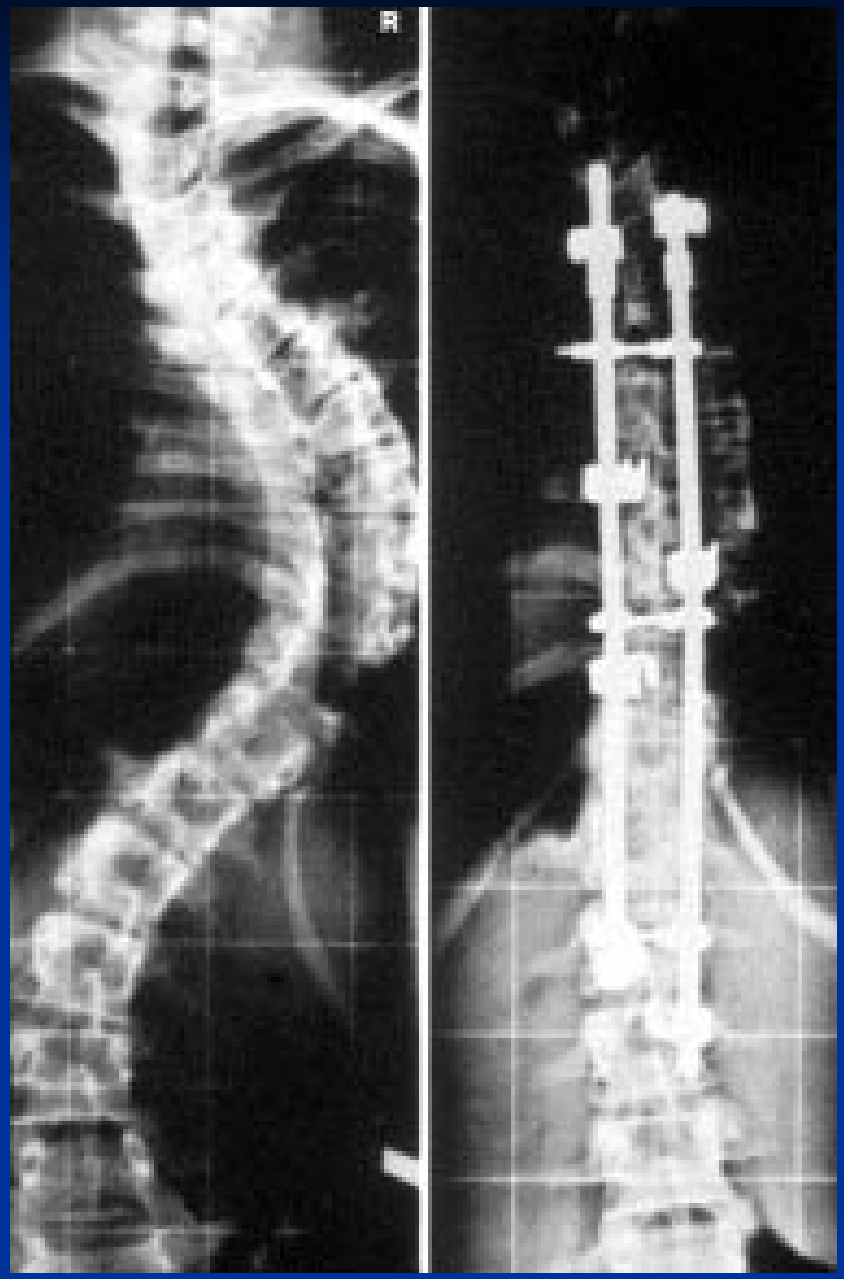
Prepare for surgery – autoextension

Management of Scoliosis – surgery

If the curve is more than 45 degrees and the child is still growing, the doctor may recommend surgery. If growth is finished, surgery may still be recommended for curves that exceed 50-55 degrees. Before the operation, your child may be asked to donate blood (which will be used during the surgery as needed). The surgery requires a bone graft from the hip, ribs or a bone bank. A series of rods, hooks, screws or wires are used to straighten the spine. Following surgery, patients are walking without a brace by the second or third day, are discharged from the hospital within a week and can rapidly resume their daily activities. A return to some sports is possible in 6 to 9 months.

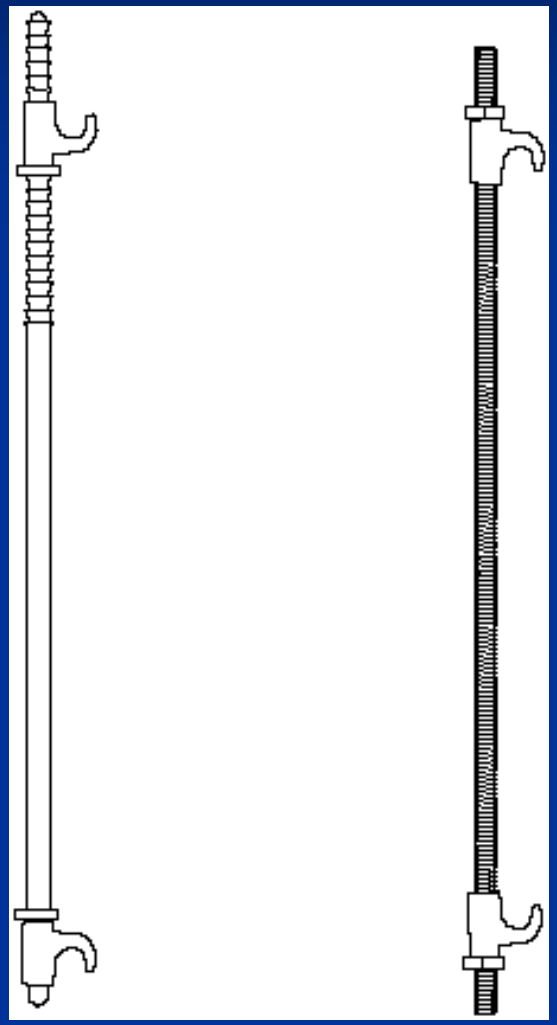
Management of Scoliosis – surgery CD method –posterior fusion

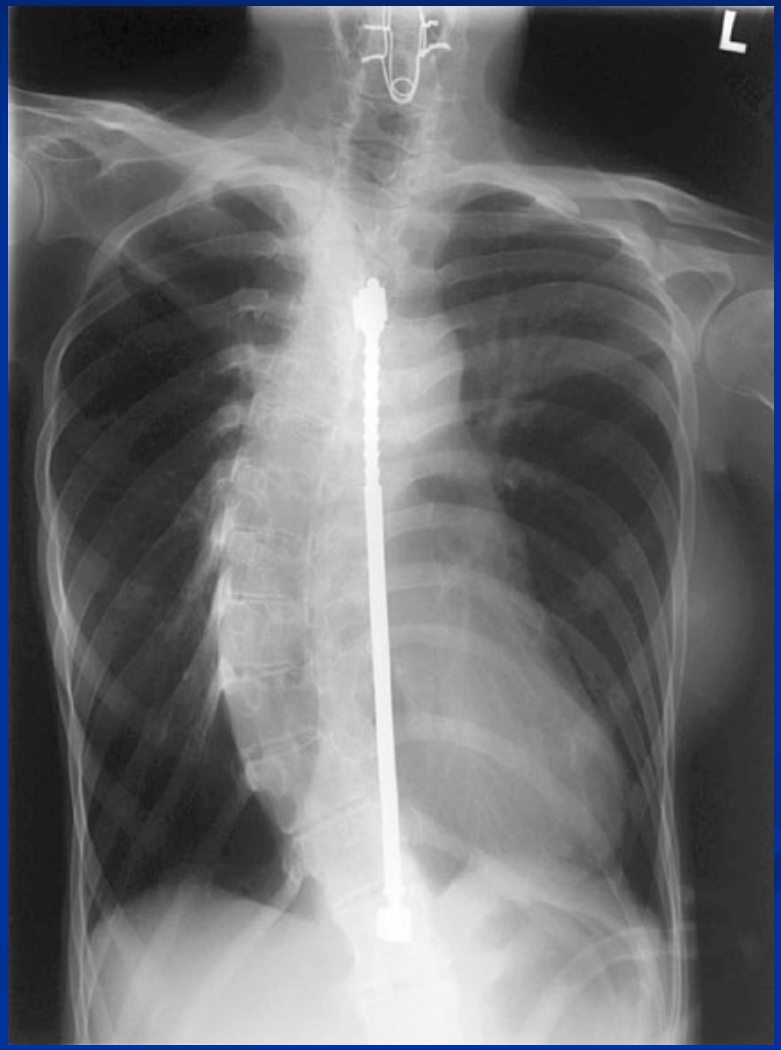
In the rare cases where the scoliosis reaches the point of no return, surgery may be required. In thoracic scoliosis it entails the insertion of metal rods - called Cotrel-Dubousset Instrumentation - along the spine. These rods act as braces to straighten the spine and prevent further deterioration of the scoliosis. These rods are usually left in the spine throughout life. These operations are performed by Orthopaedic Surgeons, who are specialised in the area of Paediatric Orthopaedics. This type of surgery does not require the patient to wear a plaster jacket after the operation. The stay in hospital is about 7 to 9 days, and return to school is about 1 month. Life after surgery returns to near normal by about 9 months, except that body contact sports are not permitted.



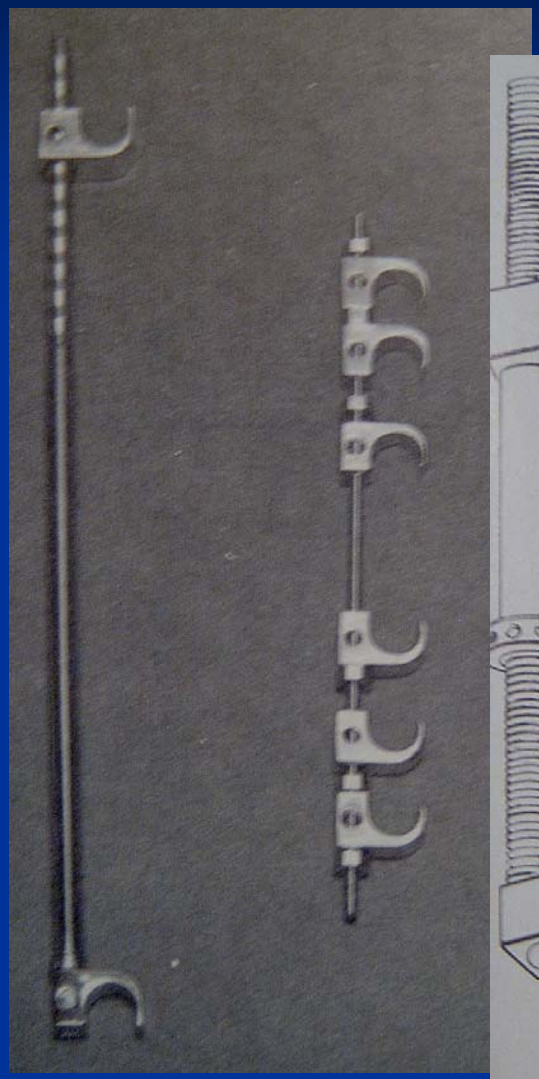
CD method

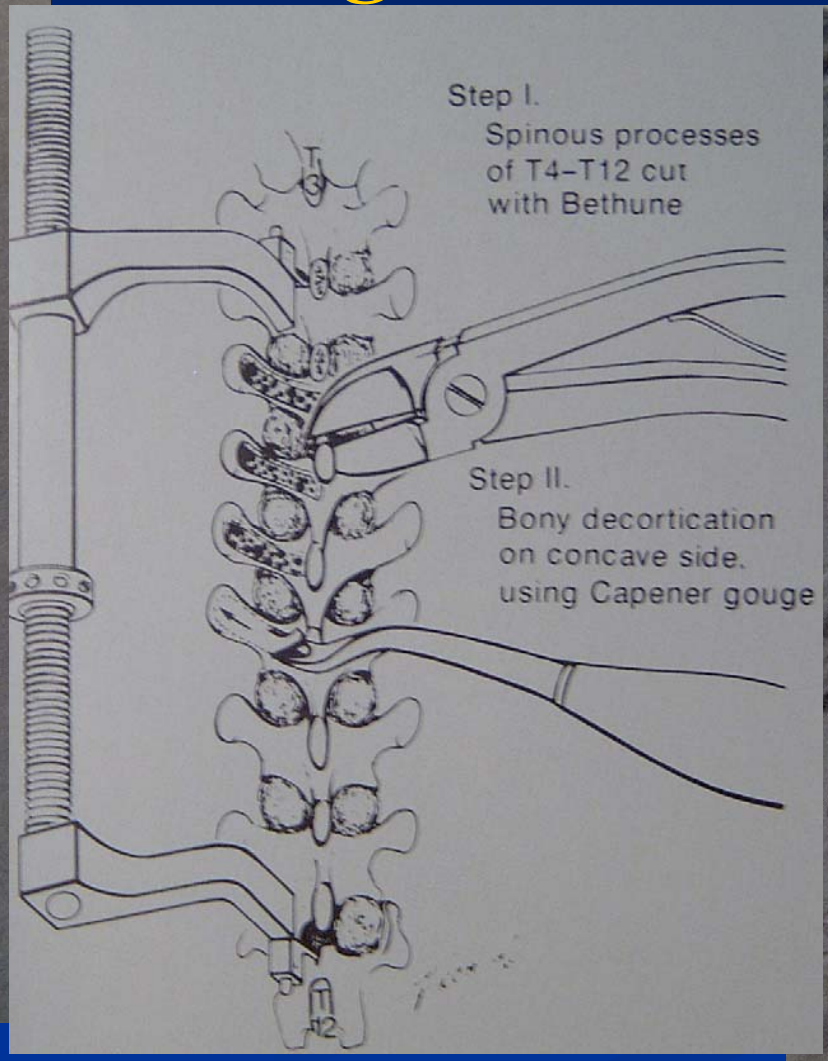
Management of Scoliosis – surgery
Harrington rod – posterior fusion

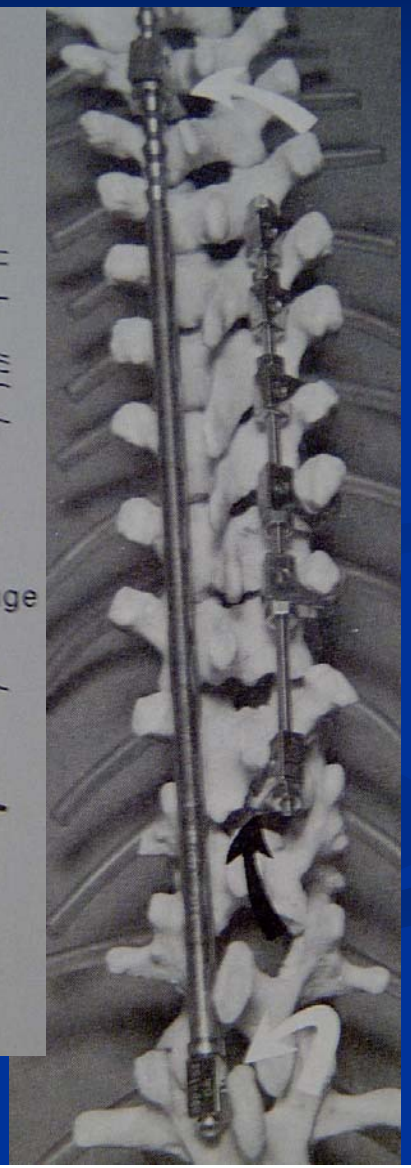




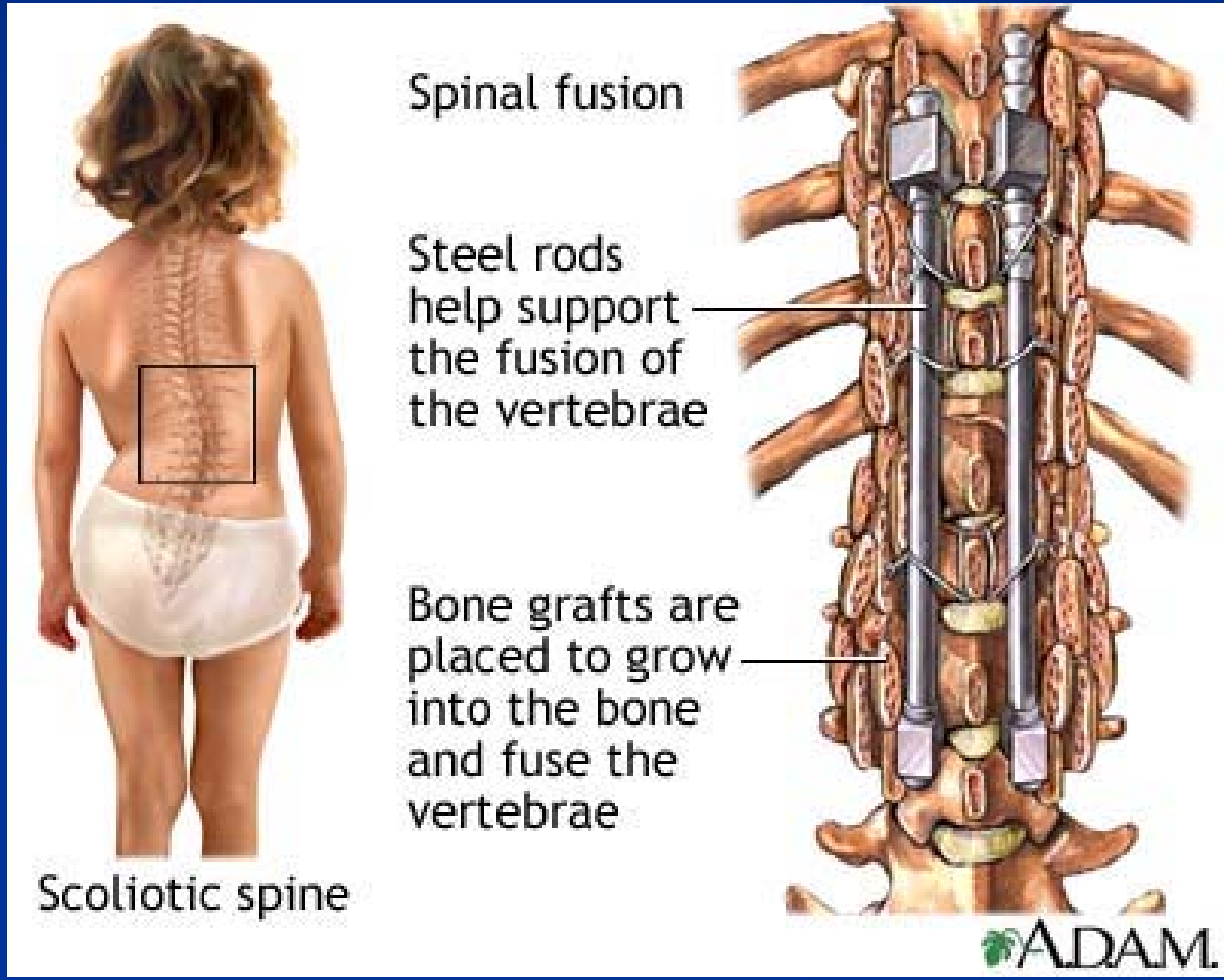
Management of Scoliosis – surgery
Harrington rod



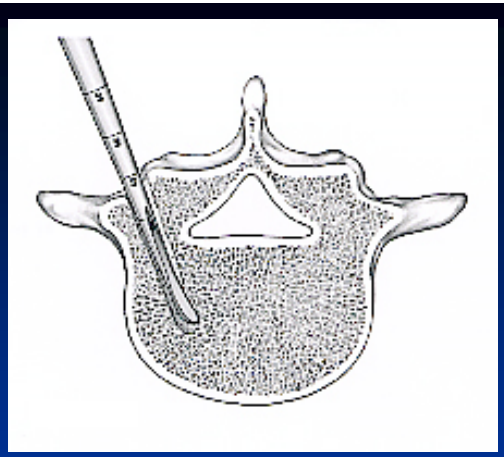


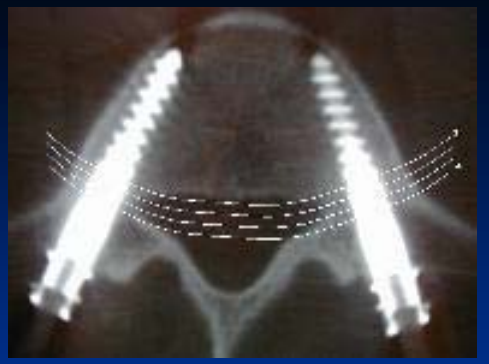


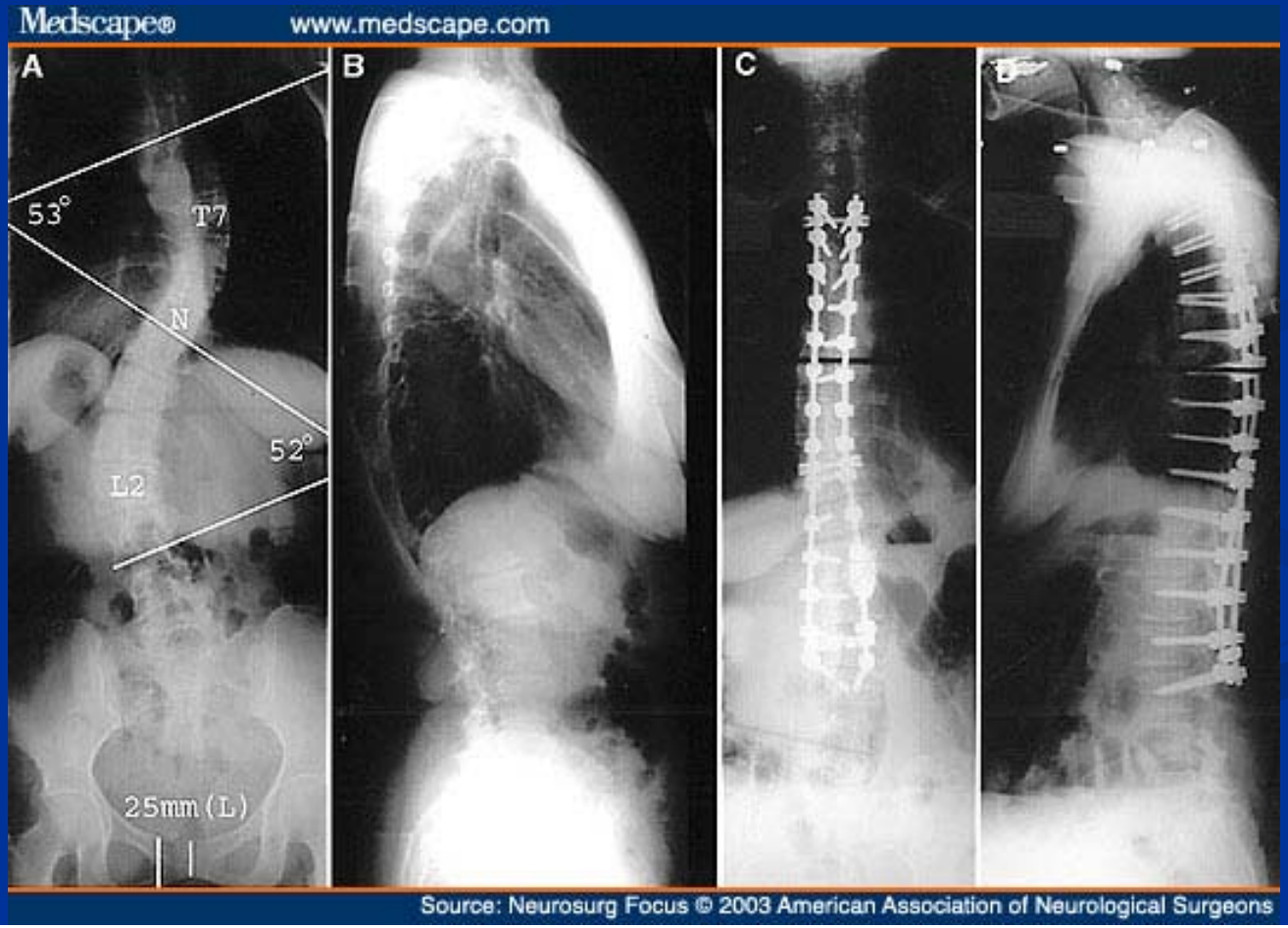
Spinal fusion

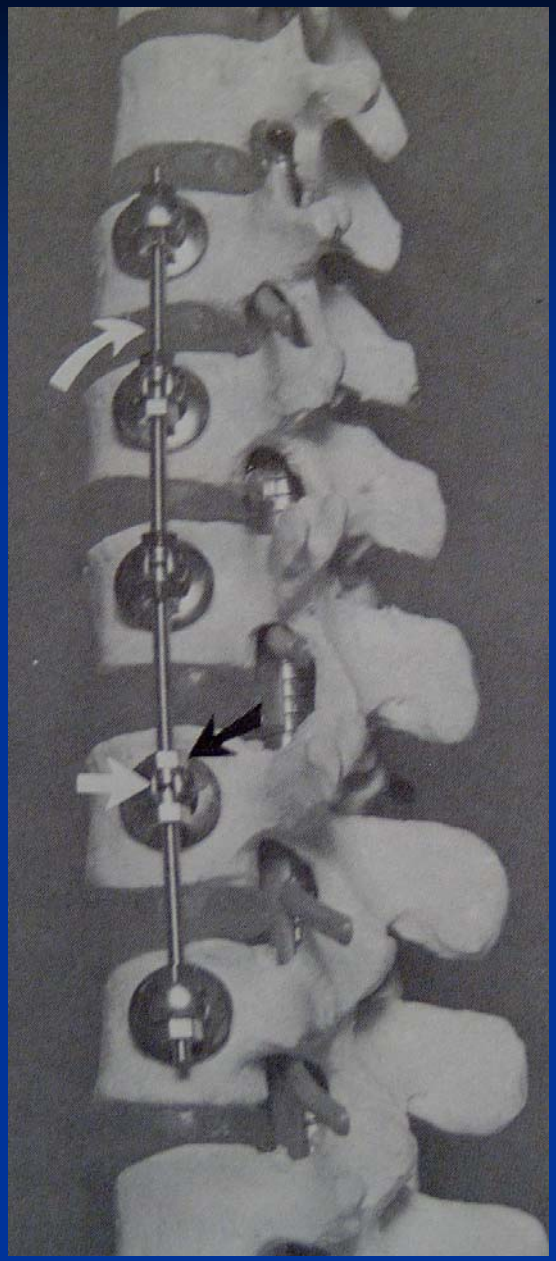



© 2002 Medtronic

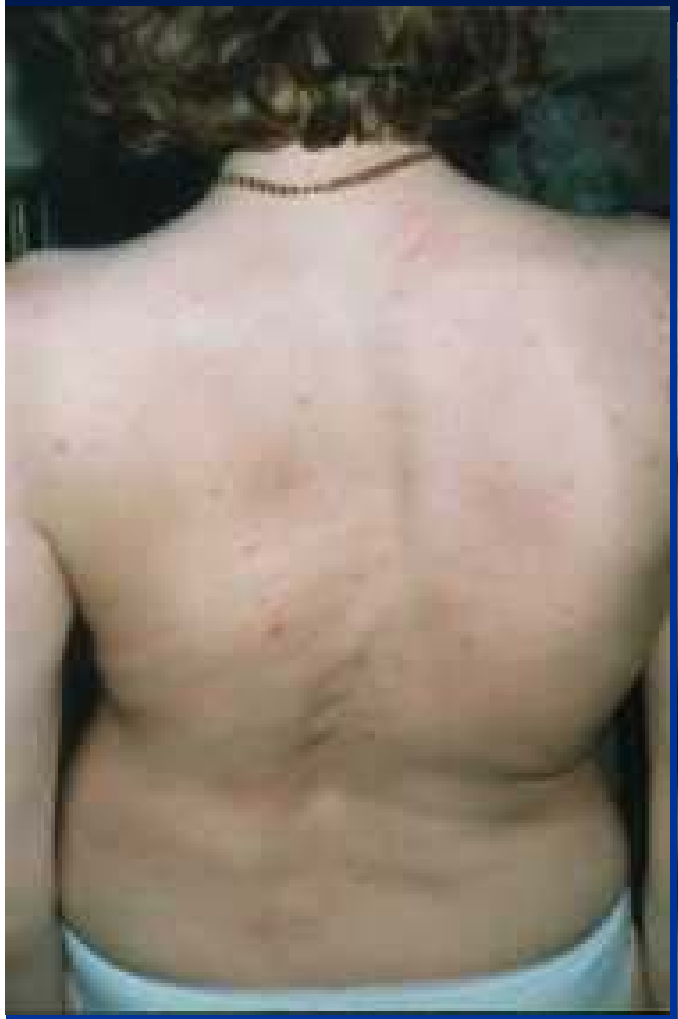


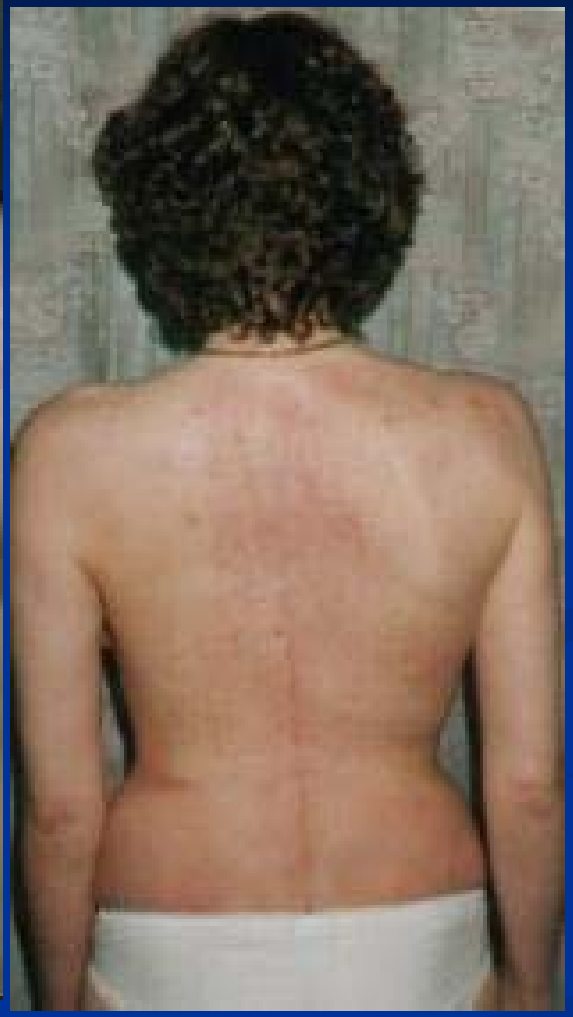


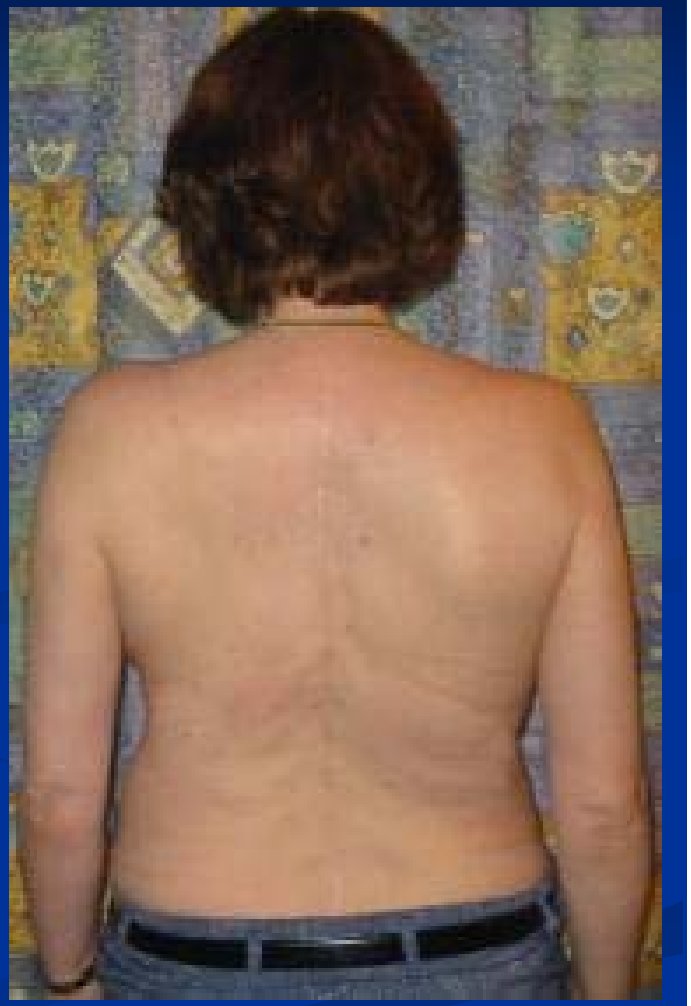

Medscape®
www.medscape.com
A
B
C
D
53°
T7
N
52°
L2
25mm (L)
Source: Neurosurg Focus © 2003 American Association of Neurological Surgeons



Anterior fusion





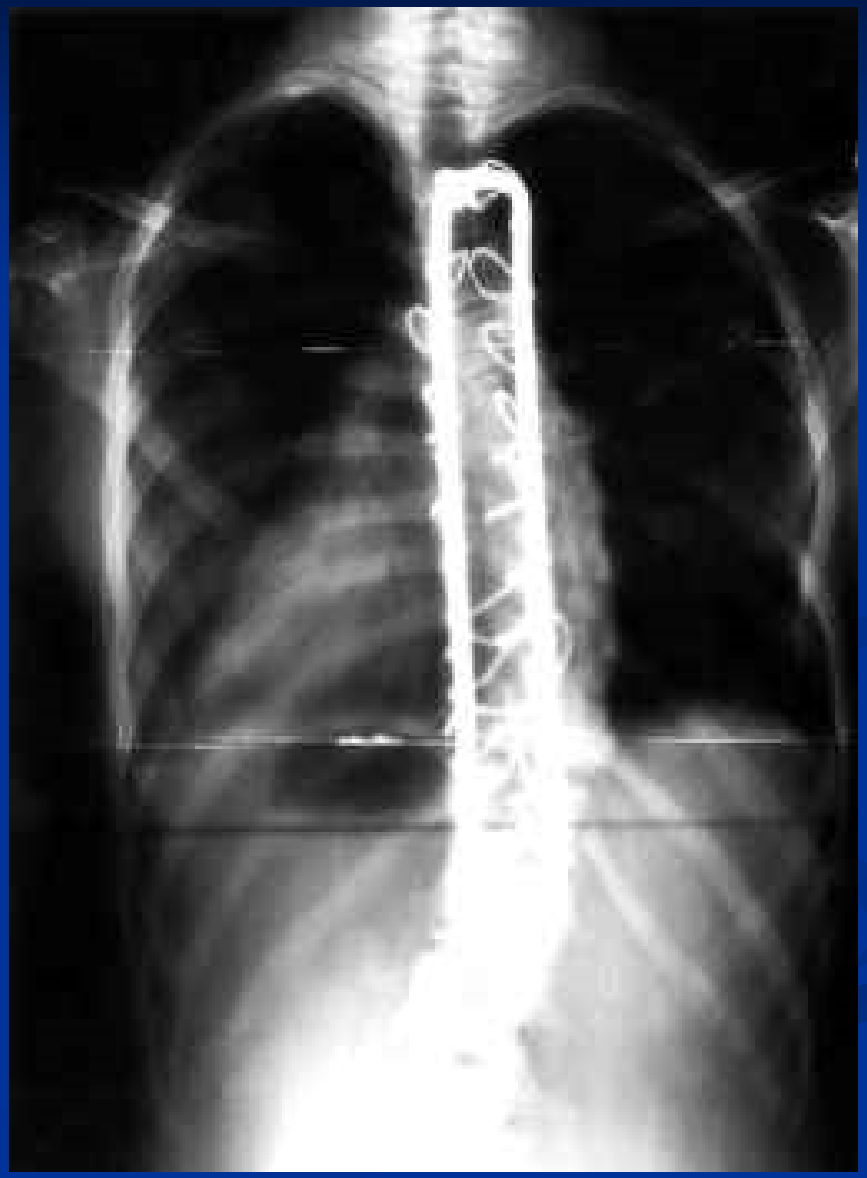


92º / 80º

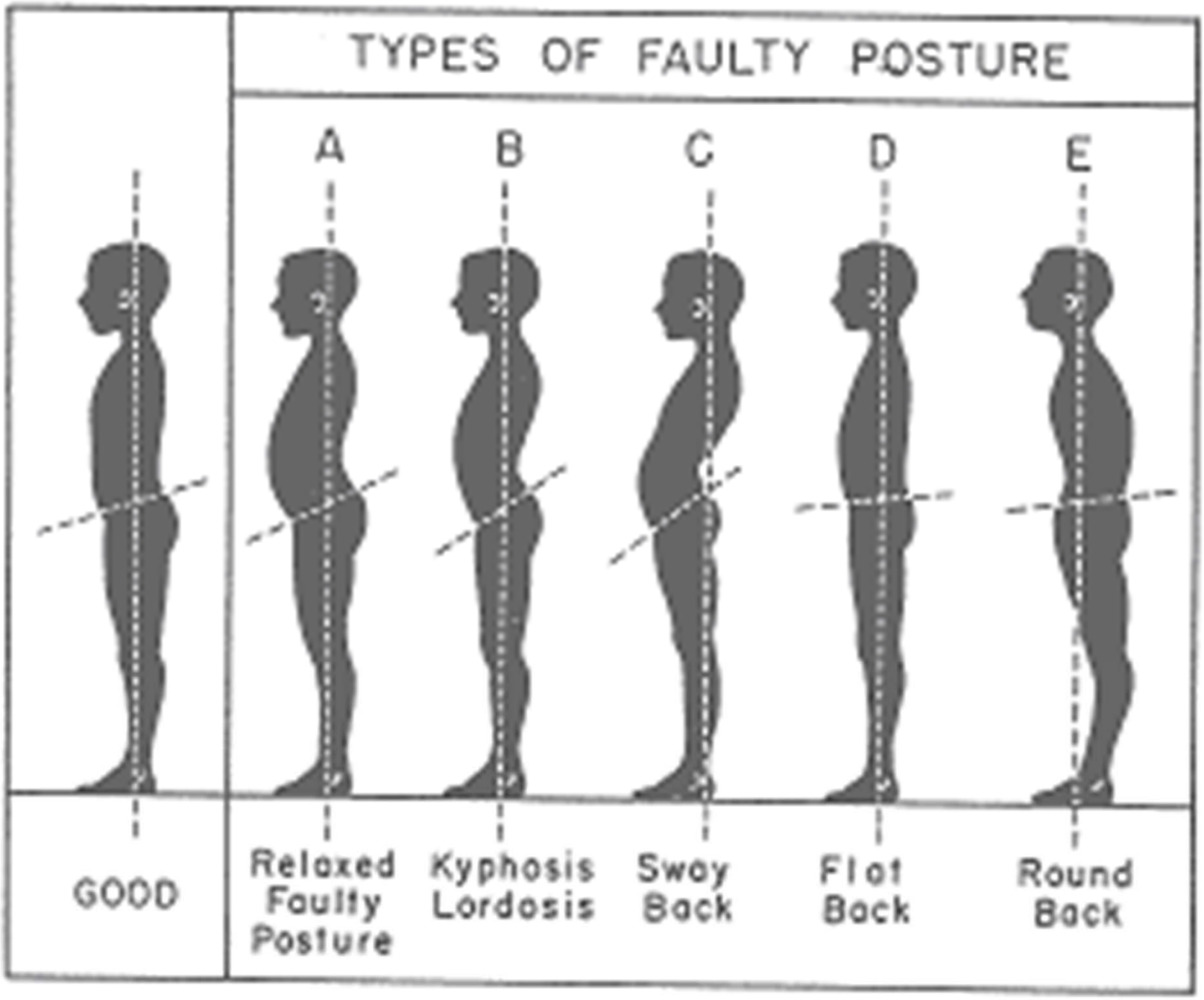
40º / 32º

Scoliosis - CP

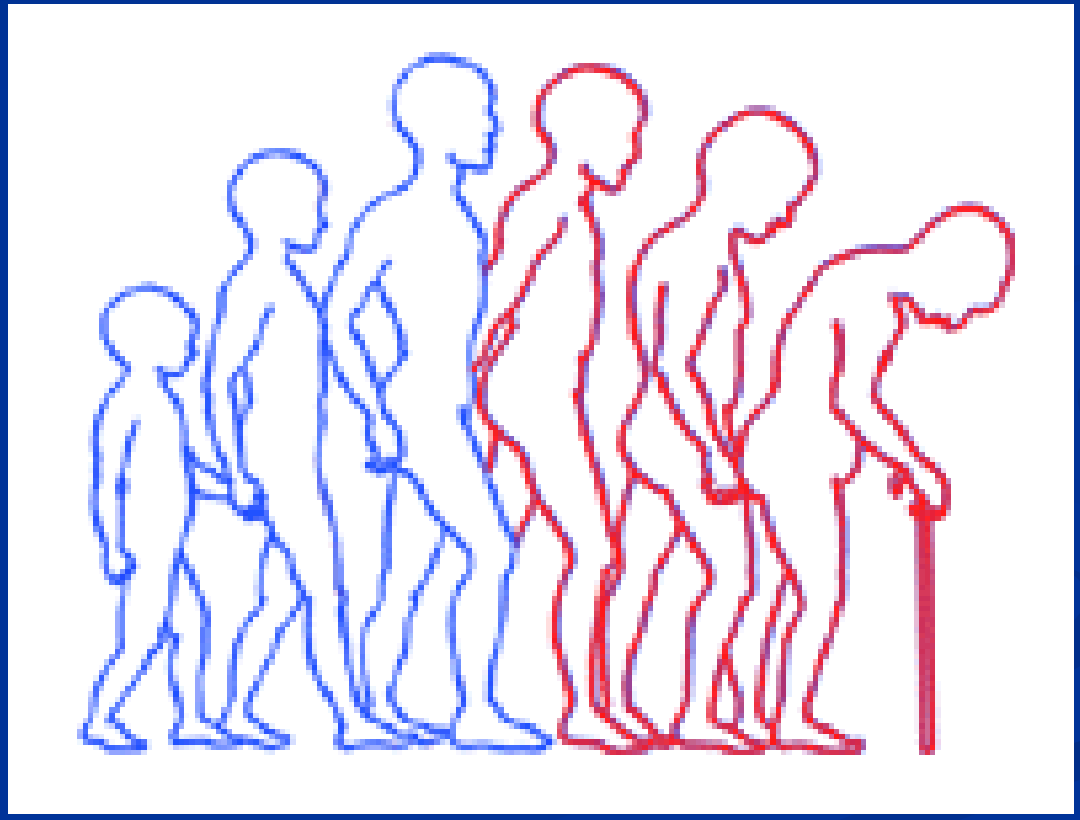
Luqué Rods, Wires: Named for Dr. Luqué, these spinal rods use sublaminar wires (wires looped around the back part or each vertebra) for attachment. Luqué type instrumentation is commonly used in paralytic scoliosis such as that seen in cerebral palsy.



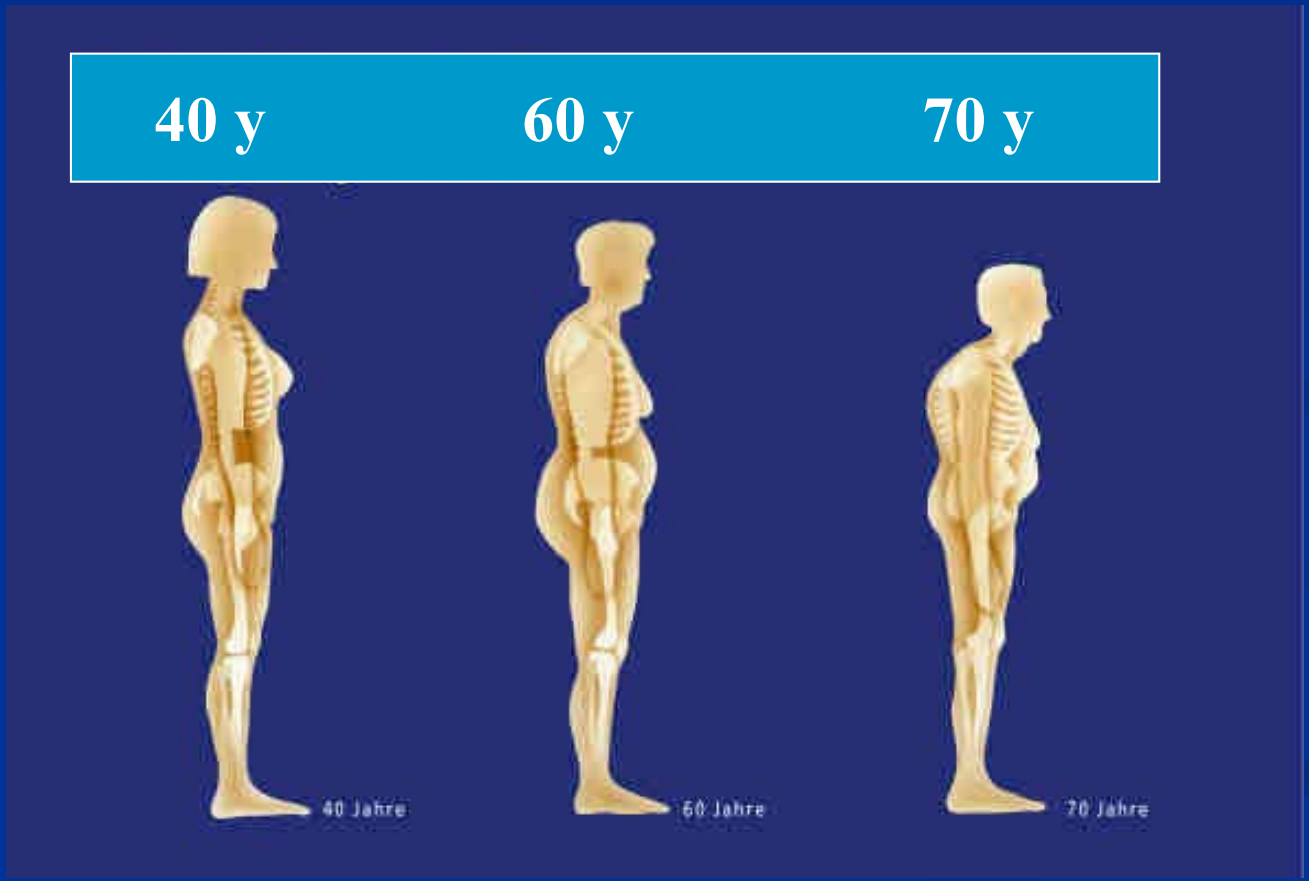
Scoliosis - myelomeningocele


TYPES OF FAULTY POSTURE
A
B
C
D
E
GOOD
Relaxed Faulty Posture
Kyphosis Lordosis
Sway Back
Flat Back
Round Back

Posture



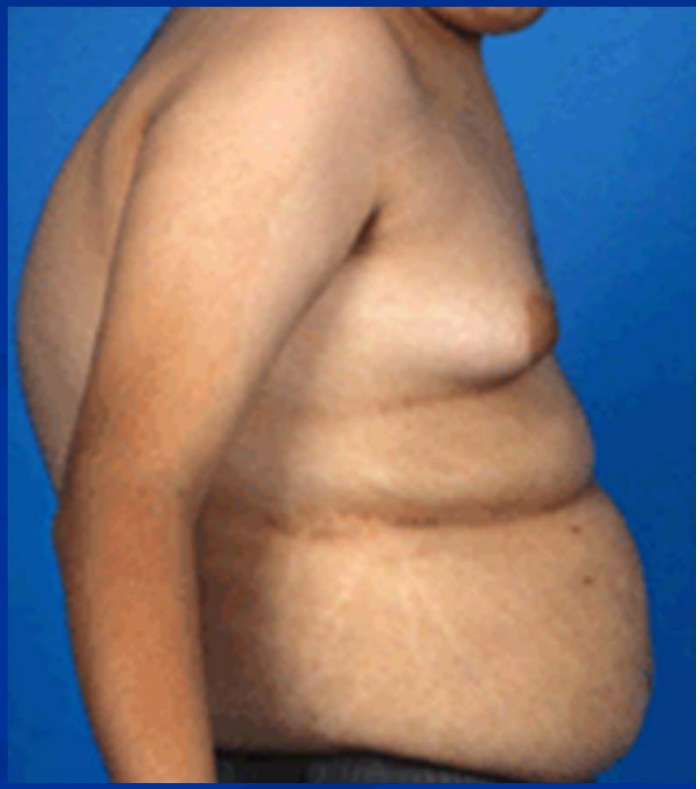
Posture



Kyphosis (Curvature of the Spine)

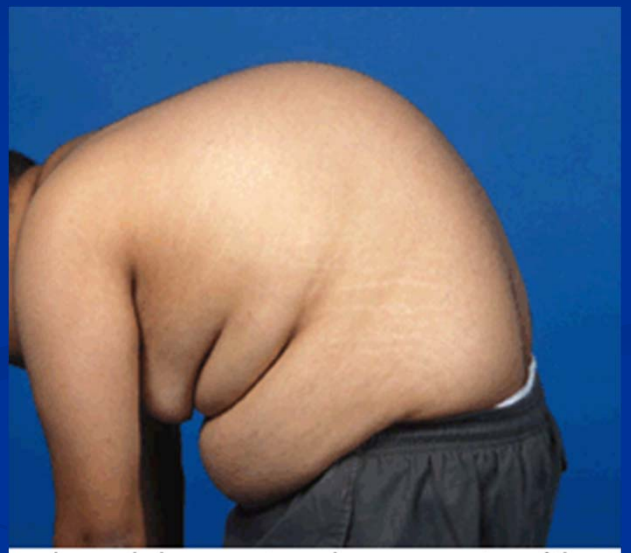
The term "kyphosis" (kI-fO-sis) is usually applied to the curve that results in an exaggerated "round-back." A variety of disorders may be responsible for this condition.

This is particularly true for an exaggerated rounding to the back. Some degree of curvature to the spine is normal.



Kyphosis

It concerns about the cosmetic deformity of a rounded back or pain combined with poor posture. The doctor may ask the child to bend forward so that he or she can see the slope of the spine. X-rays of the spine will show if there are any bony abnormalities. X-rays will also let the doctor measure the degree of the kyphotic curve. Any kyphotic curve that is more than 50 degrees is considered abnormal.



An adolescent male presents with excessive roundback localized to the thoracic spine. The severe kyphosis is most obvious when he bends forward.

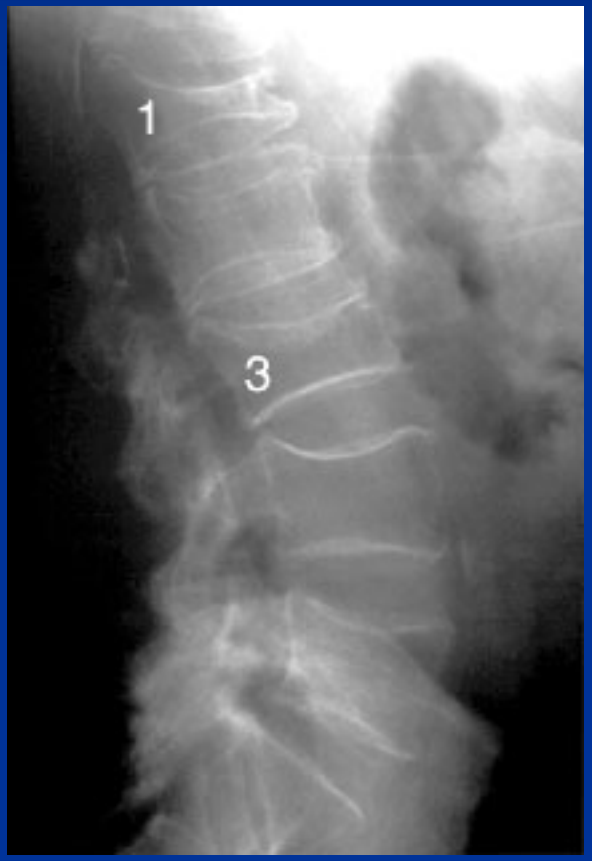
Types of kyphosis

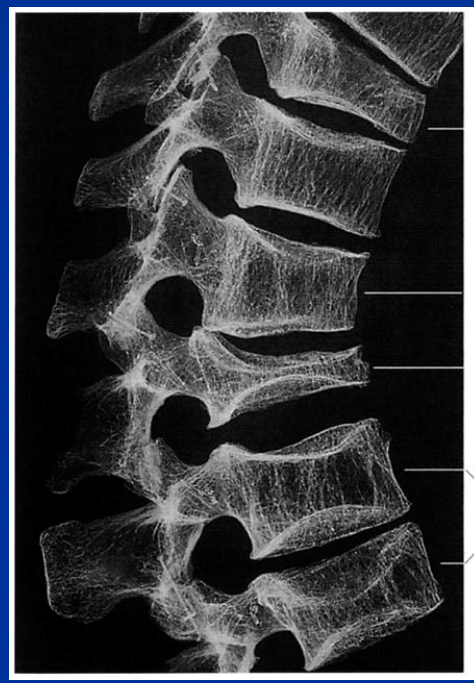
- Postural kyphosis
- Scheuermann's kyphosis
- Congenital kyphosis
- Trauma
- Osteoporosis

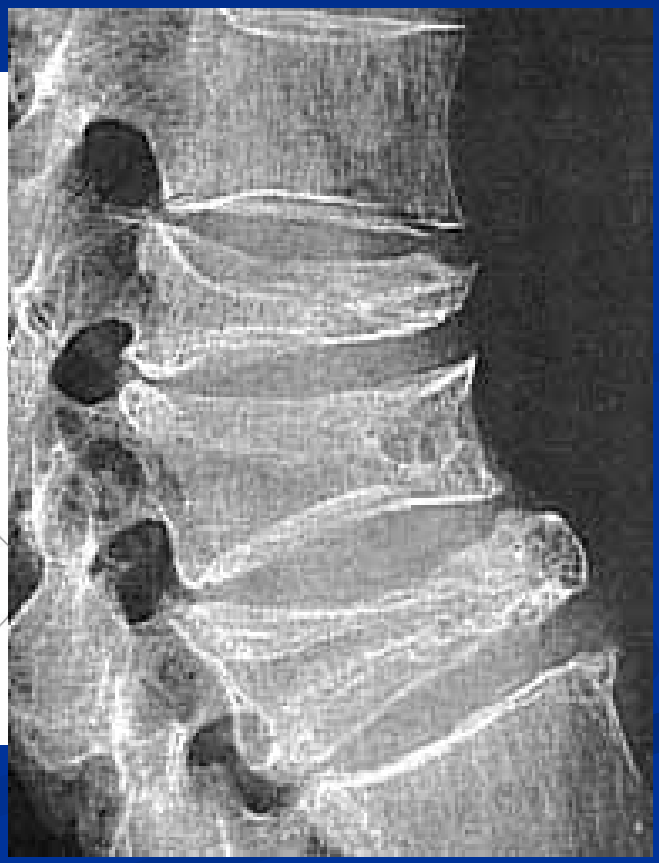
Postural kyphosis

Postural kyphosis is the most common type. It is often attributed to "slouching." It represents an exaggerated, but flexible, increase of the natural curve of the spine (usually at thoracic level). This usually becomes noticeable during adolescence. It is more common among girls than boys. It rarely causes pain. Exercises to strengthen the abdomen and stretch the hamstrings may help take away associated discomfort. But exercises probably won't result in significant correction of the postural kyphosis. This condition does not lead to problems in adult life.

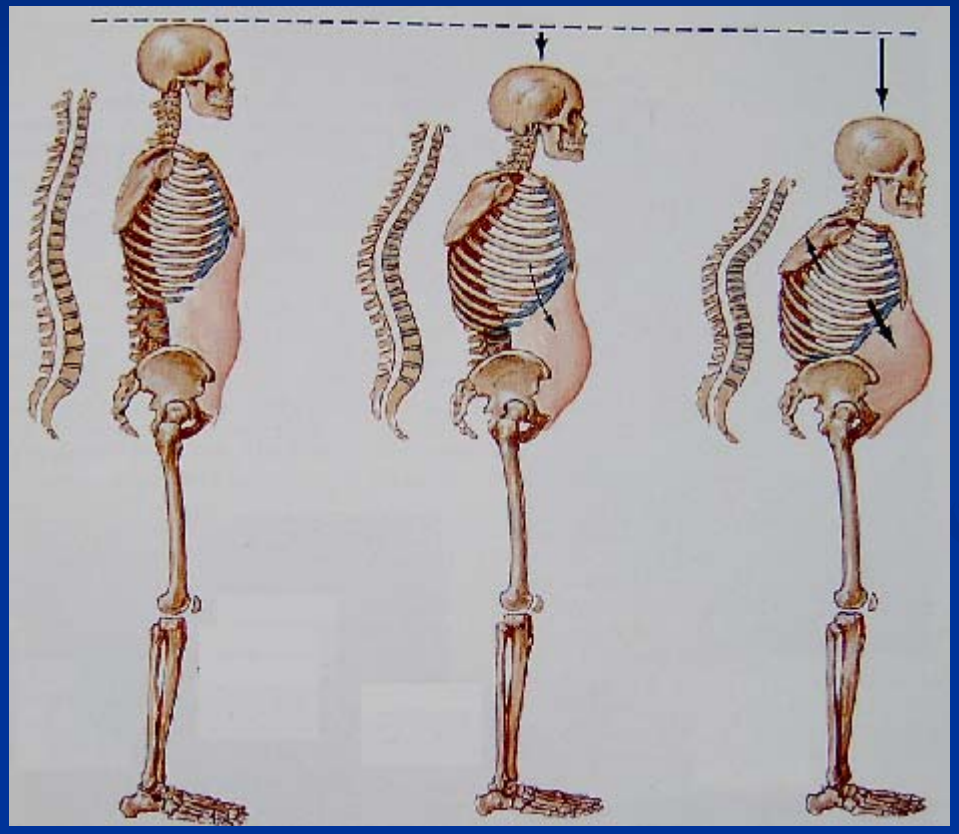
Trauma

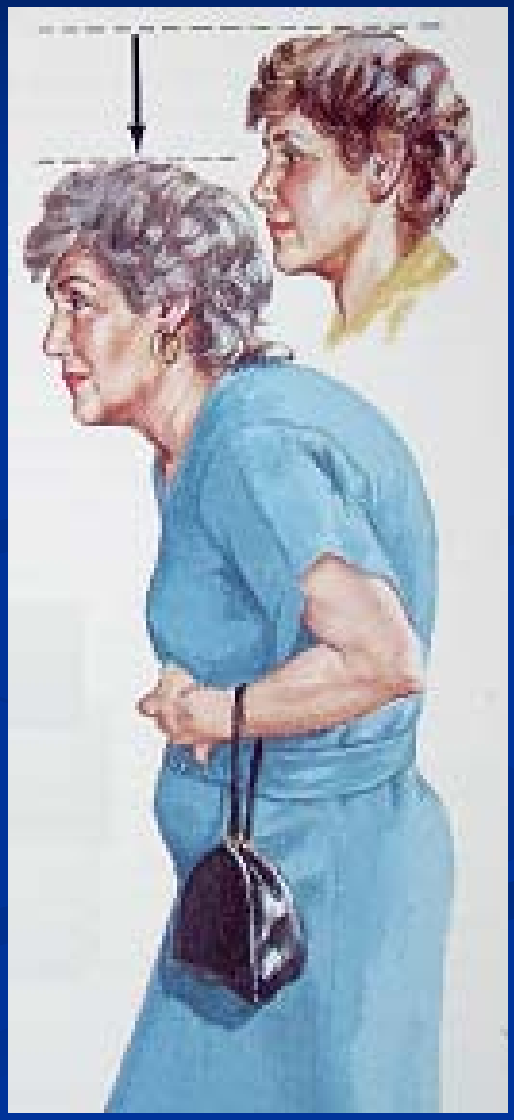




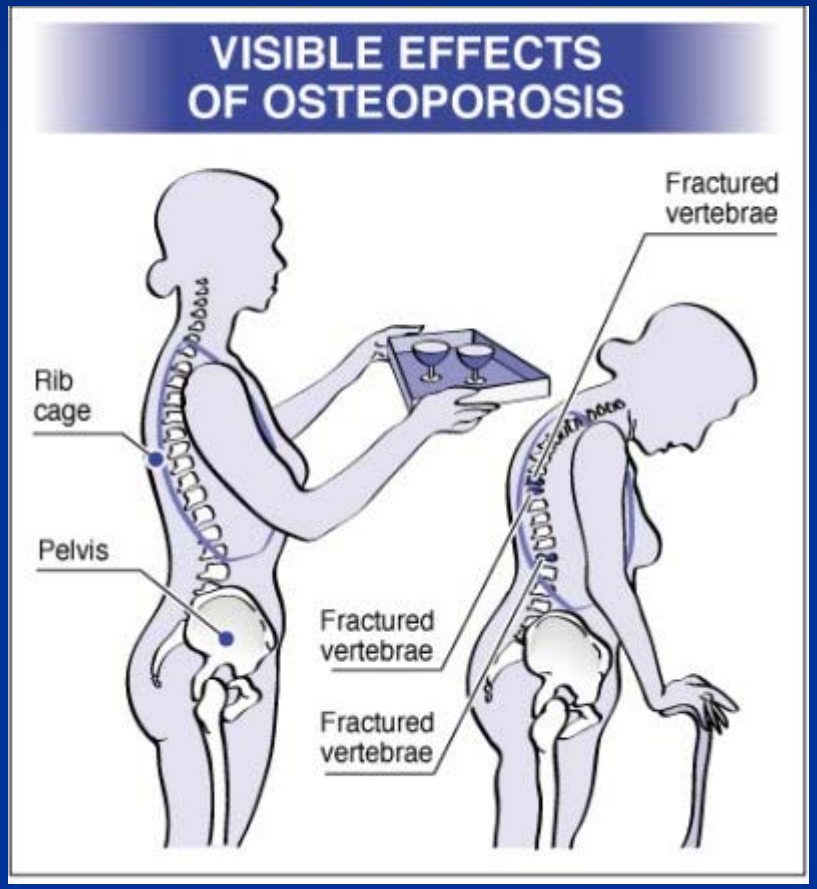


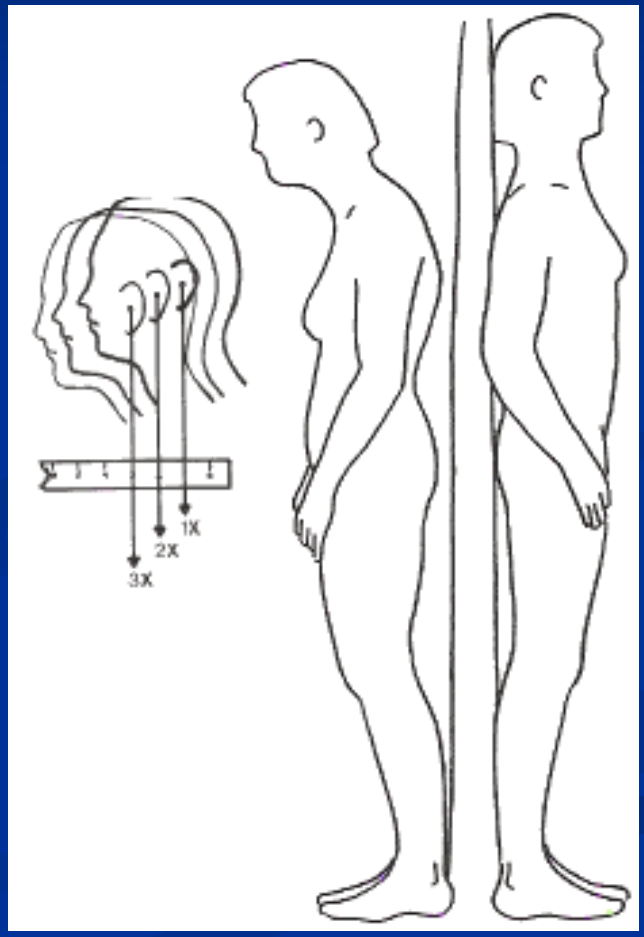
Osteoporosis





Osteoporosis

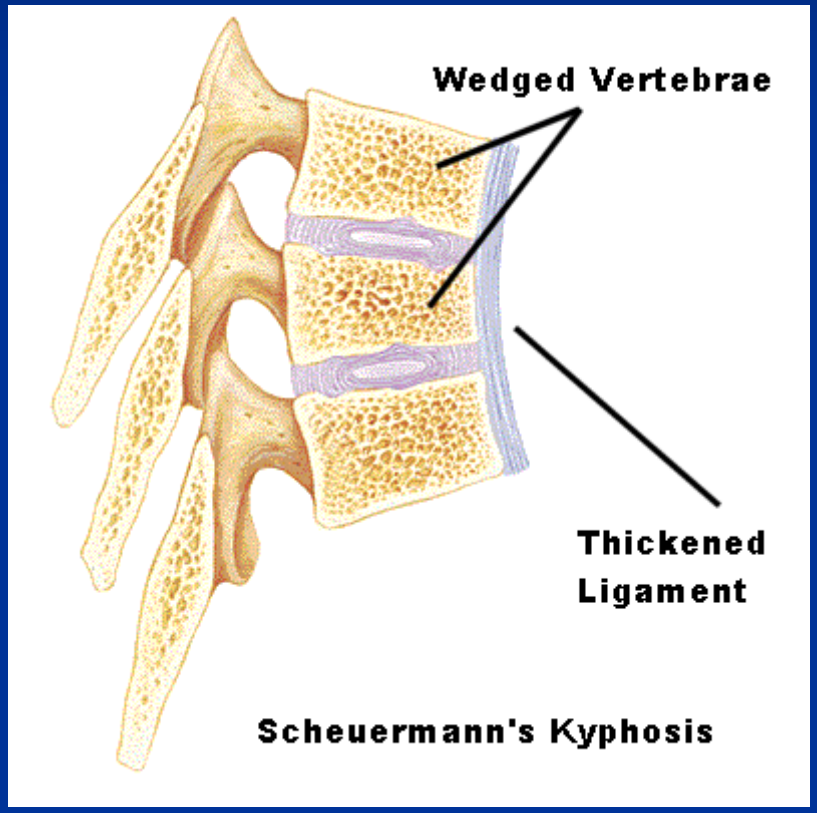


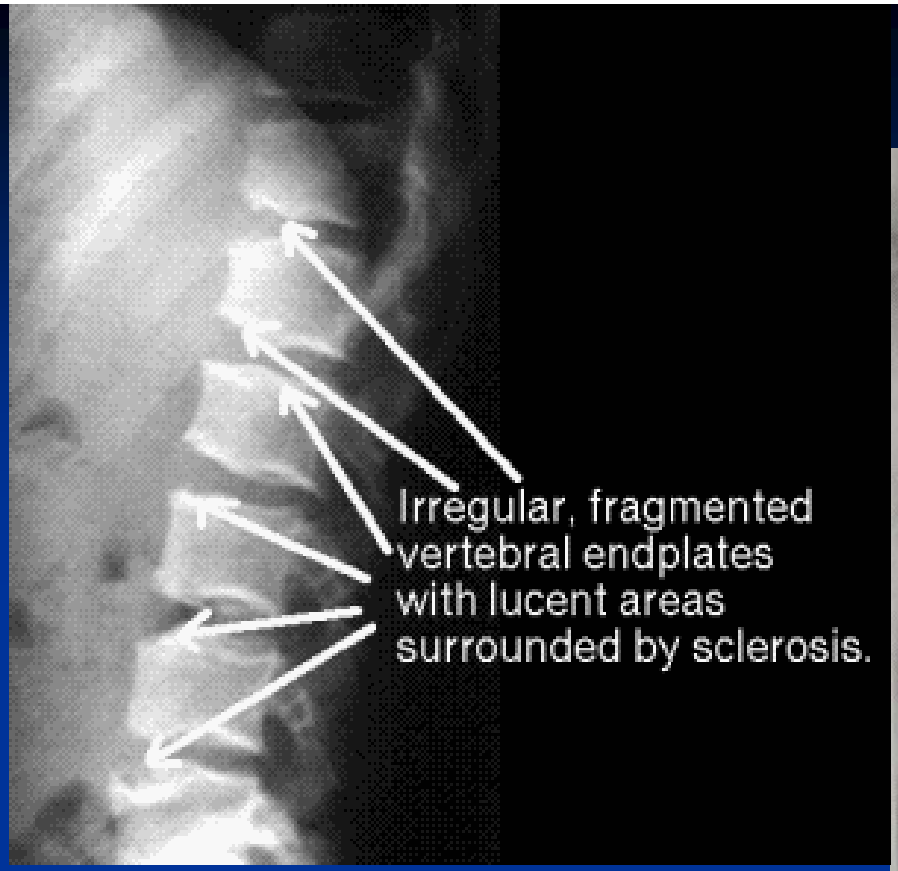


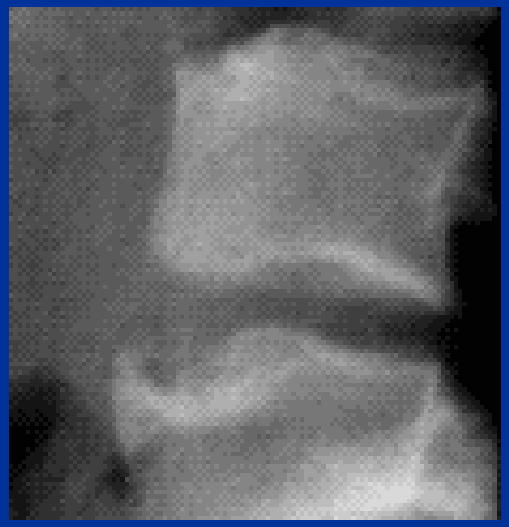
Scheuermann's kyphosis

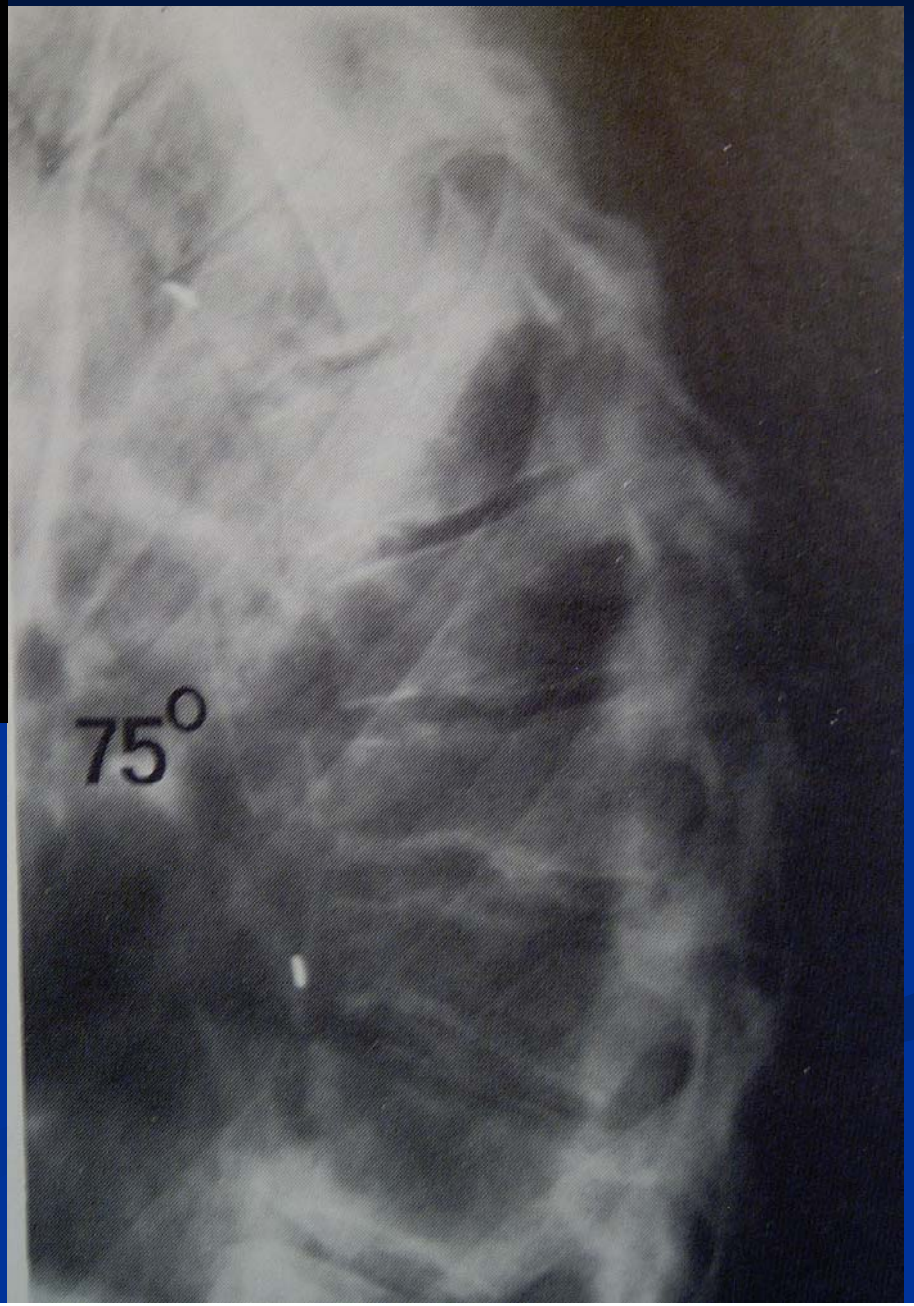
Scheuermann's (shoe-er-mans) kyphosis is named after the Danish radiologist who first described the condition. Like postural kyphosis, it often becomes apparent during the teen years. However, Scheuermann's kyphosis will present with a significantly worse cosmetic deformity. This is particularly the case in thin individuals. Scheuermann's kyphosis usually affects the upper (thoracic) spine. It can also occur in the lower (lumbar) back area. If pain is present, it is usually felt at the apex of the curve. Activity can aggravate the pain. So can long periods of standing or sitting. Exercises and anti-inflammatory medication help ease the discomfort. When X-rays are examined, the vertebrae and disks will appear normal in postural kyphosis. But they are irregular and wedge-shaped in Scheuermann's kyphosis.

Scheuermann's kyphosis



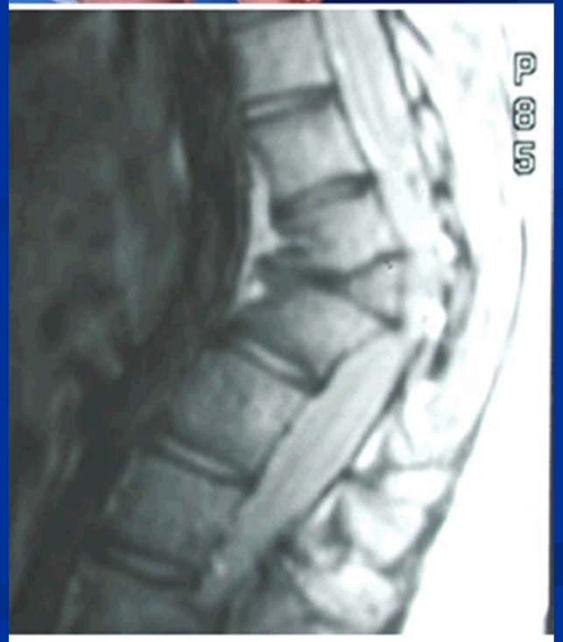

Irregular, fragmented
vertebral endplates
with lucent areas
surrounded by sclerosis.




75°

Congenital kyphosis

In some infants, the spinal column does not develop properly while the fetus is still in the womb. The bones may not form as they should. Several vertebrae may be fused together. Either of these abnormal situations may cause progressive kyphosis as the child grows. Surgical treatment may be needed at a very young age. This can maintain a more normal spinal curve. Consistent follow-up is required to monitor any changes.



This child has an abrupt congenital kyphosis located in the thoracic spine. The MRI shows a posteriorly-located mivertebra which is causing impingeme on the spinal cord.

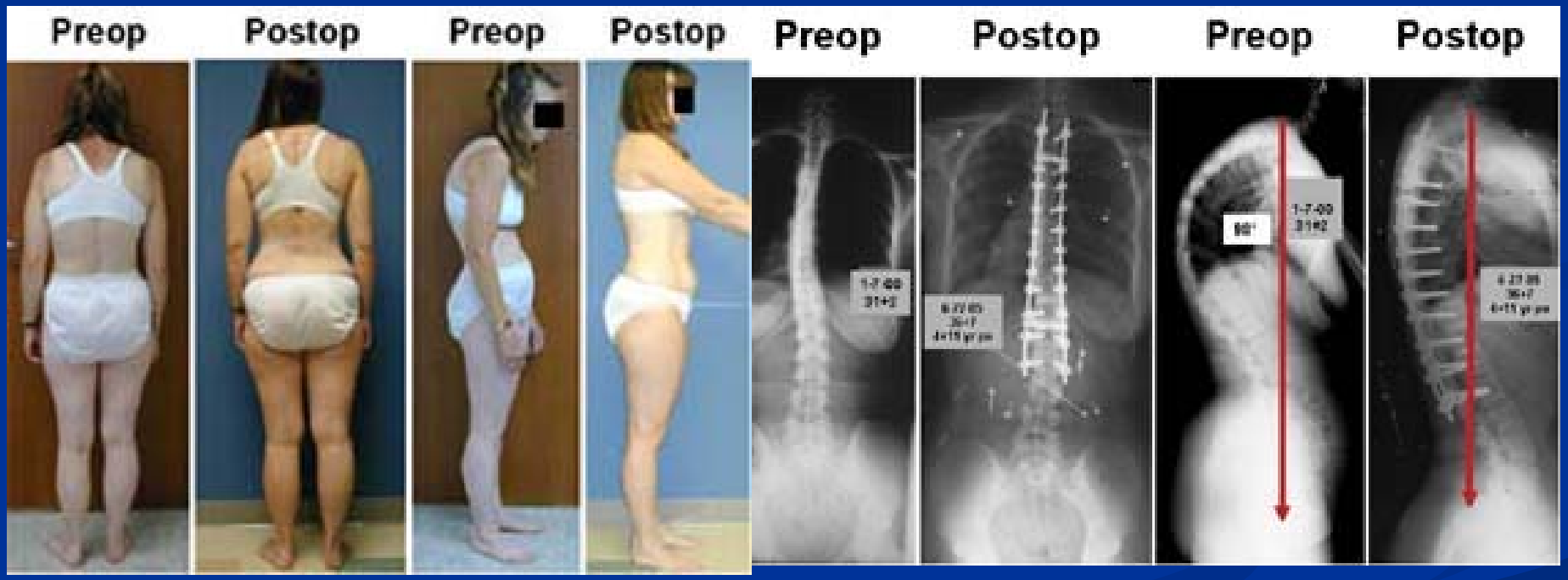
Treatment options

- Nothing - most teens with postural kyphosis will do well throughout life. In some, their posture may improve over time. An exercise program may help with back pain, if present.
- Brace - for patients with Scheuermann's kyphosis. If the child is still growing, the doctor may prescribe a brace. The child wears the brace until skeletal maturity is reached.
- Surgical - surgery may be recommended if the kyphotic curve exceeds 75 degrees.

Treatment options

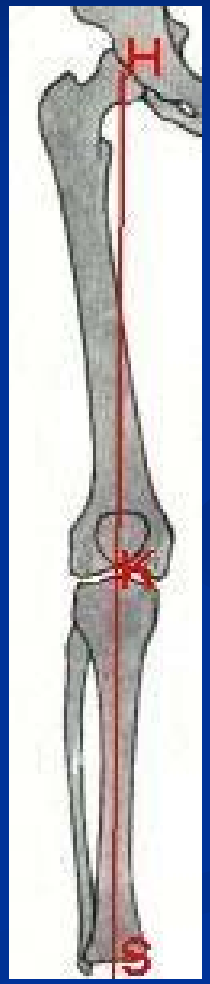
Brace - for patients with Scheuermann's kyphosis.

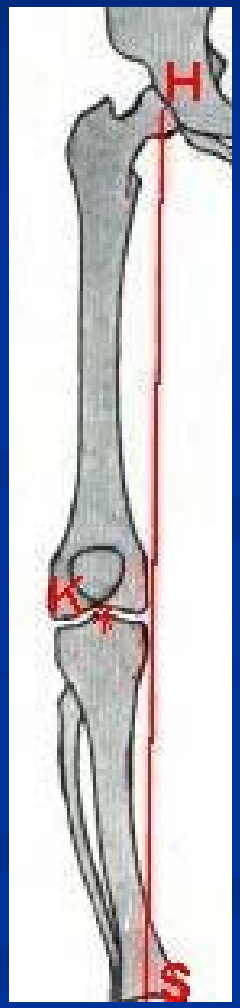
Treatment options



Genu varum

- Childhood
  - Physiological
  - Blounts Disease
  - OI
  - Rickets
  - Septical arthritis
  - Rheumatoid arthritis
  - Trauma
  - Surgery
- Adult

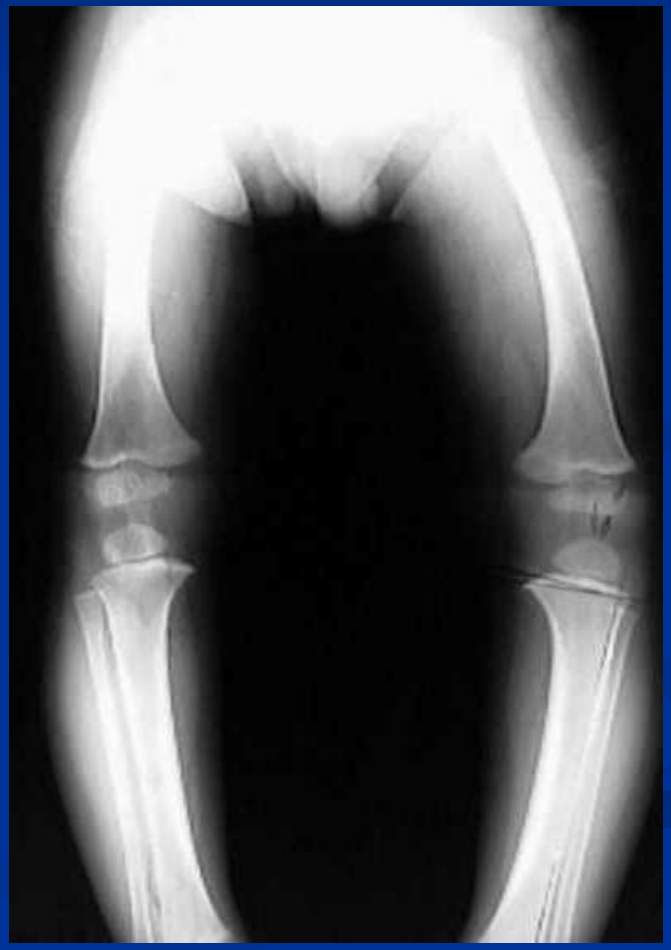




Pediatric genu varum

Most commonly presents at 14 to 36-months. It is usually associated with tibial torsion. It can be spontaneously corrected between 24 – 36 months of age.

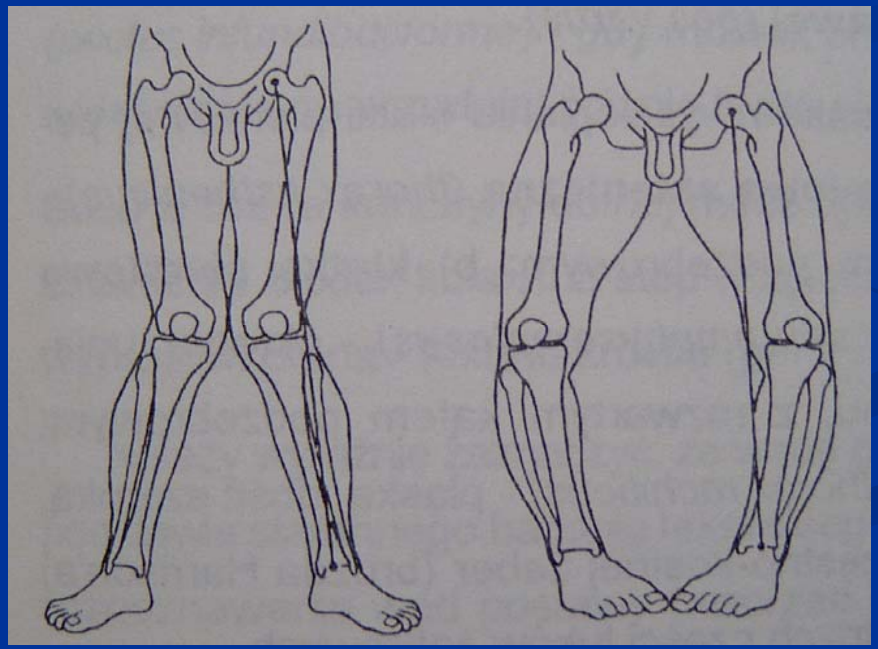
Excessive genu varum (over 15 degree) can be treated with serial casting.



Pediatric genu varum

Developmental knee alignment:

- normal knee alignment progresses from 10-15 deg of varus at birth to maximal valgus angulation of 10-15 deg at age of 3-3.5 yrs;
- neutral alignment:
  - neutral femoral-tibial alignment occurs at 12-14 months old;



Pediatric genu varum - exam

- hold the child's ankle together and measure the distance between the knees;
- knee motion and ligamentous instability are also assessed;
- in older child w/ untreated infantile tibia vara, mild laxity of LCL is common, but 14-36 mo. old child w/ this condition usually has ligamentous stability that is within normal limits;

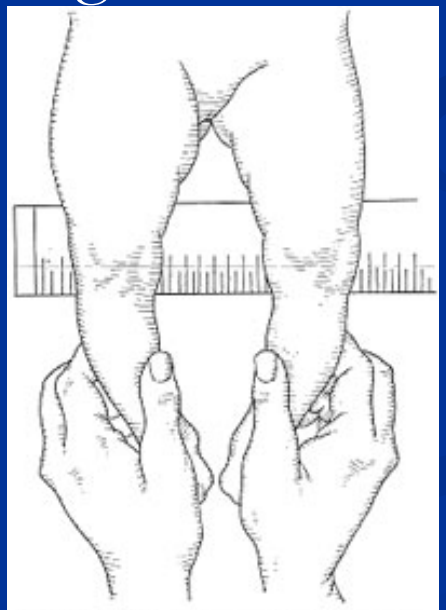


FIGURE 2 - Clinical measurement of genu varum.

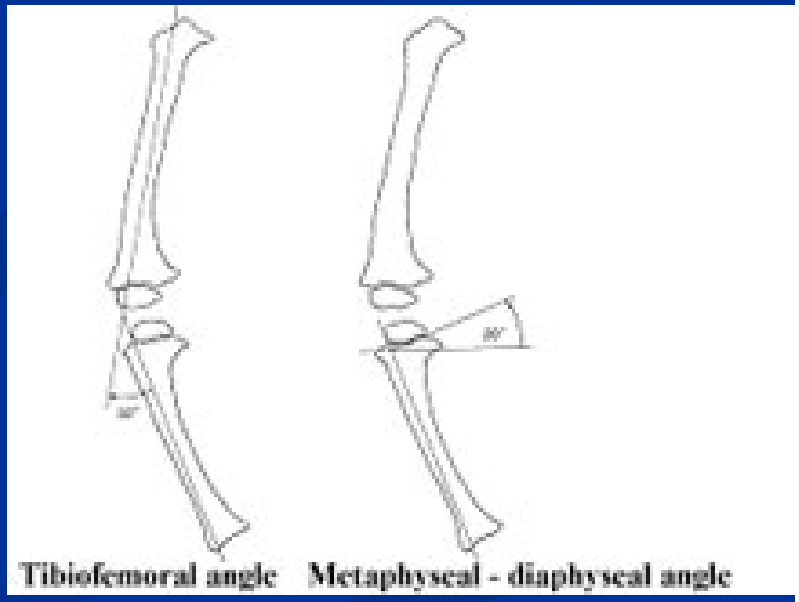
Pediatric genu varum

- **Radiographs:**

- physiologic bowing typically show flaring and bowing of tibia and femur in a symmetric fashion and is normal in children < 2 years of age (maximal at about 18 mo);

- physiologic genu valgum, or knock knees, develops next, w/ maximal deformity occurring at 3 years of age;

- gradual correction to ultimate alignment of slight genu valgum occurs by 9 years of age in the great majority of patients;

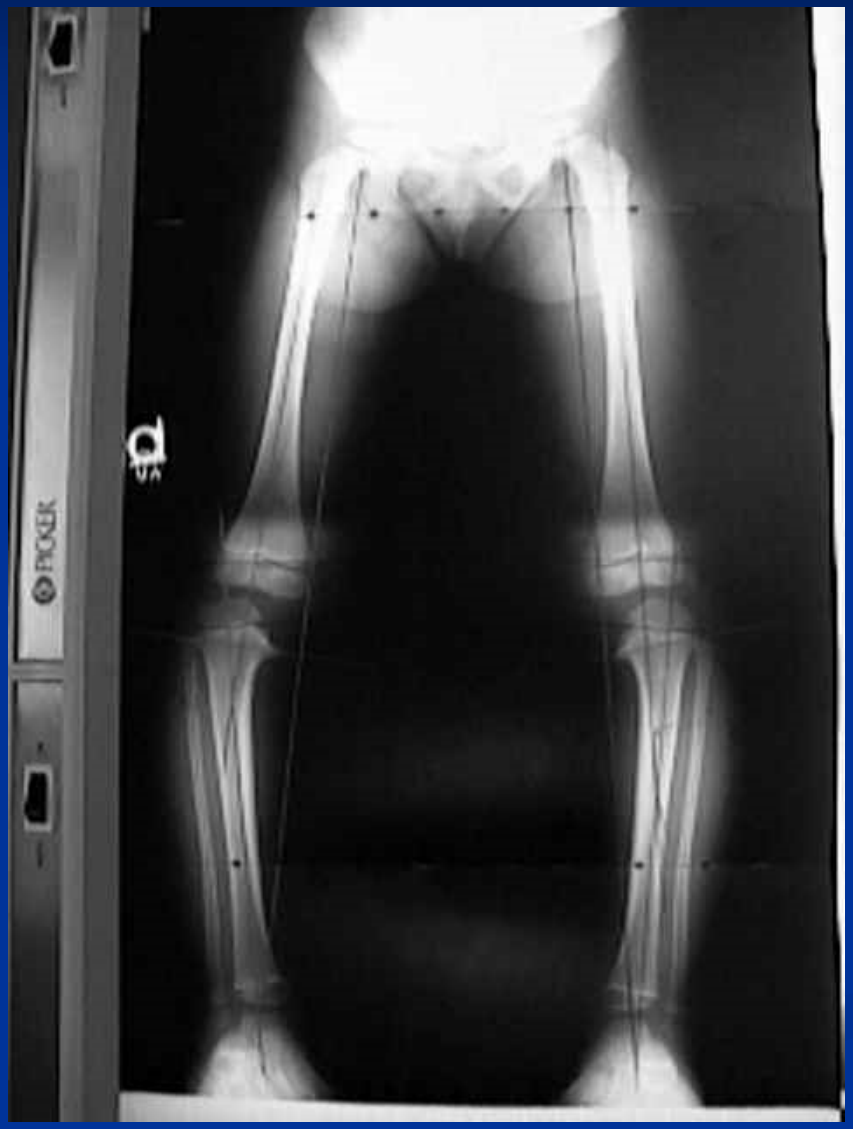


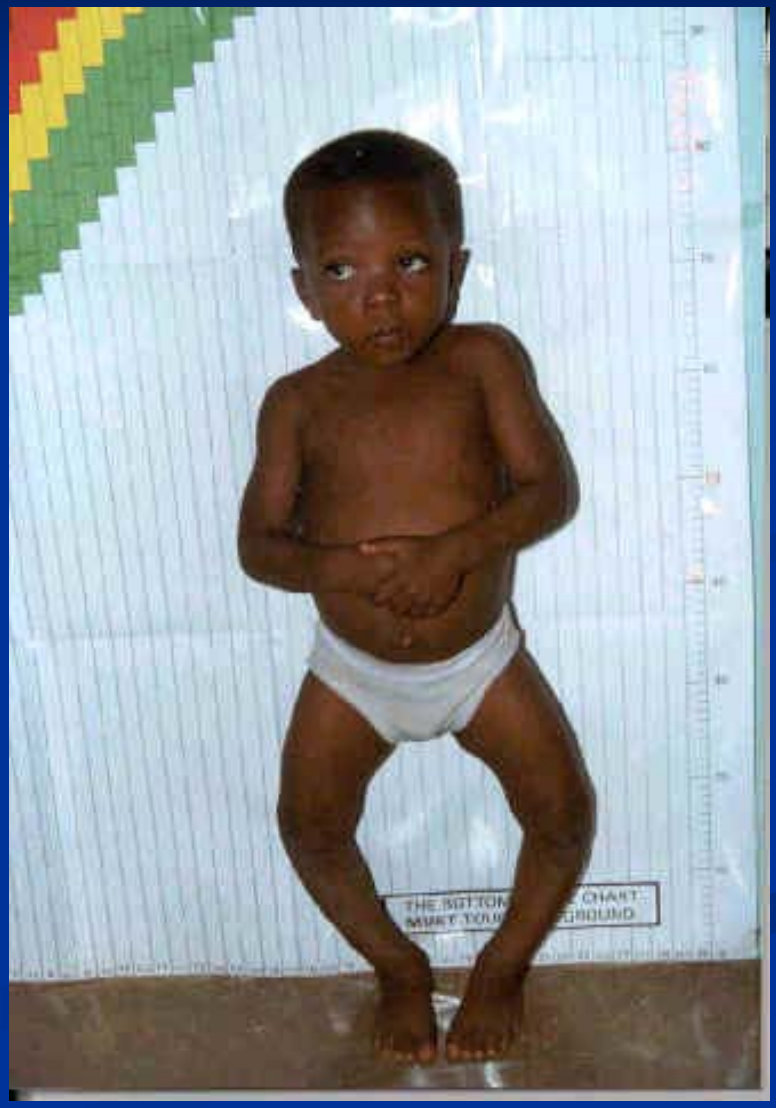
Tibiofemoral angle Metaphyseal - diaphyseal angle

Infantile Blounts Disease

- **Infantile Blounts Disease:** (pathologic tibia vara)
  - most common form of disease;
  - growth disorder of medial portion of proximal tibial physis;
  - characterized by medial angulation& internal rotation of proximal tibia;
  - etiology is related to repetitive trauma to posteromedial proximal tibia physis from ambulating on a knee with varus alignment;
  - infantile tibia vara is seen between 2-4 years of age;
  - usually bilateral;
  - associated with internal tibial torsion;
  - children w/ tibia vara are usually in upper percentiles of weight (for age)& began walking early;

Infantile Blounts Disease

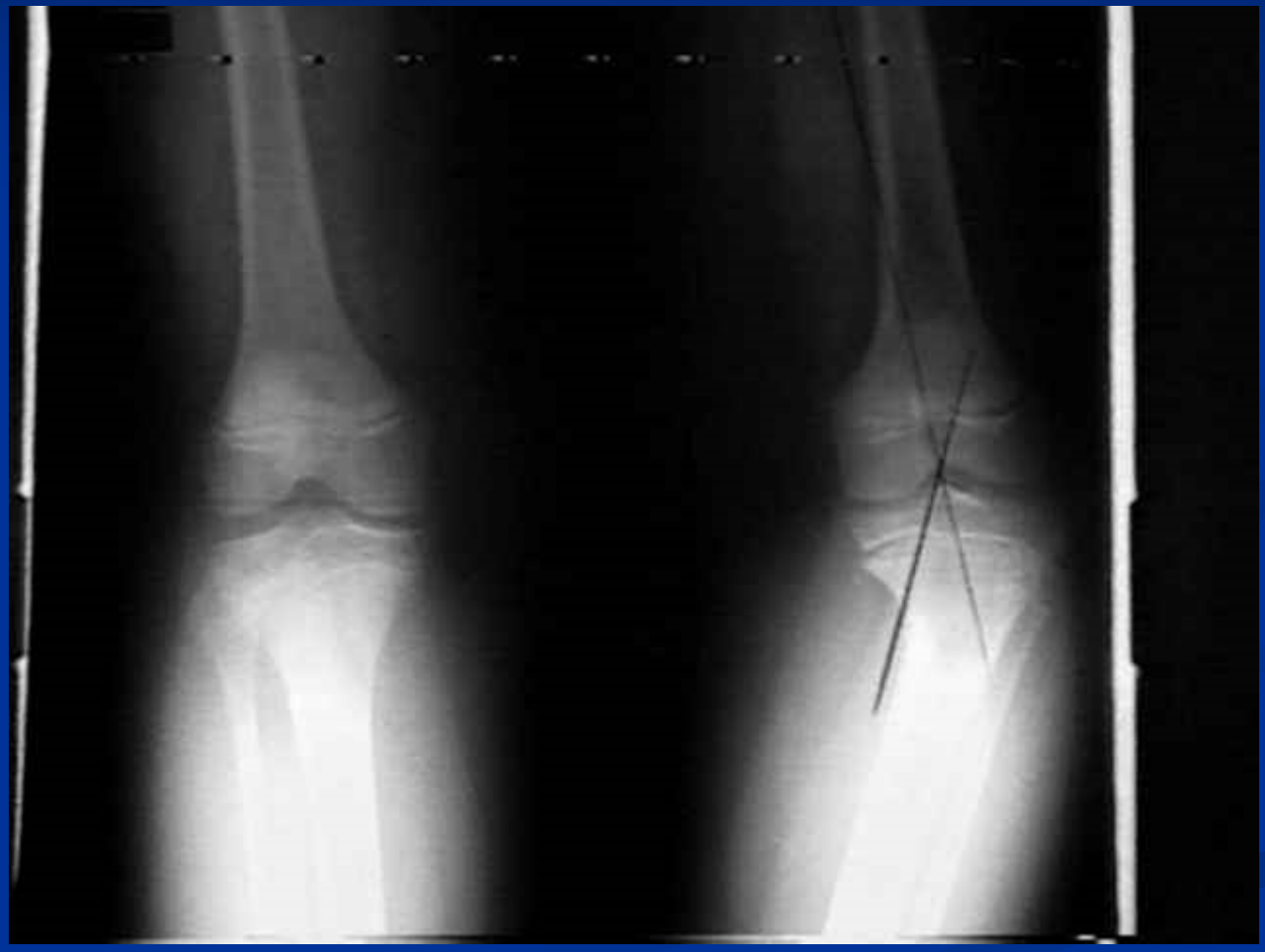




Adolescent tibia vara

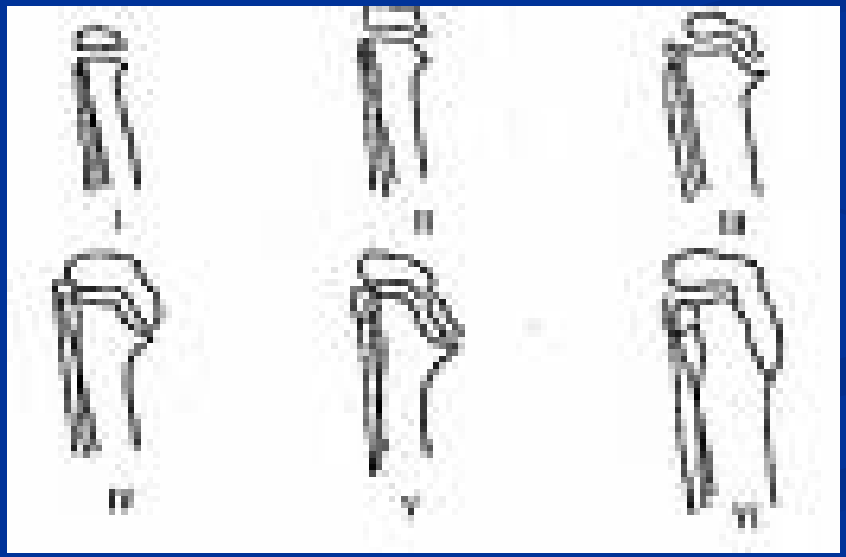
- Adolescent tibia vara (Blount's disease),
  - results from disordered growth of proximal medial physis & metaphysis;
  - localized varus deformity, often accompanied by medial tibial torsion;
  - caused by osteochondrosis resulting from mechanical stress converting physiologic bowlegs to tibia vara;
  - risk factors: common in blacks & obese children;
  - adolescent Blount's is less severe and predominately unilateral;

Adolescent tibia vara



Langenskiöld classified

- Langenskiöld classified tibia vara into 6 progressive stages relative to the degree of metaphyseal-epiphyseal changes as observed on radiograph. These stages are used to refer to the infantile form of Blount disease. Severity is based on the Langenskiöld stage and the age of the child



Blounts Disease

- **Medical therapy:**

  Treatment depends on the age of the child and the severity of the varus deformity. Treatment can be categorized into operative and nonoperative.

Blounts Disease – treatment

- Observation or a trial of bracing is used most frequently for children aged 2-5 years. However, progressive deformity usually requires osteotomy. No recommendation for operative treatment has been made for children younger than 2 years because the existing deformity may be an exaggerated physiologic genu varum.
- In a child older than 2 years, orthotic treatment can be used when the deformity is increasing or if the child has a tibiofemoral angle greater than 15°. Ambulatory daytime bracing may favorably alter the natural history of patients with tibia vara who are younger than 3 years and who have Langenskiöld stage I or II deformity because the deformity is often reversible at these stages

Blounts Disease – treatment

- If the deformity persists or increases to stage III or IV with daytime brace treatment, osteotomy is required. If possible, it is preferable to perform the osteotomy before the child is aged 4 years to prevent recurrence. If deformity is severe, Langenskiöld stage V or VI, operative correction is essential. Orthotic devices are ineffective in controlling the varus deformity in adolescents, and the treatment is surgical.

Coxa vara

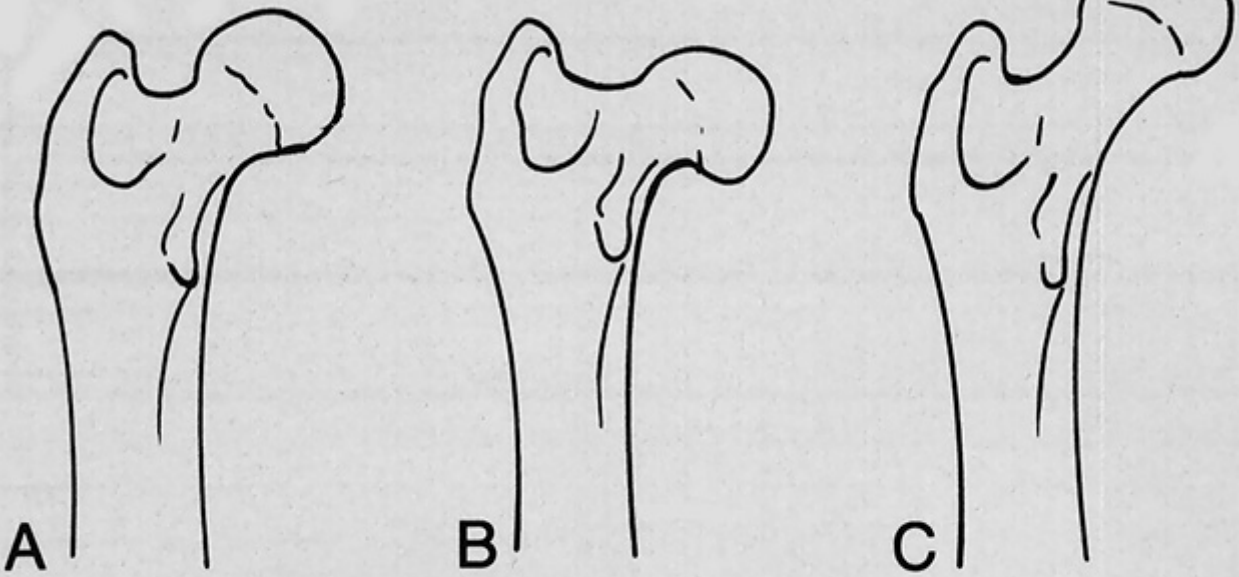


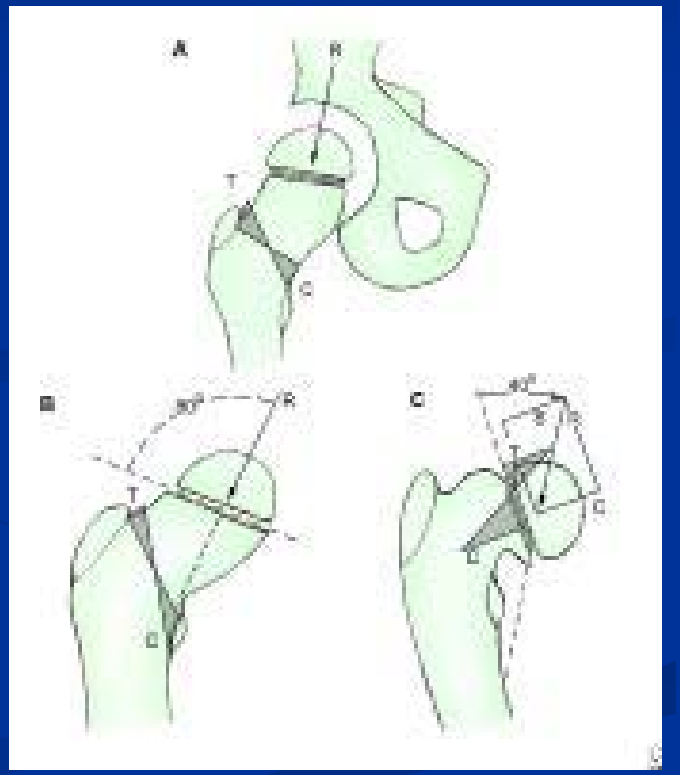
FIG. 29-1 Line drawings demonstrate normal femoral neck-shaft angle (*A*), coxa vara (*B*), and coxa valga (*C*).

Coxa vara

- Coxa vara, by definition, includes all forms of decrease of the femoral neck shaft angle to less than 120-135°.
- Etiology:
  - congenital,
  - acquired,
  - developmental

Coxa vara

Congenital coxa vara (CCV) is present at birth. It is commonly associated with a significant limb length discrepancy, segmental shortening of the femur, or other abnormalities of the bony femur. Associated diagnoses include proximal femoral focal deficiency (PFFD), congenital short femur, and congenital bowed femur.



Coxa vara

- Acquired forms of coxa vara are varus deformities of the proximal femur that develop secondary to metabolic, neoplastic, or traumatic conditions. This group includes ricketic coxa vara, fibrous dysplasia, proximal physeal injury, and premature closure. Also included in this category are secondary varus changes due to generalized skeletal conditions or dysplasias such as Morquio disease, cleidocranial dysostosis, metaphyseal diaphyseal dysplasia, and metaphyseal dysostosis.

Coxa vara

- The exact cause of CCV remains unknown. Many hypotheses have been proposed, including that mechanical intrauterine stresses affect hip development, avascular necrosis involves selected areas of the proximal femoral physis/head and neck, and metabolic abnormalities cause deficient production of, or a delay in, the normal ossification process of the proximal end of the femur.
- Abnormal development of the proximal femoral cartilaginous physis and defective ossification of the adjacent metaphysis are responsible for the progressive decrease of the neck shaft angle.

Coxa vara – clinic

- A tabletop examination may reveal weak abductors, a prominent greater trochanter, decreased abduction due to a decreased articulo-trochanteric distance, and coxa vara. A decrease in internal rotation also is often noted due to decreased femoral anteversion or true retroversion associated with this condition.
- Patients with CCV usually present with gait abnormalities. Affected children generally present between the time they begin ambulation and age 6 years.

Coxa vara – clinic

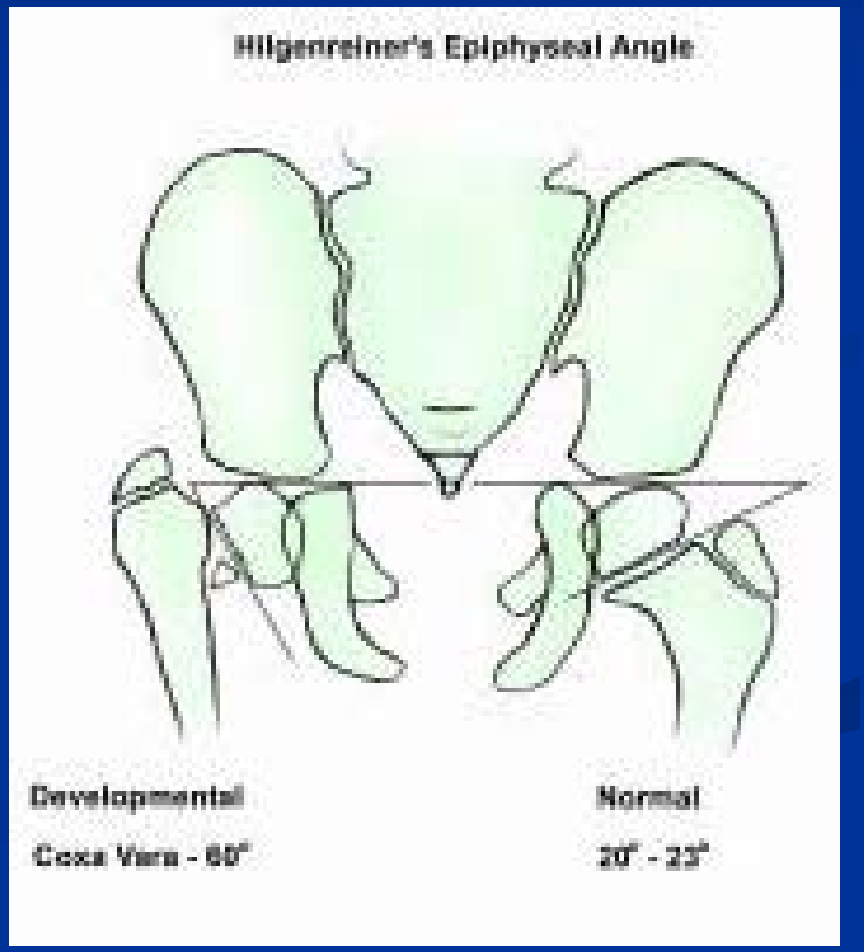
- The gait abnormality is progressive and pain free. Unilateral involvement with an associated relative limb length discrepancy and Trendelenburg limp may be noted. This discrepancy in limb lengths usually is mild and ranges from 1.5-4.0 cm. Patients with bilateral involvement commonly present with a waddling gait abnormality, similar to that of patients with bilateral DDH. The Trendelenburg sign is commonly elicited in the affected hip or hips.

Coxa vara – x-ray classification

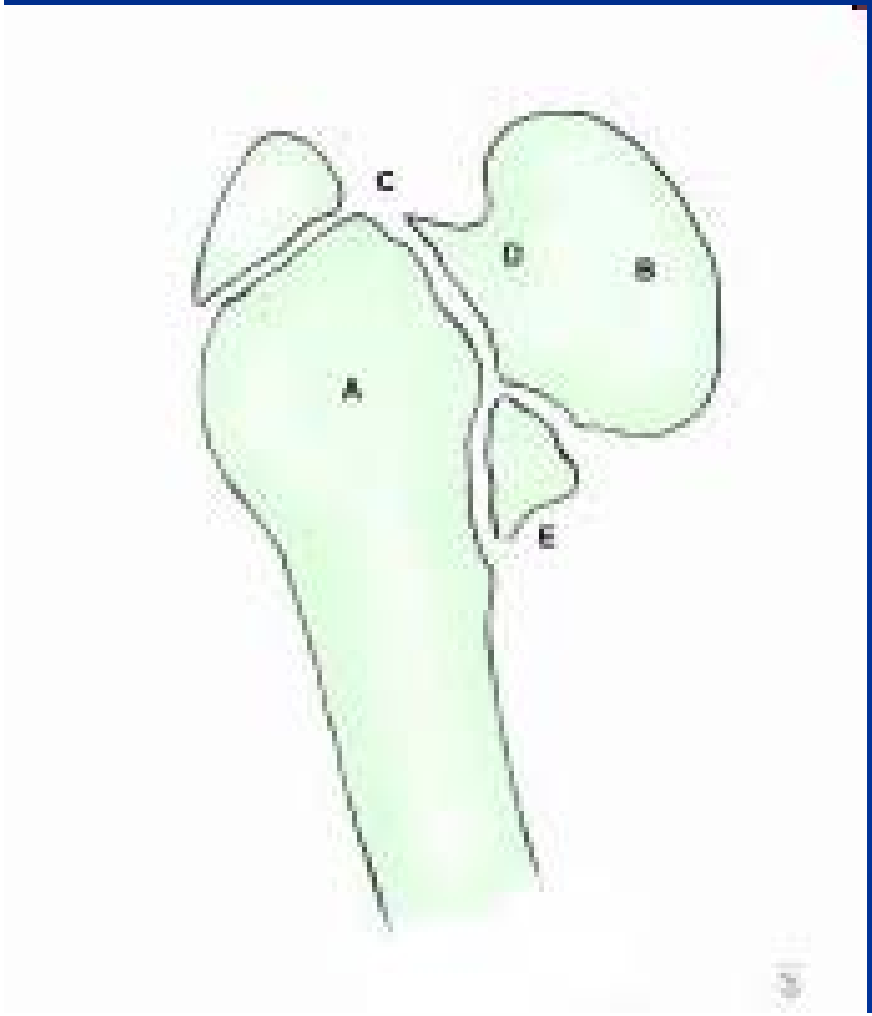
-femoral neck shaft angle to less than 120-135°

-the Hilgenreiner epiphyseal angle (the angle subtended by the horizontal Hilgenreiner line through the triradiate cartilages and an oblique line through the proximal femoral capital physes)

-the mean value to maturity is 23°, with a wide variation of 4-35°



Coxa vara – x-ray classification



Characteristic radiographic findings of congenital coxa vara. (a) decreased neck-shaft angle. (b) smaller and flatter femoral head. (c) more vertical orientation of physeal plate. (d) coxa brevis. (e) abnormal bony fragment inferolateral to physeal plate and contained in inverted Y-shaped lucency.

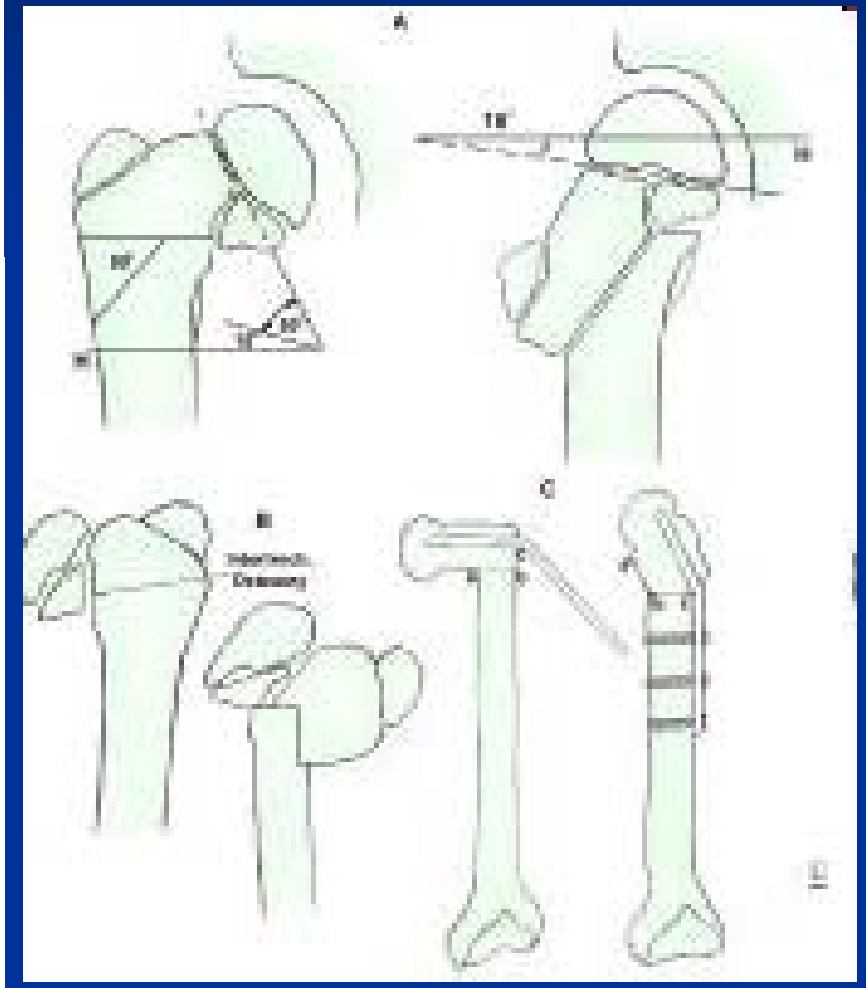
Coxa vara – indication for treatment

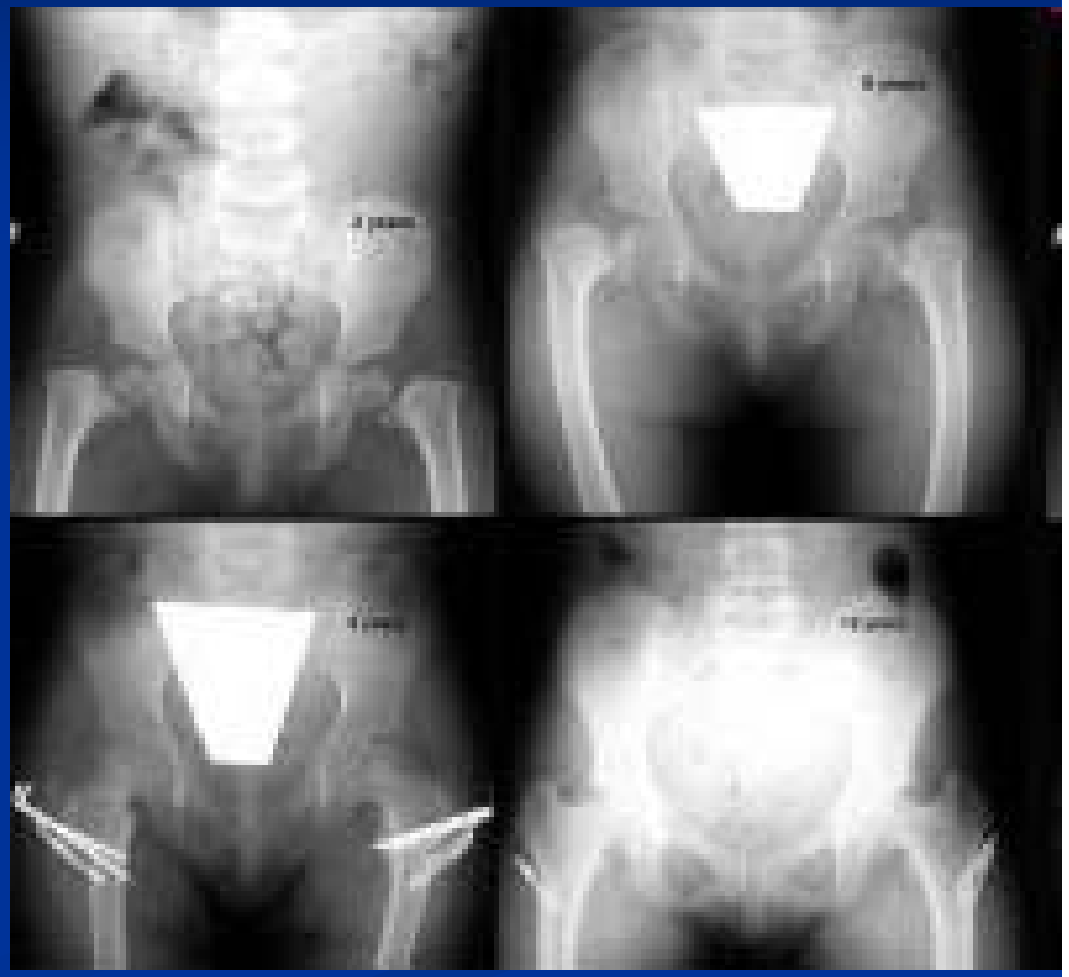
- A child with a clinical limp and an HEA of more than 60°
- A child with a clinical limp and an HEA of 45-60° with documented progression of varus deformity
- Untreated CCV leading to pain and a loss of hip function with the development of premature degenerative changes

Coxa vara – treatment

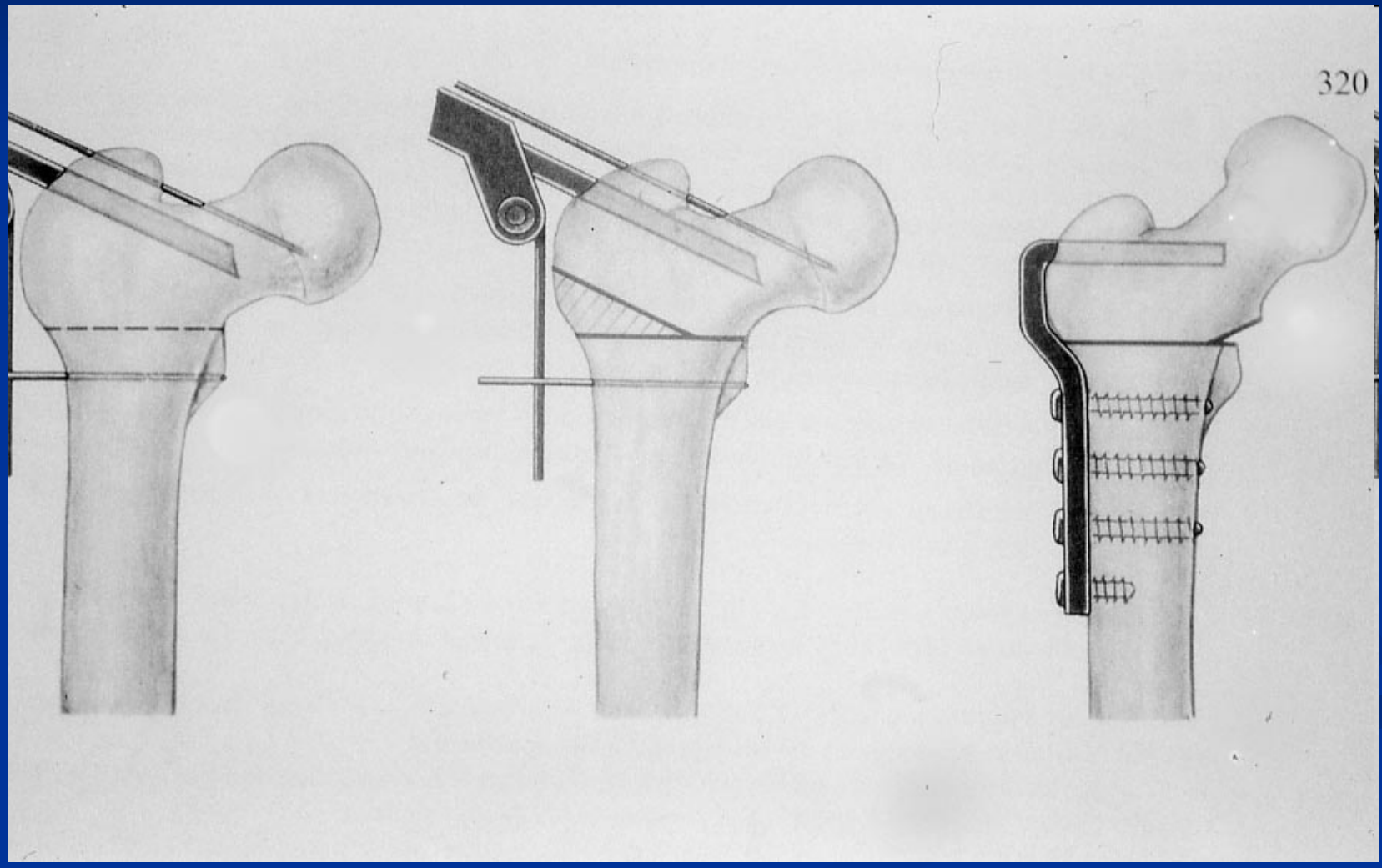
- No place for conservative treatment
- The goals of surgical intervention are as follows:
  - Correction of the neck shaft angle to a more physiologic level and HEA to less than 35-40°
  - Correction of femoral anteversion (or retroversion) to more normal values
  - Ossification and healing of the defective inferomedial femoral neck fragment
  - Reconstitution of the abductor mechanism through replacement of its normal length-tension relationship

Coxa vara – treatment

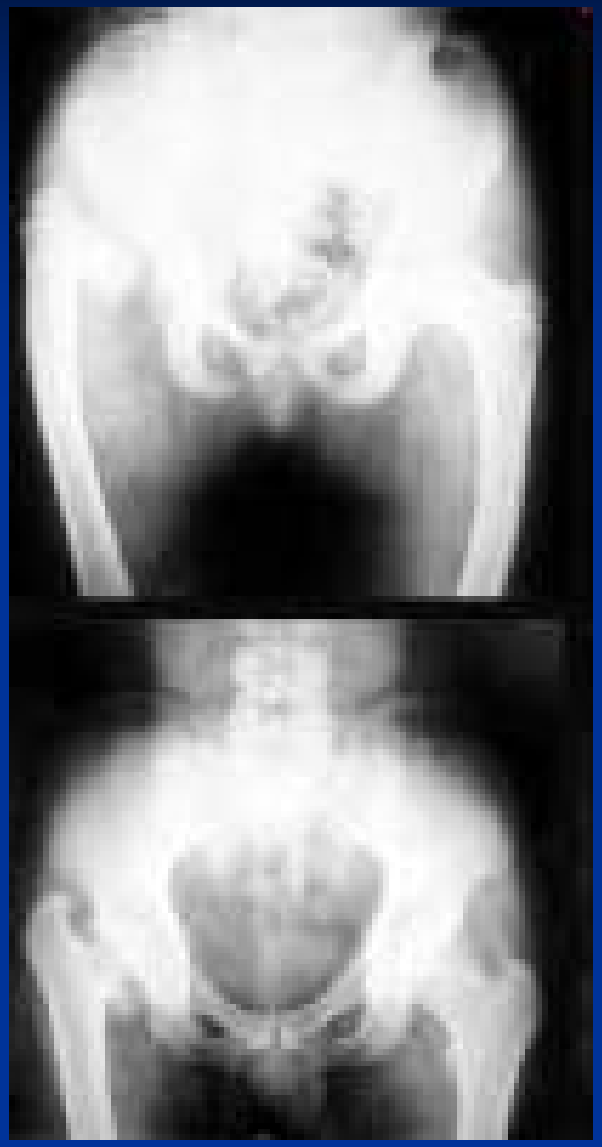


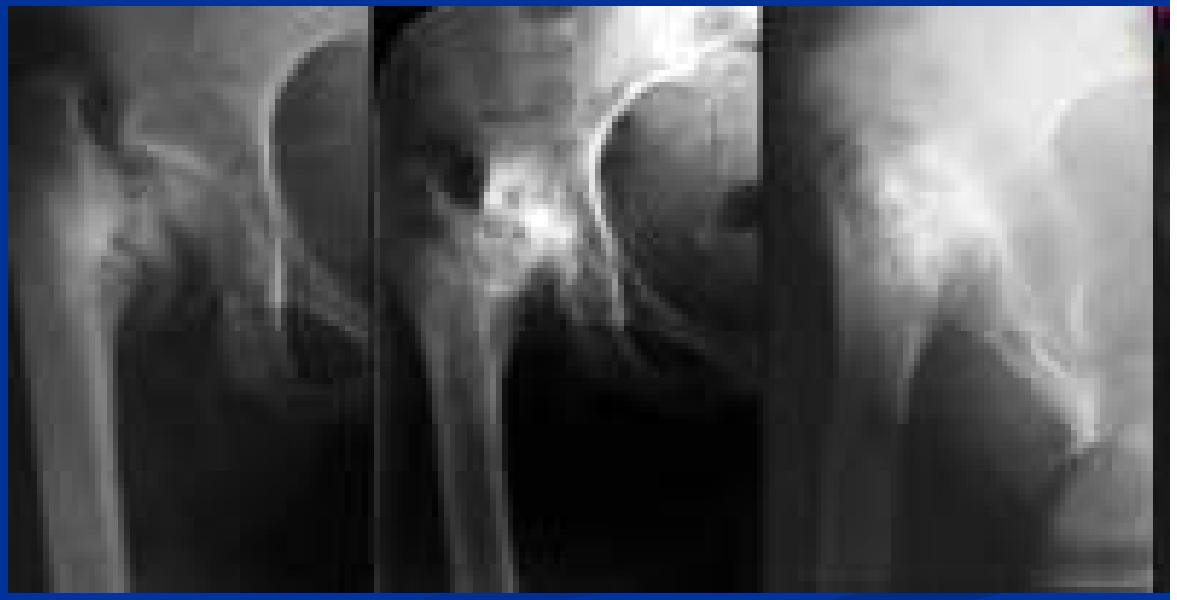


Coxa vara – treatment

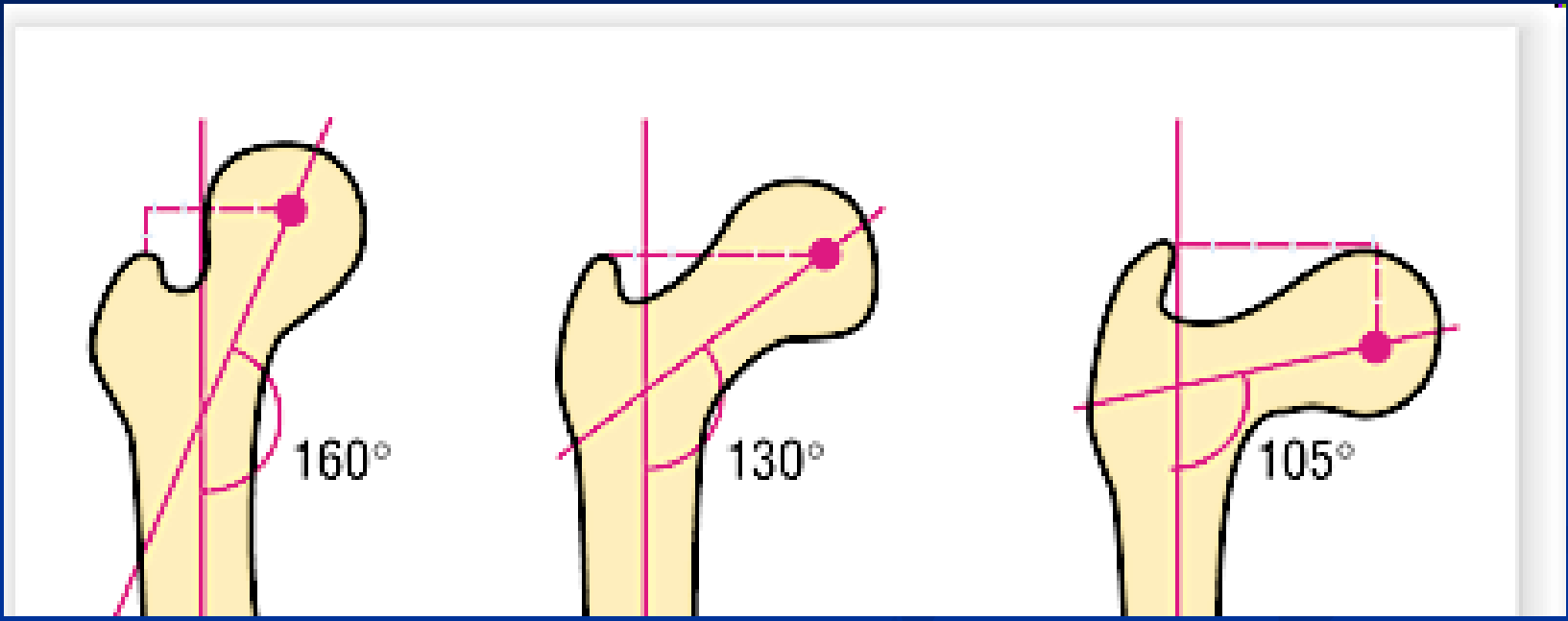


Coxa vara – natural history





Coxa valga

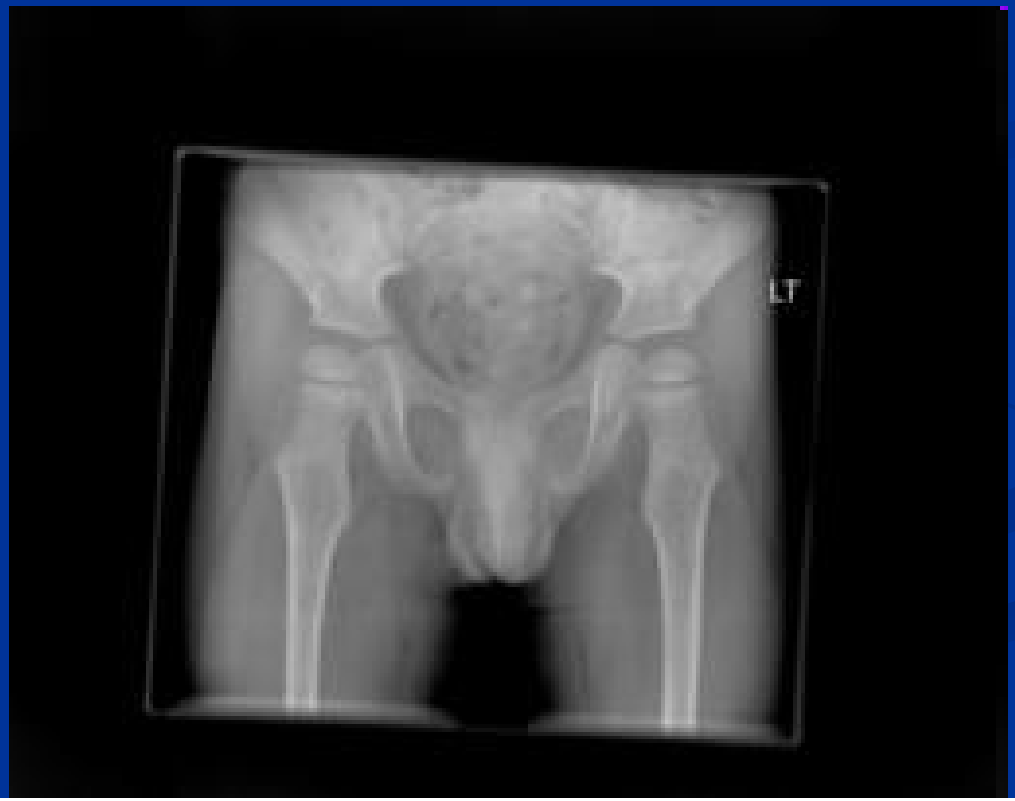


valga **normal** **vara**

It is important that the radiograph is taken with the patient correctly positioned with the leg held in a neutral position and the patellae facing forward as external rotation of the leg will increase and internal rotation will decrease the projected neck-shaft angle.

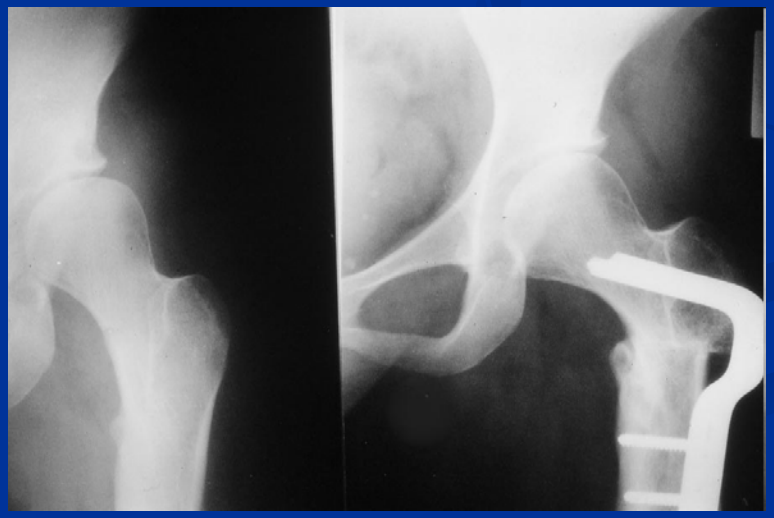
Coxa valga

Hip deformity caused by an increased angle between the femoral neck and shaft (greater than 140), as measured on an anteroposterior

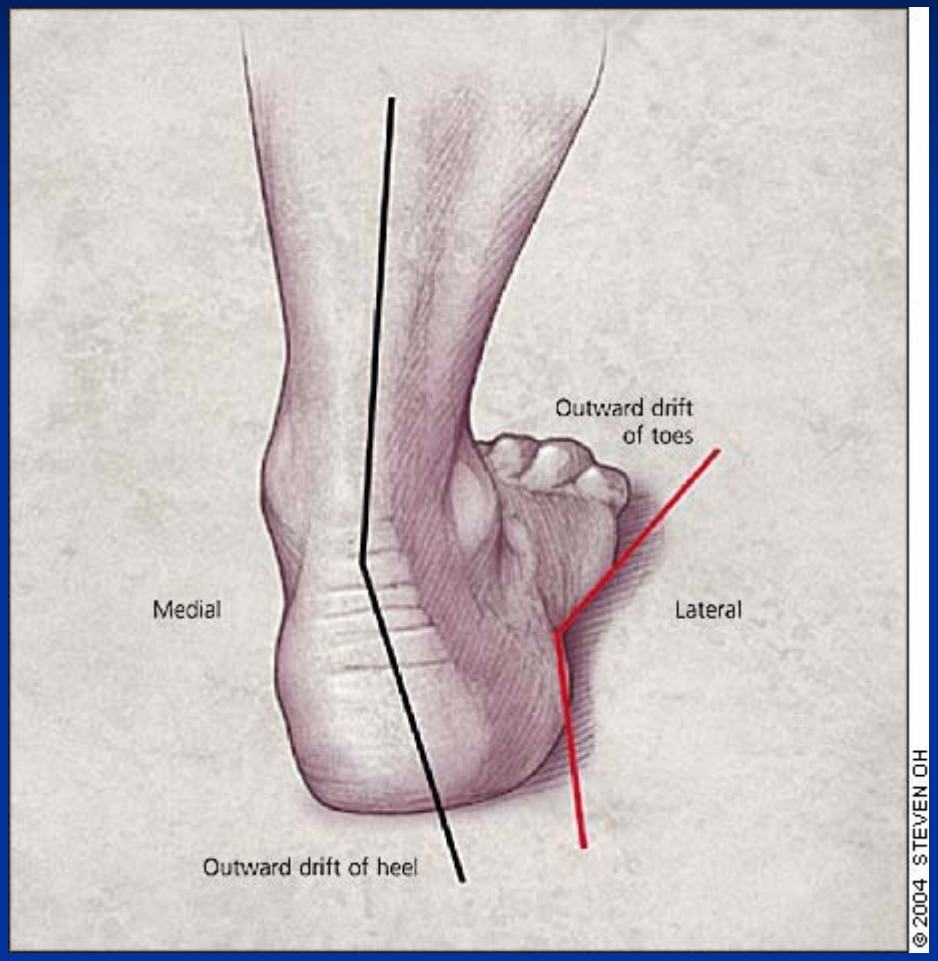


Coxa valga

Coxa valga reflects persistence of the normal neonatal alignment of the proximal femur and usually results from weakness of the abductor muscles and lack of normal weight-bearing forces. It is most commonly associated with neuromuscular disorders such as cerebral palsy, spinal dysraphism and poliomyelitis but is also seen in some skeletal dysplasias and juvenile idiopathic arthritis. If coxa valga is severe there may be associated lateral subluxation or even dislocation of the femoral head.



Pes planus, pes plano-valgus



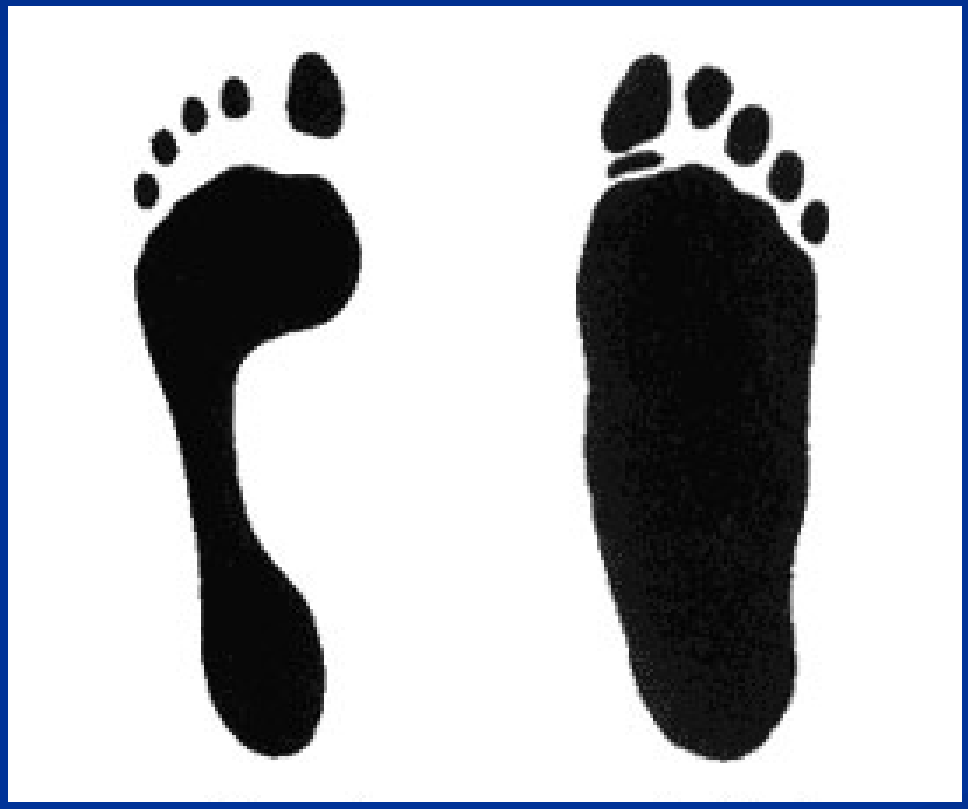
Pes Planus simply means, flat feet. There are many reasons for this condition, the first of which is heredity.

Blacks, Native Americans, Swedish, Northern Italians, Black Forest Germans and others have a natural tendency to be flat footed.

Posterior view of foot posture in patients with pes planus.

Pes planus, pes plano-valgus – definition

Foot print



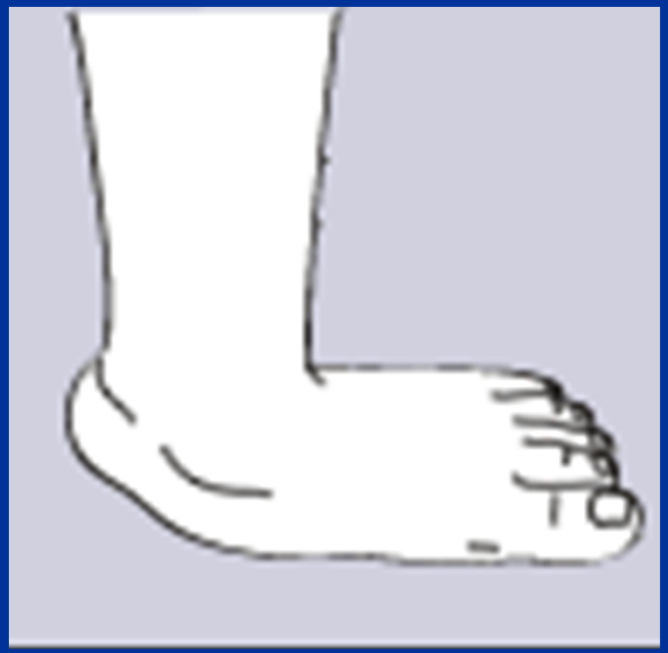
Normal Planus

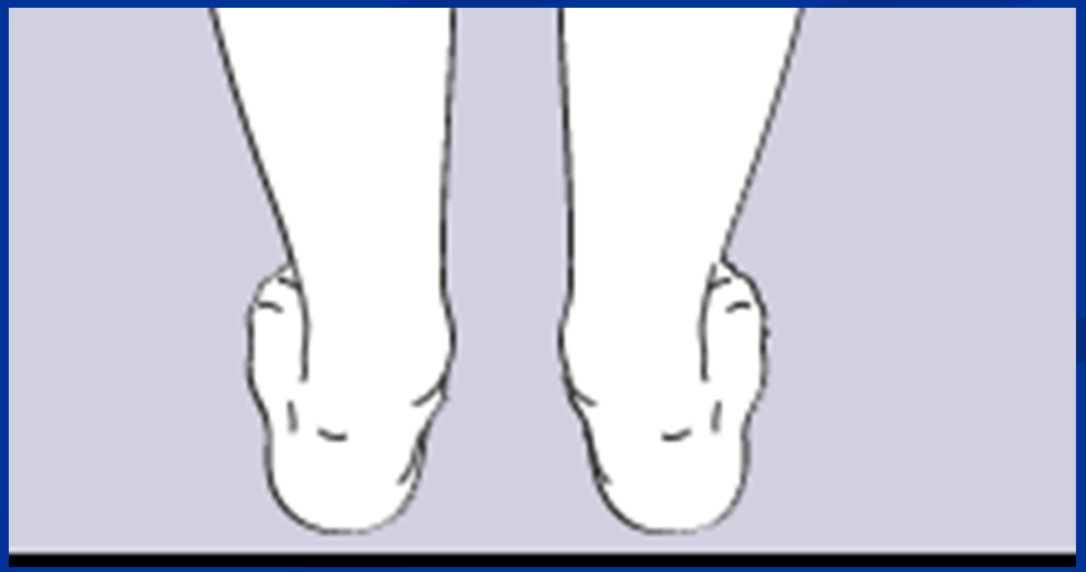
Pes planus is a condition where the arch or instep of the foot collapses and comes in contact with the ground.

In some individuals, this arch never develops.

Pes planus, pes plano-valgus

- Feet have a moderate arch which spreads the weight of the body evenly over many bones and joints. Some children have feet with a lower arch (known as *pes planus*)





Pes planus, pes plano-valgus - cause

- Flat feet are a common condition. In infants and toddlers, the longitudinal arch is not developed and flat feet are normal. The arch develops in childhood, and by adulthood, most people have developed normal arches.
- When flat feet persist, the majority are considered variations of normal. Most feet are flexible and an arch appears when the person stands on his or her toes. Stiff, inflexible, or painful flat feet may be associated with other conditions and require attention.
- Painful flat feet in children are often caused by a condition called tarsal coalition. In tarsal coalition, two or more of the bones in the foot fuse together limiting motion and often leading to a flat foot.

Pes planus, pes plano-valgus

- **Symptoms**

  - absence of longitudinal arch of foot when standing
  - foot pain
  - heel tilts away from the midline of the body more than usual

Pes planus, pes plano-valgus

- **Signs and Tests**

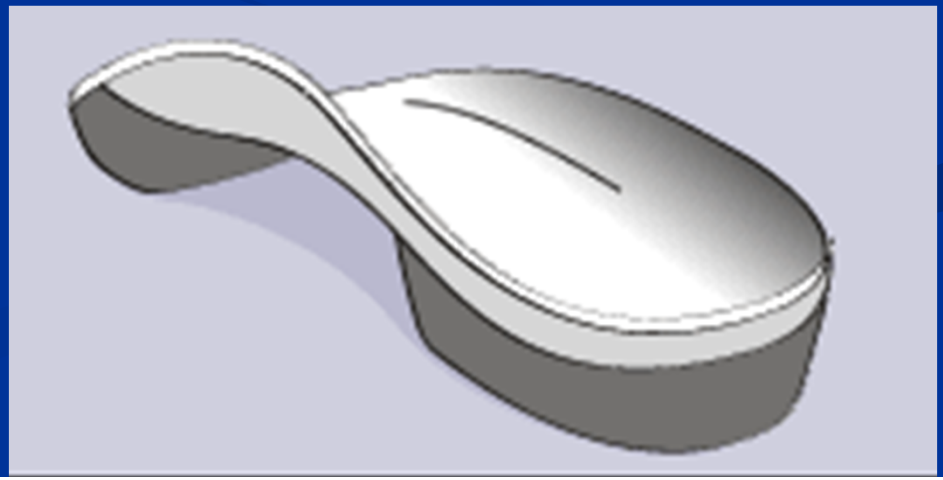
  Examination of the foot is sufficient for the physician to make the diagnosis of flat foot. However, the underlying cause must be determined. If an arch develops when the patient stands on their toes, then the flat foot is called flexible and no treatment or further work-up is necessary.

  If there is pain associated with the foot or if the arch does not develop with toe-standing, X-rays are necessary. If a tarsal coalition is suspected, a CT scan is often ordered. If a posterior tibial tendon injury is suspected, your doctor may recommend an MRI.

Pes planus, pes plano-valgus

Treatment

Flexible flat feet that are painless do not require treatment. If pain due to flexible flat feet occurs, an orthotic (arch supporting insert in the shoe) can bring relief. With the increased interest in running, many shoe stores carry shoes for normal feet and pronated feet. The shoes designed for pronated feet make long distance running easier and less tiring as they correct for the positional abnormality.



Pes planus, pes plano-valgus

- Traetment

  Rigid or painful flat feet require the evaluation. The exact treatment depends on the cause of the flat feet. For tarsal coalition, treatment starts with rest and possibly casting.

  If this fails to improve the pain, surgery may be necessary to either resect the fused bone or actually completely fuse several bones in a corrected position. For problems with the posterior tibial tendon, treatment may start with rest, anti-inflammatory medications, and shoe inserts or ankle braces.

Pes planus, pes plano-valgus

- **Complications**
  Flat feet are not really associated with any complications except pain. Some causes of flat feet can be successfully treated without surgery if caught early, but occasionally, surgery is the last option to relieve pain.

  While usually successful, surgery sometimes does not result in satisfactory results for all patients. Some have persistant pain and other possible surgical complications include infection and failure of fused bones to heal.