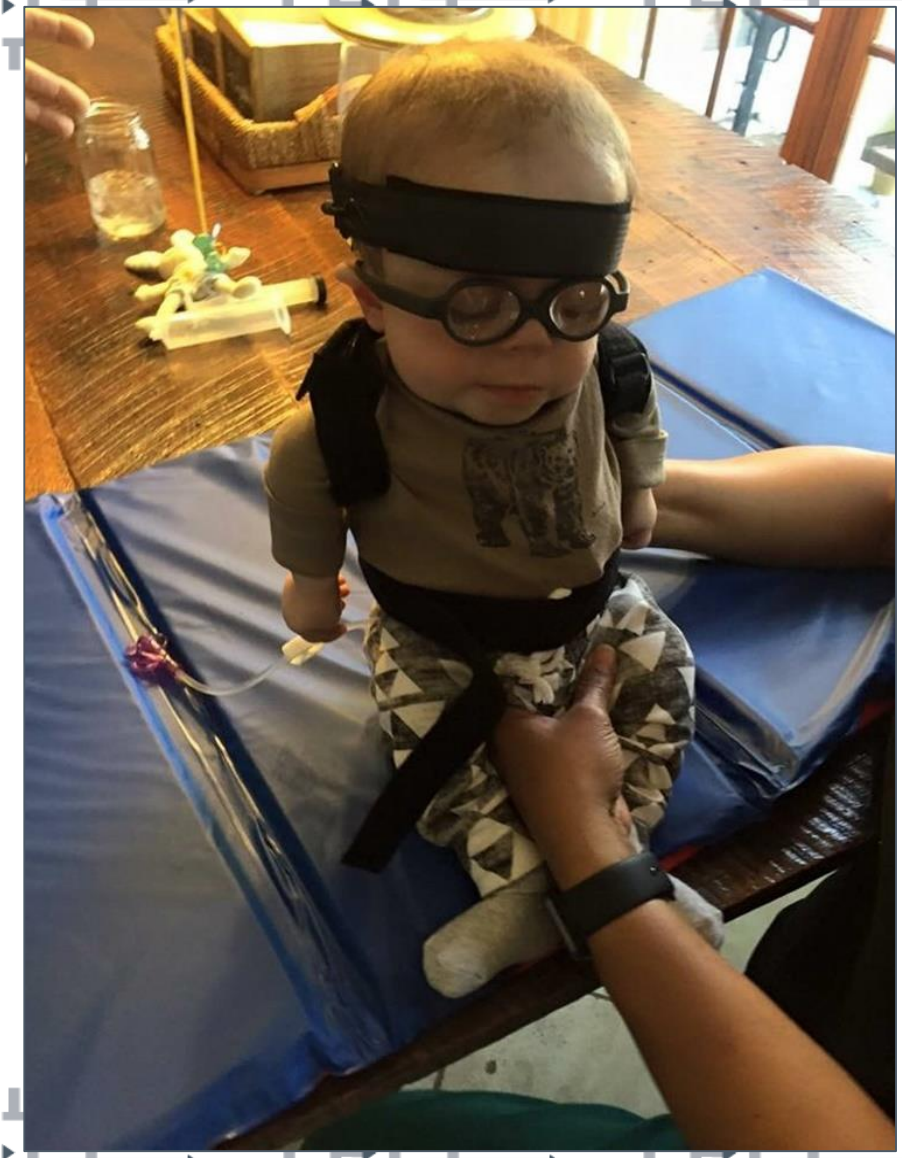
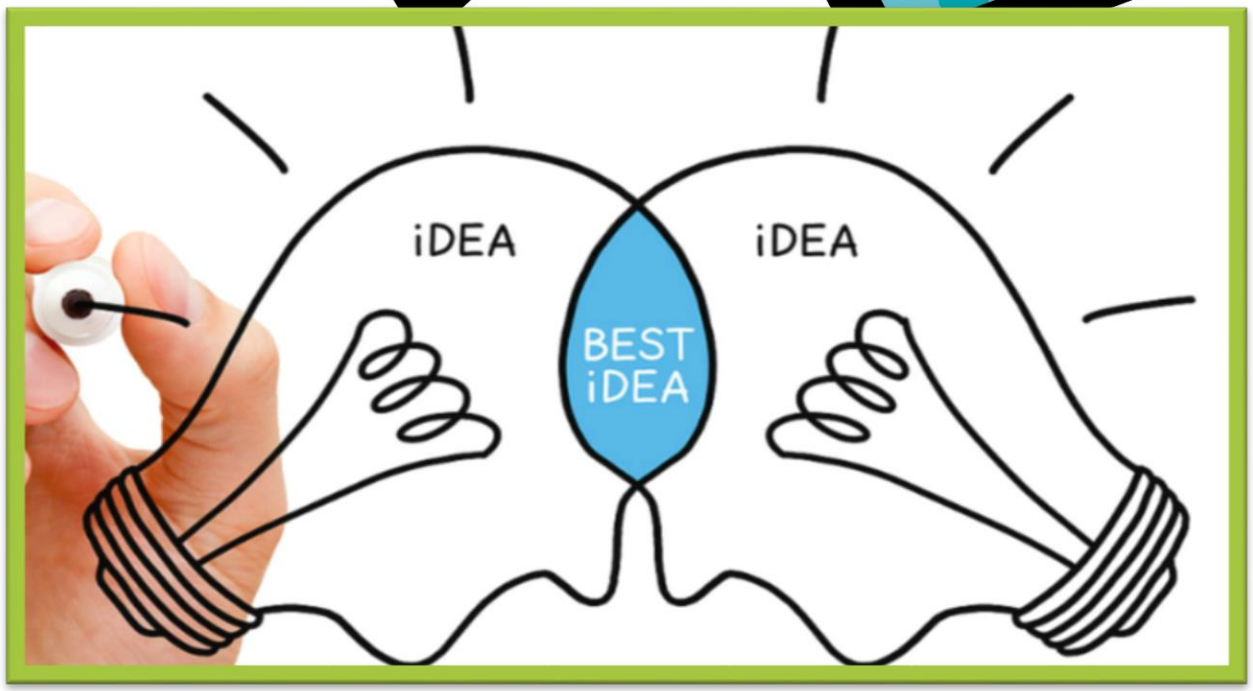


Navigating New Pathways

Steve Kulifaj CO, BOCP,
LO Director of
Education

Traditional Approach

- Rigid bracing restricts intrinsic muscle activity
- Rigid bracing on a flexible foot causes redness hot spots
- Controlling unwanted motion = Restricting required motion.



Function

Alignment

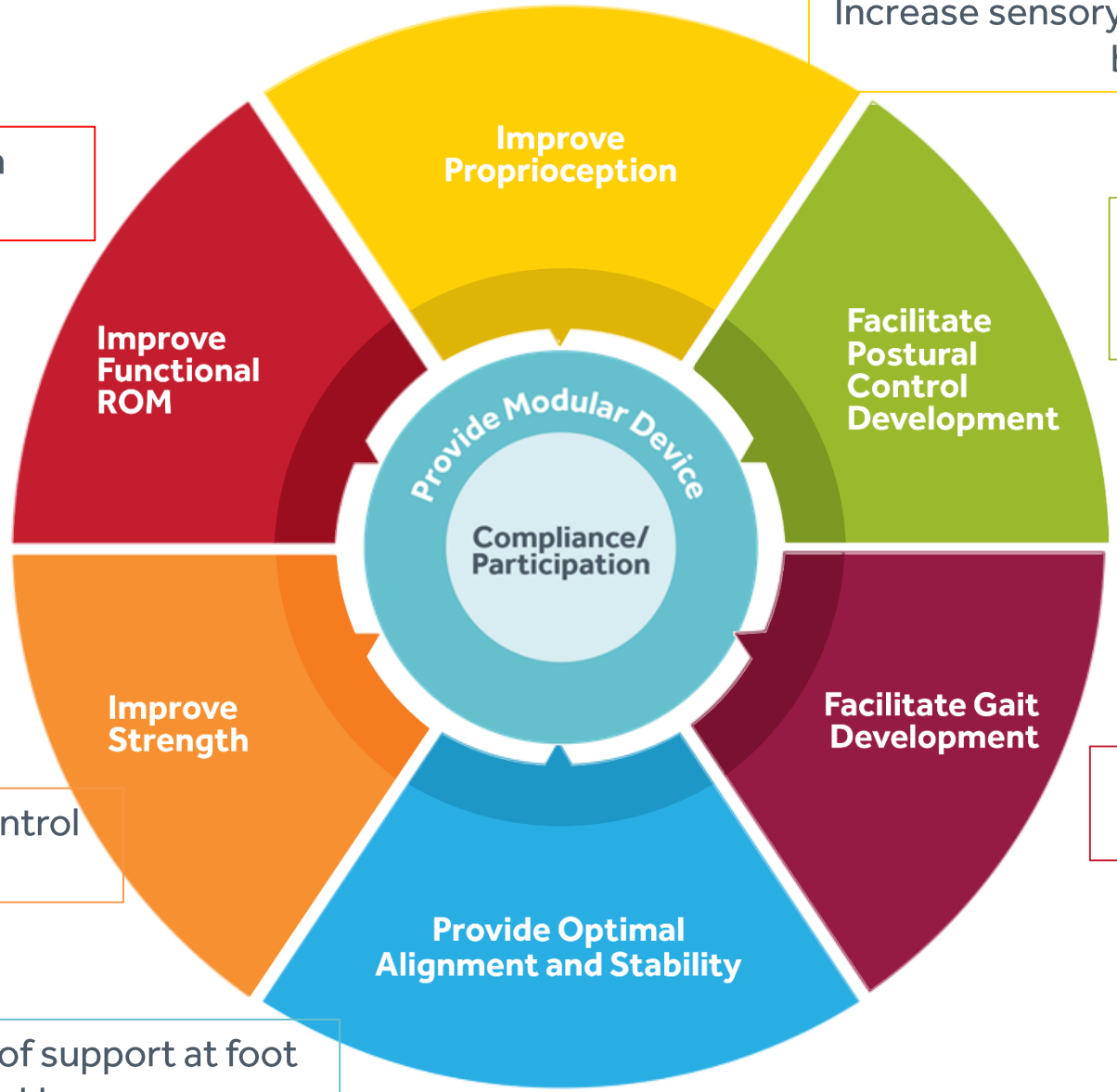
surestep

Introduce – Wheel of Function

Increase sensory input through compression, and better alignment

Improve / maintain dorsiflexion ROM

Promote lateral and posterior weight shifts and pelvic development



Facilitate heel strike and better knee and hip motion

Strengthen the muscles that control the foot and ankle

Provide good base of support at foot and ankle


"I took the road less traveled by
and that has made all the difference"
- Robert Frost

Introductions: the beginning...

surestep

- Ensures Intrinsic muscle activity
- Allows for balance reactions to transfer through the braces.
- A true Dynamic approach to bracing.

Surestep SMO is a Patented Orthotic Device made from Special Polymer

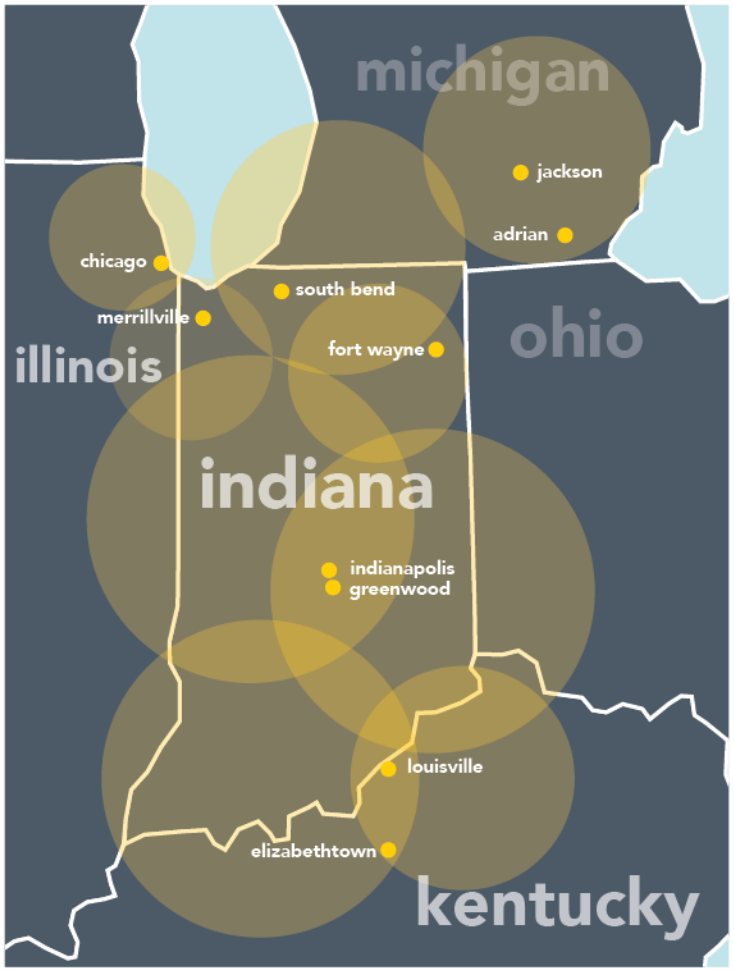
Stability

Mobility

Greater Ability

Surestep Products


texas
spring
houston
gulf of mexico


michigan
jackson
adrian
chicago
south bend
merrillville
fort wayne
illinois
ohio
indiana
indianapolis
greenwood
louisville
elizabethtown
kentucky


kansas
missouri
springfield
oklahoma
arkansas

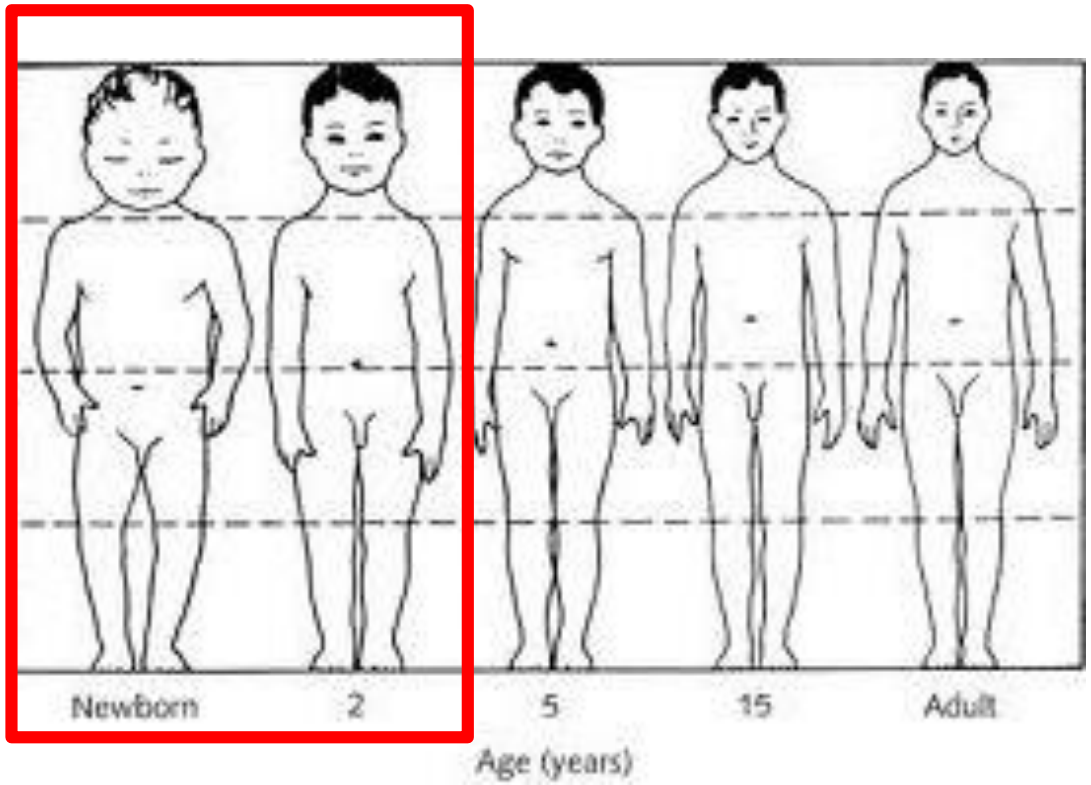
surestep

- Premier Pediatric Orthotic Manufacturer
  - Design and Development
    - New, Original Products
  - Quality Central Fabrication
  - Over 2300 US Based O&P Customers
  - Distribution in over 36 Countries

Alignment, Gross Motor Development, Gait Development

Lampl 1992

- First 2 years:
  - Weight x 4
  - Height x 2
  - Head Circ. increases by 1/3



- Ossification starts in-utero
- Secondary ossification centers develop
- Wolff's Law
- Dynamic

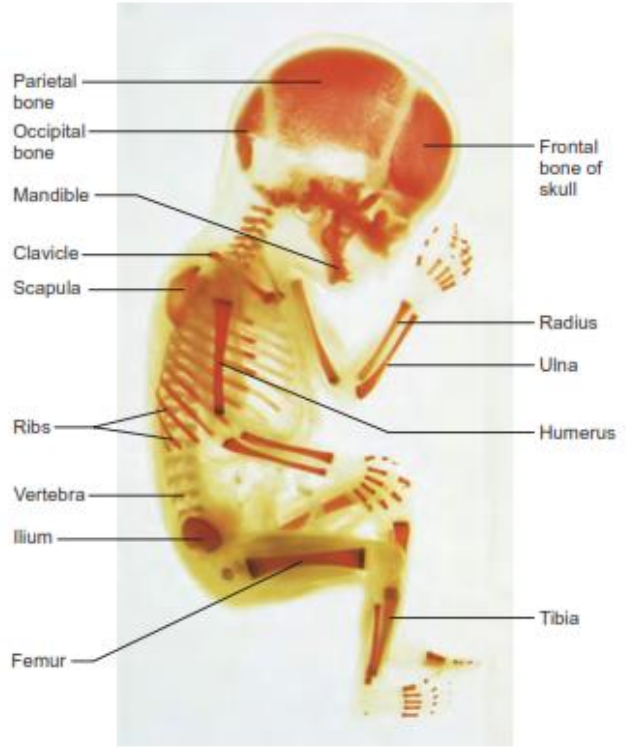
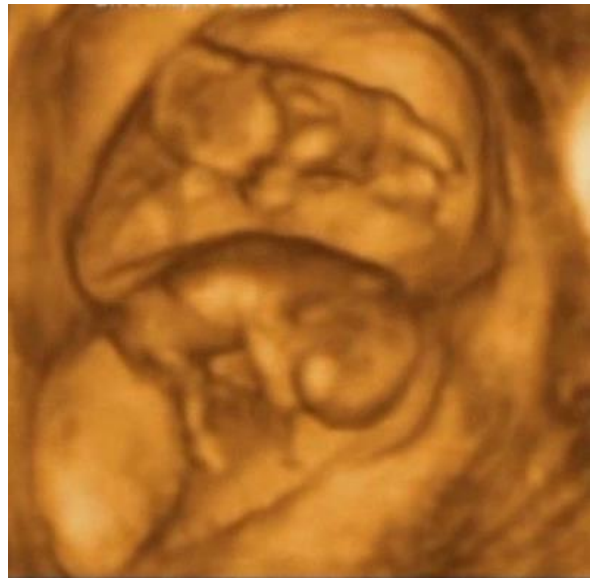


Figure 6.17 Fetal primary ossification centers at 12 weeks. The darker areas indicate primary ossification centers in the skeleton of a 12-week-old fetus.



https://www.youtube.com/watch?v=sVB0qTiq5jU

Hallemans 2006, Kathari, 2016

- The foot and ankle does not fully ossify until 6 - 7 years of age.
- Protect the medial column and keep it in a good position during ossification.

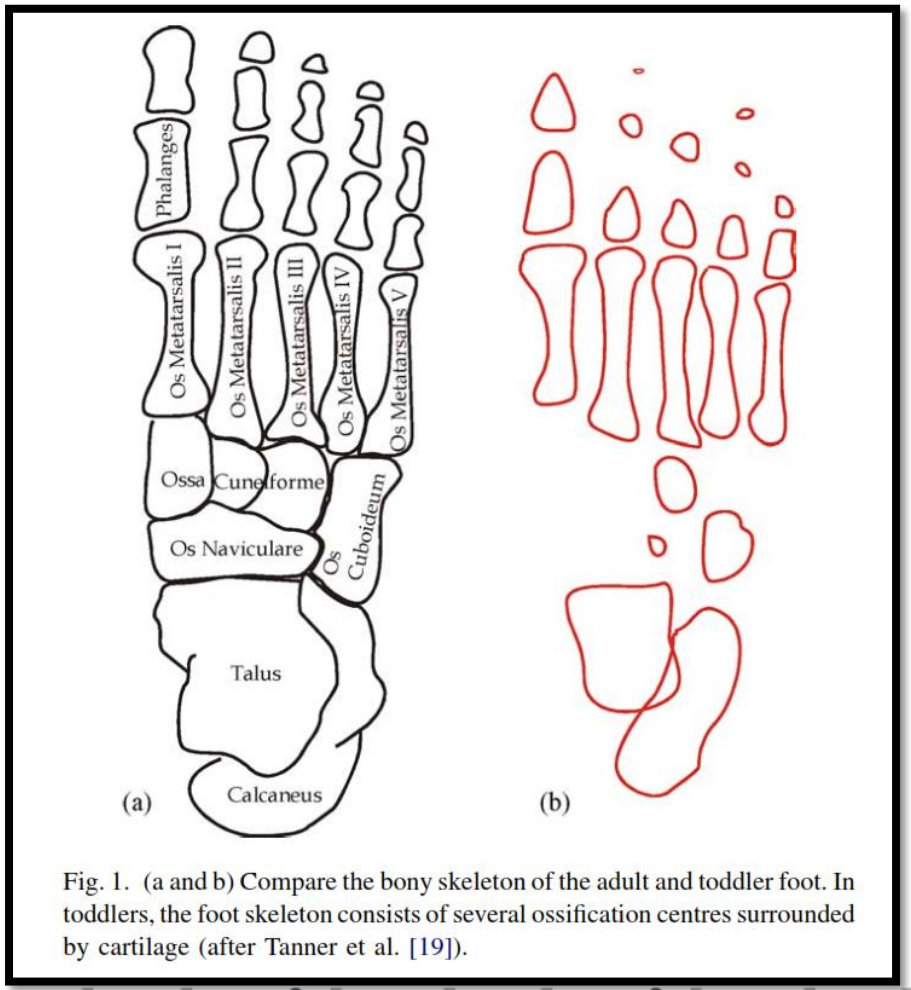
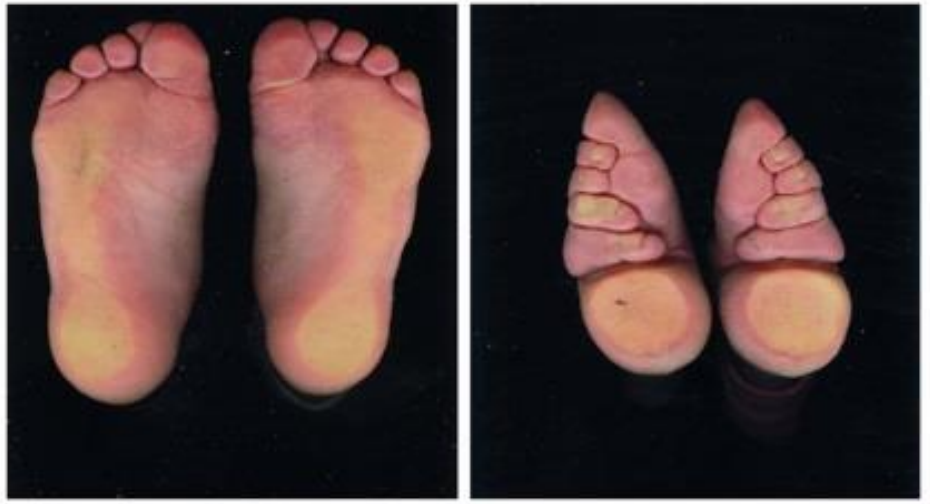
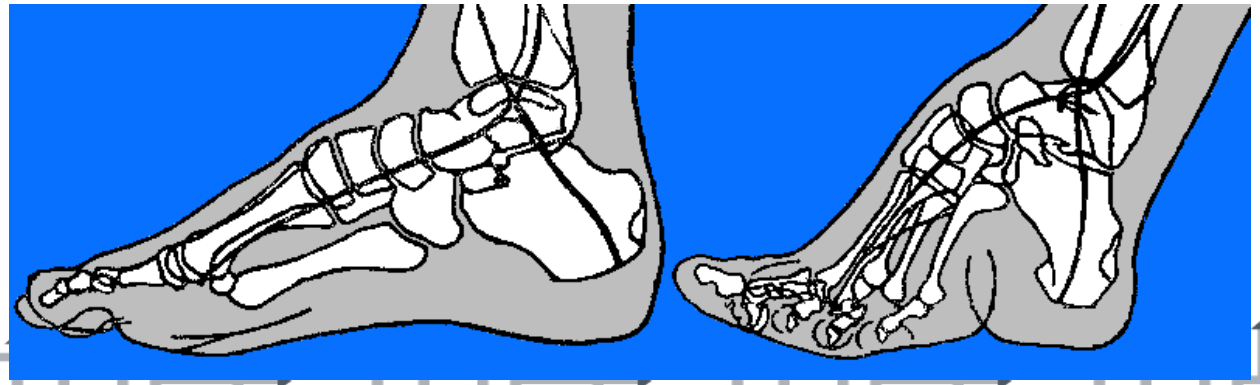


Fig. 1. (a and b) Compare the bony skeleton of the adult and toddler foot. In toddlers, the foot skeleton consists of several ossification centres surrounded by cartilage (after Tanner et al. [19]).

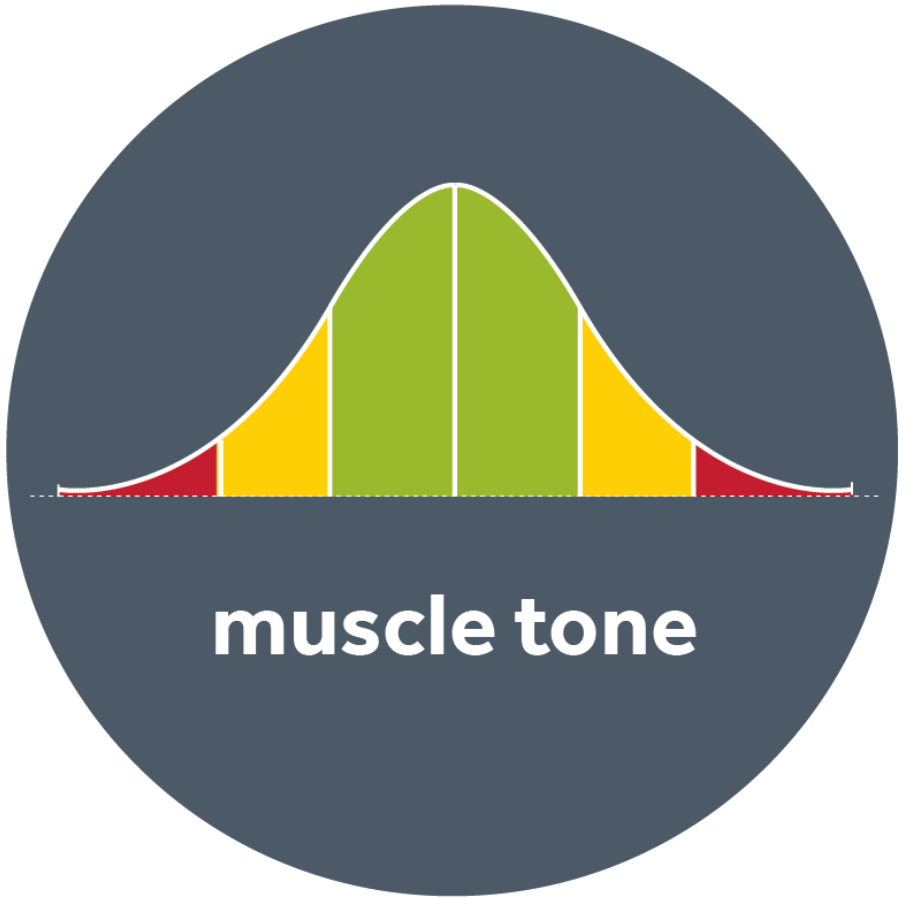
Can we effect boney development??



1997 Study (UCSF):
Less able to squat
More likely to have fallen **Poor Balance**
5.1% lower hip bone density
4.7% lower spine bone density

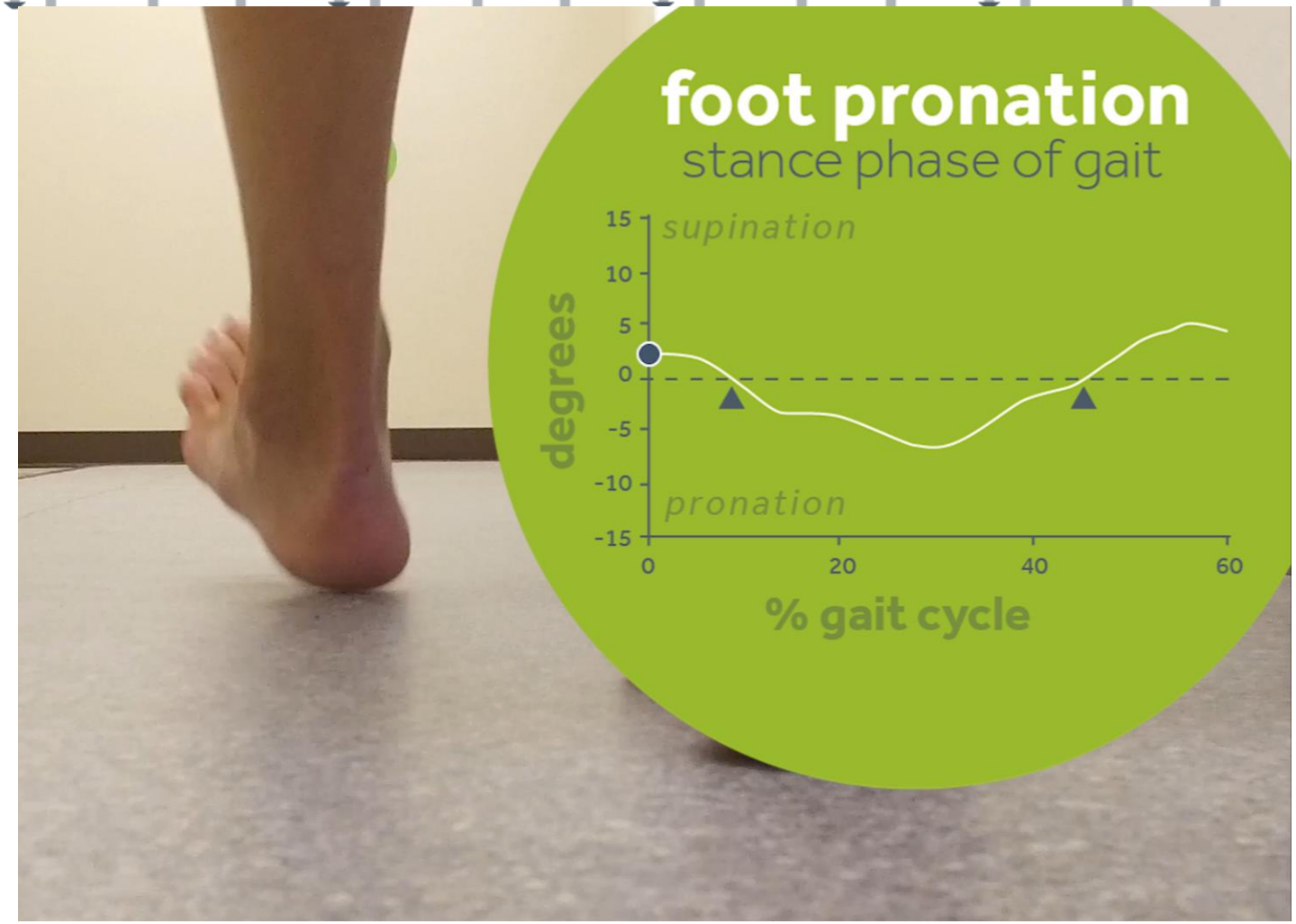


- Muscle's resistance to passive stretch
- Intrinsic property of the nervous system
- Necessary for muscles to produce effective movements
- Goal: maintain joint integrity and posture with minimal energy costs



Reischl 1999; Valmassy 1996

- Pronation is normal!
- Supination is normal!



When do we treat?

- Excessive valgus
- Symptomatic
- Lack of dynamic control

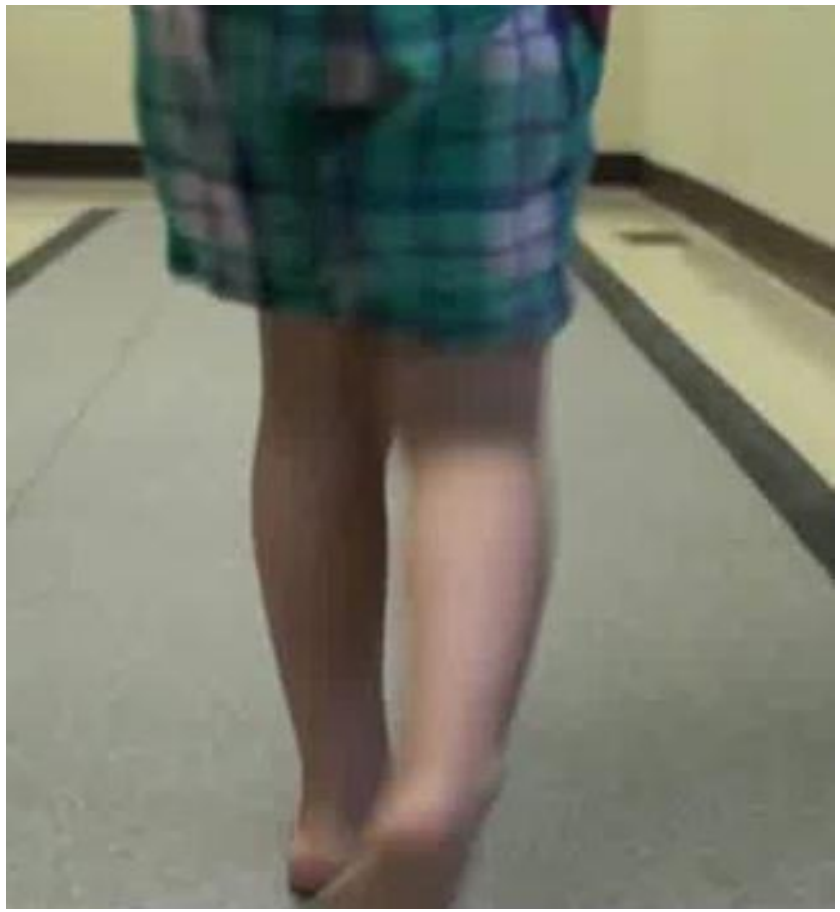
- Valmassey Foot Position Index
  - 7 minus the age

Michaud 2011 (Gould 1989)

figure 4.22
Ideal development of the sustentaculum tali

figure 4.21
The poorly developed sustentaculum tali is unable to adequately support the talar head. Adapted from tracings of x-rays as illustrated by Harris RI, Beath T. Hypermobile flatfoot with short tendo Achilles. J Bone Joint Surg. 1948;30A(1):116-138.

Deformational Forces on an Undeveloped Midfoot



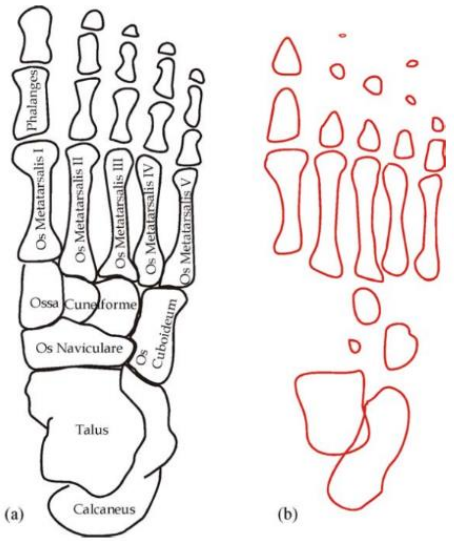
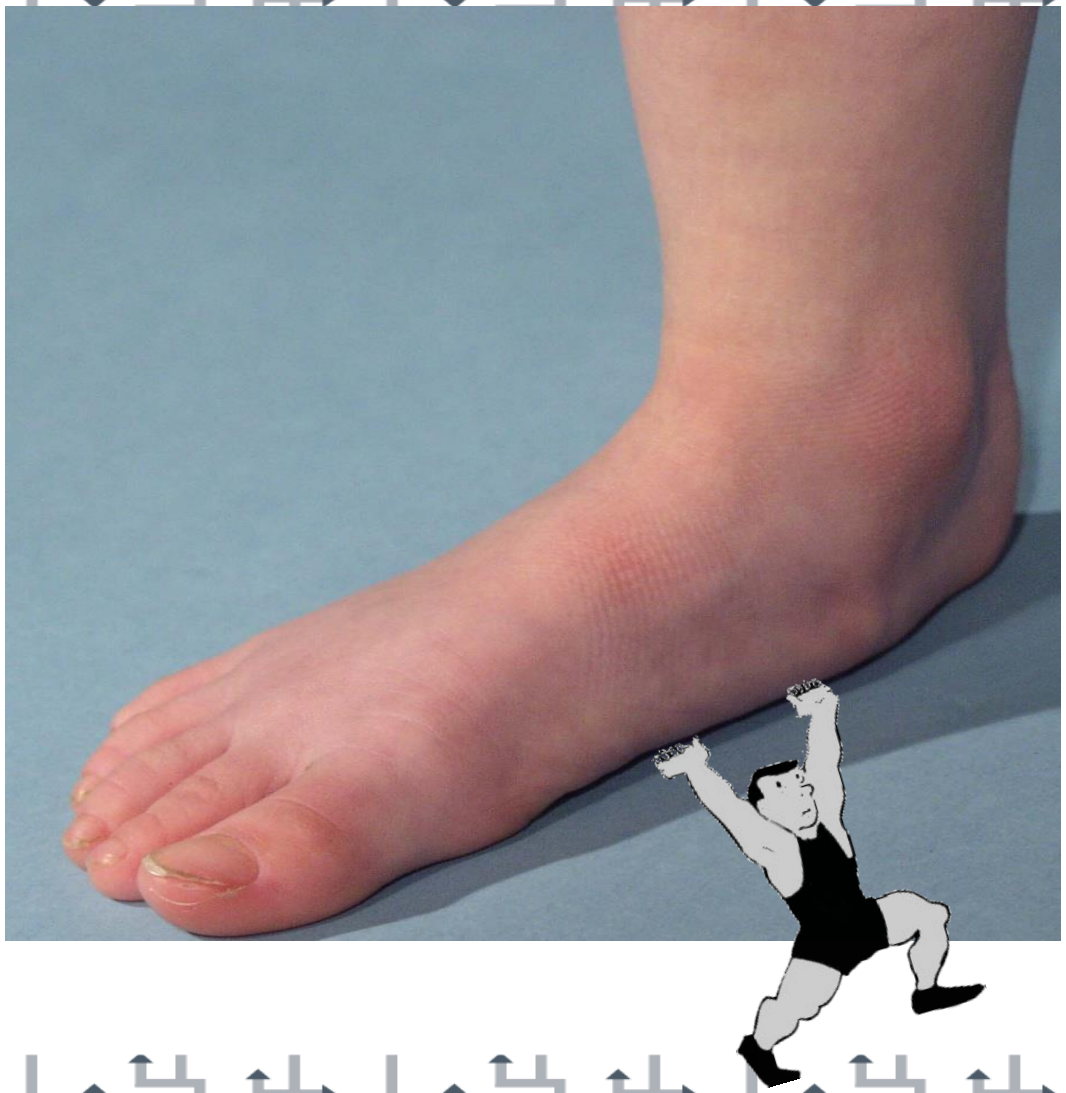


Fig. 1. (a and b) Compare the bony skeleton of the adult and toddler foot. In toddlers, the foot skeleton consists of several ossification centres surrounded by cartilage (after Tanner et al. [19]).

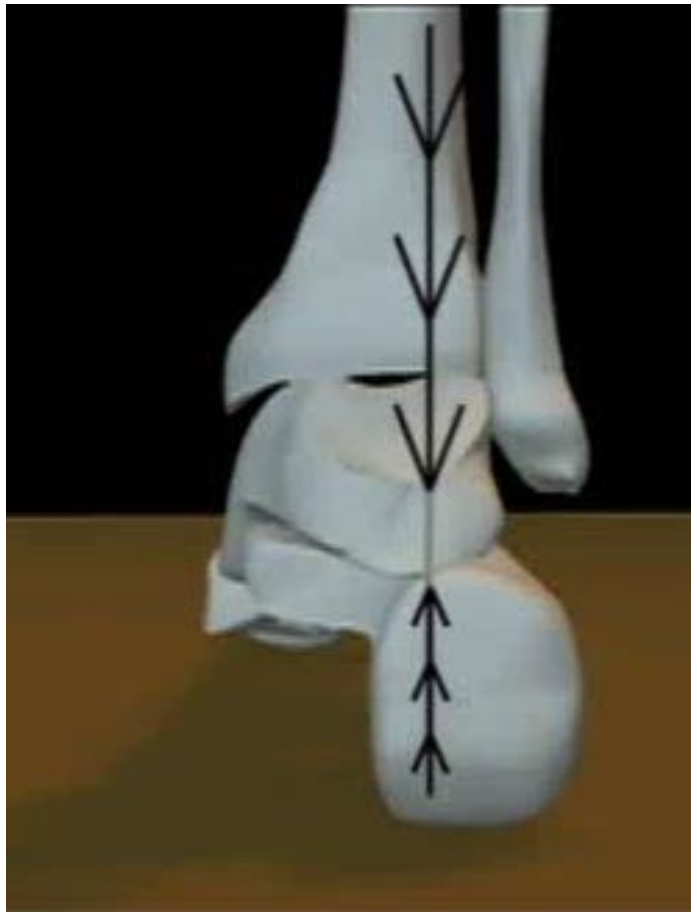
Pronation –

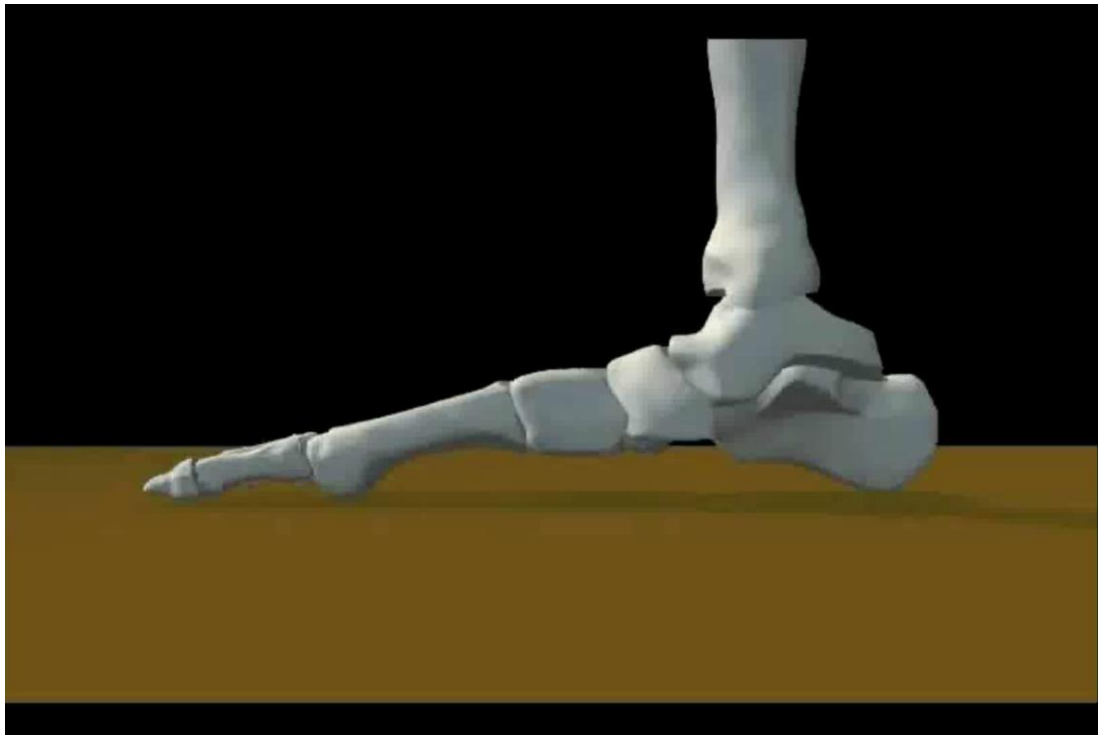
- Leads to ineffective muscle pull
- No propulsion (lack of supination for push off – 3rd rocker)



Simple fix?

Pronation: Triplanar deformity





- Minimal bracing or Underbracing?
  - Possibly for mild pronation?
  - Lacks Dynamic control

Surestep SMO

A dynamic flexible SMO without a full footplate. Works through compression to stabilize and provide sensory input.

SureStep functions not as a brace,
but as an exoskeletal ligament system. *

Distal to 5th metatarsal head

Proximal to 1st metatarsal head

- 17 children with DS
- Ages: 3.5 – 8 years
- 10 week study
- Provided Surestep SMOs
- Tested
  - GMFM Dimensions D (Standing) and E (Walking, Running, Jumping)
  - Bruininks-Oseretsky Test of Motor Performance (BOTMP) Balance Subtest

Martin, 2004

- Immediate and longer-term (after 7 weeks of use) improvement in postural stability

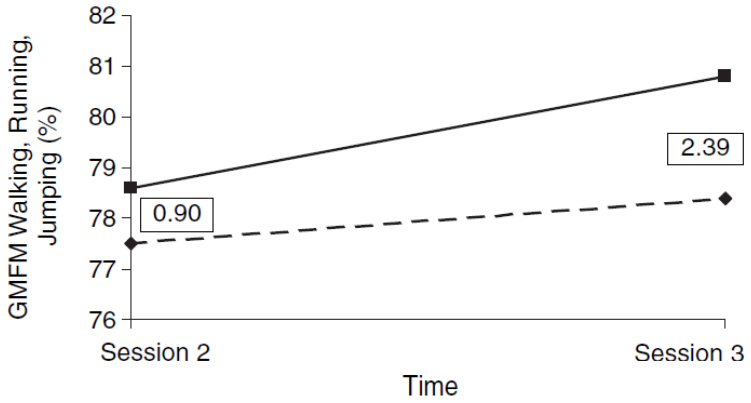


Figure 3: *Gross Motor Function Measure (GMFM) Walking, Running, and Jumping dimension results. Numbers in boxes represent mean change with supramalleolar orthoses (SMOs) intervention at each session. ■, shoes + SMOs; ◆, shoes only. Condition significant at p=0.0001.*

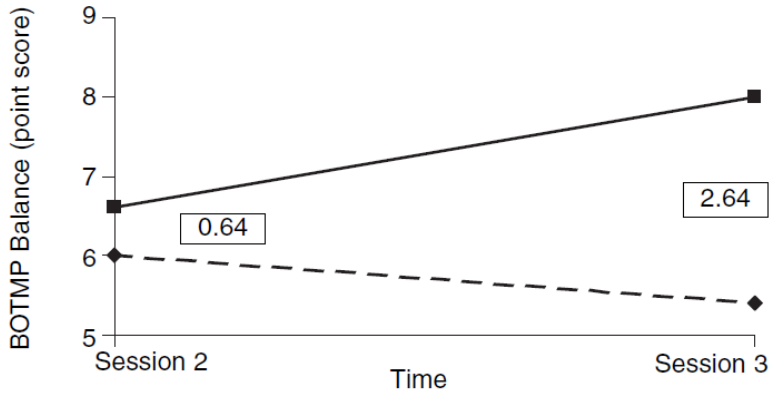


Figure 4: *Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) Balance subtest results. Numbers in boxes represent mean change with supramalleolar orthoses (SMOs) intervention at each session. ■, shoes + SMOs; ◆, shoes only. Interaction significant at p=0.039. Condition at session 3 significant at p=0.027.*

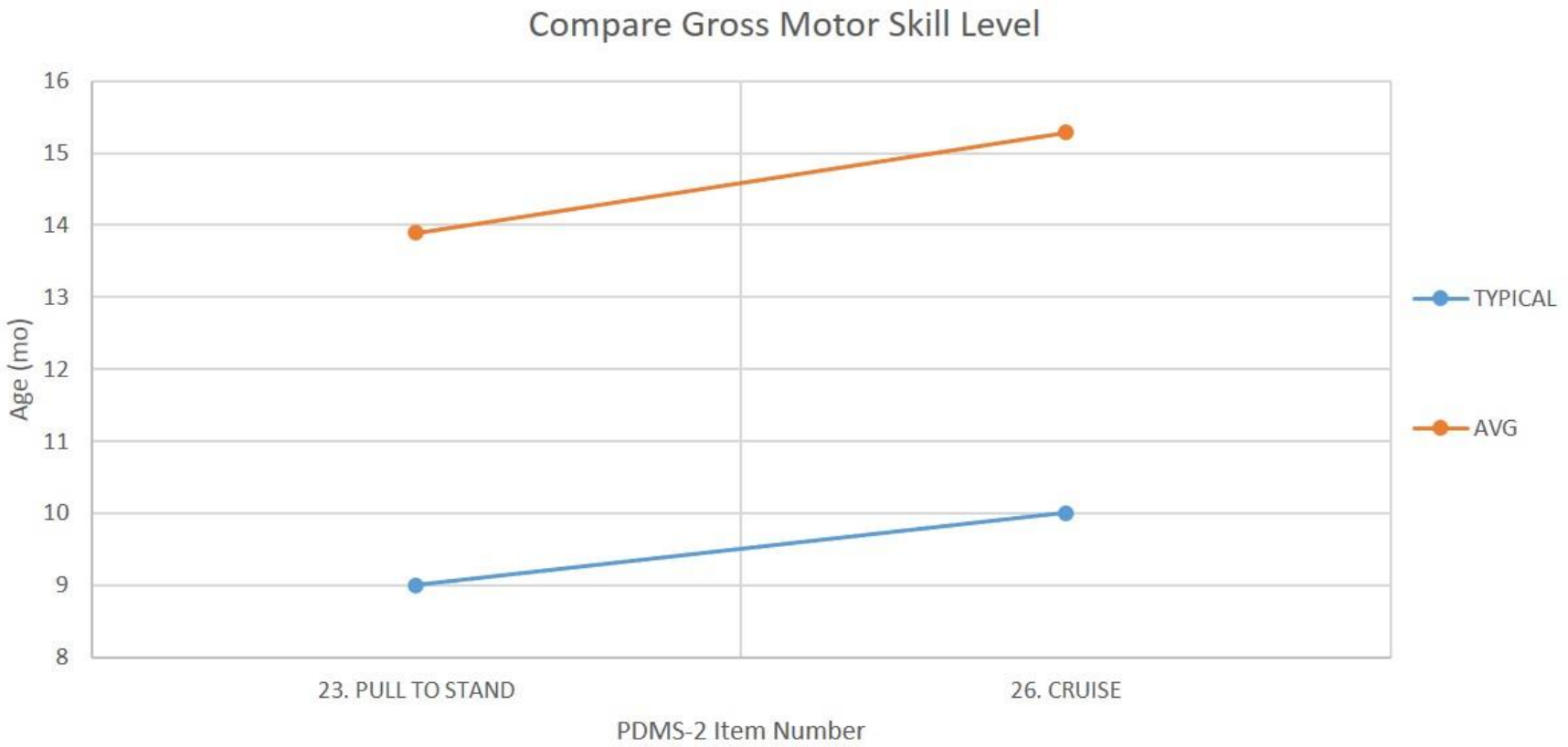
Martin, 2004

- Meet Corwin
- 16 months old
- Pulling to stand and cruising for 3 months
- No independent standing or walking
- Hypotonia; significant pronation

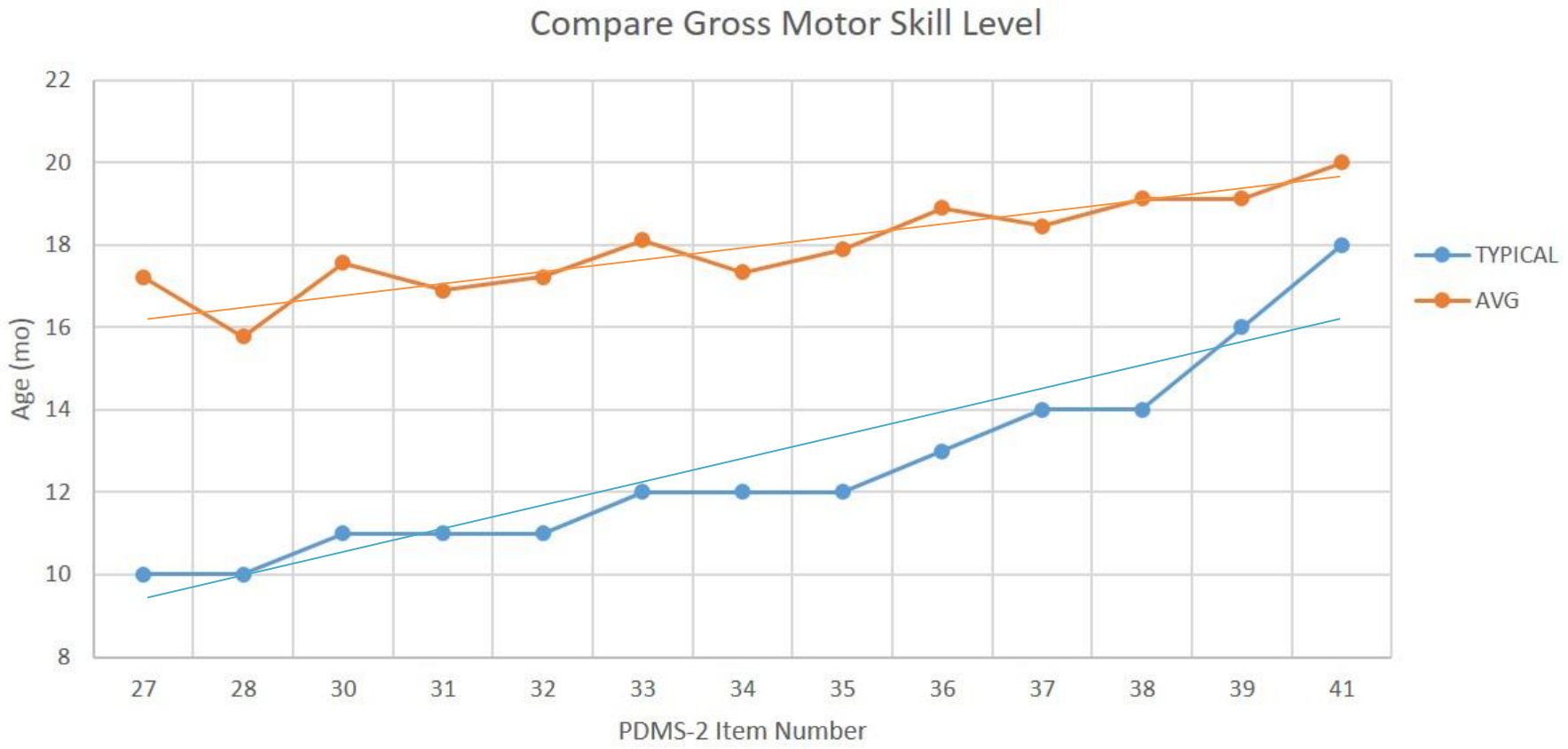

DAY 1

- Average age when:
  - Pull to Stand: 13.9 months (Range 12 – 17)
  - Cruise: 15.3 months (Range 13 – 18)
  - Received SMOs: 15.6 months (Range 13-19)
- Rate of gain of gross motor skills
  - Typical = **0.57**
  - Study participants after receiving SMOs = **0.27**
- All received regular Physical Therapy

Winning the Waiting Game – Average before SMOs



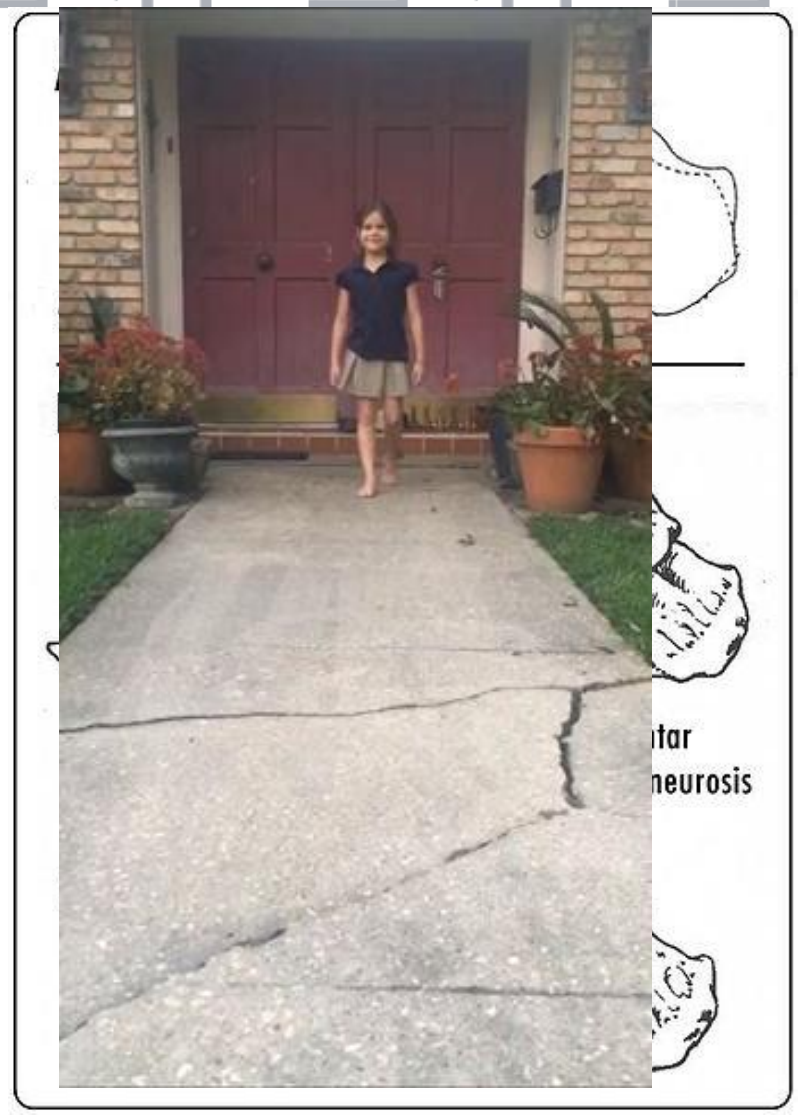
Winning the Waiting Game – Average after SMOs



- Looper J, Ulrich D. Effect of Treadmill Training and Supramallelar Orthosis Use on Motor Skill Development in Infants With Down Synrome: A Randomized Clinical Trial. Physical Therapy. 2010.90:382-390.
- Participants
  - 17 children with Down syndrome – Pull to Stand
- Intervention
  - Control Group
  - Surestep SMOs Group
- Test Dates
  - Monthly
- Data Collection
  - Gross Motor Function Measure (GMFM)

SMO Group started walking before the control group & Positively effect walking rate

- By 7-8 years, we have adult foot shape and gait patterns
- Ossification
- Foot gaining ligamentous integrity
- Development of windlass mechanism

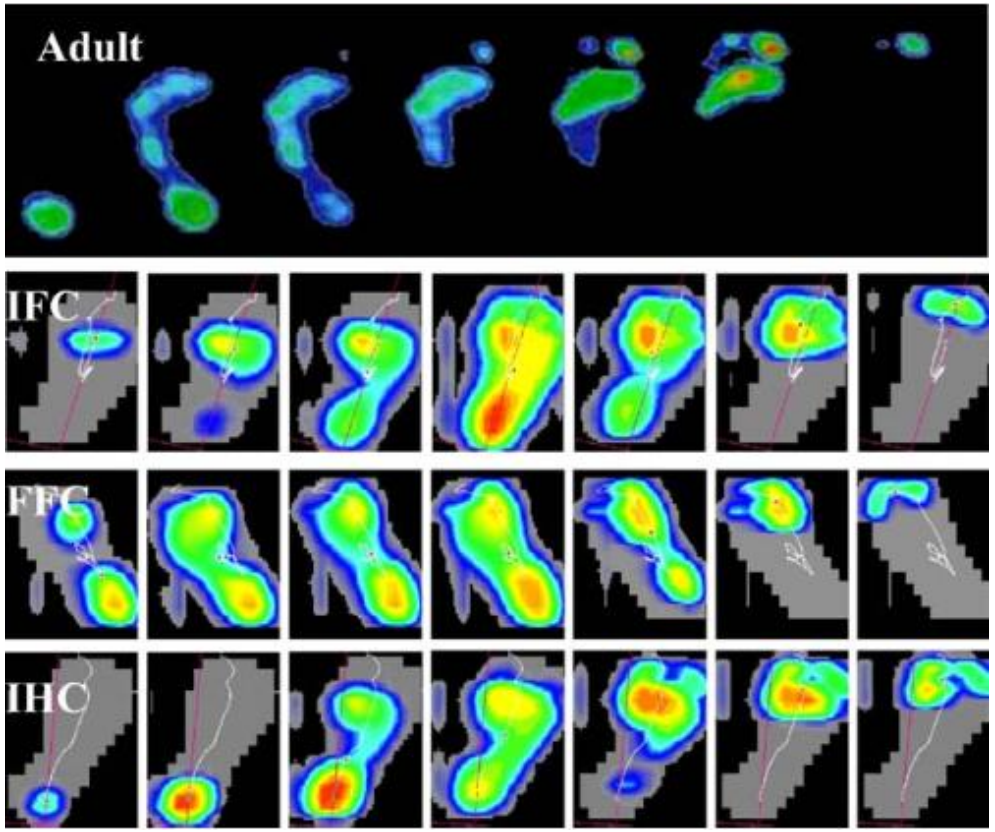


Toe Walking

- When is toe walking a concern?
- What are the primary deficits?
- What are the types of toe walking?

Hallemans 2006

- When to refer
  - Improvements in toddler gait balance coincides with changes in foot roll-over during the first 5 months of independent walking
  - By 5 months independent walking, 70% of footfalls were IHC



Toe Walking Primary Deficits

Sensory	• Seeking • Avoiding • Visual / Depth Perception
Positional	• Stability • Swing phase clearance • Excessive pronation
Plantarflexor tightness	• Jump Knee Gait • Toe-toe gait
Swing phase clearance	• Lack of DF in swing

- Meet Mya
- 3 years old
- DX: Hypotonia, Toe Walking, Pronation
- She can get to at least 90 degrees dorsiflexion and can be cued down onto her heels.

AFO with plantarflexion stop

An AFO (solid or articulated) that stops plantarflexion with a full footplate.

Articulated AFO
(full footplate / plantarflexion stop)

Surestep Toe Walking SMO

A Surestep SMO with a posterior extension


Toe Walking SMO
(Surestep trimlines)

Toe Walking SMO with heel cutout

- Increases proprioception
- Smooths transition from initial contact to mid-stance

Hypertonia

4 – 6 Moderate High Tone Toe Walking: ToeWalking SMO

Surestep Indy 2 Stage AFO

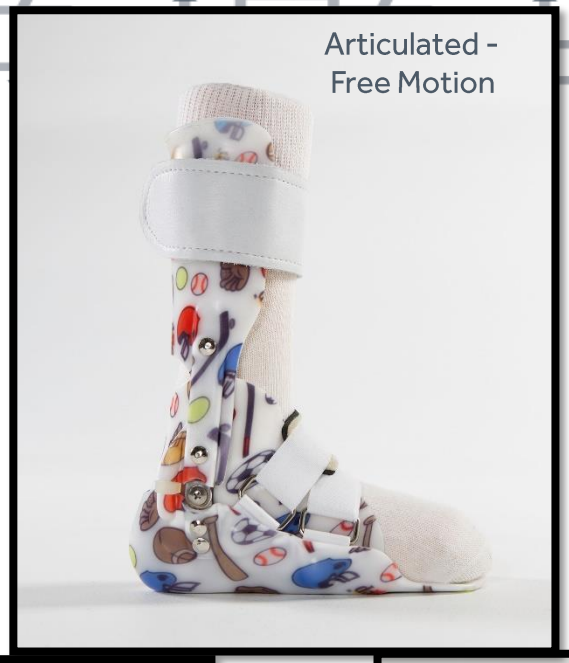
An AFO with a Surestep SMO that can be used independently or as a complete system

Gaps should be there

Gaps should be there

- SMO/AFO combo gives the physiotherapist the option to work with the patient in the SMO's only while working on postural control etc. and then with the AFO's when

Indy 2 Stage AFOs



surestep

Key to Compliance and Participation?

= Minimal bracing to get desired results

Consider the trade off's

Don't sacrifice mobility for alignment