UNILATERAL SPASTIC CEREBRAL PALSY: GAIT PATTERNS AND SURGICAL MANAGEMENT

Jon R. Davids, MD
Assistant Chief of Orthopaedic Surgery
Director, Motion Analysis Laboratory
Shriners Hospital for Children

Professor and Ben Ali Chair in Pediatric Orthopaedics
Department of Orthopaedic Surgery
University of California Davis Medical School
Sacramento, CA USA
Disclosure Information

The following relationships exist:

- **OrthoPediatrics**
  - Consultant
- **OrthoPediatrics Foundation for Education and Research**
  - Board Member
USCP: Gait Patterns and Surgical Management

- Classification of CP
  - Historical / Critical Overview

- Unilateral Spastic CP (USCP)
  - Definition
  - Common Deviations
  - Management Options
    - Surgical
    - Orthotic
  - “A Tale of 2 Unis”
Classification of CP

• **Definitions**
  - **Classification**: systematic arrangement in groups or categories according to established criteria
    - [https://www.merriam-webster.com/dictionary/classification](https://www.merriam-webster.com/dictionary/classification)

• **Purpose**
  - Incidence/Prevalence
  - Natural History
  - Clinical Decision Making
  - Outcome Assessment
Classification of CP

• **Definitions**
  
  — **Hemiplegia**: total or partial paralysis of one side of the body that results from disease of or injury to the motor centers of the brain
    
    • [https://www.merriam-webster.com/dictionary/hemiplegia](https://www.merriam-webster.com/dictionary/hemiplegia)

• **Causes**
  
  • Normal Brain
    
    — Trauma / Infection / Tumor / Vascular

  • Abnormal Brain Structure
    
    — Neuronal Migration Disorders
Classification of CP

• Definitions
  – **Hemiplegia**: total or partial paralysis of one side of the body that results from disease of or injury to the motor centers of the brain
    • [https://www.merriam-webster.com/dictionary/hemiplegia](https://www.merriam-webster.com/dictionary/hemiplegia)
  – Imprecise Terminology
    • Adult Neurology
  – **Unilateral / Bilateral**
    • More Clinically Relevant
Classification of CP

• Historical
  – Impairment-Based
    • Location of Motor Impairment
      – Topographic (Geographic)
      – Part of Body Affected
    • Type of Motor Impairment
      – Terminology: Adult Neurology
        • Spastic / Dyskinetic / Ataxic
    • Severity of Motor Impairment
      – Subjective / Imprecise
  • CNS Pathoanatomy
    – Autopsy / Imaging
Classification of CP

- **Historical**
  - Function-Based
  - **Gross Motor Function Classification System (GMFCS)**
    - Established
      - Validity / Reliability / Stability
      - Communication
      - Description of Function
      - Prognosis

© Kerr Graham, Bill Reid, and Adrienne Harvey, The Royal Children’s Hospital, Melbourne
Classification of CP

• Critical
  – Topographic
    • Poor Reliability
      – Experienced Observers: 50% Agreement
        • Blair *DMCN 1985*
  • Validity
    – Not Established (+/-)
      • SCPE *DMCN 2000*
Classification of CP

- Critical
  - GMFCS

- Distribution of USCP
  - GMFCS I: 87.8%
  - GMFCS II: 7.1%
  - GMFCS III: 2%
  - GMFCS IV: 3.1%

Gorter Dev Med Child Neurol 46: 461-467, 2004
Classification of CP

- GMFCS
- Neuromuscular Hip Dysplasia
- Relation to Function
  - Incidence
    - GMFC I: 0
    - GMFCS II: 15.1%
    - GMFCS III: 41.3%
    - GMFCS IV: 69.2%
    - GMFCS V: 89.7%

Soo, J Bone Joint Surg Am 2006
Classification of CP

- GMFCS
- Neuromuscular Hip Dysplasia
  - Natural History
    - Progressive Subluxation / Dislocation
    - Function, Pain, Quality of Life
Classification of CP

- GMFCS
- Neuromuscular Hip Dysplasia
  - Surveillance
    - Early Surgery; Salvage

Number Of Surgeries

Hagglund et al. *BJJ* 2014;96-B:1546-52
Classification of USCP

• GMFCS:
• Neuromuscular Hip Dysplasia
  – Surveillance
    • Eliminate Hip Dislocation!

% with Hip Dislocation

Before Surveillance | Surveillance First 10 years | Surveillance 10-20 years

Hagglund et al. *BJJ* 2014;96-B:1546-52
Classification of USCP

- 8+7 Year Old Male
  - CP, Left USCP
  - GMFCS I
  - C/O: Left Toe Walking, Intoeing, Ankle Instability

- PSH
  - None
Classification of USCP

• 8+7 Year Old Male
  - CP, Left USCP
Classification of USCP

- 8+7 Year Old Male
  - CP, Left USCP
- SEMLS
  - Left Medial Hamstring lengthening
  - Left Foot Sequential Medial/Plantar Release
  - Left Split Posterior Tibial Transfer
Classification of USCP

- 9+10 Year Old Male
  - 1 y Post-op
  - Extremely Satisfied, No Complaints
Classification of USCP

- 9+10 Year Old Male
  - 1 y Post-op
  - Extremely Satisfied, No Complaints
Classification of USCP

- 16+10 Year Old Male
  - 7 y Post-op
  - C/o Left Hip Pain With Activity, Sitting
Classification of USCP

16+10 Year Old Male
- 7 y Post-op
- C/o Left Hip Pain With Activity, Sitting
Classification of USCP

- 16+10 Year Old Male
  - 7 y Post-op
  - C/o Left Hip Pain With Activity, Sitting
Classification of USCP

• How / why did I miss this?
• “Comprehensive Assessment”
  – Latest Technology
  – Experienced Clinical Team
• Best Practice Protocols
  – Evidence Based
• From where?
• How utilized?
Classification of USCP

- Critical
  - GMFCS
    - Distribution of USCP
      - GMFCS I: 87.8%
      - GMFCS II: 7.1%
      - GMFCS III: 2%
      - GMFCS IV: 3.1%
    - USCP
      - Ceiling Effect

Gorter Dev Med Child Neurol 46: 461-467, 2004

94.9%
Classification of USCP

- Critical
  - GMFCS
    - Ounpuu *DMCN 2015*
    - Kinematics / TDPs
      - Overlap
        - Between Levels
      - Variability
        - Within Levels
      - Bidirectional
        - All Levels

- Decision Making
  - QGA

*Ounpuu Dev Med Child Neurol 57: 955-962, 2015*
Classification of USCP

- Impairment-Based
  - Gait Patterns
  - Experiential
  - Quantitative
    - Kinematics
    - Kinetics
    - EMG
    - Pedobarography
Classification of USCP

- USCP Gait Patterns
    - Diving Syndrome
    - Birthday Surgery
  - Gait Patterns
    - All Present!
Classification of USCP

- USCP Gait Patterns
  - Winters, Gage, Hicks
  - JBJS 1987
- Experiential
  - Impairment
- Distal to Proximal
- Sagittal Plane
- Kinematics / EMG
- Describe Patterns
Classification of USCP

- USCP Gait Patterns
  - Winters, Gage, Hicks
  - *JBJS 1987*

- Thomas F. Winters Jr, MD
  - UConn Ortho Resident
  - Sports Medicine
  - Orlando FL
Classification of USCP

- USCP Gait Patterns
  - Winters, Gage, Hicks
  - *JBJS 1987*

- Ramona Hicks, PhD
  - PhD in Neuroscience
  - NIH / NINDS
  - TBI
  - National Academies
    - Chief Scientific Officer
    - One Mind
  - Translational Research
  - Neurological / Mental Health Disorders
Classification of USCP

- **Winters, Gage, Hicks (WGH)**
  - Critical
  - McDowell *Gait & Posture* 2008
    - Algorithm
    - 49% Unclassifiable
    - Missed “Mildest” Cases

![Flow diagram illustrating the algorithm used for gait classification.](image)

Classification of USCP

- Winters, Gage, Hicks (WGH)
  - Critical
      - Kinematic Definitions
      - 23% Unclassifiable
      - Missed Sagittal Plane Ankle Patterns
      - Propose WGH 0

*FIGURE 1.* Classified groups on the hemiplegic side and normal values for the pelvis, hip, knee, and ankle joints in 112 patients with spastic hemiplegic CP. Mean values (solid line) and SDs (gray area).

Classification of USCP

• Winters, Gage, Hicks (WGH)
  – Critical
    • Multiple Gait Patterns Within Each WGH Level
      – Agostini Clin Biomech 2015
    • Pelvic Kinematics Not Considered
      – Sagittal / Coronal / Transverse Planes
      – Salazar-Torres GaiPos 2011
Classification of USCP

- **USCP Gait Patterns**
  - Hullin, Robb *JPOB 1996*
  - Experiential
    - Kinetics
      - Ankle Plantarflexor – Knee Extension Couple
      - Sagittal Plane
  - 4 Types
    - Ankle / Knee / Hip Coupling

Classification of USCP

- **USCP Gait Patterns**
  - Sutherland *Clin Orthop Rel Res* 1993
  - Experiential
    - Kinematics / EMG
    - 4 Types
      - Stance / Swing
  - Lin *GaitPos* 2000

- **Kinetic Patterns**
  - Sutherland Classification
Classification of USCP

- **USCP Gait Patterns**
  - Rodda, Graham *Euro J Neurol* 2001
  - Experiential
    - Integrated/Refined Previous Efforts
    - “Apparent” Equinus
    - Rang 1986!
    - Kinematics / Kinetics / EMG

- **Link Pattern to Treatment**
  - Tone
  - Musculoskeletal Surgery
  - Orthotics

Classification of USCP

- **USCP Gait Patterns**
  - **On the Horizon**
    - Szopa *Res Dev Disabl 2014*
    - Kinematics / Pedobarography
    - Index of Asymmetry of Weight Distribution
  - Ipsilateral Overload
    - Similar to Crouch
  - Ipsilateral Underload
    - Similar to Equinus/Jump
  - Dynamic Leg Length
    - Too Long / Short
Classification of USCP

- **USCP Gait Patterns**
  - Experiential
    - Quantitative Data
    - Describe Patterns
  - Frustratingly Subjective
  - Quantitative
    - Statistical Techniques
    - Cluster Analysis
    - Identify Patterns
    - Poor Clinical Utility

Management of USCP

- **USCP Definition**
  - Classification of Gait Deviations
    - Ispilateral / Contralateral Sides

USCP - Right
Management of USCP

- Primary Deficits / Deviations
- Related To Underlying Pathology
  - Spasticity
  - Dyskinesia
  - Motor Control
  - Balance
Management of USCP

- Secondary Deficits / Deviations
- Related To Growth / Development Of The Musculoskeletal System
  - Muscle Contractures
  - Skeletal Malalignment
    - Lever Arm Deficiency
Management of USCP

- Tertiary Deficits / Deviations
- Coping Mechanisms
- Pathologic
  - Harmful / Not Sustainable
- Compensatory
  - Helpful / Sustainable
Management of USCP

• **USCP Definition**
  – Ipsilateral
    • All Deviations
    • Primary / Secondary
  – Contralateral
    • All Deviations
    • Tertiary (Compensatory)**
  }
Management of USCP

- **USCP: Right vs Left**
  - Galli *Res Dev Disabil 2010*
  - TDPs
    - Velocity: R > L
  - Kinematics
    - Deviations: L > R
    - Distal > Proximal
Management of USCP

- **USCP: Uninvolved**
  - Cimolin *Clin Biomech 2015*
    - Invovl vs Uninvol vs TD
    - Uninvolved
      - TDPs: > St, < Sw
      - Stance: Inverted 2nd Rocker (Vault)
      - Stance / Swing: ↑ Hip / Knee Flex
  - Compensations
    - Stability / Clearance / Efficiency
Management of USCP

- **USCP: Common Gait Deviations**
  - Wren *JPO 2005*
    - Topographic
    - Most Common
      - Equinus
      - Stiff Knee
      - Intoeing
      - Increased Knee Flexion
      - Increased Hip Flexion / Internal Rotation
      - Varus

Management of USCP

- **USCP: Common Gait Deviations**
  - Rethlefsen *DMCN 2016*

- **GMFCS I**
  - Intoeing
  - Equinus
  - Increased Knee Flexion
  - Hip Internal Rotation
  - Stiff Knee
  - Anterior Pelvic Tilt

Rethlefsen *Dev Med Child Neurol 59:79-88, 2016*
Management of USCP

- **USCP: Common Gait Deviations**
  - Rethlefsen *DMCN 2016*
  - **GMFCS II**
    - Intoeing
    - Hip Internal Rotation
    - Increased Knee Flexion
    - Stiff Knee
    - Equinus
    - Increased Hip Flexion

Rethlefsen *Dev Med Child Neurol 59:79-88, 2016*
Management of USCP

• USCP: Single Event Multilevel Surgery (SEMLS)
  – Schranz GaiPos 2017
    • GMFCS I: 6 II:8
    • F/u 1, 3-5, 10 Years
    • Gait Profile Score (GPS)
      – Affected Extremity
    • PreOp vs 1 Year
      – Improvement
    • 10 Years
      – Maintained

Schranz Gait&Posture 52:135-139, 2017
Management of USCP

• USCP: Single Event Multilevel Surgery (SEMLS)
  – Schranz GaiPos 2017
    • Index Surgery
      – Soft Tissue: 54
      – Skeletal: 17
    • Second Surgery 5/14 (36%)
      – Soft Tissue: 4
      – Skeletal: 9
  – Comparable to Larger Studies
  • GMFCS (Not Topographical)
Management of USCP

- **USCP: Surgical Decision Making and Techniques**
  - Gait Patterns

![Common Gait Patterns: Spastic Hemiplegia](image)

Management of USCP

• Type 1
  – Ankle/Foot
    • Increased PF Sw
Management of USCP

• Type 1
  – Ankle/Foot
  – Increased PF Sw

• Reprint
  – jdavids@shrinenet.org
## USE OF ORTHOSES IN CP

<table>
<thead>
<tr>
<th>ORTHOTIC</th>
<th>PHYSICAL EXAMINATION</th>
<th>GAIT DEVIATION</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCBL</td>
<td>NL NL NL</td>
<td>Mild, Correctible NL NL NL NL</td>
<td>No Effect On Gait</td>
</tr>
<tr>
<td>SMO</td>
<td>NL NL NL</td>
<td>Mild, Correctible NL NL NL NL</td>
<td>No Effect On Gait</td>
</tr>
<tr>
<td>PLSO</td>
<td>NL NL DF to 5 degrees</td>
<td>Mild, Correctible - HS NL NL + PF</td>
<td>SW Control</td>
</tr>
<tr>
<td>AAFO</td>
<td>NL NL DF to 5 degrees</td>
<td>Mild, Correctible - HS + PF; + KE (mild) NL + PF</td>
<td>Primarily SW Control</td>
</tr>
<tr>
<td>SAFO</td>
<td>NL NL DF to neutral</td>
<td>Moderate, Partially Correctible - HS + PF; + KE or +KF (mild) + PF + PF</td>
<td>ST and SW Control</td>
</tr>
<tr>
<td>FRAFO</td>
<td>EXT ≥ -15 Degrees EXT ≥ -15 Degrees DF to neutral; TFA ≤ 30 Degrees EXT</td>
<td>Moderate, Partially Correctible - HS + DF; + KE; + HF + DF + DF</td>
<td>ST Control for Crouch Gait Pattern</td>
</tr>
</tbody>
</table>
USE OF ORTHOSES IN CP

- POSTERIOR LEAF SPRING ORTHOSIS (PLSO)
- TRIM LINES
  - PLANTAR
  - POSTERIOR CALF
    - NARROW AT ANKLE
- DESIGN THEORY
  - SWING
    - CONTROL ANKLE PL FLEX
  - STANCE
    - ALLOW ANKLE DOR FLEX
USE OF ORTHOSES IN CP

• POSTERIOR LEAF SPRING ORTHOSIS (PLSO)
  – MSW
USE OF ORTHOSES IN CP

• POSTERIOR LEAF SPRING ORTHOSIS (PLSO)
  – IC
Management of USCP

• Type 2A
  – Ankle/Foot
  • True Equinus
USE OF ORTHOSES IN CP

• ARTICULATED ANKLE FOOT ORTHOSIS (AAFO)

• TRIM LINES
  – PLANTAR
  – POSTERIOR CALF
    • CAPTURES MALLEOLI
  – HINGES
    • AT ESTIMATED LEVEL OF ANKLE JOINT CENTER
      – PLASTIC, METAL
Management of USCP

- **Type 2B**
  - Ankle/Foot
    - True Equinus
  - Knee
    - Recurvatum
USE OF ORTHOSES IN CP

• ARTICULATED ANKLE FOOT ORTHOSIS (AAFO)
  – MST
Management of USCP

- **Type 3**
  - Ankle/Foot
    - True Equinus
  - Knee
    - Increased Flexion
Management of USCP

• Type 3
  – SEMLS
    • Ankle/Foot
      – GSR Zone I / II
Management of USCP

- Type 3
  - SEMLS
  - Ankle/Foot
    - GSR Zone I / II
Management of USCP

- Type 3
  - SEMLS
    - Knee
      - MHL +/- RFT/L
Management of USCP

• Medial Hamstring Lengthening (MHL)
  – “Slow” Surgical Lengthening (SSL)
    • Pathoanatomy, Pathophysiology
  – Recession
    • Myotendinous Junction
    • Minimal Acute Lengthening
      – $\Delta$ Popliteal Angle Ignored
        • $\leq$ 30 Degrees
        – No Disruption of Muscle Fibers
Management of USCP

- Medial Hamstring Lengthening
  - “Slow” Surgical Lengthening
    - Pathoanatomy, Pathophysiology
  - Recession
    - Myotendinous Junction
    - Minimal Acute Lengthening
    - Subsequent Gentle Stretching
      - Knee Immobilizer / Positional
      - Serial Stretch Casting
Management of USCP

- **Type 3**
  - SEMLS
    - Knee
      - MHL +/- RFT/L

![Type 3 SEMLS Knee](image)
Management of USCP

- Type 3
  - SEMLS
- Knee
  - MHL +/- RFT/L
- Cruz JPO 2011
  - RFL
- Ellington JPO 2018
- Comparable Outcomes to RFT
Management of USCP

- Type 3
  - SEMLS
  - Knee
    - Moreira JPO 2018

- Hip Power
  - Magnitude / Timing
- Predicts Outcome of RFT

Moreira J Pediatr Orthop 20018, epub
Management of USCP

• Type 4
  – Ankle/Foot
    • True Equinus
  – Knee
    • Increased Flexion
  – Hip
    • Increased Flexion / Internal Rotation
  – Pelvis
    • Increased External Rotation / Upward Obliquity
Management of USCP

• Type 4
  – Ankle/Foot
    • True Equinus
  – Knee
    • Increased Flexion
  – Hip
    • Increased Flexion / Internal Rotation
  – Pelvis
    • Increased External Rotation / Upward Obliquity
Management of USCP

- **Type 4**
  - SEMLS
    - Ankle
      - GSR
    - Knee
      - MHL +/- RFT/L
  - Hip
    - Femoral Rotation Osteotomy
Management of USCP

- Femoral Rotation Osteotomy
- Surgical Technique
  - Proximal
  - Rotation Wires
    - Off Set To Desired Correction
Management of USCP

• Femoral Rotation Osteotomy
• Surgical Technique
  – 6.5 LC DCP Plate
  – Contoured
Management of USCP

- **Type 4**
  - Hip
    - Increased Flexion / Internal Rotation
  - Pelvis
    - Increased External Rotation / Upward Obliquity
- **Outcomes (Multiple Sources)**
  - Improved Pelvic Rotation / Hip Rotation / FPA
USCP: Foot Segmental Malalignments

- **Common Patterns**
  - Equinocavovarus
    - Most Common
  - Equinoplanovalgus
    - Early vs Late

- **Gait Disruption**
  - Pathomechanics

- **Management**
  - Soft Tissue Surgery
  - Skeletal Surgery
USCP:
Foot Segmental Malalignments

- Clinical Decision Making
  - Levels of Deformity

<table>
<thead>
<tr>
<th>Level of Deformity</th>
<th>Pharmacologic/Neurosurgery</th>
<th>Muscle Tendon Surgeries</th>
<th>Skeletal Surgeries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic soft tissue imbalance, no skeletal</td>
<td>Botulinum toxin injection</td>
<td>Face-complete tendon transfers</td>
<td>Not appropriate</td>
</tr>
<tr>
<td>deformities</td>
<td>Selective dorsal rhizotomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intrathecal baclofen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed soft tissue imbalance, no skeletal</td>
<td>Not appropriate as isolated intervention</td>
<td>Serial stretch casting (multiple possible techniques)</td>
<td>Not appropriate</td>
</tr>
<tr>
<td>deformities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed soft tissue imbalance, with skeletal</td>
<td>Not appropriate as isolated intervention</td>
<td>Appropriate in conjunction with skeletal surgery</td>
<td>Osteotomy (multiple possible techniques)</td>
</tr>
<tr>
<td>deformities</td>
<td></td>
<td></td>
<td>Arthrodes</td>
</tr>
</tbody>
</table>

Table 2: Levels of deformity and treatment options
USCP: Foot Segmental Malalignments

- Davids
- Reprints
  - jdavids@shrinenet.org
Management of USCP

• A Tale of 2 Unis
  – Clinical Decision Making
  – Diagnostic Matrix
  – SEMLS
Case #1: 10+7 yo Female, Left CPH
- GMFCS I
- cc: Toe Walking, Limping, Calf/Foot Pain
Tale of 2 USCPs

• Case #2: 10+1 yo Female, Right CPH
  – GMFCS I
  – cc: Toe Walking, Intoeing
Tale of 2 ULSCPs

- Case #1: 10+7 yo Female, Left CPH

- Physical Examination
**Tale of 2 USCPs**

- **Case #2: 10+1 yo Female, Right CPH**
  - Physical Examination

![Clinical Exam Report](image-url)
Tale of 2 USCPs

• Case #1: 10+7 yo Female, **Left** CPH
  – Kinematics
Tale of 2 USCPs

• Case #2: 10+1 yo Female, Right CPH
  – Kinematics
Tale of 2 USCPs

- Case #1: 10+7 yo Female, Left CPH
  - Kinetics
Tale of 2 USCPs

- Case #2: 10+1 yo Female, **Right** CPH
  - Kinetics
Tale of 2 USCPs

- Case #1: 10+7 yo Female, Left CPH
  - EMG
Tale of 2 USCPs

- Case #2: 10+1 yo Female, **Right** CPH
  - EMG
Case #1: 10+7 yo Female, Left CPH

Case #2: 10+1 yo Female, Right CPH

- Observational Gait Analysis
  - Similar

- Physical Examination
  - Similar

- Kinematics, Kinetics, EMG
  - Subtle Differences
Tale of 2 USCPs

- Case #1: 10+7 yo Female, Left CPH
  - Treatment Recommendations
    - Left Ankle Plantarflexor Muscle Lengthening
      - Goal: Improve Foot Contact With Floor
    - Diagnostic Matrix
      - Physical Examination
      - Kinematics
      - EMG
      - Radiographs
Tale of 2 USCPs

- Case #2: 10+1 yo Female, Right CPH
  - Treatment Recommendations
    - Right Medial Hamstring Lengthening
      - Goal: Improve Knee EXT at IC, TSw
    - Diagnostic Matrix
      - Physical Examination
      - Kinematics
      - EMG
    - Right Rectus Femoris Transfer
      - Goal: Improve Knee FLEX in Sw
  - Diagnostic Matrix
    - Kinematics
    - EMG
Case #2: 10+1 yo Female, Right CPH

- Treatment Recommendations
  - Right Gastrocsoleus Lengthening
    - Goal: Improve Foot Contact With Floor
  - Diagnostic Matrix
    - Physical Examination
    - Kinematics
    - Radiographs
  - Right Femoral Rotation Osteotomy
    - Goal: Improve Hip/Pelvic Rotation, Foot Progression Angle
  - Diagnostic Matrix
    - Physical Examination
    - Kinematics
Case #1: 10+7 yo Female, Left CPH
- 1 Year s/p Left TAL
- cc: No Toe Walking, More Stable, No Pain
Tale of 2 USCPs

• Case #2: 11+6 yo Female, **Right** CPH
  – 1 Year s/p Right MHL/RFT, GSR, FRO
  – cc: No Toe Walking, No Intoeing, More Stable
Tale of 2 USCPs

- Case #1: 10+7 yo Female, **Left** CPH
  - Physical Examination

---

<table>
<thead>
<tr>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion (Hips)</td>
<td>SC</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
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<tr>
<td>Extension (hip)</td>
<td>0</td>
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<tr>
<td>Extension (prox)</td>
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<tr>
<td>Abduction (Flex)</td>
<td>55</td>
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<tr>
<td>Abduction (ext)</td>
<td>3</td>
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<tr>
<td>Adduction</td>
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<tr>
<td>Internal Rotation</td>
<td>50</td>
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<tr>
<td>External Rotation</td>
<td>35</td>
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<tr>
<td>Ober Test</td>
<td>NT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KNEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion (top)</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>Flexion (prox)</td>
</tr>
<tr>
<td>Extension Quadriceps</td>
</tr>
<tr>
<td>Extension Lag</td>
</tr>
<tr>
<td>Popliteal Angle (was normal)</td>
</tr>
<tr>
<td>Straight Leg Raise</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>ANKLE</th>
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<tbody>
<tr>
<td>Dorsiflexion (Flex)</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>Dorsiflexion (ext)</td>
</tr>
<tr>
<td>Plantarflexion</td>
</tr>
<tr>
<td>Inversion</td>
</tr>
<tr>
<td>Eversion</td>
</tr>
<tr>
<td>Eversion</td>
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<table>
<thead>
<tr>
<th>STASIS</th>
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<tbody>
<tr>
<td>Adductors</td>
</tr>
<tr>
<td>Hamstrings</td>
</tr>
<tr>
<td>Quadriceps</td>
</tr>
<tr>
<td>Gastrocnemius</td>
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<table>
<thead>
<tr>
<th>CLINICAL</th>
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</thead>
<tbody>
<tr>
<td>Posterior Tibialis</td>
</tr>
<tr>
<td>Ankle</td>
</tr>
<tr>
<td>Unshifted</td>
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<table>
<thead>
<tr>
<th>ELY TEST</th>
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<tbody>
<tr>
<td>Slow</td>
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<tr>
<td>Fast</td>
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<table>
<thead>
<tr>
<th>CONFUSION TEST</th>
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<tbody>
<tr>
<td>Unresisted</td>
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<tr>
<td>Resisted</td>
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<thead>
<tr>
<th>STATIC TRANSVERSE/CORONAL ALIGMENT</th>
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</thead>
<tbody>
<tr>
<td>Femoral Antversion</td>
</tr>
<tr>
<td>Thigh Foot Angle</td>
</tr>
<tr>
<td>Transmalleolar Axis (Ext)</td>
</tr>
<tr>
<td>Transmalleolar Axes (Flex)</td>
</tr>
<tr>
<td>Pelvic Obliquity</td>
</tr>
<tr>
<td>Knee (Coronal)</td>
</tr>
<tr>
<td>Unshifted</td>
</tr>
</tbody>
</table>

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Tale of 2 USCPs

- Case #2: 10+1 yo Female, Right CPH
  - Physical Examination
Tale of 2 USCPs

- Case #1: 10+7 yo Female, **Left** CPH
  - Kinematics
Tale of 2 USCPs

- Case #2: 10+1 yo Female, Right CPH
  - Kinematics
Management of USCP

- **A Tale of 2 Unis**
  - Clinical Decision Making
  - Similar Patients
  - Distinct SEMLS

- **Classifications**
  - Good / Necessary

- **Individualized Assessment: QGA**
  - Best!