

Introductory Seminar  
**Primus Metatarsus Supinatus**  
known as  
**Rothbarts Foot**

presented by

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## **Introductory Seminar – Primus Metatarsus Supinatus - Rothbarts Foot**

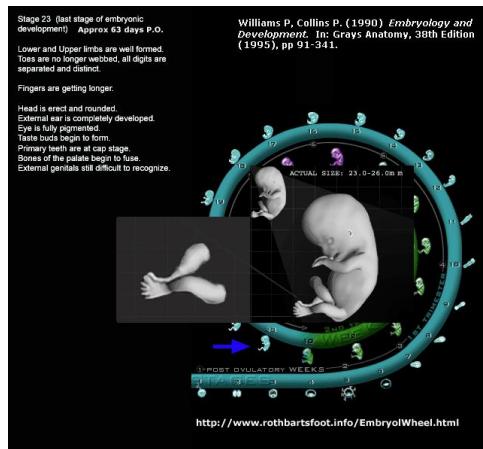
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## Introductory Seminar – Primus Metatarsus Supinatus - Rothbarts Foot

### I Embryogenesis – embryological development of the lower leg and foot

#### A. Embryogenesis<sup>1</sup> - normal ontogenetic development of the lower leg (unwinding of the leg)



- Week 3 pf – lower limb bud appears as a swelling opposite the lower lumbars
- Week 6 pf – lower limb bud sits at right angles to the rump of the embryo, soles of feet and posterior compartment of legs and thighs face cephalad
- Week 8 pf – limb bud has rotated 90 degrees around its longitudinal axis, soles and posterior surfaces of thigh and legs now face one another
- Week 9 pf – primordial ankle and knee joints appear
- Week 10pf – leg and thigh are unwinding around their longitudinal axes leaving the foot in supinatus.

#### B. Talar Ontogenesis<sup>2</sup> (unwinding of the foot)

- Full** torsional development of the talar head results in a plantargrade foot (See Fig A.)
- Incomplete** torsional development of the talar head results in a Primus Metatarsus Supinatus (PMS) Foot (See Fig B) or a PreClinical Clubfoot Deformity



**Fig A** – plantar grade foot



**Fig B** – PMS foot

Note: the PMS foot is discussed in detail (origin of, diagnosis of, clinical implications and treatment of) in Medial column foot systems: innovative tool for improving posture by Rothbart BA. Jour Bodyworks Movement Therapies (2002) 6(1):37-46

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### II. Diagnosing Primus Metatarsus Supinatus (PMS)

#### A. Screening Procedure – 3 tests:

##### a. Knee Bend Test<sup>3</sup> -

i. Knees bent and weight over the heads of the metatarsals (front of foot)<sup>4</sup>

1. Positive Test (below left) – ankles roll inward
2. Negative Test (below right) – ankles do not roll inward



**Positive Test**



**Negative Test**

##### b. Deep 1<sup>st</sup> web space<sup>5</sup> relative to the 2<sup>nd</sup> web space - **Present** or Absent



Fig. 1 - Deep 1st Web Space

##### c. Heel Wear Pattern<sup>6</sup> - **Uneven** or Even



Lateral (excessive or uneven) wear pattern

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- B. Interpretation of Screening Results:** Level of Confidence for a Diagnosis of Primus Metatarsus Supinatus (PMS)

**3 Minute Screening for  
Primus Metatarsus Supinatus**

(1) Knee Bend Test  
(2) Heel Wear Pattern  
(3) 1st Web Space

**Interpretation of Results**

**+** = 65% Level of Confidence (LC)  
**++** = 75% LC  
**+++** = 85% LC

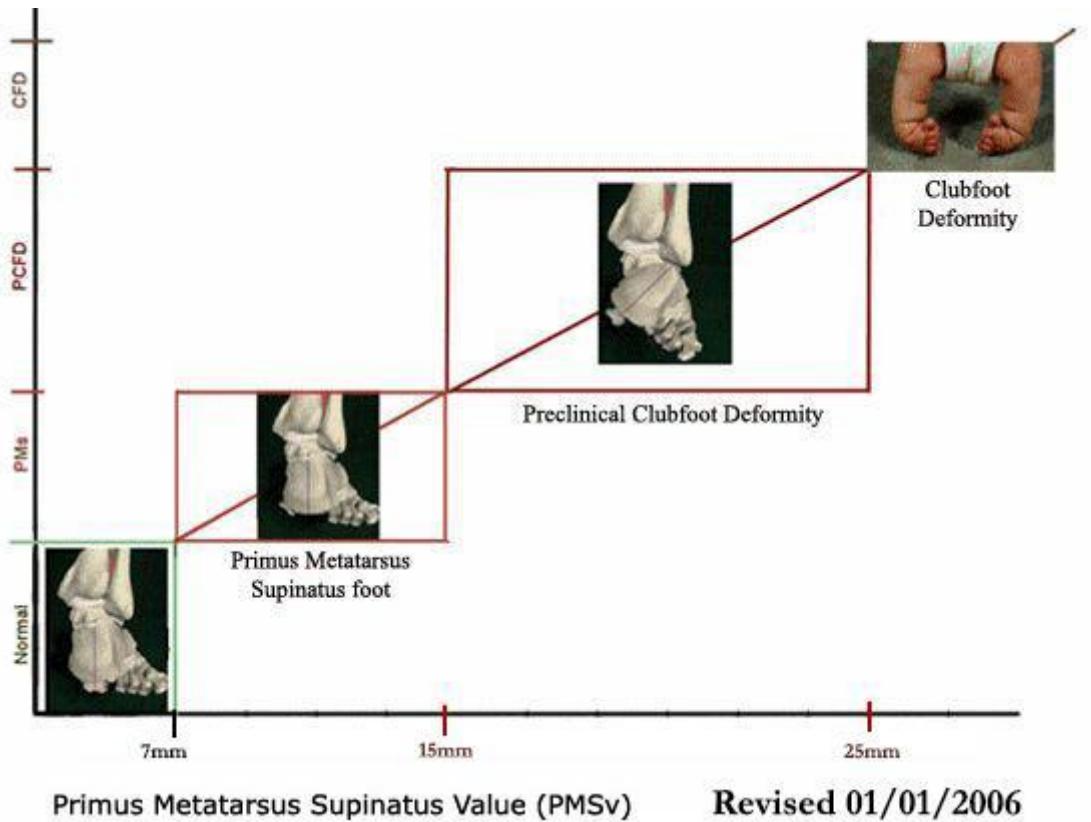
- C. Micro Wedge Measurement – gold standard** for diagnosing PMS foot structure (Independent double blind study demonstrated a **high** inter and intrarater reliability, using microwedges to measure Primus Metatarsus Supinatus (PMS) values - Cummings GS, Higbie EJ 1997. Georgia State University<sup>1</sup>)

- a. Protocol for using Microwedges<sup>7</sup>
  - i. Client standing, locate subtalar joint (STJ)
  - ii. Keeping your finger over the STJ, slowly guide the foot through pronation – supination until the margins of the STJ feel congruous
  - iii. Slide the microwedge under the ball of the foot until slight resistance is met
  - iv. Record the primus metatarsus supinatus value off the microwedge
    1. 0 - 07mm: Negative for PMS foot
    2. 07 - 15mm: Positive for PMS foot
    3. 15 - 25mm: Positive for PreClinical Clubfoot Deformity



<sup>1</sup> <http://www3.interscience.wiley.com/journal/112488776/abstract?CRETRY=1&SRETRY=0>

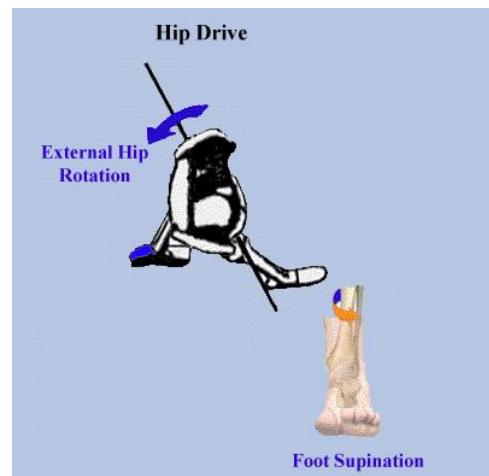
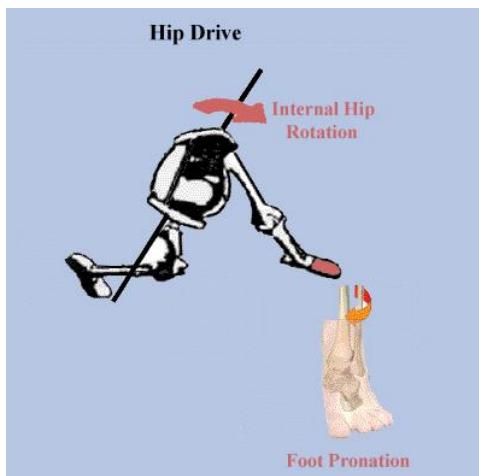
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### III. Normal vs Abnormal Pronation

#### A. Normal Pronation

- a. **Foot pronation driven by Hip Drive**<sup>8</sup> (see figures below)
  - i. When the foot is on the ground, internal hip rotation **pronates** the foot
  - ii. When the foot is on the ground, external hip rotation **supinates** the foot



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- b. Animated Normal Pronation Pattern<sup>9</sup> (Heel Contact to Heel Lift)

### B. Abnormal pronation

- a. Foot pronation driven by gravity<sup>10</sup>
  - i. Gravity forces the elevated first metatarsal (present in the Primus Metatarsus Supinatus) down to the ground, pronating the foot (see figure below, right).
  - ii. This occurs when the hip above the foot is externally rotating (see figure below, left)

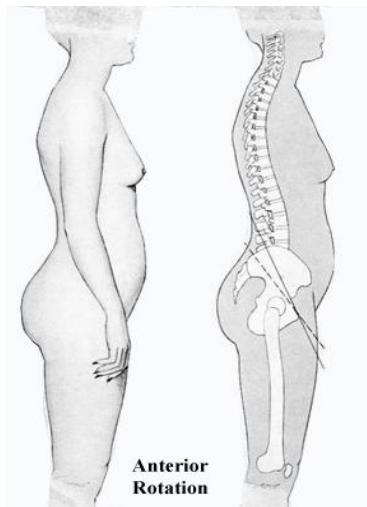


- b. Animated abnormal pattern<sup>11</sup> (Foot Flat to Heel Lift)
- c. Two common causes of abnormal pronation
  - i. Primus Metatarsus Supinatus
  - ii. PreClinical Clubfoot Deformity

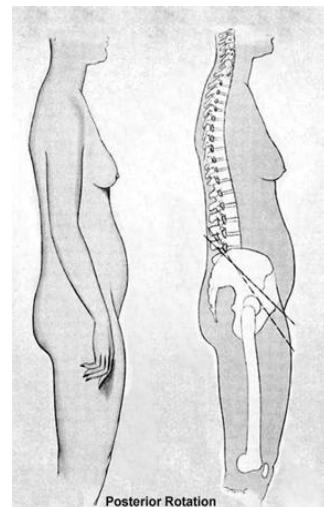
### C. Abnormal Hip Mechanics linked to abnormal pronation

- a. Rotation of the Innominate bones (hip bones) –
  - i. The pelvis is composed of
    1. two innomates (hip bones)
    2. the sacrum
- b. Abnormal pronation can rotate the innominate bones anteriorly (forward)

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Anterior (forward) Rotation

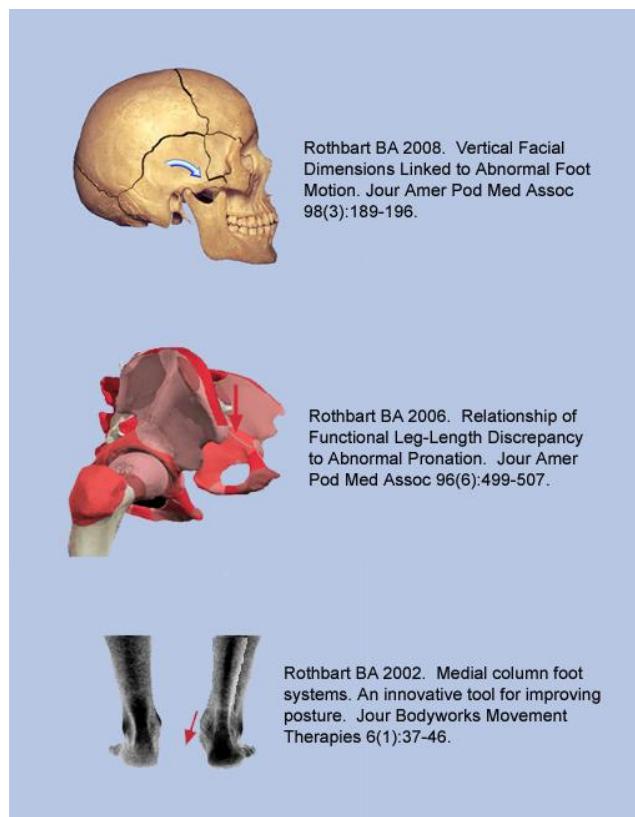


Posterior (backward) Rotation

### IV. Postural Distortional Patterns

**A. Ascending Pattern<sup>12</sup>** - initiated in the feet (for a detailed description see Rothbart BA JAPMA, 2006 and 2008)

- a. Abnormal pronation pulls innominate bones anteriorly, the more anteriorly rotated innominate on the same side as the more pronated foot.
- b. Anterior rotation of the innominate bones
  - i. pulls the acetabula, and the femoral heads, downward and posteriorly
    - 1. The legs are *functionally shortened*, the shortest leg associated with the more pronated foot (Rothbart BA 2006. *Relationship of Functional Leg-Length Discrepancy to Abnormal Pronation*. JAPMA Vol 96(6):499-507)
  - ii. Draws the temporal bones into posterior (external) rotation, the more posteriorly rotated temporal bone being on the same side as the more anteriorly rotated innominate bone (which is also on the same side as the more pronated foot).
- c. Posterior rotation of the temporal bone rotates the sphenoid bone into flexion.
  - i. A relatively more posteriorly rotated right temporal bone is linked to a flexed and right inferior cant of the sphenoid and a superior cant of the right maxilla bone.
  - ii. A relatively more posteriorly rotated left temporal bone is linked to a



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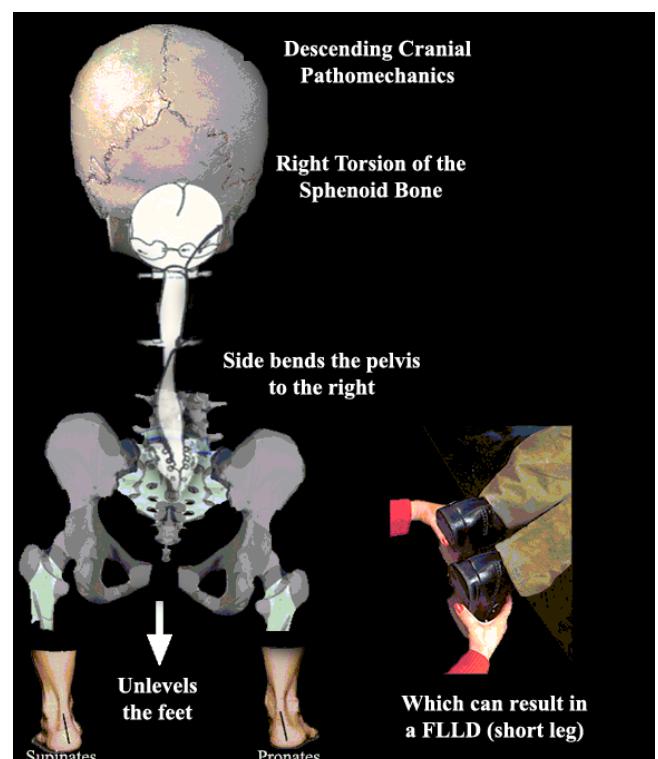
flexed and left inferior cant of the sphenoid and a superior cant of the left maxilla bone. (Rothbart BA 2008. *Vertical Facial Dimensions Linked to Abnormal Pronation*. JAPMA 98(3):189-196)

- d. Flexion of the sphenoid bone shifts the maxilla bones anteriorly, narrowing and deepening the Curve of Spee. The result is a Class II Malocclusion (See photos below).



### B. Descending Pattern<sup>13</sup>

- a. Right torsion of the sphenoid bone (clinically seen as a superior right pupil),
  - i. Twists the dura,
  - ii. Resulting in a pelvic tilt (right side down).
    1. Right pelvic tilt results in:
      - a. pronated right foot,
      - b. supinated left foot
    - b. short left leg - functional leg length discrepancy (See diagram right)
- b. Left torsion of the sphenoid bone (clinically seen as a superior left pupil)
  - i. Twists the dura
  - ii. Resulting in a pelvic tilt (left side down)
    1. Left pelvic tilt results in:
      - a. supinated left foot, pronated right foot
      - b. short right leg (functional leg length discrepancy)



## **Introductory Seminar – Primus Metatarsus Supinatus - Rothbarts Foot**

### **Referenced Web pages (updated January 2010): No Longer Available**

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<sup>1</sup> [www.rothbartsfoot.es/EmbryolWheel.html](http://www.rothbartsfoot.es/EmbryolWheel.html)

<sup>2</sup> [www. http://rothbartsfoot.es/TalarHeadUnwinding.html](http://www.rothbartsfoot.es/TalarHeadUnwinding.html)

<sup>3</sup> [www.rothbartsfoot.es/KBT.html](http://www.rothbartsfoot.es/KBT.html)

<sup>4</sup> [www.rothbartsfoot.es/ScreeningForRFS.html](http://www.rothbartsfoot.es/ScreeningForRFS.html)

<sup>5</sup> [www.rothbartsfoot.es/ScreeningForRFS.html](http://www.rothbartsfoot.es/ScreeningForRFS.html)

<sup>6</sup> [www.rothbartsfoot.es/ScreeningForRFS.html](http://www.rothbartsfoot.es/ScreeningForRFS.html)

<sup>7</sup> [www.rothbartsfoot.es/MeasuringRFS.html](http://www.rothbartsfoot.es/MeasuringRFS.html)

<sup>8</sup> [www.rothbartsfoot.es/HipDrivePronation.html](http://www.rothbartsfoot.es/HipDrivePronation.html)

<sup>9</sup> [www.rothbartsfoot.es/NormalPronation.html](http://www.rothbartsfoot.es/NormalPronation.html)

<sup>10</sup> [www.rothbartsfoot.es/FootDevelopment.html](http://www.rothbartsfoot.es/FootDevelopment.html)

<sup>11</sup> [www.rothbartsfoot.es/TreadmillAnalysis.html](http://www.rothbartsfoot.es/TreadmillAnalysis.html)

<sup>12</sup> [www.rothbartsfoot.es/AFCM.html](http://www.rothbartsfoot.es/AFCM.html)

<sup>13</sup> [www.rothbartsfoot.es/AbnormCranMech.html](http://www.rothbartsfoot.es/AbnormCranMech.html)