Management of Coronal Plane angulations around knee

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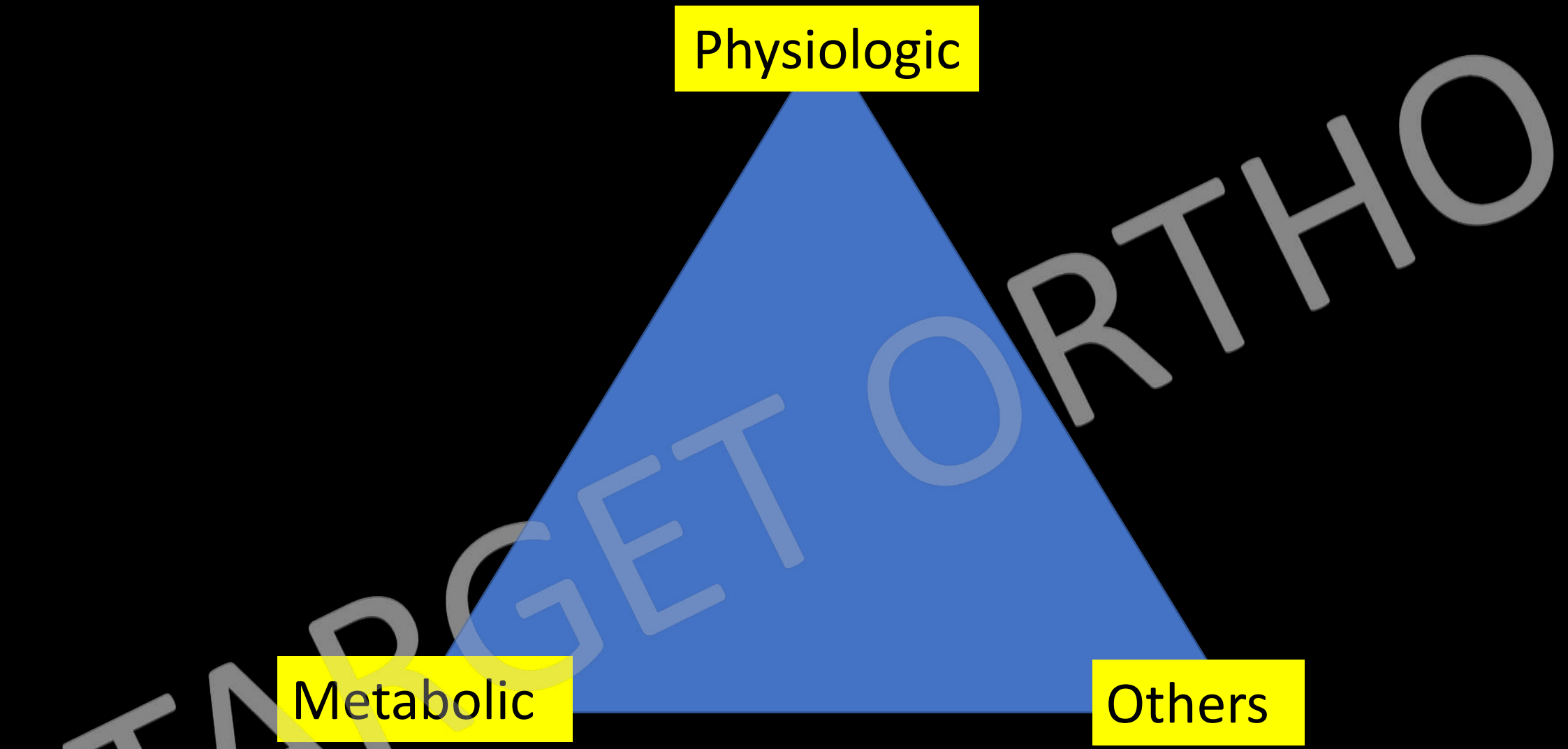
Coronal Plane Angulations

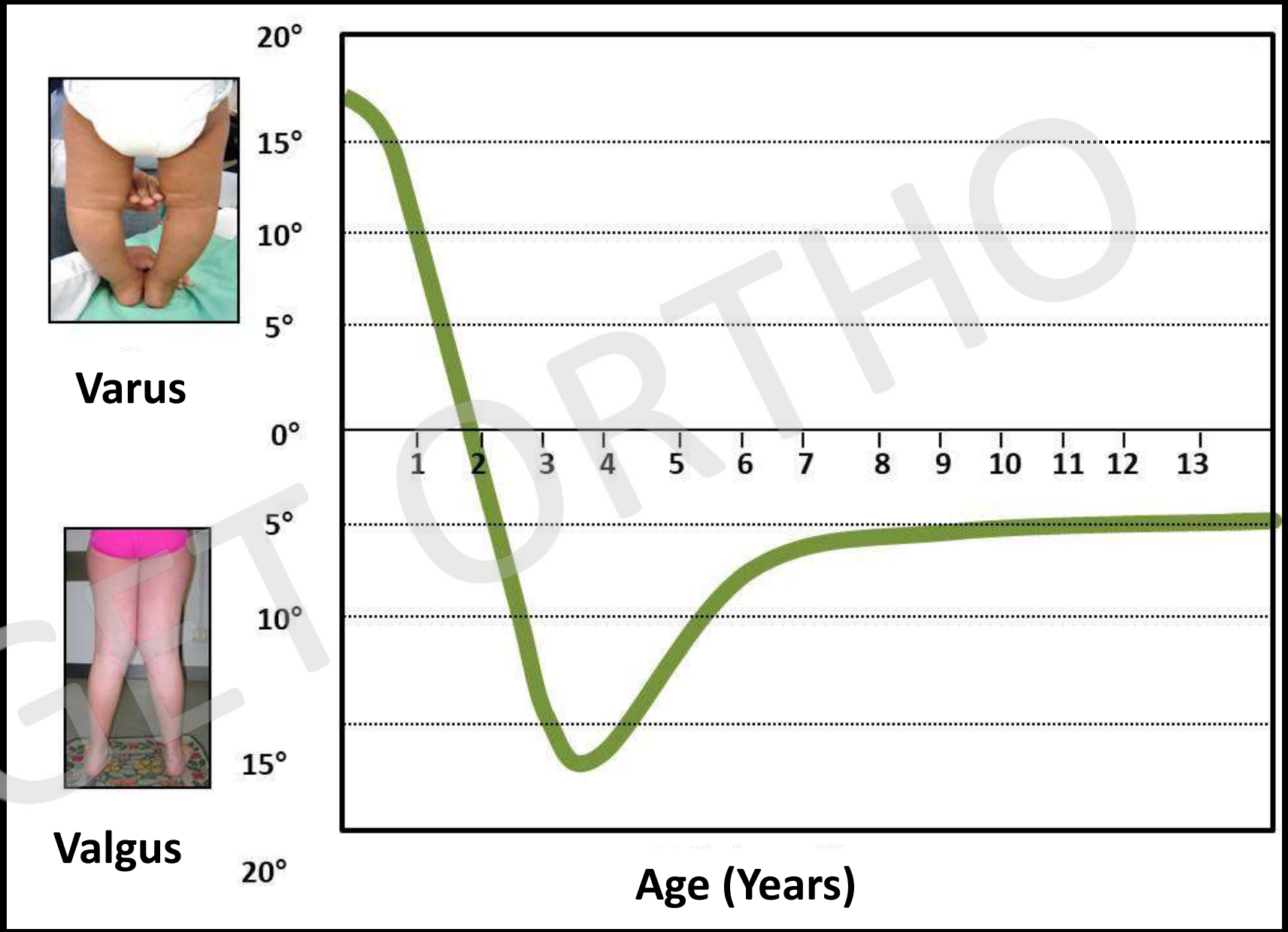
- Genu Valgum: knock-knees
- Genu Varum: Bow legs

- What is pathologic?



Physiologic Variations

Ans:
None



SALENIUS CURVE

Cover Up test (1-3 years)

- Positive test -→ Imaging
- Varus/ Neutral- Positive
- Valgus- Negative

Vit D Def:

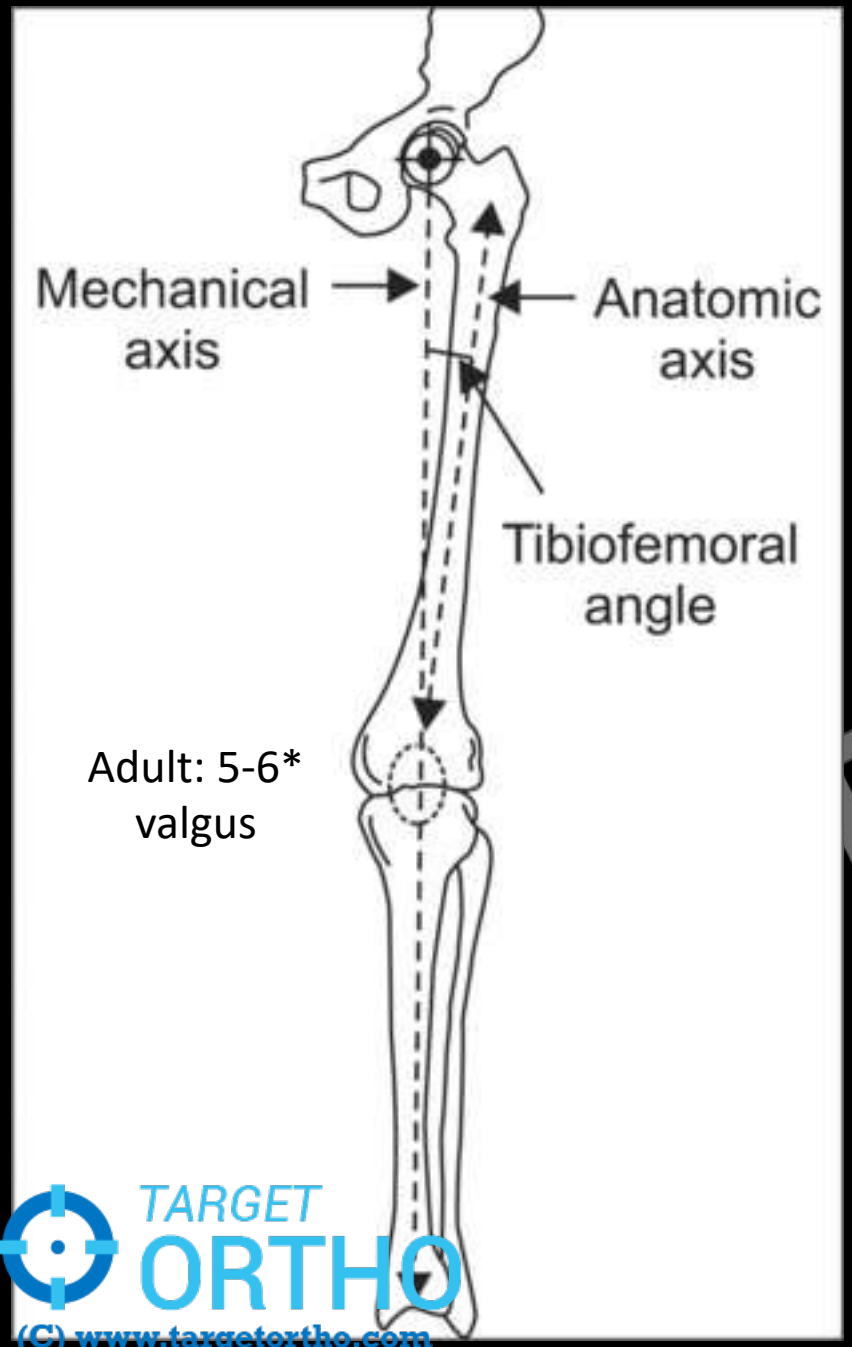
Origin of the deformity

Knocking of knees

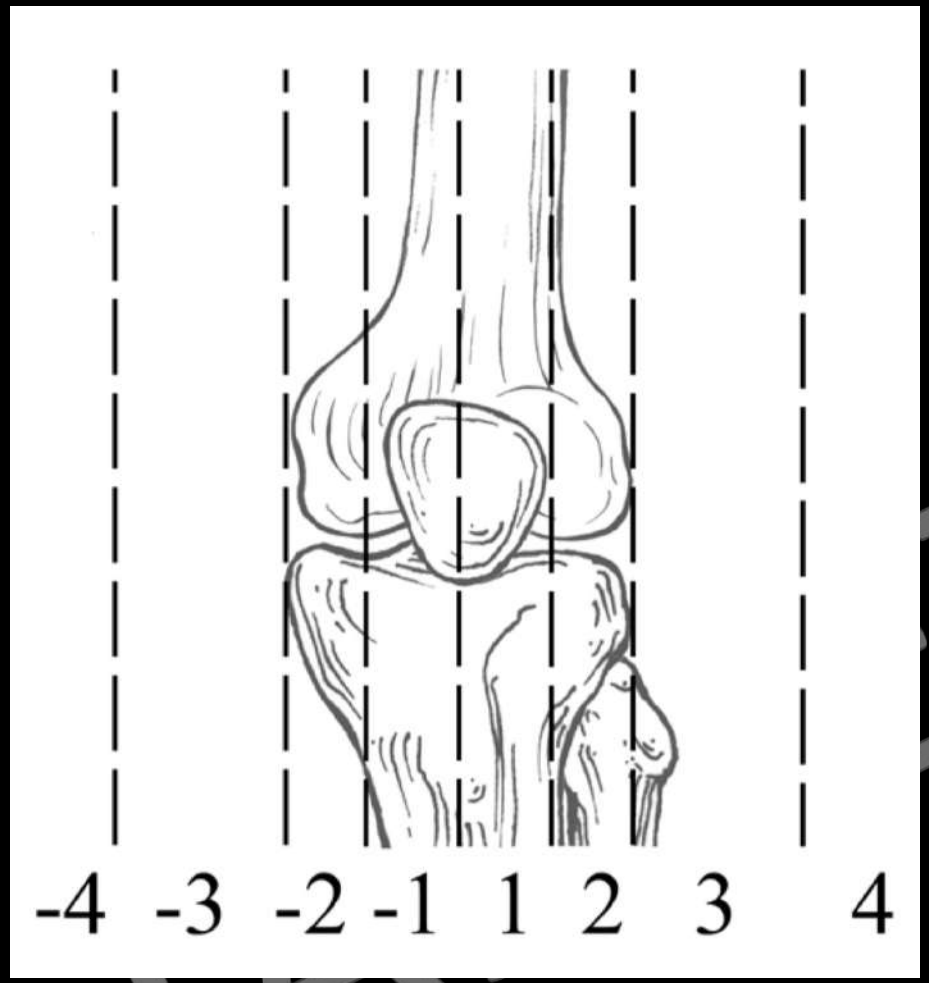
Disappear on knee bending

Origin??

Varus: Tibia
Valgus: Femur
More likely



- Tibiofemoral angle: Anatomic and Mechanical

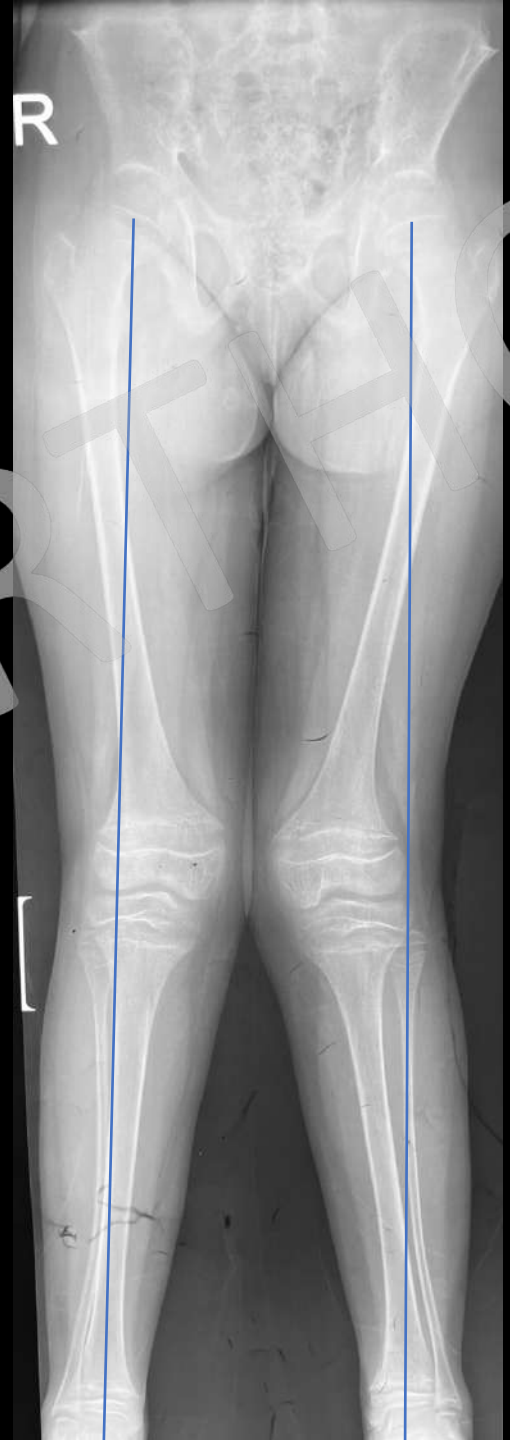


Zone 1 Tibial Spine
Zone 2 Tibial Condyle
Zone 3 Within 1 knee Jt width from centre
Zone 4 > 1 Knee width from centre

ALLIGNMENT X RAY

Lateral Deviation of Mechanical axis (Passing through zone 3)

Evidence of Rickets (Rickets healed on Follow up Xray)

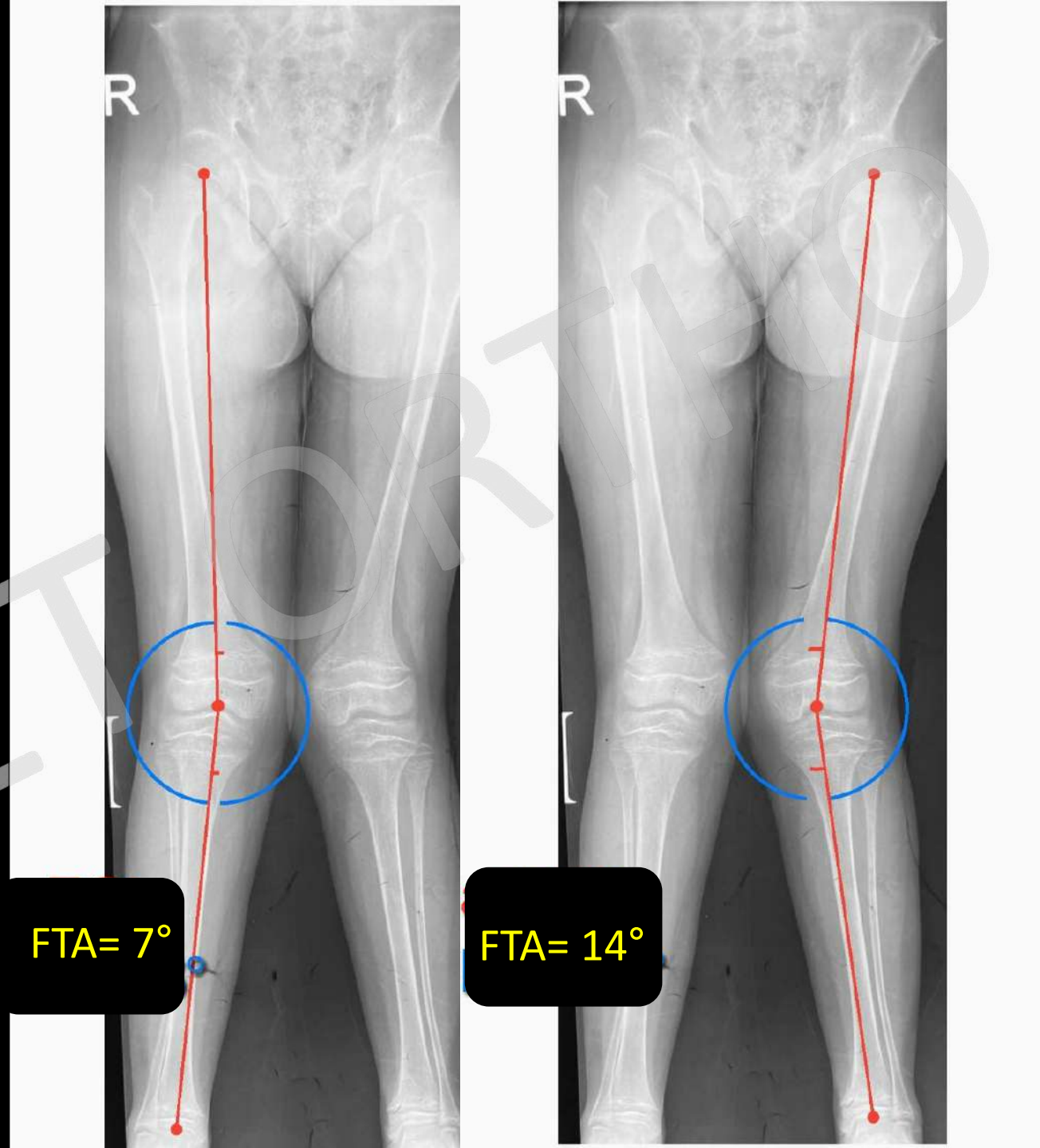


FTA – Femoro Tibial angle

Angle formed between the mechanical axis of the femur and the tibia

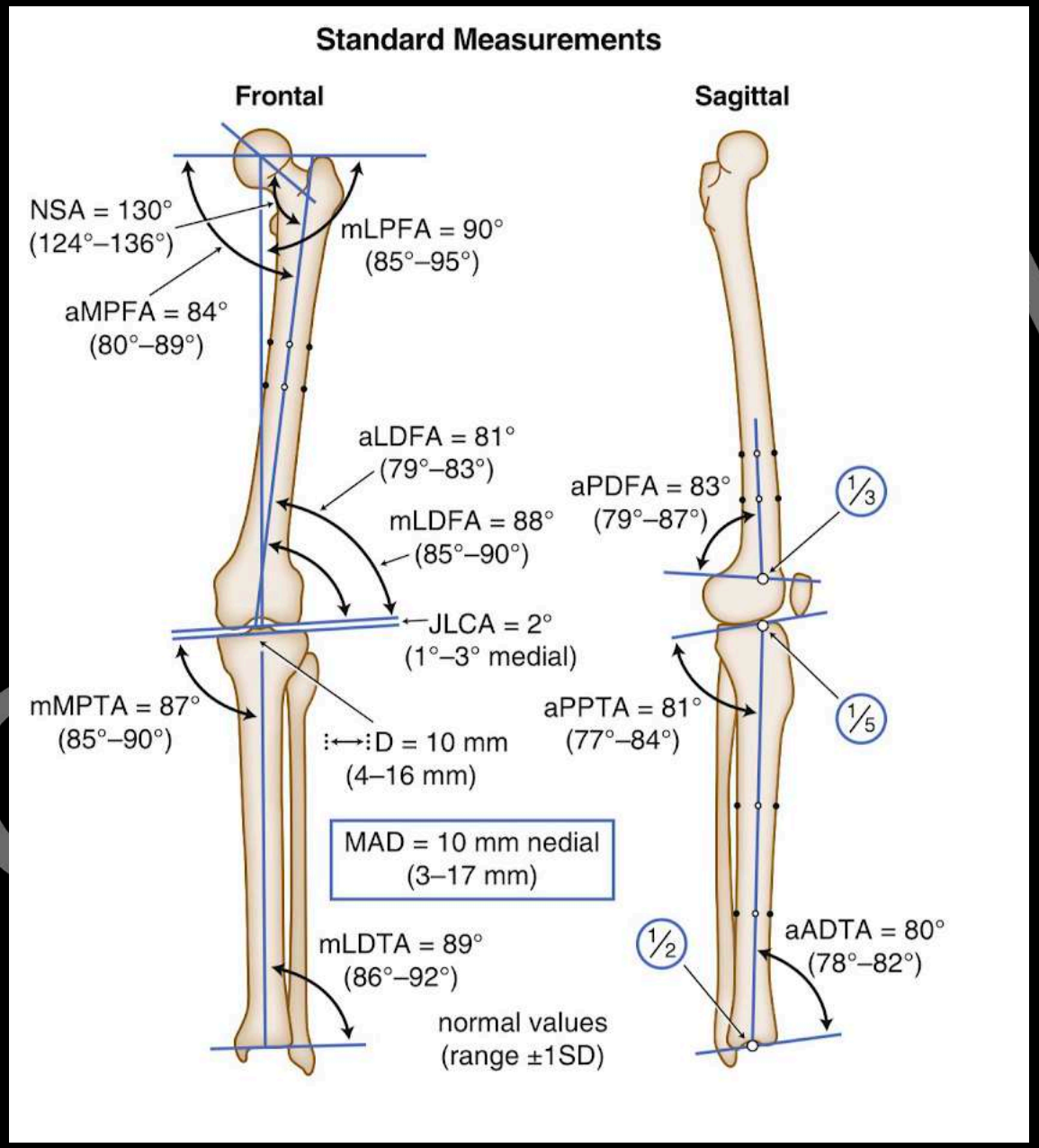
Right- 7°

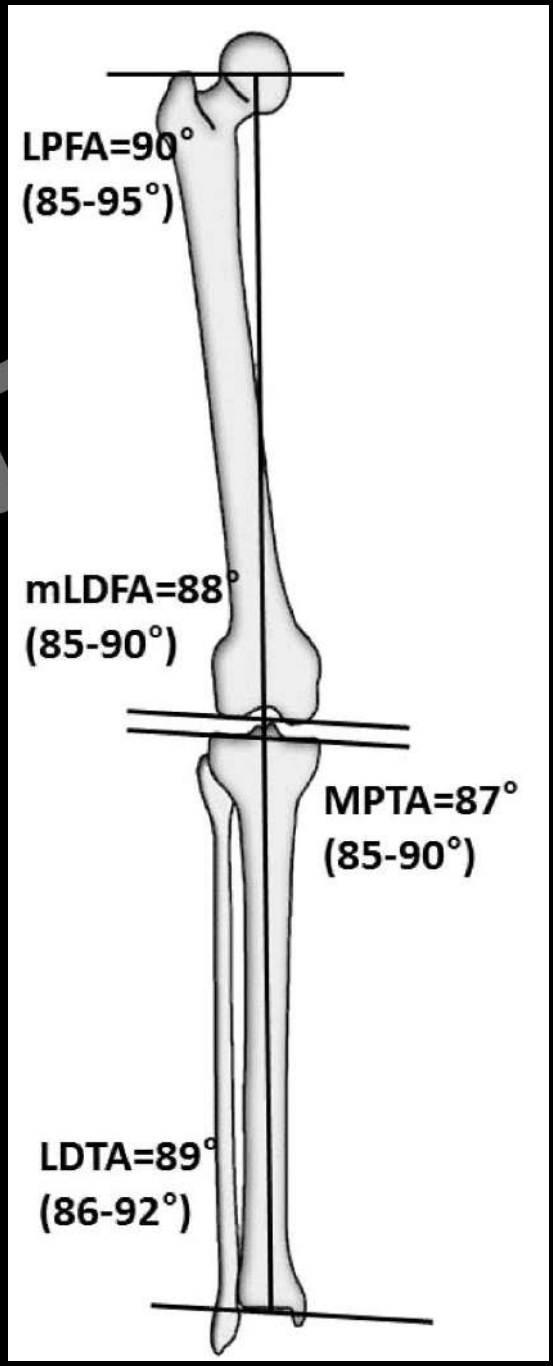
Left – 14°



Normal Alignment angles Range:

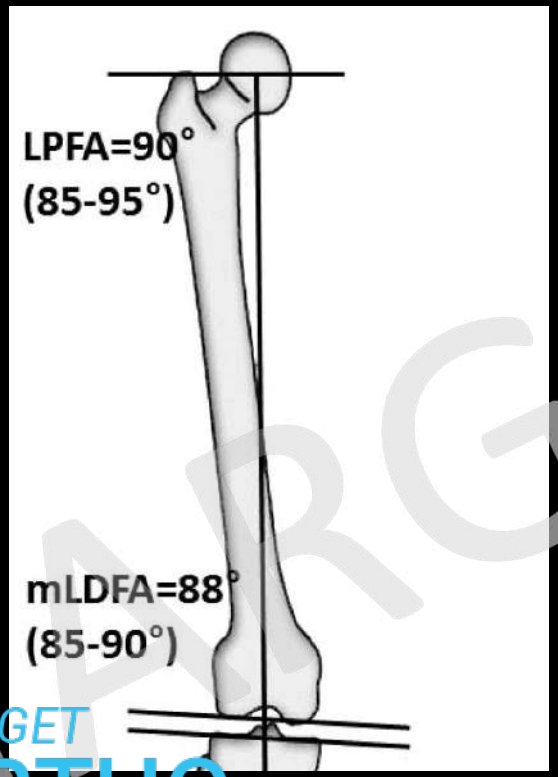
mLDFA
mMPTA
mLPFA
mLDTA

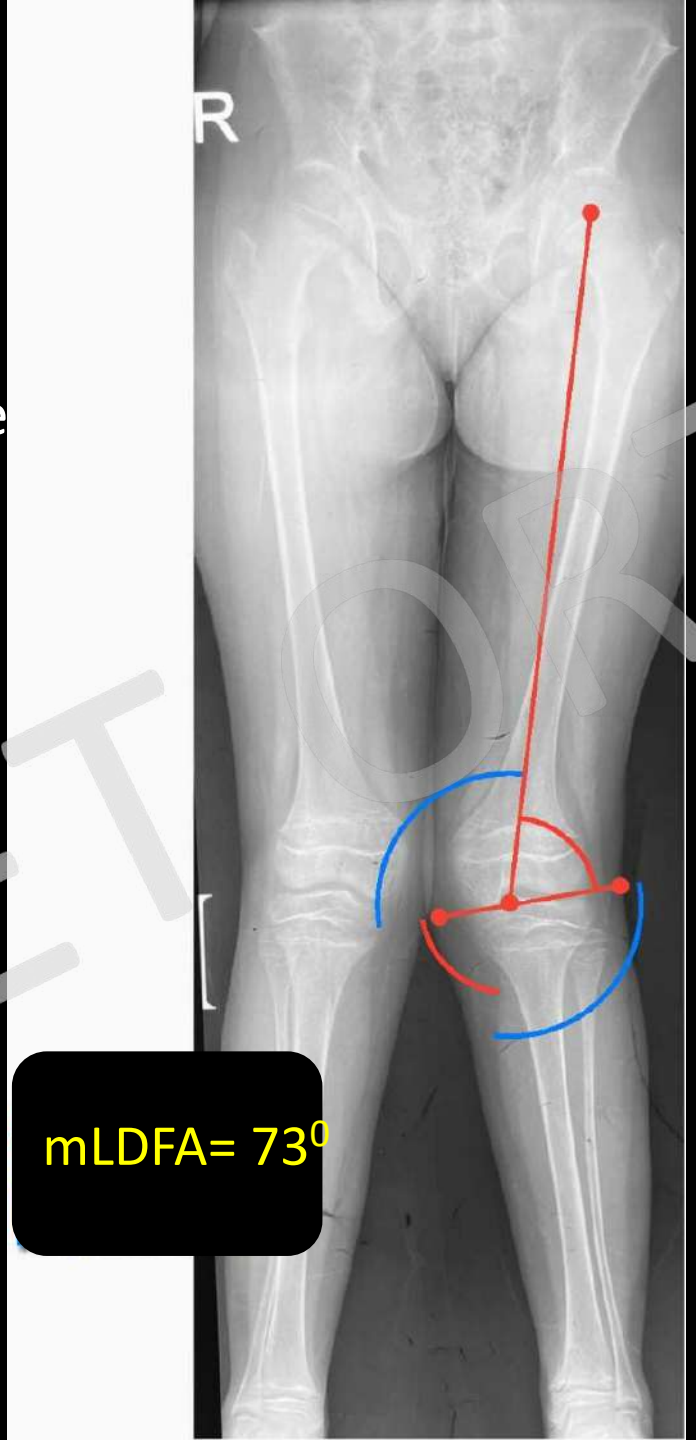


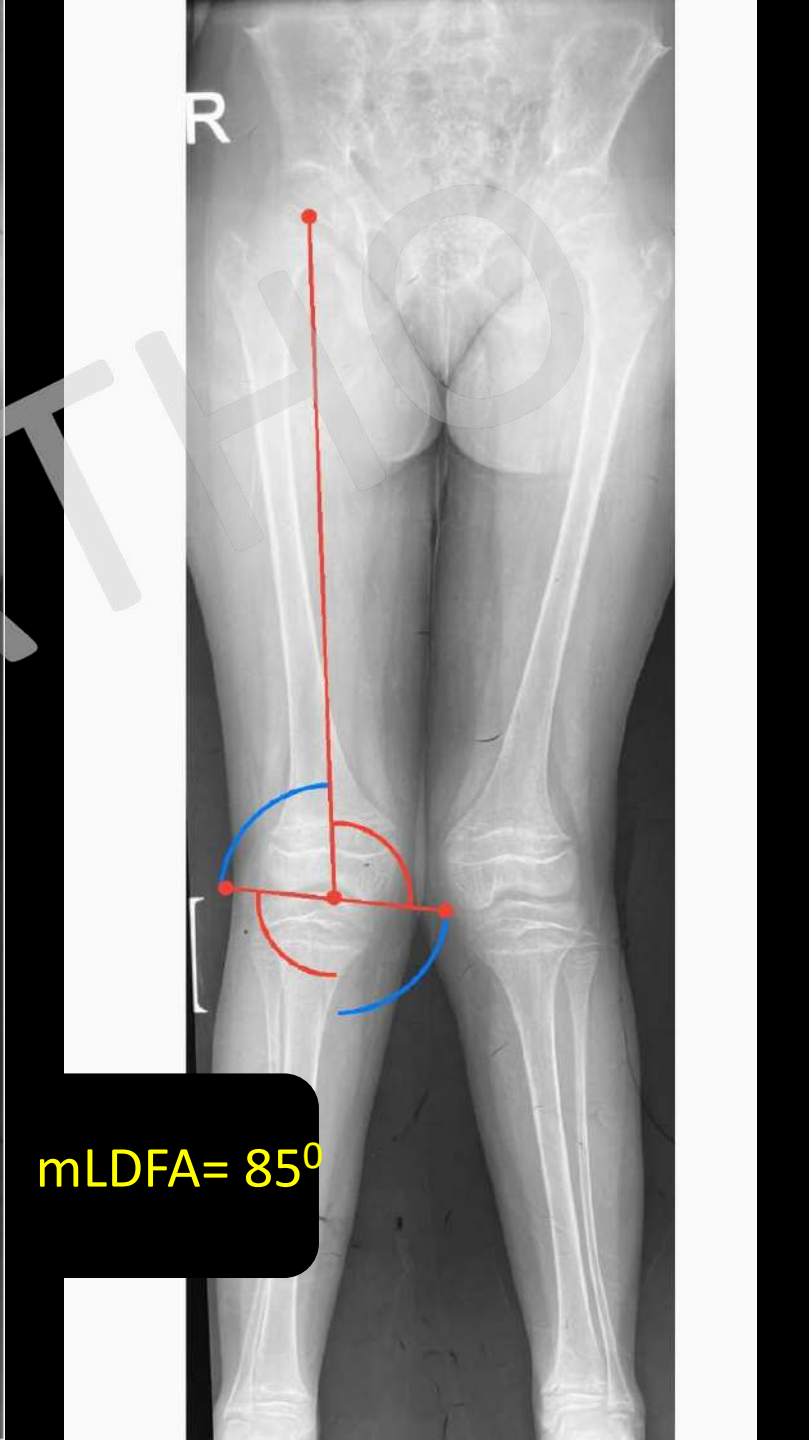


mLDFA – Mechanical lateral distal femoral angle

mPTA –Medial proximal tibial angle







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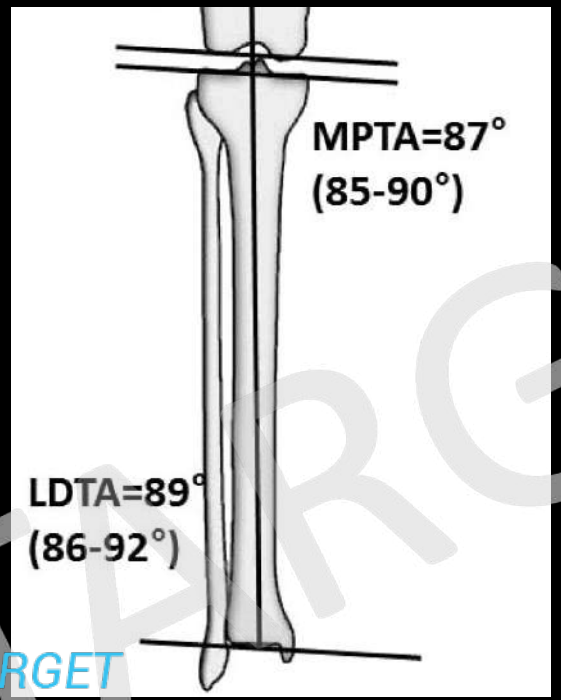
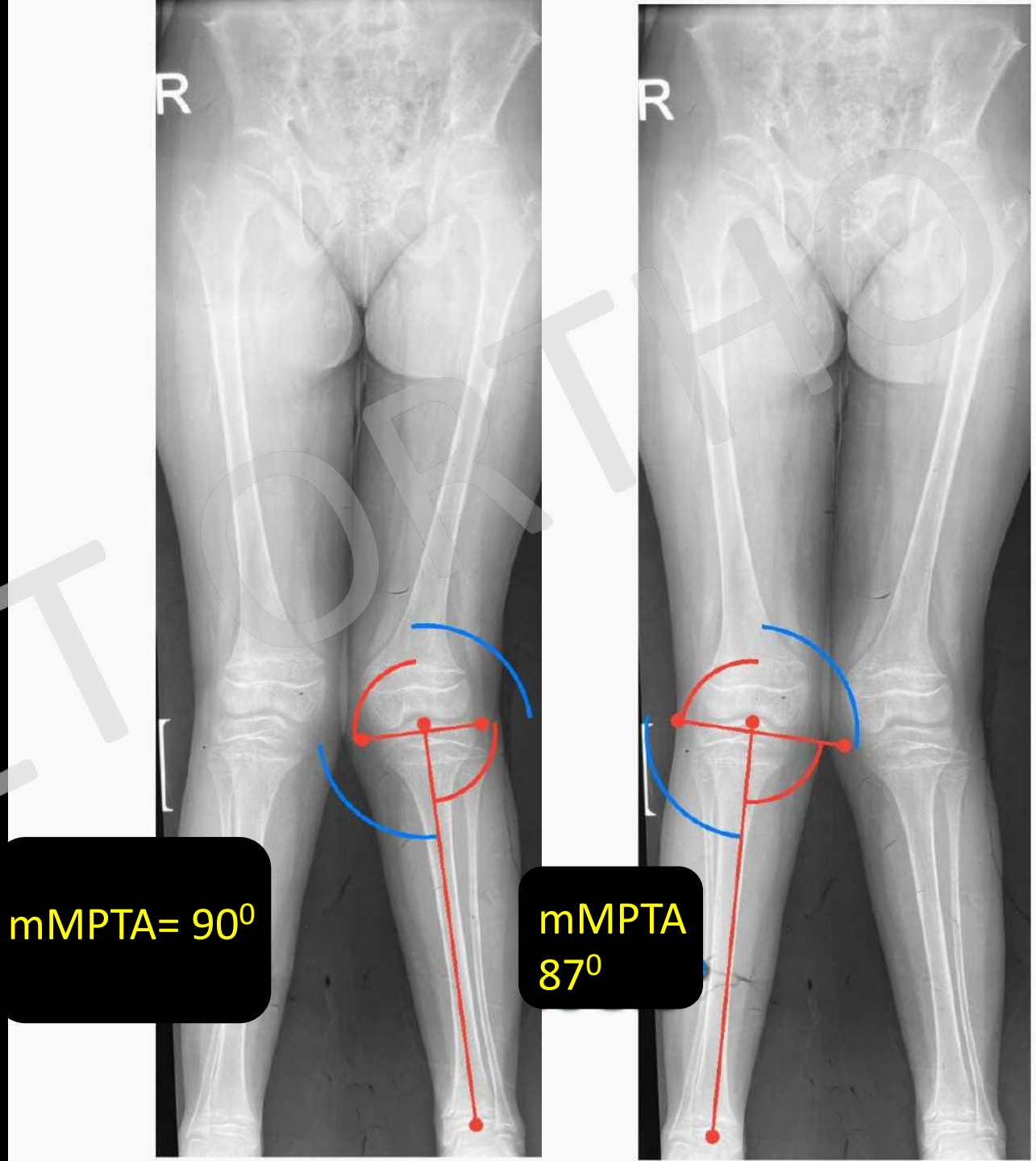
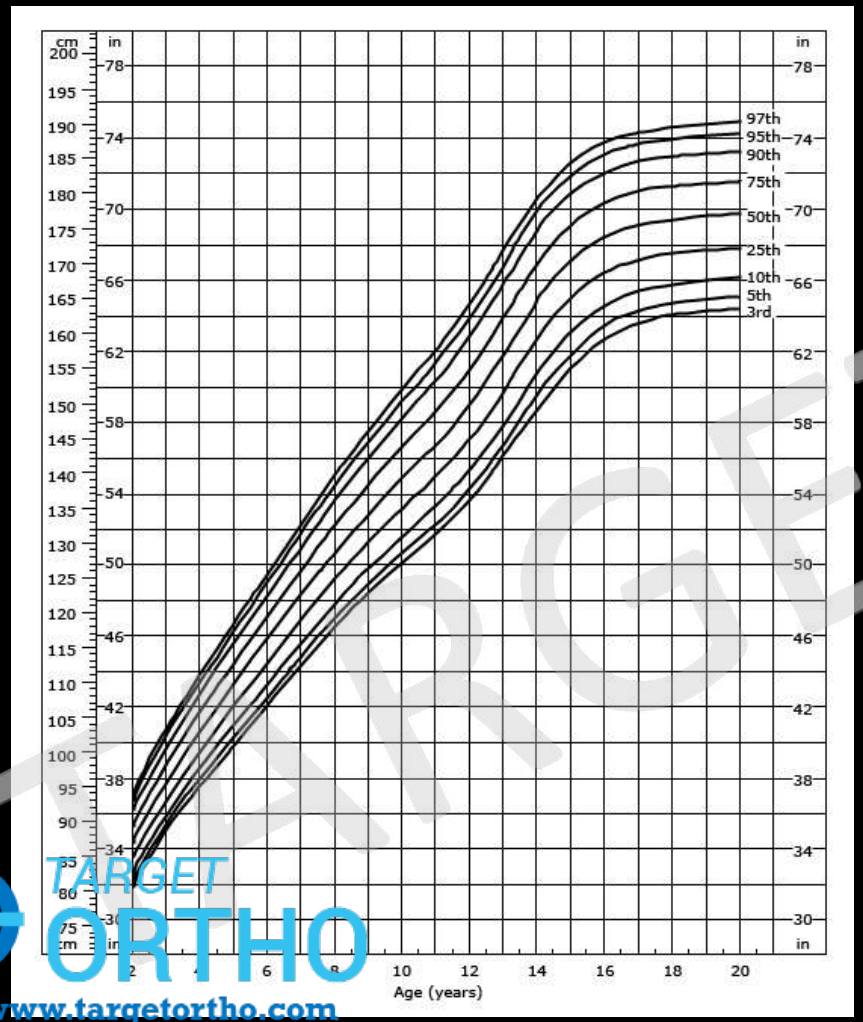
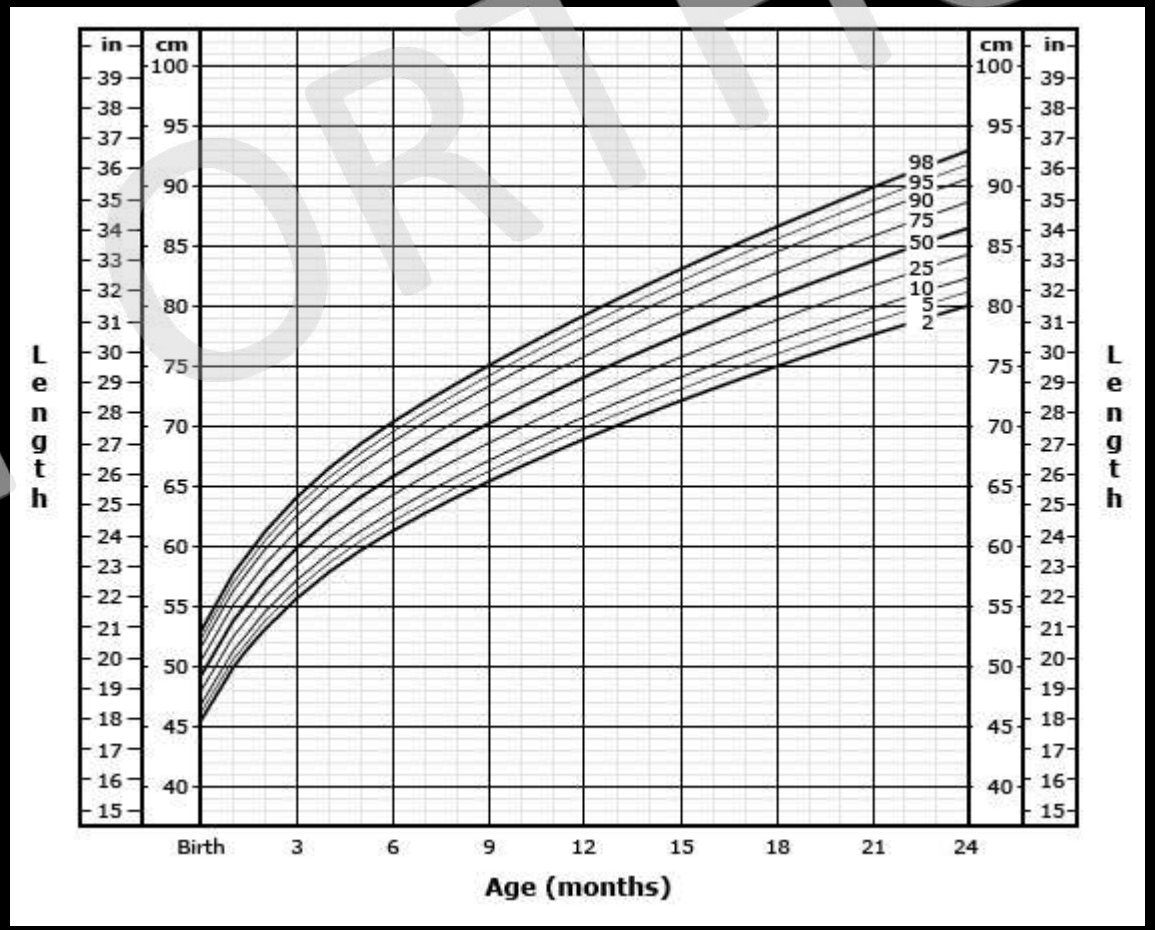




Wadia Hospitals

Growth Chart





Other examination

- Hyperlaxity
- Torsion Profile
- Limb length discrepancy
- History of trauma, Infection

Genu Varum is likely pathologic if

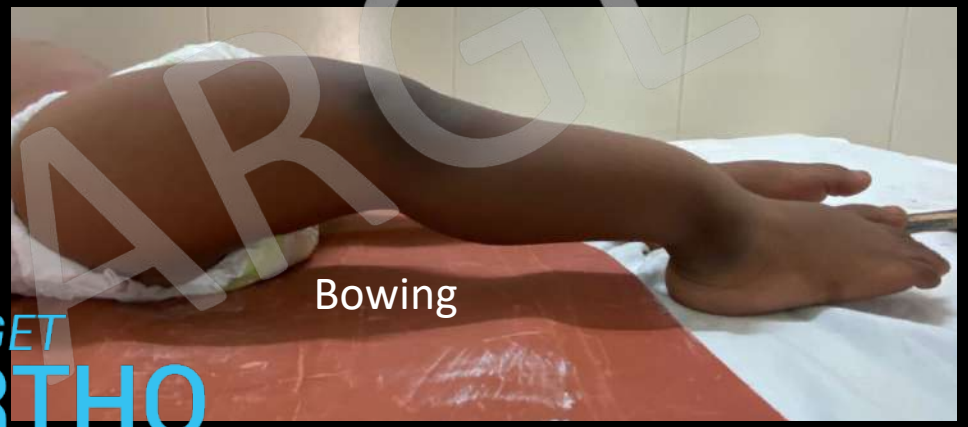
- Present after 2 years age
- Unilateral
- Associated with shortening
- Severe
- In a child with Obesity

Causes

- Rickets
- Blount’s
- FFCD, Achondroplasia
- Hemimelia
- Trauma/ Infection

Rickets

- Metaphyseal widening, Bossing of fontanelle, Double malleoli, Rachitic rosary
- Xray Changes of Cupping, Fraying, Metaphyseal widening
- Bowing



Bloodwork and Radiograph

- Managed with Vitamin D and calcium supplementation.
- Calcitriol in severe Ca deficiency

- Hypophosphatemic and Renal rickets need an endocrine workup-

S. Ca, S PO4, Alk Pase, S Creat, S. HCO3-, VBGA, S. PTH

Condition	Genetics	Ca	Phos.	Alk Phos	PTH	Vit D	1,25 (OH)VitD
Vitamin D Resistant Rickets (Hypophosphatemic)	X linked dominant	–	↓	↑	–	–	
Vitamin D Deficiency Rickets (Nutritional)	Nutritional	–↓	↓	↑	↑	↓	
Type I Vitamin D Dependent	Auto. Recessive	↓	↓	↑	↑		↓↓
Type II Vitamin D Dependent	Auto. Recessive	↓	↓	↑			↑↑
Hypophosphatasia	Auto. Recessive	↑	↑	↓↓	–	–	
Renal Osteodystrophy	Renal Disease	↓	↑	↑	↑		
Hyperparathyroidism	90% adenoma	↑	↓	↑	↑		

Blount's

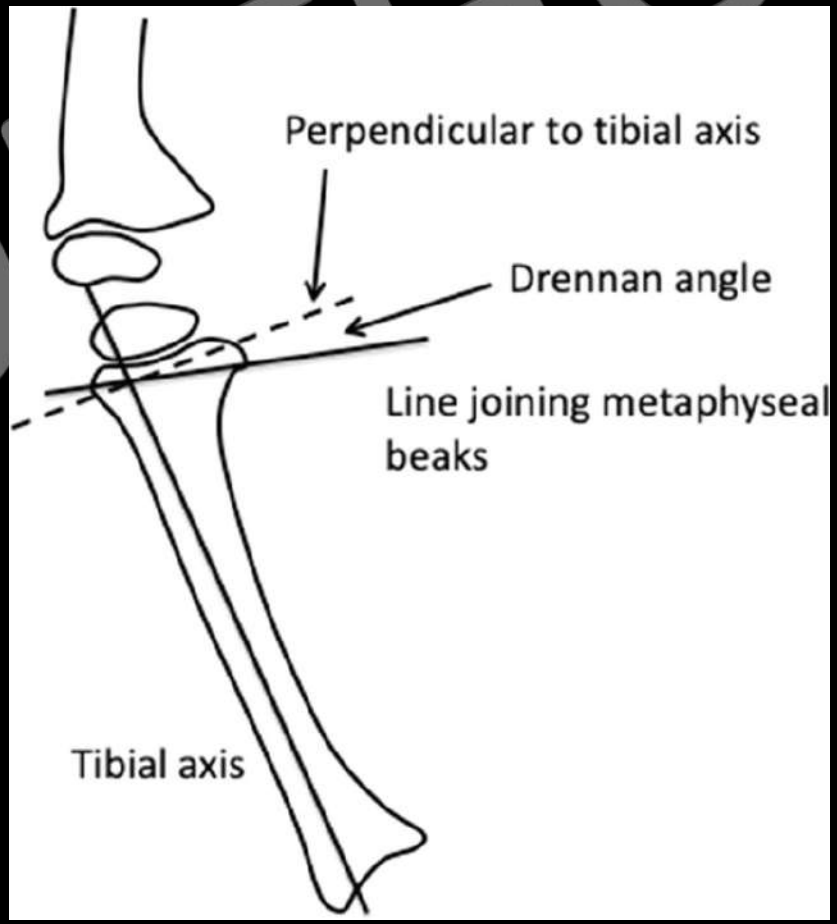
- Adolescent and Infantile type
- Infantile early may be treated with Bracing
- Associated with High BMI
- MDA of levine and Drennan
- I/A Defor**mity, May require plateau elevation**

Adolescent


Infantile

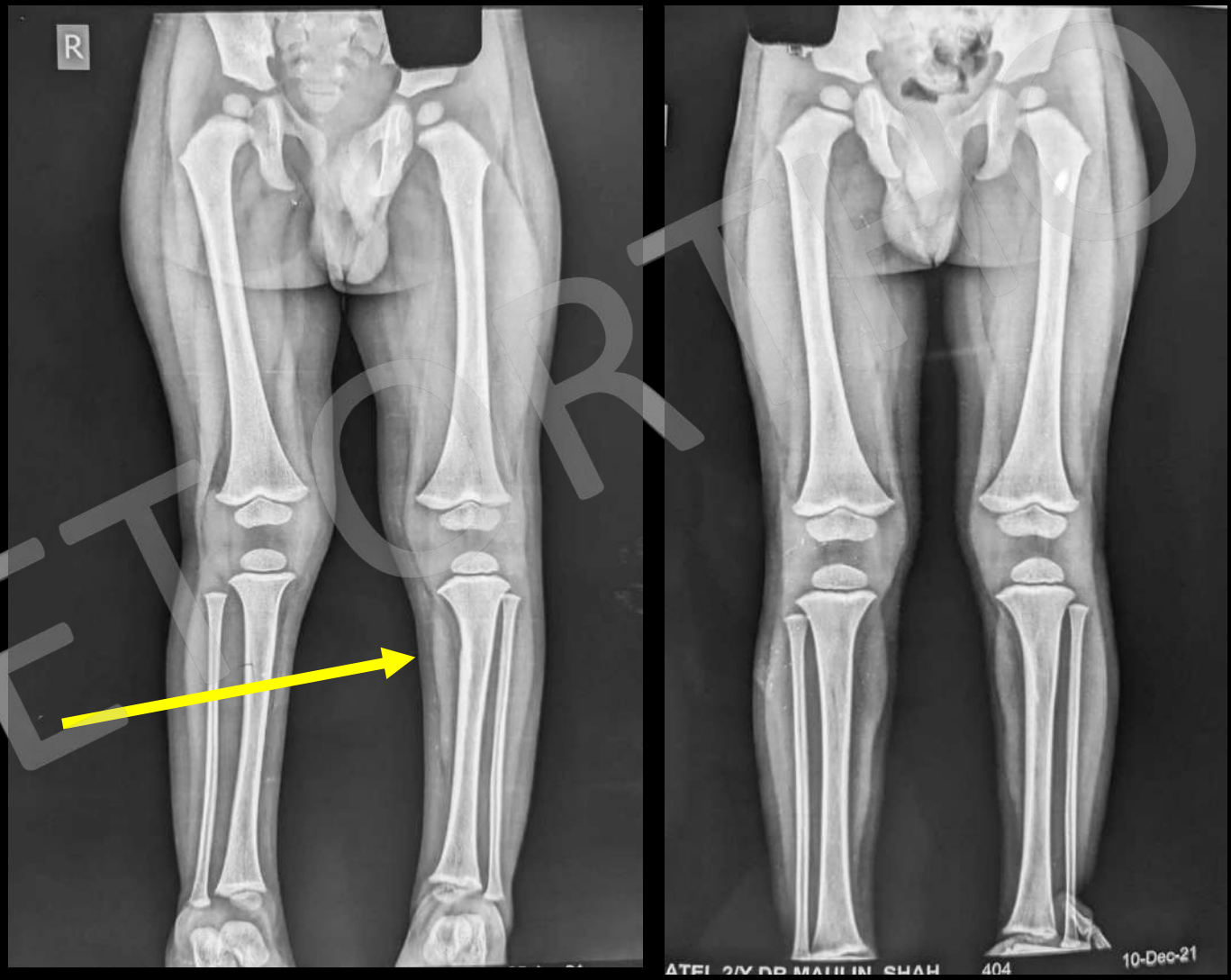
MD Angle

- Angle more than 10* is significant
- More than 16* is likely to be blount's



FFCD

- Focal Fibrocartilagenous dysplasia
- Resolves by own



Genu Valgum

- Vitamin D Deficiency/ Idiopathic
- Post Trauma
- Ass. With limb deficiency (Hypoplasia)
- SED
- Ellis ven creveld syndrome

Knocking is a gait issue

Vit D Deficiency

- More common after 6-8 years
- Genu valgum persists
- Xray is evident
- May persist even after correction in peri adolescents

Post trauma

- 2 year old boy has a post traumatic limb deformity
- Origin?

Cozen's phenomenon

- Likely to resolve on its own in 18 months
- No intervention needed

SKELETAL DYSPLASIA

Skeletal: Bone
Dys: Disordered
Plasia: Formation

SKELETAL DYSPLASIA

Disorder of cartilage and bone growth resulting in abnormal shape and size of skeleton and disproportion of long bones, spine and skull

=DISPROPORTIONATE SHORT STATURE

DISPROPORTIONATE SHORT STATURE

TRUNK- EXTREMITY RATIO:

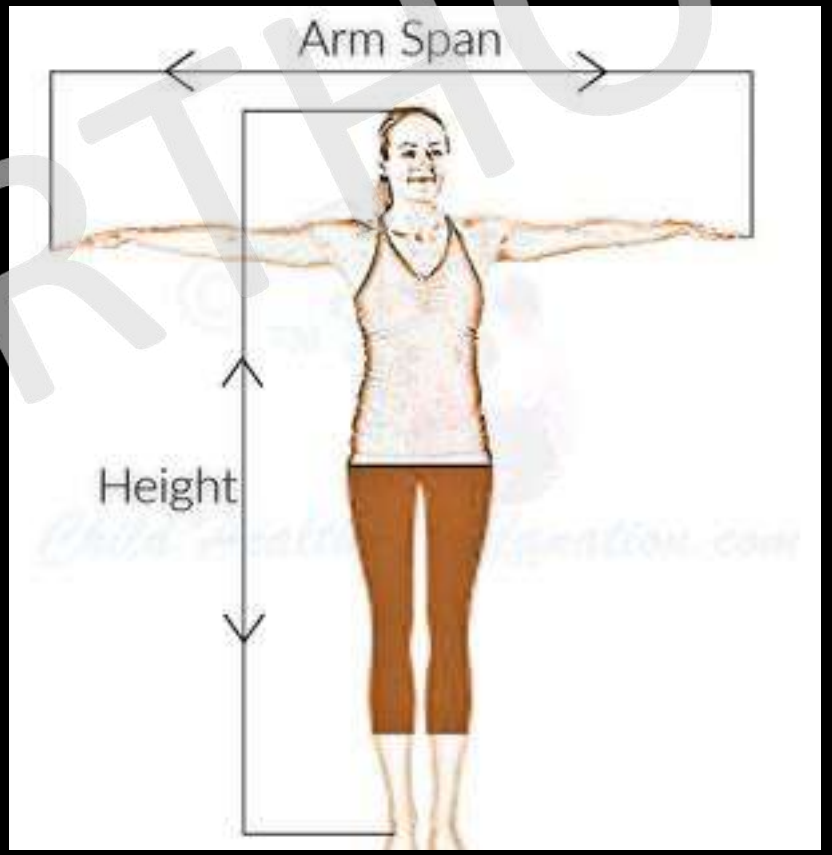
1.NORMAL TRUNK AND SHORT EXTREMITIES (ACHONDROPLASIA)

2.NORMAL LIMBS AND SHORT TRUNK

(S.E.D TARDA)(MPS)

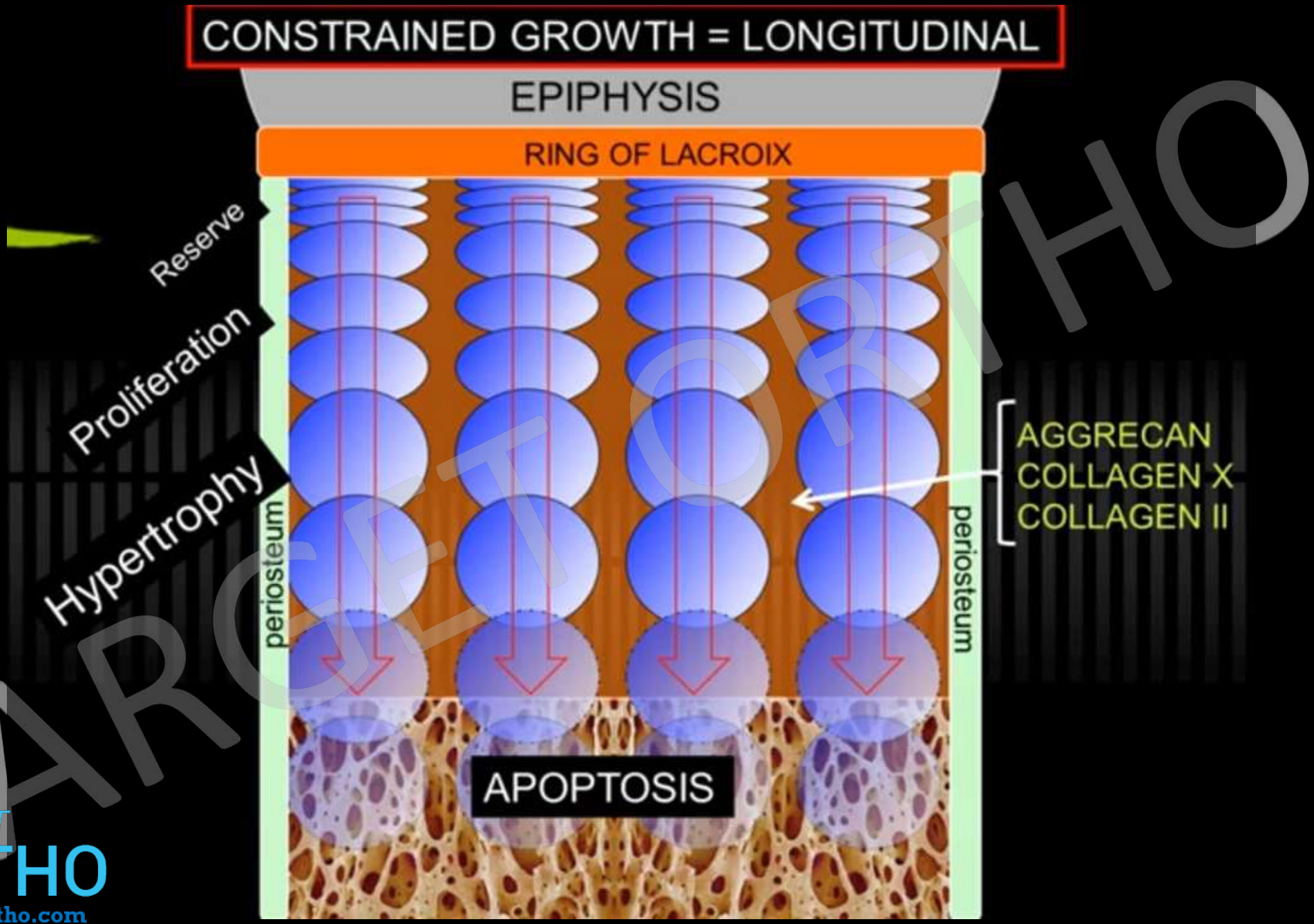
3.LONG TRUNK AND LONG LIMBS

(MARFANS)



NORMAL TRUNK AND SHORT EXTREMITIES (ACHONDROPLASIA)

NORMAL LIMBS AND SHORT TRUNK (S.E.D TARDA)(MPS)

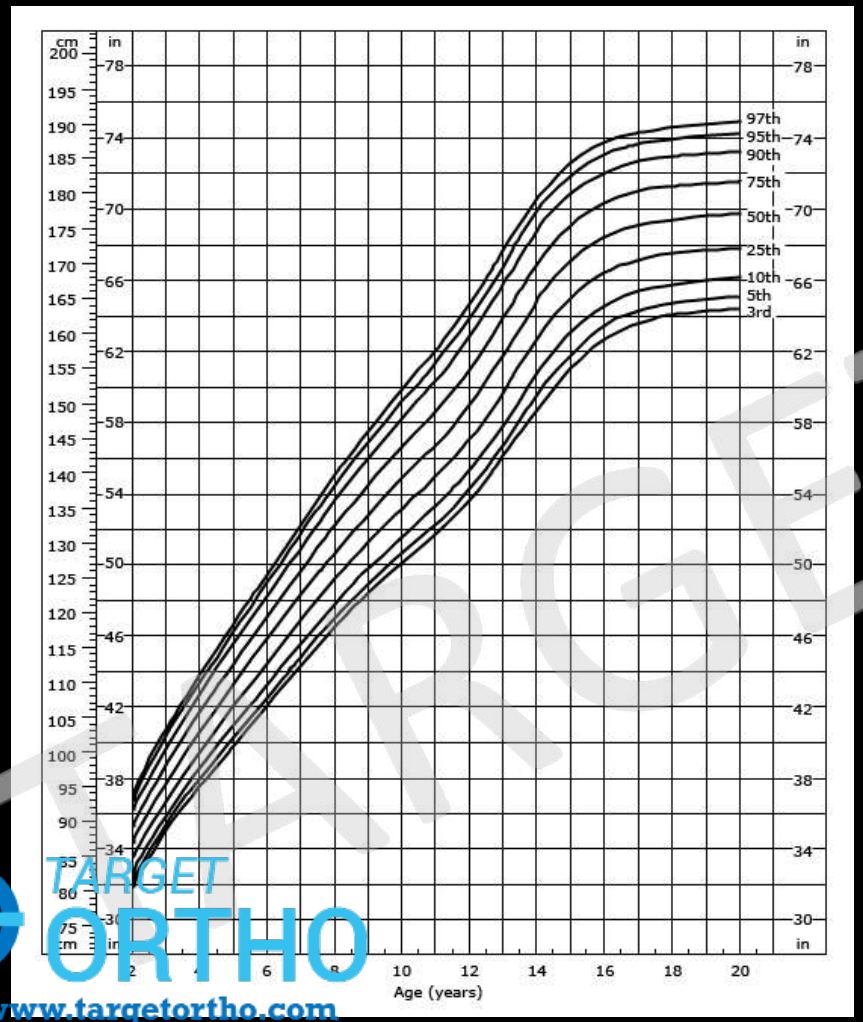


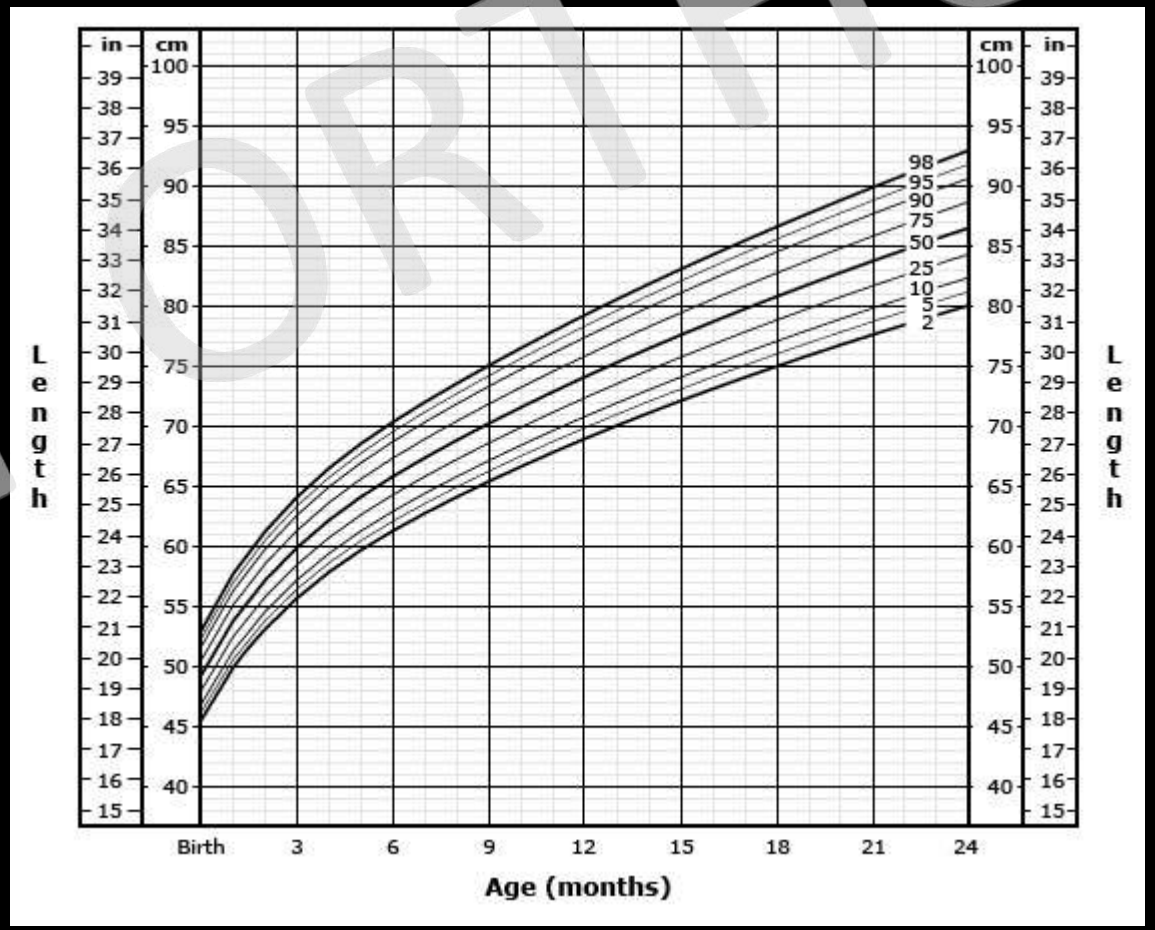
SKELETAL DYSPLASIA

CLINICAL FEATURES

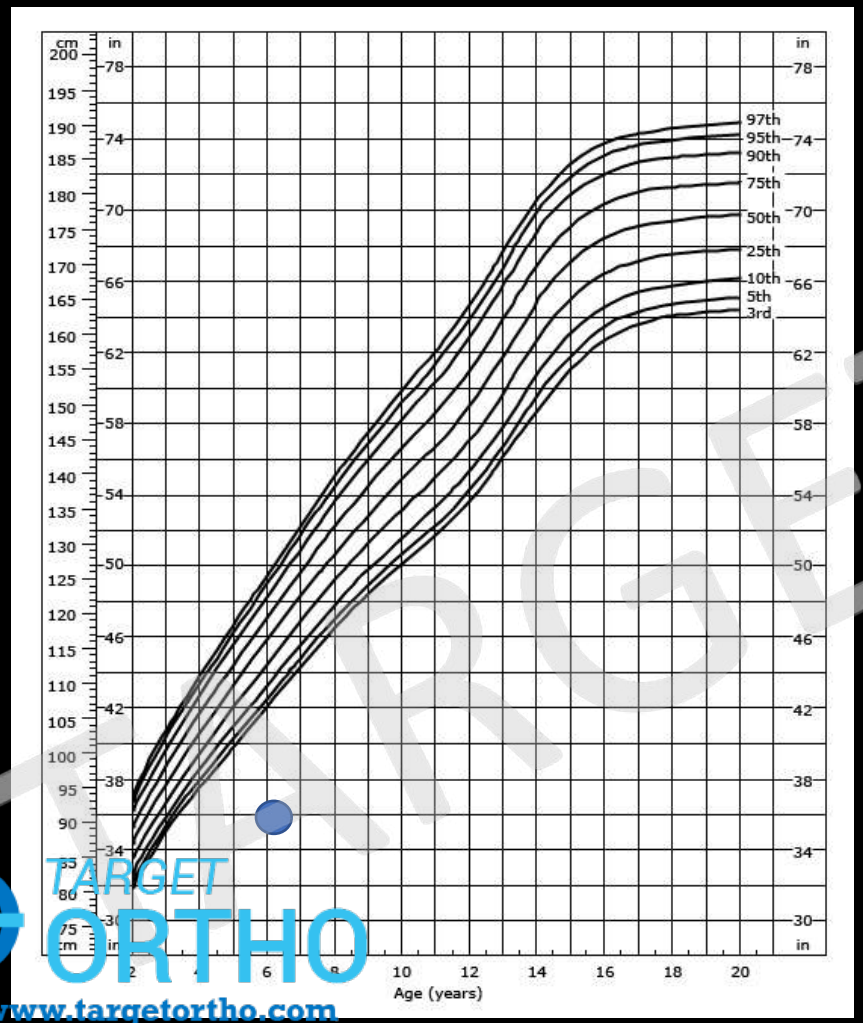
1. SHORT STATURE-
2. DISPROPORTIONATE
3. DYSMORPHISM
4. ASSOCIATED CONGENITAL MALFORMATIONS
5. DEFORMITIES

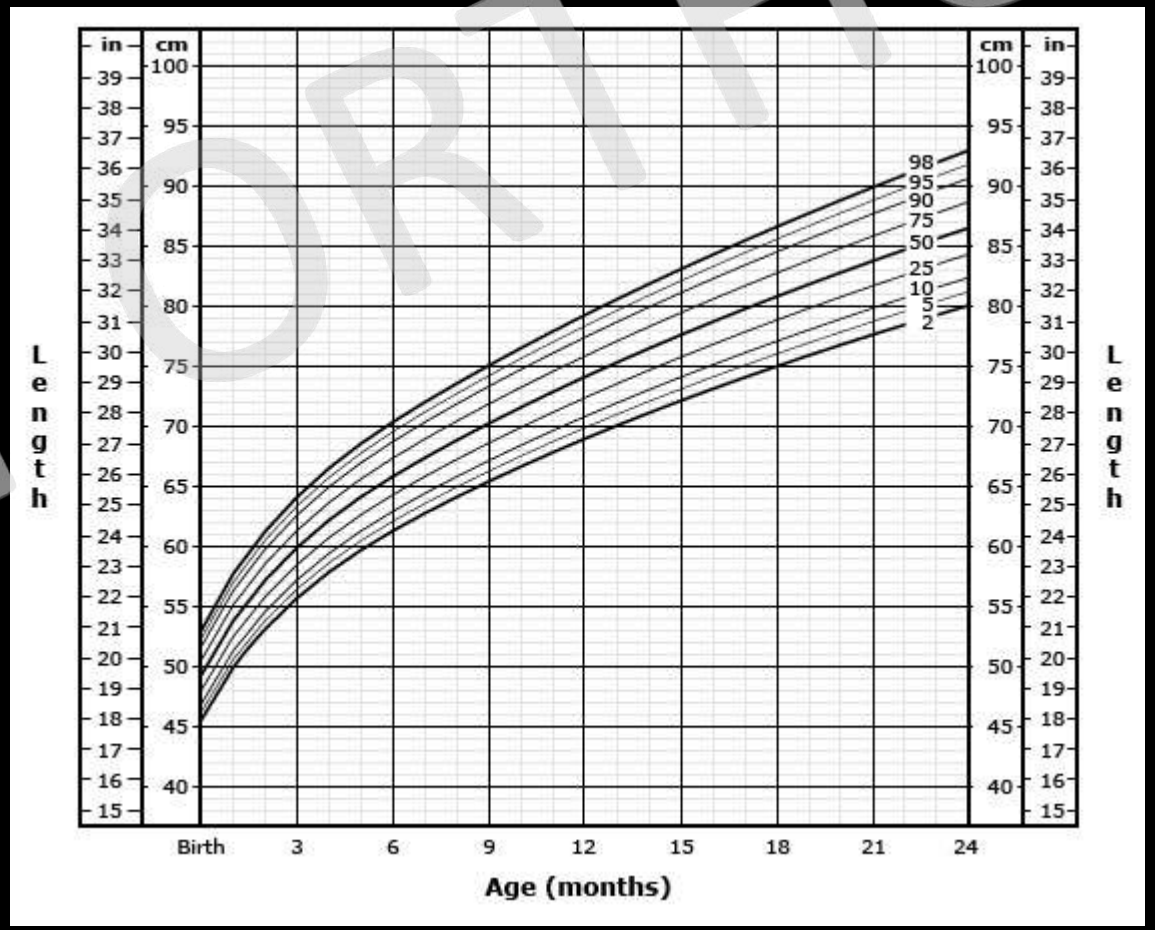
1. Short Stature





1. Short Stature

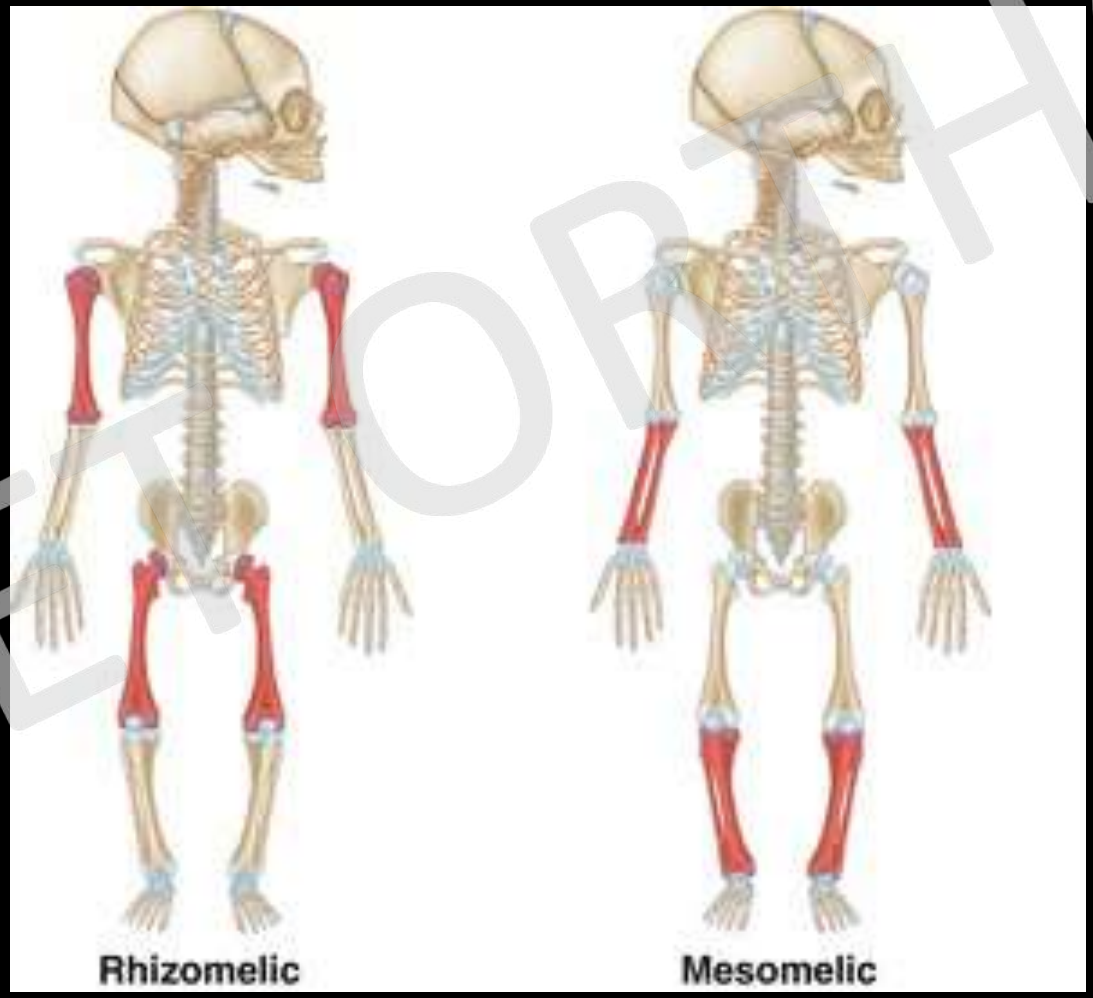




2. DISPROPORTIONATE SHORT STATURE

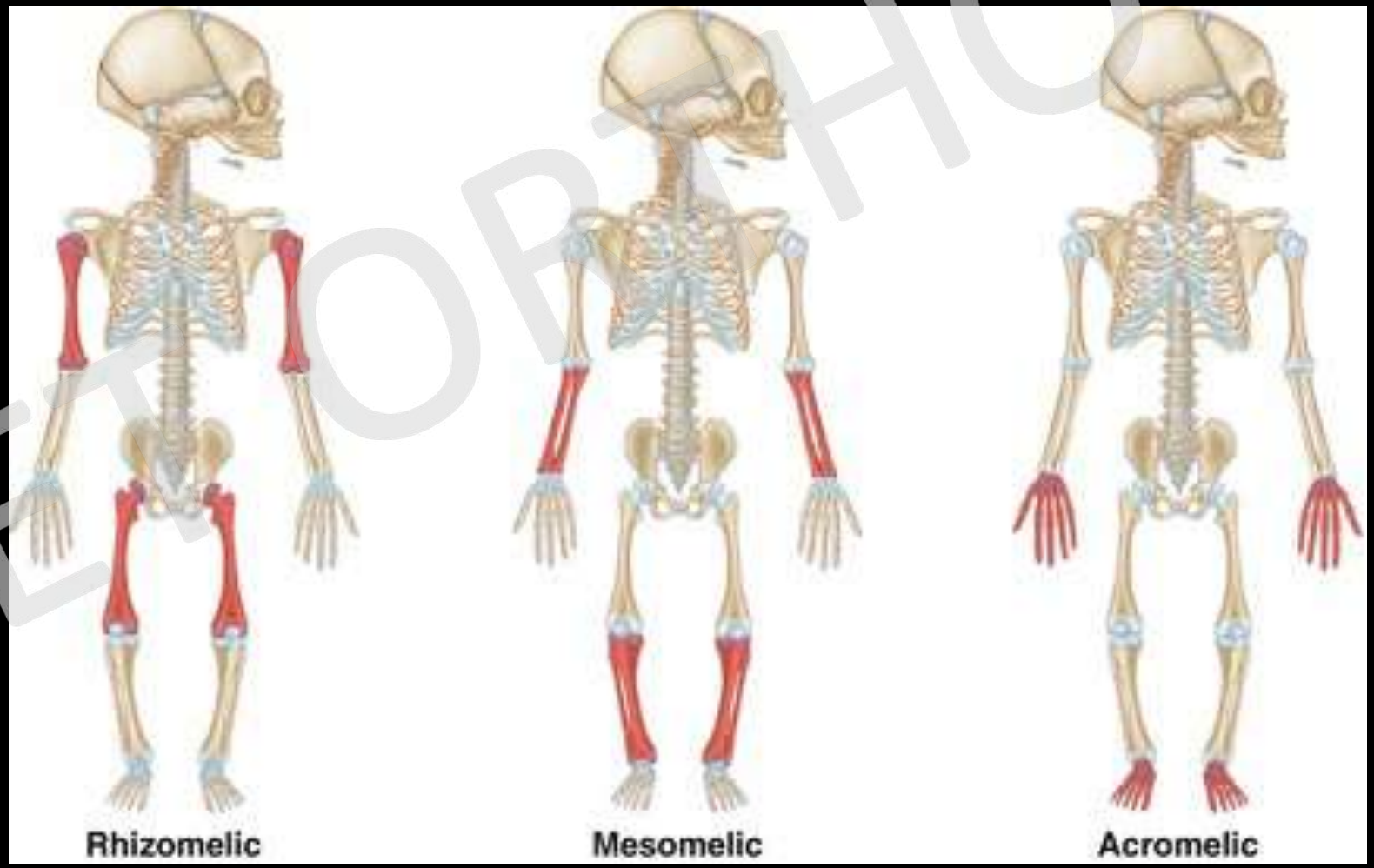
LIMB- SEGMENT RATIO

LIMB- SEGMENT RATIO



LIMB- SEGMENT RATIO

RHIZOMELIC	ACHONDRODYSPLASIA SED
MESOMELIC	MESOMELIC DYSPLASIA
ACROMELIC	ACRODYSOSTOSIS
MESOMELIC	ACHONDROGENESIS



3. DYSMORPHISM

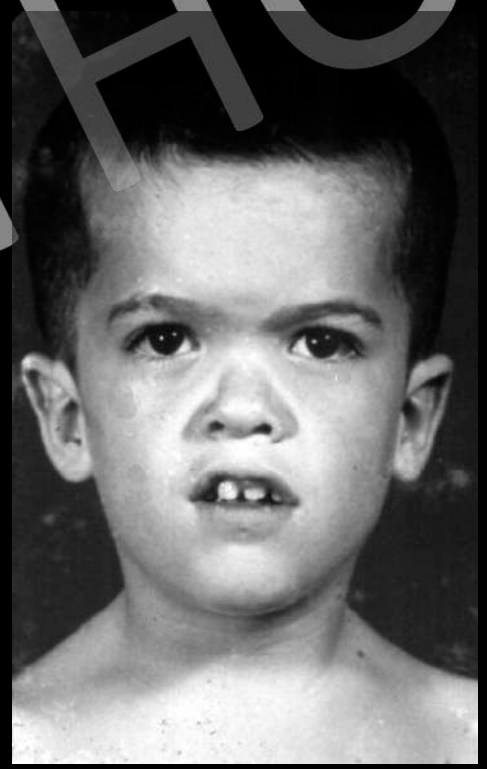
Morphologic Variation Of Bone And Soft Tissue.

Eg..

Multiple Exostosis.

Short Broad Thumbs (M.E.D).

Depressed Bridge Of Nose (Achondroplasia)



4. DEFORMITIES

SPINAL DEFORMITIES.

LIMITED JOINT MOVEMENTS.

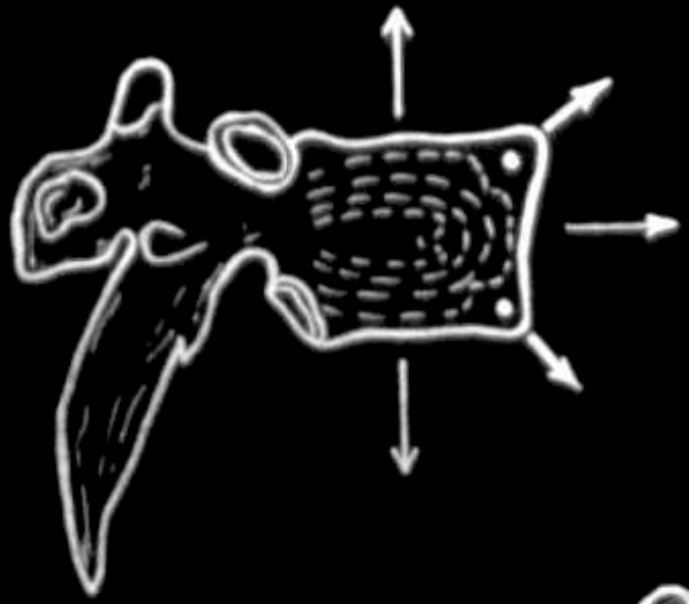
COXA VARA, GENU VARUS AND VALGUS DEFORMITIES

SKELETAL DYSPLASIAS - DIAGNOSIS

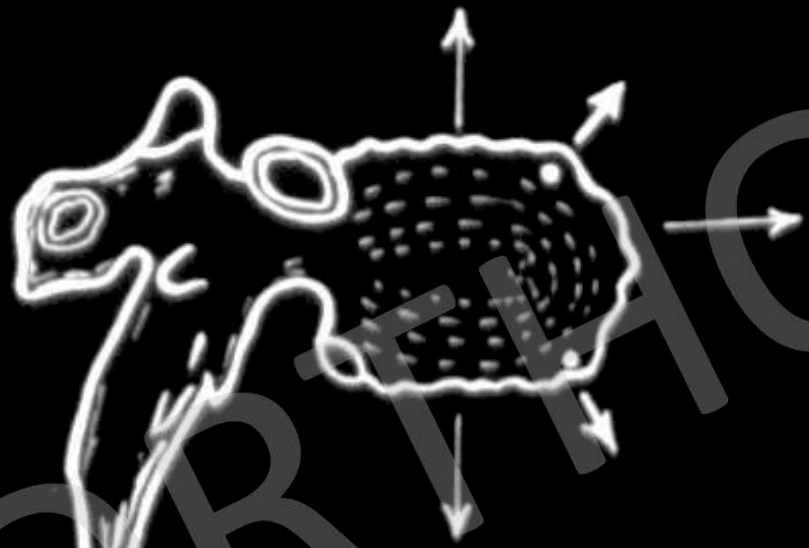
SKELETAL SURVEY X-RAYS:

- LATERAL SKULL
- AP PELVIS
- LATERAL LUMBAR SPINE
- AP KNEE
- AP WRIST AND HAND

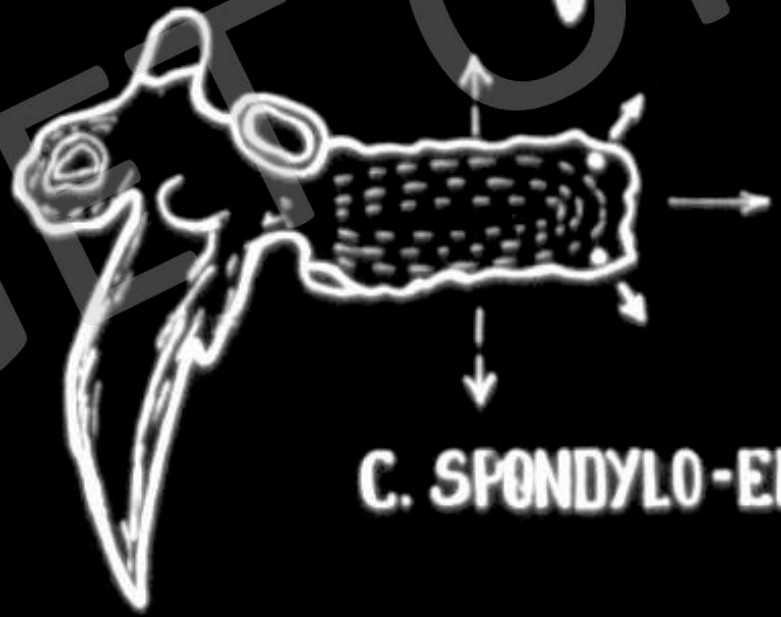
INVOLVEMENT	DISEASE CATEGORY
A + D	NORMAL
B + D	EPIPHYSEAL DYSPLASIA
C + D	METAPHYSEAL DYSPLASIA
B + E	SPONDYLOEPIPHYSEAL DYSPLASIA
C + E	SPONDYLOMETAPHYSEAL DYSPLASIA



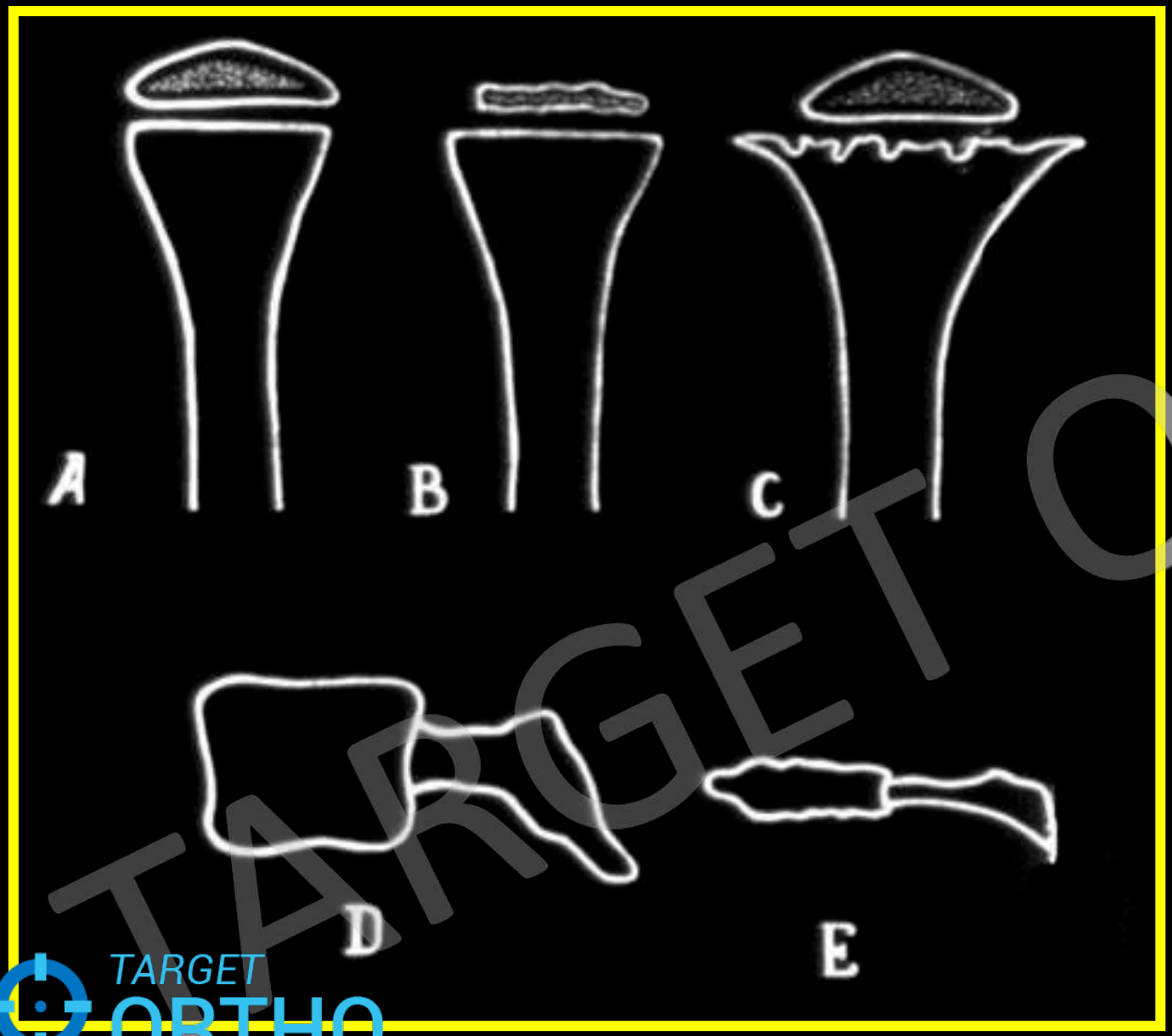
A. NORMAL

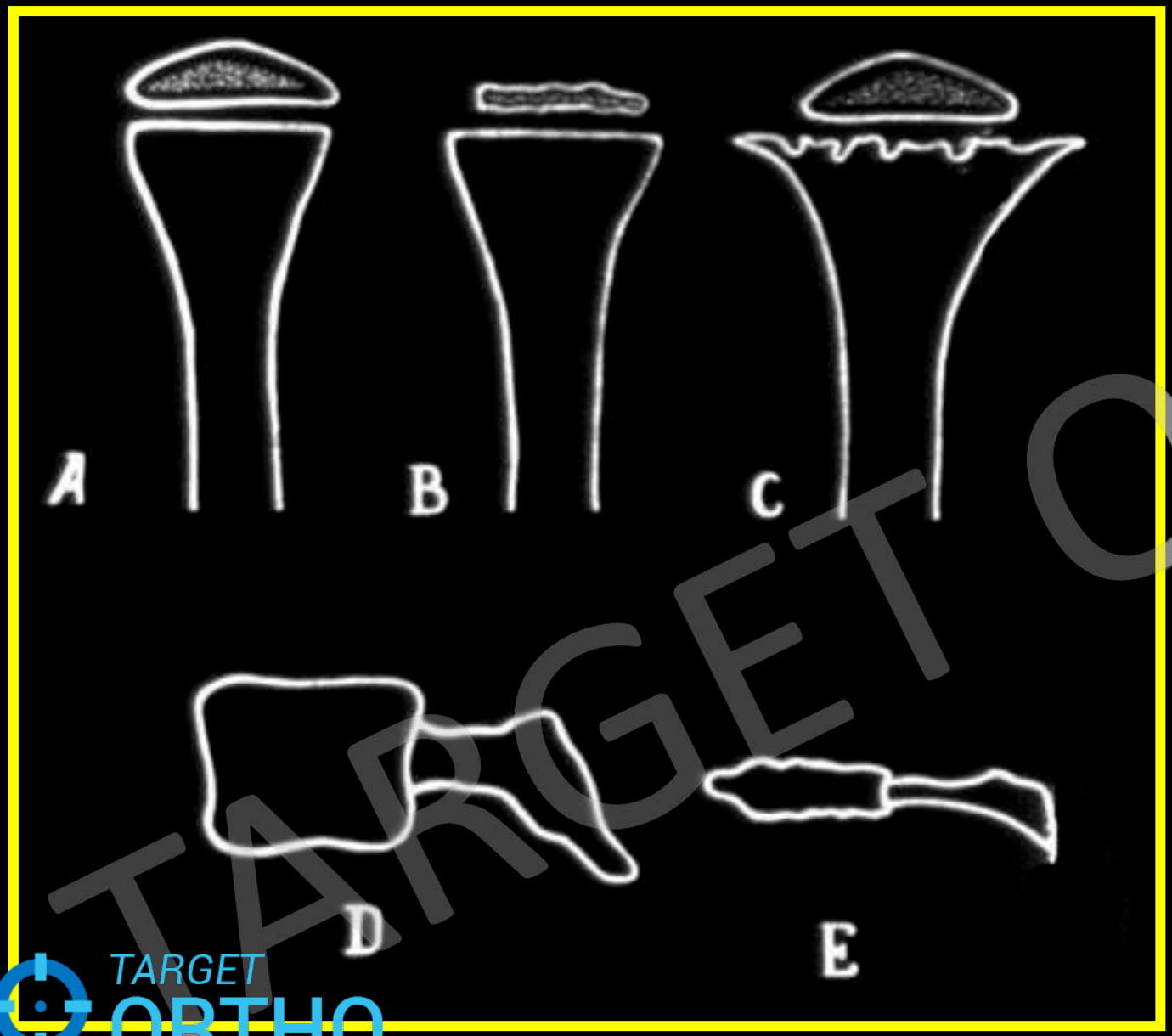


B. MULTIPLE EPIPHYSEAL DYSPLASIA TARDA



C. SPONDYLO-EPIPHYSEAL DYSPLASIA





INVOLVEMENT	DISEASE CATEGORY
A + D	NORMAL
B + D	EPIPHYSEAL DYSPLASIA
C + D	METAPHYSEAL DYSPLASIA
B + E	SPONDYLOEPIPHYSEAL DYSPLASIA
C + E	SPONDYLOMETAPHYSEAL DYSPLASIA

Nosology and classification of genetic skeletal disorders: 2019 revision.

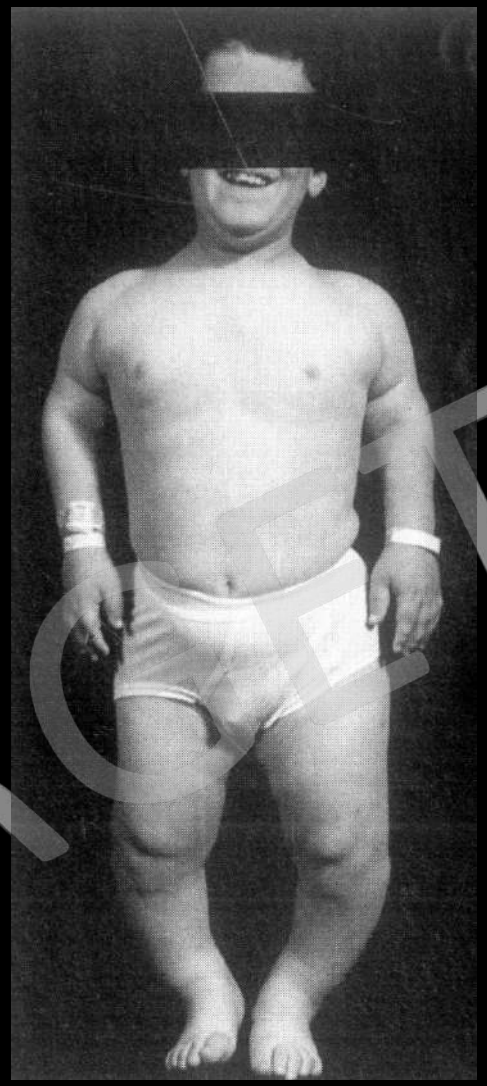
SKELETAL DYSPLASIAS - DIAGNOSIS

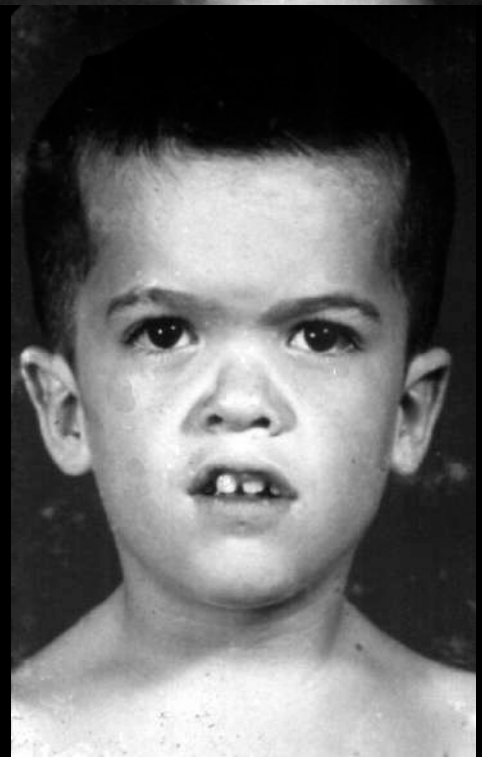
FAMILY PEDIGREE

LAB STUDIES

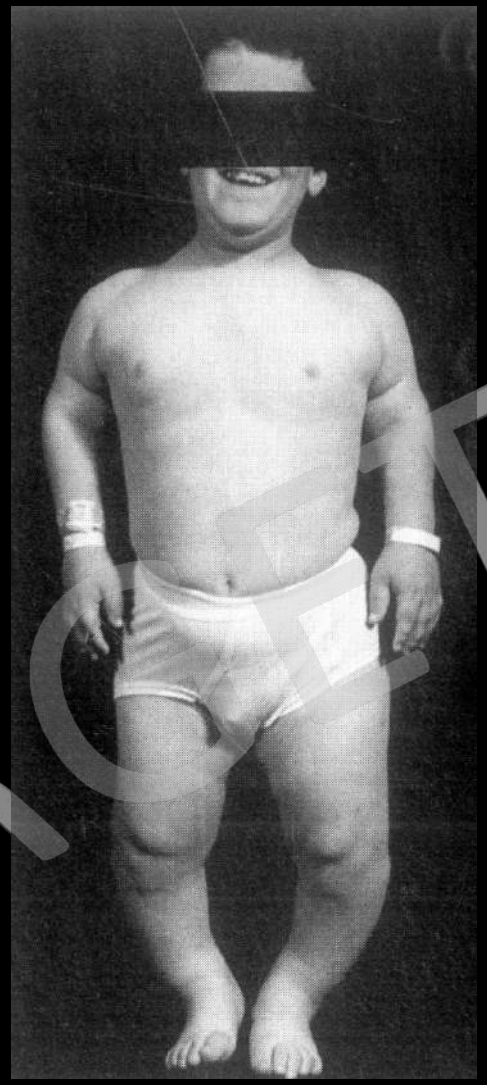
PATHOLOGICAL STUDIES (BIOPSY,GENETIC MAPPING)

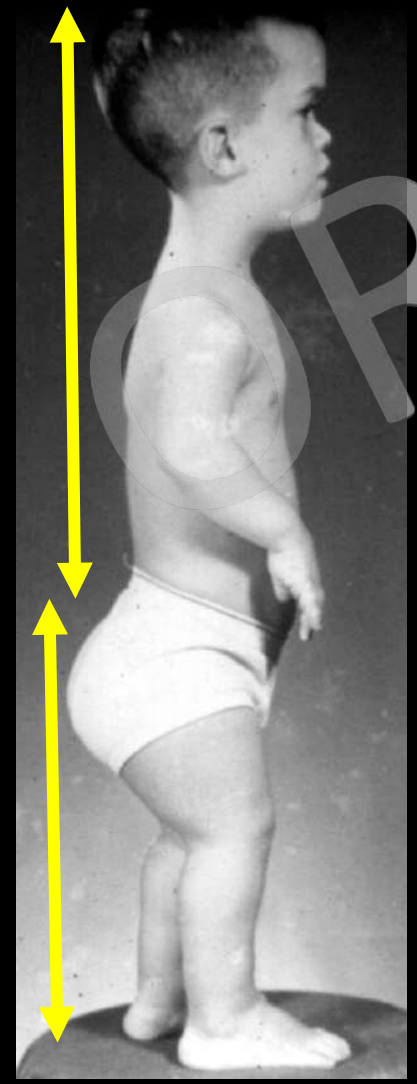
Achondroplasia

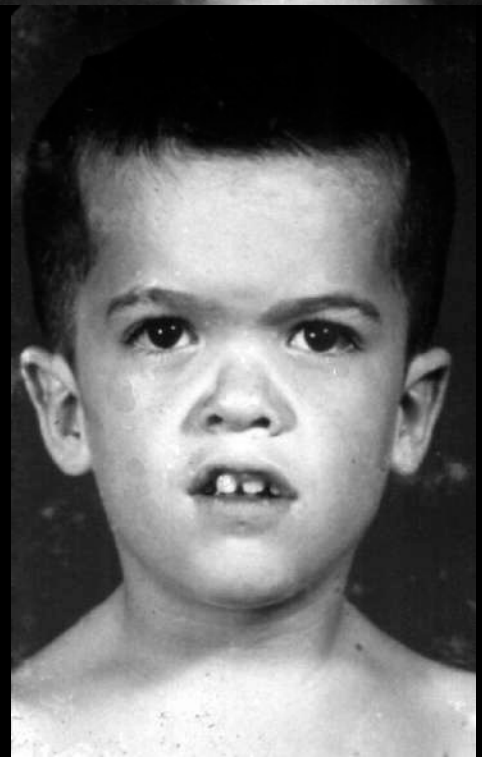




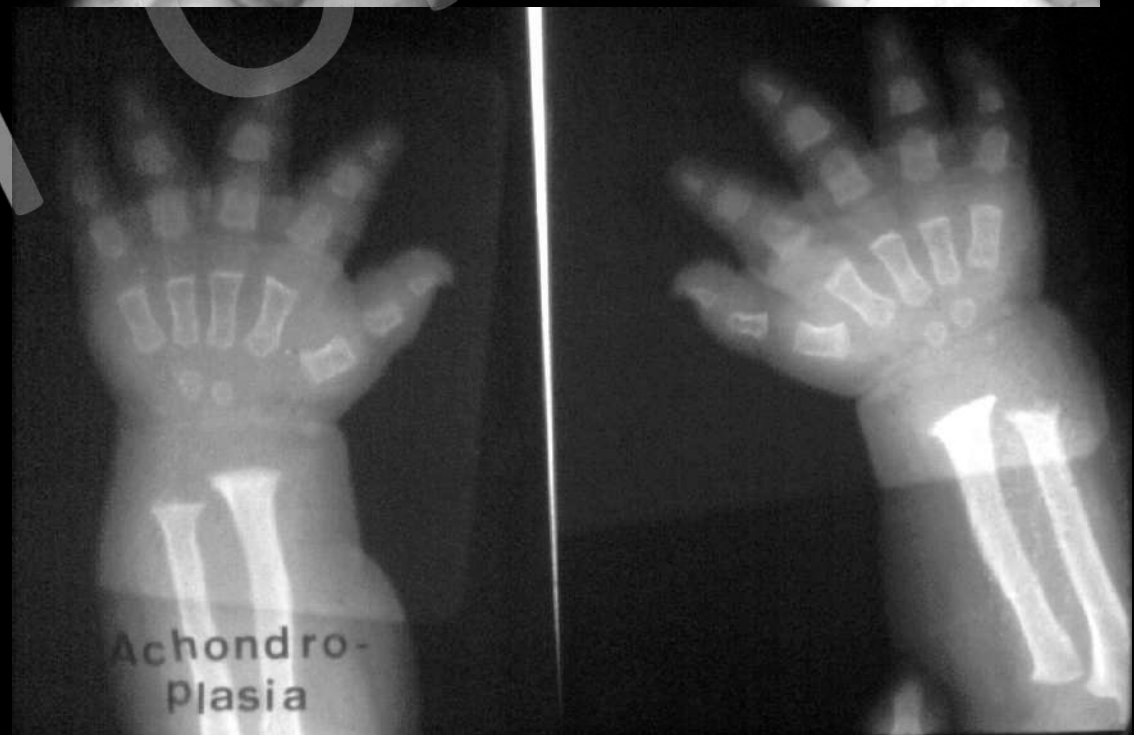
Achondroplasia

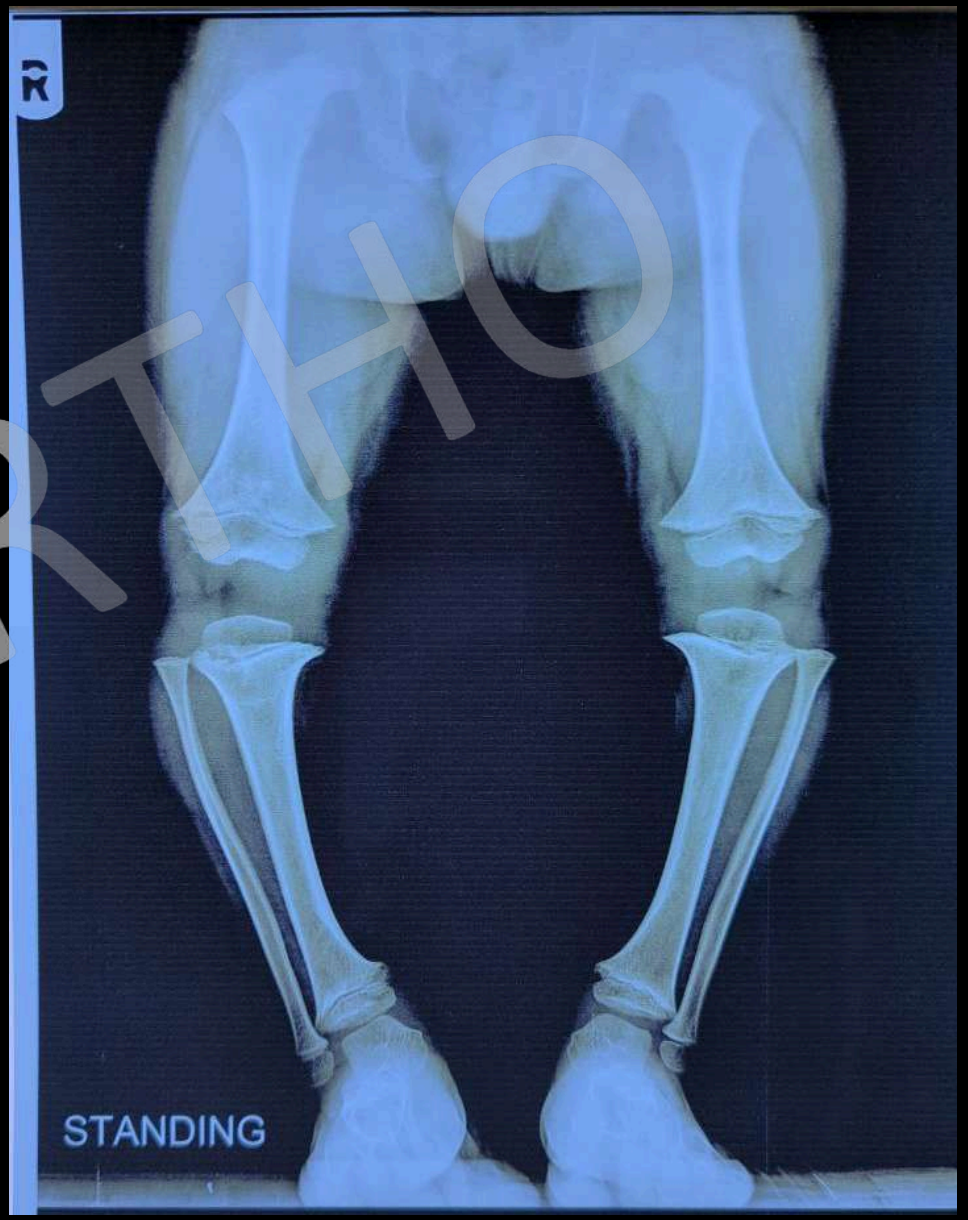






Achondroplasia





Bowing of the legs is the most common deformity in achondroplasia.

First noticed at the standing age in 40% of all children

Progresses rapidly 3 -4 yrs , and again at 6-7 yrs

Koptis SE. Orthopedic aspects of achondroplasia: human achondroplasia in children. **Basic Life Sci** 1988

PSEUDOACHONDROPLASIA

Epihyseal, Physeal And Metaphyseal Changes In Tubular Bones And Spine

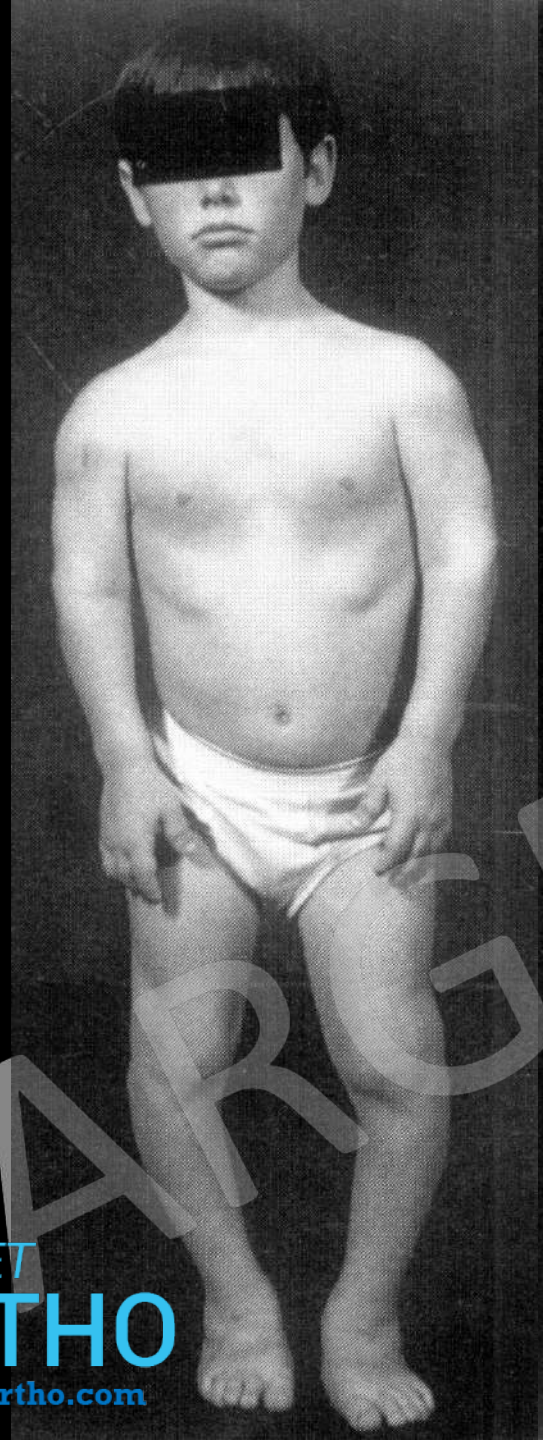
Short Limb Disproportionate Dwarfism

Head And Face Normal

Disease Manifests Between 2-3 Years Of Age

Adult Height – 3.5 – 4.5 Feet

Pseudoachondroplasia



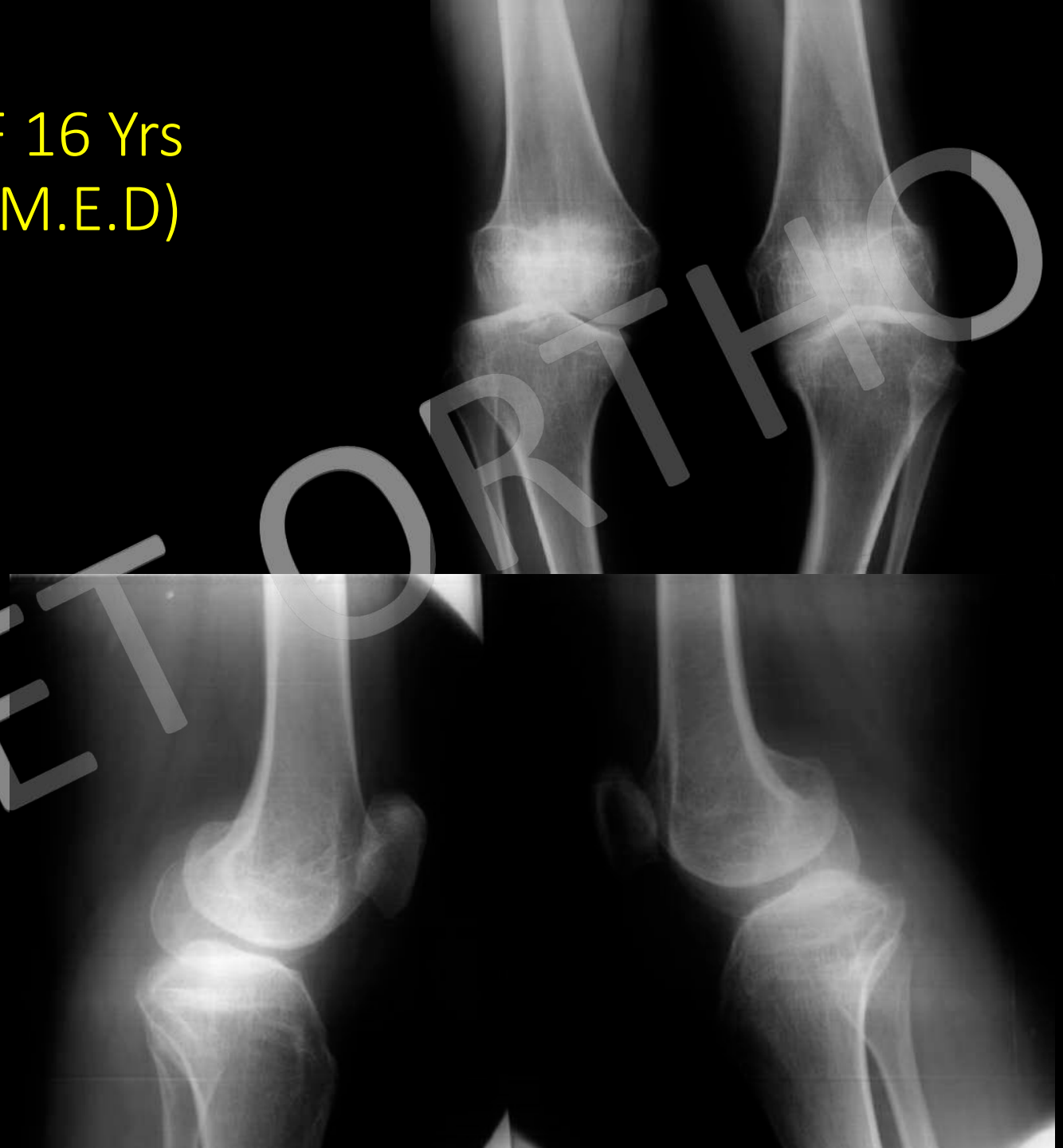
MULTIPLE EPIPHYSEAL DYSPLASIA

MILD SHORT STATURE

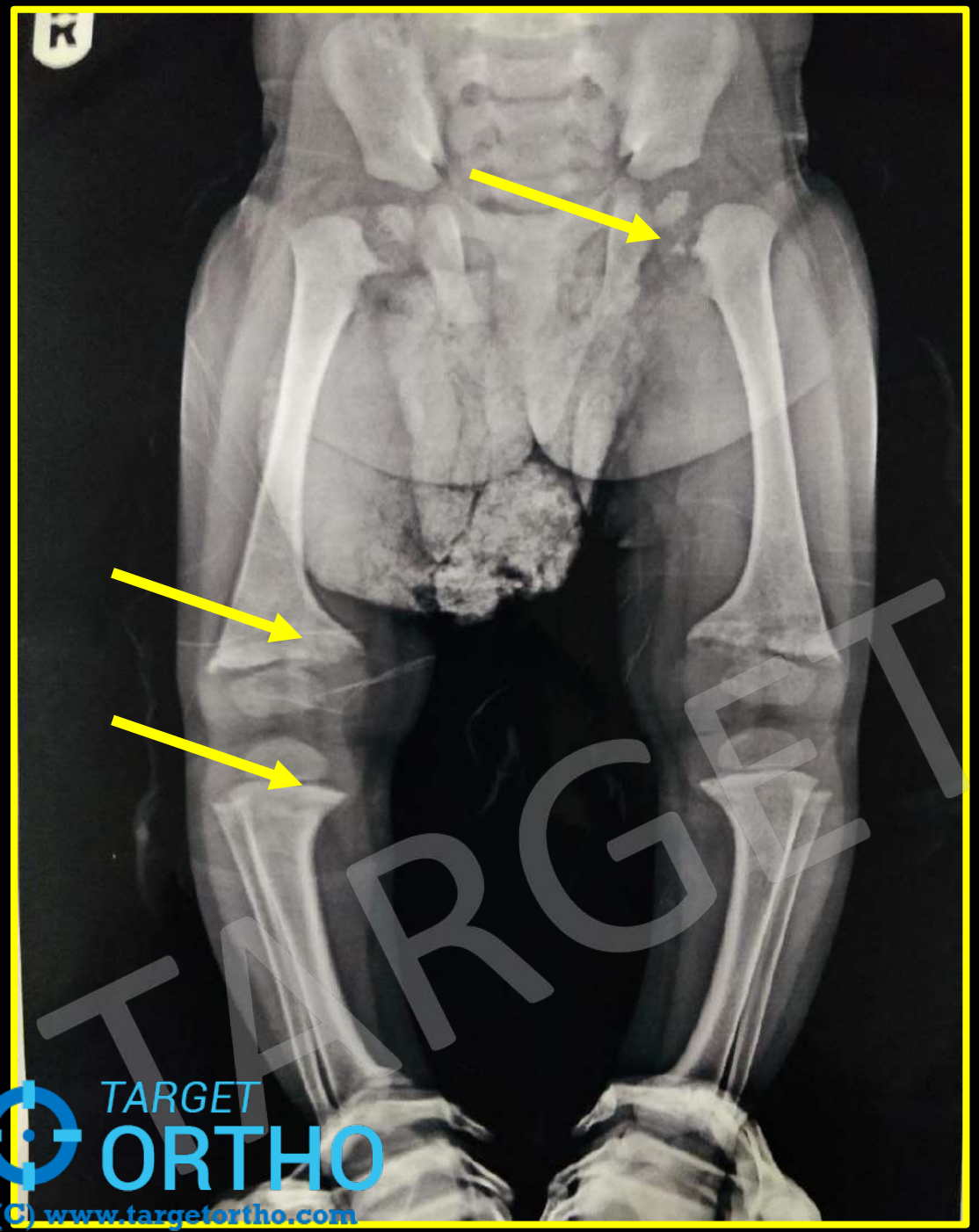
EPIHPYSEAL DEFORMITIES ARE GENERAL AND SYMMETRICAL

FACE , SKULL AND SPINE - NORMAL

F 16 Yrs
(M.E.D)



Spondyloepiphyseal Dysplasia



Schmidt’s Dysplasia

DIAGNOSTIC EVALUATION OF SKELETAL DYSPLASIA

1. RECOGNISE SHORT STATURE
2. DETERMINE SITE OF DISPROPORTION
3. DETERMINE SEGMENT OF LIMB
4. IDENTIFY DYSMORPHISM AND DEFORMITY

DIAGNOSTIC EVALUATION OF SKELETAL DYSPLASIA

5. CATEGORISE THE RADIOLOGICAL INVOLVEMENT

6. LAB EVALUATION, IF NECESSARY

7. FAMILY PEDIGREE

8. PERIODIC EXAMINATION IF DIAGNOSIS IS UNCLEAR

9. CONSULTATION WITH

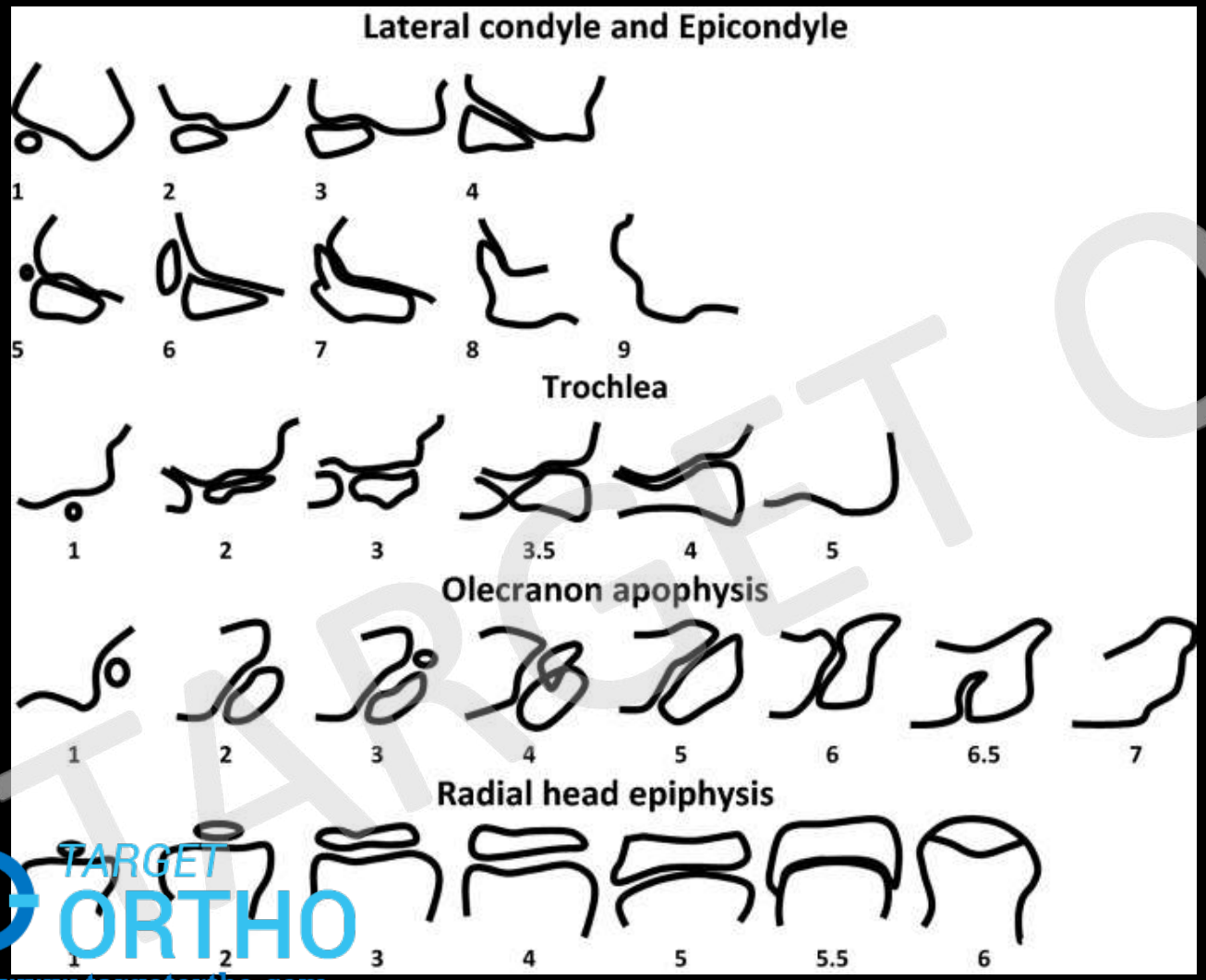
Achondroplasia	Short stature; rhizomelic shortening of the limbs; frontal bossing; midface hypoplasia; lumbar lordosis; elongated fibula; trident hand.
Pseudoachondroplasia associated with knock-knees in some patients	AD inheritance; short-limb dwarfism with onset by two years; joint laxity; vertebral anomalies.
Metaphyseal chondrodysplasia (multiple types)	Persistent bowing and short stature.
Multiple epiphyseal dysplasia syndrome	AD inheritance; mild short-limb dwarfism; brachydactyly; small, irregular epiphyses on radiographs.
Cartilage hair hypoplasia (McCusick)	Autosomal recessive inheritance; short-limb dwarfism; fine, sparse hair; sparse eyebrows, eyelashes, and beard; short hands.

PLANNING FOR MX

Interventions

- Observation
- Bracing
- Growth modulation
- Osteotomy

Sauvegrain



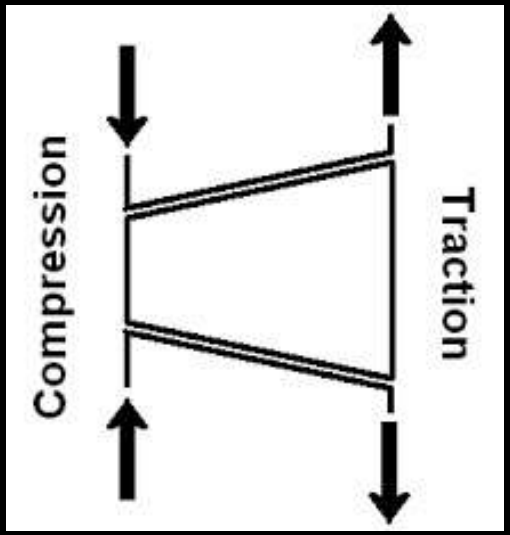
Open Phalangeal physis

Growth modulation

- Guiding growth/ MODULATION by harnessing the ability of growing bone to undergo plastic deformation is one of the oldest orthopedic principles.

- The mechanical modulation of epiphyseal growth is often referred to as the ‘Hueter-Volkmann Law’.

Heuter (1862): Growth is retarded by increased mechanical compression, and accelerated by reduced loading in comparison with normal values.



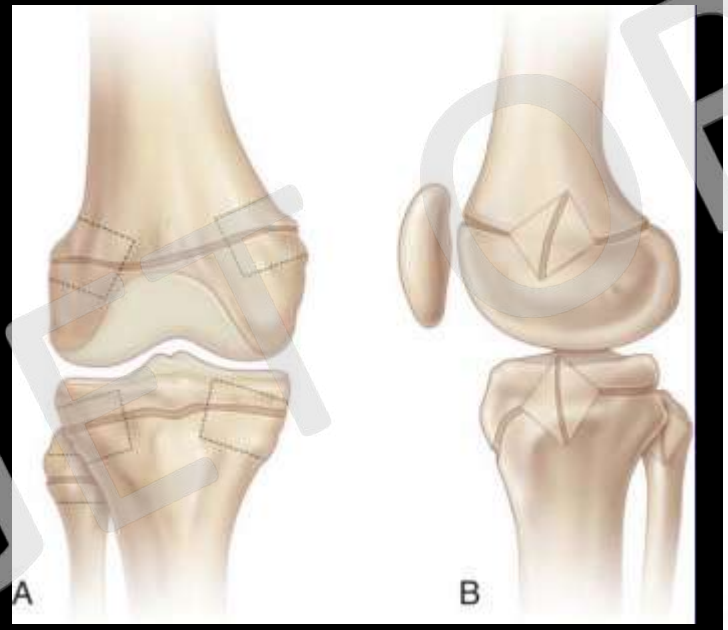
Epiphysiodesis

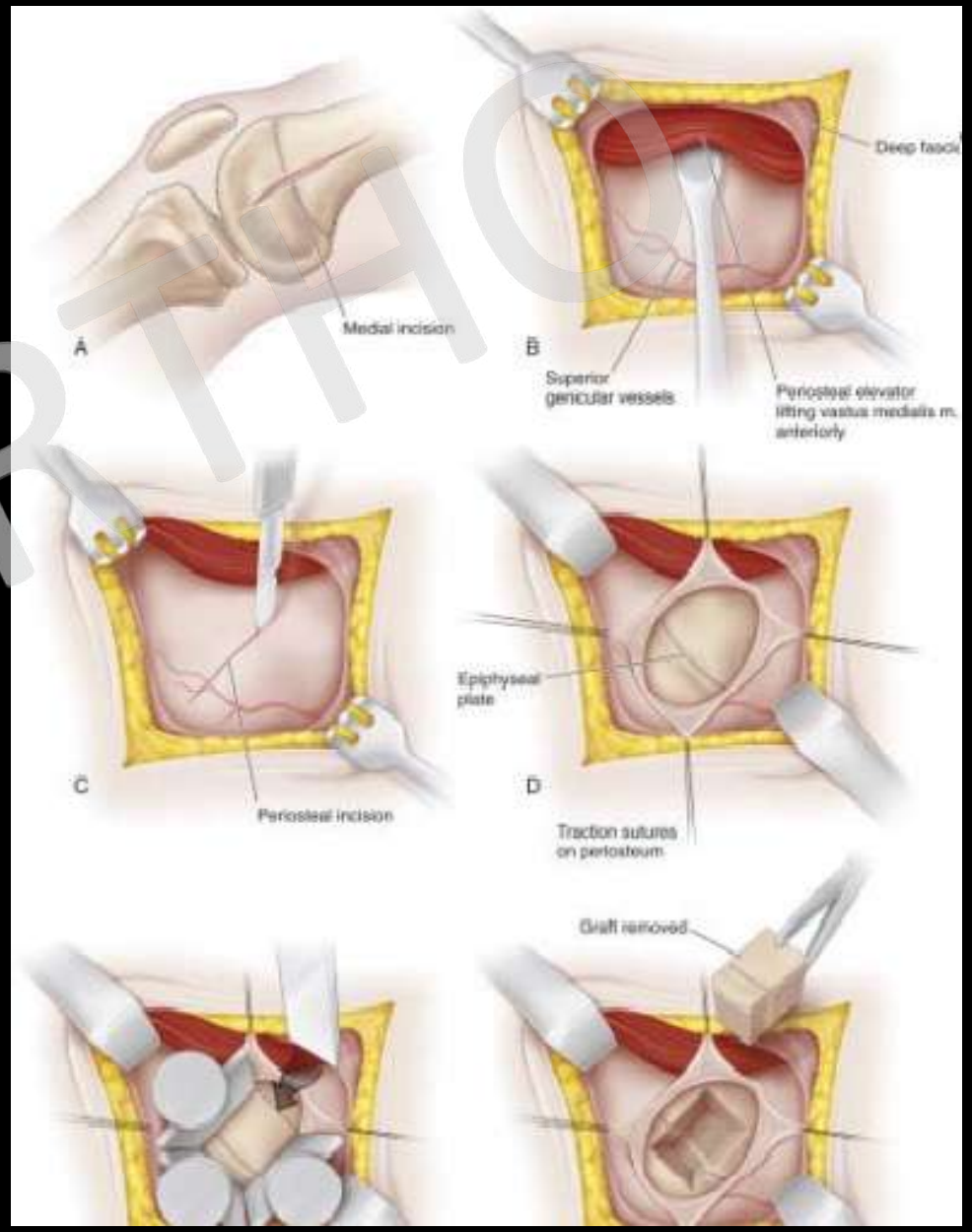
- Temporary. Reversible, differential arrest across a physis is an intuitive, simple and appealing means to correct an angular deformity of a long bone.

- Implant-mediated guided growth allows this reversibility, provided neither the implant nor the associated surgery permanently violate the physis.

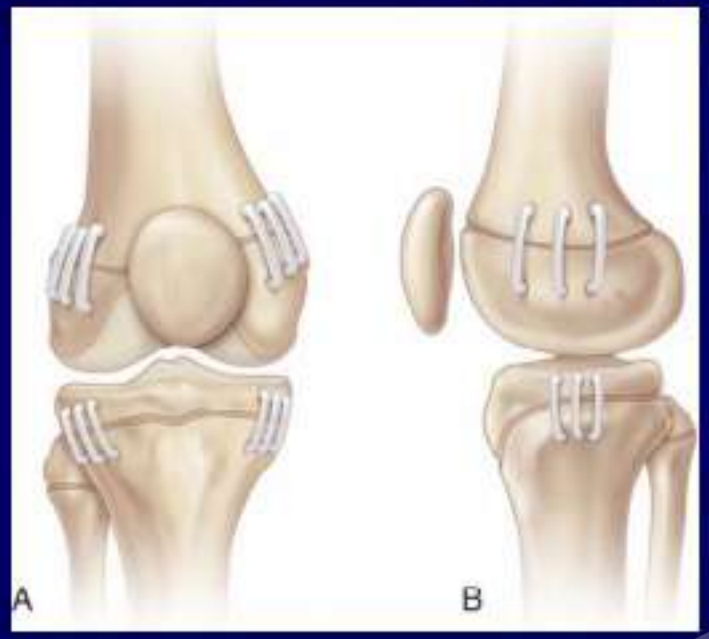
EPIPHYSIODESIS

- Phemister technique (JBJS 1933)
- To stop the growth with open destruction of physis at correct time to achieve equal limbs.





• Blount (staple) technique (CORR,1949)



12yr/female 1yr 2yr

PERCUTANEOUS EPIPHYSIODESIS

PETS(Percutaneous Epiphysiodesis using Trans epiphyseal Screws) (Metaizeau JP, et al, JPO,1998)

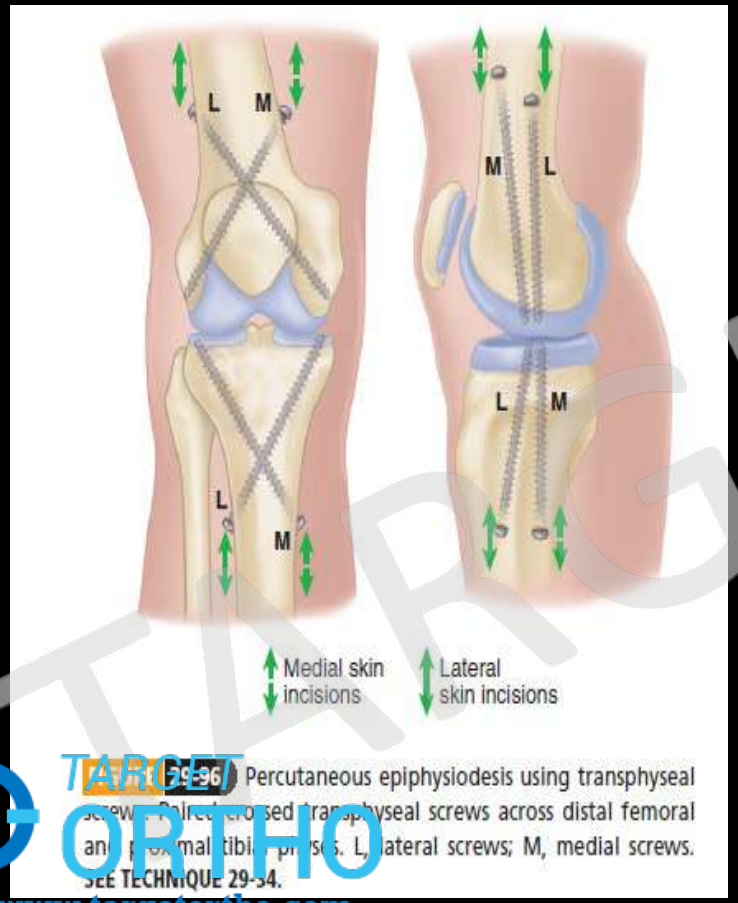


FIGURE 29-96 Percutaneous epiphysiodesis using transphyseal screws. Paired crossed transphyseal screws across distal femoral and proximal tibial physes. L, lateral screws; M, medial screws. SEE TECHNIQUE 29-34.

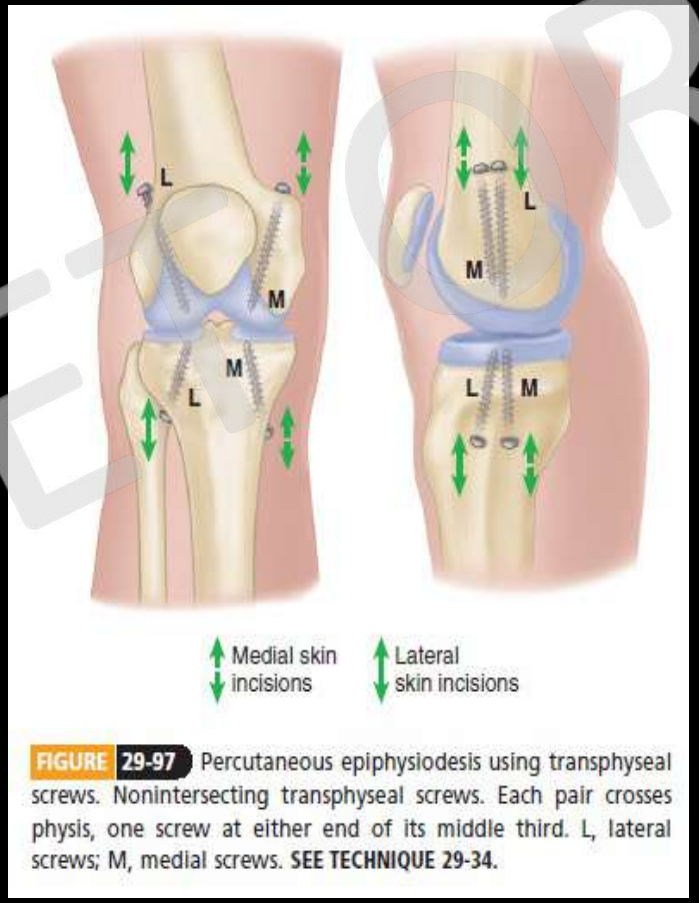
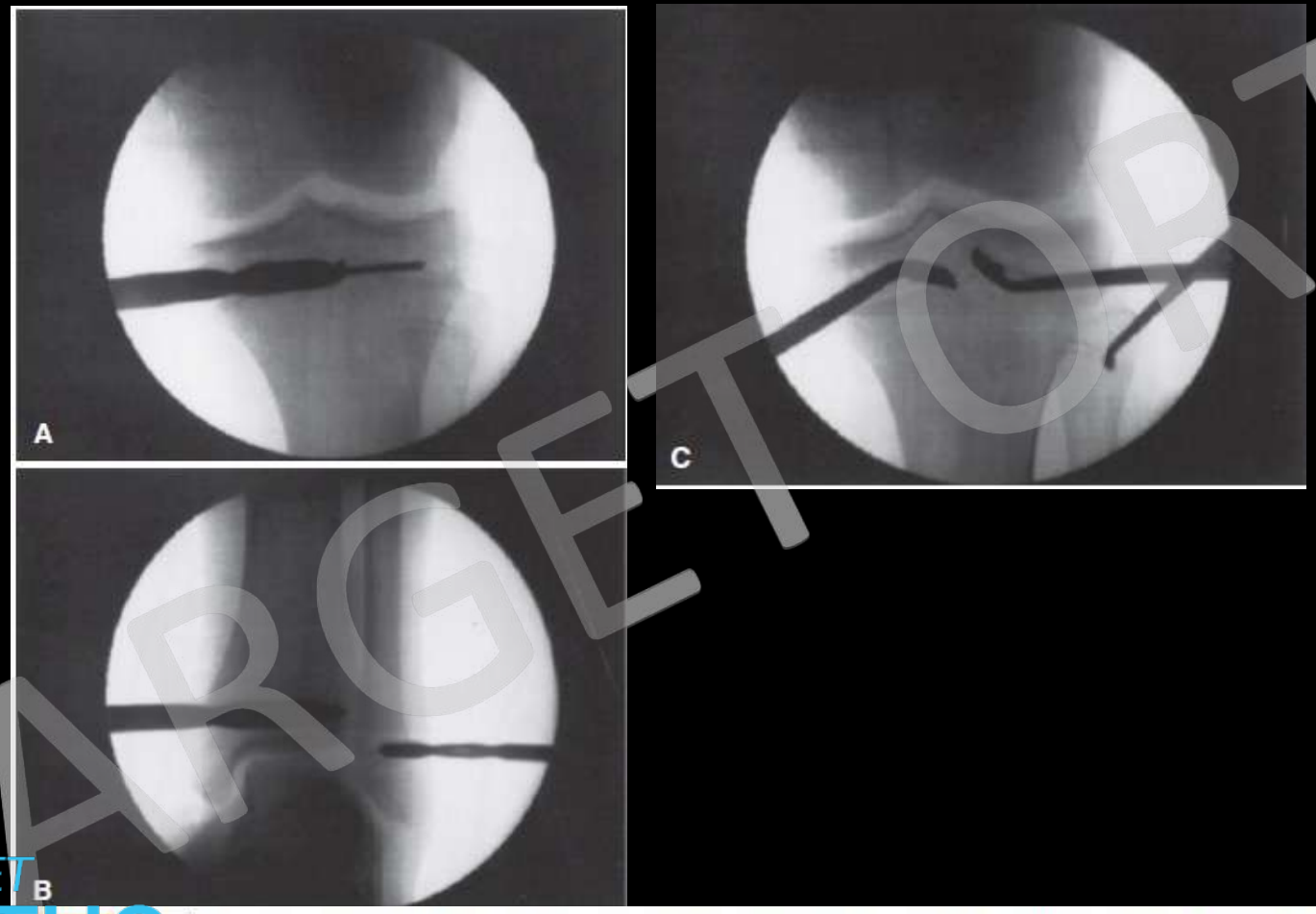


FIGURE 29-97 Percutaneous epiphysiodesis using transphyseal screws. Nonintersecting transphyseal screws. Each pair crosses physis, one screw at either end of its middle third. L, lateral screws; M, medial screws. SEE TECHNIQUE 29-34.

PETS in 14y M

PERCUTANEOUS EPIPHYSIODESIS



29-9 A, Insertion of cannulated reamer over guide pin in proximal tibia. B, Percutaneous drilling of distal tibial and fibular physes. C, Alternative method of using curets inserted through drill holes in cortex. SEE TECHNIQUE 29-37.

TENSION PLATE EPIPHYSIODESIS

- For Hemiepiphysiodesis in angular corrections
- it can be used for complete epiphysiodesis if implants are used on both sides of the physis.
- This technique also has the advantage of potential growth resumption with implant removal;
- Most of these plating systems are nonlocking

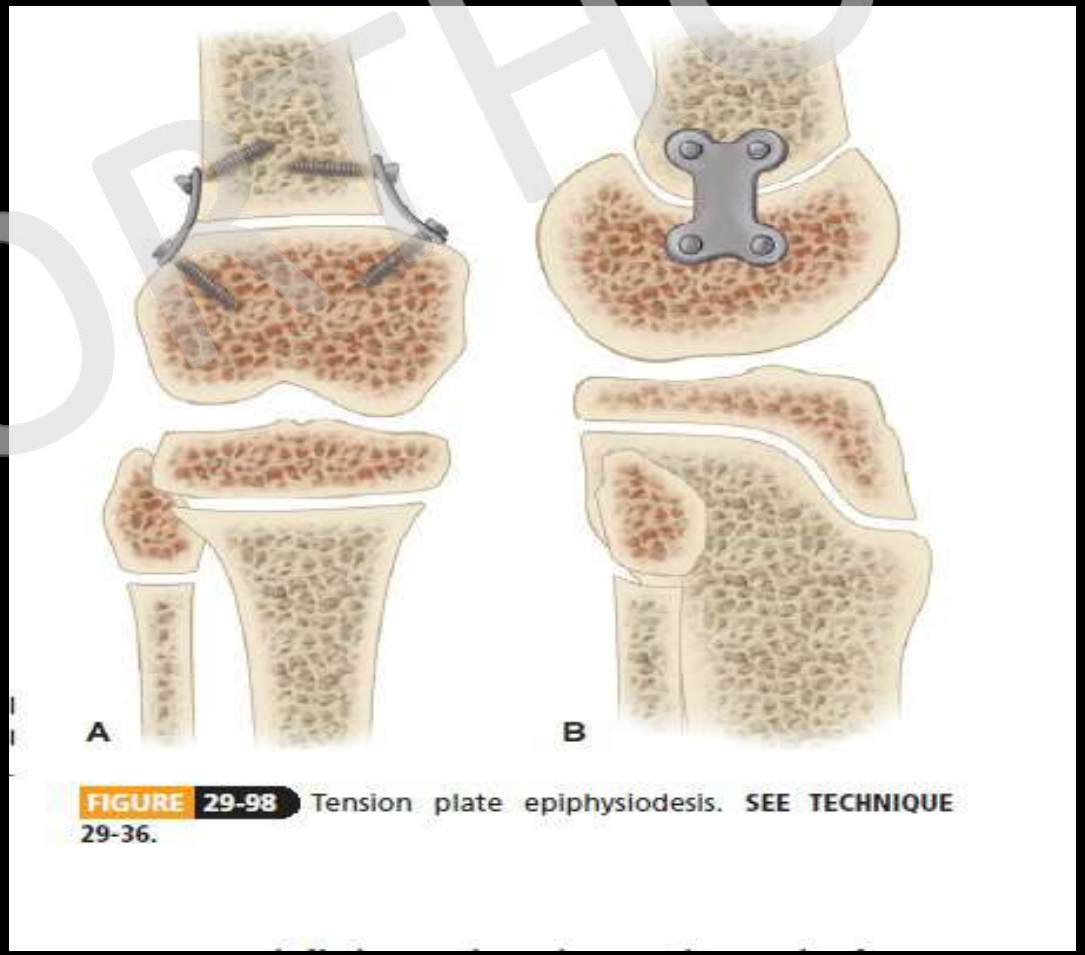


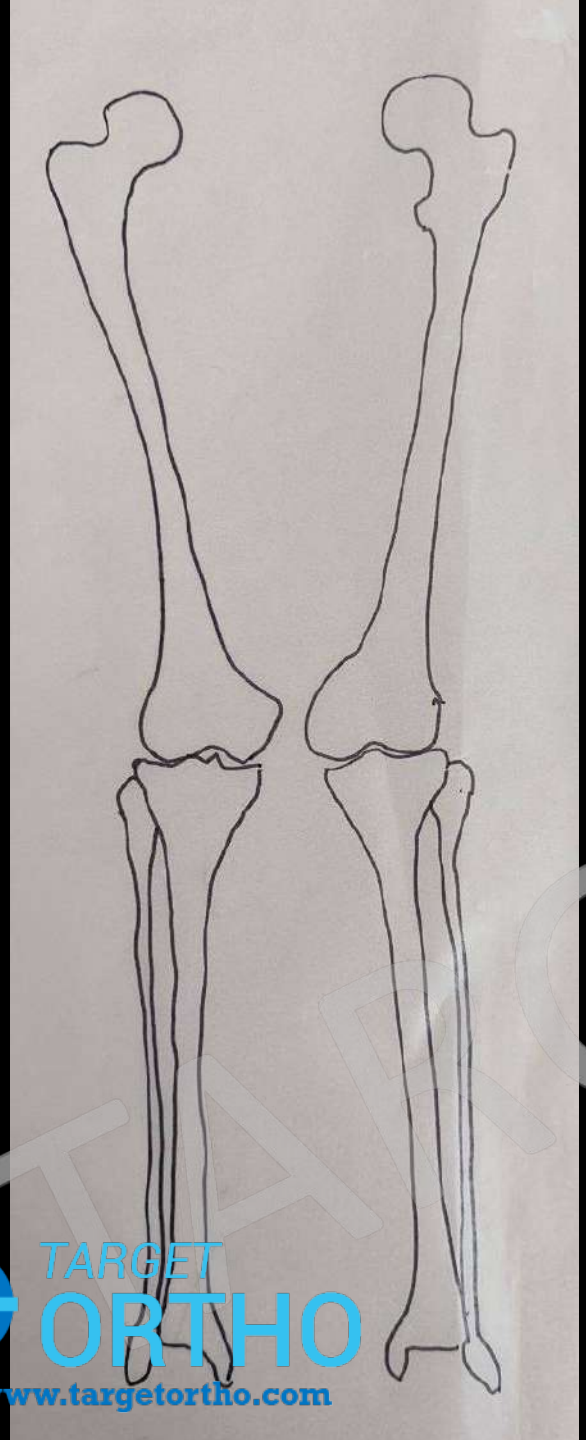
FIGURE 29-98 Tension plate epiphysiodesis. SEE TECHNIQUE 29-36.

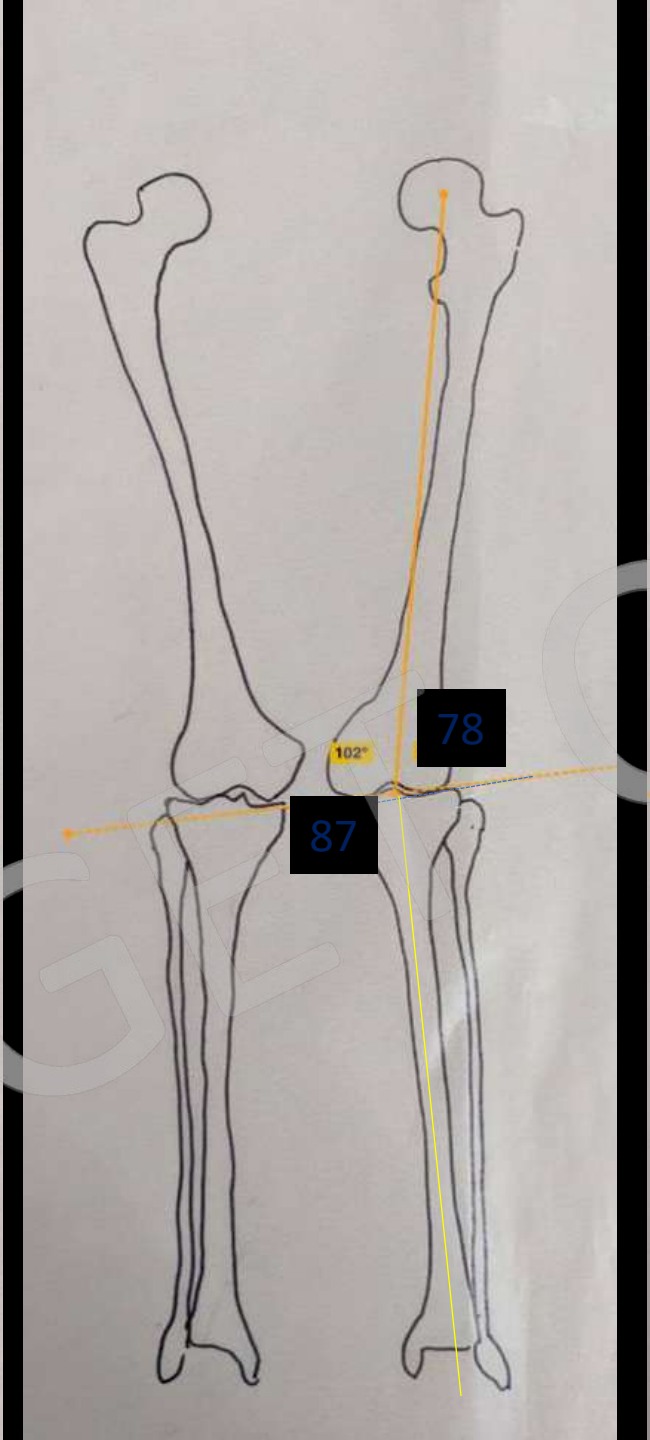
8 plate GM

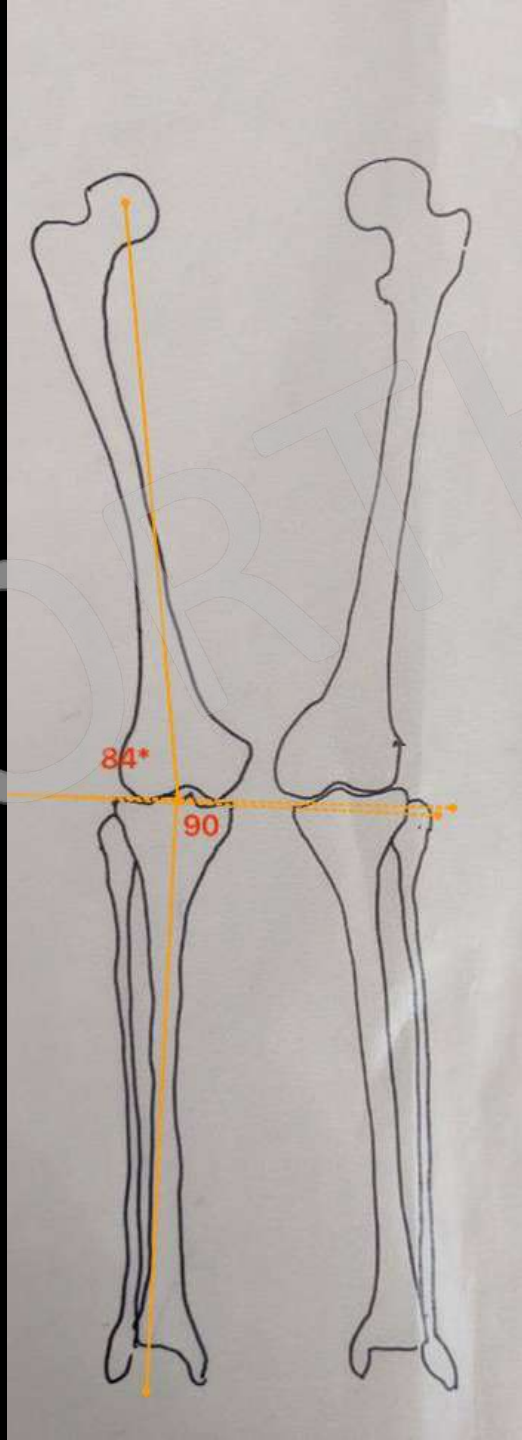
- Minimal scar and pain
- Reversible
- Early rehab

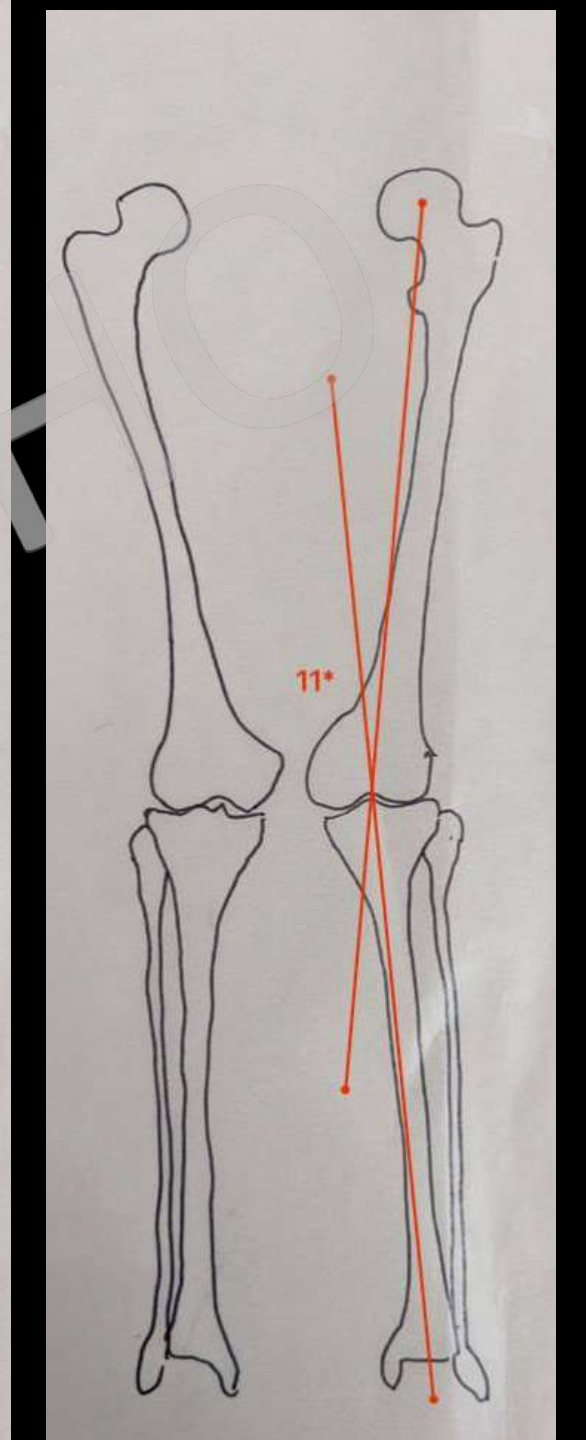
PROBLEMS OF EPIPHYSIODESIS

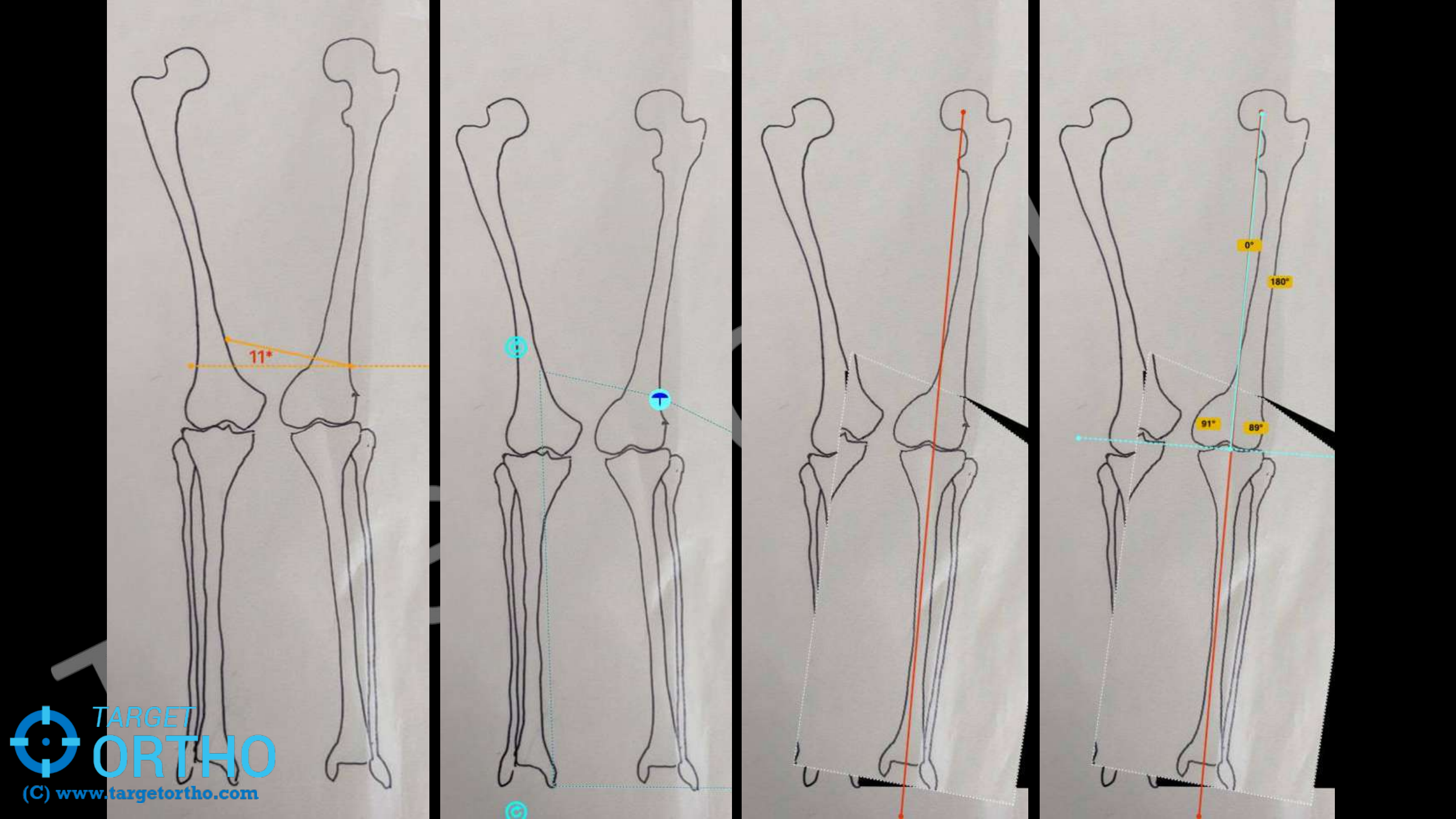
- Undercorrection
  - growth or angulation
- Overcorrection
  - growth or angulation
- Rebound phenomenon (staples or screws)
- Failure of growth restoration
- Staple breakage or bending

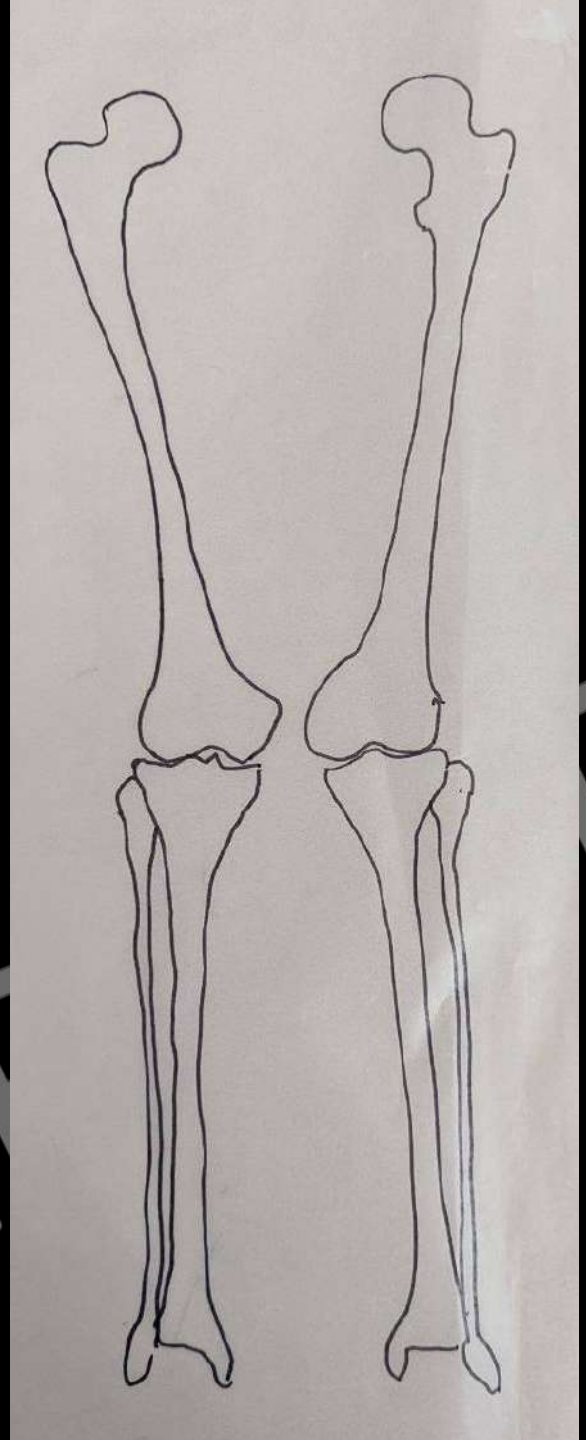


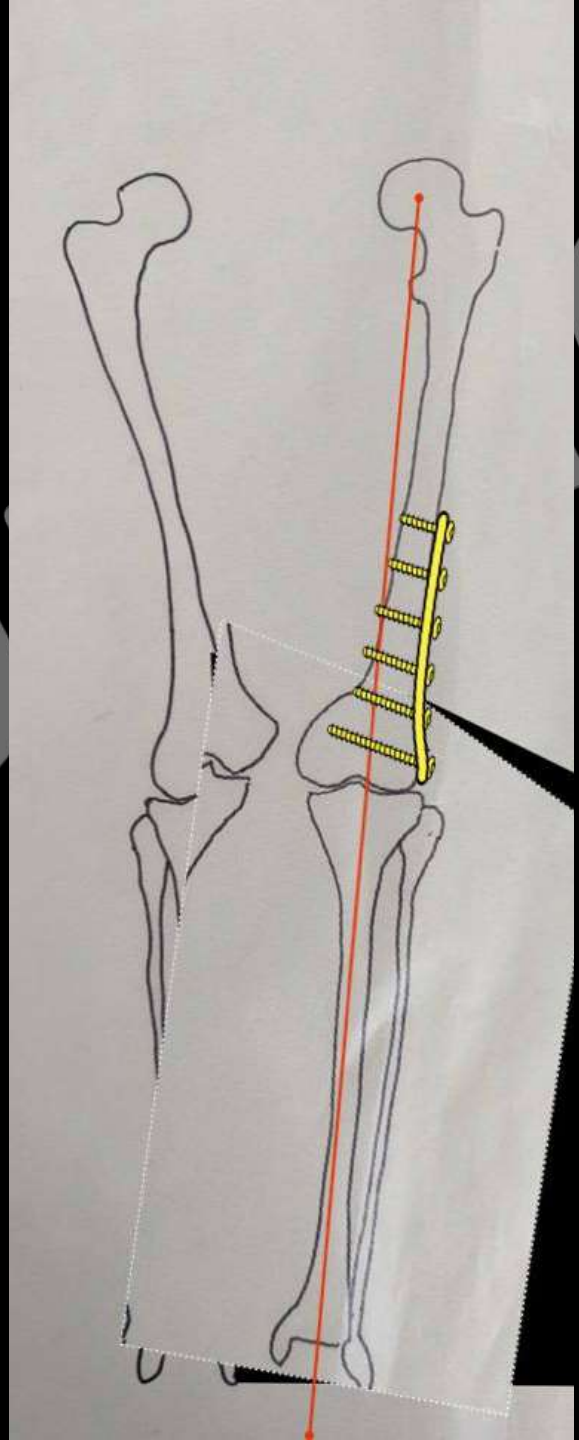




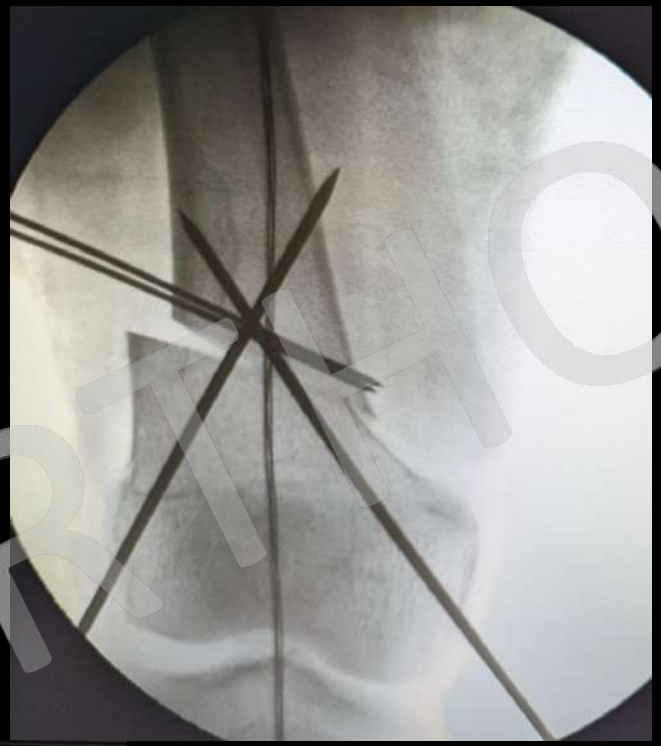








- Oblique Wedgeless osteotomy
- Herzenberg osteotomy



Question

15 Year male with progressive deformity

- Origin? Type?