

# Evaluation and Treatment of the Child with a Limb Length Discrepancy

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# DISCLOSURES

I have nothing to disclose



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# FORMULA FOR EVALUATION AND TREATMENT

1. Determine the etiology of the LLD
2. Ensure all associate issues are appropriately evaluated
3. Determine accurate lengths of the limbs and where the discrepancy is coming from
4. Predict estimated final limb length discrepancy
5. Determine ultimate treatment and treatment needed at current visit.



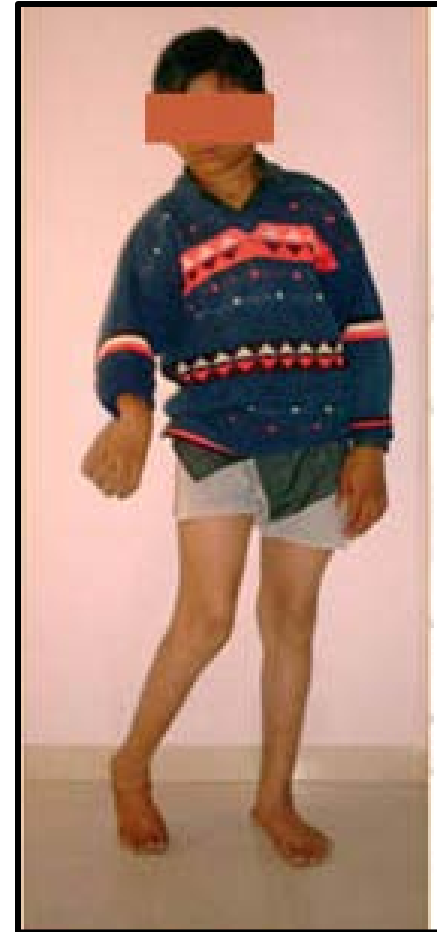
# Etiology - Congenital Causes of LLD

- Limb deficiency
- Hemihypertrophy
- Idiopathic hemiatrophy
- Tibia/fibula hemimelia
- Congenital femoral dysplasia
- Proteus syndrome
- Beckwith Wiedeman
- Klippel Trenaunay
- Idiopathic



# Etiology – Acquired Causes of LLD

- Traumatic
  - ◆ Physeal arrest
- Neurologic disorders
  - ◆ Polio
  - ◆ Hemiparesis
- Infection
- Tumor
- Radiation



# CONDITIONS ASSOCIATED WITH LLD

## 1. Intra-abdominal Neoplasm

- 10% incidence with syndromic hemihypertrophic
- 1.2% incidence with idiopathic hemihypertrophy

## 2. Joint contractures, limb bowing

- Often seen in mild forms of limb deficiency

## 3. Foot anomalies

- Limb deficiencies
- Neuromuscular diseases



# HOW TO MEASURE LLD

## Physical Measurements

1. Blocks
2. Tape Measure

## Radiographic Measurements

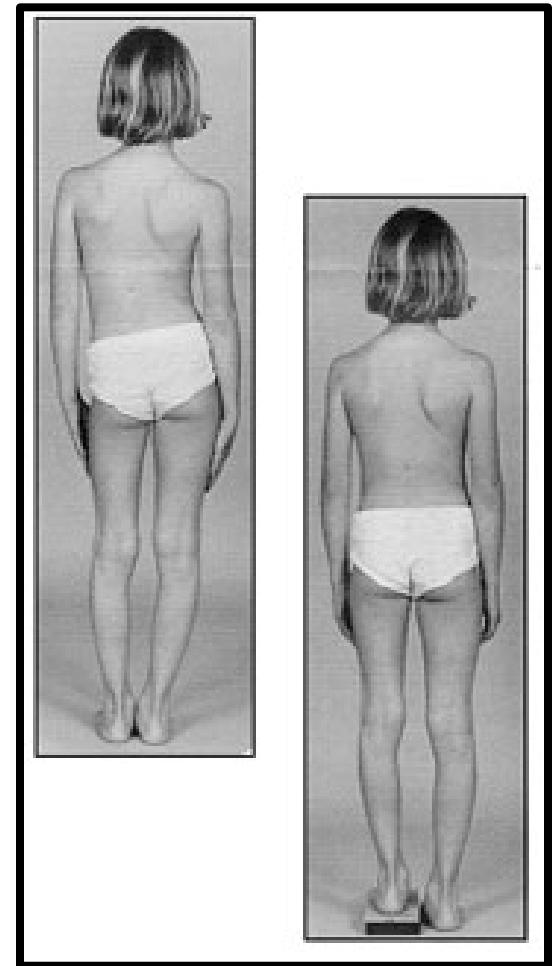
1. AP Lower Extremity Alignment Radiograph
2. Scanogram
3. CT Scanogram



# Physical Exam

- Graduated blocks

- Supine galeazzi



- Other anomalies (girth, skin, spine, neuro)





# Imaging

- Standing AP BLE
- Blocks under short limb
- Level pelvis
- Estimates overall LLD

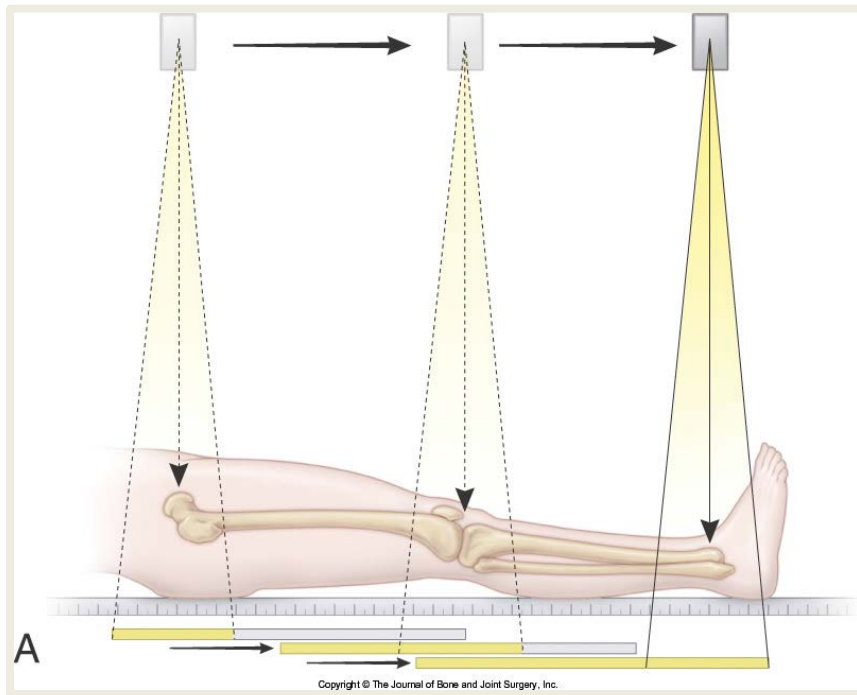


10

cm

# Scanogram

- Similar to orthoroentgenogram



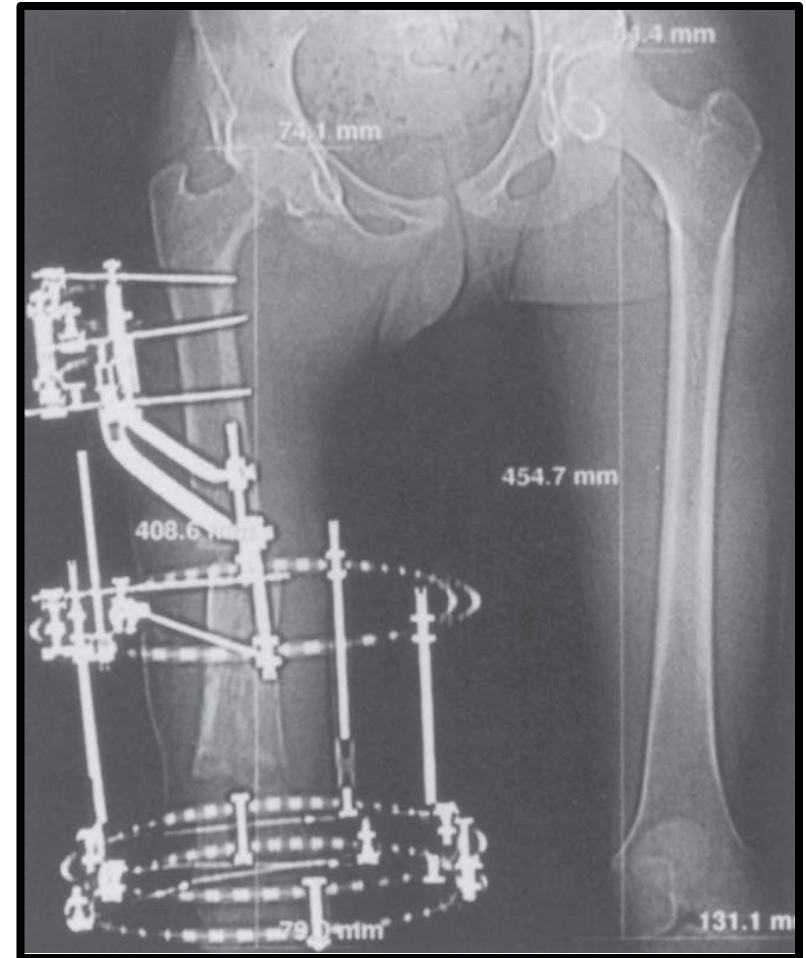
- Disadvantages

- ◆ Patient MUST remain motionless
- ◆ Does NOT account for hindfoot or pelvis height



# CT Scanogram

- More accurate if fixed joint contractures
- Nonstandard positioning (circular ex-fix)



# Caveats to Measuring LLD

- Structural vs Functional
  - 3cm for every  $10^\circ$  add/abduction contracture
    - Adduction - short
    - Abduction - long
  - Evaluate for asymmetric limb deformity
  - Need to account for feet and pelvis



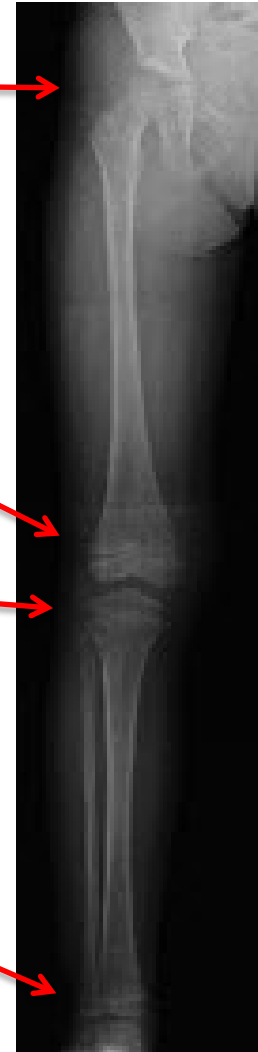
# Predicting LLD

- Understand normal skeletal growth
- Contribution of each physis
- Skeletal vs chronologic age
- Timing of skeletal maturation

# General Rules for Growth

- Proximal Femur 3 mm/yr
- Distal Femur 9 mm/yr
- Proximal Tibia 6 mm/yr
- Distal Tibia 5 mm/yr

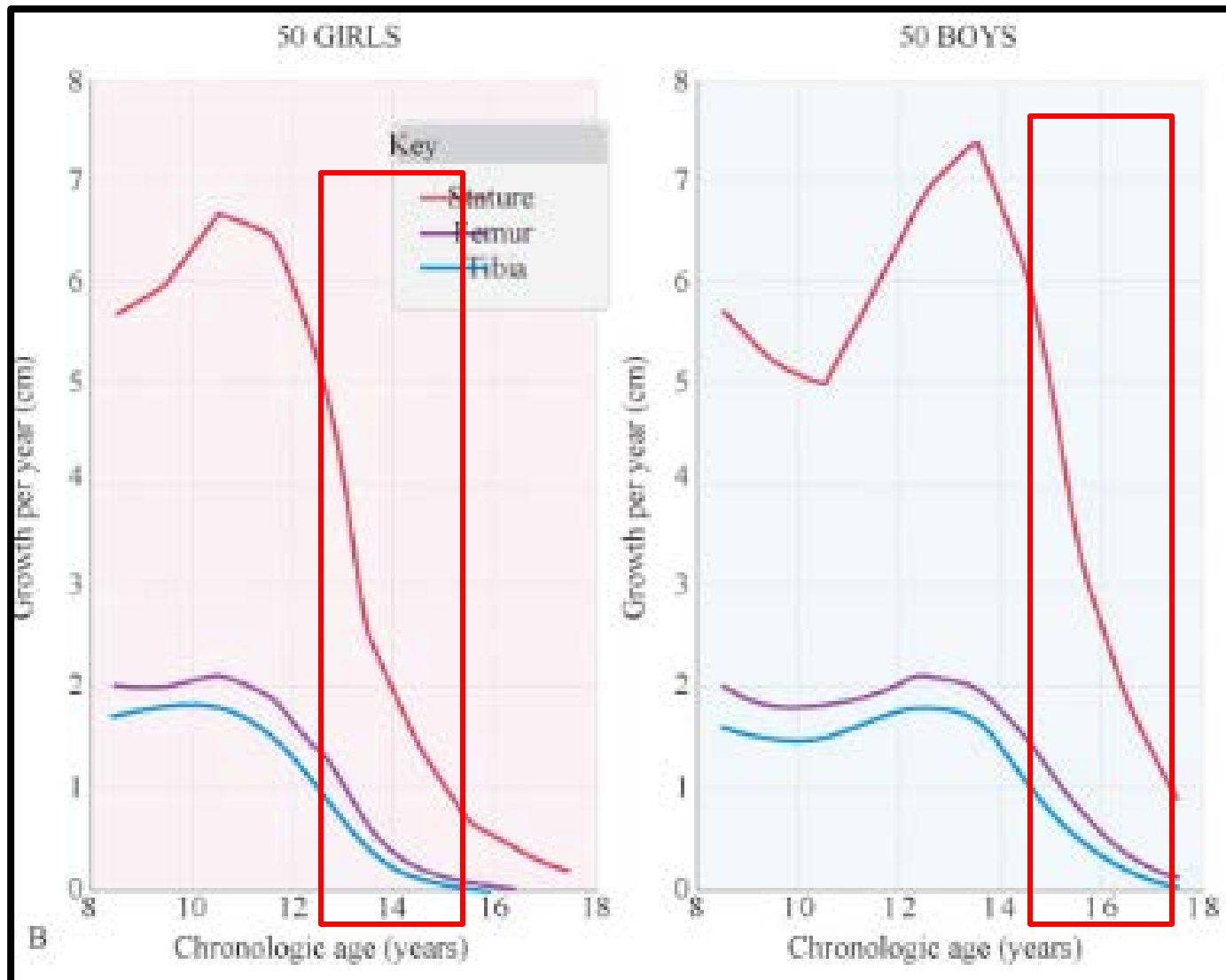
Skeletal Maturity: Boys = 16, Girls = 14



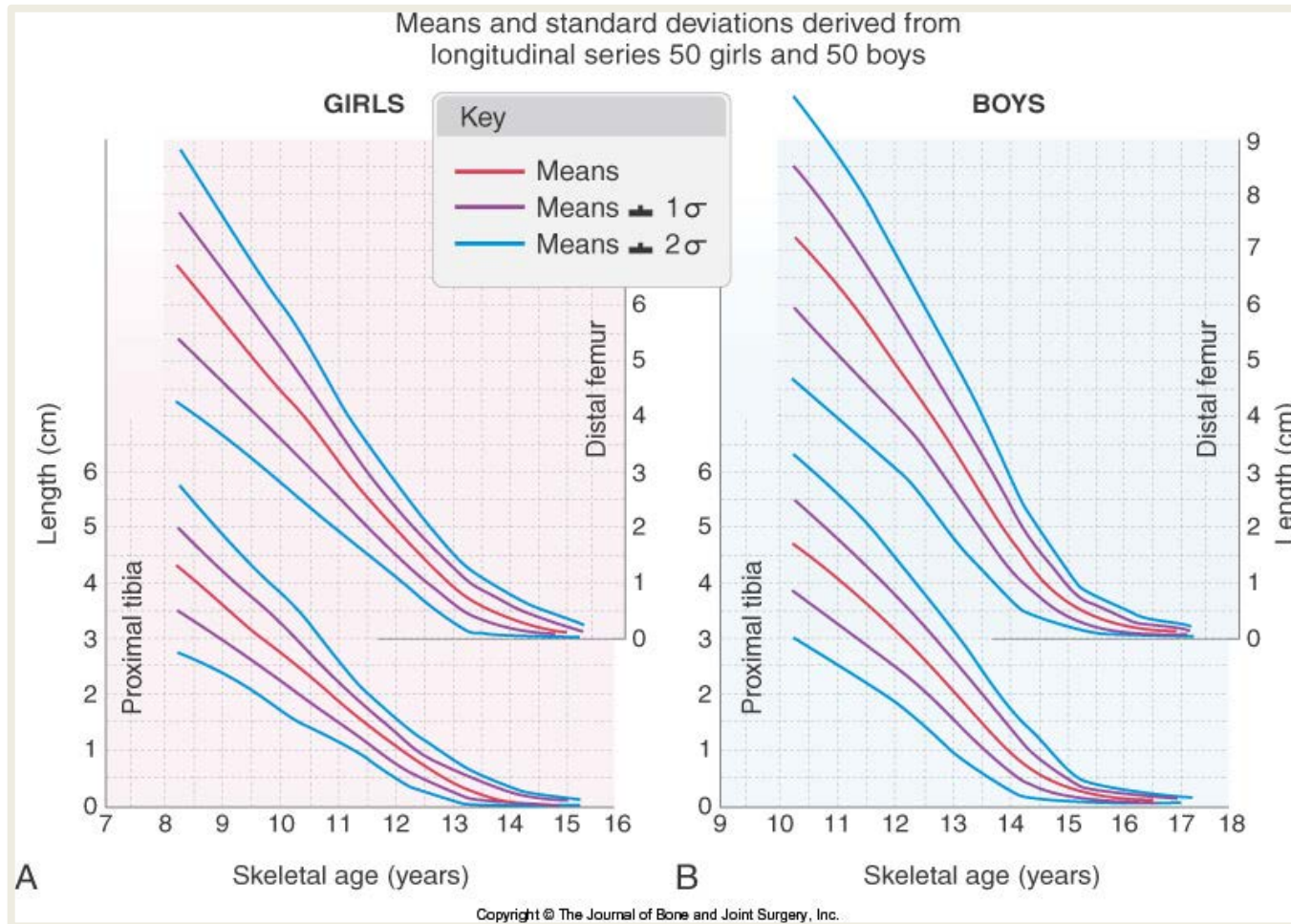
80% within ½ inch calculated discrepancy

# Yearly Growth

- Green-Anderson-Messner

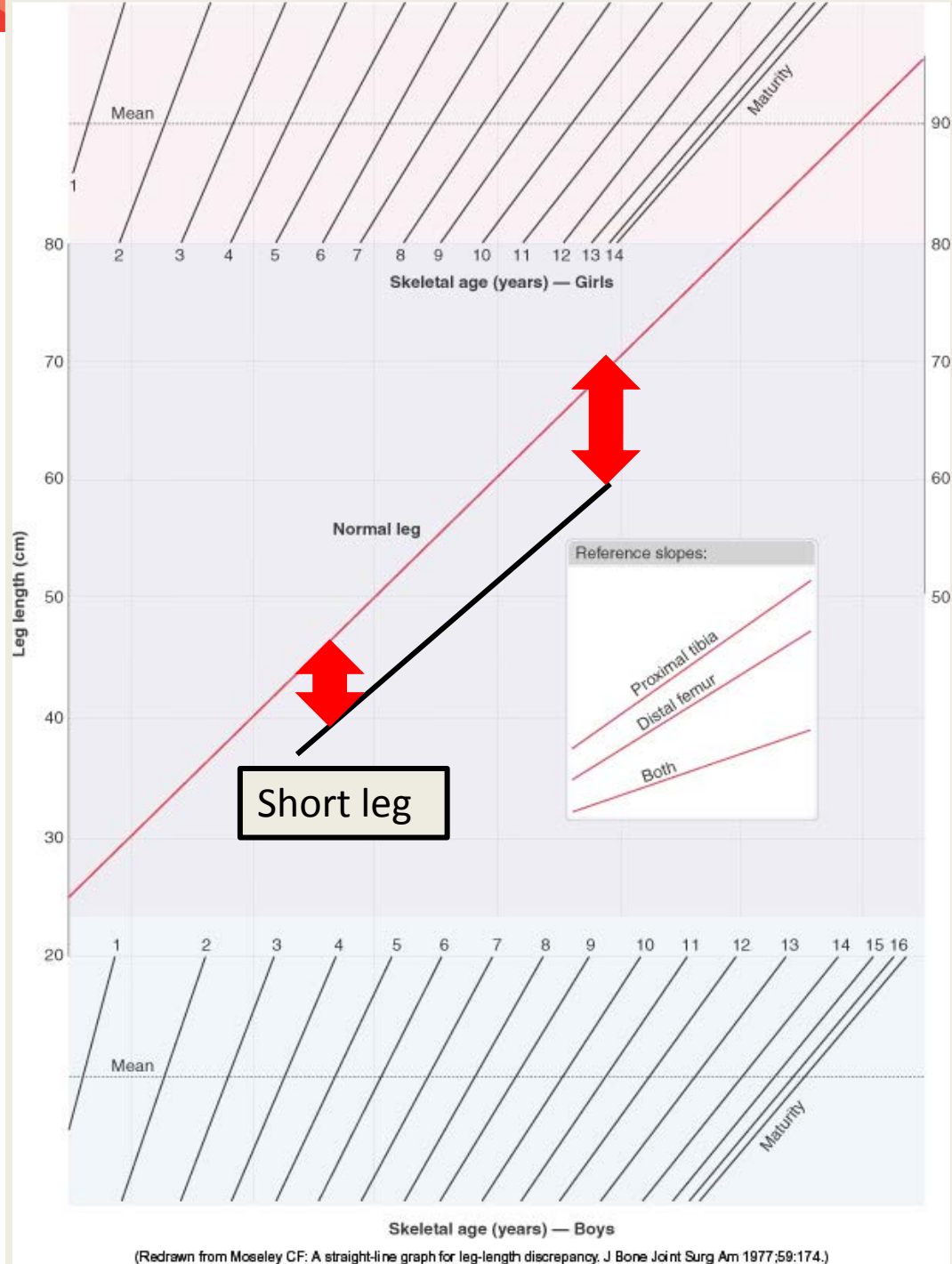


- Green-Anderson-Messner
  - Estimation of remaining growth distal femur + proximal tibia  $\geq$  age 8





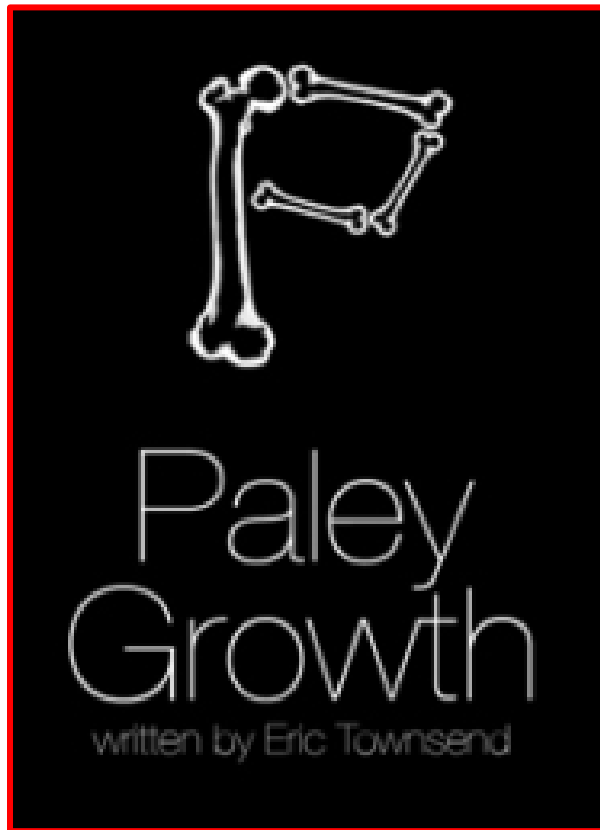
# Moseley Graph



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# Paley Multiplier Method

- Calculates LLD at skeletal maturity



# The Effect of Limb-Length Discrepancy on Gait\*

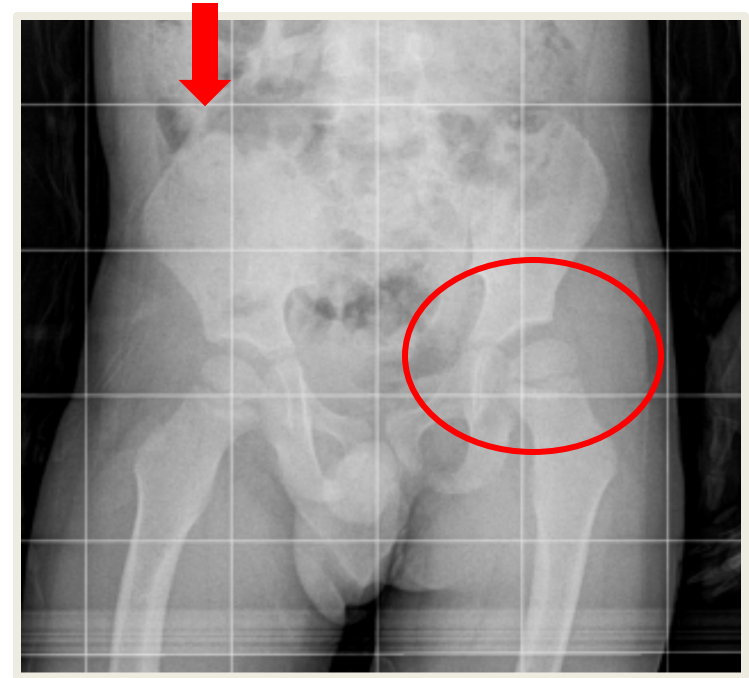
BY KIT M. SONG, M.D.†, SUZANNE E. HALLIDAY, M.Sc.‡, AND DAVID G. LITTLE, F.R.A.C.S.§, DALLAS, TEXAS

*Investigation performed at Texas Scottish Rite Hospital for Children, Dallas*

- LLD expressed as % length long leg
- <3% no compensatory strategies **2cm**
- >5.5% more mechanical work and increased vertical displacement **4cm**
- Compensatory strategies
  - Vaulting, circumducting, knee flexion, toe walking

# Effects of Inequality

- Long leg dysplasia
  - ◆ Acetabular dysplasia
  - ◆ Lateral head uncoverage
- Postural scoliosis ?
- Low back pain
  - ◆ Inc incidence LLD in chronic LBP
  - ◆ LBP improves after equalization



# DETERMINE THE TREATMENT

- Goal = Even limbs at skeletal maturity

0-2cm

No treatment necessary  
Shoe lift

2cm -5cm

Epiphyseodesis (inhibit growth in longer leg)  
Acute shortening of longer leg  
Lengthening of shorter leg

>5cm

Combined approach  
Multiple lengthenings of shorter leg



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# CONCLUSION

- Identify the cause of the limb length discrepancy
- Don't miss associated abnormalities
  - Abdominal tumors
  - Manifestations of underlying etiologies
- Measure the discrepancy accurately
  - Blocks are the best method – easy and cheap to follow over time
  - Know the imaging to order
- Predict and Treat
  - The goal is to have equal limbs at skeletal maturity!

