

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:

Free: _____
Drop Lock: _____
Adjustable: _____
Other: _____

THIGH COMPONENTS:

Metal Uprights: _____
Steel: _____
Aluminum: _____
Thigh Bands: _____
Aluminum: _____
Carbon: _____
Plastic Shell: _____
Gluteal Bearing: _____
Ischial Bearing: _____
Velcro Strap Closure: _____
Laced Leather Closure: _____

KNEE JOINT:

Offset: _____
Dial Lock: _____
Drop Lock: _____
Retention Buttons: _____
Bail Lock: _____
Trigger Lock: _____
Ratchet Lock: _____
Trick Knee: _____
Other: _____

CORRECTIVE STRAPS:

Valgum: _____
Varum: _____
Recurvatum: _____
Knee Cap: _____
Suprapatellar: _____
Infrapatellar: _____

CALF COMPONENTS:

Plastic Calf Shell: _____
Metal Uprights: _____
Aluminum: _____
Steel: _____
Calf Bands: _____
Aluminum: _____
Carbon: _____
Pre-Tibial Shell: _____
Velcro Strap Closure: _____
Calf Corset Design: _____

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: _____
Bunion Lasts: _____
Deer Skin: _____
Heel/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

Tone

Ataxia

Sensation

Neglect

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



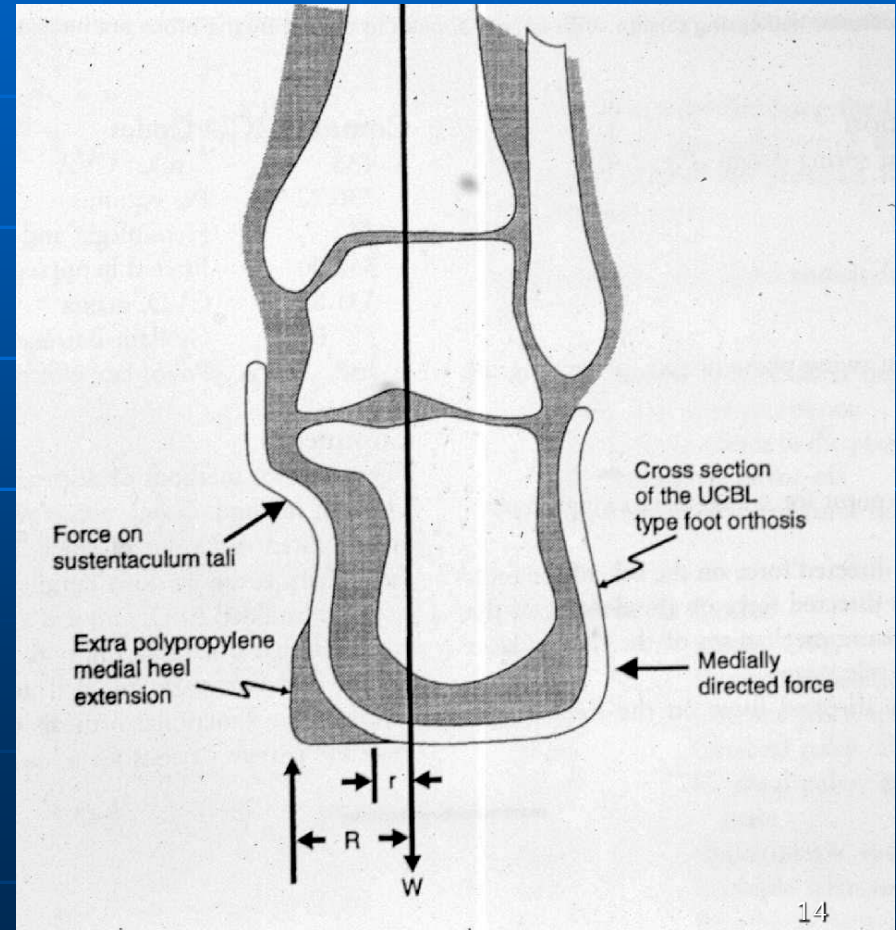
Avoidable Complications



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

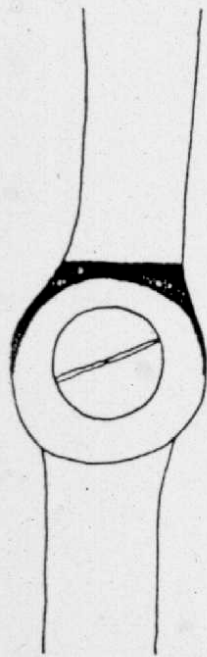


Stirrup Attachment to Shoe (solid or split stirrup)

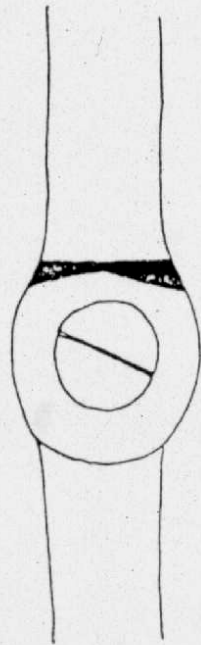


Metal Ankle Joints

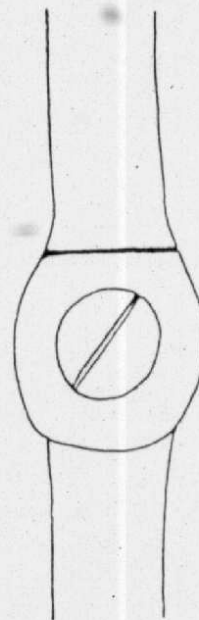
ANKLE JOINTS



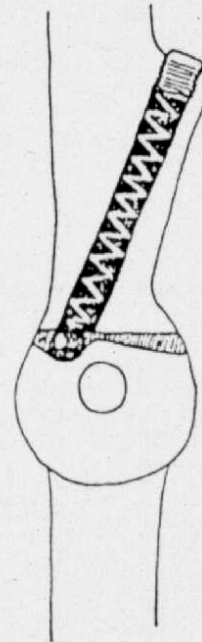
FREE MOTION



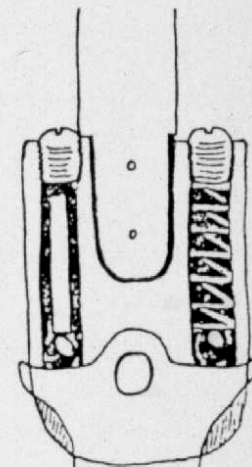
LIMITED MOTION



LOCKED



DORSI-ASSIST (Klenzak)



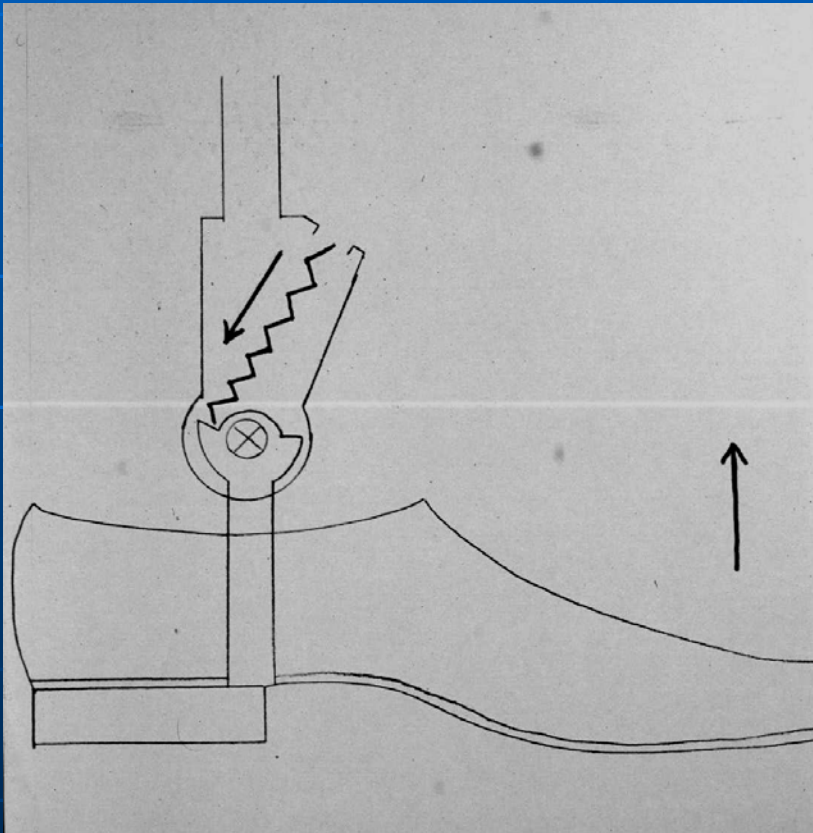
DOUBLE-ADJUSTABLE

Single Channel Ankle Joint (common names)

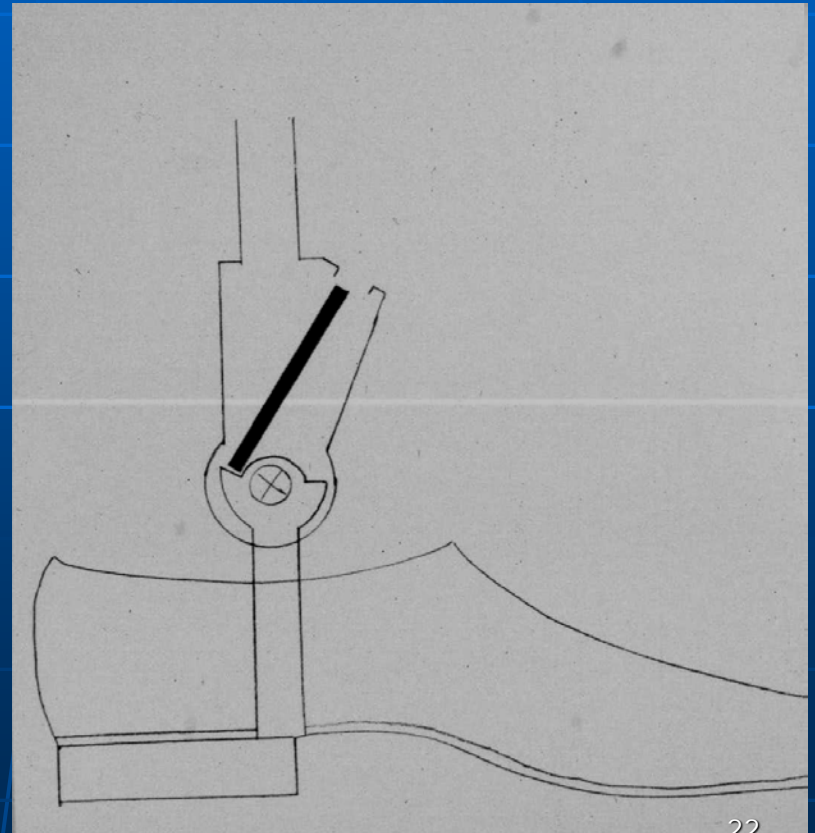
- Single Channel
- Posterior Channel
- Klenzak
- Dorsi-assist
- Single Adjustable

Single Channel Ankle Joint

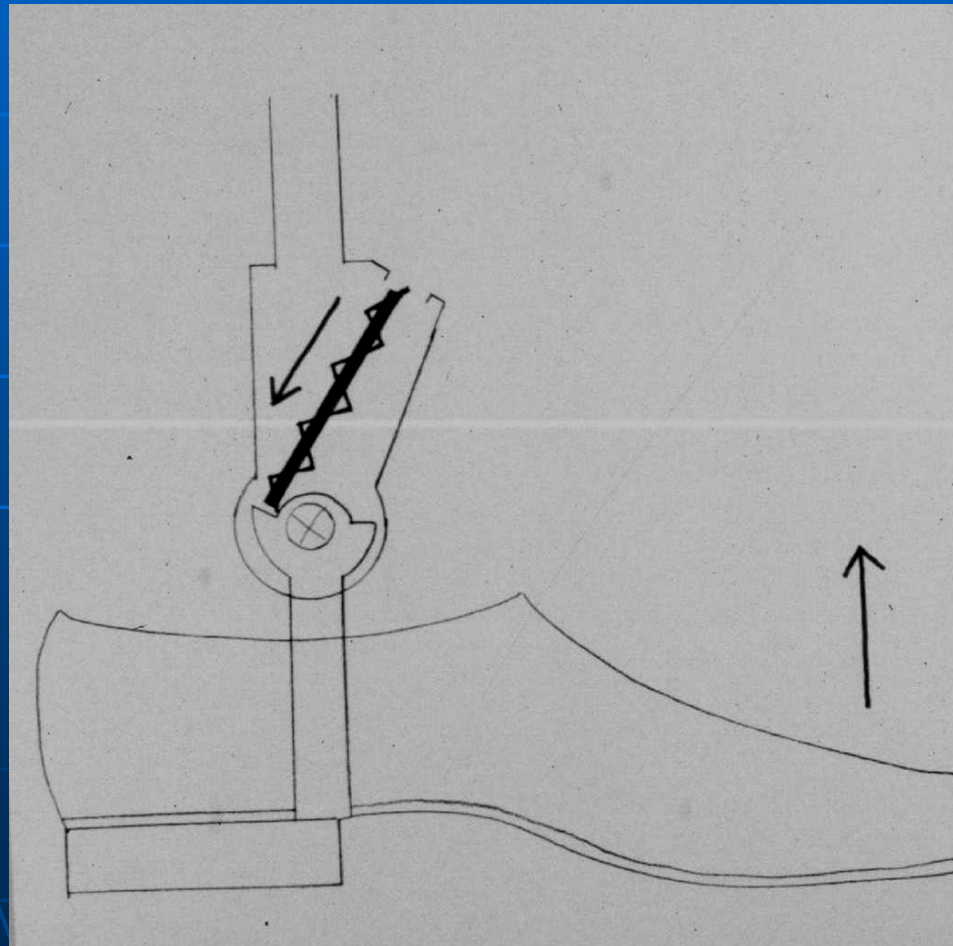
DF assist



PF stop



Single Channel Ankle Joint (DF assist and PF stop)

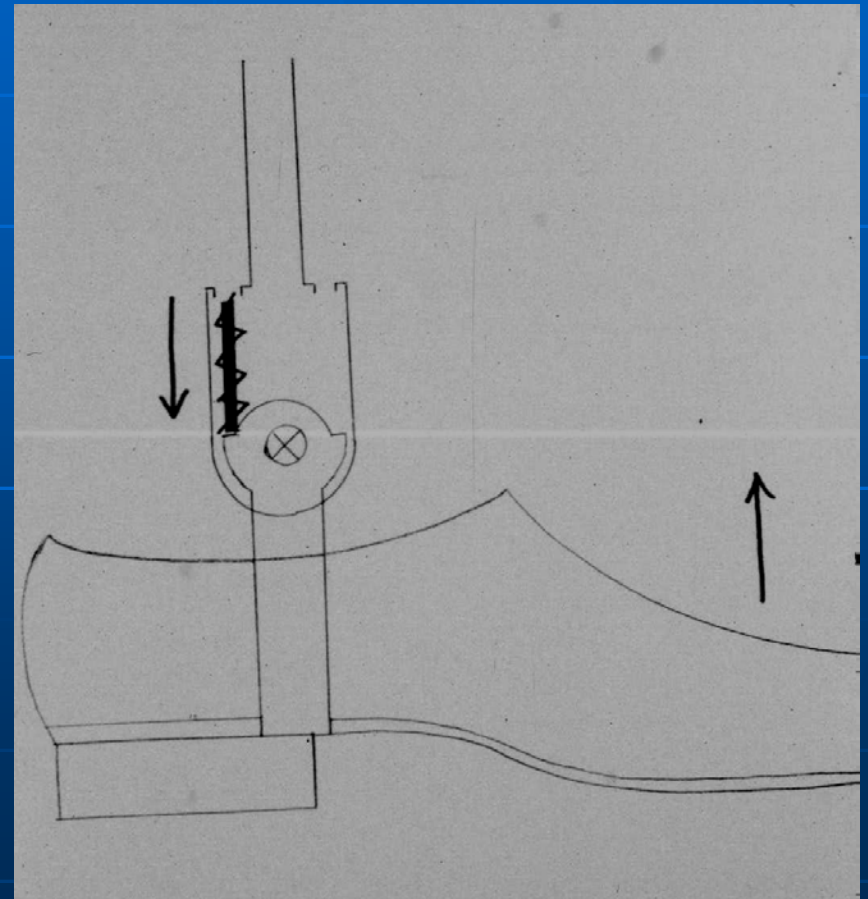
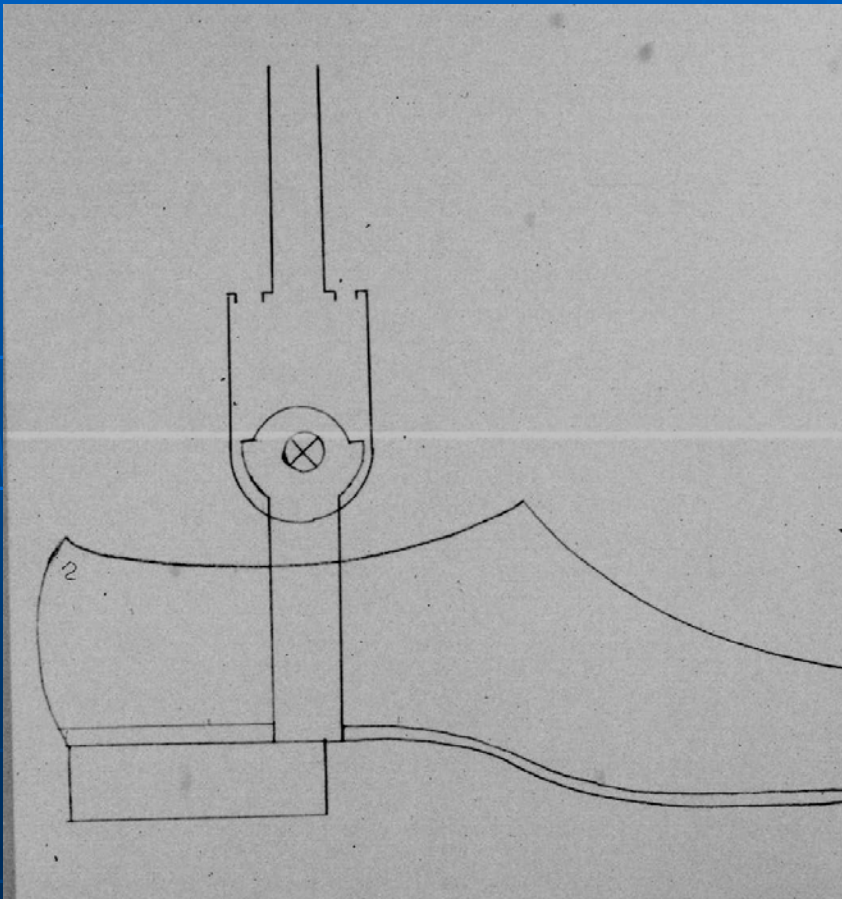


Dual Channel Ankle Joint (common names)

- Dual channel
- Bi-cal
- Double adjustable

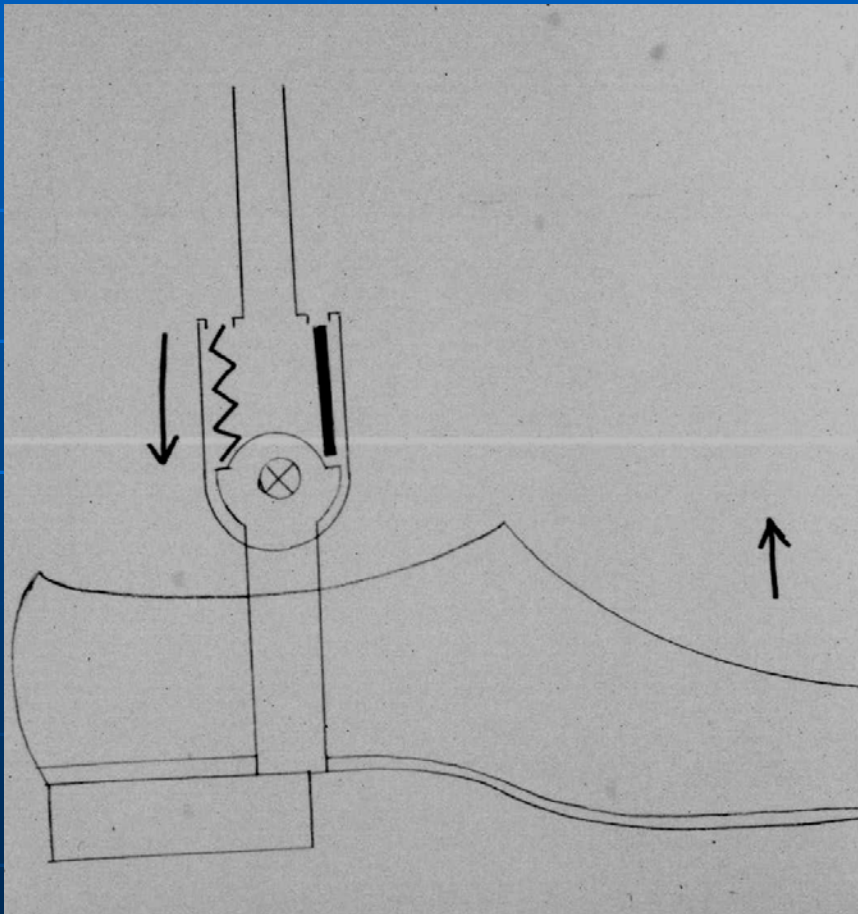
Dual Channel Ankle Joint

DF assist and PF stop

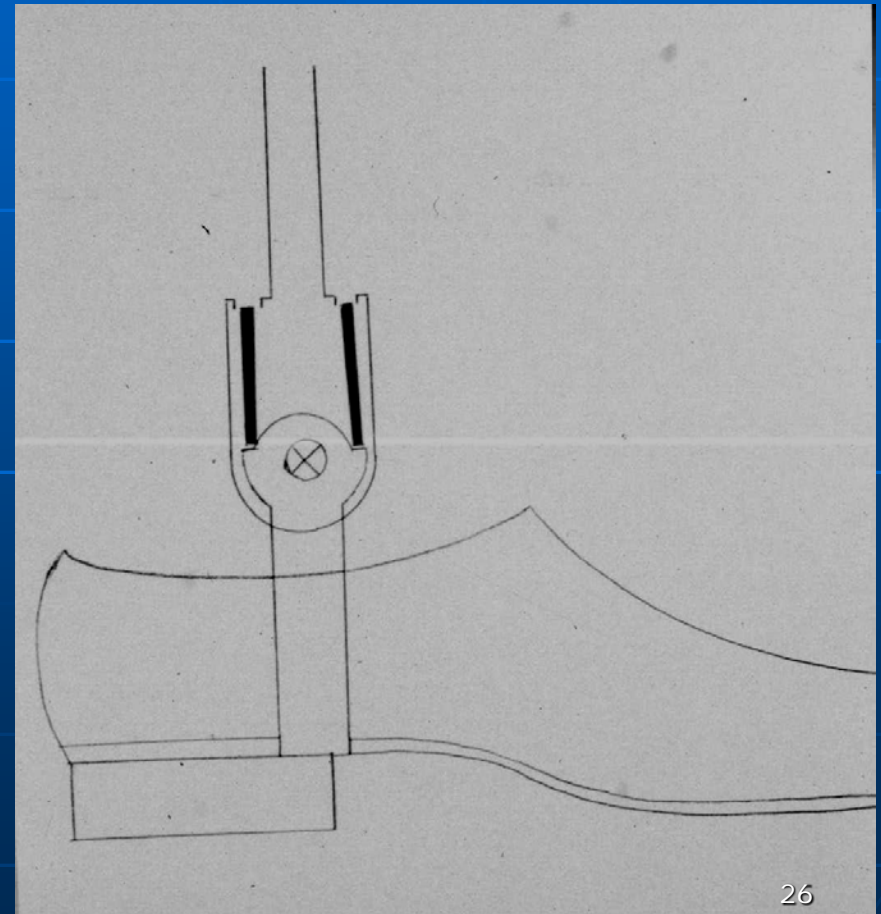


Dual Channel Ankle Joint

DF assist/stop



DF/PF stop



Dual Channel Ankle Joint video (posterior spring, anterior pin)



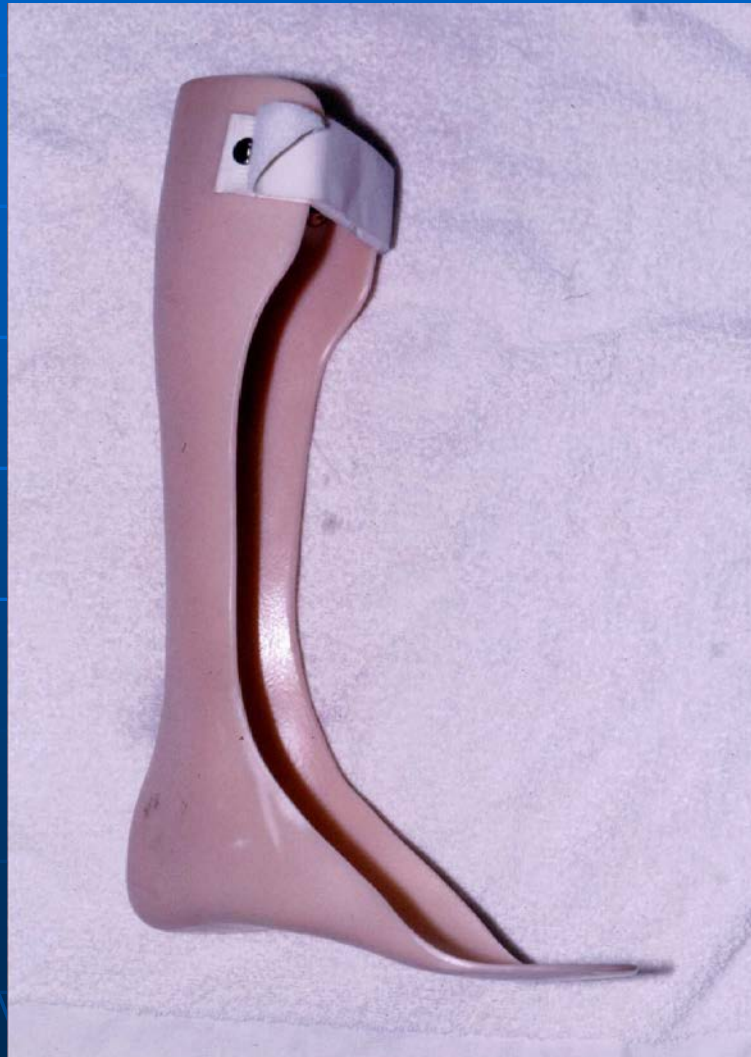
Plastic AFO Trimlines

- PLS (posterior leaf spring)
- JBM (just behind malleolus)
- Mid-malleolar
- Anterior malleolar
- Bi-valve shell

Plastic AFO Trimlines



Plastic AFO with Anterior Trim



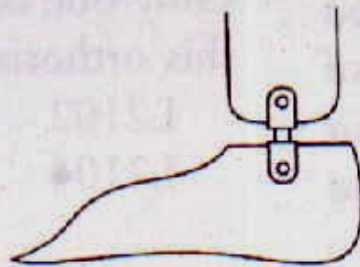
Plastic AFO with 3 point inversion control



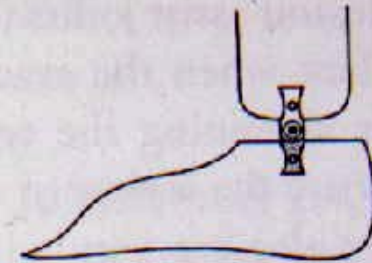
Hinged Plastic Ankle Joints



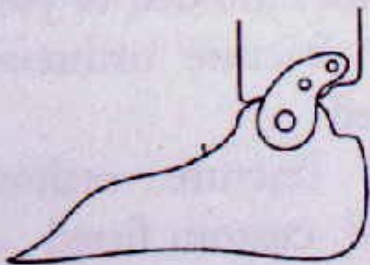
Overlap



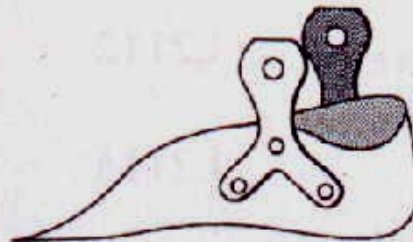
Gillette



Gaffney



Oklahoma



Insert Stirrup



Plantar Flexion Stop

Hinged Plastic AFO with pre-flexed Tamarack joint



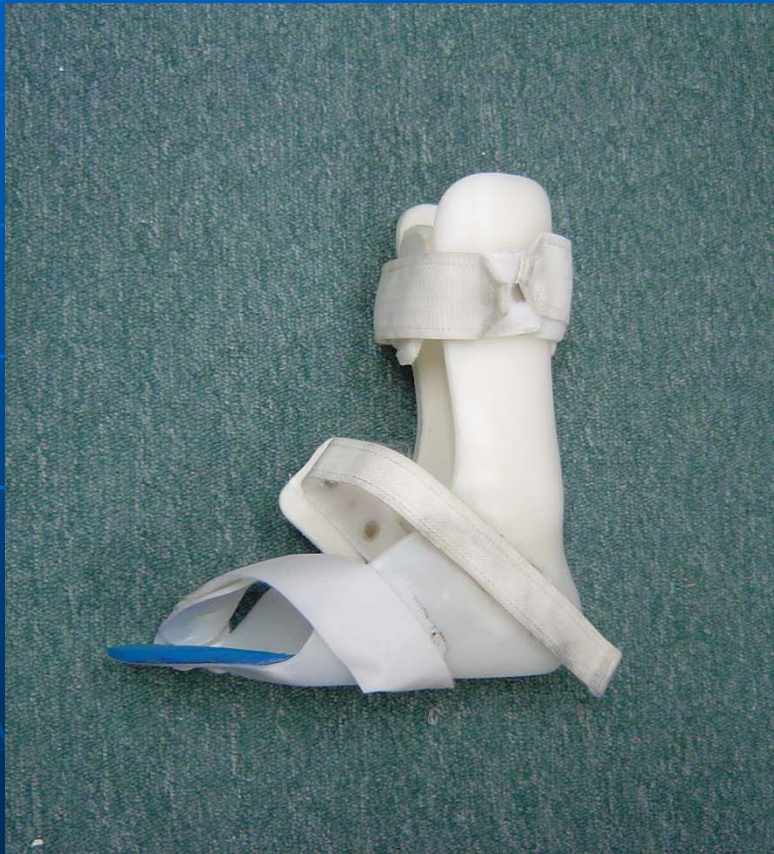
Hinged Plastic AFO with Oklahoma joint



Hinged Plastic AFO with metal joint



SMO Supra-Malleolar Orthosis



Hinged plastic AFO with insert



Carbon AFO



Custom Carbon AFO



Hinged Carbon AFO (Richie Brace)



Hybrid carbon and plastic AFO with dual channel joint



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

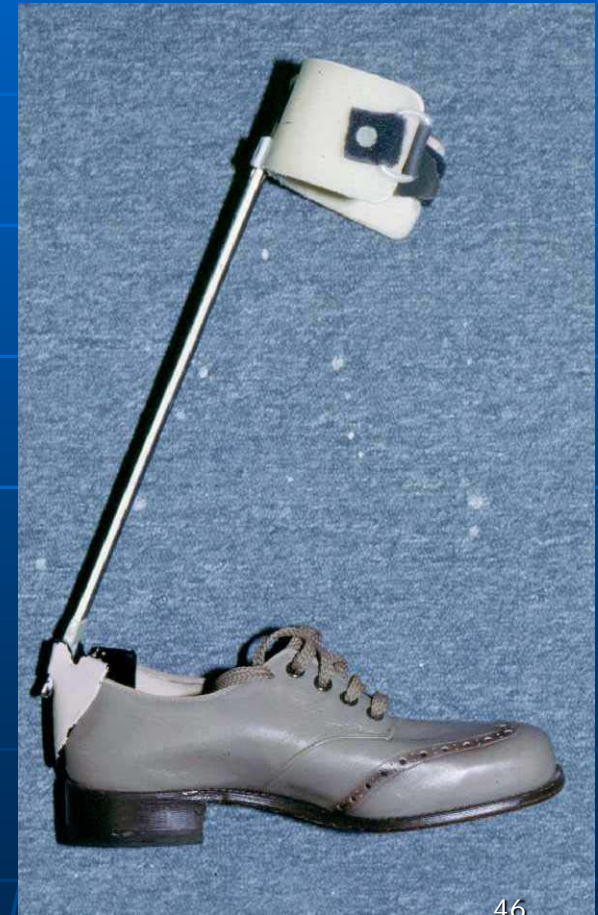
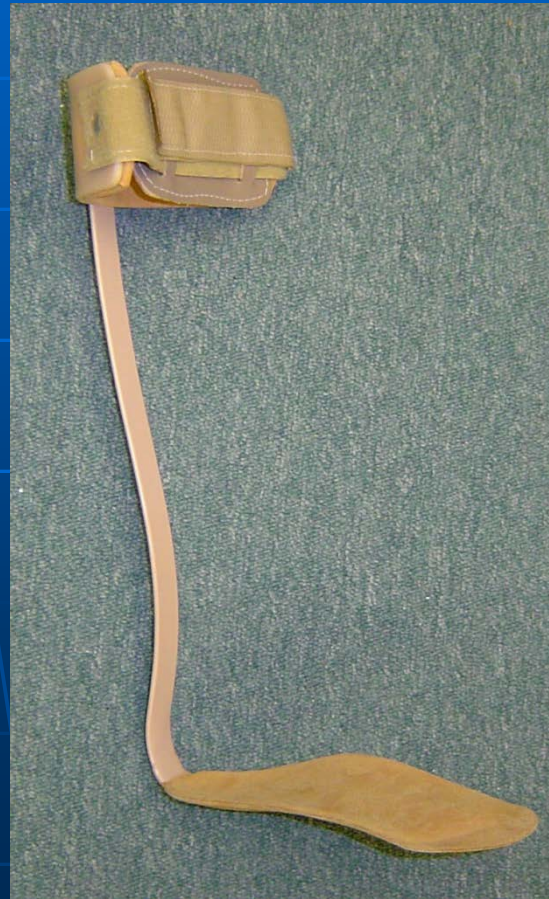


PTB orthosis

Calf-corset design



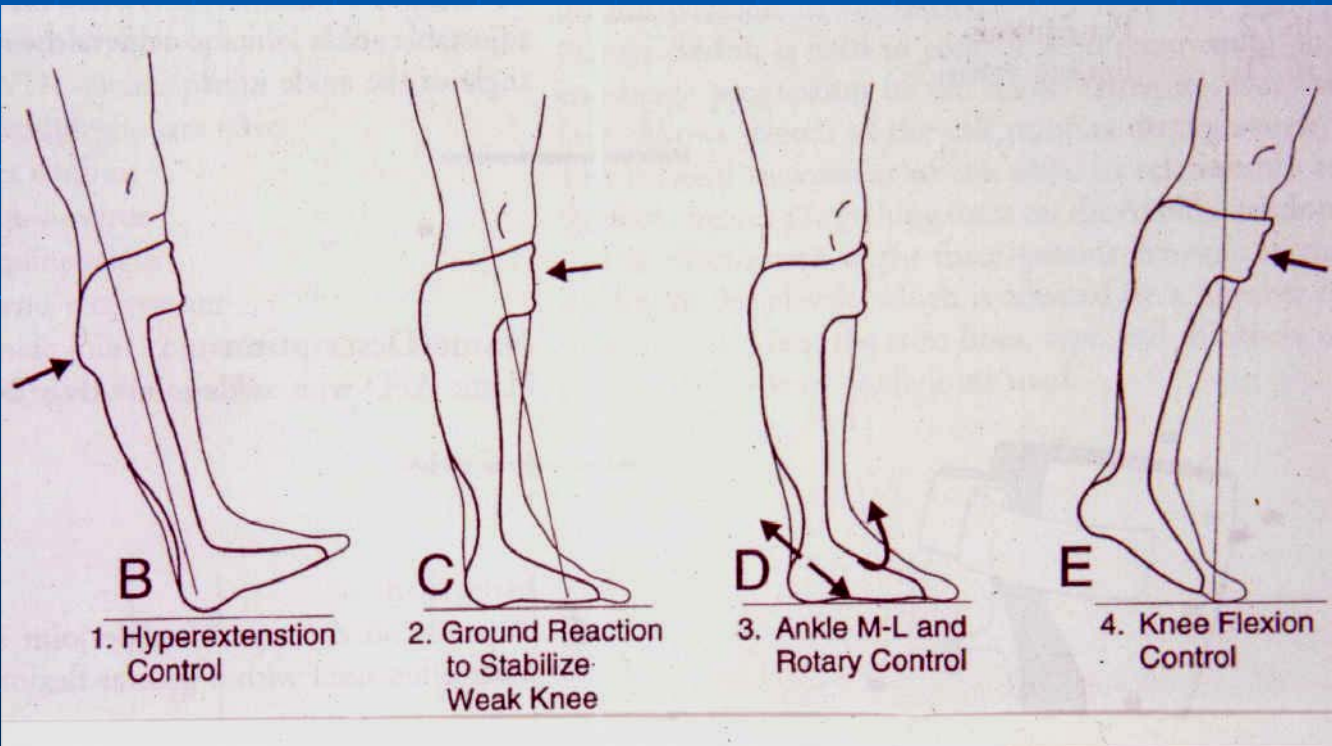
Hybrid AFO Designs



Springwire orthosis



Ground Reaction Orthosis



Time for a
new
shoe?



AFO cases

Peroneal Nerve Injury

Findings - Flaccid footdrop

Dorsiflexor and everter weakness

Mild sensory loss dorsum of foot

Normal tone; no edema

Orthosis - Plastic "PLS" design AFO

$\frac{3}{4}$ footplate, 5° DF

Plastic
AFO
PLS design



Flaccid Footdrop



Footdrop with AFO



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

$\frac{3}{4}$ 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 3° DF with vigorous stretch

Orthosis - Plastic AFO, ant. malleolar trim

Full footplate, tone-reducing design

3° DF, add ankle strap

Plastic AFO
anterior trim
lines 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 3° DF

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

Alternate – Consider metal AFO for
progressive type

AFO options



MS with footdrop and stiff knee



KAFO

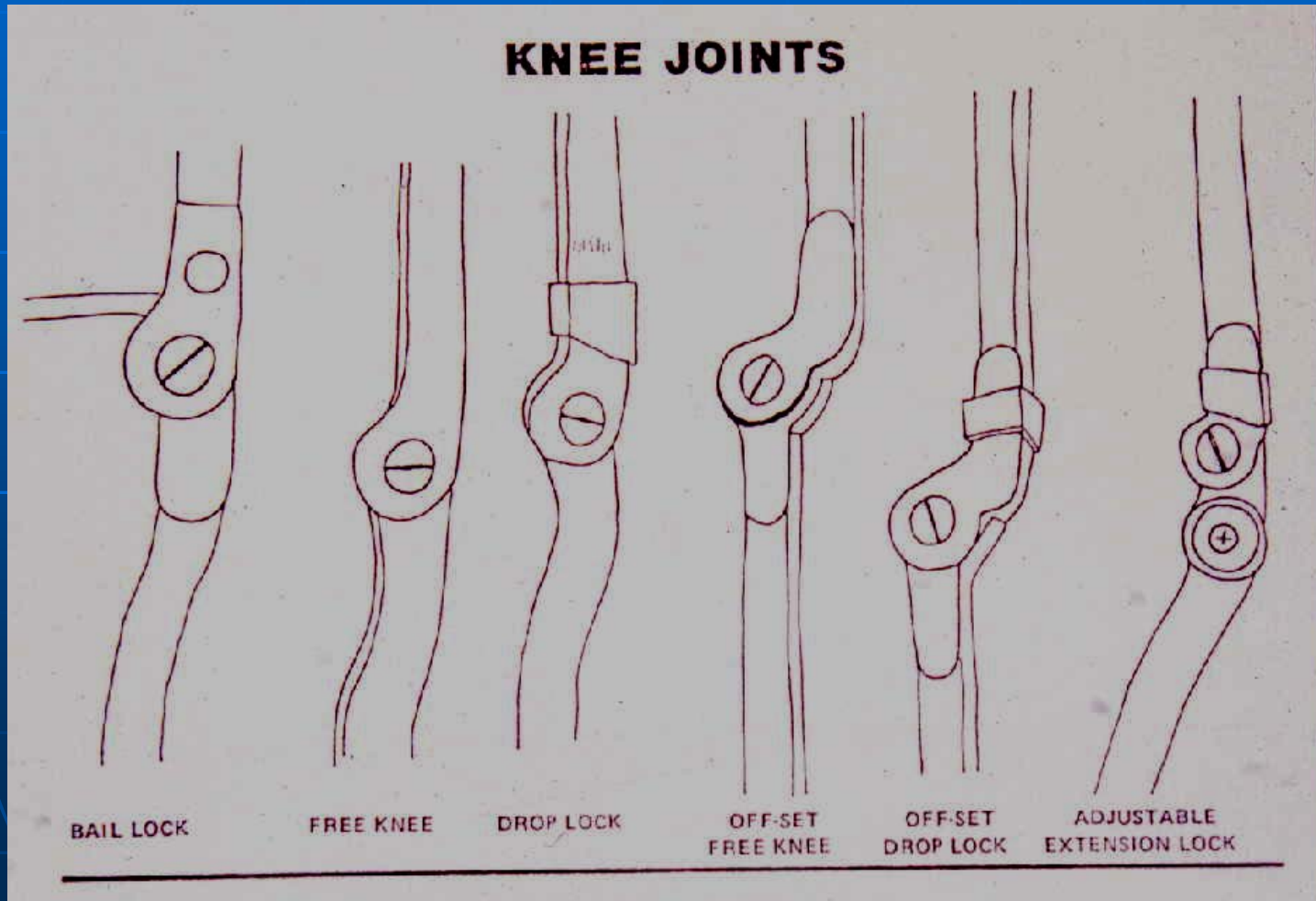
Knee-Ankle-Foot-Orthosis

- 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



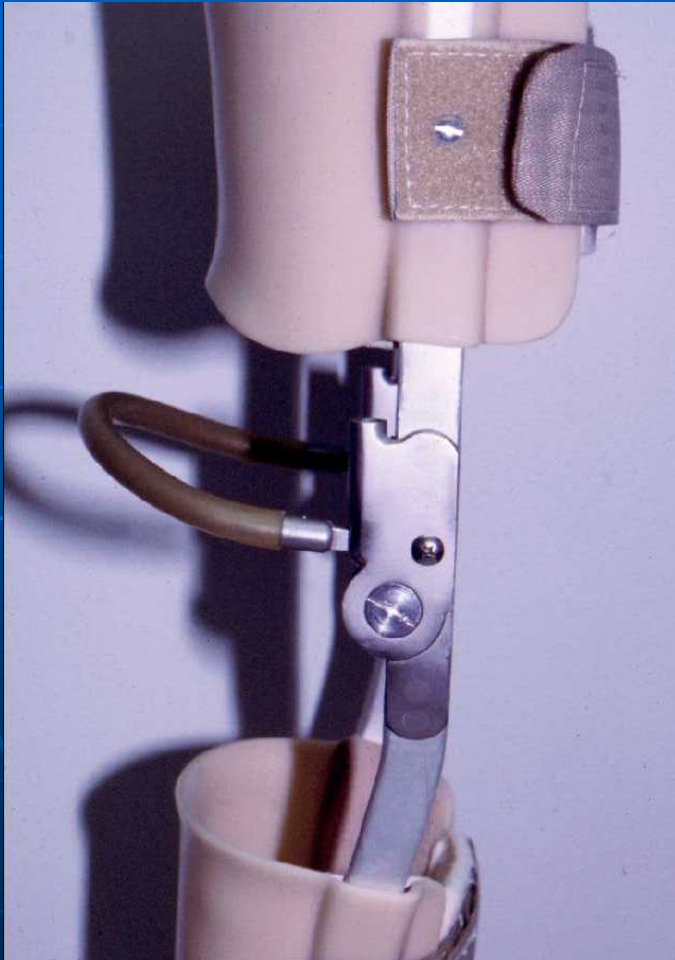
Drop lock



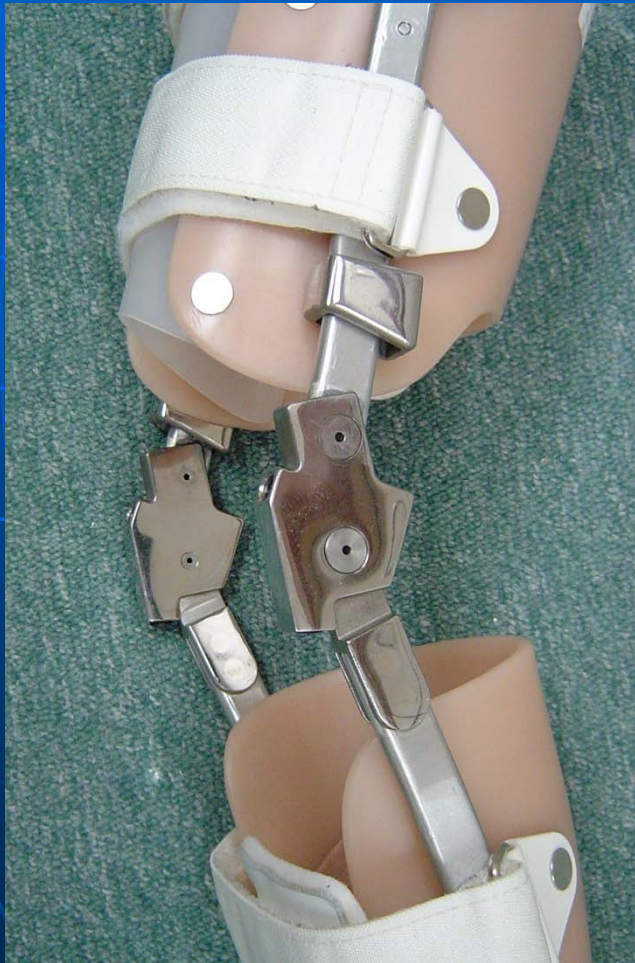
Offset with lock



Bail Lock and Trigger Lock



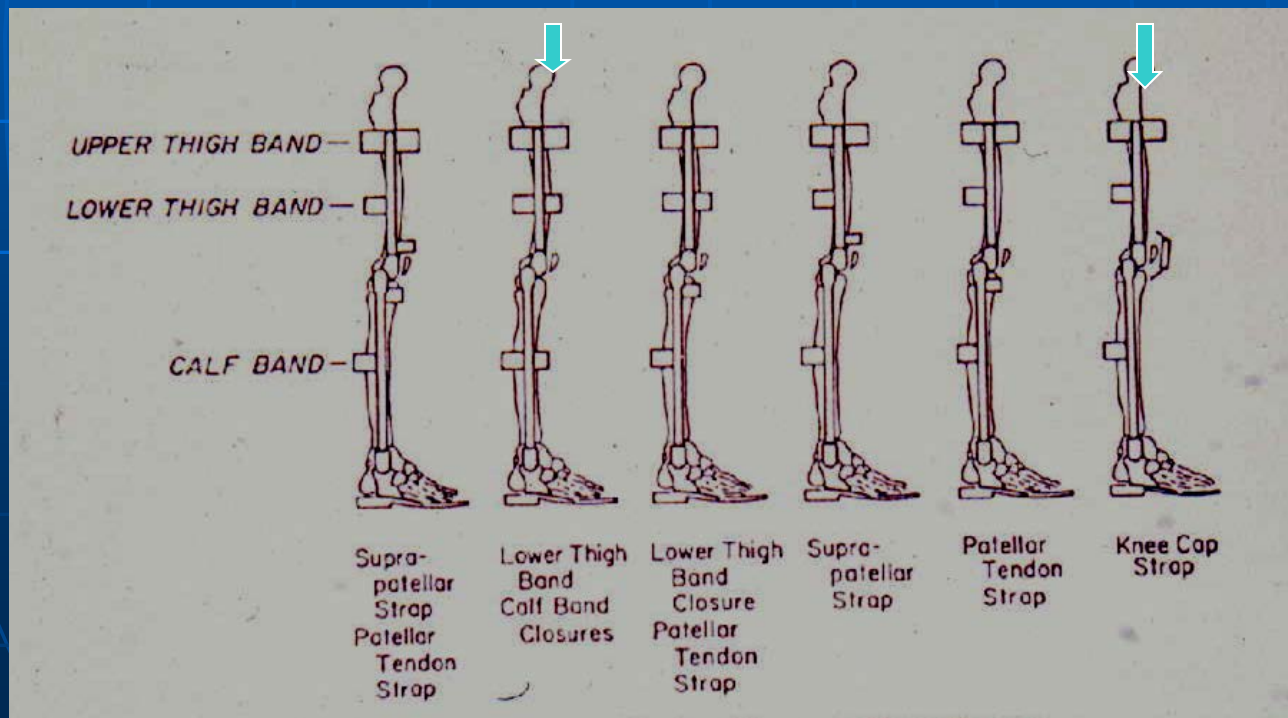
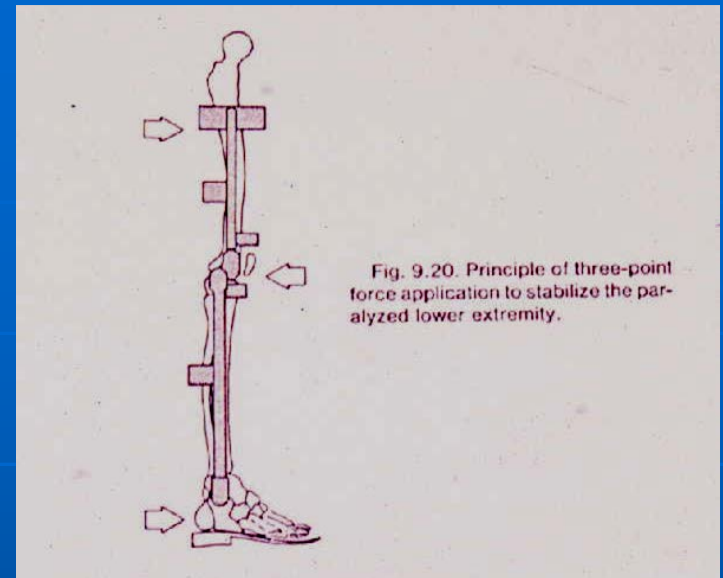
Trick Knee



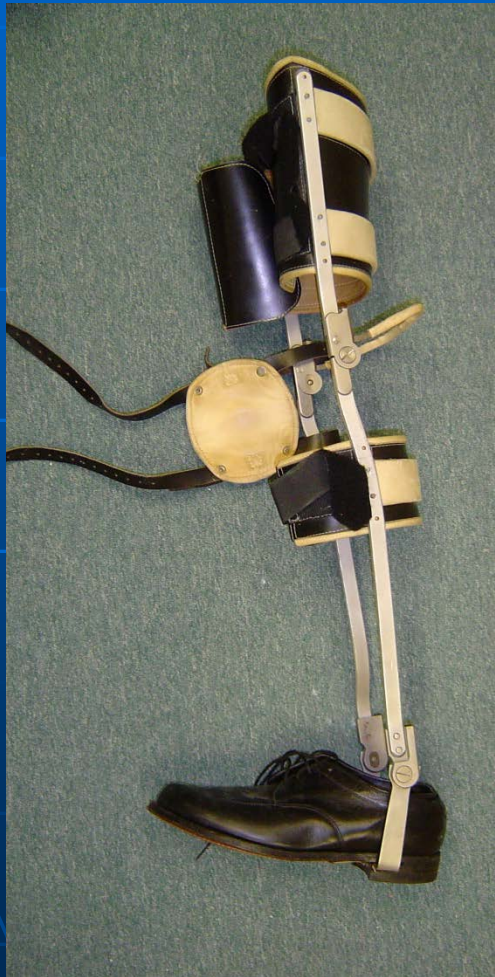
Ratchet joint



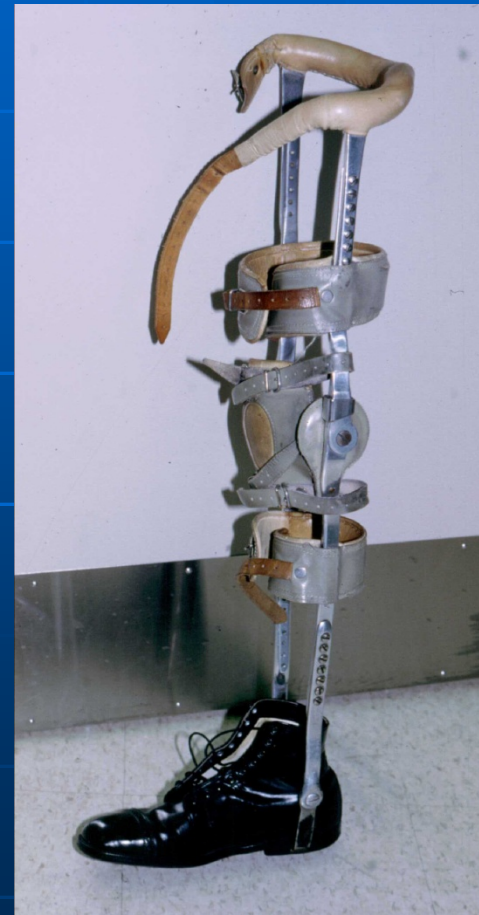
Metal KAFO Designs



Metal KAFOs



Metal KAFOs



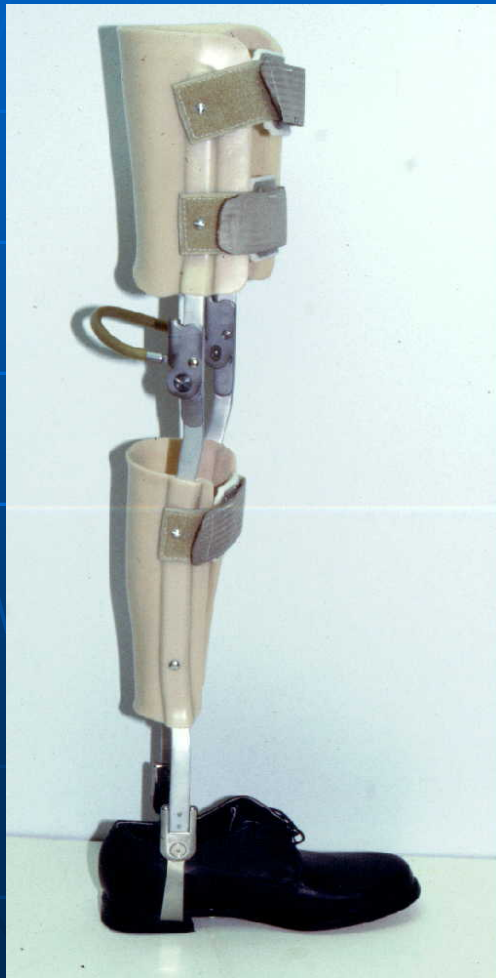
KAFO in disguise?



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

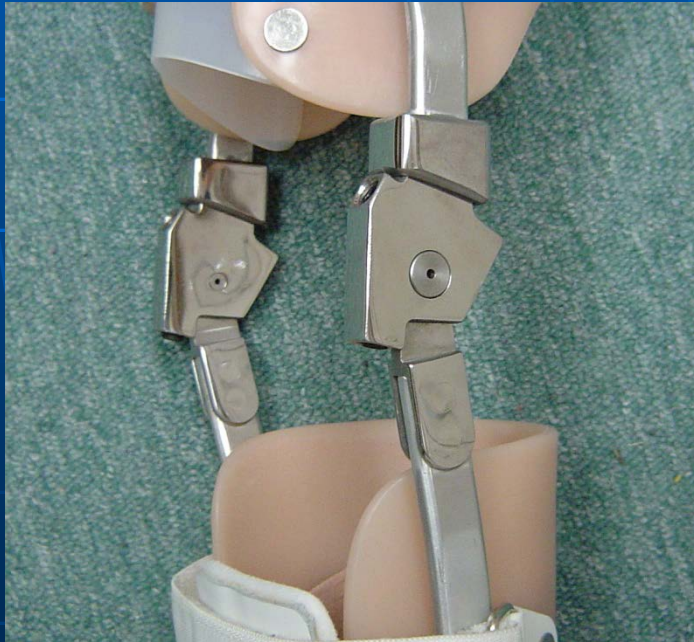
No edema

Ankle ROM to 3° DF

Orthosis - Plastic KAFO with "Trick Knee"
joint

JBM trim, 3° DF

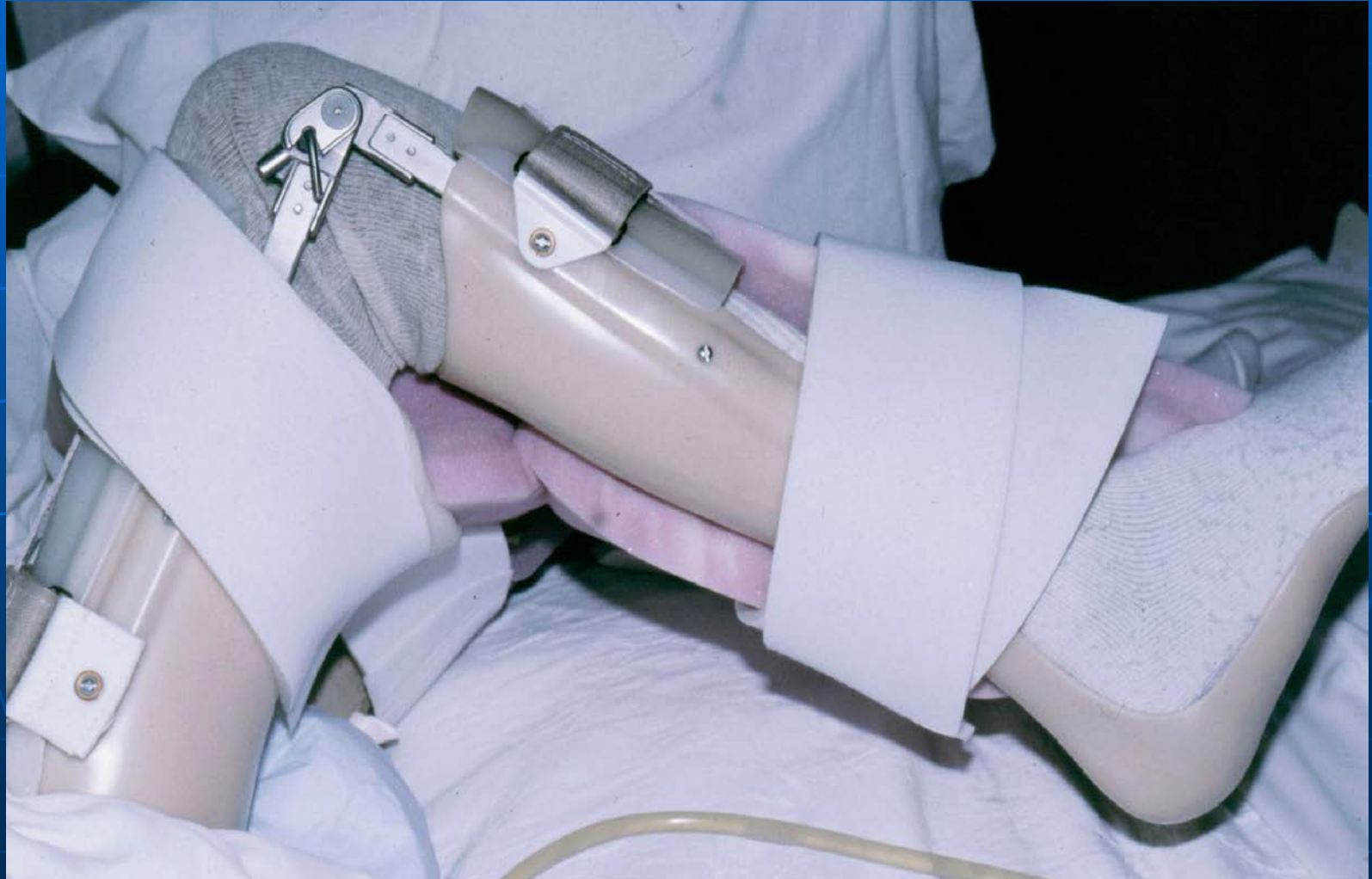
Plastic KAFO with Trick Knee



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

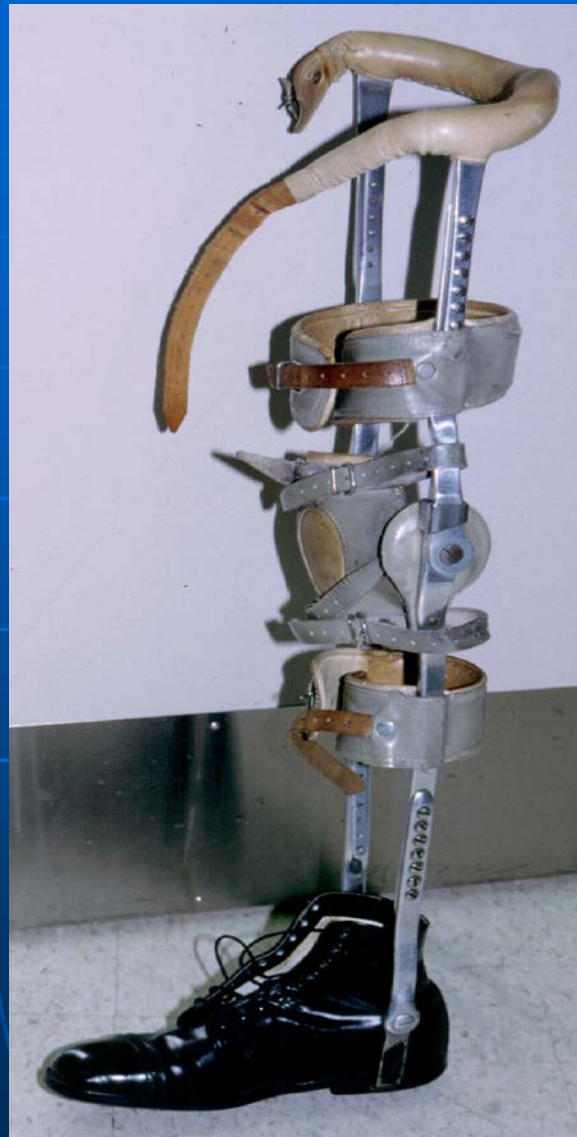
Small foot, shortened limb

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 – T₁₂ Level

Findings - Paralysis both legs

Good trunk and arm control

Sensation absent, Mild edema

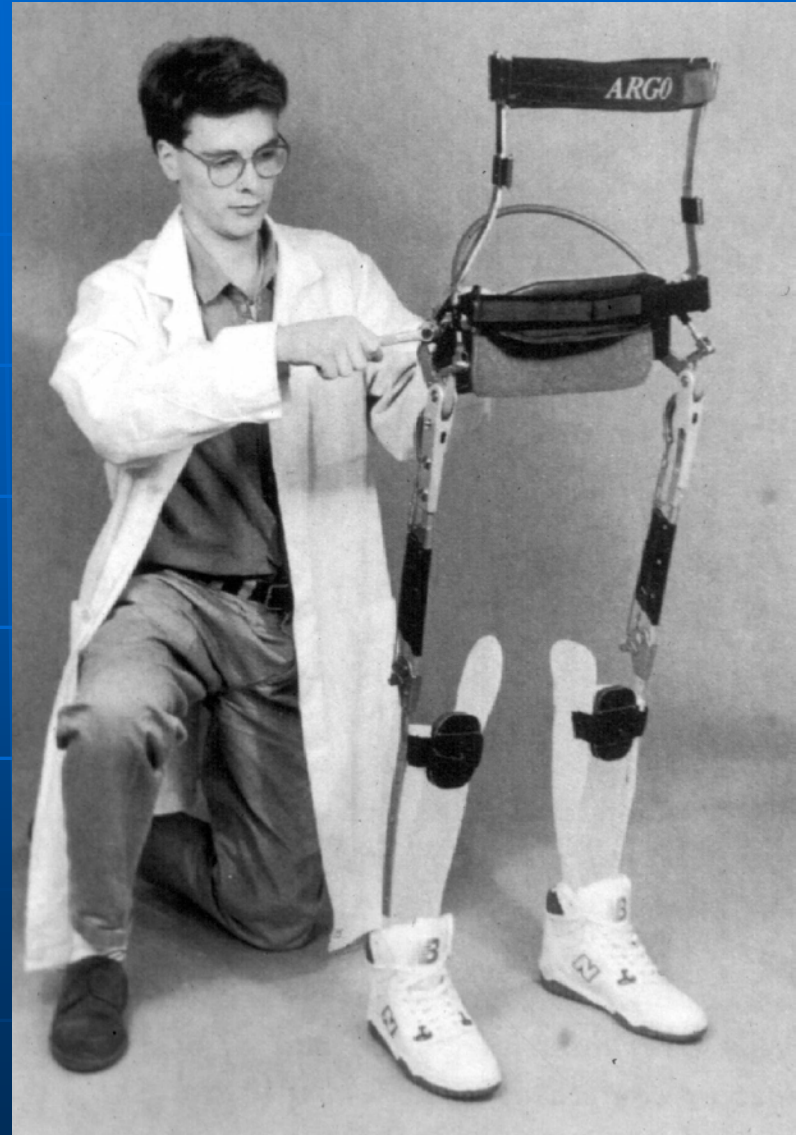
Tone is increased

Orthosis - RGO – reciprocal gait orthosis

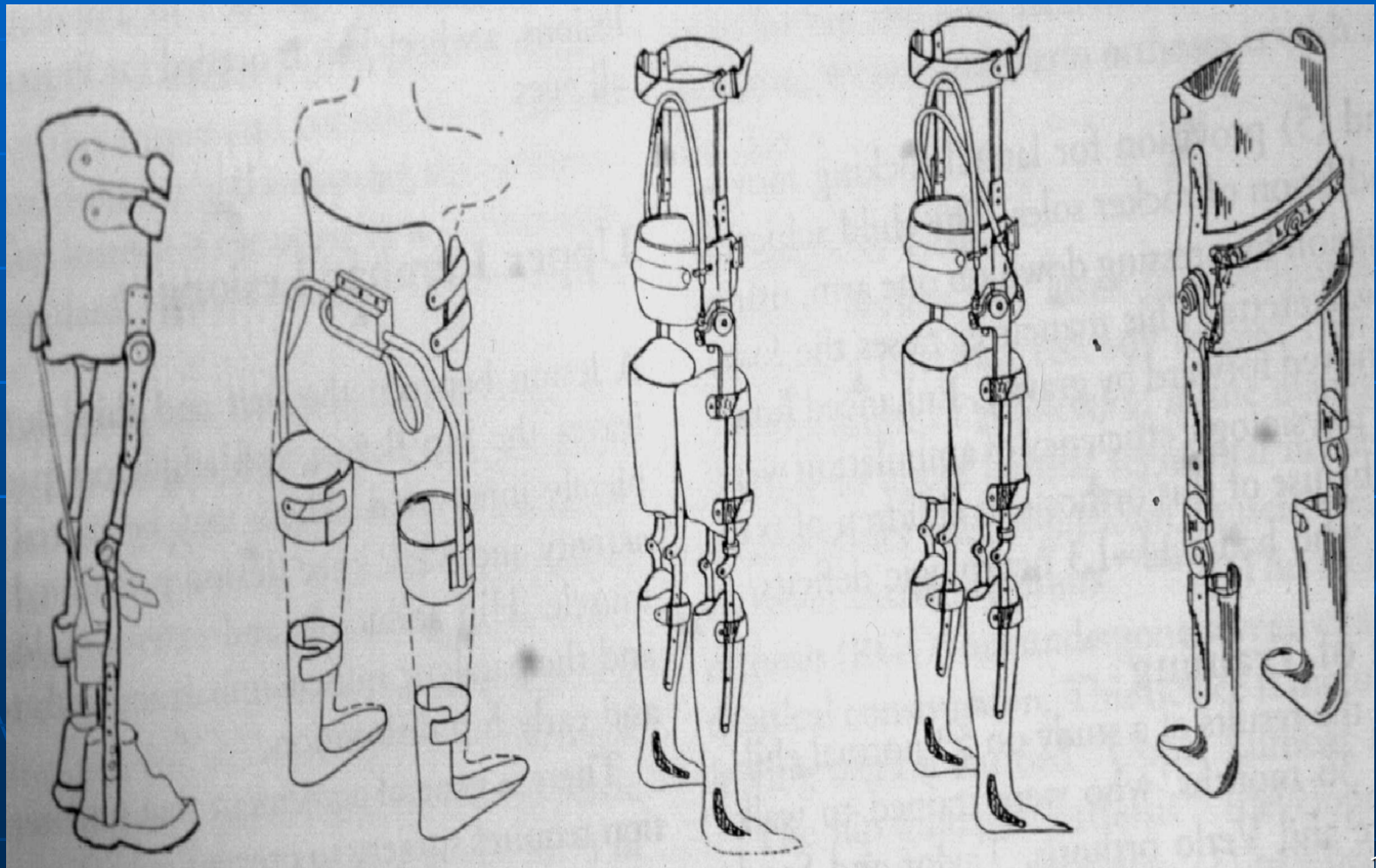
Hybrid metal and plastic design HKAFO's with droplock knee joints and plastic AFO at neutral

Alternate - Craig-Scott metal KAFO's with droplock knee joints and dual channel ankle joints

RGO reciprocal gait orthosis



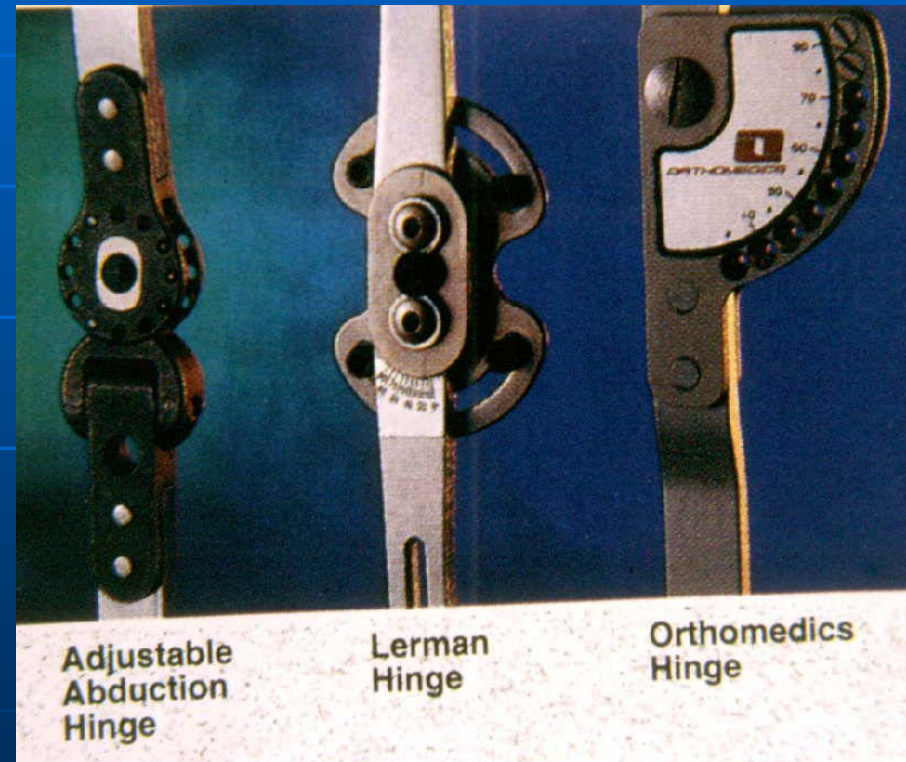
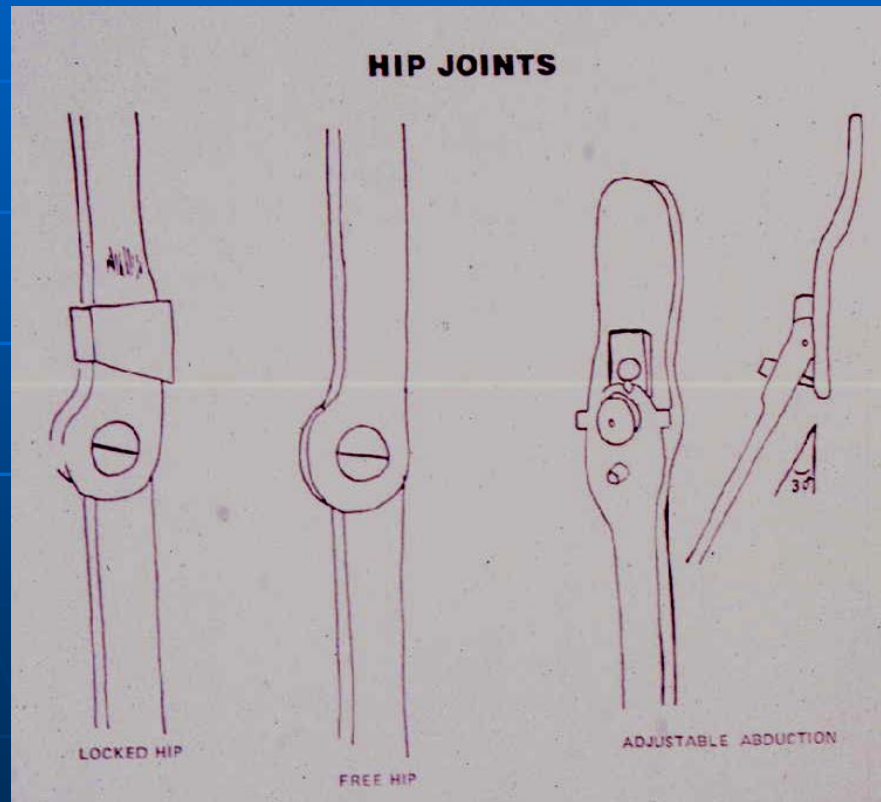
RGO design options



SCI spastic paraparesis



Hip Joints



Hip Abduction Orthosis (prevention of hip dislocation)



Thank You