

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

**TRAMA Project**

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

Susana Lillo Sarno  
Instituto de Rehabilitación Infantil Teletón Chile

---

---

---

---

---

---

---

---

**Teletón**  
REHABILITACIÓN INFANTIL

Instituto de Rehabilitación  
Infantil Teletón Chile

- A non profit Institution, founded in 1947 in Santiago Chile
- Rehabilitation of people with motor disabilities up to the age of 20
- SCI and others acquires pathologies upper age limit: 24 years
- From 1978 it began to grow due to large, annual, televised fund raising events known as TELETON Campaigns
- 2001 ORITEL was founded
- 10 Institutes around the country
  - 26.210 patients throughout the country
  - 2.500 new patients each year
  - 707.994 consultations in 2007
  - U.S. \$ 15.000.000

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project - January 14 - 17<sup>th</sup> 2008

---

---

---

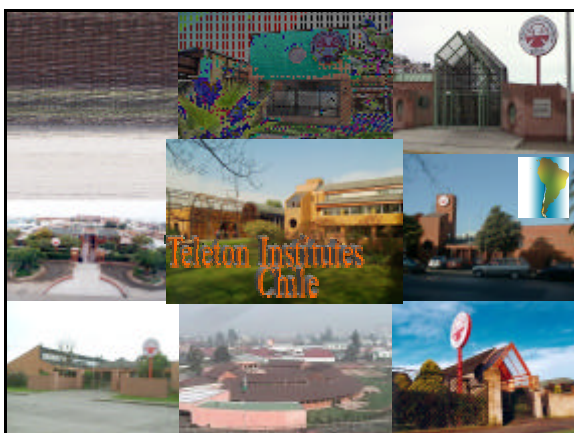
---

---

---

---

---




---

---

---


---

---

---

---

---


 Patients IRI Teletón  
 November 2007: 26.210

INSTITUTE	CEREBRAL PALSY	NEURO-MUSCULAR DISEASES	SOX CONGENITAL & ADQUIRED	AMPUTEES	OTHERONS DISEASES	OTHER PATHOLOGIES	NOT INFORMED	TOTAL
ARICA	174	78	47	80	46	223	1	648
BUIQUE	207	105	37	52	50	224	2	677
ANTOFAGASTA	434	107	94	80	114	391	23	1243
COQUIMBO	487	147	88	80	89	237	8	1131
VALPARAISO	1343	438	341	212	381	1238	9	4103
SANTAGO	3948	1354	1208	674	1051	2128	148	10404
TALCA	235	77	67	34	80	114	0	622
CONCEPCION	1369	422	312	199	361	809	5	3403
TEMUCO	657	208	151	97	183	358	8	1655
PUERTO MONTT	684	253	142	108	233	84	3	2332
<b>TOTAL</b>	<b>9503</b>	<b>3249</b>	<b>2402</b>	<b>1569</b>	<b>2603</b>	<b>6569</b>	<b>215</b>	<b>26210</b>
%	36,3	12,4	9,5	6,0	9,9	25,1	0,8	100,0

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---





### Our Mission

The Total Rehabilitation of children and young people with invalidating diseases. Our strong emphasis is on their independence and autonomy in order to improve their integration into the family, school, social and work environment.

To Rehabilitate in order to Insert in to the Community



Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---





### Our Future Vision

To be the leader in Chile in Total Rehabilitation

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---





## Gait Lab

Experience: 6 years



Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---

---

---

---

---

---





## Gait Lab: Inauguration

July 2002



Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---

---

---

---

---

---





## Gait Lab: Our Experience

- ⚡ Improvement of Knowledge about our Pathologies
- ⚡ Improvement of Rehabilitation Treatment Techniques
- ⚡ Improvement of Surgical Techniques
- ⚡ Unification of Orthoses, Prothetic and Surgical Therapeutics Criteria
- ⚡ Quantative Follow Up
- ⚡ Continuous Improvement

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---




---

---

---


---

---






### Team

- ⚡ Physiatrist
- ⚡ Orthopedic Surgeon
- ⚡ Physical Therapist
- ⚡ Bio Engineer
- ⚡ Informatic Engineer



Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008




---

---

---




---

---

---


---

---






### Implementation

- ⚡ Training Team
  - ⚡ Internal Training
  - ⚡ Foreign Training
- ⚡ Construction of Database
- ⚡ Continuous Improvement



Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008




---

---

---




---

---

---

---


---


### Training Team

Internal Training

- ⚡ Start up with support of BTS and Politecnico of Milan
- ⚡ Study and practice of the physical assessment
- ⚡ Interpretation of data
- ⚡ Development of reports
- ⚡ Establishment of gait profiles



Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008




---

---

---

---

---

---

---

---




### Training Team

Foreign Training

- ✍ Ospedale dei Bambini Buzzi di Milano and Villa Beretta
- ✍ Shriners Hospital Greenville South Carolina Mr Roy Davis
- ✍ Gillette Hospital Saint Paul Minnesota
- ✍ Gait Analysis Course Buenos Aires Argentina CANEO
- ✍ Clinical Gait Analysis course May 2006 Minneapolis USA
- ✍ TRAMA Project

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008




---

---

---



---

---

---

---

---





### Physical assessment :

Decrease the gap between examiners

- ✍ Reliability
- ✍ Validity
- ✍ Stándares - Protocols - Gold Standar

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008




---

---

---



---

---

---

---

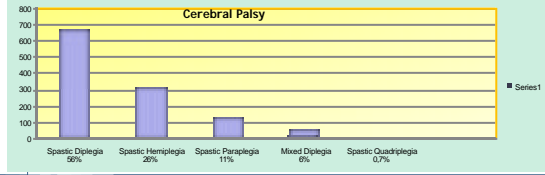
---


### Gait Lab: 2003 – November 2007

1487 patients

CP	MIMC	DMD	AMP	PPE FAMILIAR	OTHERS DG	TOTAL PATIENTS
n°	1206	82	27	13	17	1487
%	81	6	2	1	1	100



Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008




---

---

---

---

---

---

---

---

Teletón REHABILITACIÓN INFANTIL

Establissement of gait profil of our patients

Duchenne Muscular Dystrophy Myelomeningocele Cerebral Palsy

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

Teletón REHABILITACIÓN INFANTIL

Gait Profile of our Patients

Objectives

- Better understanding of the alterations mentioned in literature
- Determinate if the alterations found, are as described in literature (limited information)
- Analyze the evolution of our patients and objectively compare with literature
- Have established profiles prior to treatment
- Improvement of rehabilitation treatment techniques and surgical techniques

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

Teletón REHABILITACIÓN INFANTIL

DMD: Gait Profile

- 2004: 14 patients with DMD, 10 between 4 and 7 years, 4 between 8 and 11 years
- 2007: 3 patients are revalued and 1 new patient

Temporal & Distance Parameters

Cadence & Mean Velocity

Kinematics

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

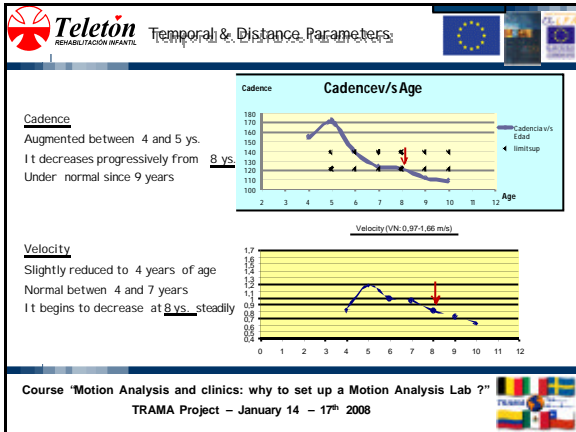
---

---

---

---

---




---

---

---

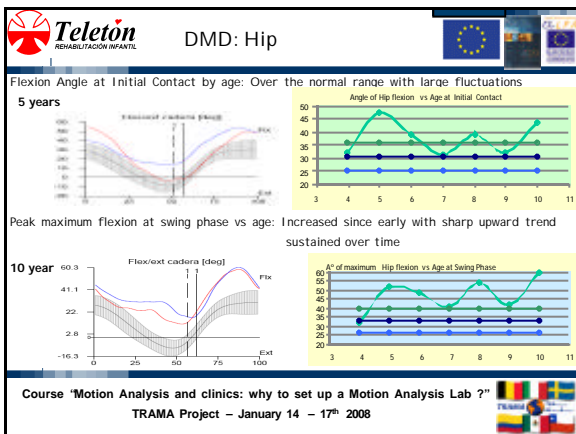
---

---

---

---

---




---

---

---

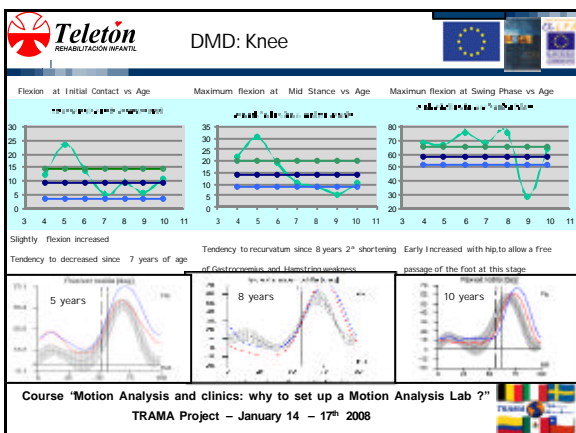
---

---

---

---

---




---

---

---

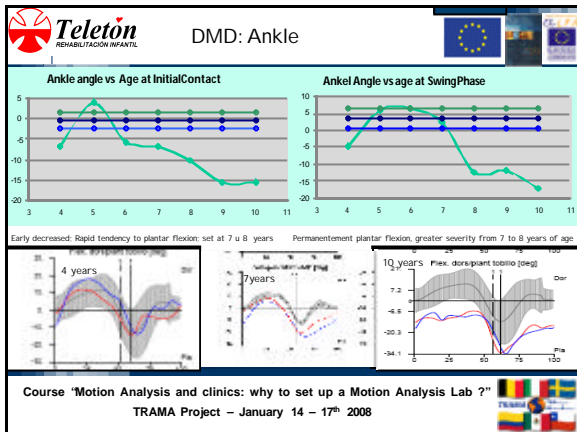
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---

**DMD: Cadence & Velocity Evolution**

- Initially, the velocity is normal, based on the increase in cadence
- As the symptoms progress, the cadence and step length decrease with secondary decrease of velocity
- Since 8-years- of age these parameters are under the normal range

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project - January 14 - 17th 2008

---

---

---

---

---

---

---

---

---

---

---

---

**DMD: Kinematics Evolution**

- The alterations observed would be more evident in the sagittal plane, as a compensatory phenomenon to muscle weakness
- The changes are very early, between 4 and 6 years of age and are almost simultaneously at the pelvis, hips, knees and ankles
- The pelvic forward tilt is usually present, with varying degrees of intensity, but not as constantly progressive as described in the literature "Pelvic forward tilt vs trunk hiper extension"

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project - January 14 - 17th 2008

---

---

---

---

---

---

---

---

---

---

---

---



**Teletón**  
REHABILITACIÓN INFANTIL

**DMD: Kinematics Evolution** 6 years

- ✦ In our sample, there is an initial undertake of the knee flexion at the Swing Phase
- ✦ Secondary and rapidly there is an increase of the hip flexion in the Swing Phase to allow a free passage of the foot at this stage
- ✦ Both were maintained over time, especially the hip, as described in literature

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

**Teletón**  
REHABILITACIÓN INFANTIL

**DMD: Evolution Kinematics** 10 years

- ✦ In the Initial Contact, there was a slight increase in the knee and hip flexion. The hip maintains this trend, but with fluctuations
- ✦ The knee decrease its flexion at the Stance Phase, emerging trend recurvatum since 8 years of age, in the Loading Response and Mid Stance, consistent with ankle plantar flexion
- ✦ The ankle goes to plantar flexion significantly since 6 years of age

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

**Teletón**  
REHABILITACIÓN INFANTIL

**DMD: Kinematics Evolution** 6 years

- ✦ In the coronal plane there is a marked pelvic oscillation since 4 years of age
- ✦ In the transverse plane, a progressive increase in the range of pelvic rotation
- ✦ The gait loss occurs in our patients, approximately since 10 years of age

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---




---

---


---


---

---

### DMD: Gait Evolution



Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---




---

---

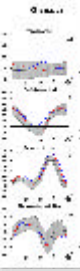
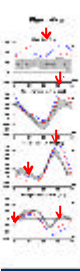
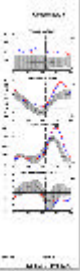
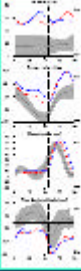
---


---

---

### Reevaluation 2007

D.A. 4 years	D.A. 7 years	V.E. 8 years	A.S. 10 years
			

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---




---

---


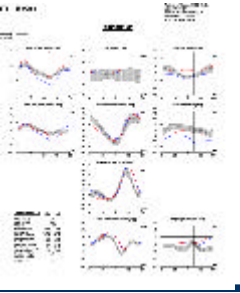
---


---

---

### Reevaluation 2007 S.V. 9 years Prednisone

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---

---

---

---

---

---



Teletón REHABILITACIÓN INFANTIL DMD: Knee Kinetics

Early great extensor moment in Mid Stance

This shows that the compensations are essentially in the sagittal plane

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

Teletón REHABILITACIÓN INFANTIL DMD: Ankle Kinetics

- Less amplitud of Ankle plantar flexor moment
- Generating power on the Stance Phase, more than usual: Important role of the Triceps Sural at this phase for forward propelation
- Reduction in the power generation at the Terminal Stance

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

Teletón REHABILITACIÓN INFANTIL DMD: Kinetics: CoP

- Reduction of the trajectory of the Center of Pressure, because of the ankle plantar flexion

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

Teletón REHABILITACIÓN INFANTIL DMD: Prednisone

C.R.S 13 years

KINETICA SAGITAL

KINETICA FRONTAL

FUERZA DE REACCIÓN DEL TALÓN (GRF) - GUP

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project - January 14 - 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

Teletón REHABILITACIÓN INFANTIL DMD: Gait Profile

DMD: Engineers of their own body

For. desplazamiento [mg]

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project - January 14 - 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

Teletón REHABILITACIÓN INFANTIL Myelomeningocele: Gait Profile

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project - January 14 - 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

**Teletón** REHABILITACION INFANTIL Myelomeningocele Lumbar- Sacral Level

- Pelvis:**
  - Increase of the oscillation in the coronal plane
  - Increase of the pelvic forward tilt in the sagittal plane
  - Increase of the pelvic rotation in the horizontal plane
- Hips:**
  - Flexion increased
- Knees:**
  - Flexion increased in the Initial Contact
  - Less range of motion
- Tobillos:**
  - Dorsal Flexion increased

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

**Teletón** REHABILITACION INFANTIL Myelomeningocele B

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

**Teletón** REHABILITACION INFANTIL Myelomeningocele L4 – L5

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

Teletón  
REHABILITACIÓN INFANTIL

Myelomeningocele S1

P. A. 1127xa03MMC S1

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

Teletón  
REHABILITACIÓN INFANTIL

Myelomeningocele asymmetrical L3 to Left and L4 to Right

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

Teletón  
REHABILITACIÓN INFANTIL

Myelomeningocele according level

L3

L4-L5

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

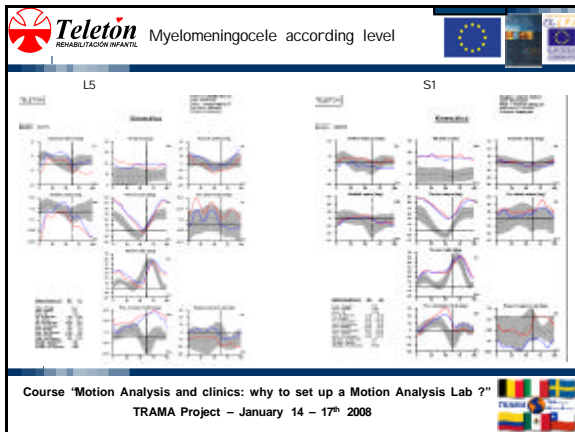
---

---

---

---

---




---

---

---

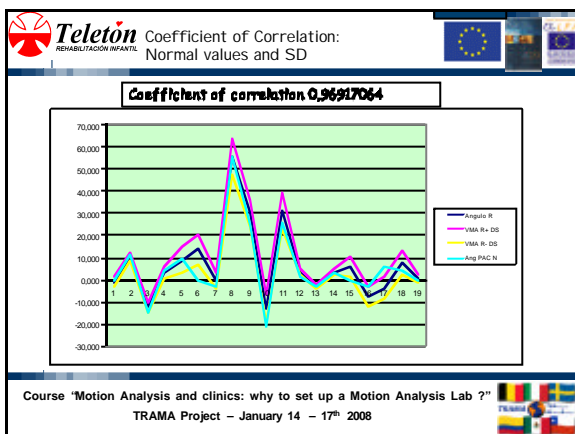
---

---

---

---

---




---

---

---

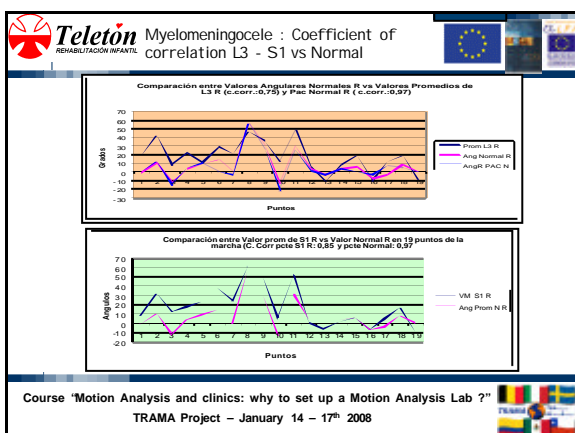
---

---

---

---

---




---

---

---

---




---

---

---

---





Myelomeningocele



---

- ✍ The result that we see in our experience agree with findings published in literature
- ✍ As the injury level is lower, these alterations decreases at:
  - ✍ Pelvis
  - ✍ Hips
  - ✍ Knees
  - ✍ Ankles
- ✍ The surgeries performed in our patients did not change their kinematic profil
- ✍ In children with asimetric level, the kinematic of the contralateral side is affected too as a compensatory phenomena

---

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---




---

---

---

---


---


Myelomeningocele



---

- ✍ There was a certain relation of the values of the coefficients of correlation with the level of injury described clinically
- ✍ The AFO improved the gait on the Temporal and Distance Parameters and the kinematics in sagittal plane
- ✍ The knee showed a moment of important overload at the higher levels. The use of cane as a preventive measure in the future must be considered
- ✍ The exercises would certainly benefit: velocity, cadence, anterior step lenght and the angle of anterior inclination of pelvis at the Initial Contact, although these improvements were not statistically significant in our experience

---

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---

---

---

---

---

---


Myelomeningocele



---

Next Challenges:

- ✍ Increased study of the impact of different types of orthoses : AFO, DAFO, GRAFO, SMO...
- ✍ Redefine orthopaedic surgery
- ✍ Increased research and redefin the exercise program



---

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---

---


---

---

---

---

Teletón REHABILITACIÓN INFANTIL Gait Lab in Cerebral Palsy



Reasons for derivation:

- ✦ Botulinum toxin
- ✦ Surgery
- ✦ Orthoses

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

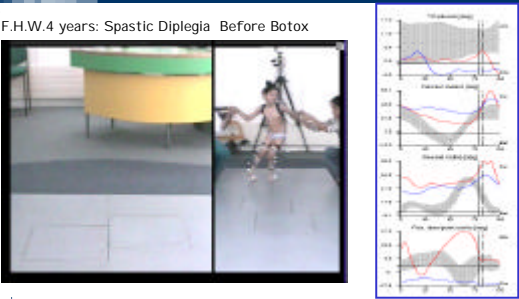
---

---

---

Teletón REHABILITACIÓN INFANTIL Cerebral Palsy: Botulinum Toxin  
Rectus Femoris, Medial Hamstrings and Gastrocnemius

F.H.W. 4 years: Spastic Diplegia Before Botox



Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---


---

---

---

Teletón REHABILITACIÓN INFANTIL Cerebral Palsy: Botulinum Toxin  
Rectus Femoris, Medial Hamstrings and Gastrocnemius

F.H.W. 4 years: Spastic Diplegia After Botox



Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

**Teletón** REHABILITACIÓN INFANTIL Cerebral Palsy: Botulinum Toxin Rectus Femoris, Medial Hamstrings and Gastrocnemius

F.H.W. Before Botox			After Botox		
Temporal Parameters			Temporal Parameters		
	RT	LT	RT	LT	
Stance time [msec]	970	1080	1460	1480	
Swing time [msec]	260	230	390	400	
Stance time [% stride]	79	82	79	79	
Swing time [% stride]	21	18	21	21	
Stride time [msec]	1230	1310	1850	1880	
Cadence [step/min]	95		64		
Double supp. time [msec]	R-Fw 200	L-Fw 540	R-Fw 660	L-Fw 400	
Double supp. [% stride]	16	44	36	22	
Distance Parameters			Distance Parameters		
	RT	LT	RT	LT	
Anterior step length [mm]	138.51	194.82	239.80	220.14	
Velocity [m/sec]	0.19	0.22	0.22	0.25	
Swing velocity [m/sec]	0.90	1.25	1.04	1.16	
Stride length [mm]	234.97	288.59	405.20	462.47	
Step width [mm]	183.00		136.34		
Mean velocity [m/sec]	0.20		0.23		

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project - January 14 - 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

---

---

**Teletón** REHABILITACIÓN INFANTIL

Before Botox

After Botox

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project - January 14 - 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

---

---

**Teletón** REHABILITACIÓN INFANTIL Patient with Spastic Right Hemiplegia, under effect of Botulinum Toxin

Before

2month

4 month

6 month

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project - January 14 - 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

---

---

Teletón RENABILITACIÓN INFANTIL Botulinum Toxin and Exercises

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

Teletón RENABILITACIÓN INFANTIL

### Experience with Botulinum Toxin

- ✦ Role of the muscles monoarticulares: Soleus and biarticular: Hamstrings , Gastrocnemius and R. femoris
- ✦ Importance of physical examination: Strength vs Spasticity
- ✦ Importance of exercise program before and after infiltration
- ✦ Significance of orthoses
- ✦ Generally must be multilevel

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

Teletón RENABILITACIÓN INFANTIL

### Multiple Surgery Orthopaedics in CP with Normalcy Index

CP: patients with MSO 2003-2007 with Normalcy Index

Normalcy Index	Number of Patients
Total pacientes	36
Spastic Diplegia	30
Spastic Paraplegia	3
Spastic Hemiplegia	3

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

Teletón  
REHABILITACIÓN INFANTIL

Multiple Surgery Orthopaedics in CP: Types of Surgery

Multilevel Surgery in C.P.

Category	Value
Cx Músculos	23
Cx Óseas	13

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

Teletón  
REHABILITACIÓN INFANTIL

Multilevel Surgery in C.P. Normalcy Index 36 patients

NORMALCY INDEX 2003 – 2006 GENERAL AVERAGE			
	Pre - Op	Post - Op	%Reduction
N.I.	270,14	156,005	42,30%

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---

Teletón  
REHABILITACIÓN INFANTIL

Multilevel Surgery in CP  
Lengthening Psoas: Medial and lateral  
Hamstrings: Right Triceps Surae & R.F. Transfer

C.G. 8 years / Pre op N.I. pr: 457,88

C.G. 9 years, 1 yr./7 Meses post op N. I. pr 215,6

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---



---

---

---

---

---

**Teleton** REHABILITACION INFANTIL Multilevel Surgery in C.P.  



C.G. Pre op N.I. average: 457,88      1 year C.G. Post op N. I. average 215,6

8 years      9 years

Temporal Parameters		ST		L2		ST		L2	
Stance time (sec)	542	482	45-56	49-59	513	533	43-54	48-59	
Swing time (sec)	332	322	30-38	31-40	332	332	30-38	31-40	
Stance time (% stride)	64	62	6-9	6-9	67	66	6-9	6-9	
Swing time (% stride)	36	42	6-8	11-17	43	41	7-14	11-17	
Stride time (sec)	862	812	80-86	80-87	862	862	80-86	80-87	
Stride time (% stride)	100	100	100-100	100-100	100	100	100-100	100-100	
Collision (sec)	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	
Collision sup. time (sec)	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	
Collision sup. (% stride)	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	

Gait Parameters		ST		L2		ST		L2	
Walking step length (cm)	273,24	277,85	467-714	467-714	478,71	487,32	467-714	467-714	
Velocity (cm/sec)	271	279	58-78	58-78	328	332	58-78	58-78	
Swing velocity (cm/sec)	188	187	38-52	38-52	242	232	38-52	38-52	
Stride length (cm)	552,92	552,92	467-714	467-714	947,42	972,37	467-714	467-714	
Step width (cm)	17,48	17,48	8,5-12,9	8,5-12,9	167,82	167,82	8,5-12,9	8,5-12,9	
Mean velocity (cm/sec)	274	274	58-78	58-78	328	332	58-78	58-78	

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"    
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---



---

---

---



---



---

**Teleton** REHABILITACION INFANTIL Multilevel Surgery in CP  

Lengthening Psoas; Medial and lateral Hamstrings  
Right Triceps Surae & R.F. Transfer

C.G. 755xa03 Pre op N.I. pr: 457,88      C.G. Post op 1543xa04 N.I. Pr 215,6

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"    
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---



---

---

---

---

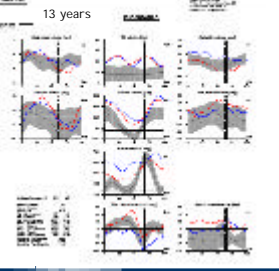
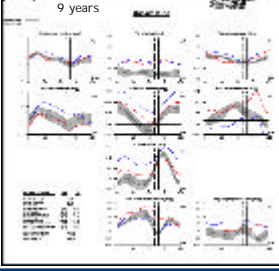
---



**Teleton** REHABILITACION INFANTIL Multilevel Surgery in C.P.  

Bilateral lengthening Medial Hamstrings;  
Vulpius right Triceps Surae; right RF transfer

M.T. Pre op 740xxa05 N. I. Pr 244,65      M.T. 1 ano 9 meses Post op 1793xa02 N.I. Pr 156,42

13 years      9 years

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"    
TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

---

---



Teleton REHABILITACION INFANTIL

Multilevel Surgery in C.P. Bilateral distal femoral extension osteotomy & patella advancement and RF Transfers

R.Z.1165 xa04 pre op

RZ. 2135xa02 post op

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"

TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

Teleton REHABILITACION INFANTIL

Multilevel Surgery in C.P.

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"

TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---

Teleton REHABILITACION INFANTIL

Multilevel Surgery in C.P.

PARAMETERS	PRE-OP WITHOUT ORTHOSES		POST-OP WITHOUT ORTHOSES		POST-OP WITH ORTHOSES	
	Right	left	Right	left	Right	left
Cadence (step/min)		108		103		102
Stance Time (%)	66%	65%	60.90%	61.50%	56.80%	57.30%
Swing Time (%)	34%	35%	39.10%	38.50%	43.20%	42.70%
Anterior Step Length (mm)	332	309	467	438	546	493
Mean Velocity (m/sec)		0,56		0,76		0,91
				36%		63%

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"

TRAMA Project – January 14 – 17<sup>th</sup> 2008

---

---

---

---

---

---

---

---




**Multilevel Surgery in C.P.**



---

Improvements

- ✍ Posture
- ✍ Balance
- ✍ Transfer
- ✍ Speed with orthoses
- ✍ Less energy expenditure



**Greater Autonomy**

---

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---

---

---

---

---




---

---

---

---

---



**Multilevel Surgery in C.P.**



---

Challenges

- ✍ Improve the acquisition of data
- ✍ Follow up
- ✍ Systematic functional analysis (WeeFIM, FAQ, Patient and family satisfaction questionnaire, KIDSCREEN-27, GMFM, etc)

---

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"  
 TRAMA Project – January 14 – 17<sup>th</sup> 2008
 

---

---

---

---

---

---

---

---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---