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# Neuro-Orthopedic Development & Rehabilitation

## Optimizing Pediatric Movement Training & Minimizing Deformities using Orthotic Modifications & TheraTogs™ Orthotic Systems

**TARGET AUDIENCE:** Ms Cusick is committed to the fostering of collaborative and educated team management of people with complex neuromotor problems. Therefore, this course is open to a range of clinicians who are likely to work together to maximize physical function as a rehabilitation team, including physical therapists, orthotists, occupational therapists, rehabilitation physicians, and orthopedists.

**Level-Avid Beginner to Advanced.** The course content can be challenging to any practitioner who does not ordinarily think in biomechanical terms. *In order to prepare for this course, all attendees are given – and required to review and study – a set of pre-course readings, a videotaped lecture on functional foot and ankle anatomy, and assigned segments of a DVD of videotaped assessment procedures.*

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### Course Description

This program offers clinicians a range of alternatives to the standard approaches to management of postural and joint deformity and movement disorders as they occur in children with orthopedic problems, sensory processing disorders, and neuromotor disabilities.

Lectures are designed to clarify, expand upon, and reinforce the content delivered in the pre-course readings. Attendees receive a comprehensive and current set of illustrated hand-outs, extensive, topic-specific reference lists loaded onto a CD, and a set of 6 assessment tools

As the foot is the body-ground interface for all clients who stand and walk, Ms. Cusick reviews the cardinal planes, the development and biomechanics of the foot and ankle, and the mechanisms and benefits of the closed kinetic/kinematic chain. She discusses new findings in the studies of muscle transformation, weight distribution on the foot, development of the somatosensory system and postural control, and the relationship between gait kinematics and kinetics. She applies these sciences to clinical management strategies that can minimize or reduce foot deformity and typical muscle contractures in children with foot pathomechanics and with CNS dysfunction.

The course content addresses the basic elements of the skeletal modeling process, the principles of Sahrman's Muscle Balance Theory, and new developments in cortical plasticity and motor learning theory. These discussions provide evidence of the relationship between specific anatomic components - such as bone geometry, joint shape, and muscle extensibility - and postural control and movement strategies. These principles are then illuminated in a brief review of normal (and ideal) orthopedic and neuromotor developmental events, with supervised musculoskeletal assessment lab sessions. Assessment findings are reviewed with implications for adapting the functioning base of support, and for designing and staging TheraTogs applications.

Videotaped case studies and live case presentations are offered in order to model and gain a components-based, clinical problem-solving process that prioritizes recommended intervention strategies. Attendees who fulfill the qualification requirements will also be certified as TheraTogs Fitters - Level 1.

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## Course Objectives

Upon completion of both the lecture and lab components of this course, participants will be able to:

- Relate movement-based compression strains at or under normal body weight to bone growth rate.
- Describe and explain the closed-chain relationships between foot positions – pronation and supination – and the alignment of the lower extremities (LEs) and pelvis.
- Name the 5 attributes of normal gait and the 3 stance-phase rockers as defined by Perry and Gage.
- Describe the ideal foot and ankle kinematics during Rockers 2 and 3, and relate them to the attributes of normal gait and to gait kinetics.
- Describe the mechanism underlying “internal moment” as a pathomechanical phenomenon.
- Discuss the relationship between somatosensory input through the foot and postural control.
- Give examples of orthotic posting in sagittal and frontal planes. Relate orthotic posting to LE closed-chain function in gait.
- Describe the “swing-limb torque generator”, and explain its influence on developing LE long bones and feet.
- Relate center of body mass distribution over the base of support to muscle recruitment strategies and contracture formation.
- Differentiate between “load” and “strain” as skeletal modeling influences, and relate them to the process of osseous maturation.
- Define torsion, antetorsion, version, anteversion, varus, valgus, tibial slope, acetabular inlet slope, femoral angle of entry, and pelvic obliquity, and assign them to the correct cardinal planes.
- Describe muscle and connective tissue transformation relative to a history of chronic, tonic muscle recruitment.
- Explain why spasticity cannot cause deformity.
- Explain the terms “dominant” and “dominated” as they pertain to muscle force couple imbalances, and describe 2 strategies for indentifying each condition.
- Discuss muscle length and related capacity for isometric contractile force generation.
- Explain the hip joint stabilizing function of the Iliotibial Band Complex, and the influence of the presence of excessive femoral antetorsion on this function.
- Explain the biomechanical and kinesiological rationales for using weight-line training and heel-loading to gain LE soft tissue extensibility.
- Explain the process that results in relative flexibility and the eventual problems. Give 3 examples of common sites of relative flexibility, and suggest orthotic and TheraTogs applications that target relative flexibility concerns.
- Execute the musculoskeletal assessments procedures reviewed in lab sessions with enough competence to continue to practice and use them in clinical practice.
- Demonstrate competency in donning a set of TheraTogs garments and strapping applications for improving postural alignment and scapular stability.
- Bring foot assessment findings to an orthotic posting plan, and implement the plan by posting a shoe insole for a presented case.
- Bring LE and postural assessment findings to the process of designing and prioritizing a rehab management plan that delivers adequate practice of improved alignment and function between therapy sessions.

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## Course Schedule

### **DAY ONE – SEMINAR & LAB**

- 8:15 Registration
- 8:45 Introduction
- 9:00 Review of Foot and Ankle Anatomy and Biomechanics
- 9:45 Postural Control Development - Command of Body COM Orientation over the Base of Support
- 10:15 SHORT Break
- 10:30 The Somatosensory System – Contributions to Balance and Walking
- 11:30 The Ideal Role of the Ankle Joint in Gait Kinetics - Rockers 1, 2, and 3
- 12:00 Lunch
- 1:00 Sagittal-Plane Orthotic Posting – Rationale and Strategies
- 1:45 Videotaped Ankle DFROM Assessments
- 2:00 Break
- 2:15 **LAB – on each other:** Ankle DFROM Assessment – Knee Extended
- 3:00 **LAB:** Ankle Equinus Posting / TogRite Ankle Motion-Assist Strapping Gait Training
- 4:30 Videotaped Case Presentation – Max
- 4:45 Questions, discussion
- 5:00 Adjourn

**Homework: Read the section on Muscle Physiology & Pathophysiology**

We'll start every following course day at 8:30AM unless declared otherwise.

Please mark your calendars. We will start without you if you are not seated at 8:30AM.

**We'll start promptly at 8:30AM tomorrow. Bring lab clothes.**

### **DAY TWO – SEMINAR & LAB** *Bring lab clothes today.*

- 7:30 Library is available, as is coffee and tea
- 8:30 Brief review: Skeletal Modeling Mechanisms
- 9:00 Foot Assessment – Pathomechanics – Posting Implications and Strategies
- 10:00 SHORT Break
- 10:15 More Posting Implications and Strategies
- 11:00 Foot Development
- 12:00 Lunch - Normal Gait DVD - Gillette Children's – new edition -12:30 (optional)
- 1:00 Name That Foot Deformity!
- 2:00 **LAB – on each other:** Open-Chain Assessments of the Foot
- 3:15 SHORT Break
- 3:30 **LAB on each other:** Resume Open Chain Assessments
- 4:45 Restore classroom set-up
- 5:00 Adjourn

**Homework: Read the section on Tone and Spasticity**

**We'll start promptly at 8:30AM. Wear lab clothes for tomorrow morning lab.**

## **DAY THREE - LAB, WORKSHOP, & SEMINAR**

- 7:30 Library is available, as is coffee, etc.
- 8:30 **LAB (on each other):** Closed-Chain Foot Assessments
- 9:30 **Workshop:** Using Assessment Findings to Design an Orthosis
- 10:15 SHORT Break
- 10:30 **Workshop:** Review of workshop results
- 11:15 Muscle Balance Theory – Sahrman’s Contributions
- 12:00 Lunch - Normal Gait DVD - bag lunch viewing at 12:30 (optional)
- 1:00 Implications of Muscle Balance Theory for Foot Deformity Management
- 1:30 Development of Kinetics of Walking
- 2:00 SHORT break
- 2:15 Development of Kinetics of Walking - continued
- 2:45 Neuromotor Re-ed for Gait Using Orthotic & Shoe Modifications
- 3:45 SHORT Break
- 4:30 Hypoextensibility Management Strategies
- 5:15 Questions and Discussion
- 5:30 Adjourn

**Homework: Review your handout & notes, prepare questions for tomorrow’s discussion**

**We’ll start promptly at 8:30AM tomorrow.**

## **DAY 4: MORNING**

- 7:30 Library is available, as is coffee, etc.
- 8:30 Q&A -Clarifications, review
- 9:00 Serial Casting – Indications, Precautions, Contraindications, - Mary Weck’s Contributions
- 9:45 SHORT Break
- 10:00 **Live case presentation** – Instructor demonstrates an orthopedic / biomechanical evaluation on a (congenial, adaptable) child with diplegic or hemiplegic CP, GMFCS Level I, II, or III – focus on feet & ankles & orthotic implications.
- 12:30 Lunch / adjourn

## **Day 4: 12:30 – 5:00**

Independent Study (Library is open) - Rest and Refresh (hike, swim, sleep) – Practice assessments – Review or Preview your handouts - Videotaped cases available on DVD. Instructor is on site and on duty to assist.

**Tomorrow, bring shorts or stretchy slacks to wear in case any children have to cancel.**

## **DAY FIVE – SEMINAR & LAB**

- 7:30 Library is available, as is coffee, etc.
- 8:30 Brief Review of Sagittal-Plane Develop. Changes; Biomechanical Influences of Full-Term Gestation
- 9:00 Review of Sagittal-Plane Musculoskeletal Assessments: Trunk, Pelvis, Hip
- 10:00 SHORT Break
- 10:15 Sagittal-Plane Assessments Review: Knee, Patella, Hamstring Length, & Ankle
- 12:00 Lunch – 12:30 Bag lunch videotaped case presentation – Sensory Processing Disorder (optional)
- 1:00 Change into shorts and prep (clean, shave) skin around the knees for patella alta taping lab.
- 1:15 **Lab (on each other):** Patella Angle Assessment & Patella Alta Taping
- 2:30 Clean up and prep for lab with children – set up stations, DVD players, games, tools, recording forms
- 3:00 Frontal Plane Developmental Changes and Assessments: Torso, Pelvis, Hip
- 3:30 **LAB:** Sagittal-Plane Assessment Procedures with Nondisabled Children – 2 hours
- 5:30 Clean up and adjourn

**Tomorrow, bring shorts or stretchy slacks for lab in case any children have to cancel.**

## **DAY SIX– SEMINAR & LAB**

- 7:30 Library is available, along with coffee, etc.
- 8:30 Frontal-Plane Developmental Changes and Assessments: Knee
- 10:00 SHORT Break
- 10:15 Videotaped Case Presentation
- 11:00 **LAB:** Sagittal-Plane Assessments – repeat and complete yesterday’s procedures on each other
- 12:00 Lunch - 12:30 Bag lunch videotaped case presentation – Kylie - Dystonic quadriplegia
- 1:00 **Try-on TheraTogs LAB #1** – Garment Donning and Sagittal Plane Strapping Applications
- 2:00 SHORT Break
- 2:15 **LAB:** Open-Chain Foot Assessments with a different partner: Congruity & ROM.
- 2:45 **LAB:** Open-Chain Foot Assessments with another different partner: Congruity & ROM.
- 3:15 Prep for assessments lab with children
- 3:30 **LAB (on nondisabled children):** Frontal-Plane Assessments & TheraTogs Garment Donning
- 5:30 Clean Up and adjourn

**Homework: Transverse-Plane Torso, Hip, & Femur, Read pages on hip rotation & femoral torsion**

**Tomorrow, bring shorts or stretchy slacks for lab in case any children have to cancel.**

## **DAY SEVEN – SEMINAR & LAB**

- 7:30 Library and TheraTogs adult-sized samples and straps are available, along with coffee, etc.
- 8:30 Transverse-Plane Developmental Changes and Assessments: Torso Hip, & Femur
- 10:00 Break
- 10:30 Transverse-Plane Developmental Changes and Assessments: Knee, Leg & Foot
- 12:00 Lunch - 12:30 Bag lunch videotaped case presentation
- 1:00 Review: Femoral anteversion & antetorsion
- 1:30 **Try-on TheraTogs LAB #2 and #3** – Frontal- & Transverse-Plane Strapping Applications
- 2:30 Break, prepare for next lab
- 3:30 **LAB (on nondisabled children):** Transverse-Plane Assessment Procedures – 2 hours

## **DAY EIGHT- WORKSHOP SESSIONS & LAB - AM**

- 7:30 TheraTogs adult-sized samples and straps are available, along with coffee, etc.
- 8:30 **DEMO:** Videotaped Case Presentation with Review of Findings & Application to Program Planning
- 9:00 **Working Session:** Videotaped Case - In small groups, attendees:
- Sort recorded findings into orthopedic categories
  - Propose targeted management strategies
  - Think of & prioritize five strategies
  - Don TheraTogs garments on a group member, and demonstrate the proposed strapping strategy
  - Explain any proposed staging of the strapping system
- 10:00 Break
- 10:15 Resume Working Session – 30 more minutes to prepare your presentation to the whole group
- 10:45 12-minute presentations led by a spokesperson for each group:  
Present the 5 management strategies, explain their selection, why they were prioritized as they were, and show and explain your strapping plan.

## **DAY EIGHT- WORKSHOP SESSIONS & LIVE CASE PRESENTATION - PM**

- 12:00 Lunch
- 1:00 **LAB: Live Case Presentation** – Attendees take turns assessing an (affable) child with mild to moderate CP (GMFCS Level I or II) until all findings are acquired. Then the child departs, returns tomorrow.
- Graze at will. No formal breaks are scheduled during this long session, though we will take short breaks as needed by our volunteer.*
- 3:30 In groups of  $\leq 4$ , review & sort findings into categories & interventions
- 4:45 Set up for tomorrow's lab, Adjourn
- Homework: For the child we saw this afternoon, determine your 5 most important management strategies, prioritize them, and give one example of each strategy.**

**We start at 8:00AM tomorrow.**

## **½-DAY NINE: SEMINAR & LAB**

- 7:45 Arrive and settle in.
- 8:00 Discuss homework assignment – try to find consensus on top 5 strategies
- 8:30 Yesterday afternoon's child returns – we try 3 top management suggestions (if possible).
- 9:30 SHORT Break
- 9:15 **LAB:** Depending upon lab group size and assistant availability, small groups evaluate a delightful, friendly, adaptable child with CNS dysfunction & innervated muscles, GMFCS Levels I, II, or III. Full musculoskeletal assessment. Try shoe modifications if possible and TheraTogs stages 1 & 2 (at least). 3 hours
- 12:15 Questions and Discussion, complete & turn in evals to receive certificates
- 12:30 Adjourn

*Thank you, and safely home!*

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## Instructor Bio - Beverly (Billi) Cusick, PT, MS

### EDUCATION:

1972 - BS in PT from Bouve College at Northeastern University (Boston) in 1972, summa cum laude.

1988 - MS in Clinical and College Teaching for Allied Health Professionals - University of Kentucky in Lexington.

### WORK EXPERIENCE:

- ◆ 1 year – PT staff at (now) Spaulding Rehabilitation Center, Boston, MA
- ◆ 3 years – PT staff and Director for UCP Center, Lawrence, MA
- ◆ 9 years - PT staff at Children's Rehab. Center (now, Kluge Center), Charlottesville, VA.
- ◆ 3 years - PT Education faculty, College of Health Related Professions at MUSC, Charleston, SC, and Director of PT Services for the Div. Of Developmental Disabilities at MUSC.
- ◆ 1 year, consultant, Cardinal Hill Hospital's Head Trauma & Pediatrics teams – Lexington, KY.
- ◆ 4 years, assisting in the PT Department at Children's Hospital at Stanford, Palo Alto, CA.
- ◆ 24 years in private practice.

### PUBLICATIONS:

- ◆ Help Patients Manage Equinus Deformity. *O&P Business News*, 2011; April: 74-77.
- ◆ Orthotic Management of Low-Toned Children: The Earlier the Better (*Co-author*). *O&P Edge*. 2011; April: 24-29.
- ◆ *Serial Casting and Other Equinus Deformity Management Strategies for Children and Adults with CNS Dysfunction* (2010) by Beverly Cusick, published by GaitWays.
- ◆ *Foot Talk* (2009), a 2-hour lecture on functional foot anatomy and closed chain biomechanics, accompanied by a set of Power Point handouts of the same lecture.
- ◆ *Legs & Feet: A Review of Musculoskeletal Assessments* (1997, revised 2005), an instructional videotape.
- ◆ *Lower Extremity Developmental Features* (2000), a home study monograph for the APTA's Orthopedic Section.
- ◆ *Progressive Casting and Splinting for Lower Extremity Deformity in Children with Neuromotor Dysfunction* (1990), a full-length text.
- ◆ Several earlier editions of serial casting texts, textbook chapters, journal articles, conference proceedings, and professional newsletters.

### CLINICAL TEACHING:

Associate Professor for the Rocky Mountain University of Health Professions – Pediatrics Program – Provo, Utah

Guest lecturer for annual conferences of the APTA, the NDTA, and the American Academy of CP and Developmental Medicine, in the US and Canada; the ISPO Consensus Conference for Orthotics in CP; the British Association of Prosthetists and Orthotists; and the American Academy of Orthotics and Prosthetics.

Instructor of more than 400 courses by invitation only in the USA, Canada, South America, Hong Kong, Singapore, Italy, Australia, New Zealand, The UK, Israel, and India.

Since 1993 Ms. Cusick has been consulting and practicing privately in or near Telluride, Colorado. There, she maintains a private practice, devoting most of her professional effort to generating literature and educational materials, to teaching, and to developing therapeutic products, including her invention, TheraTogs orthotic systems. A curriculum vita is available upon request.