

## Rancho Observational Gait Analysis: Maximizing Gait Outcomes through Targeted Interventions for Individuals with Neurologic Impairments

American Physical Therapy Association  
Combined Sections Meeting  
Anaheim, California  
February 16 - 17, 2016

Kelley Kubota, PT, MS, NCS, CBIS  
Walt Weiss, MPT, NCS, KEMG



Rancho Los Amigos National Rehabilitation Center


# Rancho Pathologic Gait



## Ankle / Knee



### RANGE OF MOTION & MUSCLE ACTIVITY



% Gait Cycle	0 - 12	12 - 31	31 - 50	50 - 62	62 - 75	75 - 87	87 - 100
Reference Limb	IC	LR	MS	TS	PSw	ESw	TSw
Opposite Limb	PSw	ESw	MSw	TSw	IC/LR	LR	TS
TRUNK	Erect → Flexion → Extension → Flexion → Extension → Flexion → Extension						
PELVIS	30° Flex Rot → 30° Flex Rot → 0° Flex Rot → 30° Flex Rot → 30° Flex Rot → 30° Flex Rot → 30° Flex Rot						
THIGH VS VERTICAL (DEP)	30° Flex → 30° Flex → 0° Flex → 30° Flex → 30° Flex → 30° Flex → 30° Flex						
KNEE	30° Flex → 30° Flex → 0° Flex → 30° Flex → 30° Flex → 30° Flex → 30° Flex						
ANKLE	0° Plant → 0° Plant → 0° Plant → 0° Plant → 0° Plant → 0° Plant → 0° Plant						
TOES	0° MTP Ext → 0° MTP Ext → 0° MTP Ext → 0° MTP Ext → 0° MTP Ext → 0° MTP Ext → 0° MTP Ext						

©2011 LARIEL, Rancho Los Amigos National Rehabilitation Center, Downey, CA 90242



## Causes

- Motor control
- ROM
- Sensation
- Pain





**GAIT ANALYSIS: FULL BODY**  
RANCHO LOS AMIGOS NATIONAL REHABILITATION CENTER PHYSICAL THERAPY DEPARTMENT

Reference Limbs: L ☐ R ☐

Major Deviation: ☐ Minor Deviation: ☐

Trunk: Lateral Lean: R/L, Rotation: R/L

Pelvis: Hip: Flexion/Extension, Lack Forward Rotation, Lack Backward Rotation, Excess Forward Rotation, Excess Backward Rotation, Spilt/Level: Drop, Contralateral: Drop

Hip: Flexion Limited, Excess, Fast Forward, Rotation: R/L, Adduction: R/L

Knee: Flexion Limited, Excess, Wobble, Hyperextension, Extension Throat, Knee Valgus: V/O, Excess Contralateral Flex

Ankle: Forefoot Contact, Foot Flat Contact, Foot Slip, Excess Plantar Flexion, Excess Dorsiflexion, Inversion/Supination: In/Out, Heel Off, No Heel Off, Drag, Contralateral: Vaulting

Toes: Claw, Inadequate Extension, Clawed/Flattened: Claw

Major Problems: (WA) Weight Acceptance, (SLS) Single Limb Support, (SLA) Swing Limb Advancement

Excessive UE Weight Bearing ☐

Name: \_\_\_\_\_ Patient #: \_\_\_\_\_ Diagnosis: \_\_\_\_\_

© 2001 LARR, Rancho Los Amigos National Rehabilitation Center, Torrance, CA 90502

# Ankle



**ANKLE, FOOT & TOES**

Reference Limbs: L ☐ R ☐

Major Deviation: ☐ Minor Deviation: ☐

Ankle: Forefoot Contact, Foot Flat Contact, Foot Slip, Excess Plantar Flexion, Excess Dorsiflexion, Inversion/Supination: In/Out, Heel Off, No Heel Off, Drag, Contralateral: Vaulting

Toes: Claw, Inadequate Extension, Clawed/Flattened: Claw

MAJOR PROBLEMS: (WA) Weight Acceptance, (SLS) Single Limb Support, (SLA) Swing Limb Advancement

## Excess Plantar Flexion with Knee Extension



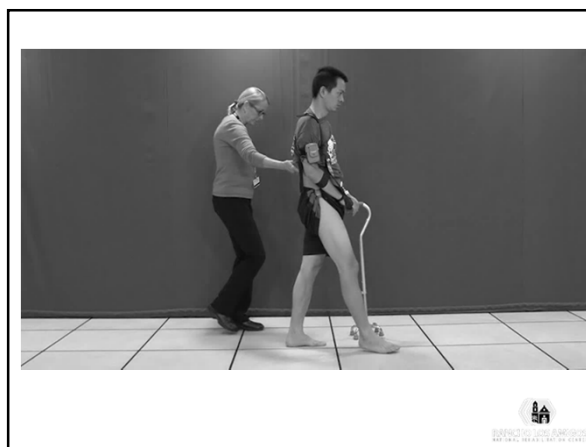
Deviation: Excess Plantar Flexion								
	Weight Acceptance		Single Limb Support		Swing Limb Advancement			
	Shock absorption Fwd progression Stability		Forward progression Stability		Foot clearance Limb advancement			
	IC	LR	MSt	TSSt	PSw	ISw	MSw	TSw
When Significant								
Causes: Motor Control								
ROM								
Pain								
Sensation								

## Excess Dorsiflexion with Knee Flexion





Deviation: Excess Dorsiflexion							
	Weight Acceptance		Single Limb Support		Swing Limb Advancement		
	Shock absorption Fwd progression Stability		Forward progression Stability		Foot clearance Limb advancement		
	IC	LR	MSt	TSt	PSw	ISw	MSw TSw
When Significant							
Causes: Motor Control							
ROM							
Pain							
Sensation							




ANKLE, FOOT & TOES									
Reference Limb L <input type="checkbox"/> R <input type="checkbox"/>		WA		SLS		SLA			
		IC	LR	MSt	TSt	PSw	ISw	MSw	TSw
Ankle		Forefoot Contact							
		Foot Flat Contact							
		Foot Slip							
		Excess Plantar Flexion							
		Excess Dorsiflexion							
		Inversion/Extension: In/Ex							
		Roll Off							
		No Roll Off							
		Drag							
		Contralateral Walks							
Toes		Up							
		Inadequate Extension							
		Closed/Flattened: G/F/B							
MAJOR PROBLEMS:									
(WA) Weight Acceptance									
(SLS) Single Limb Support									
(SLA) Swing Limb Advancement									

Musculoskeletal Evaluation: L Stroke			
DIAGNOSIS: L Frontoparietal AVM Rupture, Hematoma with midline shift			
HISTORY: Unremarkable			
TRUNK: Strength = 4 ROM = WNL			
LEFT LOWER EXTREMITY:	STRENGTH	SELECTIVITY	ROM
HIP:	Flexion	3+	0 - 120
	Extension	3	Selective with P overlay
	Abduction	3	0 - 35
KNEE:	Extension	3+	
ANKLE:	Dorsiflexion	2	0 - 0
	Plantar Flexion	2 (std)	0 - 45
Spasticity: None			
Sensation:			
Tactile: Impaired light touch; intact pinprick			
Proprioception: Impaired: at hip, knee, ankle, and great toe			



# Knee


## RANGE OF MOTION & MUSCLE ACTIVITY



% Gait Cycle	0	0-12	12-31	31-58	58-62	62-73	73-87	87-100
Reference Limb	IC	LR	MSw	TSw	PfSw	ISw	MSw	TSw
Opposite Limb				IC/LR				
TRUNK	Start			Adaptation				
PELVIS				Adaptation				
THIGH VS VERTICAL (HIP)				Adaptation				
KNEE				Adaptation				
ANKLE				Adaptation				
TOES				Adaptation				



## KNEE



Reference Limb	L	R
Major Deviation		
Minor Deviation		
Knee		
Flexion: Limited		
Extension		
Hyperextension		
Extension: Throat		
Varus/Valgus: Varus		
Deviation: Contralateral Flexion		

MAJOR PROBLEMS:

(WA) Weight Acceptance

(SLS) Single Limb Support

(SLA) Swing Limb Advancement

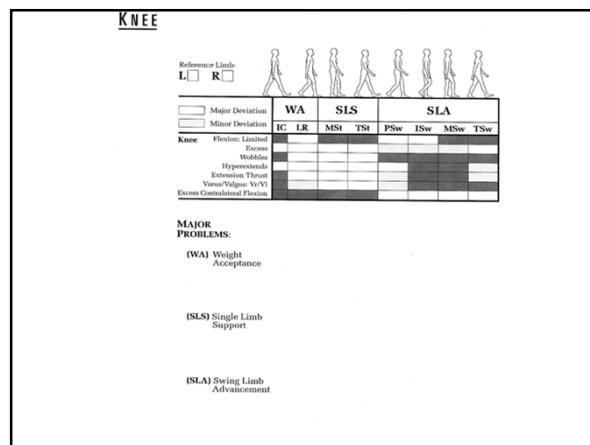
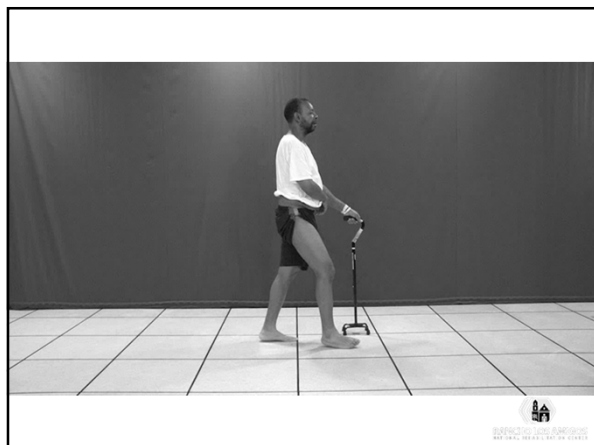
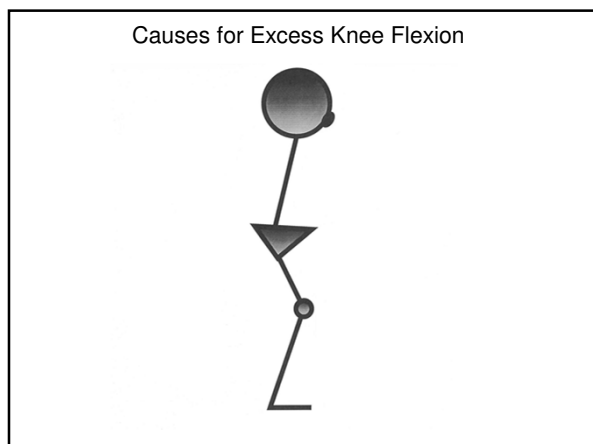
## Hyperextension



## Excess Contralateral Knee Flexion







# Musculoskeletal Evaluation: Brain Injury

DIAGNOSIS: Traumatic brain injury (20 years post), with new CSF leak				
LEFT LOWER EXTREMITY		STRENGTH/ MOTOR CONTROL	ROM	SPASTICITY
HIP:	Flexion	4	0-135	0
	Extension	2+		0
	Abduction	2	0 - 40	0
KNEE:	Extension	3+		Fast ROM (15-20°)
ANKLE:	Dorsiflexion	0	0	0
	Plantar Flexion	0	0 - 45	Fast ROM (20°)
Toes: ROM: WNL				
Spasticity (L) quads, plantar flexors				
<u>Proprioception</u> : Normal at hip, knee, ankle, and great toe				
<u>Balance Reactions</u> : Impaired bilaterally				
<u>Velocity</u> : 52% normal (42.2 m/min)				

