

Orthotics Overview



**Jason T. Kahle, CPO
Greg S. Bauer, CPO
Westcoast Brace & Limb**

**M. Jason Highsmith, PT, DPT, CP, FAAOP
University of South Florida, College of Medicine
School of Physical Therapy and Rehabilitation Sciences**

Demonstration Project on Prosthetics and Orthotics

Funded by: U.S. Department of Education, Rehabilitation Services Administration Award # H235J050020

Objectives

Upon completion of this educational material, the participant will

- Be able to define orthosis
- Demonstrate an understanding of basic and common orthotic terminology
- Demonstrate an understanding of basic orthotic goals
- Differentiate between general types of orthoses
- Be able to select an appropriate type of orthosis given a simple case scenario

Orthotist

- Specializes in the
 - design
 - fabrication,
 - fitting,
 - alignment
 - adjustment
- of **orthoses**.
- An **orthosis** is any device added to the body to stabilize or immobilize a body part, prevent deformity, protect against injury, or assist with function. (Taber's Cyclopedic Medical Dictionary. ©2001, FA Davis)

Some Basic Goals of Orthoses

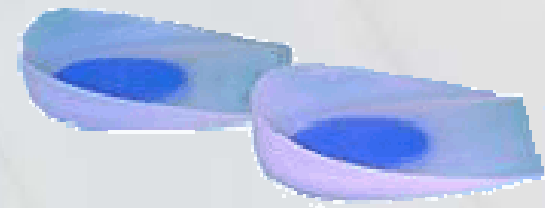
- Maintenance or correction of ***body segment alignment***
- Assistance or resistance to ***joint motion***
- Axial loading of the orthosis & therefore ***relief of distal weight bearing forces***
- ***Protection*** against physical insult

Lower Extremity Orthoses:

- **FO** foot orthosis
- **AFO** ankle foot orthosis
- **KO** knee orthosis
- **KAFO** knee ankle foot orthosis
- **HKAFO** hip knee ankle foot orthosis
- **HO** hip orthosis

FO (foot orthosis)-

- When foot cannot attain neutral, FO may shim the gap to that fixed position-**Accommodative FO**
- May help the foot attain a neutral position-**Corrective FO**
- Either may unload compromised tissue; or may provide total contact
- May be full custom or Off The Shelf (OTS)



UCBL

- University of California Biomechanics Laboratory (UCBL)
- Rigid plastic total contact design
- Hind foot / mid foot correction
- Heel cup extends proximal to inframalleolar area and distally to the metatarsal heads



AFO (ankle foot orthosis)

Most common orthosis

1. Metal bars
2. Total Contact
3. Floor reaction
4. Unweighting
5. Immobilizing
 - ***Most AFO's can be articulating or non-articulating***

SMO

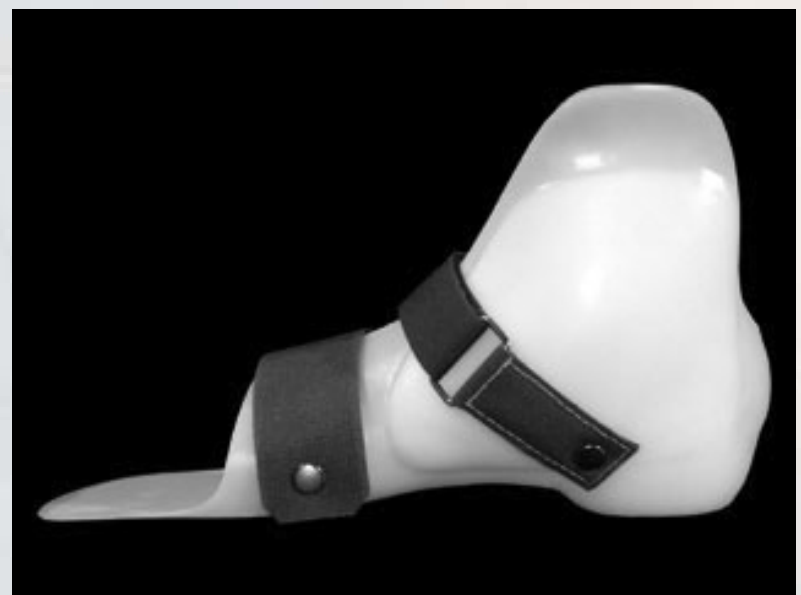
- Supra Maleolar Orthosis
- Low profile design that crosses the ankle
- Less invasive trim lines than a standard AFO



www.dafo.com/



www.pelsupply.com



www.towerortho.com

Metal bars

- Commonly used in specific scenarios
 - i.e. Post-Polio, Neuropathic feet



Total Contact AFO's

- provide sleek, intimate fit with total contact to provide better control
- Subtypes are thermoplastic and thermosetting
- higher patient acceptance possibly due to light weight & concealment (150-200gms);
- may be hotter
- more common today



Floor reaction AFO-

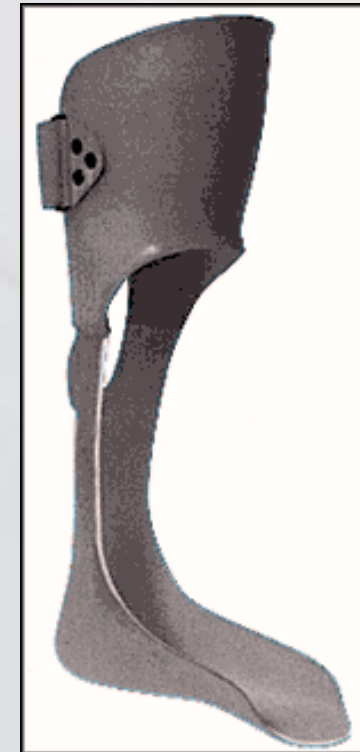
- Uses floor reaction force through toe aspect of foot plate to prevent forward tibial progression & subsequent knee collapse;
- May be articulated



http://www.scheckandsiress.com/orthotic_care/AFO_Floor_Reaction.pdf



Courtesy of Westcoast
Brace & Limb



<http://www.beckerorthopedic.com/cenfab/cfp.htm>

Unweighting AFO

- May be patella tendon bearing (PTB), specific weight bearing or total surface bearing, TSB (inverted cone with lace closure) to unweight the ankle foot using prosthetic principles



Example of a TSB unweighting AFO from <http://www.arizonaafo.com/weightbearing.html>



Example of a specific weight bearing AFO from <http://www.pttd.com/PhotoGallery.html>

Immobilizing AFO

Commonly used with a lower extremity deficiency when ankle immobilization is desired

- distal tibia/ fibula fracture
- foot bone fractures
- tendocalcaneus rupture
- Diabetic Foot (Charcot Foot)



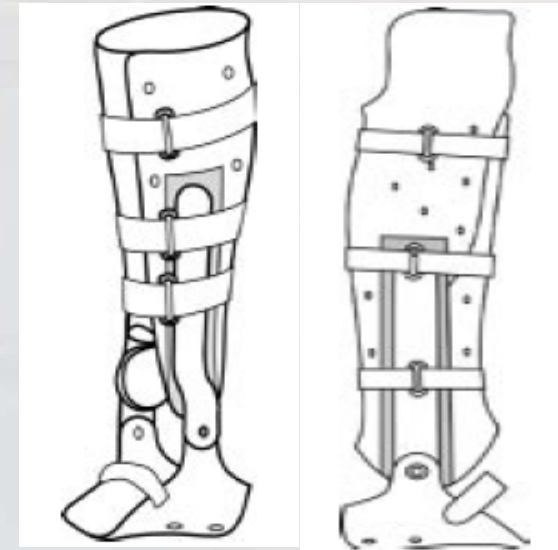
Crow Walker

www.towerortho.com



CAM Walker

<http://www.orthopedictechreview.com/issues/octnov99/productivity.htm>



AFO for Fracture Management.

<http://www.orthoactive.com/downloads/pdf/fractureBracing.pdf>

Articulated or Non-articulated

- May be designed for progressive increases or decreases in sagittal plane ROM and control
- An articulating option may be available in many designs of AFO's

Non-Articulating (Solid Ankle)



Articulating



KO (knee orthosis)

- Useful for malalignment
 - genu varum,
 - valgum,
 - recurvatum,
- to protect knee structures from undue loading/stress
- may be preventative or corrective
- may be permanent treatment for repaired/compromised knee structures



Photo of a patient with Genu Recurvatum courtesy of Westcoast Brace & Limb

Several Types of KO's:

- *Athletic KO-*
- *Non-articulated KO-*
- *Custom or OTS KO-*

Athletic KO-

- Preventative.
- Controversial as short lever arms may not be sufficient to diminish realistic damaging forces.
- Proprioception thought to play a role.



<http://www.abrace.com/hinged/flex-lite.htm>



Courtesy of Westcoast
Brace & Limb

non-articulated KO-

- usually for short term use
- difficult to transfer with

Swedish knee cage for Genu Recurvatum



http://www.sammonspreston.com/ca/Supply/Product.asp?Leaf_Id=438901

Knee Immobilizer KO



<http://www.yourdr.com/kneesupport/donjoy/immobil-deluxe.htm>

Off-the-Shelf KO-

- Offers limited control of the knee.
- Restricts gross motion



<http://www.kneebracesonline.com/product.php?productid=307&cat=681&page=1>



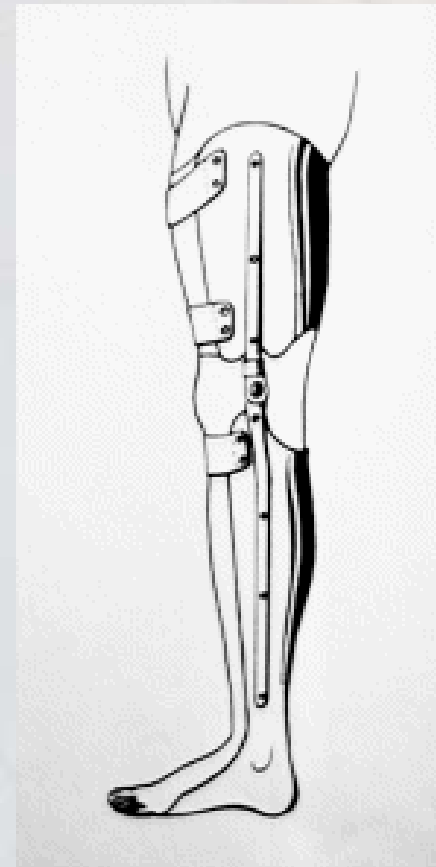
Dynamic Extension assist KO
to prevent contractures



http://www.orthomerica.com/products/owext/polaris_2.htm

KAFO Knee Ankle Foot Orthosis

- Indicated when lesser devices are biomechanically insufficient;
- Combines KO & AFO



http://www.aodmobility.com/body_kafos.htm

Subtypes:

- *Single/Double bar (upright) KAFO-*
- *Total contact KAFO-*
- *Ischial Weight Bearing (unweighting) KAFO-*

Single/Double Bar KAFO-

- Accommodates volume fluctuation,
- Cooler than total contact,
- Highest material strength.
- Several lock options.
 - Lock for ambulation, unlock for sitting.
- May incorporate hyperextension stops.
- Various knee joints are available
 - e.g. Weight activated stance control, locking, polycentric, single axis, extension assist, etc.



Courtesy of Westcoast
Brace & Limb



<http://www.ottobockus.com/>

Total Contact KAFO-

- More customizable.
- Better load distribution.
- Includes Sarmiento Style Fracture Bracing.



http://www.orthomerica.com/products/lowext/orlando_kafo.htm



Courtesy of Westcoast Brace & Limb



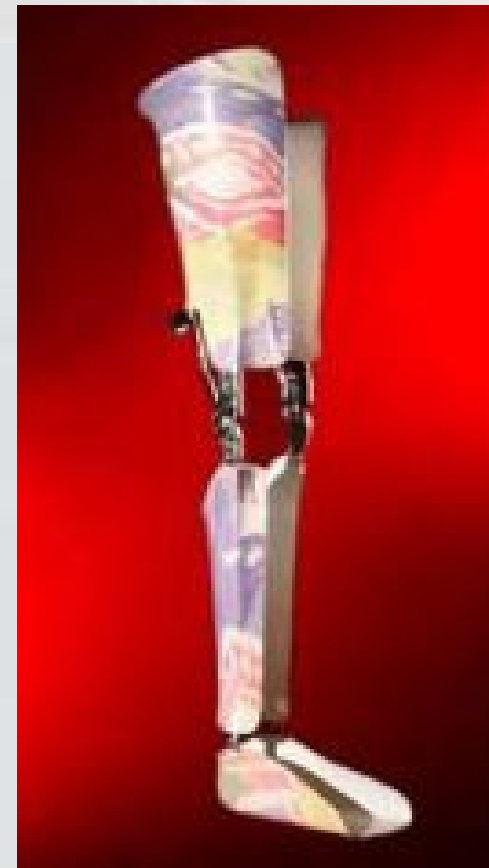
<http://www.pandocare.com/products.html>

Ischial Weight Bearing (unweighting) KAFO-

- Ischial containment or Quadrilateral style brims with high trimlines.
- Generally used with paralytic limbs.
- Not as effective with larger or obese individuals.



<http://www.beckerorthopedic.com/cenfab/cfp.htm>



<http://leedergroup.com/bulletins/limited-definition-of-orthotics>

HKAFO

Hip Knee Ankle Foot Orthosis

- Very restrictive and laborious to swing-to or through in gait
 - causing high rejection rates
 - Includes Reciprocating Gait Orthoses (RGO), total contact, leather and metal upright, postural and others



<http://leedergroup.com/bulletins/limited-definition-of-orthotics>

Specific HKAFO: Reciprocating Gait Orthosis (RGO)

- Commonly used in cases of spina bifida and spinal cord injury.
- Combines flexion of one hip with extension of the opposite hip.
- The flexion power of one hip is utilized to extend the opposite hip.



Courtesy of
Westcoast Brace
& Limb



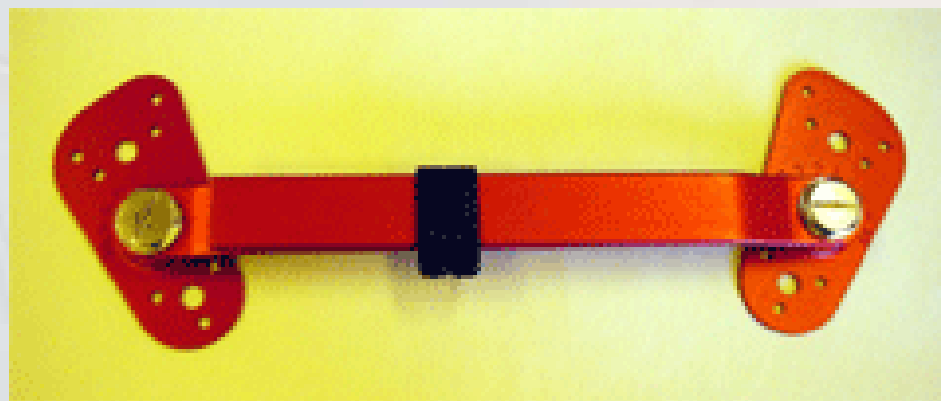
Hip Orthosis (HO)

- Hip Abduction Orthosis
- Standing Walking AND Sitting Orthosis (SWASH)
- Some Orthoses can intervene at the hip without crossing the hip. Select examples:



A-Frame Orthosis

www.pelsupply.com



Dennis Brown Bars

Hip Abduction Orthosis

- Commonly used post-operatively to position the femoral head optimally within the acetabulum



Hip Abduction orthoses can be an HO only or can have a KAFO extension.

www.pelsupply.com

Specific Case Hip Orthosis (HO): S.W.A.S.H Orthosis

- **Standing Walking And Sitting Hip Orthosis**
- Maintains femoral abduction in standing, walking and sitting



Courtesy of Westcoast Brace & Limb

Upper Extremity Orthoses:

- HO hand orthosis
- WHO wrist hand orthosis
- EO elbow orthosis
- EWHO elbow wrist hand orthosis
- SO shoulder orthosis

Hand Orthosis (HO)

- Opponens Orthosis
- Maintain, assist or provide opposition by stabilizing the thumb in a functional position



www.pelsupply.com

Wrist Hand Orthosis (WHO)

- Commonly referred to as a “resting hand splint”
- Commonly used to prevent contractures
- Maintains neutral/static wrist, hand, and finger



Courtesy of Westcoast Brace & Limb

Wrist Hand Orthosis (WHO)

- Commonly referred to as a “cock-up splint”
- Commonly used in cases of carpal tunnel syndrome
- Maintains wrist in slight extension



Courtesy of Westcoast Brace & Limb

Wrist Hand Orthosis (WHO)

- Commonly used with fractures or mild to moderate soft tissue sprains/strains of the distal forearm, wrist and proximal hand
- Maintains wrist in a static position



<http://www.wisdomking.com/product215219c361.html>



<http://www.thebonestore.com/HelyWeberwrist.html>

Wrist Hand Orthosis (WHO)

- Commonly referred to as a “tenodesis orthosis”
- Commonly used in cases of cervical spinal cord injury that result in paralysis of prehension
- Creates approximation of the 2nd and 3rd digits and the thumb with active extension of the wrist



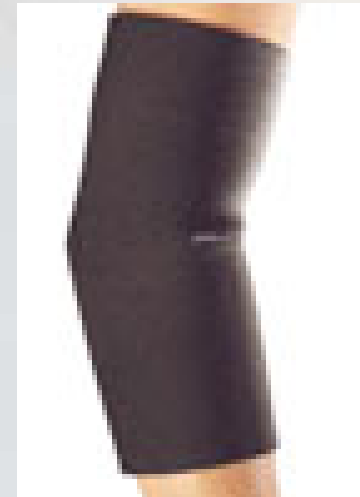
Courtesy of Westcoast Brace & Limb

OTS Orthoses around the elbow

- Lateral Epicondylitis Brace-



- Elbow Sleeve- commonly used for minor soft tissue injuries, compression, sprains and strains



www.pelsupply.com

Elbow Orthosis

- Custom molded, total contact elbow orthosis
- Can be used for prevention of contracture(s), fracture, immobilization
- May include a wrist or wrist/hand component
- May be custom or OTS
- Elbow joints may be static or dynamic



Courtesy of
Westcoast Brace & Limb

Shoulder Orthosis

- Commonly called “shoulder sling”
- Used for shoulder immobilization



<http://www.armsling.com/?source=Overture>

Shoulder Orthosis

- Commonly called a shoulder abduction orthosis
 - Sometimes referred to as an “airplane splint”
- Maintains abduction at the glenohumeral joint



www.pelsupply.com

Spinal Orthoses

- CO cervical orthosis
- CTLSO cervical, thoracic, lumbosacral orthosis
- TLSO thoracic, lumbosacral orthosis
- LSO lumbosacral orthosis

Cervical Orthosis (CO)

- Soft Cervical Collar
- Commonly used for mild soft tissue strains and sprains
- Kinesthetic reminder to limit motion



Courtesy of Westcoast Brace & Limb

Cervical Orthosis

- Semi-Rigid Cervical Orthosis
- Can provide access to the trachea
- Moderate Control of ROM
- Kinesthetic Reminder
- Adjustable
- OTS
- Examples: Philadelphia, Malibu, Aspen

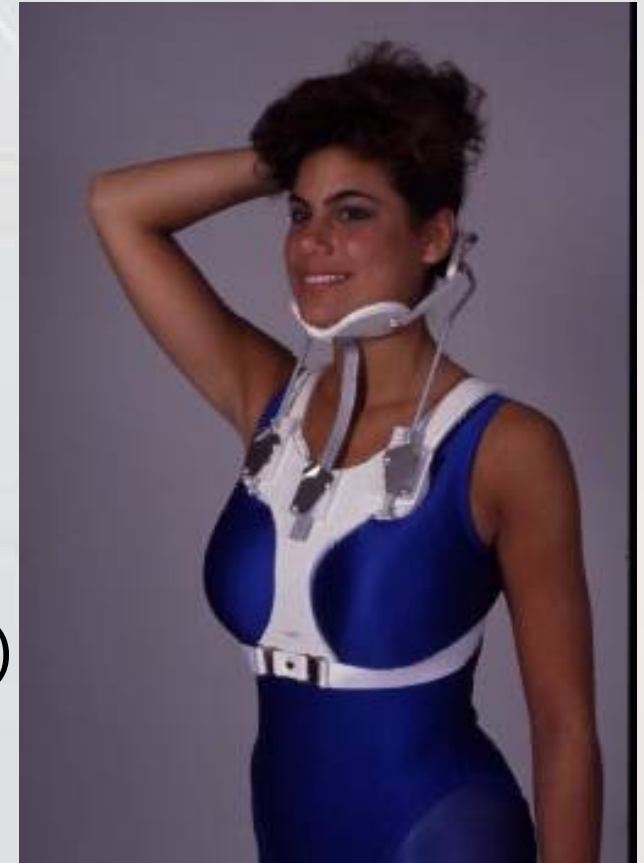


Aspen Cervical Orthosis

Courtesy of Westcoast Brace & Limb

Cervical Orthosis

- Rigid Frame Design
- Commonly used in stable fractures and Moderate to Severe soft tissue damage
- Limits Flexion and Extension
- Extends Inferior into the Thoracic Region for greater control of all cervical levels
- Examples: Denison, Guilford, SOMI (Sternal Occipital Mandibular Immobilizer)



SOMI Orthosis

Courtesy of Westcoast Brace & Limb

Cervical Orthosis

- Rigid Frame Design
- Commonly used in stable fractures and Severe soft tissue damage
- Limits All Motion
- Extends Inferior into the Thoracic Region for greater control of all cervical levels



Minerva

Courtesy of Westcoast Brace & Limb

Cervical Orthosis

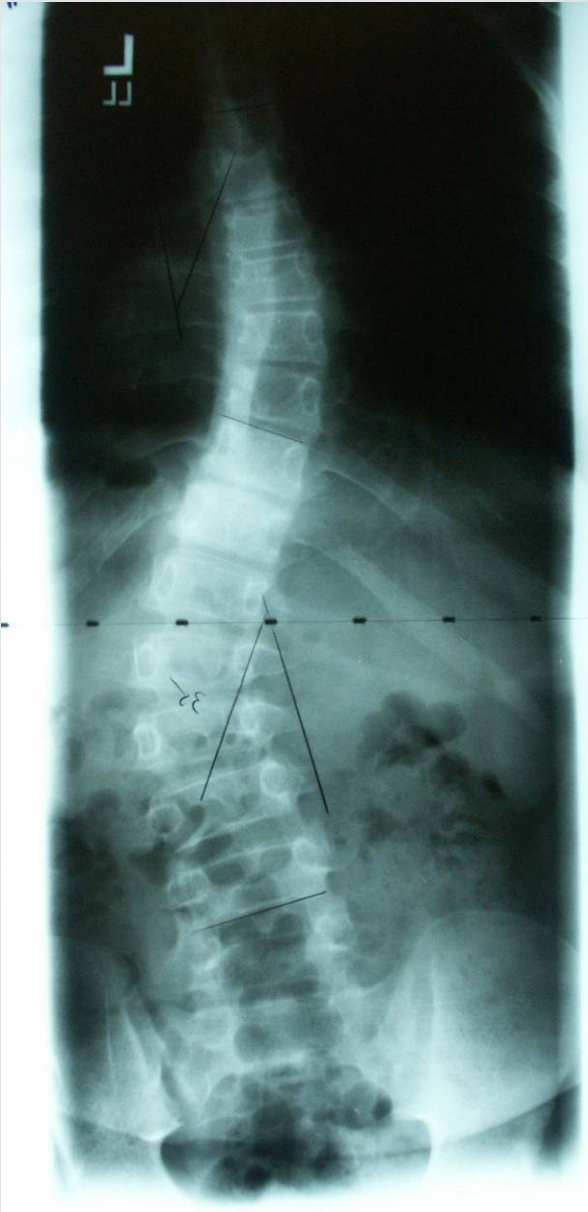
- Rigid Frame Design
- Commonly used in unstable fractures
- Limits All motion
- Extends Inferior into the Thoracic Region for greater control of all cervical levels
- Screws Directly into the skull



HALO

Courtesy of Westcoast Brace & Limb

Scoliotic Curve



- 0°- 30° Treated with signs of progression
- 30°- 45° Orthotic Intervention
- 45° < Surgical Intervention

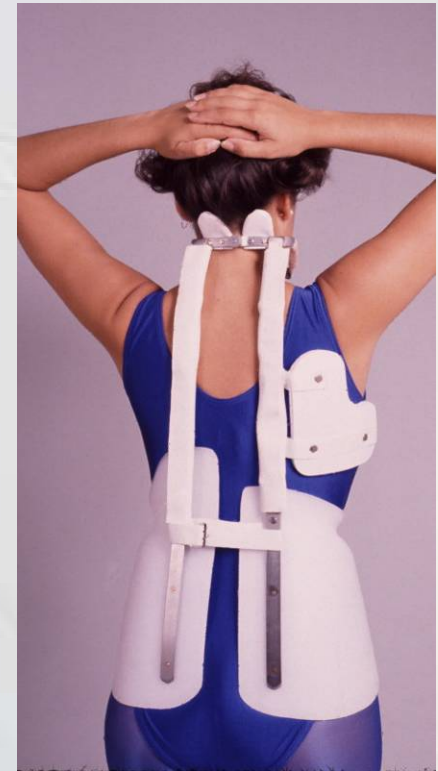
Courtesy of Westcoast Brace & Limb

CTLSO

- Traditional Method of Scoliosis Treatment
- Rigid frame Design
- Uses three point pressure and kinesthetic reminder
- Worn 23 hours / day



Neck Ring Component



**Courtesy of
Westcoast Brace & Limb**

Milwaukee Scoliosis CTLSO

TLSO

- Low Profile TLSO for Scoliosis
- Worn 23 Hours / Day
- Made of semi-rigid plastic and foam



**Low Profile
Milwaukee Brace**



Boston TLSO

Courtesy of Westcoast Brace & Limb

TLSO

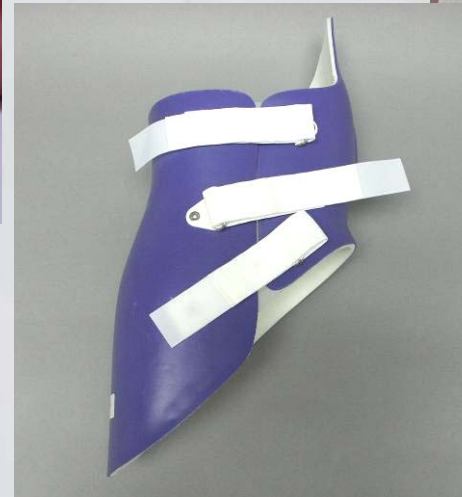
- Low Profile TLSO for Scoliosis
- Worn when sleeping only
- Made of semi-rigid plastic and foam



Charleston Bending Orthosis



ProvidenceOrthosis

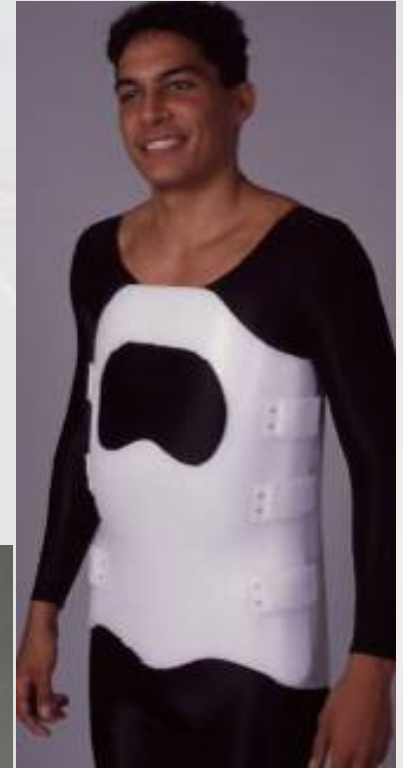


Courtesy of Westcoast Brace & Limb

TLSO

Semi-Rigid Design (various rigidity options)

- Increases Intra-abdominal pressure
- Limits ROM
- Commonly used for Herniated Nucleus Pulposus, and moderate soft tissue strains and sprains and fractures
- Commonly referred to as a body jacket



Courtesy of Westcoast Brace & Limb

TLSO

- Anterior Compression Fractures of the vertebral body
- Semi rigid design (Taylor, Knight Taylor)
- Commonly used for osteoporosis, trauma Degenerative



Courtesy of Westcoast Brace & Limb

TLSO

- Anterior Compression Fractures of the vertebral body
- Soft design (mother's hug)
- Commonly used for osteoporosis, trauma Degenerative

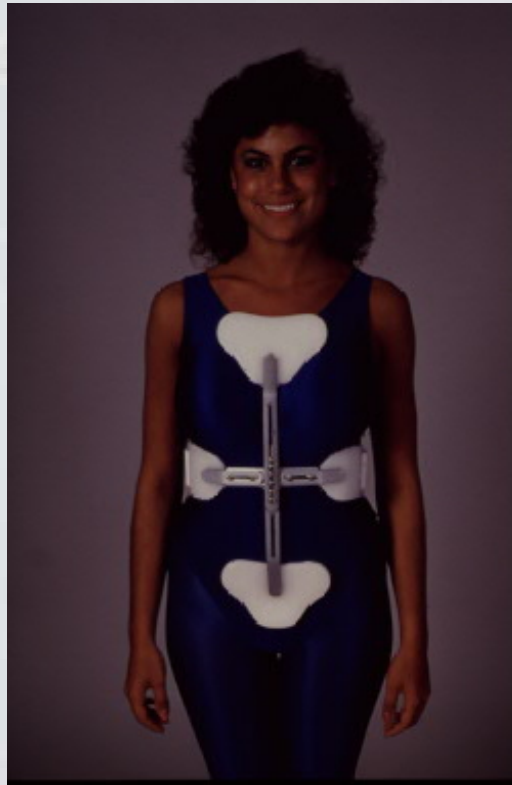


Courtesy of
Westcoast Brace & Limb

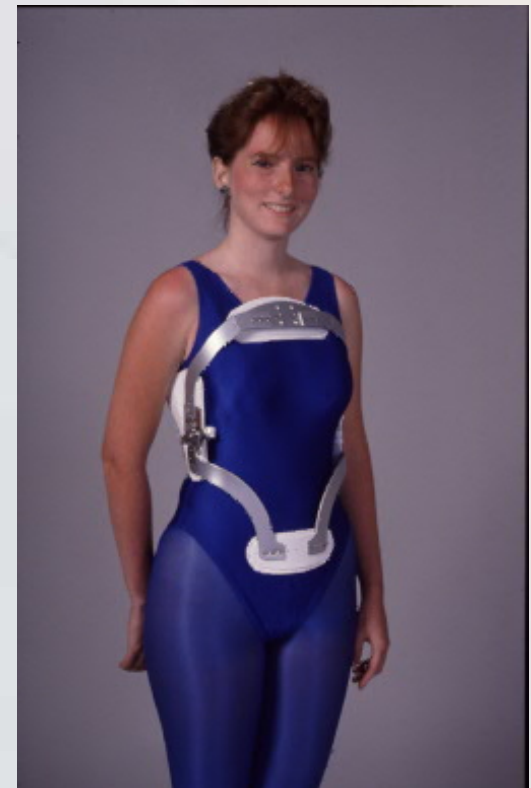
TLSO

- Anterior Compression Fractures of the vertebral body
- Rigid Design
- Commonly used for osteoporosis, trauma,
- Degenerative disc disease
- Limits Flexion

Courtesy of Westcoast Brace & Limb



**CASH Hyperextension
Orthosis**



Jewett Hyperextension Orthosis

Lumbosacral Orthosis (LSO)

- Routinely OTS
- Soft Design
- Increases Intra-abdominal pressure
- Commonly used for Herniated Nucleus Pulposus, and other mild to moderate soft tissue strains and sprains
- Can be used preventatively



Courtesy of Westcoast Brace & Limb

Lumbosacral Orthosis (LSO)

- Routinely OTS
- Semi-rigid / rigid design
- Commonly referred to as a “chair back” (Knight)
- Restricts trunk extension and lateral motion
- Increases Intra-abdominal pressure
- Commonly used for Herniated Nucleus Pulposus, and other mild to moderate soft tissue strains and sprains



Courtesy of Westcoast Brace & Limb

Boston Overlap Orthosis

Semi-Rigid Design (various rigidity options)

- **Increases Intra-abdominal pressure**
- **Limits ROM**
- **Commonly used for Herniated Nucleus Pulposus, and moderate soft tissue strains and sprains**



Courtesy of Westcoast Brace & Limb

For further information about the content of the module, contact

University of South Florida

dpt@health.usf.edu

(813)974-8870

Fax: (813)974-8915



**SCHOOL OF PHYSICAL THERAPY
& REHABILITATION SCIENCES**



Westcoast Brace & Limb

www.wcbl.com

(813)985-5000

Fax: (813)985-4499



Funded by the Department of Education, Rehabilitation Services Administration

Award# H235J050020

“Demonstration Project on Prosthetics and Orthotics”

University of South Florida

College of Medicine: School of Physical Therapy & Rehabilitation Sciences

College of Engineering: Mechanical Engineering Department

M. Jason Highsmith, PT, DPT, CP, FAAOP

William S. Quillen, PT, PhD, SCS, FACSM

Rajiv Dubey, PhD



**SCHOOL OF PHYSICAL THERAPY
& REHABILITATION SCIENCES**

