Developmental Orthopedics of the Trunk & Lower-Extremity
A Review of Operating Processes with Implications for Management

LEVEL: INTERMEDIATE – Pre-course readings are assigned.

TARGET AUDIENCE: Rehabilitation team members, including orthotists, physical therapists, occupational therapists, physical medicine and rehabilitation physicians, and pediatric orthopedists.

COURSE DESCRIPTION

This program features an overview of somatosensory function and development, the role of postural control in movement acquisition and physiologic adaptation, skeletal modeling mechanisms and influences, and ideal and pathomechanical features of orthopedic development of the trunk and lower extremity. Normal developmental events are related to:

- The operations of the somatosensory system
- Postural control acquisition and body weight management
- Biomechanical influences of full-term gestation
- Functioning postural and limb joint alignment
- Elements of Sahrmann’s approach to analysis of the Movement System
- The process of physiologic adaptation of bone, soft tissues, and the sensorimotor cortex

Deformity development is discussed in relation to:

- Spasticity
- Ligament laxity
- Premature birth
- Movement strategies in the presence of inadequate postural control and innate righting reactions
- Use history in postural malalignment
- Skeletal modeling errors

Management strategies are related to:

- Body weight distribution onto the functioning base of support
- Functioning joint alignment and related muscle lengths
- Weakness
- Skeletal modeling potential
- Musculoskeletal assessment findings.

Selected musculoskeletal assessments are described and the implications of their findings are brought to therapeutic and orthotic management planning with the goal of optimizing functioning postural alignment and control in order to optimize musculoskeletal and sensorimotor use history. Proposed management strategies include tuned ankle-foot orthoses and TheraTogs™ Orthotic Undergarment and Strapping Systems. The relevance of the findings obtained in the musculoskeletal assessment to target selected interventions is made evident in videotaped cases.
**Course Objectives**

Participants completing this course are expected to be able to:

- Describe these features of normal, postnatal immaturity of skeletal structure and alignment: thoracolumbar kyphosis, hip flexion contracture, increased femoral anteversion, increased femoral antetorsion, coxa valga, genu varum, and medial thigh-foot angle.
- Distinguish between strain and load, and apply this distinction to the skeletal modeling process and to modeling potential in an aging child.
- Discuss the sources and the significance of the achievement of bilateral, symmetrical, antigravity neck and trunk extension by age 4 months.
- Explain the presence of symmetry in supine and prone positions at age 4 months as evidence of fundamental postural control.
- Describe how the normal neonatal hip flexion contracture influences the early modeling of the spine in the sagittal plane.
- Relate ideal, full-term neonatal posture and lower limb joint alignment to postural control acquisition in prone, supine, sitting, and standing positions.
- Relate ideal, full-term neonatal posture and lower limb joint alignment to the acquisition of skilled transitions between quadruped and sitting positions.
- Describe the typical progression from postural control acquisition to movement acquisition in sequential play postures, and relate this progression to neuromotor re-education.
- Relate the achievement of competent weight shifting in the frontal plane to emerging limb use.
- Describe the apparent relationship between postural control status and limb muscle extensibility.
- Give an example of normal massed practice.
- Explain the relationship between frontal-plane weight shift skill, the swing limb torque generator in gait, and long bone torsion reduction in the lower extremities.
- Explain the potential impact of Level 1 (basic) direction-specific postural responses on the development of common contractures in ambulatory children with cerebral palsy and “Idiopathic” toe walking.
- Referring to the active and passive muscle length-tension relationships, describe a muscle imbalance, and differentiate between muscle dominance and muscle strength.
- Differentiate between femoral anteversion and femoral antetorsion, and explain the relevance of the distinction to the safe use of orthotic interventions.
- Explain why measurements of “hip” medial and lateral rotation range of motion (ROM) do not represent hip joint motions.
- Describe the anatomical components of the thigh-foot angle and its typical developmental progression.
- Discuss the rationale and effectiveness of passive manual muscle stretching in terms of Sahrmann’s approach to contracture management.
- Explain the potential somatosensory and therapeutic benefits of optimizing the postural base of support and functioning joint alignments in daily life.
## Developmental Orthopedics - Program Schedule

<table>
<thead>
<tr>
<th>Start</th>
<th>Topic</th>
<th>Contact Hours</th>
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</thead>
<tbody>
<tr>
<td>8:00</td>
<td>Register and settle in</td>
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<tr>
<td>8:30</td>
<td>An Overview of Developmental Changes in the Spine and Lower Extremities</td>
<td>.25</td>
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<tr>
<td>8:45</td>
<td>Strain and Load: Shaping Bones and Joints with Skeletal Modeling Mechanisms</td>
<td>.50</td>
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<tr>
<td>9:15</td>
<td>Proximal Before Distal: The Contributions of Postural Control Acquisition &amp; Maintenance to Orthopedic Development</td>
<td>.75</td>
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<tr>
<td>10:00</td>
<td>Short Break – 15 minutes</td>
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<tr>
<td>10:15</td>
<td>Biomechanical Advantages of Full Term Gestation in Orthopedic Development</td>
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<tr>
<td>10:45</td>
<td>Contributions of Weight Shifting &amp; Walking to Skeletal Modeling</td>
<td>.50</td>
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<tr>
<td>11:15</td>
<td>Measurements of Lower Limb Muscle &amp; Soft-Tissue Extensibility – Evidence of Use History</td>
<td>.75</td>
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<tr>
<td>12:00</td>
<td>Lunch</td>
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<tr>
<td>1:00</td>
<td>Lower Extremity Contracture Development and Management Strategies</td>
<td>.75</td>
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<tr>
<td>1:45</td>
<td>Key Elements of Sahrmann’s Approach to Managing Muscle Imbalances &amp; Movement-Related Modeling Errors</td>
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<tr>
<td>2:30</td>
<td>Short break – 15 minutes</td>
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<tr>
<td>2:45</td>
<td>Clinical Evidence of Femoral Modeling: “Hip” Rotation ROM &amp; the Modified Ryder’s Test for Torsion - Clinical Implications</td>
<td>1.00</td>
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<tr>
<td>3:45</td>
<td>The Knee, Leg, &amp; Foot in the Transverse Plane - Clinical Implications</td>
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<td>4:30</td>
<td>Videotaped Cases</td>
<td>.75</td>
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<tr>
<td>5:15</td>
<td>Questions &amp; Discussion</td>
<td>.25</td>
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<tr>
<td>5:30</td>
<td>Adjourn</td>
<td>Didactic Contact 7.50</td>
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