Lower Extremity Orthotics

Pathology and Prescription

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Lower Extremity Orthotic Goals

- Stabilize weak or paralyzed segments
- Support damaged or diseased joints or segments
- Unload distal segments
- Control abnormal or spastic movements
- Limit or augment motion across joints
Orthotic Evaluation

- Comprehensive team evaluation including physician, orthotist, therapist, patient
- Establish the orthotic and rehab goals early
- Educate the patient
- Clarify the limitations of the orthosis
- Order appropriate therapy for the device
- Follow up with the patient
Orthotic Issues to Consider

- Biomechanics of the device (3-point control across a joint)
- Durability of the materials
- Tissue tolerance to pressure
Lower Extremity Orthotic RX

JFK JOHNSON REHABILITATION INSTITUTE
LOWER LIMB ORTHOTIC PRESCRIPTION

NAME: ___________________________  AGE: ________  DOB: ________  SEX: ________  PT.#: ________

REFERRING M.D.: ___________________________  PRESCRIBING M.D.: ___________________________

DIAGNOSIS: ___________________________  DISABILITY: ___________________________

PROGNOSIS: ___________________________  PRACTITIONER: ___________________________

TYPE OF ORTHOSIS: HKAFO: R___L___ KAFO: R___L___ AFO: R___L___ FOOT: R___L___ SHOES: R___L___

Specialty Orthosis: Craig-Scott: ___________________________  Floor Reaction Orthosis: ___________________________

Patellar-Tendon Bearing Orthosis: ___________________________

TRUNK COMPONENTS:
- Corset: ___________________________
- Pelvic Band: ___________________________
- Other: ___________________________

HIP JOINT:
- Fixed: ___________________________
- Drop Lock: ___________________________
- Adjustable: ___________________________
- Other: ___________________________

THIGH COMPONENTS:
- Metal Uprights: ___________________________
  - Steel: ___________________________
  - Aluminum: ___________________________
- Thigh Bands: ___________________________
  - Steel: ___________________________
  - Aluminum: ___________________________
- Carbon: ___________________________
- Plastic Shell: ___________________________
- Gluteal Bearing: ___________________________
- Iliac Bearing: ___________________________
- Velcro Strap Closure: ___________________________
- Laced Leather Closure: ___________________________

KNEE JOINT:
- Offset: ___________________________
- Dual Lock: ___________________________
- Drop Lock: ___________________________
- Retention Buttons: ___________________________
- Ball Lock: ___________________________
- Trigger Lock: ___________________________
- Ratchet Lock: ___________________________
- Trick Knee: ___________________________
- Other: ___________________________

CALF COMPONENTS:
- Plastic Calf Shell: ___________________________
- Metal Upright: ___________________________
- Aluminum: ___________________________
- Steel: ___________________________
- Calf Bands: ___________________________
- Aluminum: ___________________________
- Carbon: ___________________________
- Pre-Tibial Shell: ___________________________
- Velcro Strap Closure: ___________________________
- Calf Corset Design: ___________________________

CORRECTIVE STRAPS:
- Valgum: ___________________________
- Varum: ___________________________
- Recurvatum: ___________________________
- Knee Cap: ___________________________
- Suprapatellar: ___________________________
- Infraapatellar: ___________________________

TRIM LINES:
- Ant. Mall: ___________________________
- Mid. Mall: ___________________________
- Just Behind Mall: ___________________________
- Flexible Pls: ___________________________
- 3 Point Inv. Control: ___________________________

PLASTIC FOOTPLATE:
- Full Length: ___________________________
- Standard 3/4 Length: ___________________________
- Padding: ___________________________
- Tone Reducing Design: ___________________________

ANKLE JOINT:
- Post Channel: ___________________________
- Dual Channel: ___________________________
- Plastic Hinge: ___________________________
- Free Motion: ___________________________
- Rigid Stop: ___________________________
- Dorsiflexion Angle: ___________________________

CORRECTIVE STRAPS:
- Medial T-Strap: ___________________________
- Lateral TStrap: ___________________________
- Ankle Strap: ___________________________

SHOE/FOOT CONNECTION:
- Solid Stirrup: ___________________________
- Split Stirrup: ___________________________
- Caliper Box: ___________________________
- Long Steel Shank: ___________________________
- Heel to Toe: ___________________________
- Heel to Met Heads: ___________________________

SHOES:
- Orthopedic/Blucher: ___________________________
- Sneaker Style: ___________________________
- Surgical: ___________________________
- High Top: ___________________________
- Extra Depth: ___________________________
- High Toe Box: ___________________________
- Bunions Lasts: ___________________________
- Deer Skin: ___________________________
- Heal/Sole Lift: ___________________________
- Type of Sole: ___________________________
- Other: ___________________________

CLOSURE TYPE:
- Laces: ___________________________
- Velcro Patch: ___________________________
- Velcro D-Ring: ___________________________

CUSTOM FOOT ORTHOTICS:
- Left: ___________________________
- Right: ___________________________
- Accommodative: ___________________________
- Corrective: ___________________________

MATERIAL:
- Plastazote: ___________________________
- PPT: ___________________________
- Neoprene: ___________________________
- Polypropylene: ___________________________
- Other: ___________________________

Special Features/Instructions: ___________________________

The above prescribed devices are a medical necessity to increase the patient's safety and functional status.

Duration of Necessity: ___________________________

Date: ___________________________  Physician Signature: ___________________________
Correct choice of brace design?
Goal = Functional Ambulation

Primary Factors: Trunk Control
Weight Shift
Advance The Leg

Concerns: Apraxia
Ataxia
Neglect

Tone
Sensation
Edema
Focused Examination - Motor

Strength: Hip Extensors
Knee Extensors
Ankle DF/PF/inver/ever

Tone: Flaccid
Normal
Increased
Focused Examination – Sensory/Skin

Sensation: Normal
Decreased but “protective”
Absent
Hypersensitive or tender
Proprioception

Skin Integrity: Intact
Dysvascular
Wounds
Focused Examination – ROM/Edema

A/PROM: Hip extension
  Knee extension
  Ankle DF/PF/inver/ever

Edema: None
  Controlled
  Not Controlled
  ✫ DVT
Bad Foot
Avoidable Complications
Orthotists Nightmare
UCBL Custom Foot Orthotic
AFO
Ankle Foot Orthosis

- Metal
- Plastic
- Carbon
- Hybrid
Components of a Metal AFO

- Calf band
- Uprights
- Ankle joints
- Stirrup (solid or split with caliper box)
- Additional shank if needed
- T-strap if needed
- Shoe (preferably leather sole)
Components of a Metal AFO (common examples)
Components of a Metal AFO
Stirrup Attachment to Shoe (solid or split stirrup)
Metal Ankle Joints

FREE MOTION  LIMITED MOTION  LOCKED  DORSI-ASSIST (Klenzak)  DOUBLE-ADJUSTABLE
Single Channel Ankle Joint (common names)

- Single Channel
- Posterior Channel
- Klenzak
- Dorsi-assist
- Single Adjustable
Single Channel Ankle Joint

DF assist               PF stop
Single Channel Ankle Joint (DF assist and PF stop)
Dual Channel Ankle Joint (common names)

- Dual channel
- Bi-cal
- Double adjustable
Dual Channel Ankle Joint
DF assist and PF stop
Dual Channel Ankle Joint

DF assist/stop

DF/PF stop
Dual Channel Ankle Joint video (posterior spring, anterior pin)
Plastic AFO Trimlines

- PLS (posterior leaf spring)
- JBM (just behind malleolus)
- Mid-malleolar
- Anterior malleolar
- Bi-valve shell
Plastic AFO Trimlines
Plastic AFO with Anterior Trim
Plastic AFO with 3 point inversion control
Hinged Plastic Ankle Joints

Overlap

Gillette

Gaffney

Oklahoma

Insert Stirrup

Plantar Flexion Stop
Hinged Plastic AFO with pre-flexed Tamarack joint
Hinged Plastic AFO with Oklahoma joint
Hinged Plastic AFO with metal joint
SMO Supra-Malleolar Orthosis
Hinged plastic AFO with insert
Carbon AFO
Custom Carbon AFO

**Posterior**
- Velcro Closure
- Airux Core
- Posterior to Malleoli
- Solid Ankle Rigidity

**Anterior Medial**
- Airux Core
- Anterior Medial Strut
- Foam Liner
- Open Heel Design

**Custom Lateral Strut AFO**
- Velcro Closure
- Foam Liner
- Light weight advanced composite construction
- Custom Foot Bed
Hinged Carbon AFO (Richie Brace)
Hybrid carbon and plastic AFO with dual channel joint
Break time
Unloading AFOs

- Total contact devices for plantar ulcers or Charcot Joint
- Patellar-tendon-bearing devices with bi-valve shell
- Calf-corset design devices with lace or velcro closure
Total Contact Orthoses (Crow walker, Cam walker)
PTB Orthoses

Bi-valve

Calf-corset
PTB orthosis
Calf-corset design
Ground Reaction Orthosis

1. Hyperextension Control
2. Ground Reaction to Stabilize Weak Knee
3. Ankle M-L and Rotary Control
4. Knee Flexion Control
AFO cases
Findings - Flaccid footdrop
  Dorsiflexor and everter weakness
  Mild sensory loss dorsum of foot
  Normal tone; no edema
Orthosis - Plastic “PLS” design AFO
  ¾ footplate, 5º DF
Plastic
AFO
PLS design
Polio Involving Foot/Ankle Only

Findings - Flaccid footdrop
- Poor medio-lateral control
- Marked muscle atrophy
- Sensation intact, no edema
- Small foot, shortened limb

Orthosis - Double metal upright design AFO
- Posterior channel ankle joints
- Custom orthopedic shoe with lift
Metal AFO
posterior
channel ankle joint
Charcot Foot with Neuropathy

Findings - Weakness in DF/PF/inver/ever
Sensation absent
Bony destruction of midfoot
ROM limited

Orthosis - Patellar-Tendon-Bearing-Orthosis
(PTBO)
Calf-corset design or Bivalve Plastic
Dual channel ankle joint
Custom orthopedic shoe with insert
Charcot Foot
PTB Orthosis
Charcot-Marie-Tooth Disease

Findings - Absent DF/PF/inver/ever
- Sensation intact
- Muscle atrophy
- ROM normal, no edema

Orthosis - Plastic AFO, mid-mall trim
- 3/4 footplate, 3-5° DF
Plastic AFO
mid-mall
trim lines
Bedbound/Non-Ambulatory Patient

Findings - Generalized weakness
  Tone low
  Fluctuating edema
  Sensation questionable
  High risk of heel ulcer
  High risk of PF contracture

Orthosis - PRAFO
PRAFO
CVA with Hemiplegia

Findings - DF weakness, M-L instability
PF and inversion increased tone
Protective sensation
Controlled edema
ROM to neutral only

Orthosis - Plastic AFO, mid-malleolar trim
Full footplate, 0° DF
3-point inversion control
Plastic AFO inversion control
CVA with spastic hemiplegia
CVA With Hemiplegia

Findings - DF weakness, M-L instability
PF and inversion tone
Sensation absent
Fluctuating edema

Orthosis - Double upright metal AFO
Posterior channel ankle joint
Lateral T-strap
Orthopedic extra-depth shoe with insert
Metal AFO with T-strap
Traumatic Brain Injury

Findings - Marked spasticity and extensor tone
Weakness DF/PF/inver/ever
Sensation intact
No edema
ROM to 3º DF with vigorous stretch

Orthosis - Plastic AFO, ant. malleolar trim
Full footplate, tone-reducing design
3º DF, add ankle strap
Plastic AFO
anterior trim
tlines and full
footplate
TBI with spastic equinovarus
Multiple Sclerosis – Progressive Type

Findings - Weakness DF/PF/inver/ever
Sensation protective
Tone increased
No edema
ROM to 3º DF

Orthosis - Plastic AFO, just-behind- malleolus trim ,3/4 footplate, 3º DF

Alternate – Consider metal AFO for progressive type
AFO options
MS with footdrop and stiff knee
KAFO
Knee-Ankle-Foot-Orthosis

- Metal design
- Plastic design
- Carbon design
- Hybrid designs
Knee Joint Options

- Free knee
- Drop lock
- Bail lock
- Trigger lock
- Ratchet lock
- Offset
- Trick knee
Knee Joints
Bail Lock and Trigger Lock
Trick Knee

Ratchet joint
Metal KAFO Designs
Metal KAFOs
Metal KAFOs
KAFO
in disguise?
Plastic KAFOs
Hybrid KAFO Designs
KAFO
Poorly made KAFOs
Stance Control Orthoses

- New generation of KAFO’s that lock the knee joint automatically in stance, but allow knee flexion in swing
- Electronic or mechanical feedback from ankle and/or knee to determine stance phase
- Currently available by central fab directly from manufacturer
CVA with Hemiplegia

Findings - Weakness at knee and ankle
Some extensor tone
Sensation protective
No edema
Ankle ROM to 3° DF

Orthosis - Plastic KAFO with “Trick Knee” joint
JBM trim, 3° DF
Plastic KAFO with Trick Knee
Traumatic Brain Injury

Findings - Marked spasticity and flexor tone
Knee flexion contracture 45°
Ankle ROM to neutral
Strength – flexion synergy only
Sensation protective
No edema

Orthosis - Plastic KAFO with ratchet knee joint
Mid-malleolar trim, neutral ankle
Plastic KAFO with ratchet knee
TBI with spastic quadriparesis
Polio Involving Knee And Ankle

Findings - Weakness at knee and ankle
M-L instability at knee and ankle
Marked muscle atrophy
Sensation intact, no edema
Small foot, shortened limb

Orthosis - Metal KAFO with drop lock knee joint
Knee cap, dual channel ankle joint
Custom orthopedic shoe with lift
KAFO
polio
design
Polio involving left leg
Guillain-Barre-Syndrome

Findings - Weakness at knee and ankle bilaterally
Low tone, good hip extension/flexion
Sensation intact, no edema
ROM is normal

Orthosis - Plastic KAFO with offset knee joint
JBM trim, neutral ankle
Plastic KAFO with offset knee joint
Severe Peripheral Neuropathy

Findings - Weakness at knee and ankle
            Amputation of other leg
            Sensation nearly absent, no edema
            Knee instability with dislocation

Orthosis - Plastic KAFO with offset knee joint
            Anterior trimline, neutral ankle
            Anterior plastic thigh shell with partial weight-bearing thru femoral condyles
Plastic KAFO with Anterior Thigh Shell
Charcot Knee and BKA
Spinal Cord Injury – $T_{12}$ Level

Findings - Paralysis both legs
Good trunk and arm control
Sensation absent, Mild edema
Tone is increased

Orthosis - RGO – reciprocal gait orthosis
Hybrid metal and plastic design HKAFO’s with droplock knee joints and plastic AFO at neutral

Alternate - Craig-Scott metal KAFO’s with droplock knee joints and dual channel ankle joints
RGO reciprocal gait orthosis
RGO design options
SCI spastic paraparesis
Hip Joints

- Locked Hip
- Free Hip
- Adjustable Abduction Hinge
- Lerman Hinge
- Orthomedics Hinge
Hip Abduction Orthosis (prevention of hip dislocation)
Thank You