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:___
Rachet 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

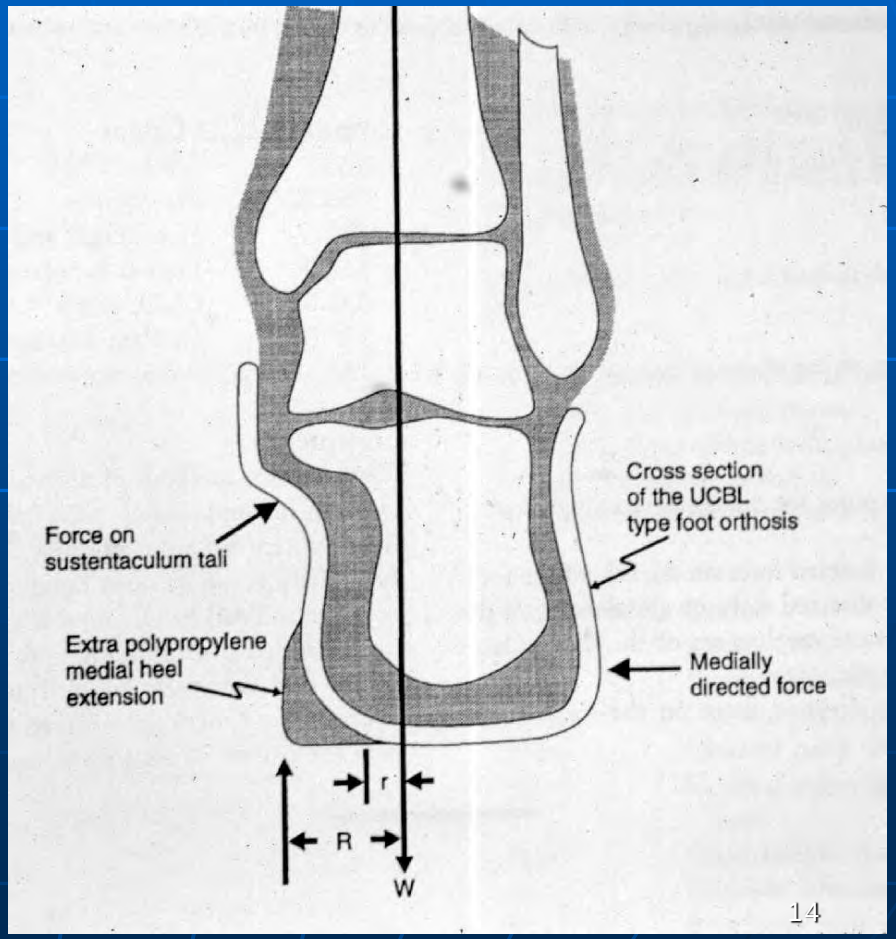
Edema: None
Controlled
Not Controlled
⊕ DVT

Bad Foot

Avoidable Complications

Orthotists Nightmare

UCBL Custom Foot Orthotic



AFO
Ankle Foot Orthosis

- Metal
- Plastic
- Carbon
- Hybrid

Components of a Metal AFO

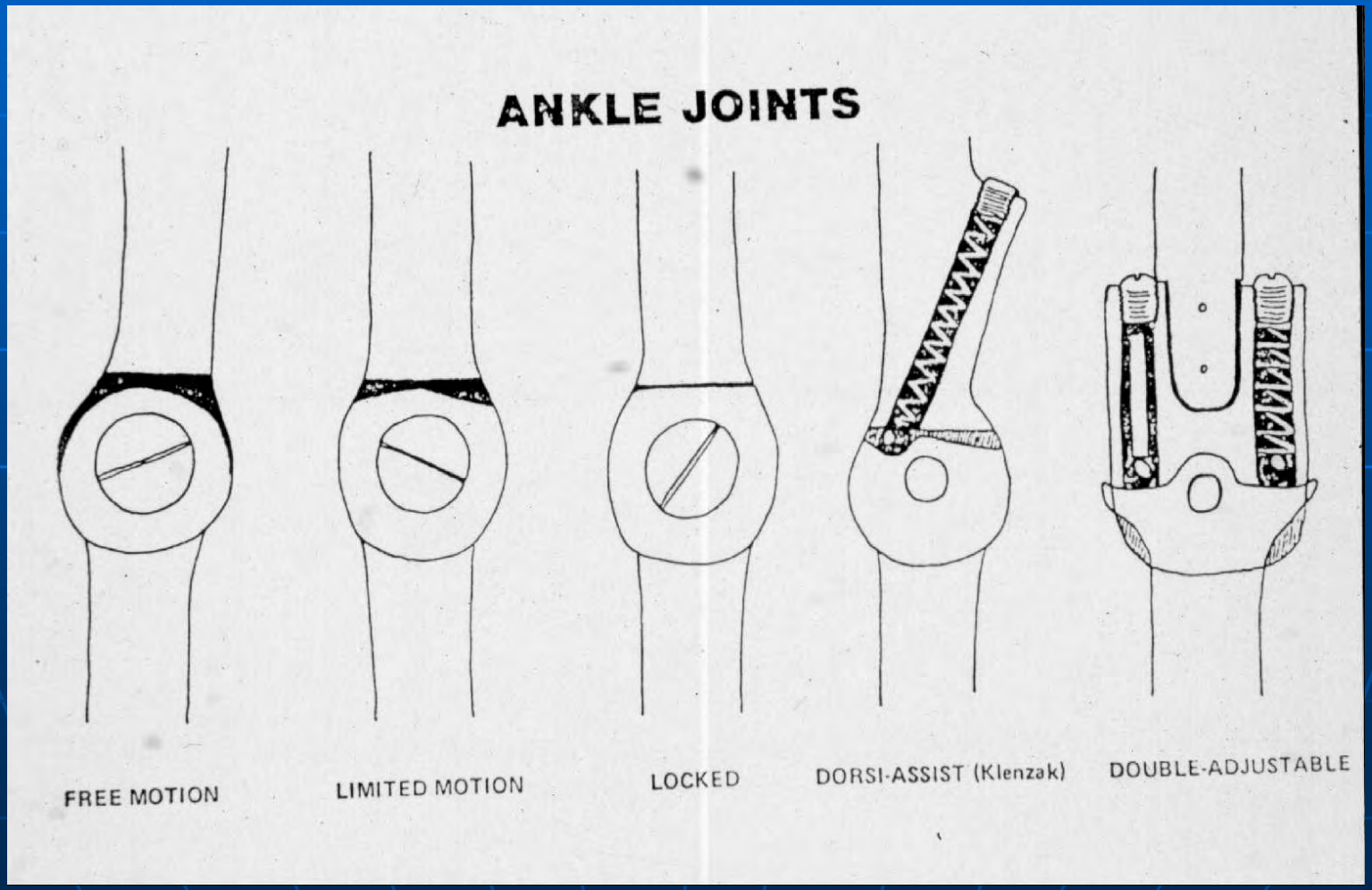
- Calf band
- Uprights
- Ankle joints
- Stirrup (solid or split with caliper box)
- Additional shank if needed
- T-strap if needed
- Shoe (preferably leather sole)

Components of a Metal AFO (common examples)

Components of a Metal AFO

Stirrup Attachment to Shoe (solid or split stirrup)

Metal Ankle Joints

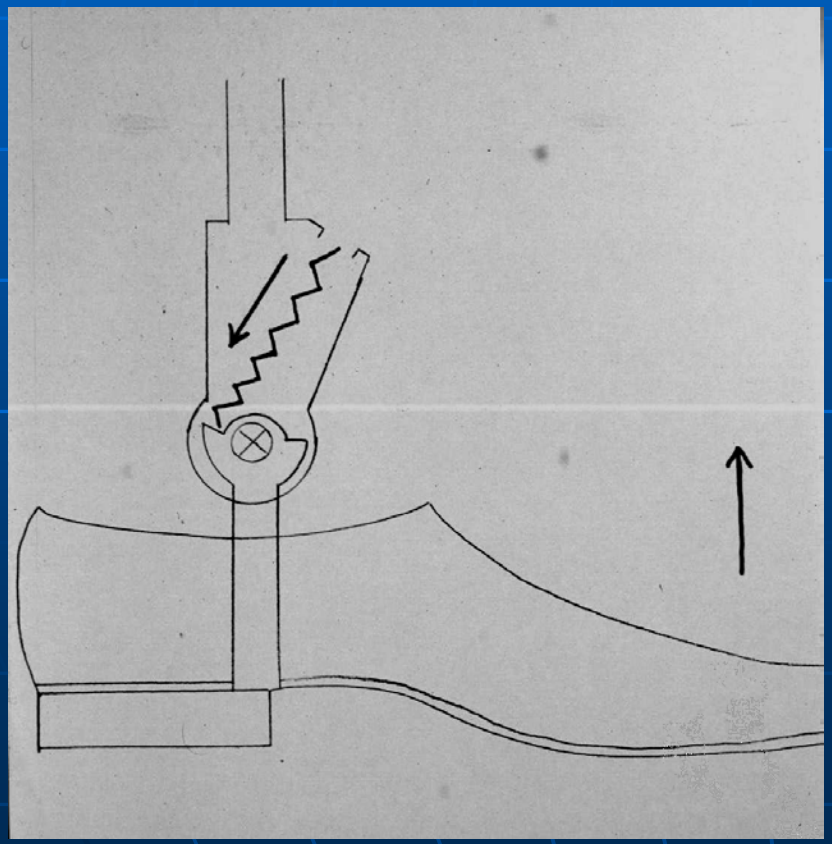


Single Channel Ankle Joint (common names)

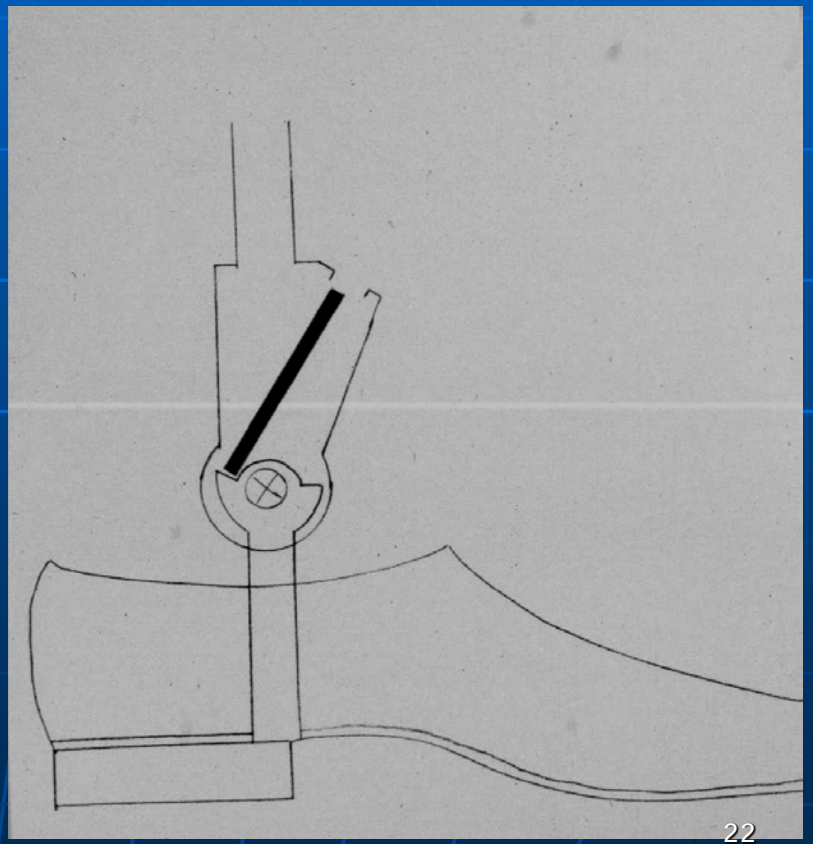
- Single Channel
- Posterior Channel
- Klenzak
- Dorsi-assist
- Single Adjustable

Single Channel Ankle Joint

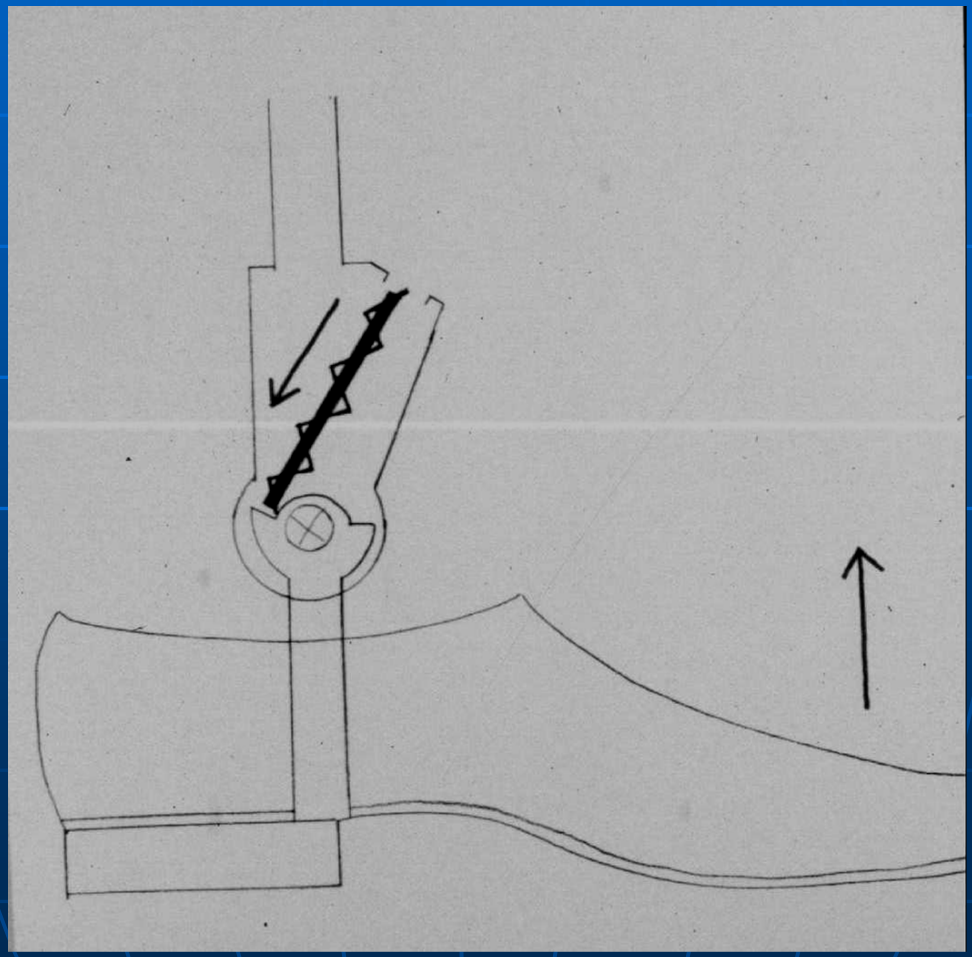
DF assist



PF stop



Single Channel Ankle Joint
(DF assist and PF stop)

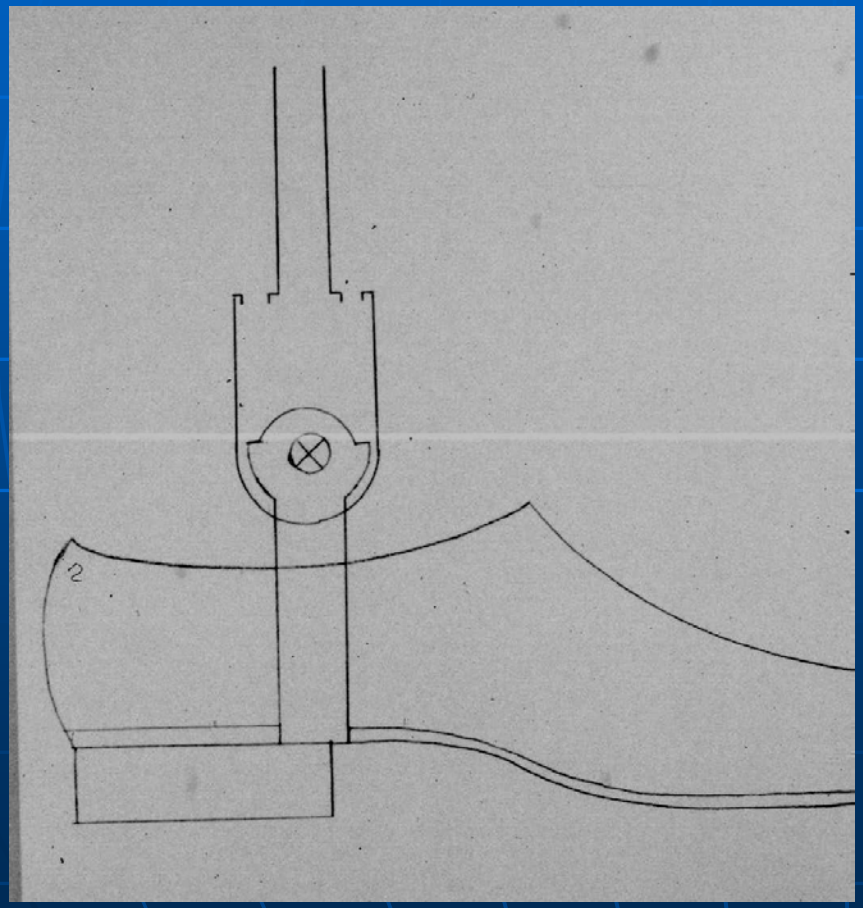


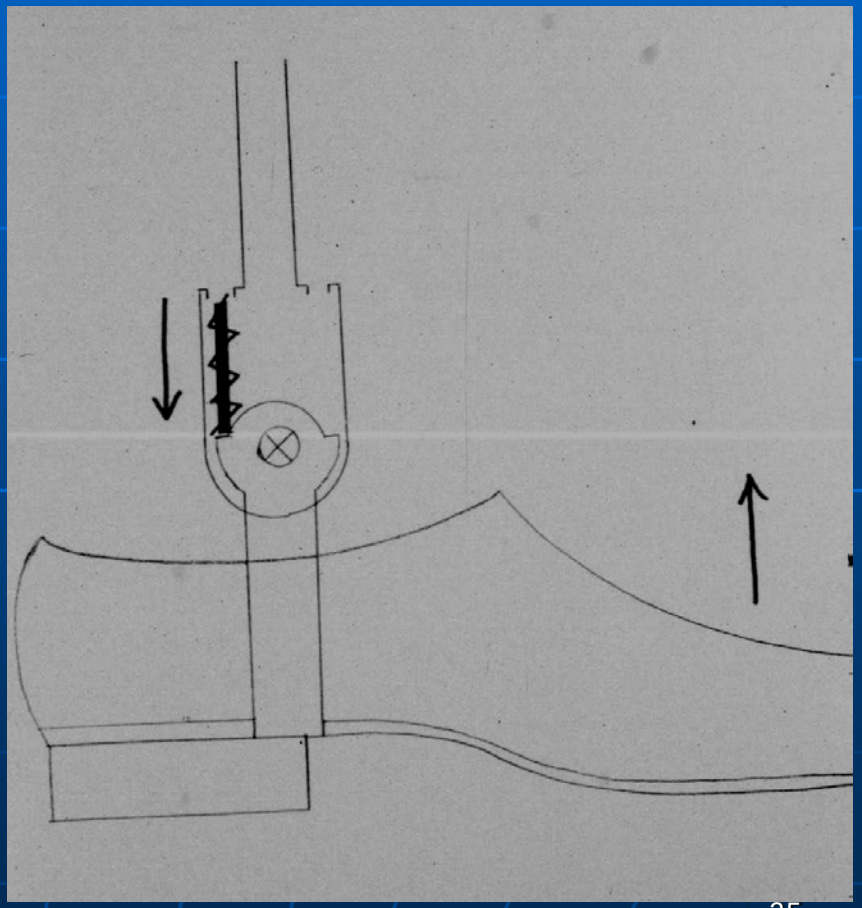
Dual Channel Ankle Joint (common names)

- Dual channel
- Bi-cal
- Double adjustable

Dual Channel Ankle Joint

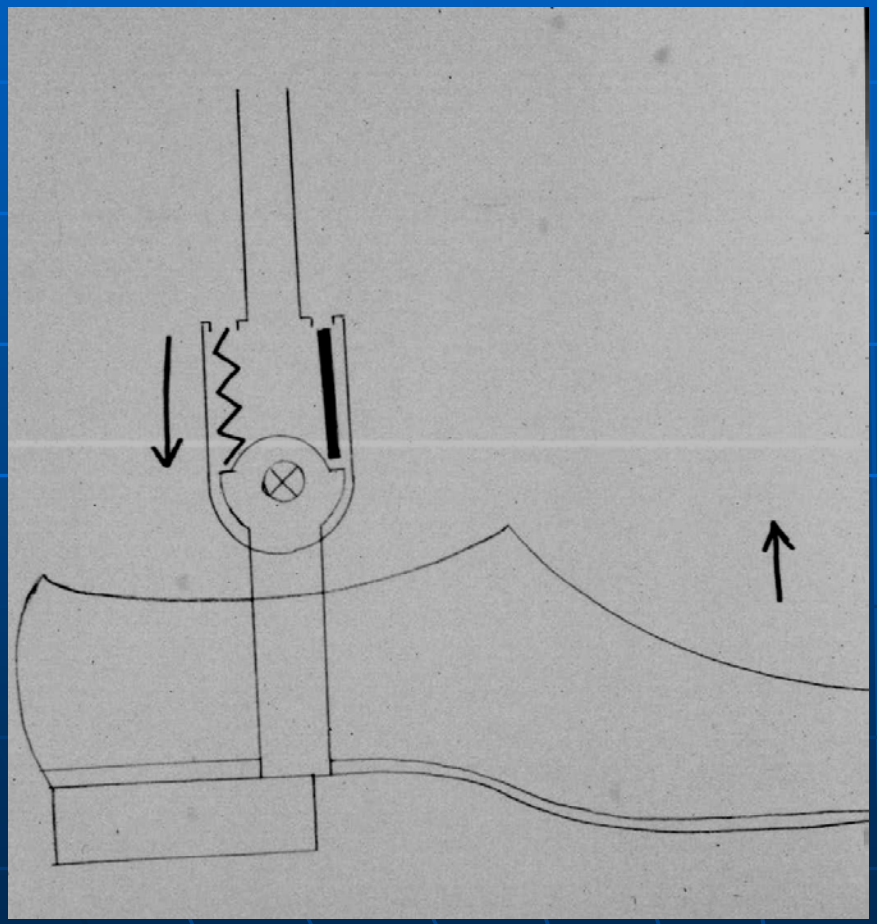
DF assist and PF stop



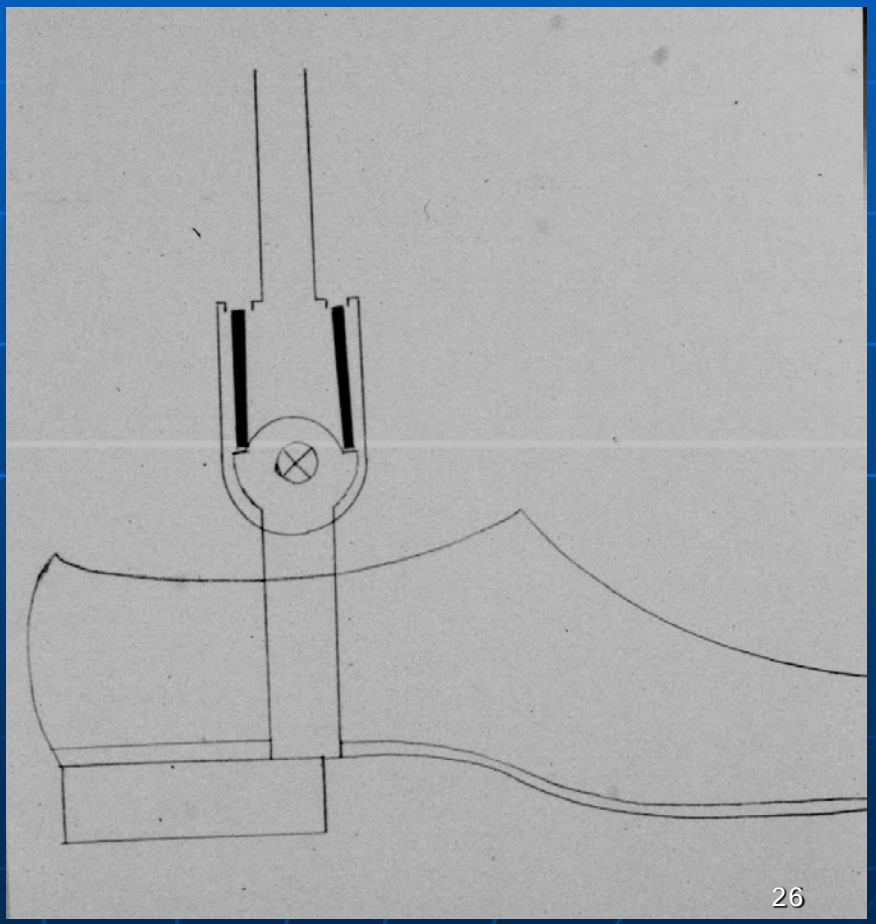


Dual Channel Ankle Joint

DF assist/stop



DF/PF stop



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

Plastic AFO Trimlines

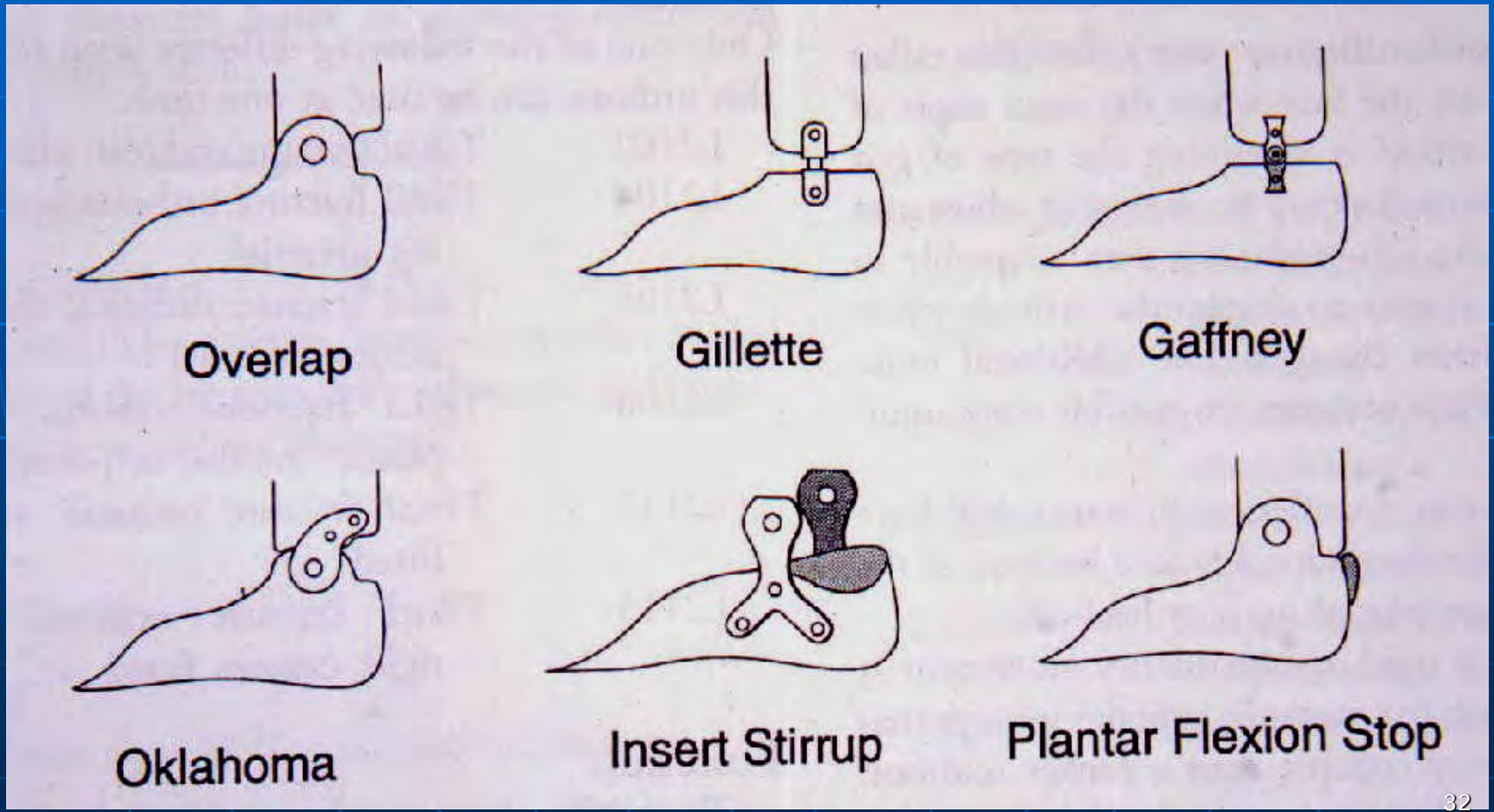
- PLS (posterior leaf spring)
- JBM (just behind malleolus)
- Mid-malleolar
- Anterior malleolar
- Bi-valve shell

Plastic AFO Trimlines

Plastic AFO with Anterior Trim

Plastic AFO with 3 point inversion control

Hinged Plastic Ankle Joints

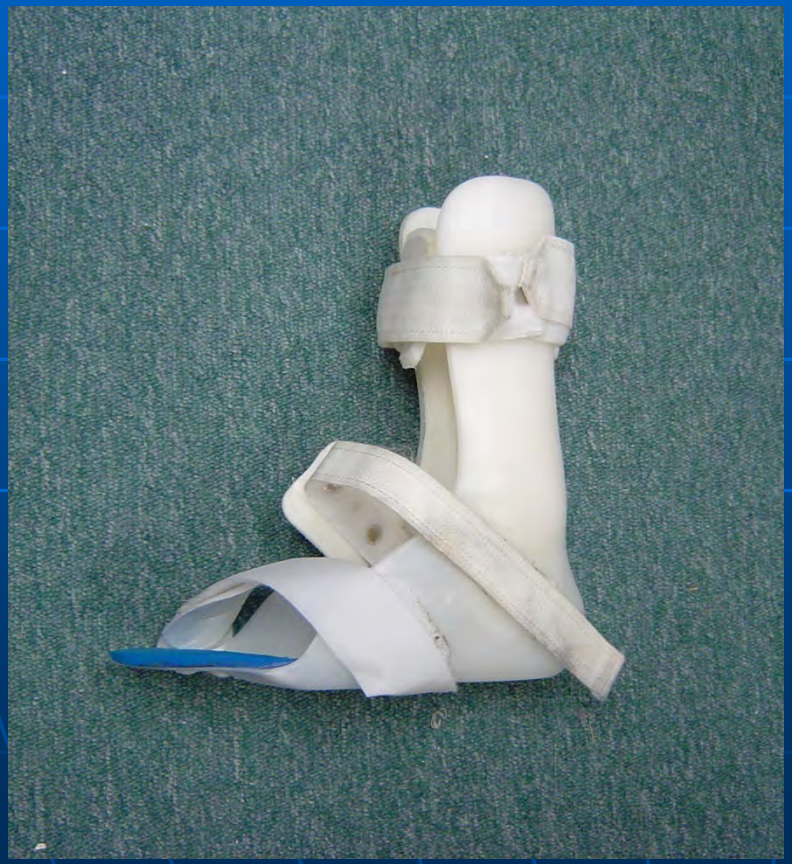


Hinged Plastic AFO with pre-flexed Tamarack joint

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

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)

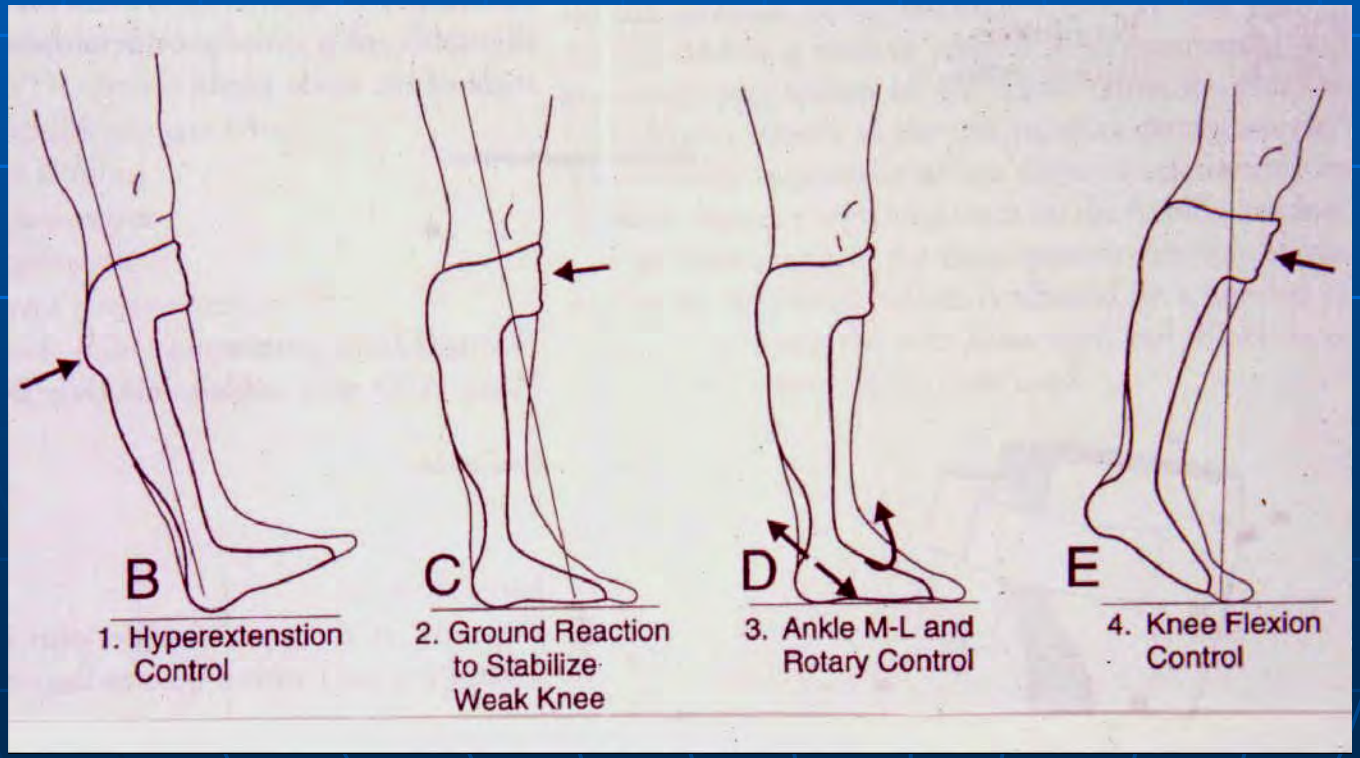
PTB Orthoses

Bi-valve

Calf-corset

PTB orthosis
Calf-corset design

Ground Reaction Orthosis



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
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
¾ footplate, 3-5º 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, 0º 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

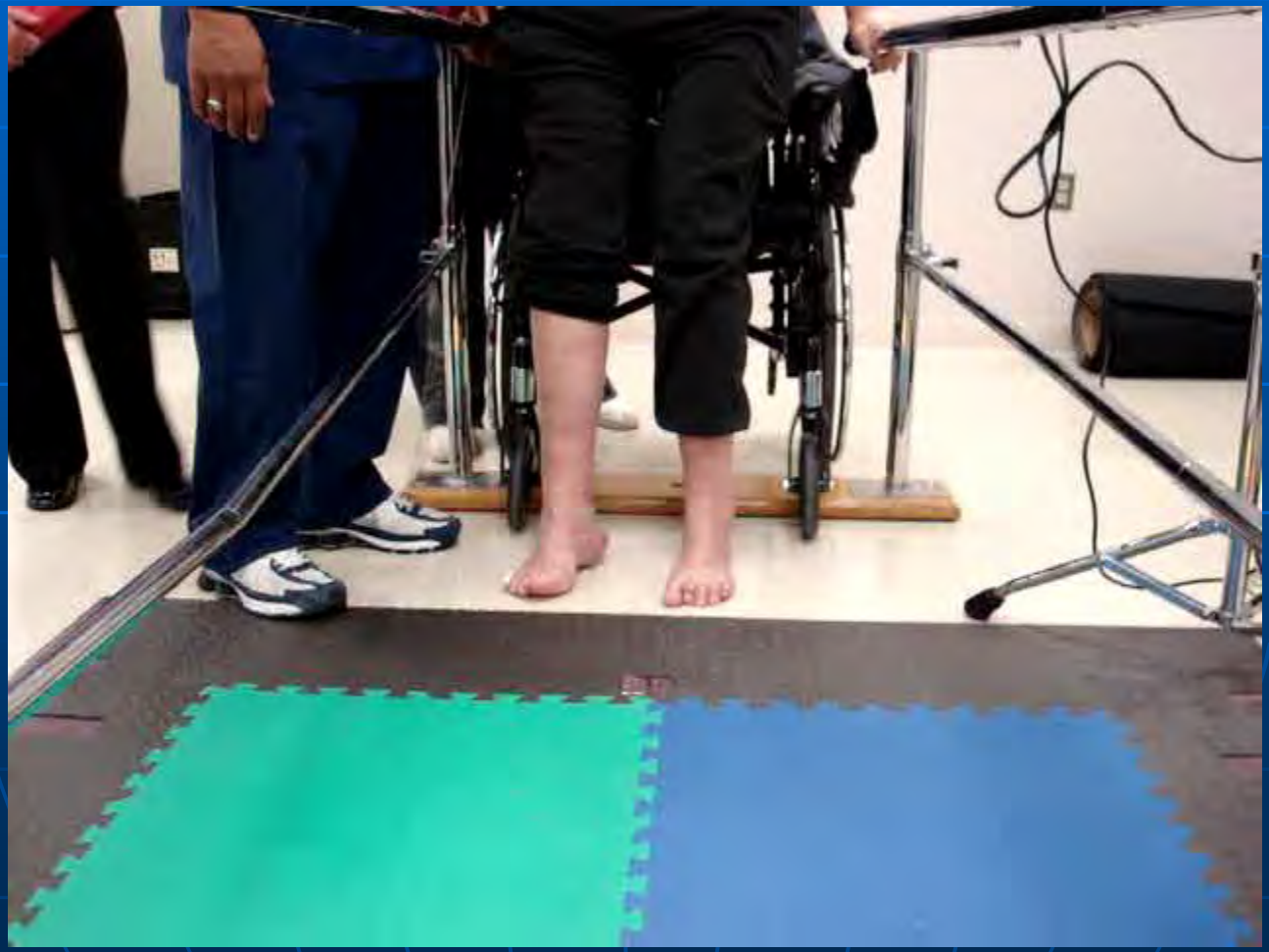
Traumatic Brain Injury

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 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 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

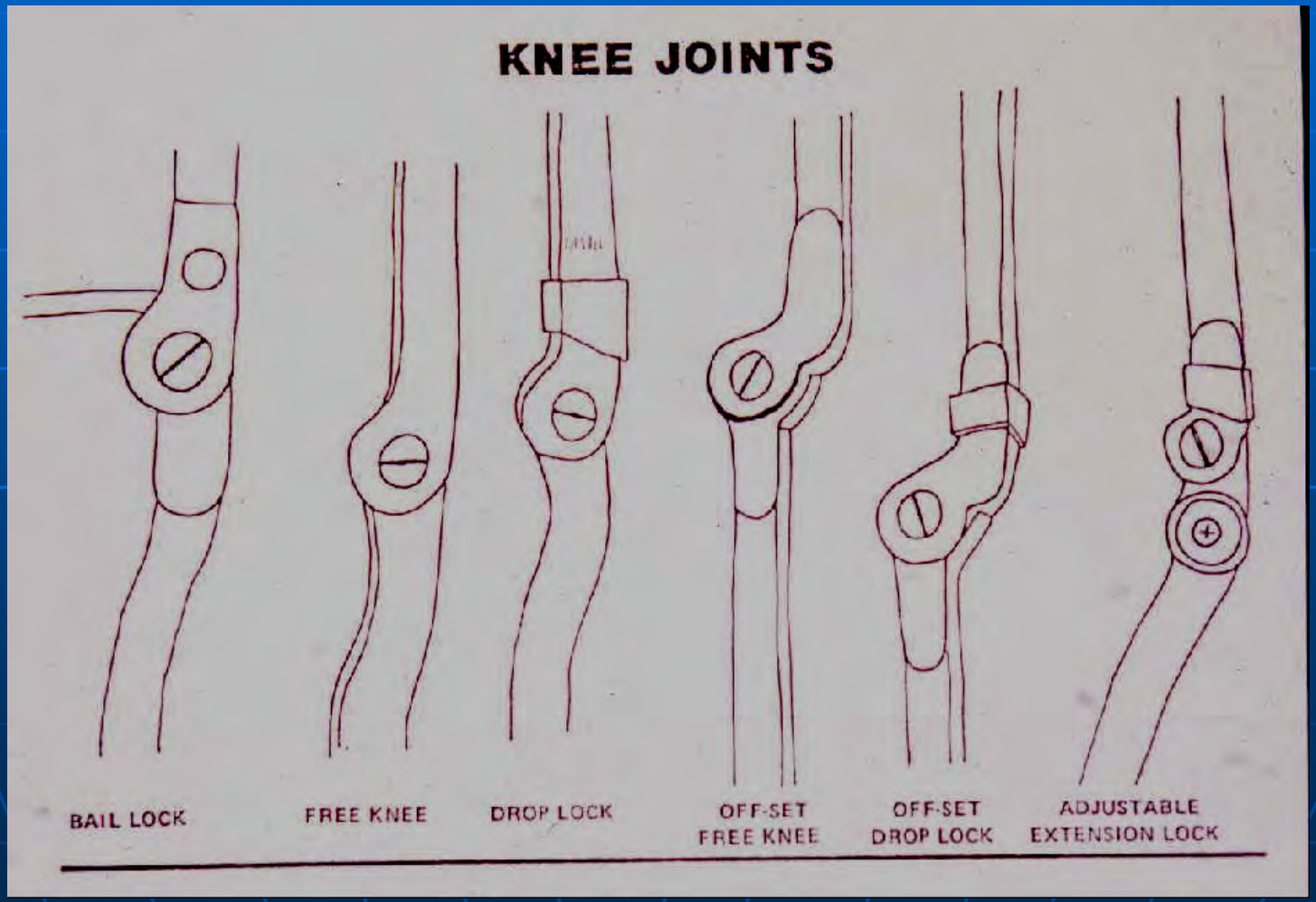
KAFO
Knee-Ankle-Foot-Orthosis

- Metal design
- Plastic design
- Carbon design
- Hybrid designs

Knee Joint Options

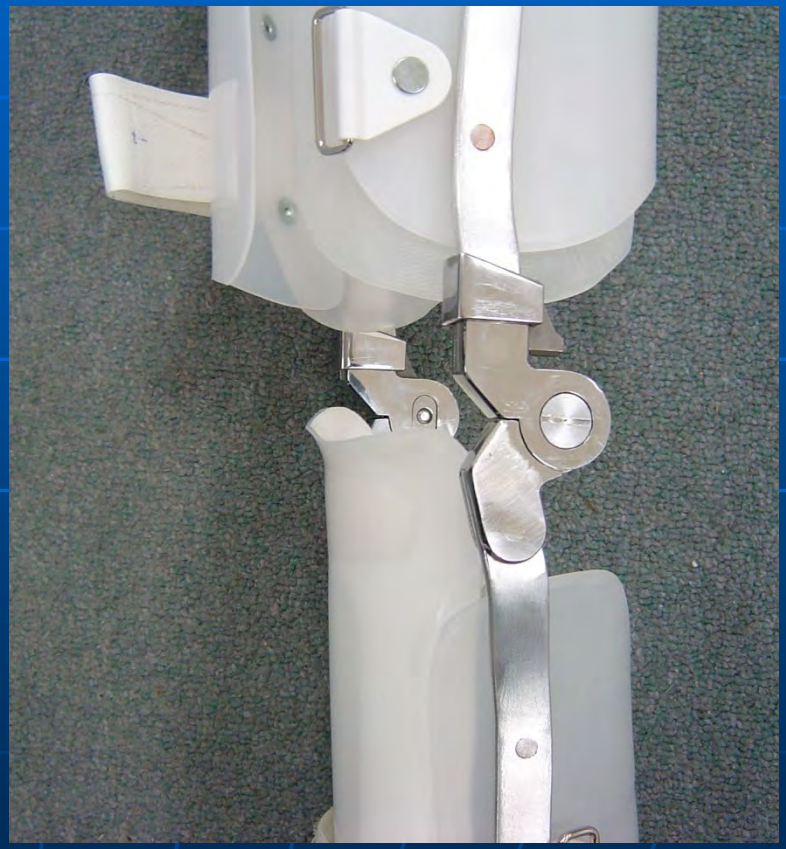
- Free knee
- Drop lock
- Bail lock
- Trigger lock
- Ratchet lock
- Offset
- Trick knee

Knee Joints

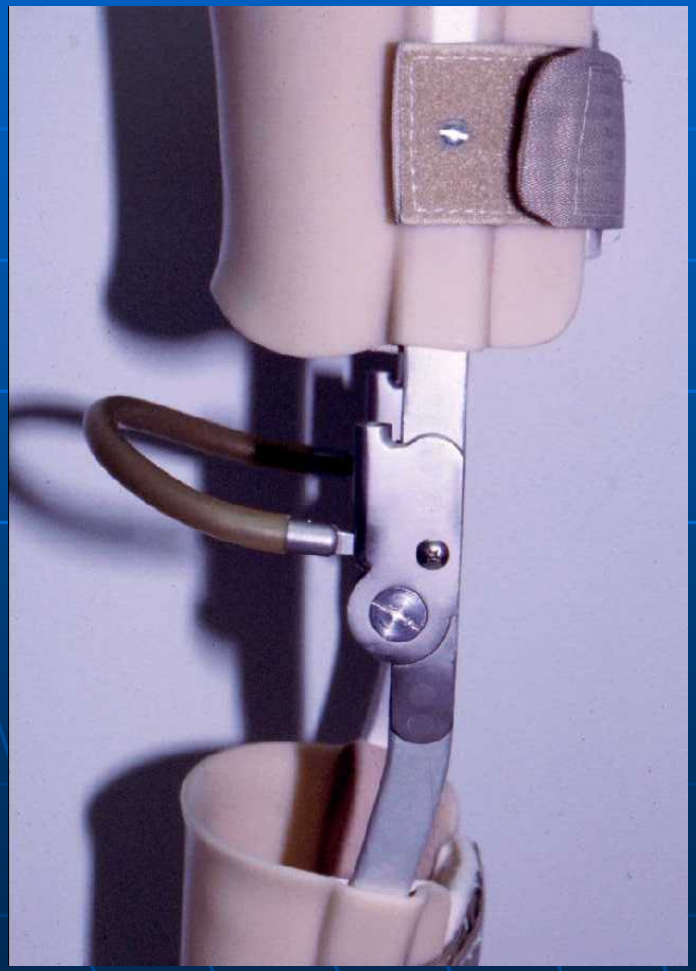

KNEE JOINTS
BAIL LOCK
FREE KNEE
DROP LOCK
OFF-SET FREE KNEE
OFF-SET DROP LOCK
ADJUSTABLE EXTENSION LOCK

Drop lock

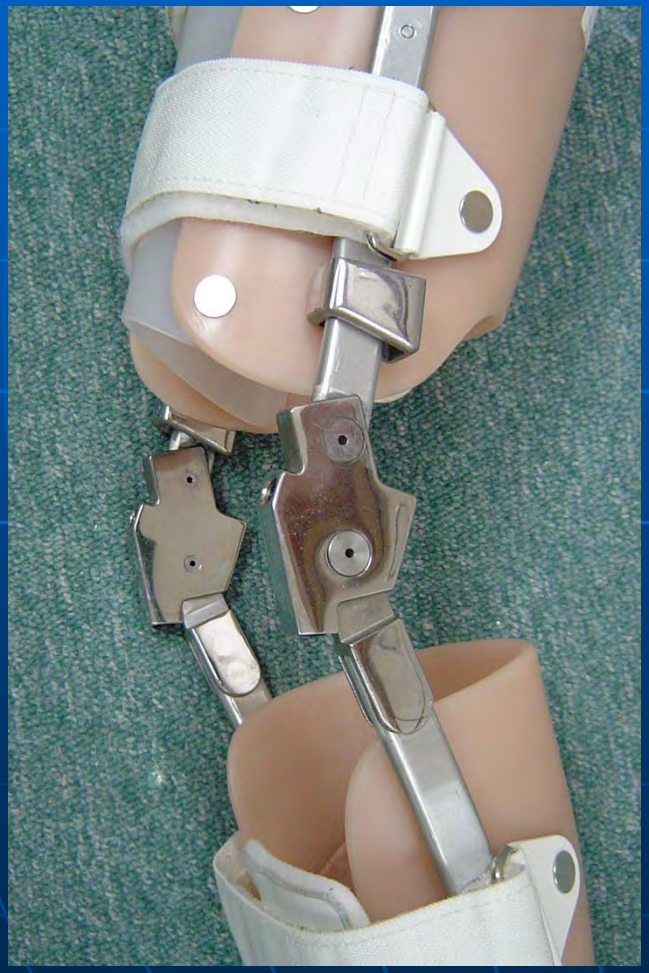
Offset with lock



Bail Lock and Trigger Lock



Trick Knee



Ratchet joint

Metal KAFO Designs

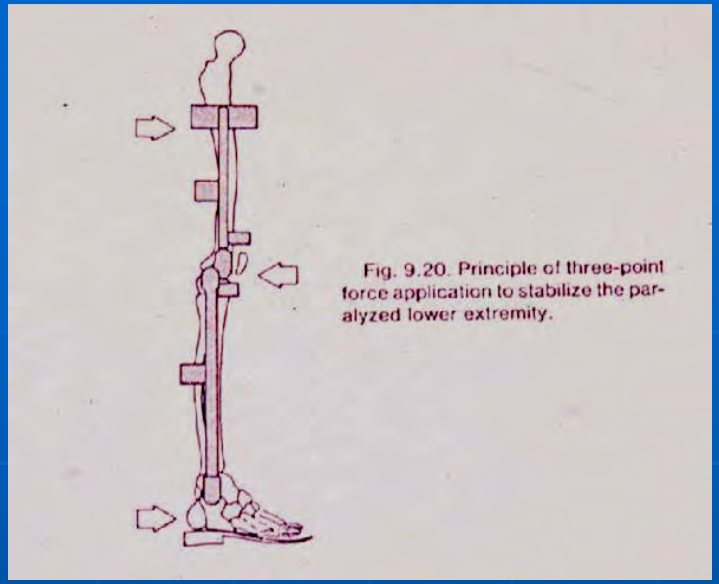
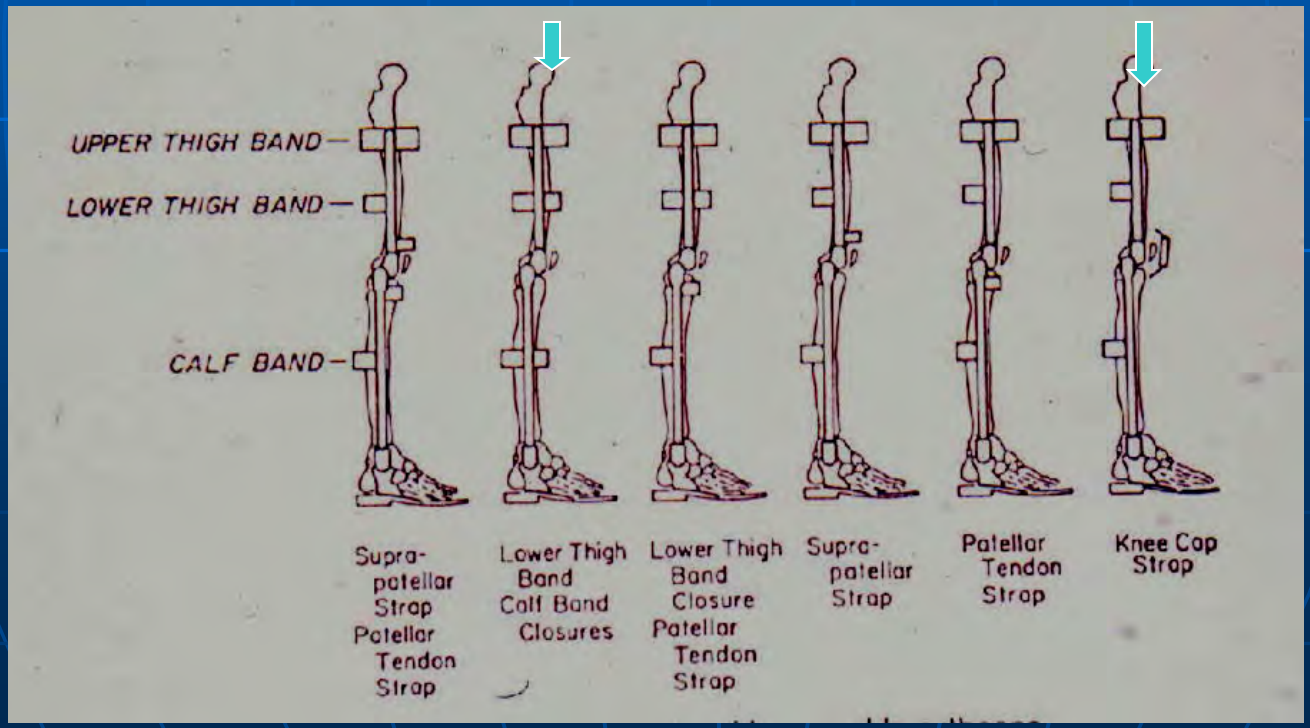
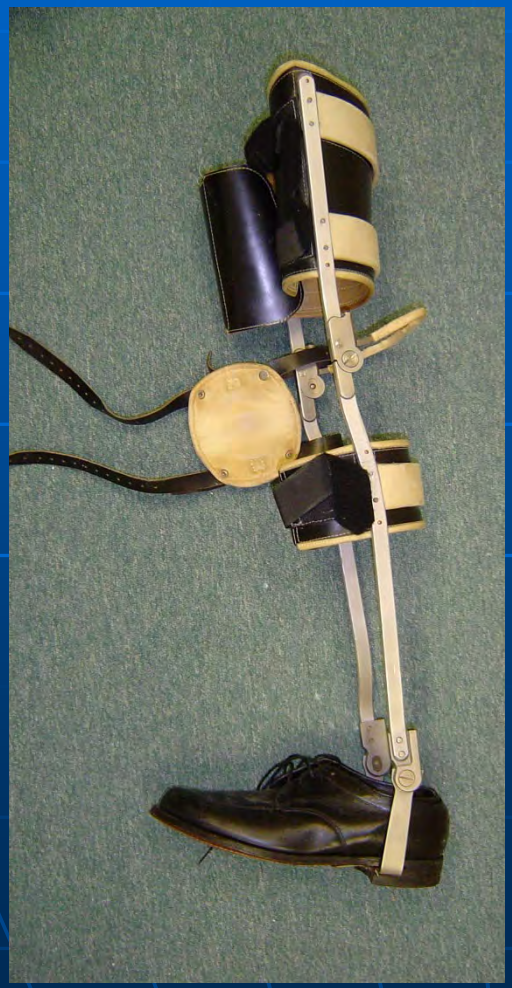


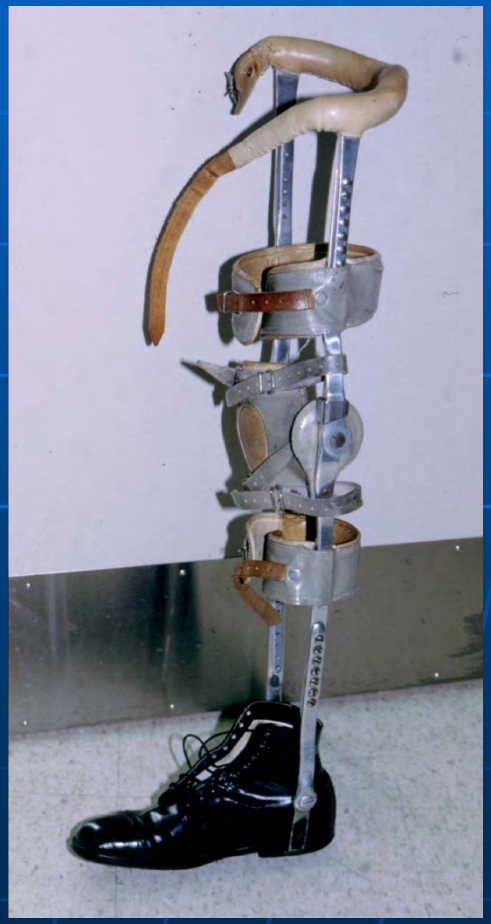
Fig. 9.20. Principle of three-point force application to stabilize the paralyzed lower extremity.



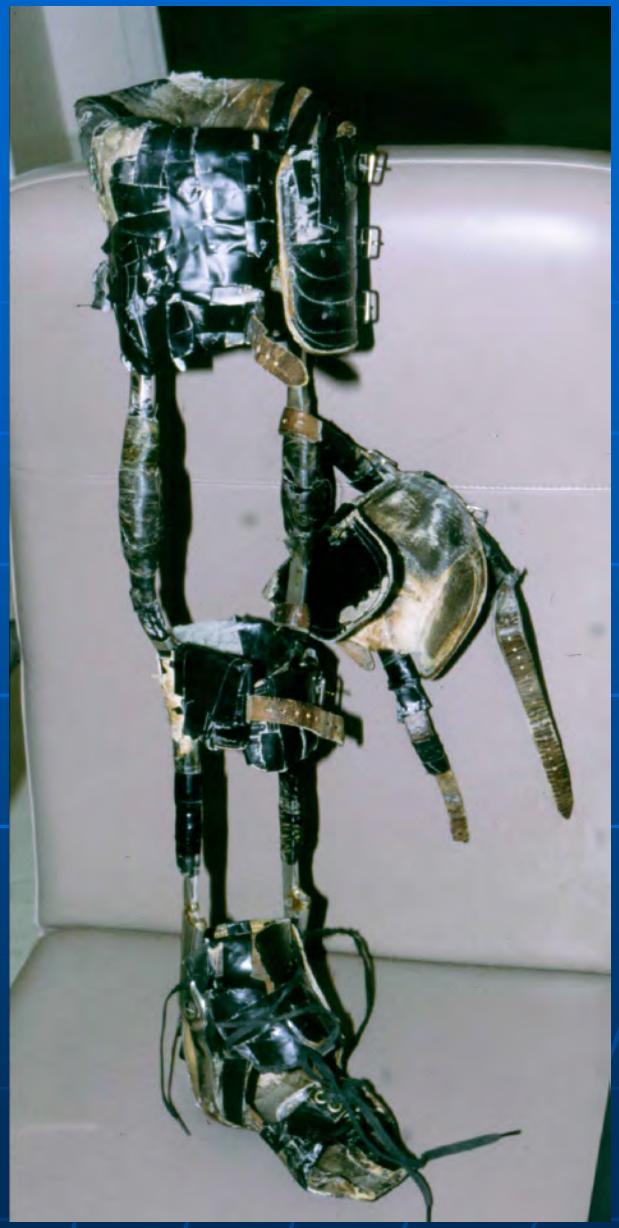
Metal KAFOs



Metal KAFOs

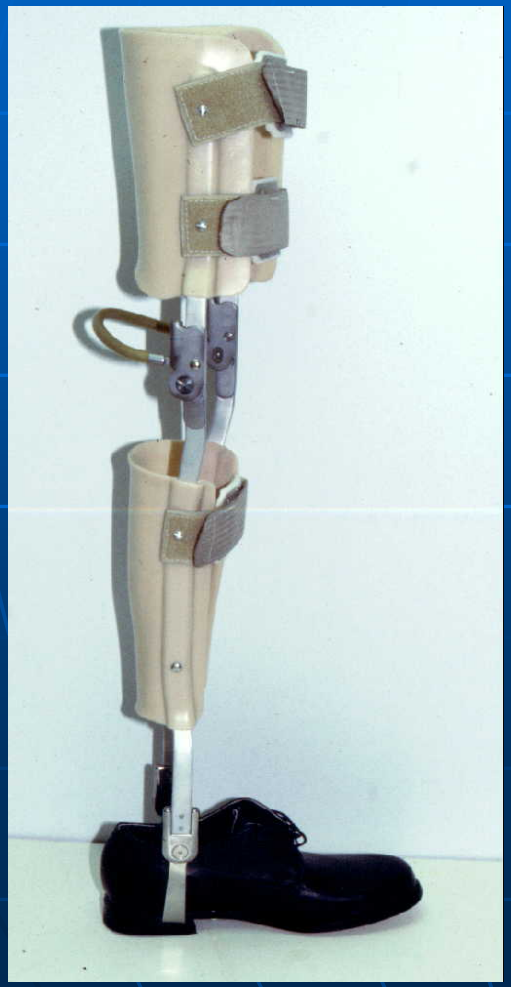


KAFO
in disguise?



Plastic KAFOs

Hybrid KAFO Designs



KAFO

Poorly made KAFOs

Stance Control Orthoses

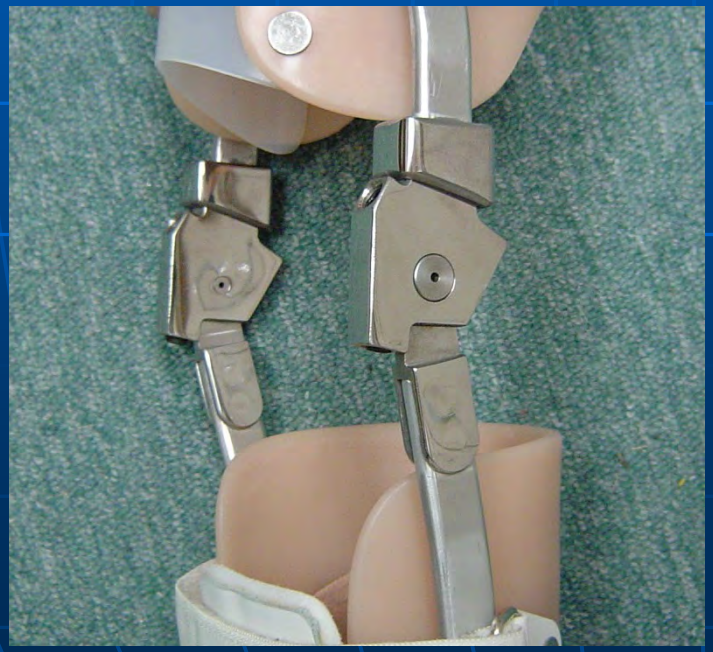
- New generation of KAFO's that lock the knee joint automatically in stance, but allow knee flexion in swing
- Electronic or mechanical feedback from ankle and/or knee to determine stance phase
- Currently available by central fab directly from manufacturer

CVA with Hemiplegia

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

Orthosis - Plastic KAFO with “Trick Knee” joint
JBM trim, 3º DF

Plastic KAFO with Trick Knee

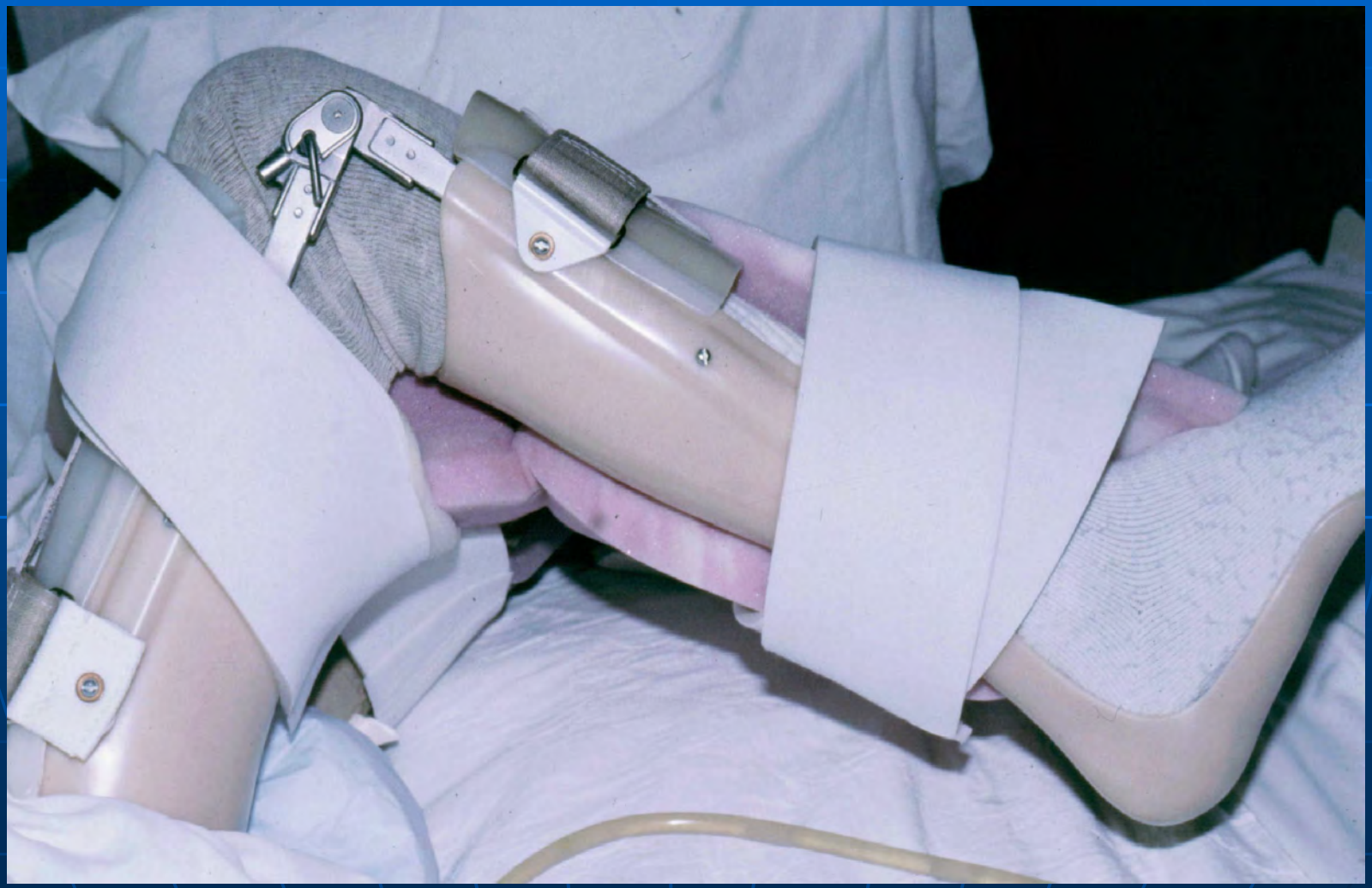


Traumatic Brain Injury

Findings - Marked spasticity and flexor tone
Knee flexion contracture 45º
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



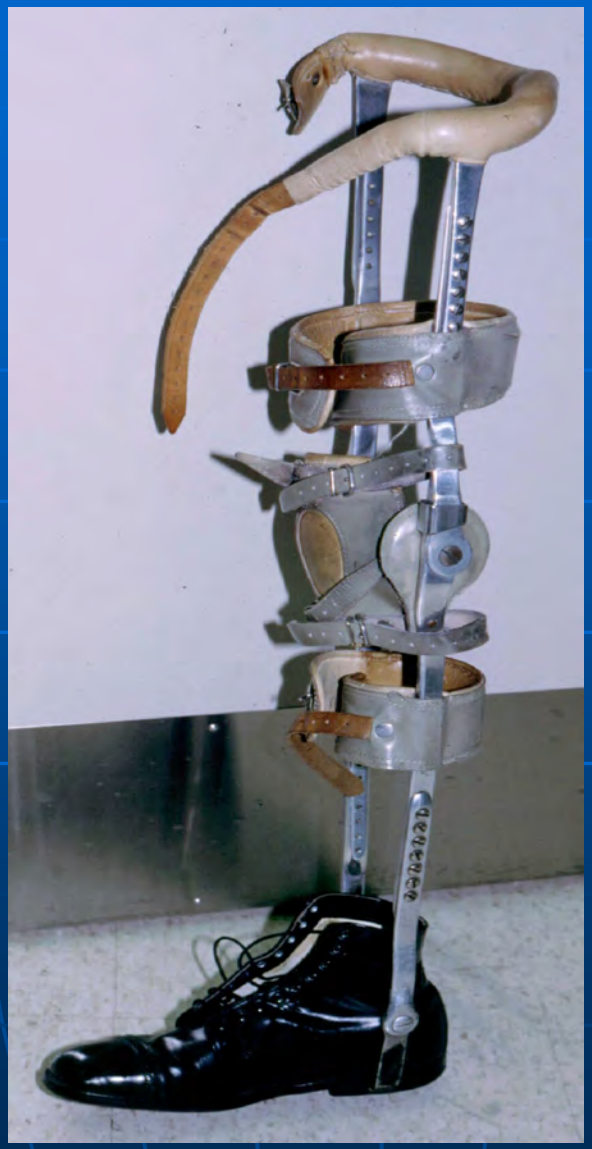
TBI with spastic quadriparesis

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

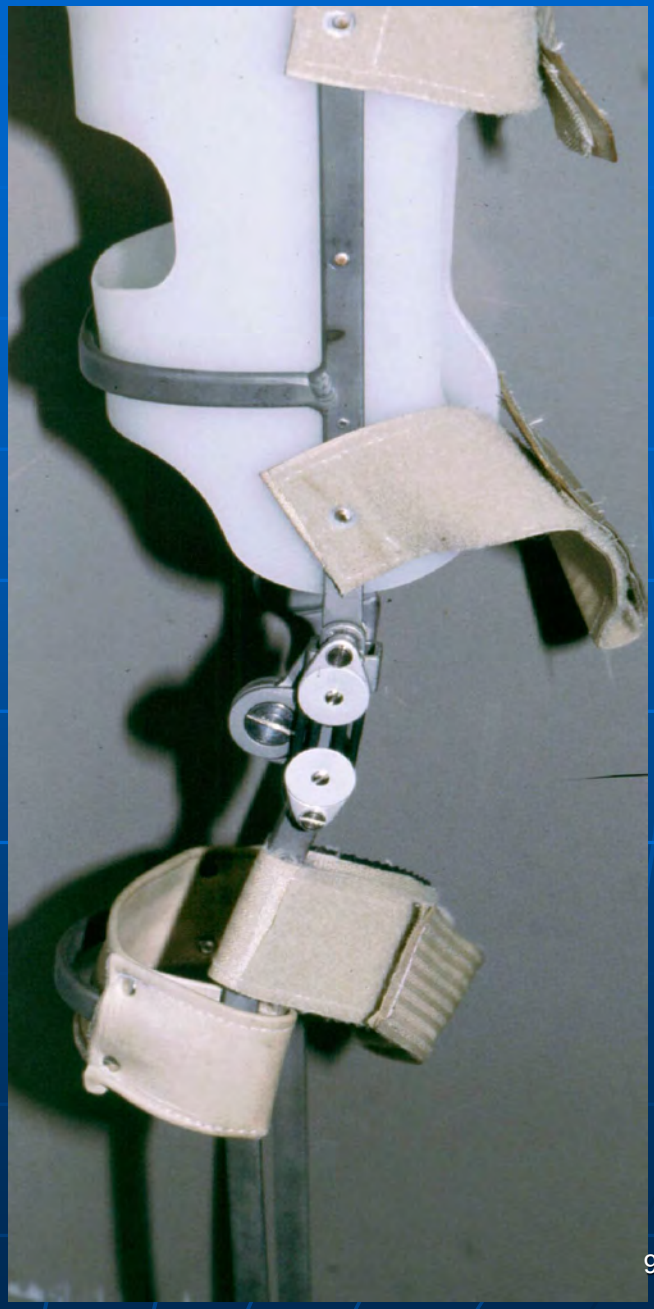
Sensation intact, no edema

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

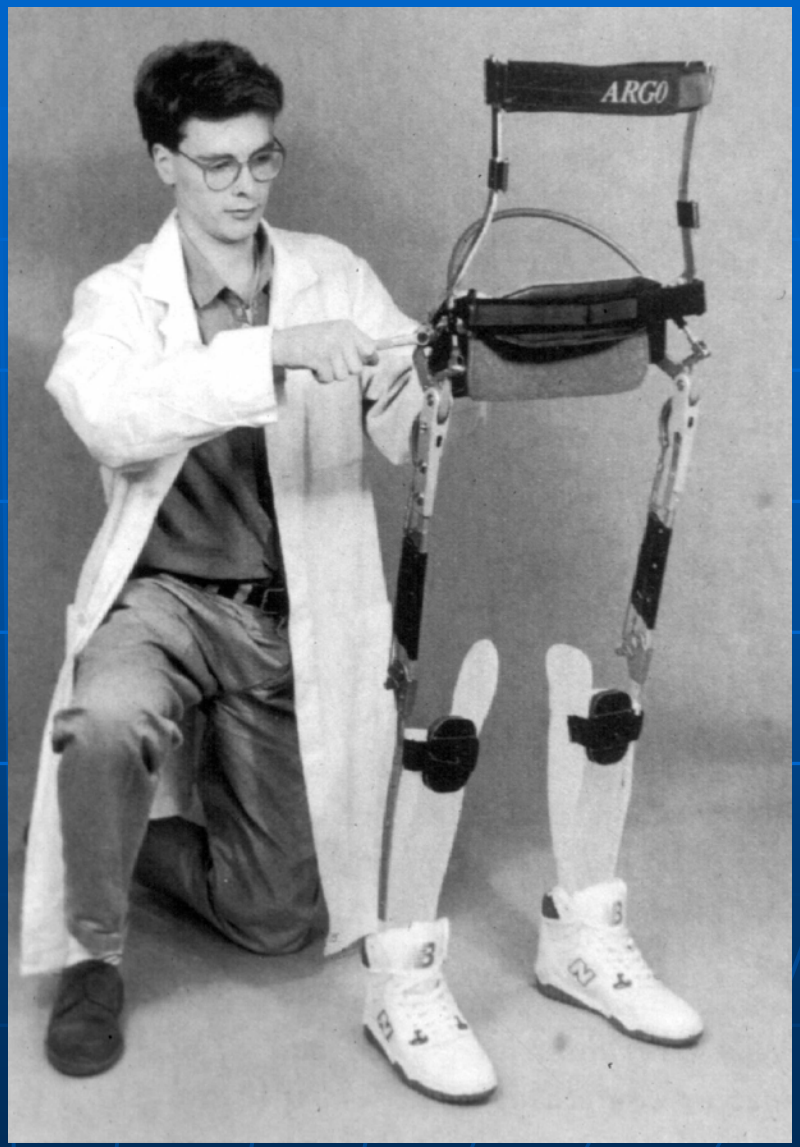
Spinal Cord Injury – T_{12} Level

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

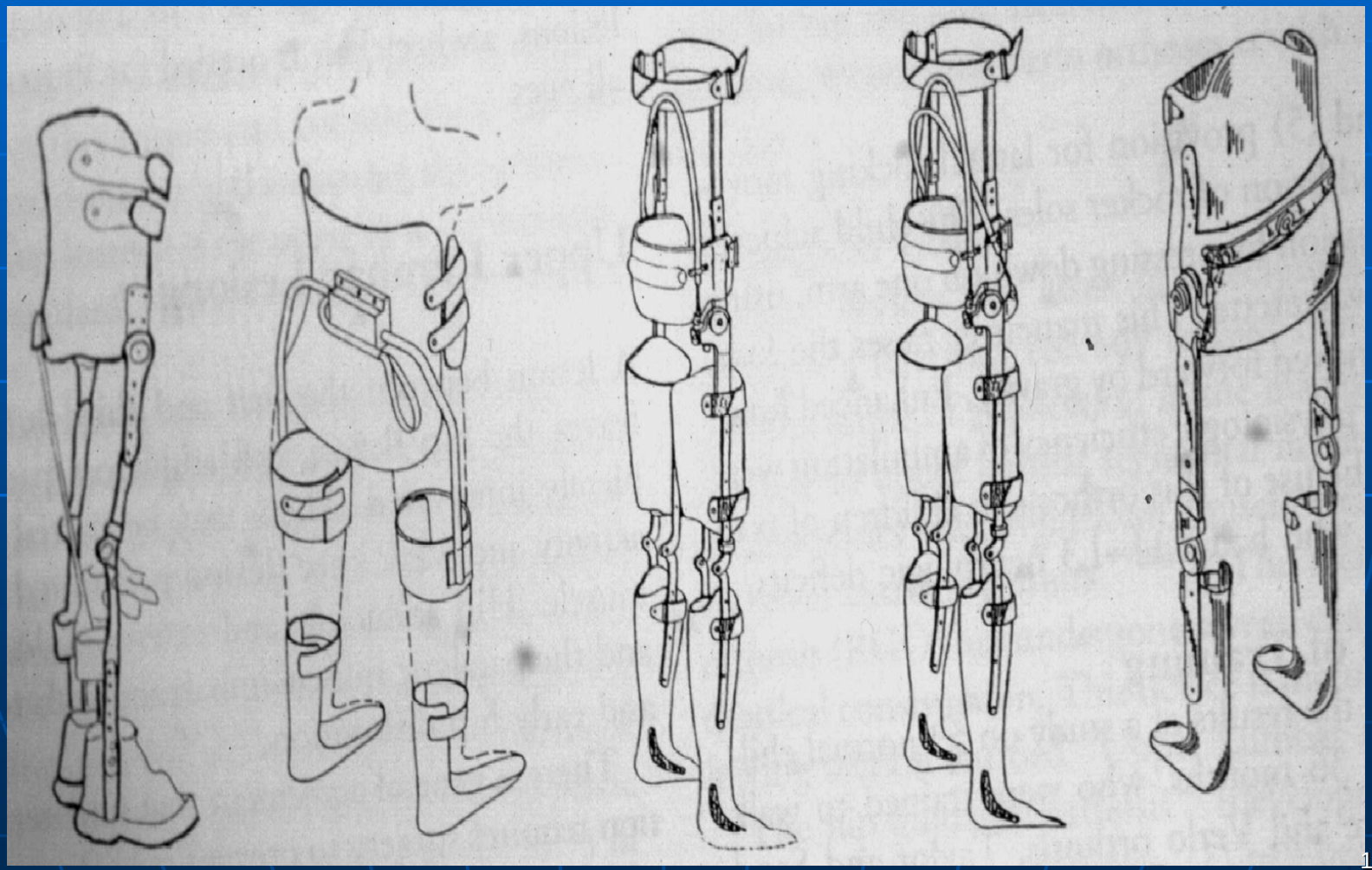
Orthosis - RGO – reciprocal gait orthosis
Hybrid metal and plastic design HKAFO's with droplock knee joints and plastic AFO at neutral

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

RGO reciprocal gait orthosis

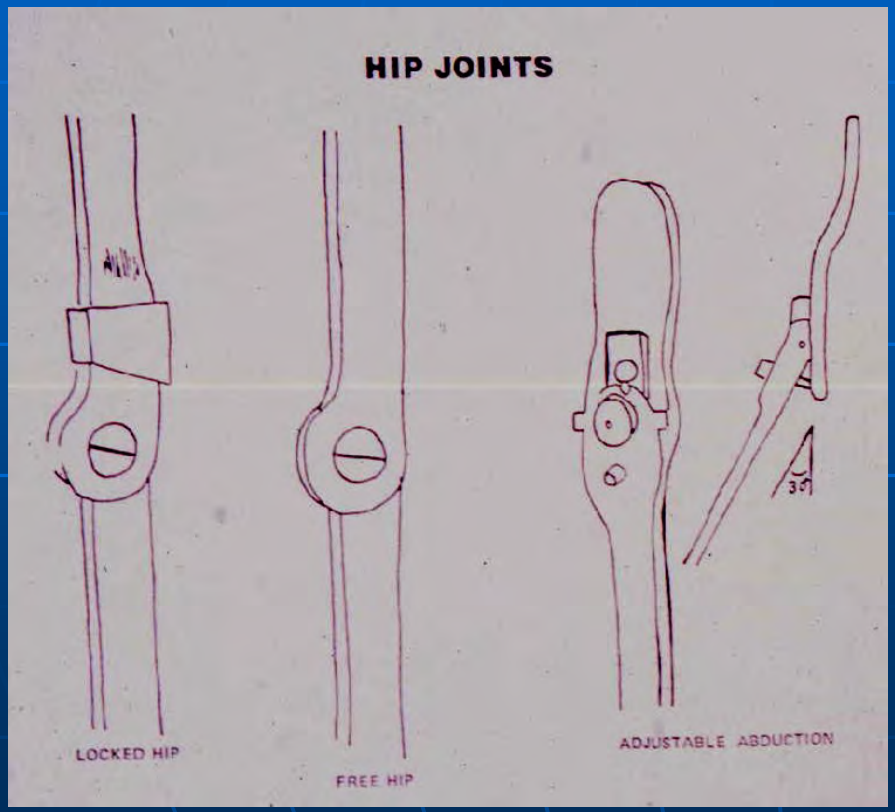


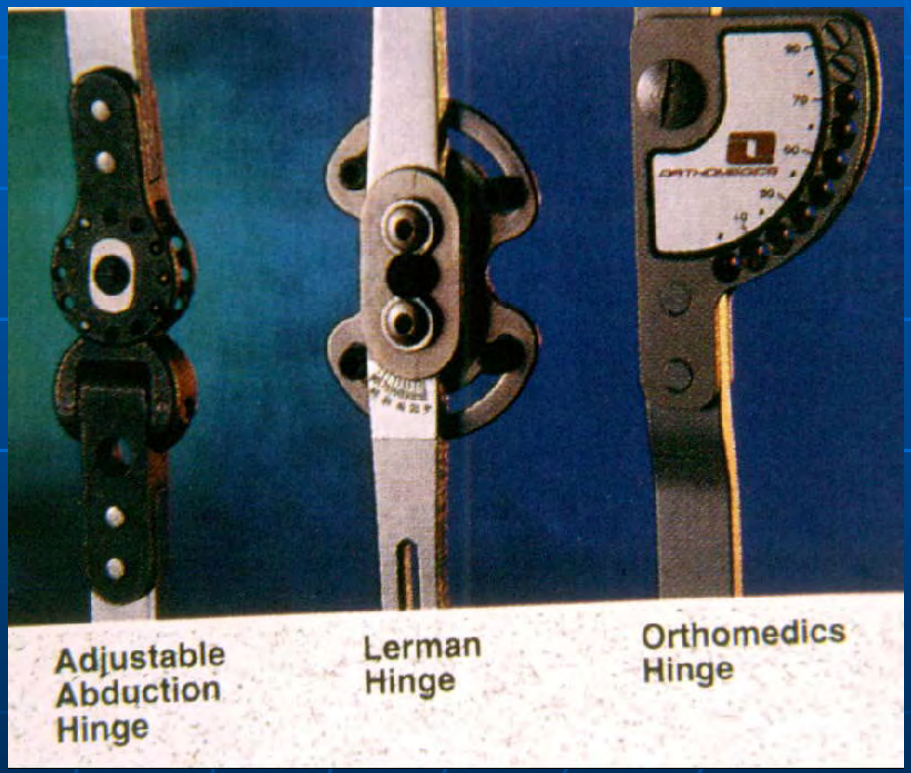
RGO design options



SCI spastic paraparesis

Hip Joints


HIP JOINTS
LOCKED HIP
FREE HIP
ADJUSTABLE ABDUCTION


Adjustable Abduction Hinge
Lerman Hinge
Orthomedics Hinge

Hip Abduction Orthosis (prevention of hip dislocation)

Thank You