Orthotics Overview

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Demonstration Project on Prosthetics and Orthotics
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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

[Image of foot orthotic device]

www.towerortho.com

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**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

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

Courtesy of Westcoast Brace & Limb
Floor reaction AFO-

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

[Image of AFO with floor reaction force indicated]


Courtesy of Westcoast Brace & Limb

http://www.beckerorthopedic.com/centaf/cfp.htm

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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.arizonafo.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.  
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.orthomerica.com/products/lowext/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.

http://www.ottobockus.com/

Courtesy of Westcoast Brace & Limb
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

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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](http://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
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
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

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 2\textsuperscript{nd} and 3\textsuperscript{rd} digits and the thumb with active extension of the wrist
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)
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

Milwaukee Scoliosis CTLSO

Courtesy of Westcoast Brace & Limb
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

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TLKO

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

Charleston Bending Orthosis

Providence Orthosis

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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
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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

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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

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For further information about the content of the module, contact

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