

SCOREBUILDERS



SPOTLIGHT
Series

Orthotics Review for the NPTE

*Presented by
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About Me

- Specializations
- Experience
- Education
- Teaching
- Research



Purpose

1. Identify areas of focus for your study plan.
2. Draw parallels between other content areas and orthotics.
3. Prepare you for orthotics content that could be encountered on NPTE.

NOT

1. Comprehensive course on orthotics (but covers a lot!).
2. Rehash of Scorebuilders book.



- **Don't go into slideshow mode or else you will see the answers!**
- All of the reasons for the braces...
 - Covered elsewhere
- LE Orthotics=biomechanics
- So many different names...
- Focus on what is **MOST** likely
 - Cut out much of the unlikely
- This goes fast...



Terms

- Custom
 - Fabricated
 - Built from scratch
 - Fit (aka “off the shelf”)
 - Prefabricated
 - Customized to patient
- “Over the counter”
 - Prefabricated
 - No customization
- Splint
 - temporary
- Brace
 - Outdated (but acceptable) term for an orthotic device
- Orthotic
 - Adjective
- Orthosis/-es
 - noun



Photo courtesy of Dong Rikie J., DPM, FACFAS



Terms

- Conventional
 - Metal uprights
 - Leather cuffs
 - Can be anchored to the shoe directly
 - Patient preference...



Terms

- Molded
 - Thermoplastics
 - Built off a mold of the client
 - Total contact
 - Inserts inside the shoe opening
 - Variety of materials



Conventional



Molded



Terms

- Functional
 - More rigid
 - Control unwanted movements
- Accommodative
 - Decrease forces in unwanted areas
 - Redistribute remaining forces
 - Not built to control movement/abnormal biomechanics
 - Made for pain relief or de-weighting
 - Usually softer

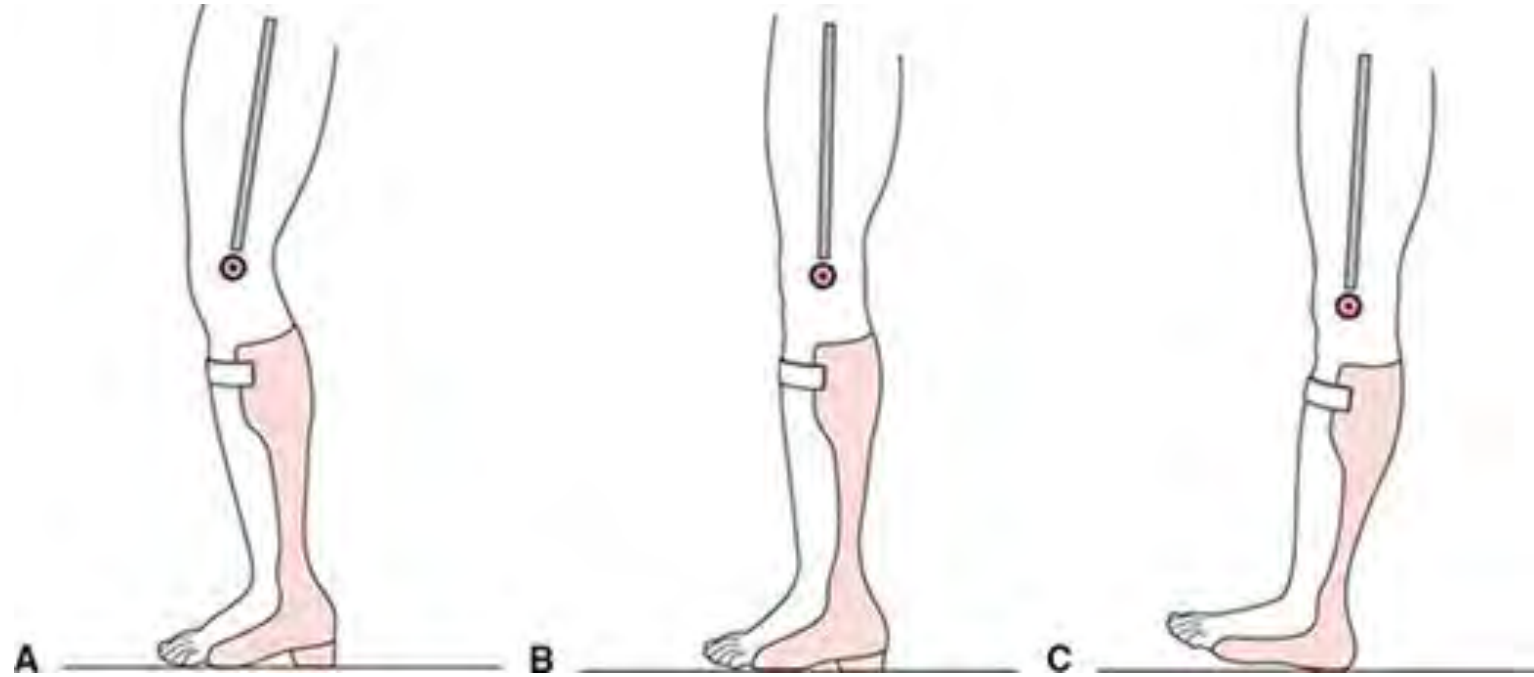


Terms

- Toe box: for diabetics
- Heel
- Reliefs
- Wedges
- Rockers



rcpell.ca



Terms



1. Fibula
2. Lateral malleolus
3. Anterior ankle
4. Sinus tarsi
5. Subtalar joint
6. Kager's triangle
7. Achilles tendon insertion
8. Peroneal tendons
9. Peroneal tubercle
10. 5th metatarsal base
11. Cuboid
12. 5th metatarsal head
13. Lisfrank's joint
14. Anterior talo-fibular ligament (ATF)
15. Calcaneo-fibular ligament (CFL)
16. Posterior talo-fibular ligament (PTF)
17. Talo-navicular joint



Terms

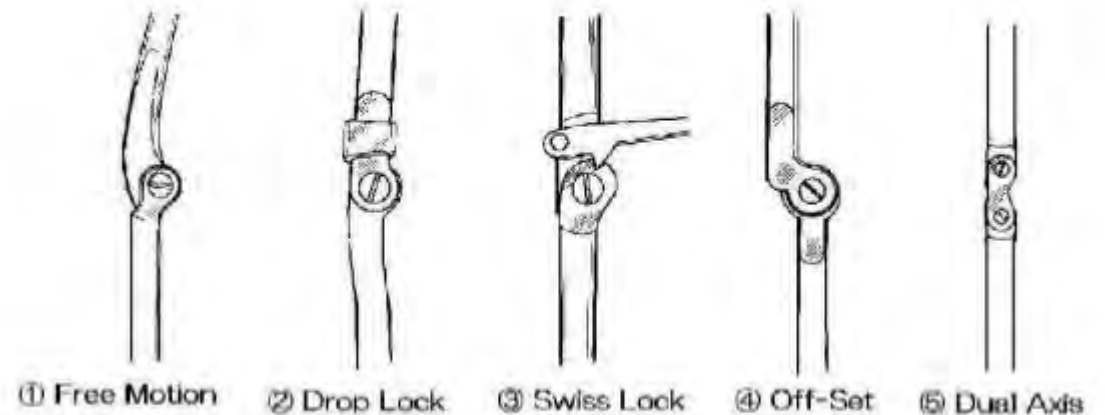
- Free= no restriction in specified plane
- Assist= helps movement in a specified plane
- Resist= controls against unwanted motion
- Stop=prevents unwanted motion
- Lock=selectable stopping of motion
- Deweighting=off-loads an area
- Molded= solid plastic
- Hinged= axis of rotation



Rigid (R)

Dorsi Assist/Stop (DA-DS)

Plantar Stop (PS)



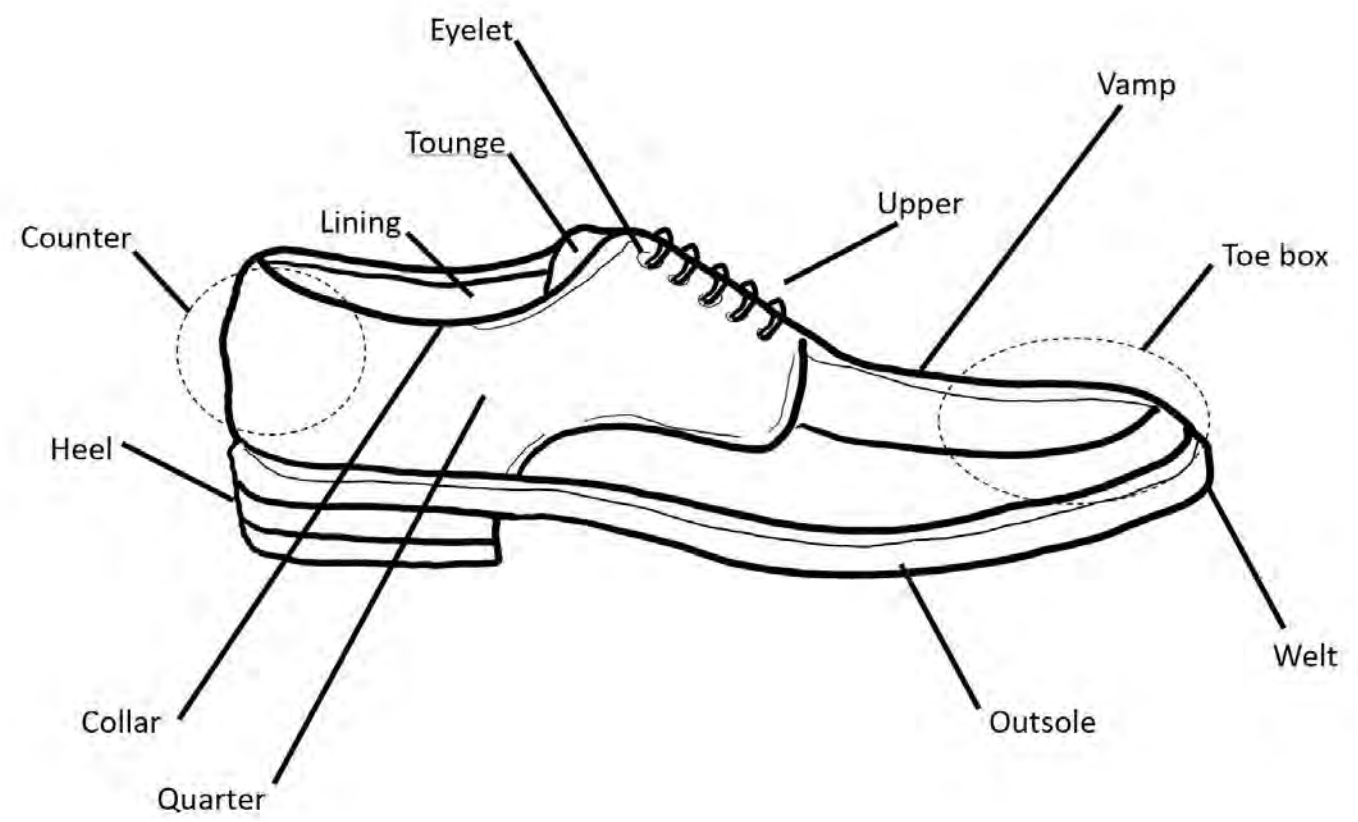
① Free Motion

② Drop Lock

③ Swiss Lock

④ Off-Set

⑤ Dual Axis



Q1: Terms

- A 89-year old male patient reports to physical therapy for gait training. They use an over the counter AFO to improve their efficiency secondary to drop foot. Upon inspecting their skin, you notice an area of breakdown over the fibular head. What is the **MOST** appropriate intervention to perform?
- 1- relieve around fibular head
- 2- pad over fibular head
- 3- refer to an orthotist
- 4- apply anti-bacterial ointment

Goals

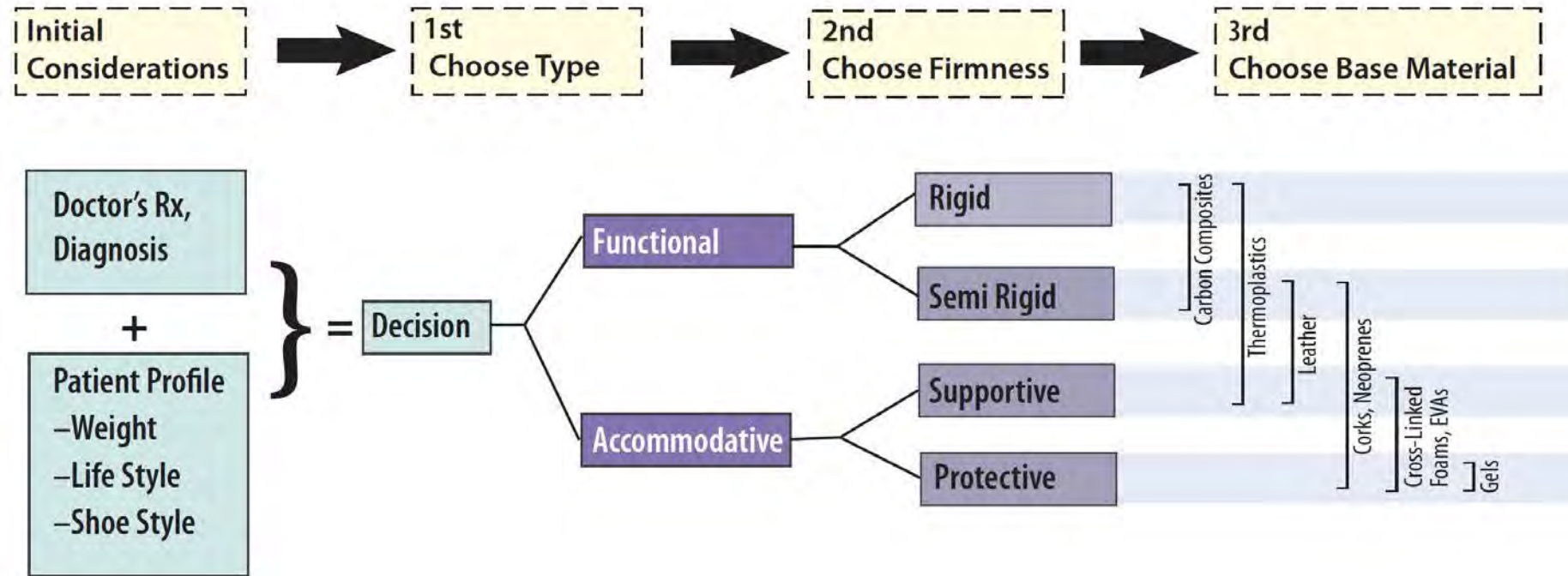
- Assist movement = weakness
- Stabilize= restrict unwanted motion
- Protect= unload joint
- Prevent = deformities
- Accommodate= existing deformities than cannot be corrected
- Correct= if possible/plausible



Materials

- Properties
 - Strength
 - Stiffness
 - Durability
 - Elasticity
- Person
 - Weight
 - Activity level
 - Specific situation

Figure 1



Materials

- Carbon fiber
 - Durable
 - Has energy storing properties
 - Lightweight
 - expensive



Thermoplastic

- Cheap
- Easy to mold and modify
- Lightweight
- OK durability
- Cumbersome
- Cosmetically unappealing
- Poor energy return



Forces



Knee OA without bracing
(bone-on-bone contact)



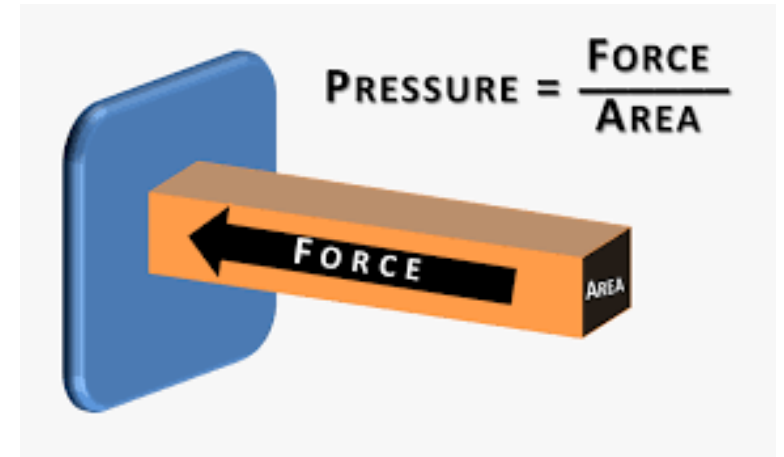
The 3-Point Leverage
System



Knee OA with bracing
(space created between bones)

Forces

- Must be softened through padding
 - Force/area=pressure
- Watch those bony prominences



High Pressure

Low Pressure

1



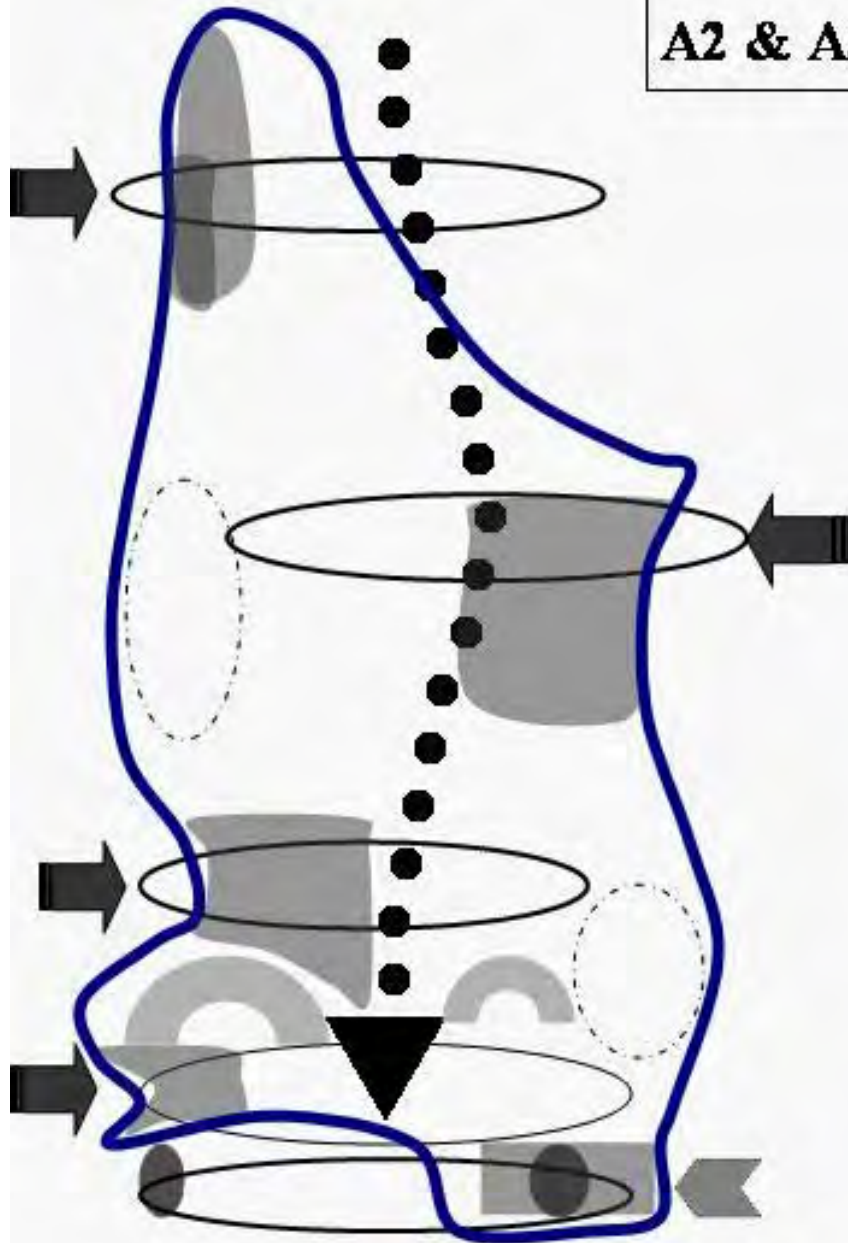
2



When a force is applied on a **smaller surface area**, it produces **high peak pressures** under the bony prominences.

When the same force is applied over a **larger surface area**, a **lower pressure** is produced.

A2 & A3 Type Brace



VISSION™



Q2: Forces

- A female patient presents with complaints of medial knee pain. Upon examination, it is found that she demonstrates genu valgum of the knee. You trial a 3-point bracing solution. Where should the **GREATEST** padding be placed?
- 1-lateral joint line
- 2-medial joint line
- 3-anterior joint line
- 4- posterior joint line

Wearing Schedule

- Very similar to that of a prosthesis
 - 1 hour a day rule
 - Skin checks every 15 minutes until skin demonstrates the ability to tolerate
 - About 2 weeks until full time wearing with every 2-4 hour checks
 - About 4 weeks until all day wear with checks pre/post
- Anyone with neuropathy must check more frequently and be vigilant about skin inspection
- Watch for sharp trimlines or crowded shoes



Skin Management

- Same as for prosthetics
- Use pre/during/post inspections
 - More frequently for high risk
- Use inspection mirror/selfie stick
- Scabs/wounds/breakdown in a patient with DM?
 - Better to leave it off and consult orthotist

Types



Lower-Foot orthosis (FO)

- Purpose
 - Control the magnitude and timing of foot movements
 - Improve the dispersion of forces through the kinetic chain
- Part of a comprehensive rehabilitation plan
 - Patellar Femoral Pain Syndrome
 - Knee osteoarthritis
 - Hip pain
 - “runners knee”



FO

- Custom made foot orthotics
 - Meet with a pedorthotist
 - Running stores
 - PT made
 - At home: <https://www.upstep.com/>
- Postings
 - Medial heel wedge
 - For overpronation
 - Lateral knee pain
 - “runners knee”
 - Lateral wedge
 - For oversupination
 - Medial knee pain



Pediatrics

- Denis-Browne
 - Correct/maintain correction for clubfoot
 - DF
 - Eversion
 - FF ABD



UCBL

- University of California Biomechanics Laboratory
- Corrects/limits hindfoot valgus
- Limits forefoot abduction
- Basically for overpronators
- Small size/big forces...



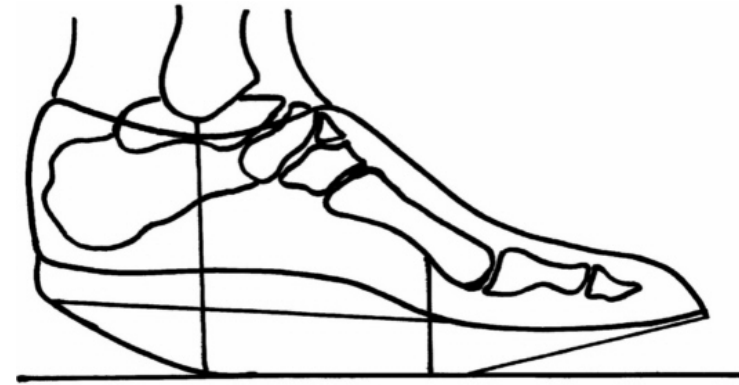
Lower-Supramalleolar orthosis (SMO)

- Stabilizes calcaneus and limits
 - STJ motion
 - FF ABD
 - Midfoot pro/sup
- Trimlines limit m-L while allowing sagittal motion
- Typically kids



Lower-Ankle orthosis (AO)

- Purpose
 - Protect ankle from unwanted motions
 - During activity
 - Restrict mobility
 - After surgery



Lower-Ankle foot orthosis (AFO)

- Purpose
 - Stabilize the ankle joint during gait
 - Assist the process of dorsiflexion
 - Prevent knee collapse
 - Restrict unwanted motion
- For most AFO's
 - Elastic shoelaces
- Stability determined by:
 - Struts
 - Shell position and width
 - Trimlines
 - Straps

KOTLIKOFF®



Conventional AFO

- Heavy
- Durable
- “old school”
- Stuck with the shoe its mounted in
- Patient preference
- Can be hinged, fixed, assisted...
- Not total contact
- Good for fluctuating edema!
- Sensation issues



AFO Types-Anterior shell

- Assists with foot clearance
- Assists with heel off
- Poor cosmesis
- Moderate M-L stability
- Good knee stabilization
- Watch skin
- Dynamic



AFO Types -Posterior Leaf Spring

- Assists with toe off and swing...not so much midstance!
- Good cosmesis
- Poor M-L stability
 - Can add a flange if needed
- Poor knee stabilization
- Must have at least 3+/5 MMT in PF to wear.



Solid AFO

- anterior ankle trimlines
- Good for knee stability during midstance
- Good for spasticity
- Bulky
- Watch skin
- Restricts motion
- Set it to desired position
 - DF for knee hyper extension
 - PF for knee instability
- Shoe mods to help with gait



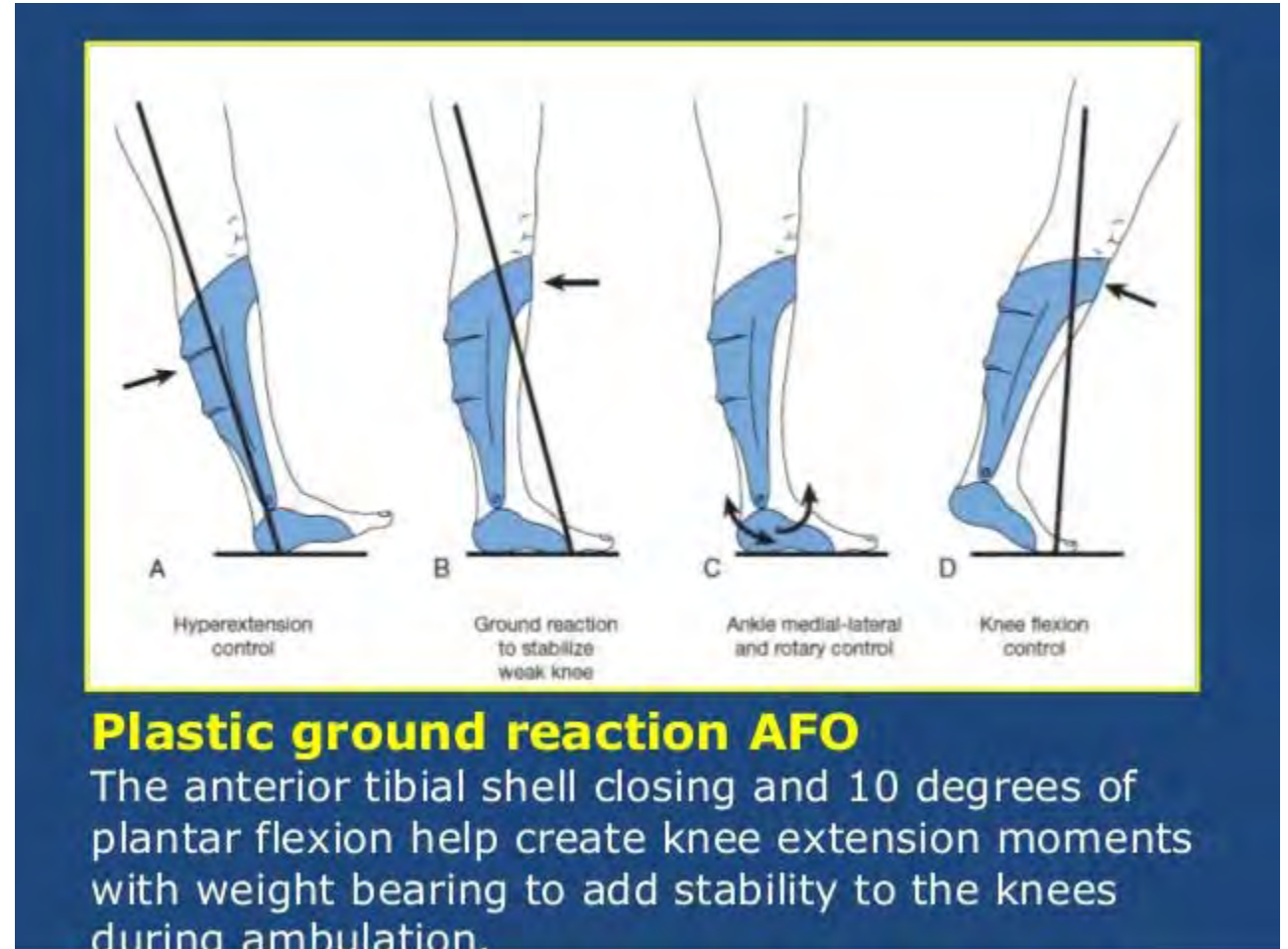
AFO Types- Hinged

- Restricts unwanted motion
- Poor cosmesis
- Moderate M-L stability
- Moderate knee stabilization
- Must have strength to oppose the motion



AFO Types- Ground Reaction Force (GRF)

- Lighter
- Similar in function to an anterior shell
- Foot plate long
- Good stability
 - Actively assists knee extension in midstance
- Crouch gait (CP)



Q3: AFO

- A male patient with knee extension and dorsiflexion/plantarflexion MMT of fair minus (3-/5) unilaterally reports to physical therapy for an evaluation of their gait. What AFO would be **MOST** appropriate for the patient to use to prevent the risk of knee instability during midstance?
- 1- solid AFO
- 2-hinged AFO
- 3-PLS AFO
- 4- conventional AFO

Q4: AFO

- A female patient presents to physical therapy for fall risk assessment. She has a PMH of multiple sclerosis and fluctuating peripheral lymphedema in the lower extremities. Her ankle PF's are fair plus (3+/5) bilaterally. What orthotic intervention would be the **MOST** appropriate to decrease fall risk during gait?
- 1-Solid AFO
- 2-PLS AFO
- 3- conventional AFO
- 4- hinged AFO with DF stop

Q5: AFO

- A female patient presents to physical therapy for examination. She wears bilateral solid AFO's. What functional movement would be the MOST difficult for her to perform?
- 1-turning during gait
- 2-sit→stand transfer
- 3- walking reciprocally
- 4-side-stepping up stairs

Lower-Knee orthosis (KO)

- Typically for OA or genu recurvatum
- Can be for proprioception (neoprene)
- 3 point systems for unloading
- Post surgical restrictions
- Used when the PF/DF are strong and an AFO would inhibit movement/mm activity





Knee OA without bracing
(bone-on-bone contact)



The 3-Point Leverage
System



Knee OA with bracing
(space created between bones)

Right vs Wrong Knee Immobilizer



Lower-Knee ankle foot orthosis (KAFO)

- Great M-L Stability of knee and ankle
- Requires at least 3+5 Hip MMT
- Can be stance control
- Can restrict wanted motion
- Cumbersome
- Cosmetically unappealing
- Heavy



Stance control



Scott-Craig Orthosis (KAFO)

- Use for those with Lower level SCI
 - T11 considered cut-off
- Common enough to know specifically
- Ankle set in 10 DF
 - Improve toe clearance
 - Knees locked
- Anterior tibial band
- Uses tension in Y-ligament to maintain hip extended position



Lower-Hip knee ankle foot orthosis (HKAFO)

- Has a pelvic component for stabilization
- Used for paresis of a limb
 - If very weak then HKAFO may extend up to mid-thoracic (LS-HKAFO/ TLSO-HKAFO)
- Triplanar control
- Can be used for hip dislocations s/p THA
- For greater mobility hip extension strength is needed otherwise joint is limited in its motion
- Can be locked out much like the KAFO or used with free motion
- Can be joined with a stance control knee.



Q6 : Knee and above

- A female patient presents for physical therapy with difficulty walking. Upon examination it is found that her knee extensors are fair (3/5), ankle PF good minus (4-/5), and hip extensors good (4/5). Medial-lateral stability of the knee during gait is intact. What is the **MOST** appropriate bracing solution?
- 1-Ground reaction force AFO
- 2- KAFO
- 3- KO
- 4- HKAFO

LOWER- Reciprocating Gait Orthosis



RGO

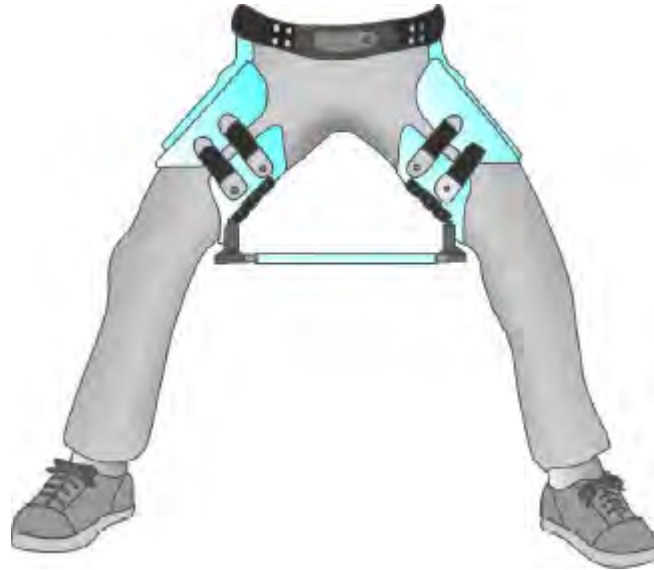


EXOSKELETON!



Lower- Hip orthosis

- Used for hip dysplasia
- Protection from falls
- Restrict motion after surgery



Deviations

Deviation	Device	Reason
Foot slap	AFO	Inadequate PF stop Inadequate DF assist
Knee instability	AFO	Inadequate DF stop Set in too much DF Heel too high
Knee hyperstability	AFO	Set in too much PF Heel too low
Early departure from terminal stance	AFO KAFO or above	DF stop restricts Knee joint doesn't allow flexion
Drop foot (swing)	AFO	Inadequate PF stop Inadequate DF assist
Circumduction (swing) Vaulting (swing)	KAFO or above	Knee joint locked out Fear of falling

Q7: Gait

- A male patient ambulating with a hinged AFO demonstrates decreased foot clearance during swing phase. During midstance the knee remains stable in slight flexion. What is the **MOST** likely issues with the orthotic device?
- 1- DF stop failure
- 2-PF stop failure
- 3- PF assist too strong
- 4- DF assist too strong

Upper

- Hand orthosis



Upper

- Wrist-hand orthosis
 - Position of functional grip
 - Wrist extension
 - Ulnar deviation
 - MCP flexion
 - IP's slightly flexed
 - Thumb ABducted



Upper

- Elbow wrist hand orthosis



Upper

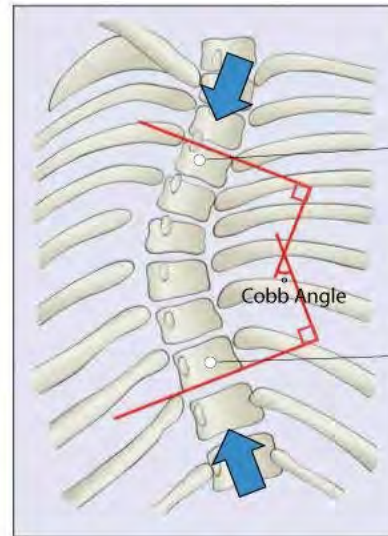
- Shoulder elbow wrist hand orthosis
- Post surgical
- PT's must be proficient in donning/doffing, as well as teaching others.



Spinal

- Scoliosis (<35* cobb angle)
 - Boston
 - Milwaukee

MEASURING THE COBB ANGLE



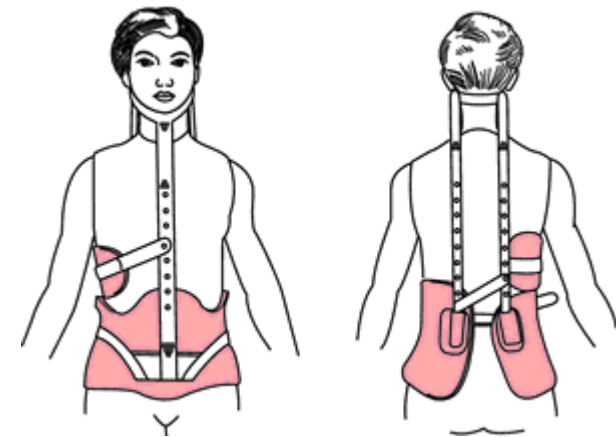
From the top, the most displaced vertebrae

From the bottom, the most displaced vertebrae

Source: e-radiography.net and core concepts



Adolescent patient in a Boston Brace



Spinal

- Sacroiliac orthosis
 - Post-partum
 - Proprioceptive feedback
 - No real motion control



Spinal

- Lumbarsacral orthosis
 - Post-surgery
 - I/s fusion
 - I/ laminectomy
 - Proprioceptive/comfort
 - Must teach patient how to don/doff
 - Not usually worn when supine but check orders!



Spinal

- Thoracolumbarsacral orthosis
 - CASH
 - Clamshell (most restrictive)
 - Knight Taylor (or just Taylor)
- Used for Vertberal Compresison Fx's



Spinal

- Cervical thoracolumbosacral orthosis
 - Restrict unwanted motion Halo
 - Greatest reduction in cervical mobility



Spinal-Cervical orthosis

- Usually LIFE SAVING!
 - Assess fit frequently and tighten/loosen
 - It is usually 24 hours a day
 - The pads can be changed and washed
 - Look for signs of fungal rashes
- Soft collar is for comfort
 - Usually PRN



Q8: Spinal

- A male patient is in acute care rehabilitation status post an MVA. T6-T12 vertebral bodies were fractured, as well as suspected anterior longitudinal ligamentous instability of the cervical spine. What bracing solution would be the **MOST** appropriate?
- 1- cervical thoracolumbar brace
- 2- cervical thoracic brace
- 3- thoracolumbar brace
- 4-TLSO

Functional Electric Stimulation

- Purpose:
 - Facilitate gait, reaching, and other ADL's/IADL
- Considerations
 - Patients level of spasticity
 - Available ROM
- EFFICACY/Use:
 - Ankle dorsiflexors for gait
 - Shoulder musculature for subluxations

Other Orthoses

- Multi-podus boots
 - Prevent heel ulcers
 - Prevent contractures
 - Must be stabilized
 - Not used for individuals capable of actively moving their ankle sufficiently to prevent contractures
 - NOT for gait!



Walking boots



Surgical Shoes



Need more info?

- Email: Daniel.lee29@touro.edu
- https://media.lanecc.edu/users/howardc/PTA103L/103OrthoticsLab/103OrthoticsLab_print.html
- <https://musculoskeletalkey.com/lower-limb-orthoses-for-persons-with-spinal-cord-injury/>
- <https://ouhsc.edu/bserdac/dthompso/web/namics/leorthot.htm>
- <https://ouhsc.edu/bserdac/dthompso/web/>



Questions?





Feedback? Let Us Know!



We would love to get
your general
feedback on today's
session and ideas for
subject matter for
future Spotlight
Sessions!





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In!**

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