Rancho Observational Gait Analysis: The Major Components and A Review of Critical Events

Lite Gait Presenter Series
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Overview

• Introductions
• Webinar Objectives

Review of Normal Gait

This gait series is a fine time to make new friends, learn facts of clinical significance, develop skills of observation, and gain a foundation of knowledge for the future.
GAIT CYCLE

Stance 62%
Swing 38%

Stance
Swing

IC LR MSt TSt PSw ISw MSw TSw

Initial Contact

Loading Response

Initial Contact

Loading Response
Functional Tasks

- Weight Acceptance
- Single Limb Support
- Swing Limb Advancement
Weight Acceptance

Accomplishments:
- Forward progression
- Stability
- Shock absorption

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Single Limb Support

Accomplishments:
- Stability
- Forward progression

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Swing Limb Advancement

Accomplishments:
- Foot clearance
- Limb advancement

Reference Limb
IC/LR
MSt
TSt
PSw
ISw
MSw
TSw

Contralateral Limb
PSw
ISw/MSw
TSw
IC/LR
MSt
MSt
TSt

Swing
Stance

IC
LR
MSt
TSt

Weight Acceptance
Single Limb Support
Swing Limb Advancement

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Motion Analysis

Footswitches

—Mulroy et al., 2003

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Fine Wire EMG

–Mulroy et al., 2003

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Normal Ankle
Joint Motion, Torque Demand & Muscle Action

Normal Knee
Joint Motion, Torque Demand & Muscle Action

Normal Ankle and Normal Knee
Joint Motion

Range of Motion

0 12 31 50 62 75 87 100

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Initial Contact

- 20° flx, 5° fwd rot
- 5° flx
- 0°, STJ 0°
**Initial Contact**

- 20° flx, 5° fwd rot
- 5° flx
- 0°, STJ 0°
- TA, long toe ext

**Loading Response**

- 20° flx, 5° fwd rot
- 15° flx
- 5° PF, STJ 5° ev
- pre-tibials, inv (TA, TP)
Initial Contact

Body Weight

Floor Contact

Loading Response

5° Eversion
Unlocks the Midtarsal Joint

Mid-Stance

• 0°, 0° neutral
• 5° flx
• 5° DF

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RANCHO LOS AMIGOS
Pathokinesiology Service / Physical Therapy Department
Mid-Stance

- 0°, 0° neutral hip abd
- 5° flx
- 5° DF Calf

Terminal Stance

- 20° hypext, 5° bkwd rot
- 5° flx
- 10° DF with heel rise
- 30° MTP ext, STJ 2° ev

Reduced Eversion Increases Stability of the Midtarsal Joint

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Terminal Stance
- 20° hypext, 5° bkwd rot
- 5° flx
- 10° DF with heel rise
- 30° MTP ext, STJ 2° ev
***CALF!!!***
TP, peroneals

Pre-Swing
- 10° hypext, 5° bkwd rot
  Add longus
- 40° flx passive
- 15° PF with heel rise
- 60° MTP ext, STJ 0° pre-tibials

Initial Swing
- 15°, 5° bkwd rot
  hip flexors, add longus
- 60°
- 5° PF, STJ 0° pre-tibials

Mid-Swing
- 25° flx, neutral
  HS start to fire
- 25° flx
- 0°, STJ 0° clear by 1 cm pre-tibials
Terminal Swing
• 20° flx, 5° fwd rot
  HS, hip ext (WA), abd
• 5° flx
  quads
• 0°, STJ 0°
  pre-tibials

Influence of Trailing Limb

Influence of Trailing Limb

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Influence of Trailing Limb

Sproing!

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Terminal Stance
“Trailing Limb”
Pelvis
• 5° backward rotation
Hip
• 20° apparent hyperext
Knee
• 5° flex
Ankle
• 10° DF (heel off)

Terminal Swing
“Reaching Limb”
Pelvis
• 5° forward rotation
Hip
• 20° hip flex
Knee
• 5° flex

Components of Step Length

Critical Events
Joint positions or motions

↓

Task Accomplishments
Forward Progression, Stability, Shock Absorption,
Foot Clearance, Limb Advancement

↓

Functional Tasks
WA, SLS, SLA

Initial Contact
• Heel first contact
  Forward progression
**Loading Response**
- Hip stability
- Controlled knee flexion and ankle plantar flexion
  - Shock absorption
  - Forward progression

**Mid-Stance**
- Controlled tibial advancement
  - Forward progression
  - Stability

**Terminal Stance**
- Controlled ankle dorsiflexion to 10°
- Trailing limb
- Heel rise
  - Forward progression
  - Stability

**Pre-Swing**
- Passive knee flexion to 40°
  - Foot clearance
- Ankle plantar flexion
  - Limb Advancement
Initial Swing
• 15° hip flexion
• 60° knee flexion

Mid-Swing
• Hip flexion to 25°

Terminal Swing
• Knee extension to 5°

Problem Solving Approach
• Problem identification
• Cause identification
• Treatment
Identify Deviations

Remember to link deviations!

Problem Identification

- Identify deviations
- Determine significant deviations
Determine Significant Deviations (Major Problems)

Cause Identification
- Relate to normal
- Consider all possible causes

Causes
- Motor control
- ROM
- Sensation
- Pain

Consider
- Diagnosis
- Other phases
- Evaluation results
Treatment

• Direct treatment to cause
• Assess effectiveness

Flexed Gait Video

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Weight Acceptance

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Causes?

- Motor control
- ROM
- Sensation
- Pain
Extended Gait Video

Weight Acceptance

Single Limb Support

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### Swing Limb Advancement
![Image of a person performing swing limb advancement]

### Causes?
- Motor control
- ROM
- Sensation
- Pain

### Musculoskeletal Evaluation: Brain Injury

**DIAGNOSIS:** Traumatic brain injury, 11 months post injury

<table>
<thead>
<tr>
<th>LEFT LOWER EXTREMIT Y</th>
<th>STRENGTH: MOTOR CONTROL</th>
<th>UPRIGHT CONTROL</th>
<th>ROM</th>
<th>SPASTICITY</th>
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<tbody>
<tr>
<td><strong>HIP:</strong></td>
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<td></td>
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<tr>
<td>Flexion</td>
<td>Synergy</td>
<td>Moderate</td>
<td>5 - 120</td>
<td>Mild</td>
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<tr>
<td>Extension</td>
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<td>Weak</td>
<td>0 - 20</td>
<td>Mild</td>
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<tr>
<td>Abduction</td>
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<td>0 - 30</td>
<td>0</td>
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</tr>
<tr>
<td>Adduction</td>
<td></td>
<td>0 - 20</td>
<td>Mild</td>
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<tr>
<td><strong>KNEE:</strong></td>
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</tr>
<tr>
<td>Flexion</td>
<td></td>
<td>Moderate</td>
<td>0 - 135</td>
<td>Mild</td>
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<tr>
<td>Extension</td>
<td></td>
<td>Strong</td>
<td>0 - 135</td>
<td>Mild</td>
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<tr>
<td><strong>ANKLE:</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Dorsiflexion</td>
<td></td>
<td>Weak</td>
<td>-15</td>
<td>Mild</td>
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<td>Plantar Flexion</td>
<td></td>
<td>Weak</td>
<td>15 - 65</td>
<td>Severe</td>
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<tr>
<td>Inversion</td>
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<td>Weak</td>
<td>0 - 35</td>
<td>Mild</td>
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<tr>
<td>Eversion</td>
<td></td>
<td>0 - 5</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

- Toes: ROM: WNL
- Slight spasticity (L) toe flexors
- Proprioception: Normal at hip, knee, and ankle
- Balance Reactions: Impaired bilaterally
- Velocity: 34% normal

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