Rancho Observational Gait Analysis:

The Major Components and A Review of Critical Events

Lite Gait Presenter Series
November 21, 2013

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Walt Weiss, MPT, NCS, KEMG

Rancho Los Amigos National Rehabilitation Center

Overview

- Introductions
- Webinar Objectives

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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.

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Review of Normal Gait

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GAIT CYCLE

Stance 62%	Swing 38%

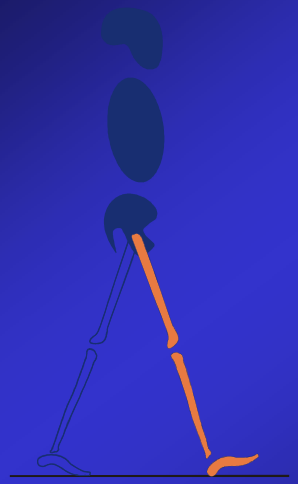
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Stance					Swing		
IC	LR	MSt	TSt	PSw	ISw	MSw	TSw

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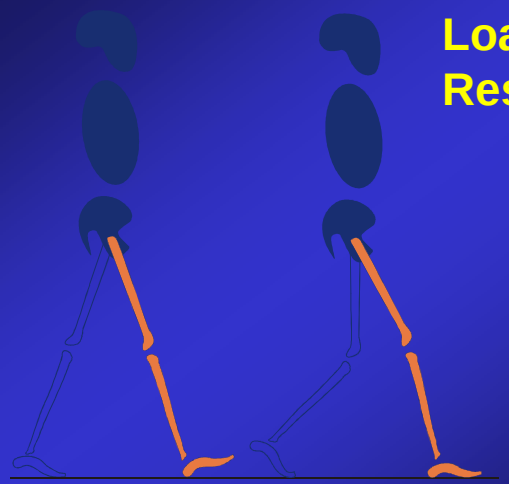
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Initial Contact

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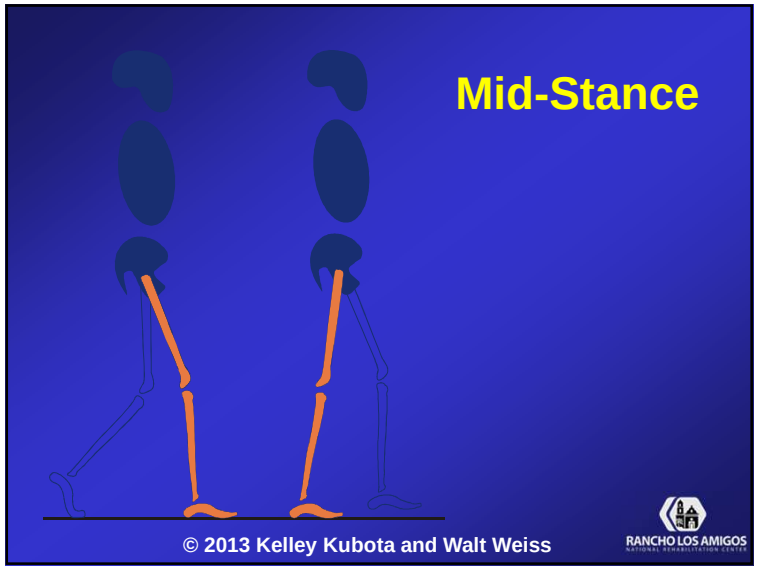


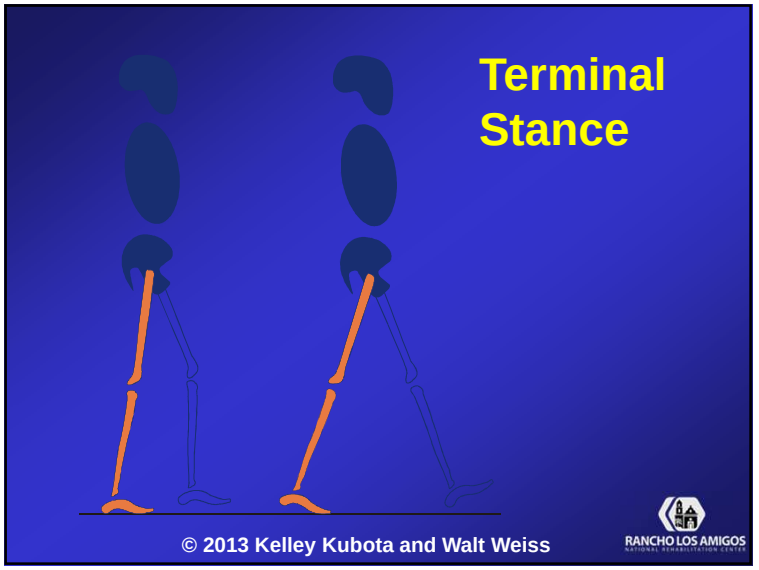
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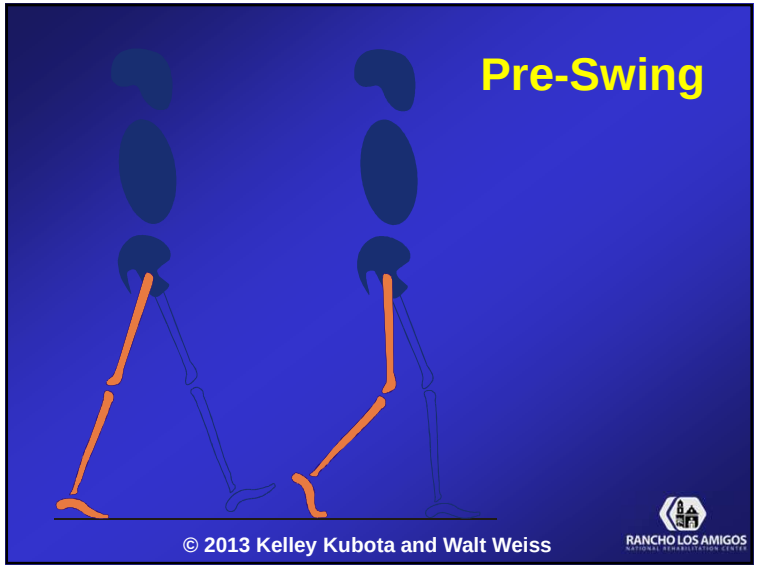
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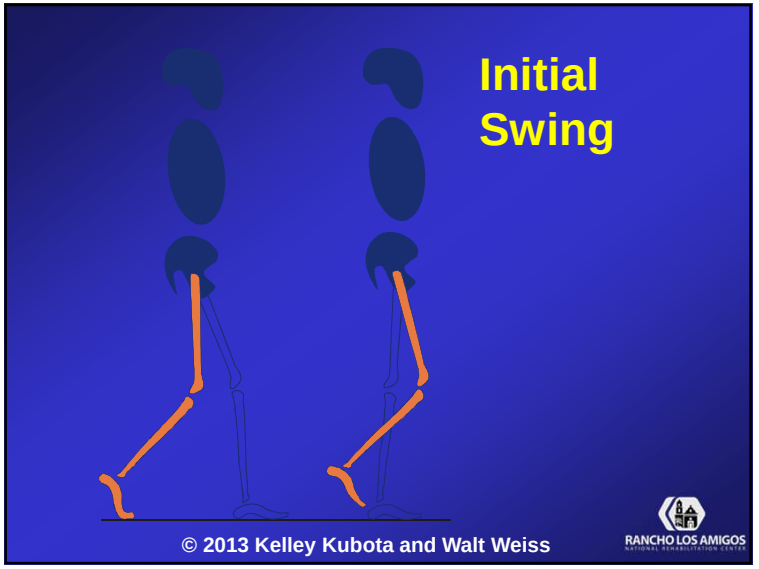
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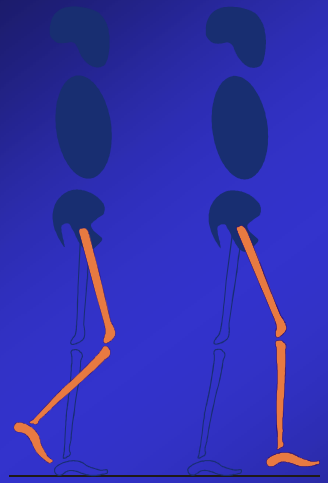






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Mid-Swing



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Terminal Swing



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Normal Gait Video



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Functional Tasks

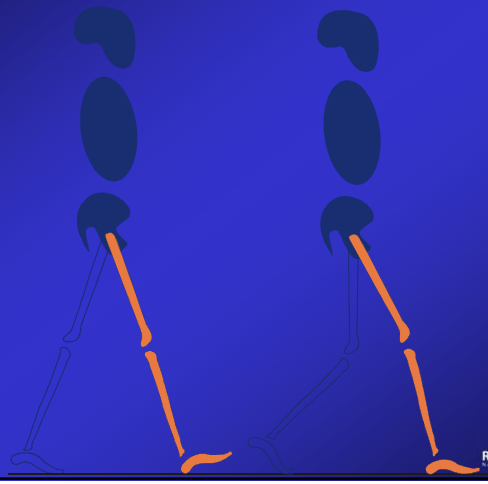
- Weight Acceptance
- Single Limb Support
- Swing Limb Advancement

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Weight Acceptance



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Weight Acceptance

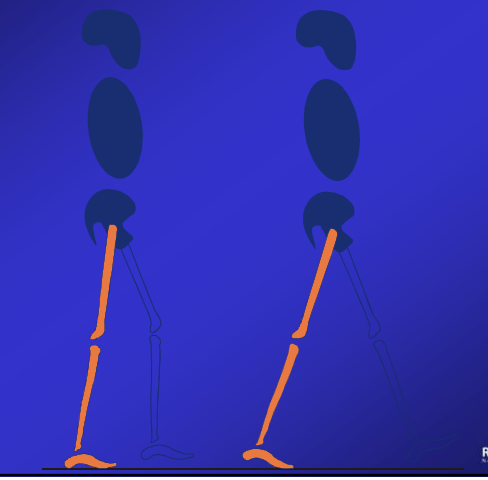
Accomplishments:

- Forward progression
- Stability
- Shock absorption

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Single Limb Support



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Single Limb Support

Accomplishments:

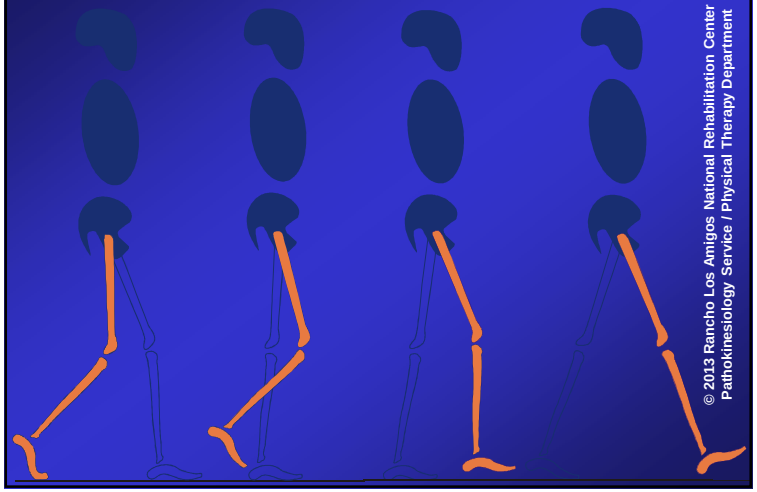
- Stability
- Forward progression

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Swing Limb Advancement



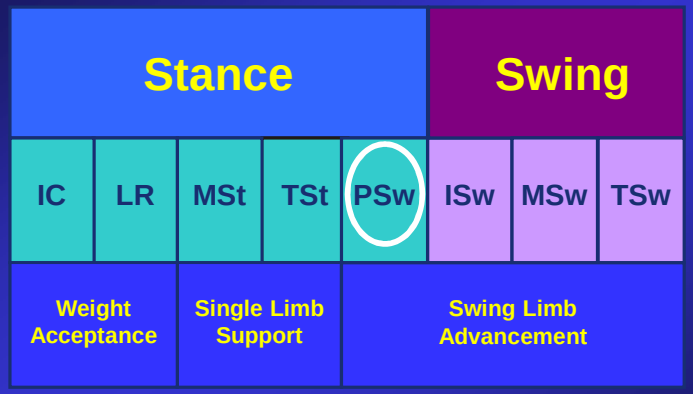
Swing Limb Advancement

Accomplishments:

- Foot clearance
- Limb advancement

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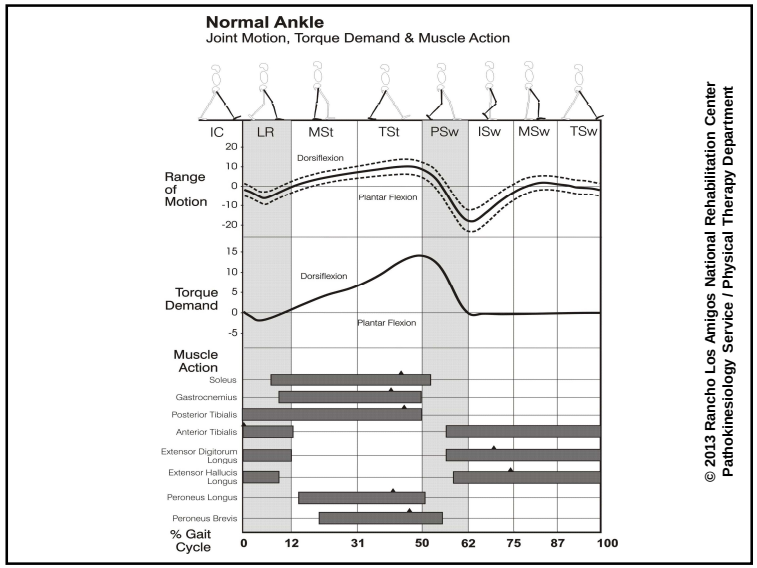
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Reference Limb	Contralateral Limb
IC/LR	PSw
MSt	ISw/MSw
TSt	TSw
PSw	IC/LR
ISw	MSt
MSw	MSt
TSw	TSt

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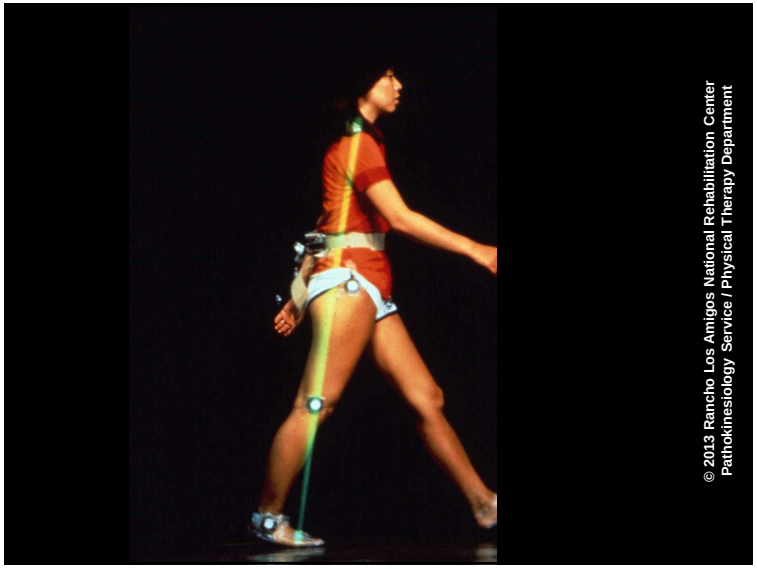
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Fine Wire EMG

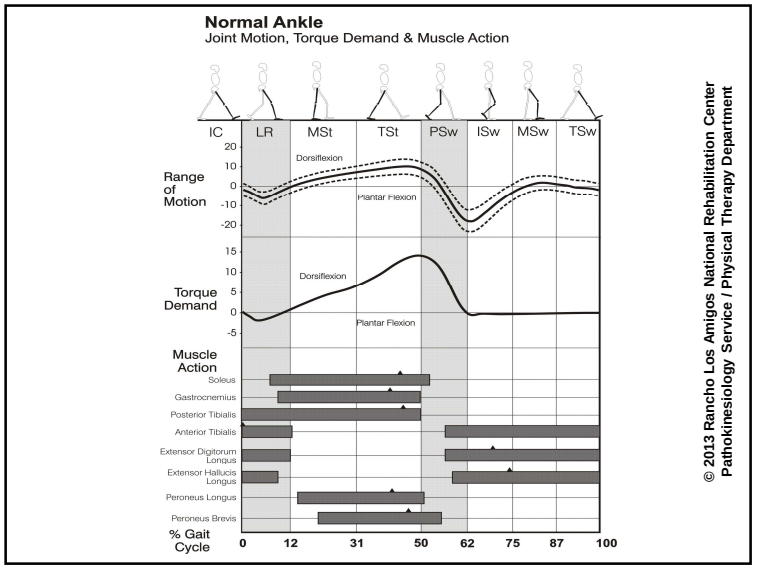


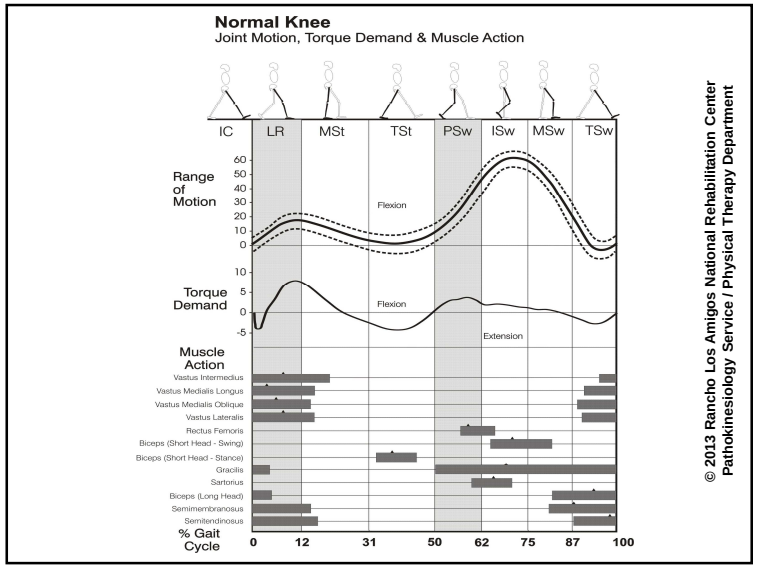


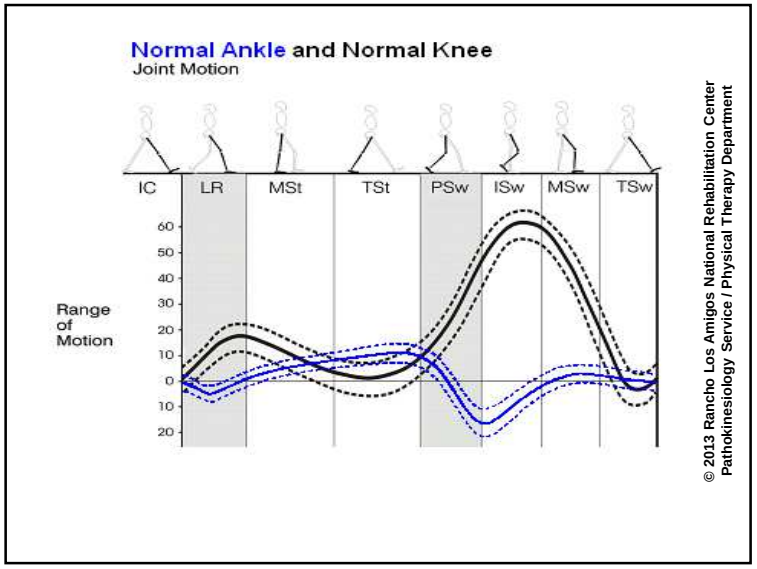
–Mulroy et al., 2003

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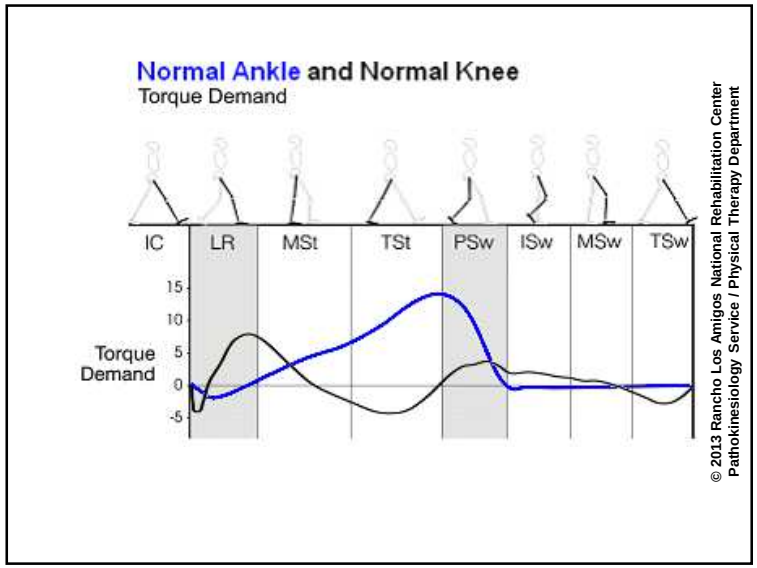
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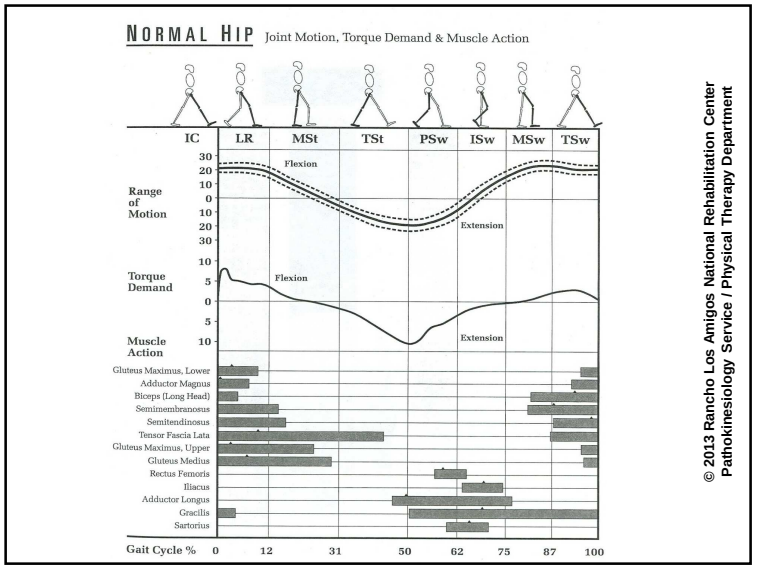


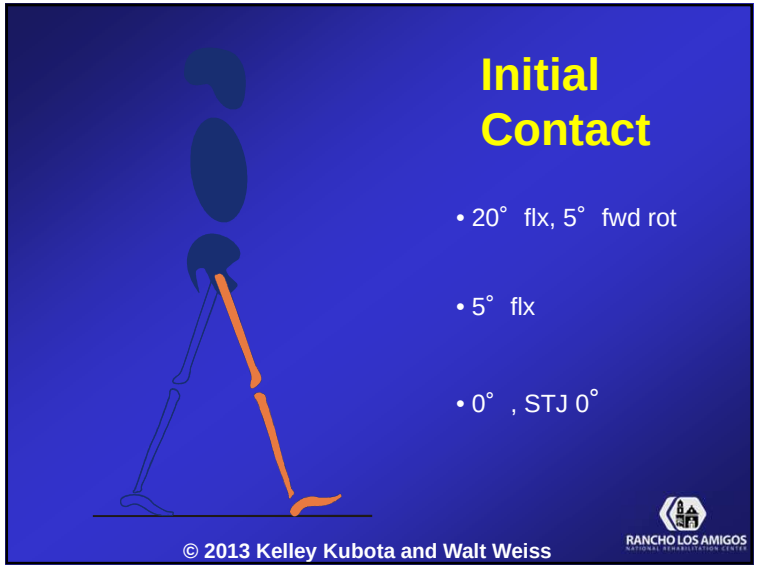




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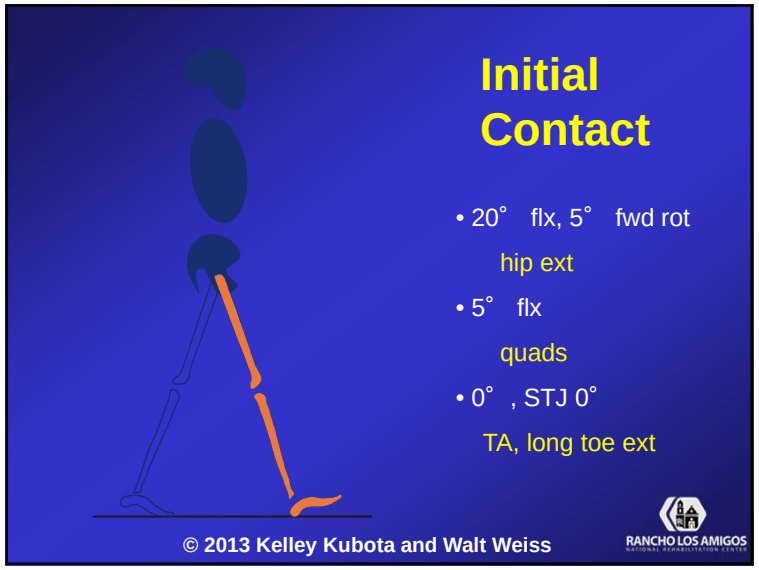


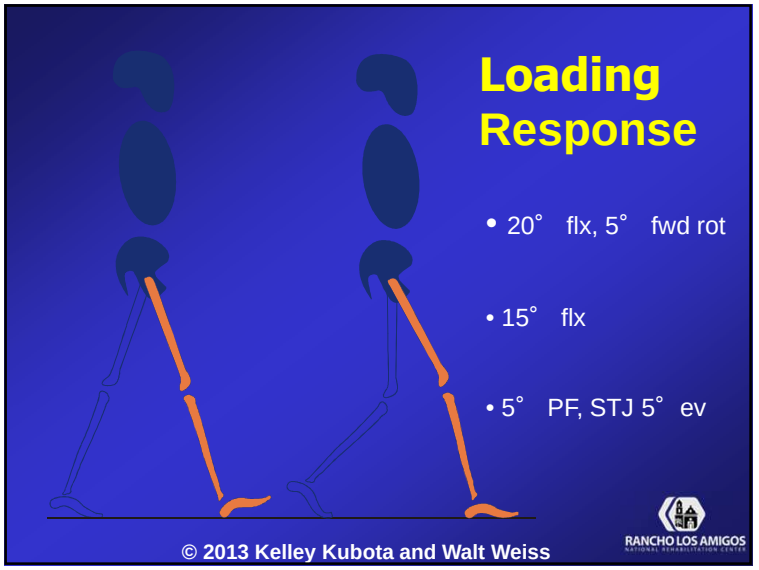


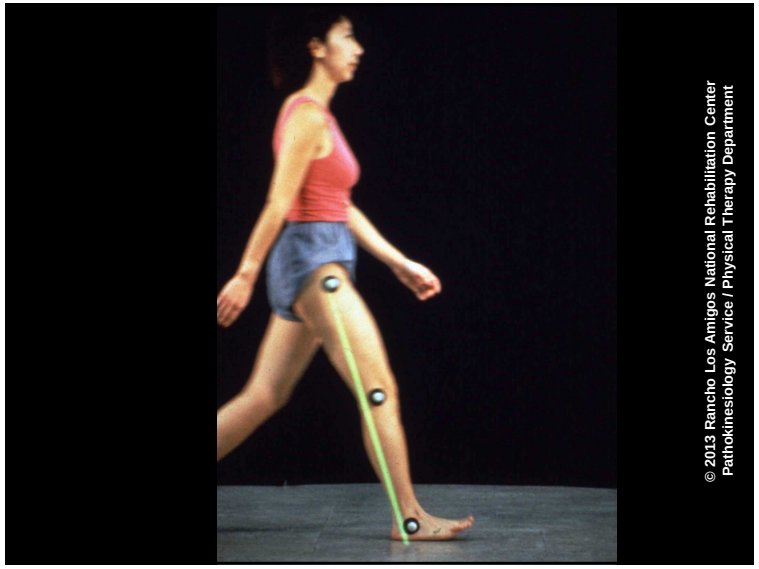


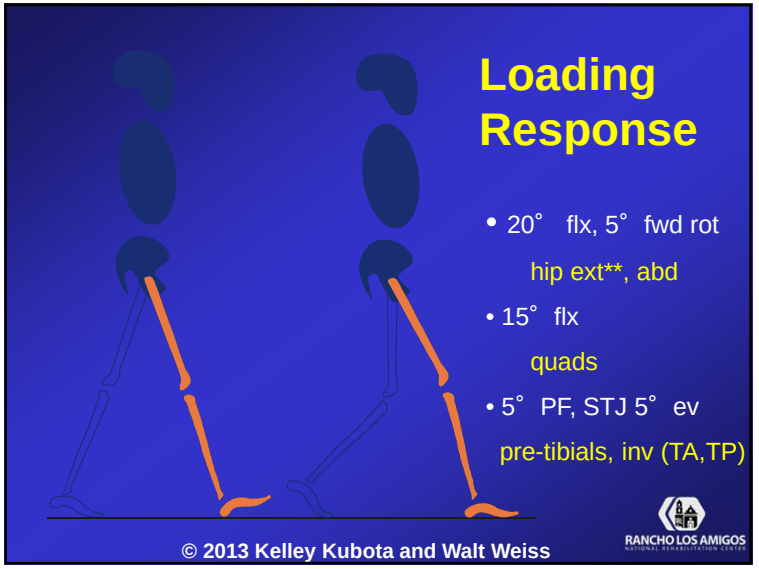


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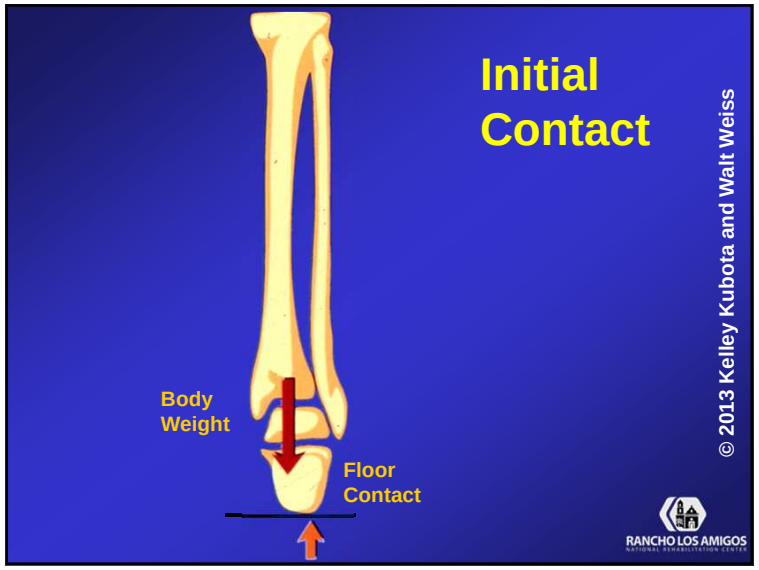


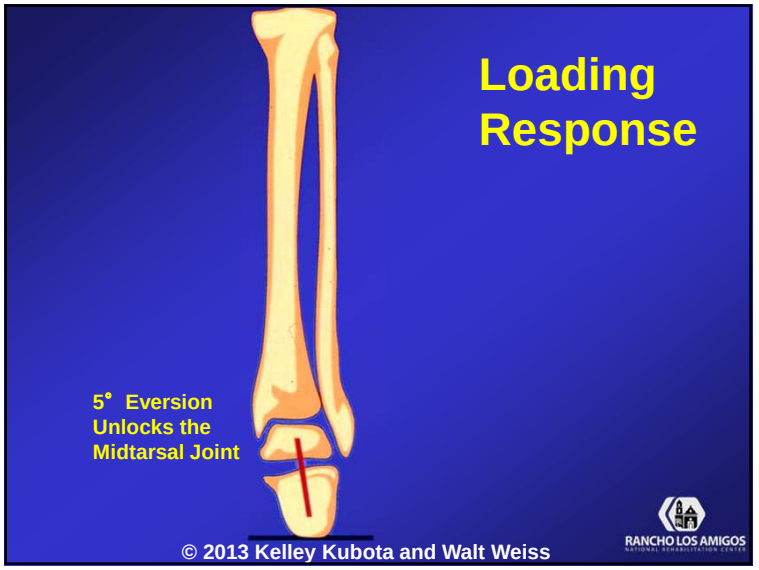


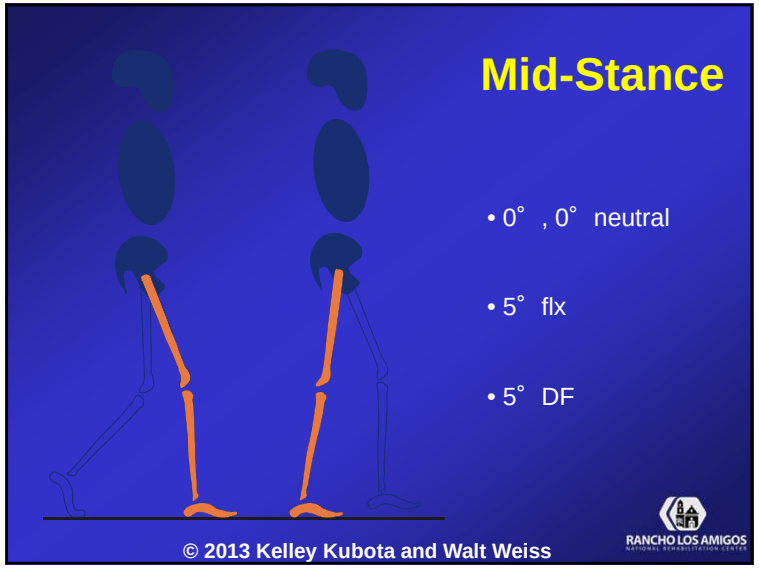




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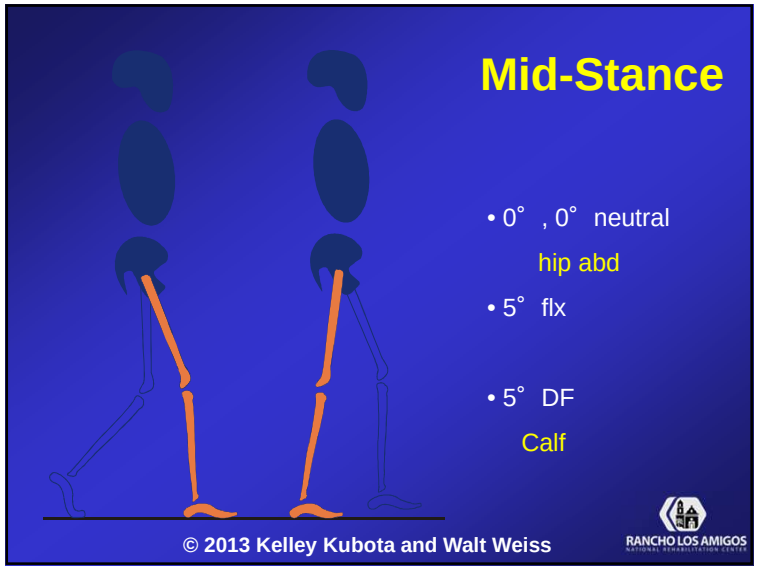


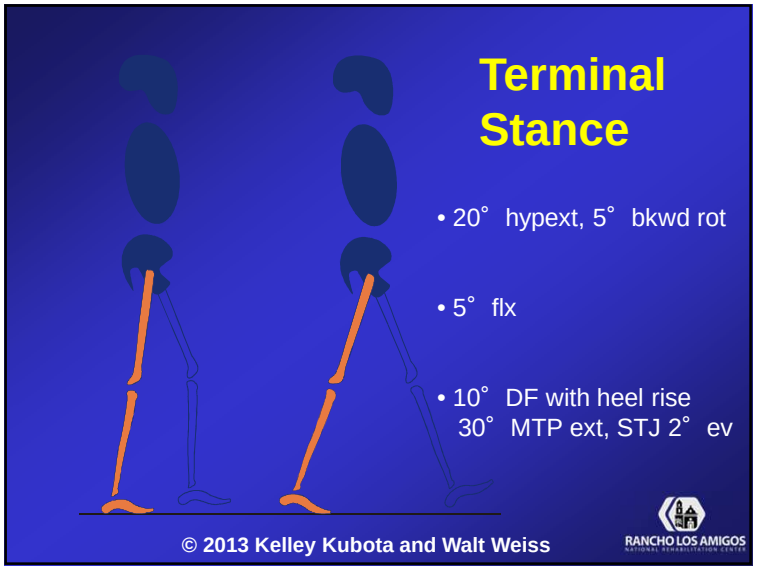


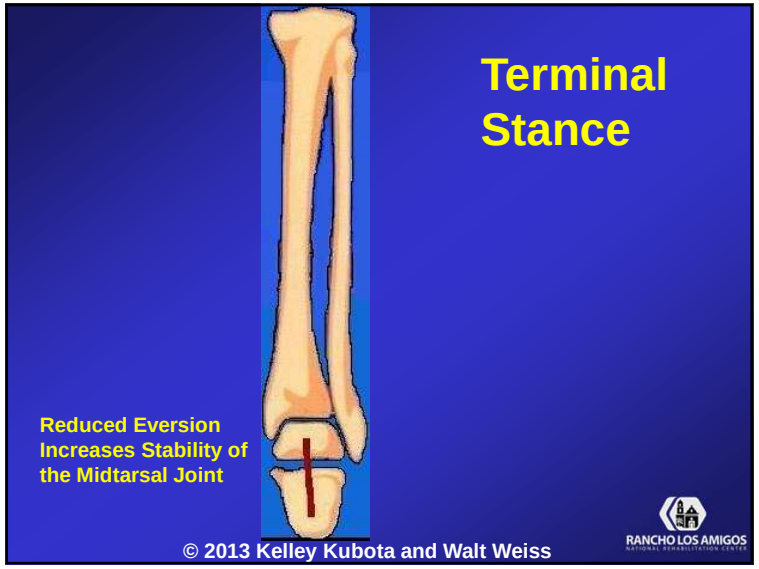


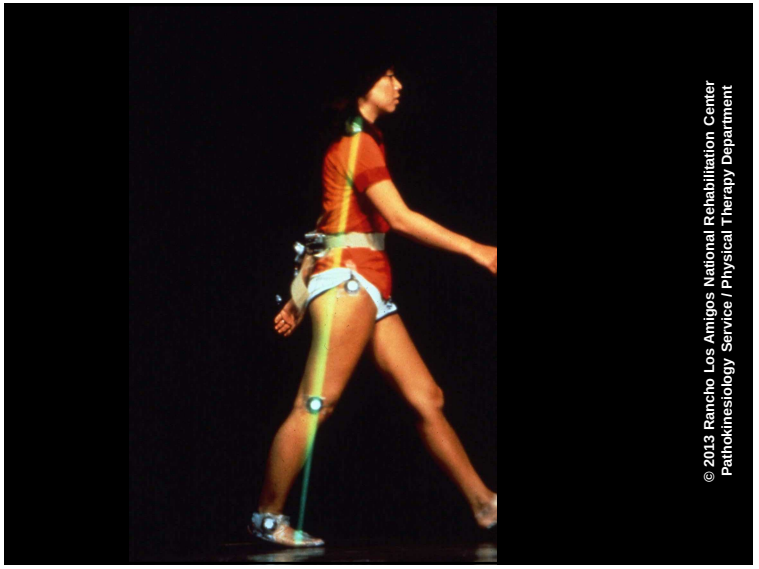


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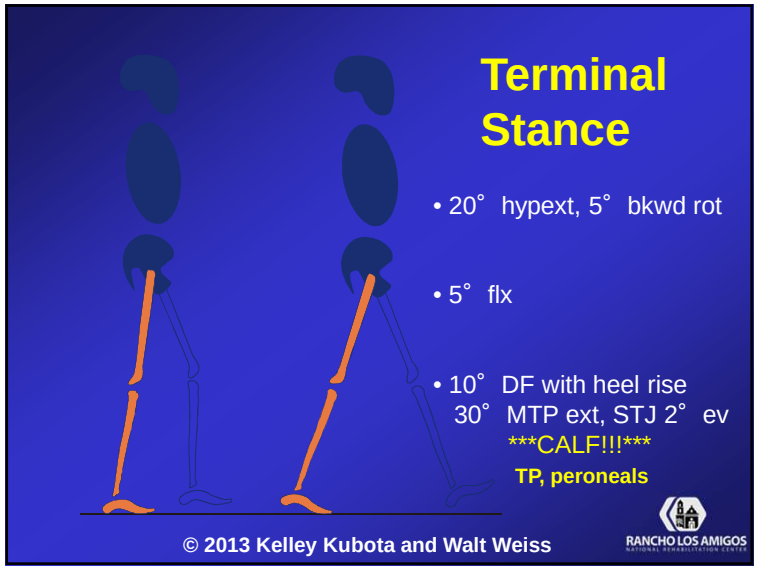


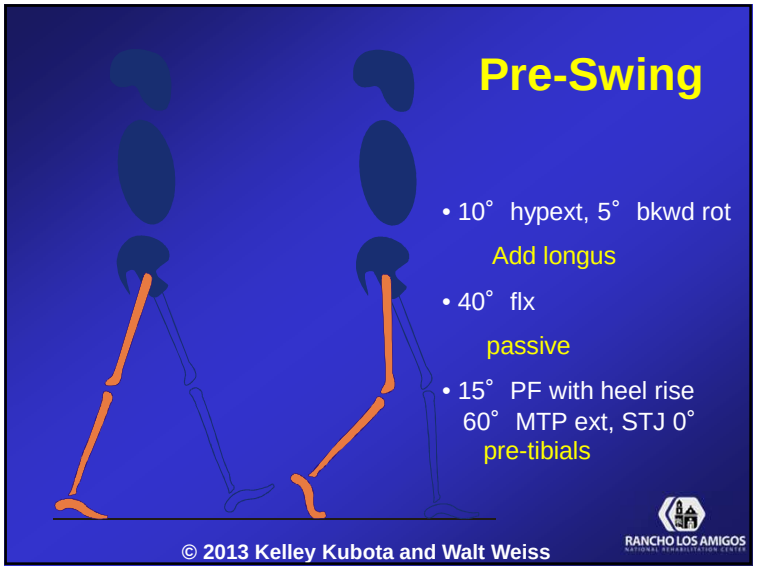


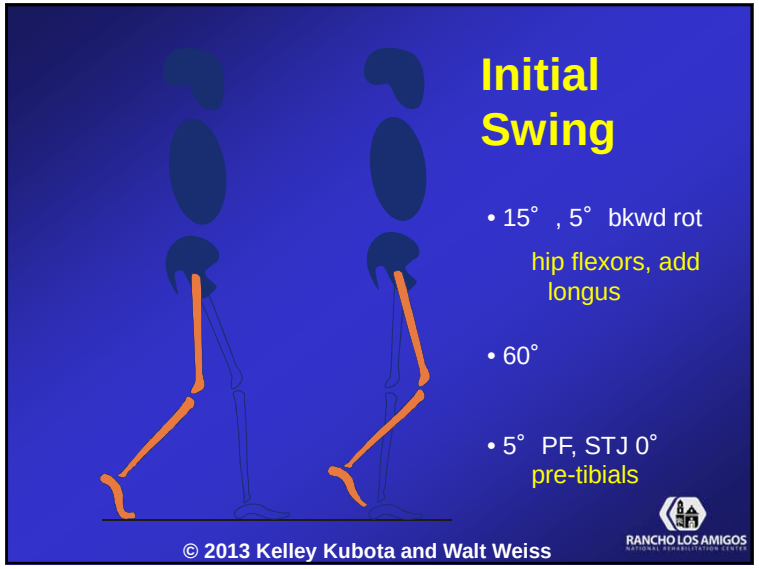


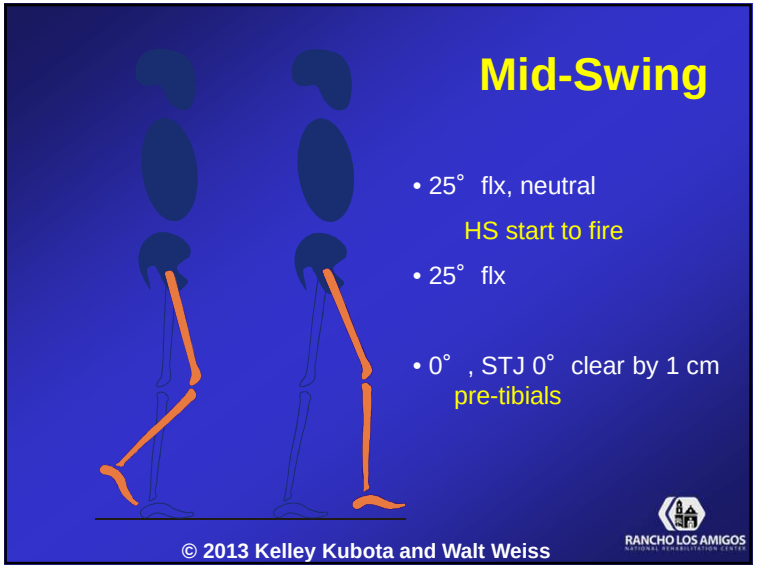


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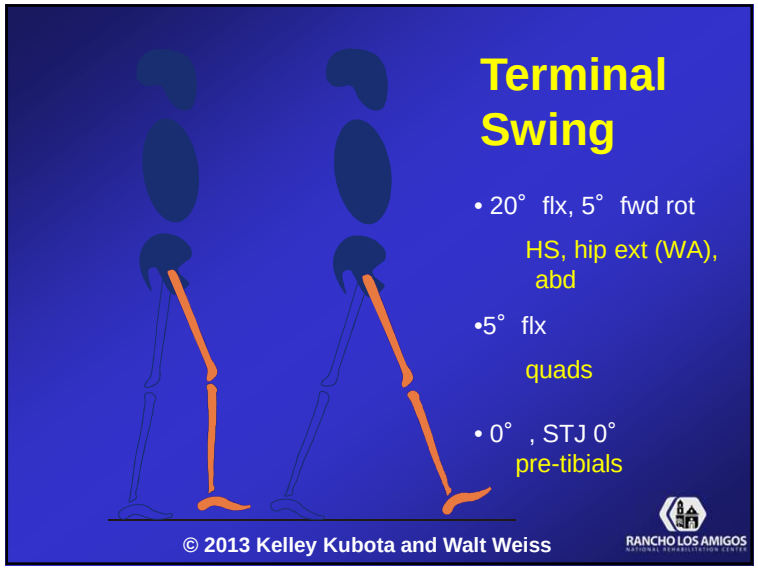




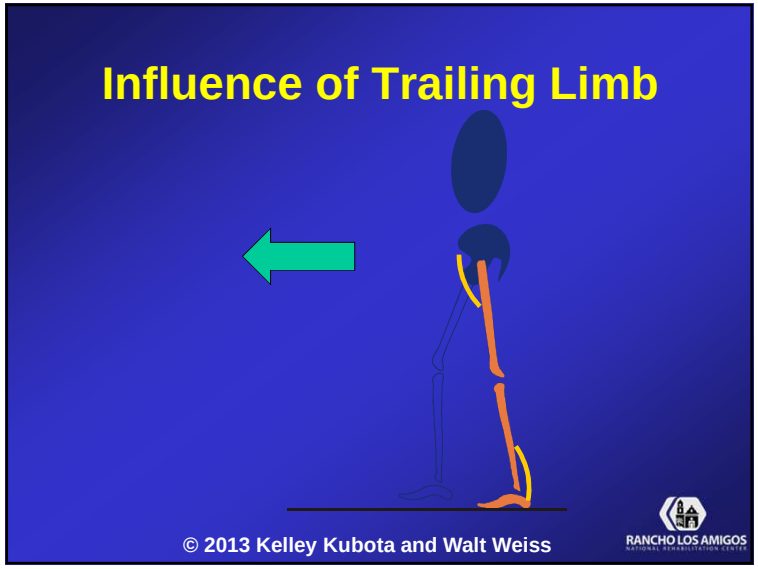


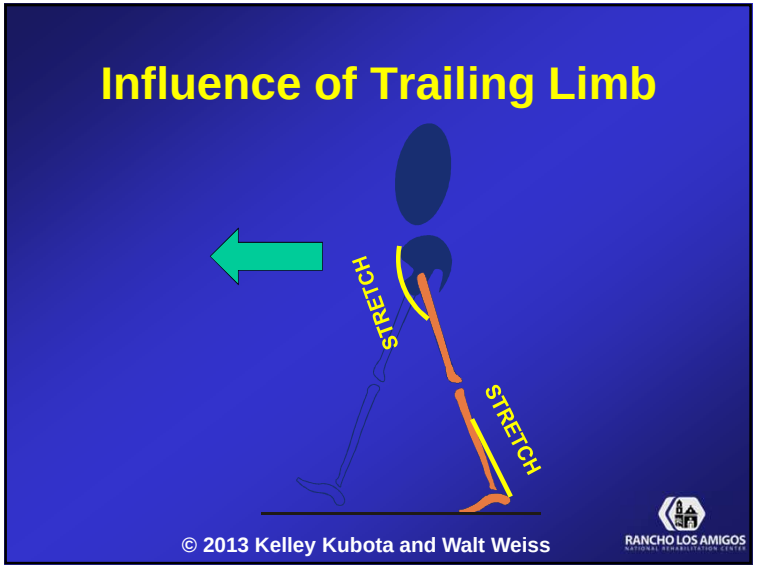


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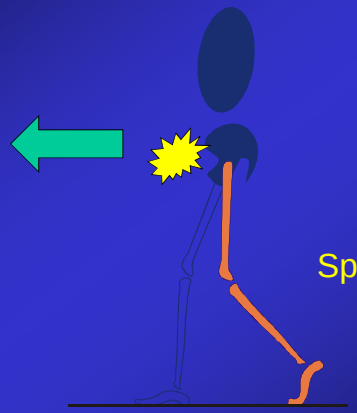






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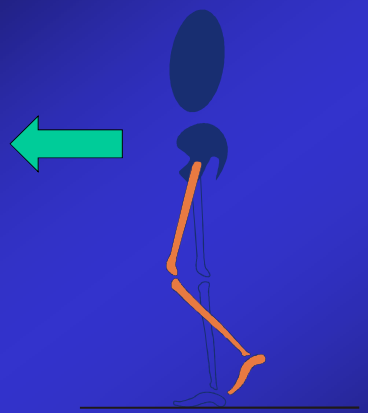
Influence of Trailing Limb



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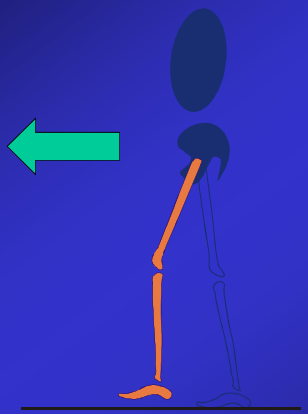
Influence of Trailing Limb



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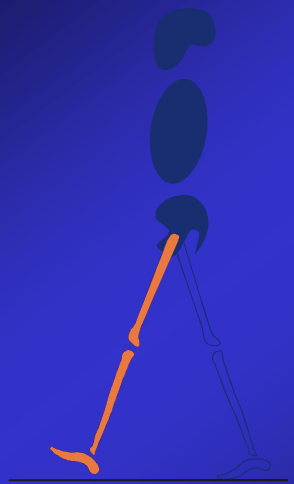
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Influence of Trailing Limb



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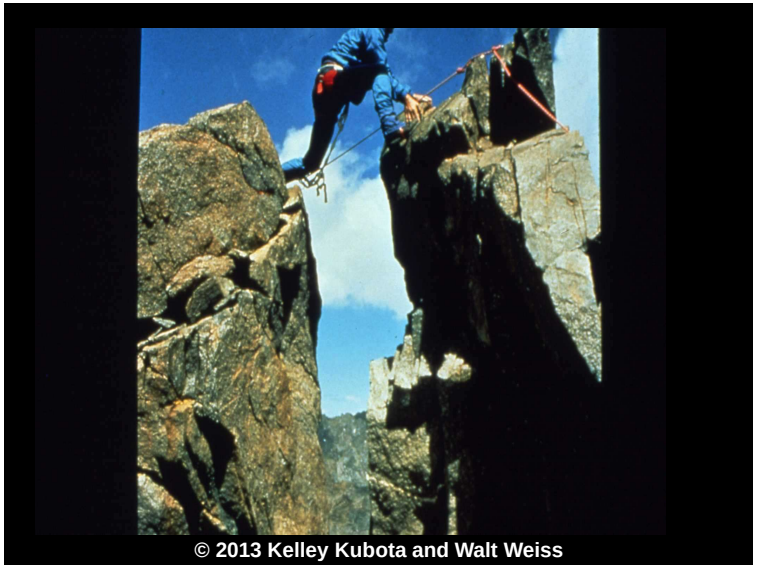
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Components of Step Length

Terminal Stance	Terminal Swing
"Trailing Limb"	"Reaching Limb"
Pelvis	
• 5° backward rotation	• 5° forward rotation
Hip	
• 20° apparent hyperext	• 20° hip flex
Knee	
• 5° flex	• 5° flex
Ankle	
• 10° DF (heel off)	

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Critical Events

Joint positions or motions

↓

Task Accomplishments

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

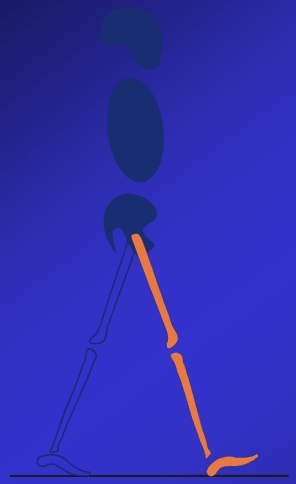
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Functional Tasks

WA, SLS, SLA

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Initial Contact

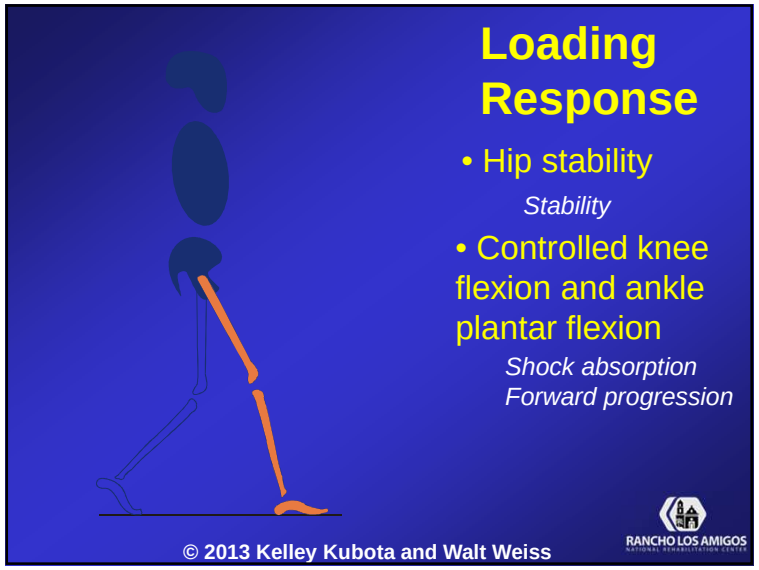
- Heel first contact

Forward progression

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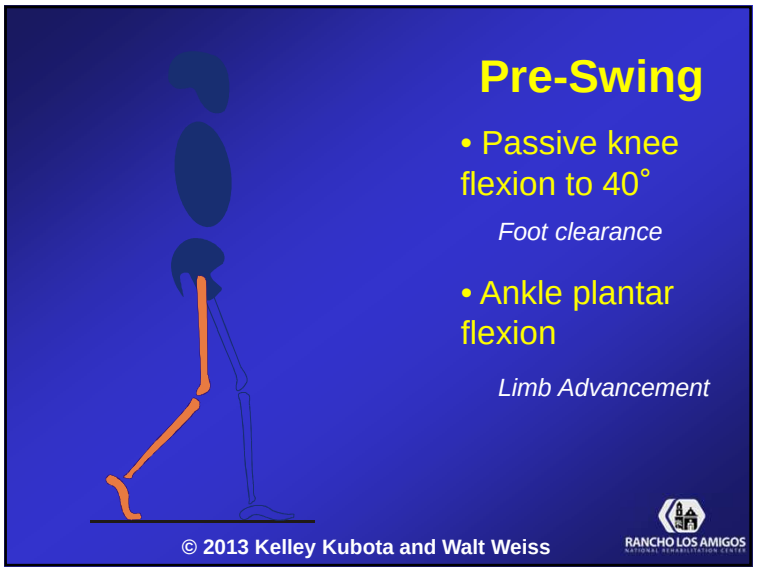
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Initial Swing

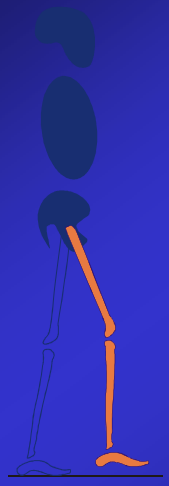
- 15° hip flexion

Limb Advancement

- 60° knee flexion

Foot Clearance

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Mid-Swing

- Hip flexion to 25°

Limb Advancement

- Dorsiflexion to neutral

Foot Clearance

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Terminal Swing

- Knee extension to 5°

Limb Advancement

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Problem Solving Approach

- **Problem identification**
- **Cause identification**
- **Treatment**

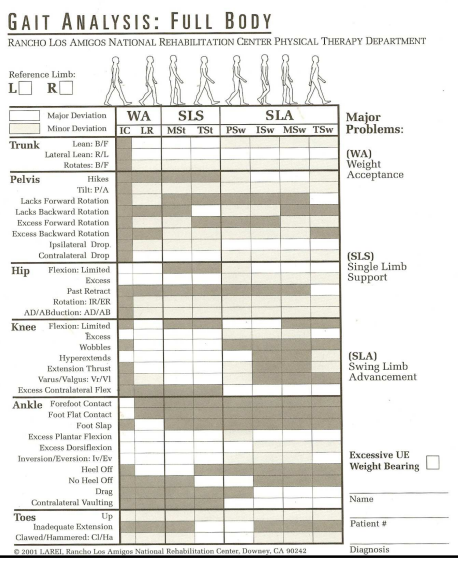
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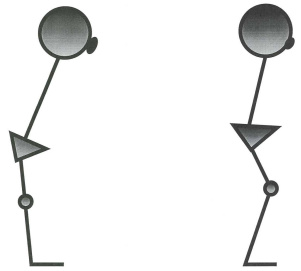
Identify Deviations

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Remember to link deviations!



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Problem Identification

- Identify deviations
- Determine significant deviations

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Determine Significant Deviations (Major Problems)

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Cause Identification

- Relate to normal
- Consider all possible causes

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Causes

- Motor control
- ROM
- Sensation
- Pain

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Consider

- Diagnosis
- Other phases
- Evaluation results

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Treatment

- Direct treatment to cause
- Assess effectiveness

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Flexed Gait Video



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Weight Acceptance





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Single Limb Support




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Swing Limb Advancement






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Causes?

- Motor control
- ROM
- Sensation
- Pain

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Musculoskeletal Evaluation: Spinal Injury

DIAGNOSIS: L4 incomplete paraplegia 2° to herniated disc

HISTORY: 10 yr h/o of back pain

TRUNK: Strength = N ROM = Limited Lumbar Extension

LEFT LOWER EXTREMITY:		STRENGTH	ROM
HIP:	Flexion	4	30 - 120
	Extension	2	
	Abduction	2-	0 – 35
	Adduction	4	0 - 20
KNEE:	Flexion	2	0 - 135
	Extension	5	
ANKLE:	Dorsiflexion	3+	0 - 0
	Plantar Flexion	0	0 - 45
SUBTALAR:	Inversion	0	0 - 20
	Eversion	0	0 - 20

Spasticity: None (Cauda Equina injury)

Sensation: **Tactile:** Absent in lower extremity

Proprioception: Normal: hip & knee Absent: ankle & toes

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Extended Gait Video



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Weight Acceptance





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Single Limb Support





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Swing Limb Advancement



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Causes?

- Motor control
- ROM
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Musculoskeletal Evaluation: Brain Injury

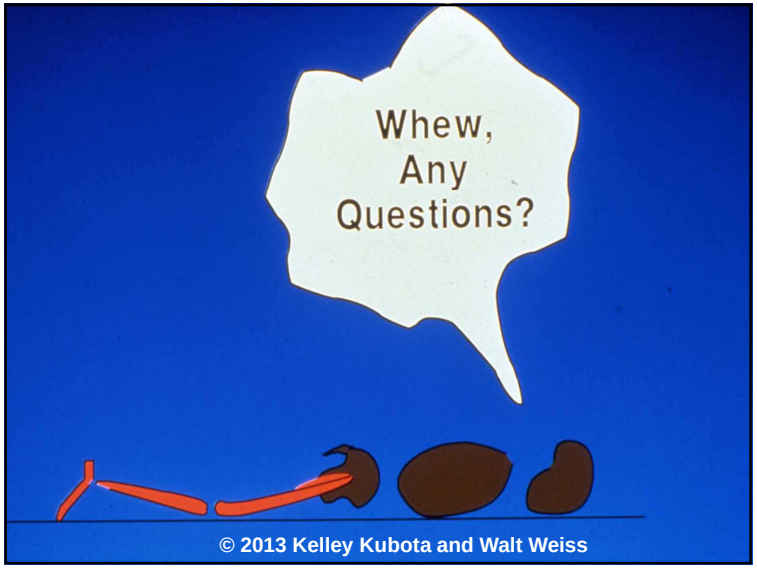
DIAGNOSIS: Traumatic brain injury, 11 months post injury

LEFT LOWER EXTREMITY		STRENGTH/ MOTOR CONTROL	UPRIGHT CONTROL	ROM	SPASTICITY
HIP:	Flexion	Synergy	Moderate	5 - 120	Mild
	Extension		Weak		Mild
	Abduction			0 - 30	0
	Adduction			0 - 20	Mild
KNEE:	Flexion		Moderate	0 - 135	Mild
	Extension		Strong		Mild
ANKLE:	Dorsiflexion		Weak	-15	0
	Plantar Flexion		Weak	15 - 65	Severe
SUBTALAR:	Inversion			0 – 35	Mild
	Eversion			0 - 5	0

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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