


**TRAMA** TRAMing in Motion Analysis

**Second Course: "Motion Analysis and clinics:  
why to set up a Motion Analysis Lab ?"**  
- *Clinical cases presentation* -

**TRAMA Project**

**January 14 - 17<sup>th</sup> 2008**

Mariana Haro Divin MD  
Mónica Morante Rodríguez MD  
Claudio Rozbaczylo Fuster Ph D  
Instituto de Rehabilitación Infantil Teletón Chile




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**General data**

- ▶ MJAP. 9 years old girl.
- ▶ Myelomeningocele, Hydrocephalus with ventriculo-peritoneal catheter derivation, Arnold Chiari II malformation.
- ▶ Motor neurological level: L3 bilateral (according Sharrard 1964). But partially preserved L4, L5 roots function, better on the left side.
- ▶ Third level Elementary School. Average performance and good social integration with peers.

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**History**

- ▶ Normal pregnancy
- ▶ Prenatal Myelo diagnosis
- ▶ Cesarean delivery at 37<sup>th</sup> gestation week
- ▶ Myelo closure 6 hours post birth
- ▶ Hydrocephalus derivation 5 days post birth

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*History*



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Gait with bilateral solid AFO and walker since 18 months of age

Independent gait with AFOs since 3 years old, until March 2007 when she started to use bilateral crutches

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*Previous treatments*




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**Surgeries**

Right Aquiles tenotomy in November 2001

Right hip varus osteotomy in September 2003

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*Previous treatments*




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**Orthosis**

Solid AFO bilateral

FLSO to control hiperlordosis

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**Teletón** REHABILITACIÓN INFANTIL *Rehabilitation Program*

**Physical Therapy**

- Strengthening exercises
- Gait pattern training
- Pool hydrotherapy

**Occupational therapy**

Appropriate autonomy development in activity of daily living according to age

**Educational aspects**

Early integration to normal school system

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**Teletón** REHABILITACIÓN INFANTIL *Physical Assessment*

**Range of Motion (ROM)**

	Right	Left
Thomas test	5°	0°
Knee ROM	-5°/0°/130°	0°/130°
Ankle ROM:		
-dorsiflexion (FK/EK)	+8°/0°	+12°/+8°
-plantarflexion	45°	55°
Anteversion test	30°	32°
Tibial torsion:		
-thigh-foot angle	+30°	+6°

- Spine: Scoliotic posture and lumbar hyperlordosis partially reversible

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**Teletón** REHABILITACIÓN INFANTIL *Physical Assessment*

**Feet examination**  
weight bearing

	Right	Left
<b>Hindfoot</b>	valgus	mild valgus
<b>Midfoot</b>	pronated, longitudinal arch decreased	mild pronated, longitudinal arch decreased
<b>Forefoot</b>	abducted	mild abducted

Callus on right navicular bone.

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**Teleton** *Physical Assessment*  
REHABILITACIÓN INFANTIL

**Muscle Strength**(Medical Research Council)

Muscle group	Right	Left
Gluteus maximus	2	2
Hamstring (in extension)	2+	3+
Hip Abductors	2	3
Hip adductors	4	4
Hip flexors	3+	4
Knee extensors	5	5
Knee flexors	2+	3+
Ankle dorsiflexors	0	0
Ankle plantarflexors	0	0
Abdominals	4	4

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**Teleton** *XR* AP  
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**Teleton** *XR* LATERAL  
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HIP



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Experimental description



- z Gait analysis
- z Equipment: BTS Elite Clinic (EI 30)
- z Protocol used: Davis Protocol

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		TEMPORAL PARAMETERS							
		RT	LT	RT	LT	RT	LT	RT	LT
Barefoot	STANCE TIME (%)	57.6	45.7	41.9	44.4	39	43.2		
	SWING TIME (%)	42.4	54.3	58.1	45.6	41	56.8		
	DOUBLE SUPP. TIME (%)	11.9	19.9	0	4.4	14.2	18.4		
	STANCE TIME (s)	0.57	0.45	0.73	0.42	0.70	0.79		
	SWING TIME (s)	0.42	0.57	0.49	0.52	0.55	0.46		
	DOUBLE TIME (s)	0.99	1.02	1.19	1.04	1.24	1.25		
		0.940		1.0479		0.776			
With AFO			RT	LT	RT	LT	RT	LT	
	STEP LENGTH (m)	0.382	0.714	0.792	0.846	0.758	0.806		
	VELOCITY (m/s)	0.794	0.688	0.812	0.832	0.698	0.676		
	SWING VELOCITY (m/s)	0.461	1.79	2.129	1.823	1.702	1.8706		
	STRIKE LENGTH (m)	0.088	0.447	0.098	0.408	0.576	0.505		
	STEP PITCH (deg)	0.72	0.137	0.817	0.046	0.698	0.084		
		0.619		0.822		0.687			
AFO & crutches			RT	LT	RT	LT	RT	LT	
	STEP LENGTH (m)	0.382	0.714	0.792	0.846	0.758	0.806		
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		0.619		0.822		0.687			

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# KINEMATIC

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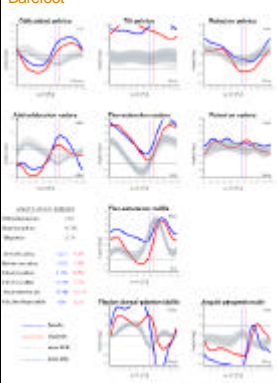
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**Barefoot**



VIDEO

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**With AFO**



VIDEO

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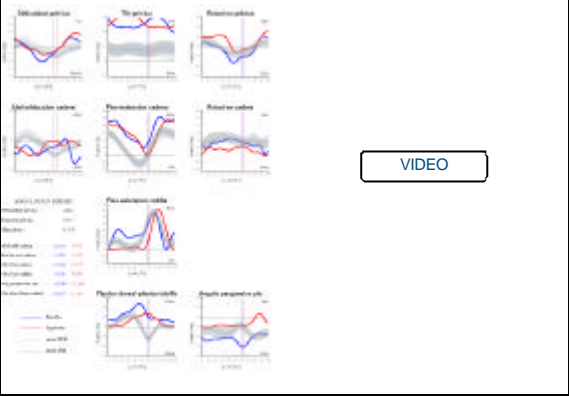
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AFO & crutches




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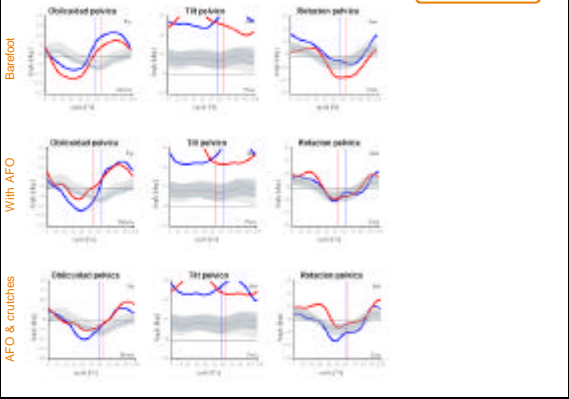
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KINEMATICS

PELVIS




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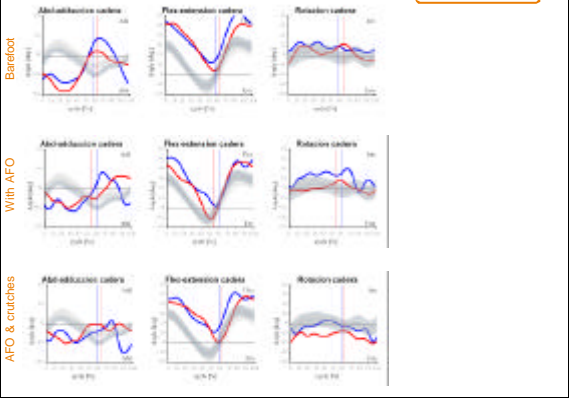
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KINEMATICS

HIP




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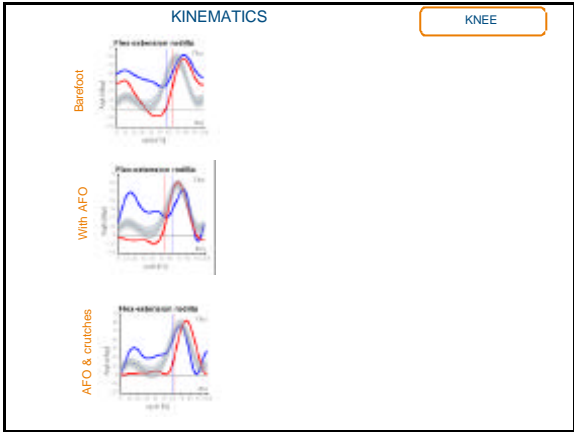
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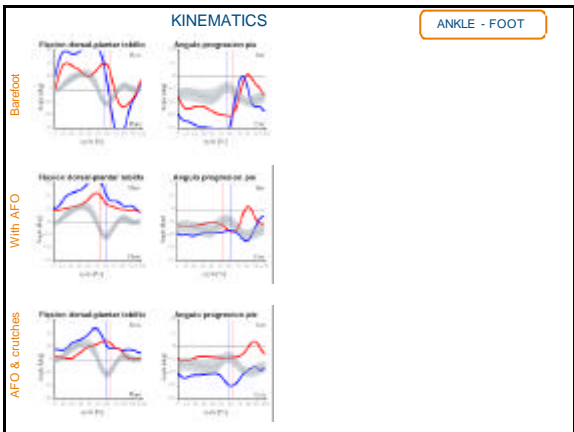
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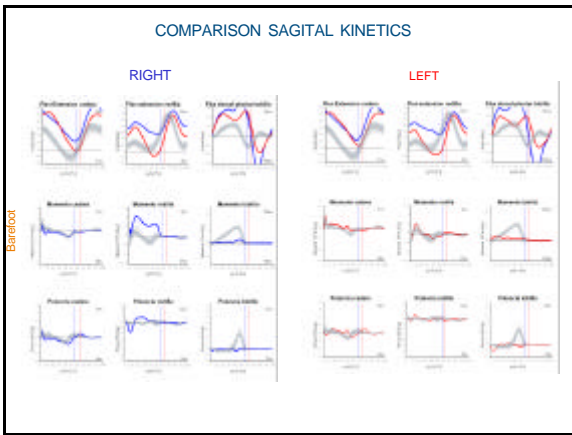
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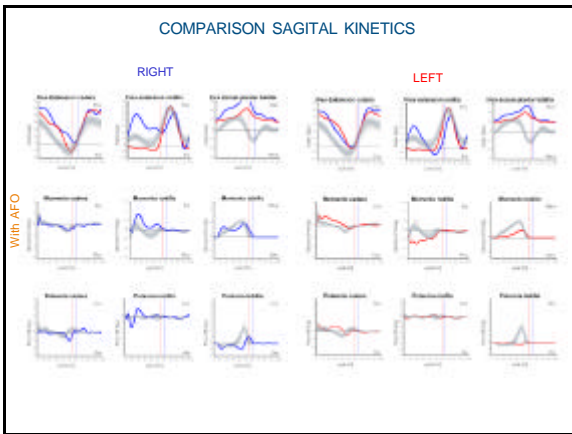
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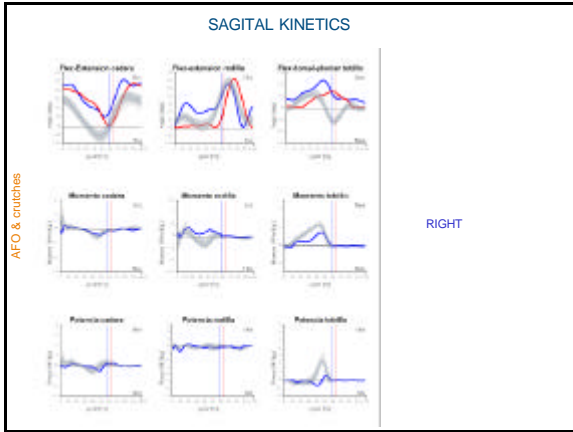
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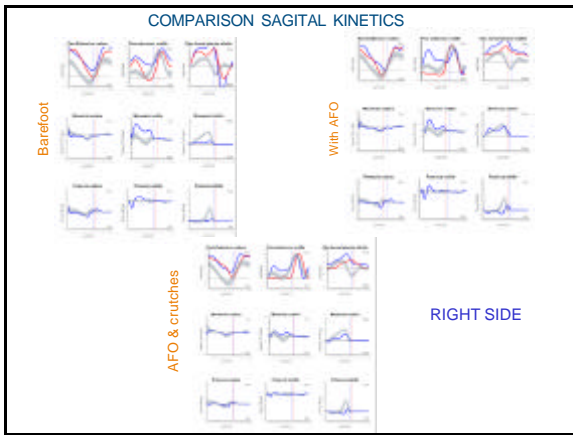
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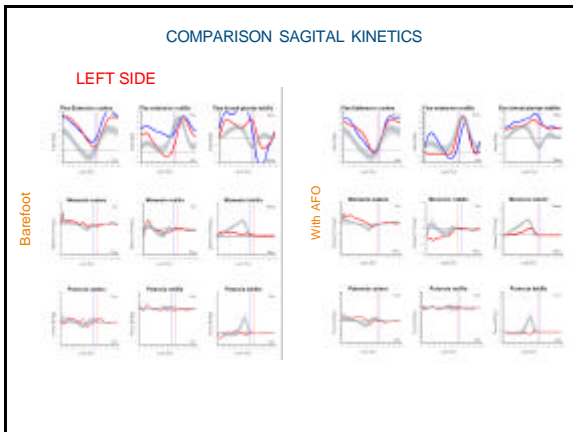
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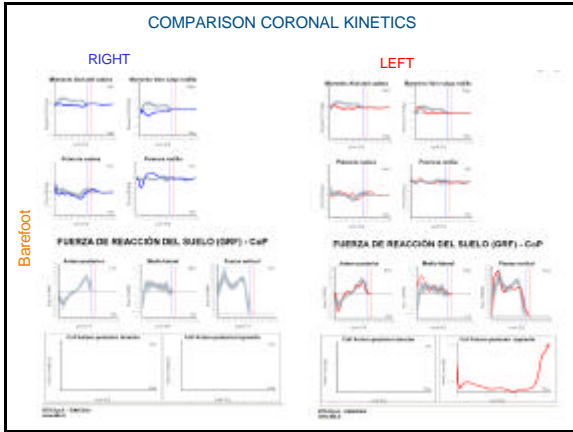
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VIEWER 3D

Barefoot

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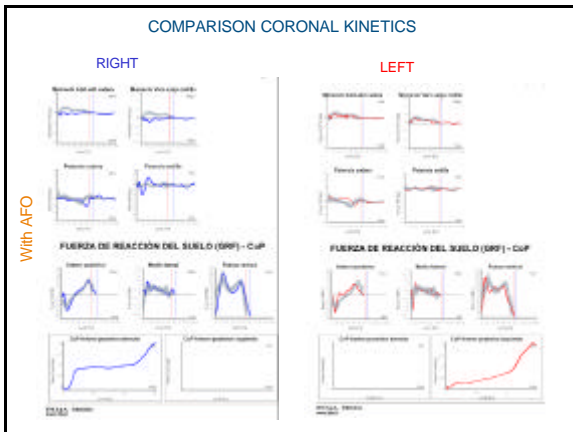
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Teletón  
REHABILITACIÓN INFANTIL

VIEWER 3D

AFO

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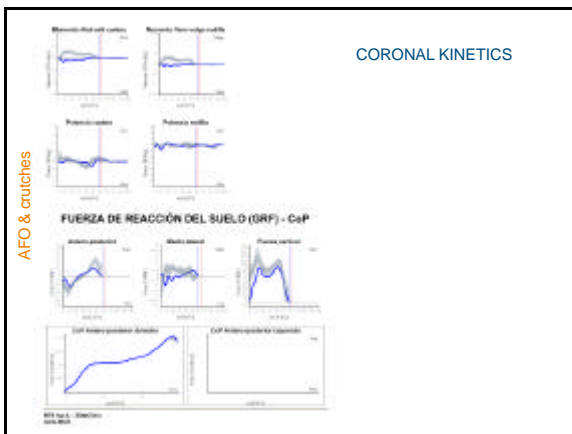
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Teletón  
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VIEWER 3D

AFO & crutches

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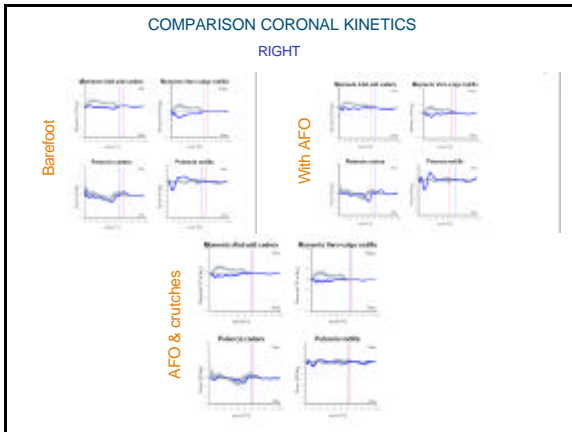
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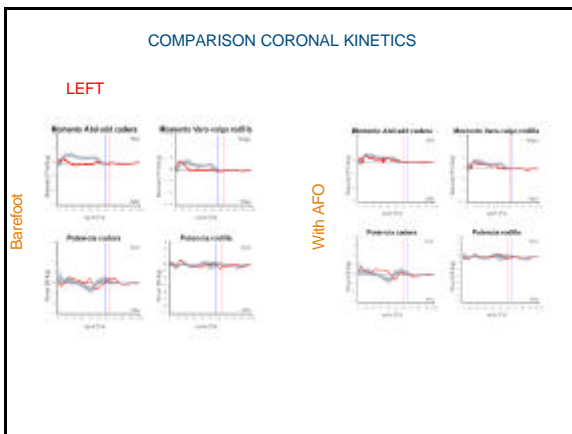
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**Conclusions**





≈Gait pattern according motion lab in our patient is compatible with alterations described in literature for L4-level lesions.

≈In this case, orthoses improve temporal and distance parameters, without reaching normal values. Crutches don't contribute, additional benefits and make gait slower than only orthoses condition.

≈Crutches decrease pelvic range of motion and hip abduction in coronal plane

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*Conclusions*



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∞Orthoses help to control excessive ankle dorsiflexion and improve knee and hip extension in stance. Also they help to control the external foot progression angle through correction of feet valgus

∞AFO restore partially on both sides plantar flexor moment and power generation in terminal stance, not present in barefoot condition

∞Right AFO decrease anterior overload, through control excessive knee flexion and reduction of extensor moment. The use of crutches give additional benefits in both aspects

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*Conclusions*



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∞The AFO fails in controlling adequately ankle dorsiflexion and knee flexion in stance due to increased external tibial torsion

∞On the left there's a deleterus effect over the knee related to AFO configuration

∞On the right knee there's improvement with partial correction on abnormal varus moment through the use of AFO with limited benefits additioning crutches probably related with external tibial torsion

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*Conclusions*



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∞On the left knee the use of AFO restore the normal valgus moment

∞Platform configuration is a fundamental aspect to obtain all information needed (kinetics)

∞Trunk kinematics is an important aspect to analyze according to the influence over lower limbs redirecting forces which is used to compensate muscle weakness during gait in patients with Myelodisplasia

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 **Telethon**  
REABILITACION INFANTIL

*Conclusions*

There's no big doubts related to the use of AFO but....  
Is it really necessary the use of crutches in this patient?  
Differents points of view....

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