

# Guidelines for Pediatric Orthotic Identification, Selection, Fabrication, Use, and Care



**Sean Greer, CO/LO**

**MILLER**  
PROSTHETICS & ORTHOTICS

# What is an Orthosis?

- Fancy word for brace
- Ortho = Straight
- External device designed to
  - Support a weak or deformed body part
  - Immobilize for healing or pain reduction
  - Improve function
  - Prevent deformity

# What is an Orthosis?

- May be custom made
  - Patient model
  - Measurement
- May be pre-fabricated
  - Small, medium, large. Etc
  - Often stock items



# What's that called?

How are braces named?

- By the joints, or body segments, they cover.
- By the Inventor's name
- For the city where they were developed
- Brand Name

# By body segment

- KAFO = Knee Ankle Foot Orthosis



# By body segment

- SEWHO = Shoulder Elbow Wrist hand Orthosis



# By body segment

- AFO = Ankle Foot Orthosis



# By body segment

- TLSO = Thoraco Lumbo Sacral Orthosis





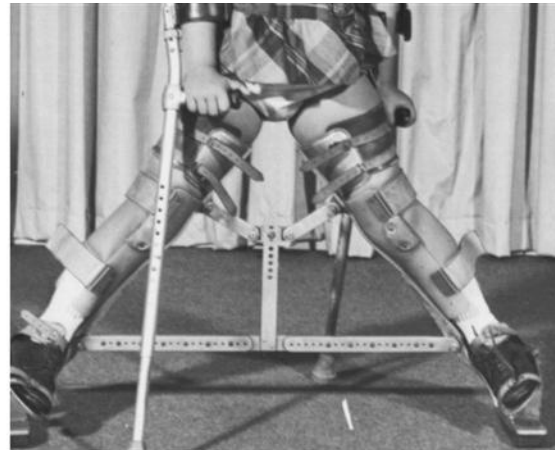
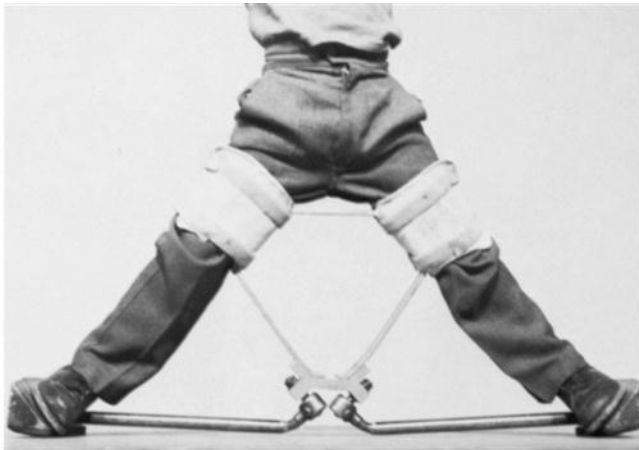
# By the inventor

- Jewett brace
- Sarmiento Brace
- Dobbs Bar



# For the city where it was developed

- Boston Overlap Brace
- Charleston Bending Brace
- Toronto Brace



A

B

# Brand Name

- Benik
- CASH
- Cybertech
- Aircast
- Surestep



# What does that mean?

- Sometimes extra letters are added or abbreviations are created separately
  - DAFO, SAFO, HAFO, FRAFO, GRAFO, CMO, FFO, TPAFO, SCAFO
- May denote brand name
- May denote special function
- May denote regional preference
- May be completely made up on the spot

# L-Coding System

- Billing codes used to describe braces to insurance companies for payment
- Base codes
- Addition codes
- Miscellaneous codes

# L-Coding System

- Code what you do
- Do what you code
- All visits and services included in price of the device

# Orthotic Biomechanical Considerations

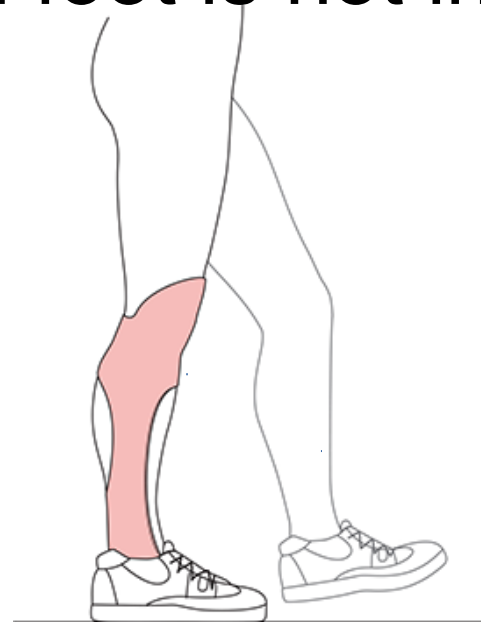
- A brace can influence what happens to a joint from underneath it
- A brace must cross a joint to control it



# Orthotic Biomechanical Considerations

- Controlling knee flexion in stance
- Plantarflexion in weight bearing (resisting dorsiflexion) causes knee extension
- No effect on knee when foot is not in contact with the floor

Ground Reaction AFO





# Orthotic Biomechanical Considerations

- By crossing the knee the joint can be controlled at any angle or weight bearing condition
- The example is sagittal plane
- But this is true for all planes
  - Gait plate vs twister cable
  - Lateral shoe wedge vs OA brace



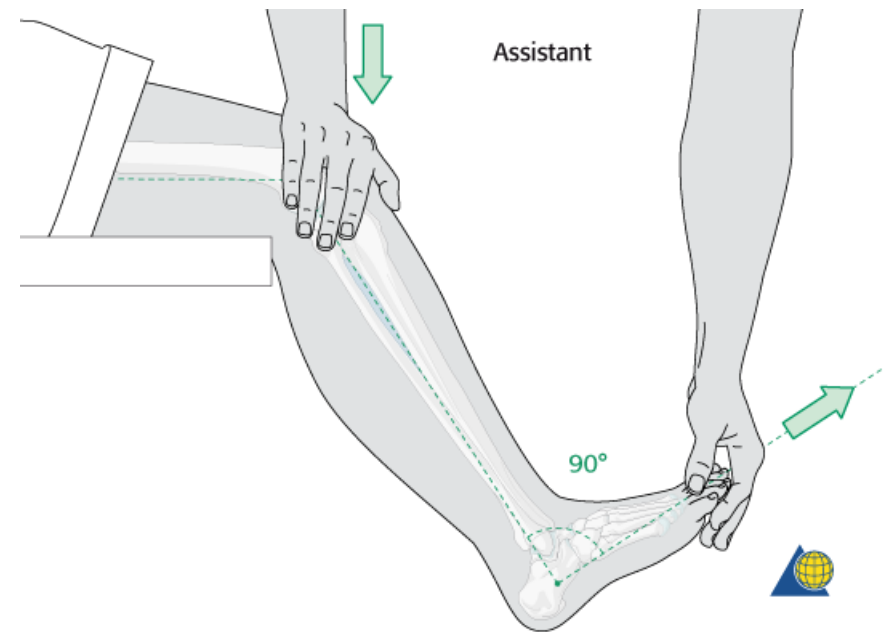
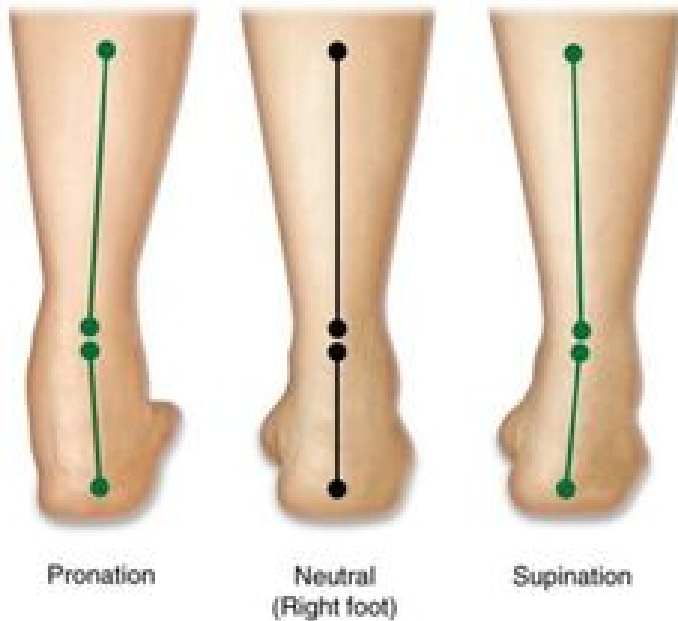
# Orthotic Biomechanical Considerations

- Braces made in “neutral position”
- Braces hold a position that the patient can already achieve



# Orthotic Biomechanical Considerations

- Ankle at 90 deg in sagittal plane
- Talus in neutral in frontal plane



# Orthotic Biomechanical Considerations

- Can the patient actually achieve this position?



A



B



C

VS.



# Orthotic Biomechanical Considerations

- If the patient can not achieve the 90 and neutral position with passive stretching, the contours of the brace will not match the contours of the leg and will cause problems with excess pressure

# Orthotic Biomechanical Considerations

- Articulations on a brace do not cause therapeutic gains in ROM
- Articulations protect and preserve ROM
- Gains can only be made if the patient has dorsiflexion ROM already
  - Weight line ahead of joint
- If the brace moves and the body can't, excess friction is created

# Orthotic Biomechanical Considerations

- Dynamic stretching braces



Spasticity AFO  
with SMO

# Orthotic Biomechanical Considerations

- Braces can be designed to increase ROM
- Soft tissue stretches best with
  - Low load
  - Long time
- Like silly putty
- Often used at night



# Orthotic Biomechanical Considerations

- Spastic children who are growing
  - Bones grow faster than muscles can stretch
- Muscular dystrophy and Spina Bifida
  - Weakness causes muscle imbalance
- Toe walker
  - Excess of tonic muscle fiber
- Post injury or Surgery
  - Stretch scar tissue

# Custom vs. Prefabricated

- Prefabricated braces
  - No specific patient in mind
  - Small, medium, large, etc
- Custom Braces
  - Made for a specific person
  - Made from measurements or model

# Prefabricated

- Stock items
- Can be obtained quickly
- Can test brace function
- Usually lower cost
- Can sometimes be obtained without Rx
- Not for all shapes/sizes
- Forces may be less intimate

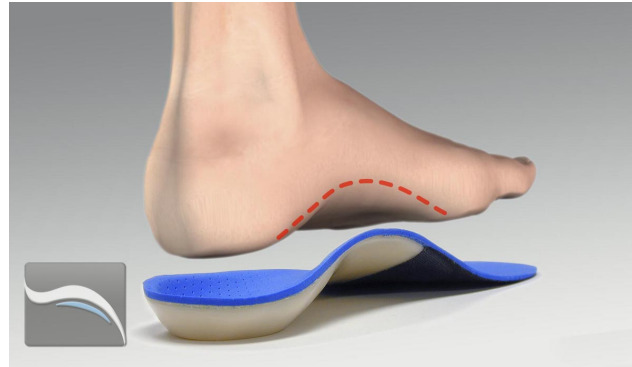
# Prefabricated



# Custom

- Match patient shape
- Direct application of forces
- Match patient activity level
- Increased creativity
- Increased fabrication time
- Increased cost
- Prescription required

# Custom



# Measuring

- Tape measure/ruler
- M/L gauge
- Tracing
- Specialty devices
- Custom models

# Tape Measure

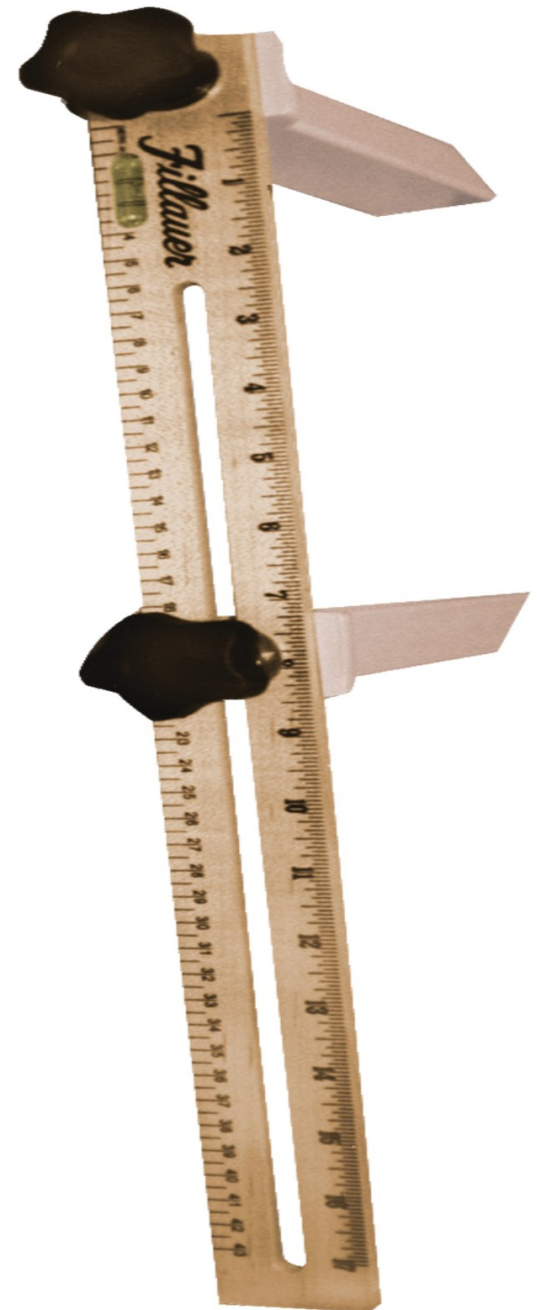
- Flexible cloth with plastic reinforcement
- Metal edges can injure skin
- Measures
  - Circumference
  - Length
  - Straight line
  - Contours





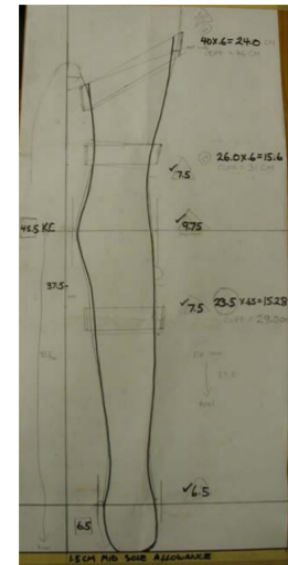
# M/L Gauge

- Large Caliper
- Measures
  - Width
  - Length
  - Diameters



# Tracing

- Everything I need to know I learned in Kindergarten
- Usually used for metal braces
- Trace contours of the limb
  - Keep pencil 90 deg



# Specialty Devices

- Brannock
- Knee braces
- Cascade DAFO
- To name a few



# Custom Models

- Physical
  - Plaster from cast
- Digital
  - 3D Scanning

# Casting

- Capture the patient's anatomy
- Corrected alignment
- Simulated weight bearing
  - When possible or appropriate



# Casting

- Stockinette applied to protect skin
- Cutoff strip
- Fiberglass casting material
- Hold position until dry
- Cut mold off limb
- Seal and fill
- Rectify mold
- Fabricate brace



# Digital Model

- Purpose built Scanner
- Tablet attachment
- 3D photogrammetry



# Digital Model

- Capture the surface shape
- 3 Dimensions
- Digital model can be carved then rectified
- Or can be rectified digitally then carved
- Pt. must hold still
- Can not capture weight bearing model
- Can not hold pt in corrected position



# Central Fabrication

- Cascade DAFO
- Surestep
- Spinal Tech
- Orthomerica
- Benik
- Etc.

# Central Fabrication

- Product consistency
- FDA clearance
- Specialty products
- Market Monopoly
- Proprietary materials
- Excellent marketing department

# Local Fabrication

- Direct knowledge of the patient
  - Better understanding of abilities and limitations
  - Better knowledge of body part
  - Understand how brace fits into the treatment plan
- Experimentation
  - Control cost, makes it easier to try new things
- Fabrication speed
  - Can save up to 10 days in shipping alone
  - Rush orders cost extra with central fab

# Pediatric Concerns

- Growth
- Progression of disease
- Development
- Progression of deformity
- Wear and tear
- Difficulty with communication
- Parental concerns

# Pediatric Concerns

- Growth
  - Increase in length
  - Increase in volume
  - Growth of bone vs growth of muscle



# Pediatric Concerns

- Progression of disease
  - CP is static
  - MD is progressive
  - Scoliosis is progressive until skeletal maturity
  - Spina Bifida is static but is affected by growth

# Pediatric Concerns

- Development

- Children develop muscle strength and coordination from proximal to distal
- Stabilize distal while strengthening proximal
- Child may not look bad now but bracing can prevent them from deformity later



# Pediatric Concerns

- Progression of deformity
  - Joint surfaces not congruent
  - Abnormal wear
  - Muscle tightness causes next flexible joint to accommodate
  - Excessive stretch of connective tissue



# Pediatric Concerns

- Wear and tear
  - Kids are hard on Braces
    - Running, jumping, dirty, food, etc.
  - Don't understand insurance restrictions
  - Don't care about the cost
  - Sandboxes unique to peds
    - Sand scratches braces inside shoes

# Pediatric Concerns

- Difficulty with communication
  - May not be able to communicate at all
  - Can't always describe problem
  - May not be accurate
  - May just not want to wear braces



# Pediatric Concerns

- Parental Concerns
  - Parent's attitude toward bracing
  - Dr. Google
  - Parent understanding/ education
  - Overprotection
  - Some parents actually know quite a bit
  - Access to care

# Pediatric Concerns

- Specialty braces for pediatrics
  - DAFO
  - Surestep
  - SWASH
  - Kiddie Gait
  - TAOS
  - Flexfoam TLSO
  - Benik
  - Theratogs
  - Medikids pedi wraps

# Pediatric Concerns

- Cascade DAFO
  - National manufacturer of custom and OTS braces
  -



# Pediatric Concerns

- Surestep



# Pediatric Concerns

- SWASH
  - Standing Walking And Sitting Hip orthosis



# Pediatric Concerns

- Kiddie Gait
  - Carbon fiber OTS AFO
  - Can be combined with other devices for frontal plane control



KiddieGAIT with SMO



KiddieGAIT



# Pediatric Concerns

- TAOS
- Therapeutic Ambulatory Orthotic System



# Pediatric Concerns

- Flex Foam TLSO
  - Spinal Tech



# Pediatric Concerns

- Scoliosis bracing
  - Day vs night bracing
  - Brand vs brand



# Pediatric Concerns

- Benik



# Pediatric Concerns

- Theatogs
  - Beverly Cusik PT



# Pediatric Concerns

- Medikids pedi wraps



# Pediatric Concerns

- Cranial remolding



# Fitting and delivery

- Trial fitting
- Trimming and adjustment
- Test function
- Check skin
- Family instruction
- Set follow up schedule



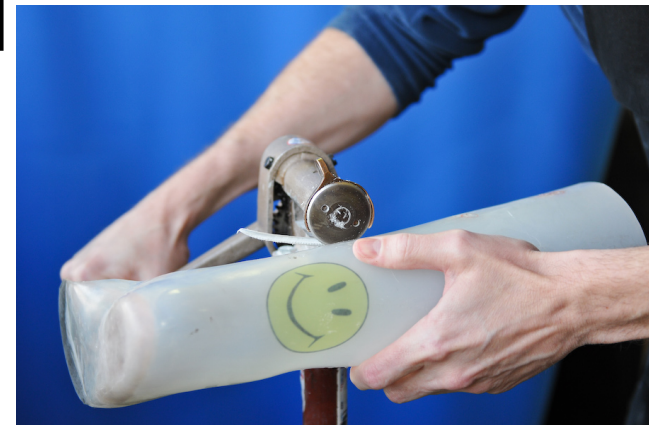
# Fitting and Delivery

- Trial fitting
  - Check contours
  - Check lengths
  - Check angles and alignment
  - Plastic stiffness
  - Joint alignment and motion (mechanical)
  - Straps holding



# Fitting and Delivery

- Trimming and adjustment
  - Can always trim extra material
  - Some adjustments require specialized tools
  - Smooth plastic edges
  - Trim straps so they wont fray
  - Heat and flare plastic to reduce pressure
  - Add pads after pressure is reduced



# Fitting and Delivery

- Test Function
  - Only if appropriate and safe
  - Standing, walking, grasp, etc
  - Adjust again if necessary
    - Function
    - Comfort



# Fitting and Delivery

- Check Skin
  - Pink is normal
    - 15-30 min functional braces
    - 1hr for body remolding braces
  - May not be any mark
  - Often just get an idea of the pressure in the office



# Fitting and Delivery

- Family instruction
  - Consistent wording
  - New forces
  - Gradual increase in wear
  - Frequent skin inspection
  - Hygiene
  - Importance of follow up

# Fitting and Delivery

- Follow up
  - 2 weeks for new users
  - 1 week for fractures
  - Previous users get more leeway
  - Always follow up as needed
  - No extra charge for follow up
  - Occasional long term follow up for growth

# Follow up and Adjustment

- Adjust for growth
- Refurbishment
- Cutting down braces (AFO/SMO)
- Adding Joints
- When anyone else adjusts

# Questions/Discussion

why?  
how? who?  
WHEN?  
Where?