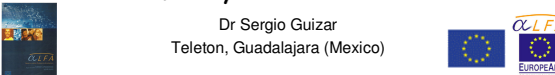







TRAMA *TRAINING in Motion Analysis*


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

TRAMA Project
January 14 - 17th 2008
 Dr Sergio Guizar
 Teleton, Guadalajara (Mexico)









GAIT ANALYSIS LABORATORY






Dr. Sergio Román Guizar Macias
 Medical Director
 Telethon's Rehabilitation Center for Children

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








CRIT Occidente

Course "Motion Analysis and clinics: why to set up a Motion Analysis Lab ?"
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Before I begin, I wish to offer an apology because my level of English is not very clear. Therefore, if you don't mind.

I wish to express my gratitude to the organizers and specially to Dr. Manuela Galli, for the invitation and for letting me share with you today a little of our experience at CRIT Occidente.

Before CRIT was build in the city of Guadalajara in the year two thousand (CRIT means Telethon's Rehabilitation Center for Children), it was designed with a gait analysis laboratory in mind.

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However, due to economic issues, this project was delayed until October, two thousand and three. It was then when thanks to the generosity of the ARANSA company, we were able to install the BTS elite plus system. Dr. Ariadna Cedillo was appointed as head of department.

She was trained by Dr. Galli and Ing.. Demetrio Villanueva (of Mexico's National Polytechnic Institute)

Our laboratory started the six- month test run on October 20th, two thousand and three.

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Now that we had the system, the next step was to find a way to raise awareness among the doctors regarding the clinical use of this technology.

We came up with a three-stage plan:

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First Stage: *Raising awareness*





Dr. Cedillo started offering lectures about the use, purpose and clinical results of human gait analysis to the CRIT Occidente's medical staff as well as from other public and private health institutions.

Also, a required visit to the lab was included in the tour given to all visitors (businessmen, doctors, general public, etc.) It was presented as an added value of the medical care received by disability patients.

The technology was advertised as a diagnostic tool that could be offered to other health institutions and sports clubs, etc.

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Second Stage: *Productivity and performance report*





We set up the schedule in a way that made it possible to do at least 3 studies per day.

We make sure that all our doctors receive a congratulation letter and suggestions when, during follow-up, there is an improvement in outcome attributable to gait analysis.

This has been favorable to the lab schedule: the occupancy rate is between 95% (ninety-five) and 100% (one hundred) percent.

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Third Stage: *Consolidation and renewal*


This stage comprises the full acceptance of the CRIT's medical staff about the use and purpose of gait analysis.

We also favor Dr. Cedillo's ongoing medical update in the field.


We want to set up a multi-disciplinary lab team by 2008 that includes a biomedical engineer and a movement analysis technician.

And above all, we want to update our current system with a state-of-the-art one.

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Let me show you a graphical summary of our work up until today. This gives us the opportunity to view the utilization tendency by clinical areas, by most frequent diagnoses as well as by other variables of future interest.



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Age Average of Evaluated Patients

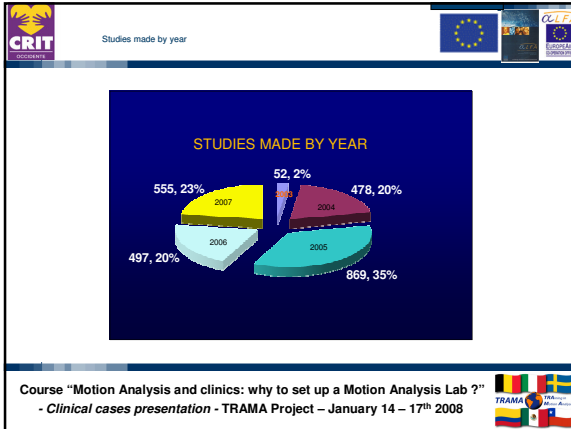
	Age	
Median	10	
Standard Deviation	4,63	
Minimum	1	
Maximum	22	
Percentile		
	25	6
	50	10
	75	13

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Studies made by year

Year	Frequency
2003	52
2004	478
2005	809
2006	497
2007	555
TOTAL	2451

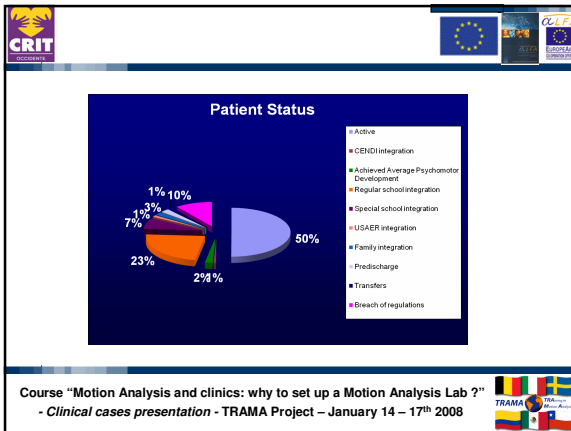
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Patient Status

STATUS	Frequency	Percentage	Accumulated Percentage
Active	374	56.07	56.07
Integration into CENDI school system	5	0.67	56.74
Achieved Average Psychomotor Development	15	2.01	58.74
Integration into regular school system	174	23.29	76.04
Integration into special school system	54	7.23	83.27
Integration into USAER school system	9	1.20	84.47
Family integration	14	1.87	86.35
Predischarge	18	2.41	88.76
Transfer to another institution	8	1.07	89.83
Breach of Regulations	76	10.17	100.00
Total	747	100	

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2451 appointments given to 747 patients
Average 3.3

Appointments	Frequency	Percentage	Accumulated Percentage
1	221	35.92	35.92
2	162	21.89	57.81
3	104	15.92	73.73
4	78	11.64	85.37
5	42	6.02	91.39
6	29	3.88	95.27
7	27	3.69	98.96
8	20	2.69	101.65
9	14	1.87	103.52
10	11	1.47	105.00
11	4	0.54	105.54
12	5	0.67	106.21
13	3	0.40	106.61
14	2	0.26	106.87
15	1	0.13	107.00
17	1	0.13	107.13
Total	747	100	

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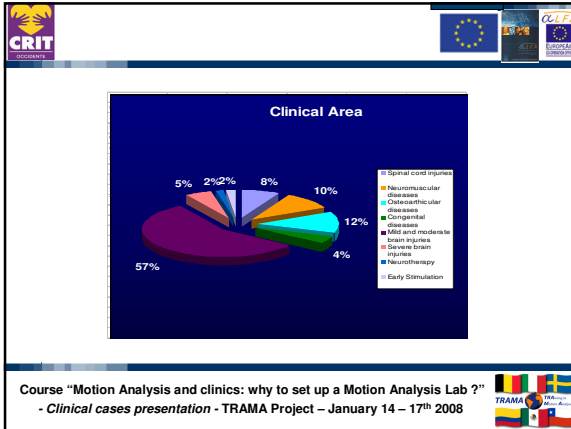
Appointments per patient

Appointments	Frequency	Percentage
1	221	35.92
2	162	21.89
3	104	15.92
4	78	11.64
5	42	6.02
6	29	3.88
7	27	3.69
8	20	2.69
9	14	1.87
10	11	1.47
11	4	0.54
12	5	0.67
13	3	0.40
14	2	0.26
15	1	0.13
17	1	0.13

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CLINICAL AREA	Frequency	Percentage
Spinal cord injuries	96	7,31677852
Neuromuscular diseases	76	10,2013423
Osteoarthicular diseases	93	12,4632215
Congenital diseases	33	4,4295302
Mild and moderate brain injuries	420	56,2753289
Severe brain injuries	40	5,34912752
Neurotherapy	12	1,61073826
Early Stimulation	15	2,01342282
Total	745	100

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Diagnosis	Frequency	Percentage
Alzheimer disease	4	1.07483
Amyotrophic	3	0.80488
Spin ataxia	1	0.26459
Alzheim	2	0.07146
Alzheimer	1	0.02646
Cerebellum	2	0.05292
Congenital hemiparesis	2	0.05292
Spin ataxia	11	1.07483
Intellectual disability	7	0.18379
Spin ataxia	26	0.68026
Cerebellum	2	0.05292
Mandibular atrophy	21	0.54673
Talipes equinovarus	1	0.02646
Schizophrenia	1	0.02646
Stroke	7	0.18379
Cerebellar atrophy	4	0.10391
Amnesia	4	0.10391

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Diagnosis	Frequency	Percentage
Spina cord injury	2	0.05292
Congenital Spin Cord Injury	2	0.05292
Acquired Spin Cord Injury	46	1.19464
Dislocation as cause of injury	2	0.05292
Metabolic disease	1	0.02646
Manuscript	2	0.05292
Manuscript	12	0.30926
Metabolic Diseases	14	0.35964
Epilipse test	22	0.56459
Midline Central Palsy	7	0.18379
Midline Central Palsy	42	1.07483
Stroke Central Palsy	26	0.68026
Stroke Brain	1	0.02646
Stroke	2	0.05292
Psychomotor development delay	12	0.30926
Stroke Motor	1	0.02646
Stroke	1	0.02646
Total	742	100

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Total: 2451 appointments given to 747 patients

CLINICAL AREA	Appointments			Total Patients
	1 appointment	2-5 appointments	6-17 appointments	
Congenital diseases	12	19	3	34
Early Stimulation	8	7	0	15
Mild and moderate brain injuries	54	216	117	417
Severe brain injuries	9	26	2	37
Brain injuries, afternoon shift	3	3	0	6
Spinal cord injuries	22	27	6	55
Spinal cord injuries, afternoon shift	0	1	0	1
Neuromuscular diseases	39	37	1	77
Neurotherapy	5	7	0	12
Osteoarthicular diseases	47	43	1	91
Osteoarthicular diseases, afternoon shift	2	0	0	2
Total	231	386	130	747

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Total: 2451 appointments given to 747 patients

Appointments by Clinical Area

Clinical Area	1 appointment	2-5 appointments	6-17 appointments
Congenital diseases	12	19	3
Early Stimulation	8	7	0
Mild and moderate brain injuries	54	216	117
Severe brain injuries	9	26	2
Brain injuries, afternoon shift	3	3	0
Spinal cord injuries	22	27	6
Spinal cord injuries, afternoon shift	0	1	0
Neuromuscular diseases	39	37	1
Neurotherapy	5	7	0
Osteoarthicular diseases	47	43	1
Osteoarthicular diseases, afternoon shift	2	0	0

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Spectrum of body involvement

Sequelae of illness	Frequency	Percentage
Quadriplegia	220	29.5
Diparesis	356	47.8
Muscle weakness	94	12.6
Monoparesis	66	8.9
Dystonia	2	0.3
Total	738	100

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Sequelae

Sequelae	Percentage
Quadriplegia	30.30%
Diparesis	48%
Muscle weakness	2.00%
Monoparesis	12.6%
Dystonia	6.8%

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CONCLUSIONES

Our gait analysis laboratory started working on October 13th, 2003.
2451 appointments given to 747 patients.
Study average: 3.3 studies per patient.
Appointment average: 600 appointments per year.
On 38% of the patients, the study has been used to evaluate discharge with some type of integration.
Age average of patients: 10 years.
57.8% of the patients were male.
The most frequent diagnosis was Moderate Cerebral Palsy (57.7%); followed by Muscular Dystrophy and Spinal Cord Injury (6%).
47.8% had diparesis, 29.5% had quadriplegia and 12.6% had muscle weakness.
56.4% of the patients belonged to the Mild Spinal Cord Injuries clinical area; 12.5% were from the Osteoarthicular clinical area and 10.2% came from the Neuromuscular clinical area.
420 patients from the Mild and Moderate Brain Injuries clinical area came on average 4.12 times to get a study done. That is a total of 1731 appointments.

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I want to conclude my presentation with some thoughts about human movement.

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We often hear the following:

"we offer a system capable of kinematics and kinetic analysis, dimensional measuring and electromyography, that is able to measure movement at different angles, speeds and acceleration so that we can study the physical reactions that are responsible for movement and its changes. The major components of this system are: a force platform, etc."



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And all these things are for what purpose?
What is the profound, comprehensive and existential meaning of this technology?
It is only a cold technology or it is a technology for the human life?
Let's begin our reflection with the "why" and the "what for" of movement:

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Movement as a complex system
The system is complex due to the overabundance of relationships and possibilities of connection, which makes it impossible to establish a linear relationship. Differentiation allows the interaction of multiple subsystems with different complexity levels.
From this point of view, human movement exists as the summation of the physical, motor functioning, sensitive, cognitive and emotional areas.




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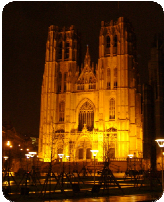
CRIT **Movement as a complex system**   










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CRIT **Structure of the complex system:**   

- Motor control
- Motor learning
- Motor capacity
- Motor activity











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CRIT **I. Motor control**   

It's highly dependant of the environment, which conditions it and determines its bidirectional relationships that allows the transformation of man and the environment.

Another characteristic of this level is the high defining it has with the environment. Because motor control is an intrinsic process to man as a unit body-movement and an integrating process of the biological, psychological and social components of this capacity.

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2. Motor learning





It is defined by a level of independence and intermediate delimitation that assures the constant flow between stimulus, environmental conditions and the responses that arise through action, activity and motor behavior.

Learning, as a vital process of mankind, refers to the relationship between a person's internal world, the material world and the social world through motor learning.

To be able to understand motor learning requires us to address the permanent transformation of movement patterns as an interaction outcome of the biological and psychological capacities of the person.

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3. Motor capacity

It is man's potential to use the biological, psychological and social components. It is the necessary knowledge for human development.

The biological component integrate the organic, hereditary and functional elements. The psychological component mesh the emotional and cognitive part. The social component refers to the conditions, style and quality of life.

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4. Motor activity



It is the transition from potential to enactment. It is the means by which motor capacity manifest in observable human movement.

Motor activity is the execution of movement in the present. It is the result of the integration of multiple simple and complex movement patterns, as proposed by Wisckstrom (1993).

The movement pattern needs to be understood as the combination of movements organized by a specific spatio-temporal disposition. This movement pattern is the manifestation of the adequate integration of the body awareness with spatiality and temporality.

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So, from this point of view:

As a philosophical category, movement is an existing form of matter as well as a characteristic of animal life. There is movement in the cell, in the muscular fiber, in the muscle groups, in the organs, in the systems... in the body as a whole.

Since the beginning, movement gave mankind the ability to interact easily with the world.

This is a different point of view because it is necessary to consider the human movement as a significant manifestation of behavior by means of observing mankind on the move and during the dialectic relationships between one another and with the environment.

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It is from this perspective that we begin to analyze human movement and not from the usual segmentational form based on anatomy and physiology.

"Human movement is the universal means used by mankind to face the exterior world; it is far-reaching than human language...Every relationship between the organism and the exterior world has, in one way or another, dynamic acts."

"the human body movement is a effective means to interact in a constructive and satisfactory way with one's self, with others, and with the physical and natural environment.

As Sechenov (1861) says in his major classic "The Reflexes of the Brain": "the feeling transforms into reason and purpose, and movement into action."

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Closing statements:

The importance of researching and promoting human movement analysis by means of the technology available in the laboratories it is quite clear. However, this technology is out of reach for the majority of health institutions, mainly in Latin America.

That is why we are committed to strengthen in every possible way the following: updating processes, developing local and multicentre research studies, being the spearhead of the movement to install new laboratories, and train their staff ; but above all, we are committed to make this technology a highly requested tool.


Without forgetting that human movement analysis is a fundamental part of the human being as biological, psychoaffective and socio-cultural whole.

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Thanks to movement, your patients can walk up to you and give you a hug.
Thanks to movement, they stand up and the world seems different.
Thanks to movement, the athlete thrills an entire country.
Thanks to movement, mankind creates and rehabilitates.
Thanks to movement, we are able to say: "I love you".
Thanks to movement, I am able to say:

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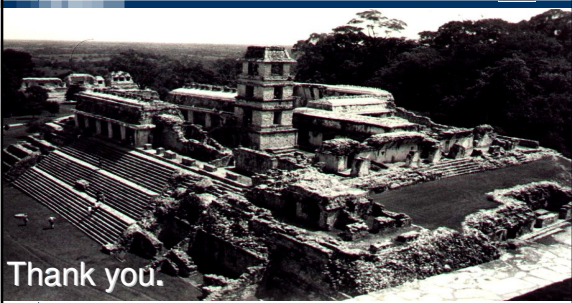





Thank you.

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Thank you.

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